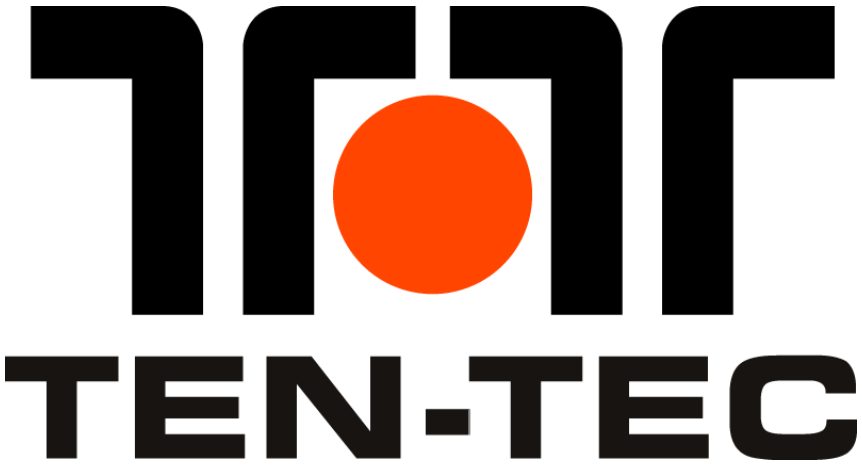

This obsolete manual file is provided as a courtesy to you by Ten-Tec, Inc.

Ten-Tec's service department can repair and service virtually everything we have built going back to our first transceivers in the late 1960's. It is our ability to continue offering service on these rigs that has led to their re-sale value remaining high and has made a major contribution to our legendary service reputation.

Printed and bound copies of all manuals are available for purchase through our service department if you would prefer not to use this copy as your transceiver manual.

We can repair or service your Ten-Tec equipment at our facility in Sevierville, TN. We also offer support via telephone for all products via during usual business hours of 8 a.m. to 5 p.m. USA Eastern time, Monday through Friday. We have a large supply of parts for obsolete products. Repairing a transceiver or amplifier yourself? Contact us for parts pricing information.

Service department direct line: (865) 428-0364
Ten-Tec office line: (865) 453-7172
Service department email: service@tentec.com
Address: 1185 Dolly Parton Parkway, Sevierville, TN 37862 USA

We have found it is most effective for us to help you troubleshoot or repair equipment with a consultation via telephone rather than by email.

Suggested contact methods are:

Troubleshooting or repairing equipment – call (865) 428-0364
Other inquiries – call (865) 428-0364 or email service@tentec.com

THANK YOU AND 73 FROM ALL OF US AT TEN-TEC

TEN-TEC

OPERATOR'S MANUAL

CENTAUR

MODEL 411

HF LINEAR AMPLIFIER

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

SPECIFICATIONS

BAND COVERAGE:	160, 80, 40, 30, 20, 17 and 15 meters (12 and 10 meters for authorized users).
POWER OUTPUT:	600 watts output SSB/CW on 80 through 15 meters, 500 watts on 160 and 10 meters. 350 - 400 watts RTTY/SSTV (Band dependant).
DRIVE POWER REQUIRED:	90 to 100 watts typical for rated output.
DUTY CYCLE:	SSB - continuous voice modulation: 600W PEP. CW - 50% duty cycle continuously: 600W PEP. 30 seconds maximum continuous key-down at 550 watts output.
EFFICIENCY:	Up to 70% depending on frequency and load impedance.
INPUT AND OUTPUT IMPEDANCES:	50 ohms unbalanced, VSWR < 2:1.
HARMONICS:	Meets or exceeds FCC requirements.
METERING:	Switch selectable Forward Power, Grid Current, Plate Voltage and Plate Current.
FRONT PANEL CONTROLS:	Plate TUNE and LOAD, band switch, operate/standby, QSK/PTT, power on/off.
FULL BREAK-IN:	Built-in with T/R switching time less than 7 milliseconds.
PROTECTIVE CIRCUITS:	Hot switching T/R protection, plate transformer primary interlock and high voltage shorting bar.
PRIMARY POWER:	120 VAC @ 12 amps or 240 VAC @ 6 amps, 50/60 Hz.
TUBE COMPLEMENT:	Three - 811A SVETLANA vacuum triodes; class AB2 in grounded grid.
PLATE VOLTAGE:	1800 volts no load, 1500 volts full load.
COOLING:	Internal forced air. 100 CFM tube axial fan.
CONSTRUCTION:	Aluminum chassis, front and rear panels. Steel top and bottom covers.
SIZE:	HWD - 6" x 15.5" x 13" (15.2 x 39.4 x 33 cm).
WEIGHT:	40 lbs. (18.14 Kg).

WARNING!!!

This amplifier contains lethal voltages when operating.
DO NOT operate this amplifier with the covers removed.
The power supply circuits in this amplifier produce
1800 VOLTS which is LETHAL!!!

CAUTION!!!

Never attempt to operate the Centaur without first connecting a suitable antenna or 50 ohm dummy load of sufficient power rating or SERIOUS DAMAGE MAY RESULT

TEN METER OPERATION OF THE CENTAUR AMPLIFIER

FCC rules permit licensed amateurs to modify their own amplifiers for operation in the 28 - 29.7 MHz band. If you enclose a copy of your valid amateur radio license with the warranty registration card for your new amplifier, appropriate information will be sent to you without charge.

INTRODUCTION

The CENTAUR Model 411 is an advanced design linear amplifier that uses three 811A triode tubes in a grounded-grid configuration. This amplifier contains a forced air cooling system and operates at up to 600 watts of output power with a maximum efficiency of up to 70%.

Two panel meters provide indication of plate current or plate voltage, and grid current or forward power.

Band coverage includes 160, 80, 40, 30, 20 and 17 meters, as well as 12 and 10 meters for authorized users.

Primary power of 120 VAC is standard. However 240 VAC operation is possible by changing the jumpers on the input board. Primary lines are fused at 12 Amps for 120 VAC or 6 Amps at 240 VAC. Interlocks in the primary line and high voltage lines are provided to ensure operator safety. **NEVER DEFEAT THESE SAFETY PRECAUTIONS!!**

UNPACKING

Carefully remove the amplifier from the packing carton and inspect it for signs of shipping damage. If the amplifier has been damaged, notify the delivering carrier immediately, stating the full extent of the damage. Save all damaged cartons and packing material. Liability for any shipping damage rests with the carrier. Complete the warranty registration form and mail to TEN-TEC immediately. Save the packing material for re-use in the event that moving, storage, or reshipment is necessary. Shipment of your TEN-TEC amplifier in other than factory packing may result in damage. This is not covered under the warranty. The following hardware and accessories are packed with your CENTAUR. Make sure you have not overlooked anything.

1	-	#38088 .062" Allen Wrench
2	-	#27067 Fuse, 12A AGC
1	-	#74020 Warranty Card
1	-	#74400 Owner's Manual

If any of the above items are missing, contact the repair department at TEN-TEC for replacement.

Repair Department 423-428-0364
Switchboard 423-453-7172
FAX 423-428-4483
E-Mail .....74130.212@Compuserve.com

Before powering up your CENTAUR for the first time, carefully inspect the three amplifier tubes. They are visible through the ventilation holes in the top cover. Check to make sure they are centered in the opening and have not been jarred loose during shipment. If they are loose or out of position, remove the 10 screws that secure the top cover and carefully re-install the tubes in their sockets.

WARNING !!!

The plate caps are delicate and easily broken when removing or installing tubes. Do not hold the tube only by the glass envelope but support both glass envelope and plate cap to minimize chance of breakage.

CHAPTER 1

INSTALLATION

1.1 INTRODUCTION: When setting up the station, provide adequate ventilation for the amplifier. Also, select a location that allows comfortable access to the front panel controls and adequate clearance for rear panel connections.

1.2 ELECTRICAL CONNECTIONS: The CENTAUR amplifier draws up to 10A at 120 VAC. Care should be taken not to overload house circuits usually fused or breakered at 15 to 20 A.

1.3 TRANSCEIVER INTERCONNECTIONS: When using the CENTAUR with newer TEN-TEC transceivers with TX EN - TX OUT, follow the diagram in figure 1-1. The QSK-PTT switch on the CENTAUR should be in the QSK position for all modes of operation. This hookup arrangement will work with the OMNI-V, OMNI-VI and the PARAGON-I AND II. When connecting the CENTAUR to other transceivers, use the diagram in figure 1-2. Note that the key or keyer must be connected to the KEY IN jack on the CENTAUR, and that the line from the external T\R n.o. relay contacts on the transceiver must be connected to the PTT\VOX jack on the CENTAUR for proper SSB operation. When using this hookup system, the QSK-PTT switch on the CENTAUR must be in the QSK position for CW, and in the PTT position for SSB.

Today most solid state transceivers provide no connection for ALC input and it is entirely unnecessary to make any external ALC connection to these rigs. The ALC input jack is used primarily with tube-type transmitters/ transceivers with a negative going ALC system. The ALC ADJUST control is used to set the threshold for proper ALC action.

1-4 ANTENNA REQUIREMENTS: The CENTAUR amplifier is designed for use with antennas resonant at the frequency of operation and having impedances within the limits of 25 to 100 ohms, or an SWR of 2:1 or less.

The nominal output impedance of the amplifier is 50 ohms and the SWR of the load should not exceed 2:1. Many antennas exhibit an SWR in some part of a band that exceeds 2:1. For operation under this condition, we recommend using an antenna matching network that will enable the CENTAUR to work into a 50-ohm load for maximum power transfer to the antenna. TEN-TEC Models 229, 238 or 253 are suitable companion tuners.

CAUTION !!!

Never attempt to operate the CENTAUR without first connecting a suitable antenna or 50 ohm resistive load of sufficient power rating, or SERIOUS DAMAGE MAY RESULT.

1.5 GROUND CONNECTIONS: In the interest of personal safety, and to reduce the possibility of stray RF pickup on interconnecting cables, all station equipment should be well grounded to earth. It is important to strap all equipment chassis together with short, heavy leads.

1.6 HIGH POWER OPERATION: The CENTAUR amplifier operates very comfortably at a maximum of 600 watts output. The problem is that other components in your station may not. Before operating at this power level be certain to check the following items:

1. The coax from the CENTAUR to the feed point of your antennas must be top quality RG-58, RG-8X or larger. We recommend silver plated connectors rather than chrome plated connectors. Make sure that all coax connectors are tight (snug them up with a pair of pliers).

2. All coax switches or relays in the coax line must be rated at 600 watts or higher. NEVER ACTIVATE IN-LINE SWITCHES WHILE TRANSMITTING.

3. Verify that the components in your antennas are rated for the CENTAUR maximum RF power level (dipole center insulators, end insulators, etc.). Make sure that the radiating sections are well clear of metallic objects such as rain gutters and antenna supporting structures. For the first few hours of operation check the SWR frequently. Any increase in reflected power during transmission is a warning that something between the amplifier and the ends of the antenna elements, including end insulators, is heating and must be corrected.

4. A solid earth ground is essential. If you use an antenna tuner, make all SWR/matching adjustments with the CENTAUR in STAND-BY and use transceiver low power only.

5. If any of your home entertainment electronic devices have RF leaks, the CENTAUR will find them. The problem will develop because of fundamental overloading, rather than from spurious emissions or harmonics. If you are not familiar with the standard practices for controlling this type of interference, consult the ARRL Radio Frequency Interference Manual.

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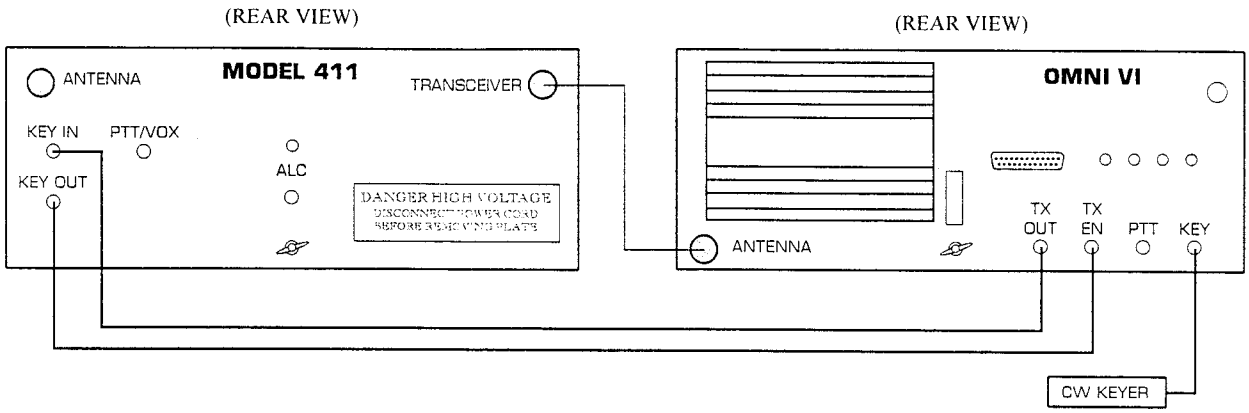
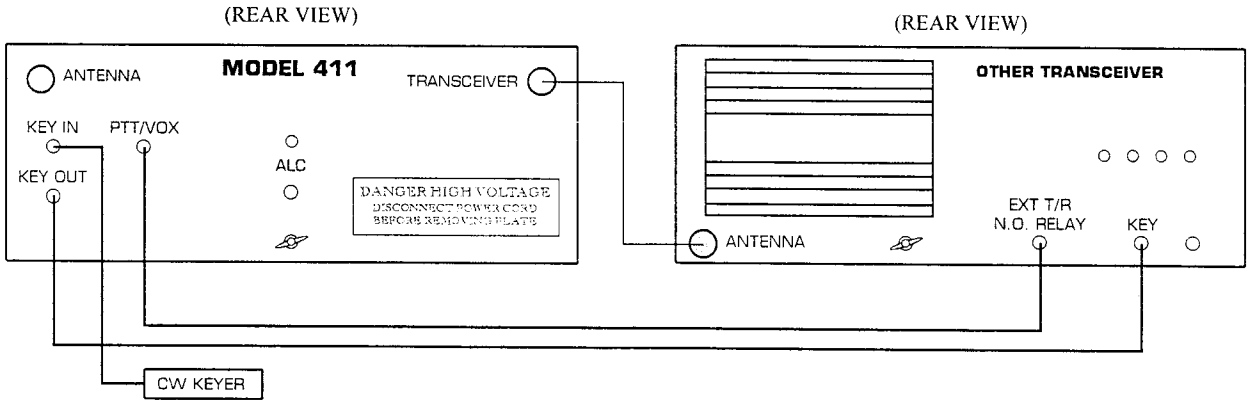
August, 1996



CONNECTIONS:

TEN-TEC TRANS.	MODEL 411
TX OUT	KEY IN
TX EN	KEY OUT
ANTENNA	TRANSCEIVER

FIGURE 1-1. T/R CONNECTIONS FOR TEN-TEC TRANSCEIVERS WITH TX OUT & TX EN



CONNECTIONS:

OTHER TRANS.	MODEL 411
KEY	KEY OUT
EXT. T/R N.O. RELAY	PTT/VOX
ANTENNA	TRANSCEIVER

FIGURE 1-2. T/R CONNECTIONS FOR OTHER TRANSCEIVERS

CHAPTER 2

OPERATING INSTRUCTIONS

2.1 INTRODUCTION: The following instructions will enable the operator to quickly place the CENTAUR in operation. Included are descriptions of the Front Panel controls and Rear Panel connections followed by a detailed Tune-Up procedure. Refer to CHAPTER 3 for further information and operating hints.

2.2 FRONT PANEL CONTROL FUNCTIONS: The Front Panel controls and their functions are described below.

2.2.1 BAND: This switch selects the desired frequency of operation. This is a six-position switch that covers the 160 through 10 meter bands. Note: A built-in switch stop prevents operation in the 10 and 12 meter bands. For 10 or 12 meter operation you MUST contact the factory for an authorized modification kit.

2.2.2 TUNE: This control adjusts variable capacitor C4 to provide resonance at the operating frequency. FIGURE 2-4 (page 2-7) shows the approximate settings for both the TUNE and LOAD controls on each band. Keep in mind that the settings in this chart are for operation into an ideal 50 ohm load. On page 2-8, there is a blank TUNE and LOAD Log Sheet that you can use to record the control settings for your antennas.

2.2.3 LOAD: This control adjusts variable capacitor C5 for the proper amplifier output loading. See the chart on p. 2-7.

2.2.4 POWER: This switch routes the AC line to the amplifier power supply. When ON, the amplifier will "power up" and the meter lamps should light.

2.2.5 OPR/STBY: This switch, when in the OPERATE position, places the amplifier online. When in STBY position, the amplifier is bypassed and only the transceiver power is routed to the antenna.

2.2.6 Ep-Ip: This switch, when in the Ep position, connects the right hand meter to the HV rectifier through a voltage dropping network to measure Plate voltage. When in the Ip position, the meter is connected in series with the HV B minus for monitoring plate current.

2.2.7 Ig-FWD: This switch, when in the Ig position, connects the left hand meter to the grid bias circuit for monitoring grid current. When in the FWD position, the meter is connected to the amplifier output for RF power measurement.

2.2.8 QSK-PTT: This switch, when in the QSK position, configures key circuits for CW/QSK operation. For late model TEN-TEC transceivers with TX EN and TX Out, this position is used for all modes of keying. When in the PTT position, the key circuits are configured for voice operation with other than TEN-TEC transceivers.

2.3 REAR PANEL CONNECTIONS AND CONTROLS: The Rear Panel connections and their functions and the ALC control are described below.

2.3.1 TRANSCEIVER: This is a standard SO-239 receptacle designed for a mating PL-259 plug. RG-58/U or similar 50 ohm coaxial cable is required to connect to the transceiver's antenna output jack.

"Great sounding rig! Must be a Ten-Tec."

All the Ten-Tec rigs that I've owned have excelled in audio. I owned a pair of (other brand) transceivers but Ten-Tec beats them in transmit audio - K4NTY

Great audio! Full, rich, natural! - K4TEN

Good audio quality and it sounds like my natural voice - K6WLM

Excellent audio. I was working a station in Puerto Rico and he stopped the calling stations and asked me what I was running. I told him the Jupiter and he said "I should have known it was a Ten-Tec." - WD4PG

I'm confident that I will have the best signal I can possibly produce! – W1RGO

TEN-TEC

I am amazed how clean and clear I sound – W4WUQ

Very well balanced audio; natural sounding, pleasing to listen to. One of the best sounding rigs on the band. Well rounded with clarity. – KA4ICK

I get great unsolicited audio reports with the Ten-Tec Orion – WA8VSJ

Hearing is everything.

What separates one rig from another? The way they sound on the air. When you hear quality SSB transmit audio, you know it's Ten-Tec. No one matches our combination of great audio, ease of use, and receiver performance. Visit our webpage at radio.tentec.com/videos/howto and see an audio and video demo on Ten-Tec transceiver transmit audio! For complete information on our HF transceiver line, visit our website or call (800) 833-7373.

Proudly made in Sevierville, Tennessee USA

www.tentec.com

1185 Dolly Parton Pkwy., Sevierville, TN 37862. Sales: 800-833-7373 M-F 8:00-5:30 (Eastern Time) sales@tentec.com. Office: (865) 453-7172. FAX: (865) 428-4483.
Service: (865) 428-0364 M-F 8:00-5:00 (Eastern Time), service@tentec.com. We accept Visa, MC, American Express and Discover.

2.3.2 ANTENNA: This is a standard SO-239 receptacle designed for a mating PL-259 plug. RG-58/U or similar 50 ohm coaxial cable rated for 1 kW must be used to connect to the antenna system.

2.3.3 KEY IN: This jack controls the CENTAUR transmit/receive relay system. When used with all late model TEN-TEC radios, this jack is connected to the TX OUT connector on the transceiver. When used with other transceivers, a key or keyer is plugged into this jack.

2.3.4 KEY OUT: When used with all late model TEN-TEC radios this jack is connected to the TX EN jack on the transceiver. When used with other transceivers, this jack is connected to the transceiver KEY input jack.

2.3.5 PTT/VOX: When used with other than late-model TEC-TEC transceivers, this jack is connected to the N.O. contacts of the relay key out jack of the transceiver (Not used with OMNI V, OMNI VI or PARAGON).

2.3.6 ALC: This jack provides a negative going ALC, used primarily with tube-type transceivers.

2.3.7 ALC CONTROL: This control adjusts the threshold of the ALC voltage for proper ALC action.

2.3.8 AC LINE: This cable is connected to standard 120 VAC. Be sure that the AC line you use for powering the CENTAUR is capable of providing at least 15 amperes of current at 120 VAC, and that it is protected with either a fuse or circuit breaker of at least a 15 ampere rating.

2.4 INITIAL TURN-ON: The following steps should be followed when turning on your CENTAUR.

A) Set METER switch to the Ep position.

B) Place the POWER switch to ON. If any of the following do not occur, press OFF at once and investigate before proceeding.

1) The meter should read approximately 1800 volts DC.

2) The meter lamps should illuminate.

3) The blower should start, and exhaust air should be detectable from the right side of the top cover.

4) The plate-current meter should continue to read zero.

2.5 TUNE UP PROCEDURE: The following sections describe important points to observe during tune up. A suggested procedure for safely tuning up the CENTAUR is included.

2.5.1 CHECKS TO MAKE BEFORE TUNING UP: Check the load connected to the CENTAUR. This can best be done by leaving the CENTAUR in the STANDBY mode and using only the transceiver output power. Use a reliable SWR bridge or wattmeter to determine the SWR of the load (antenna) connected to the amplifier output. If the reflected power is less than 10% of the forward power, the VSWR is less than 2:1. If the reflected power is 4% or less, then the VSWR is 1.5:1 or lower. A VSWR of 2:1 or less is required.

2.5.2 IMPORTANT POINTS TO REMEMBER: The most critical parameter to observe during tune up is the grid current of the power tubes. Excess grid current, even for a relatively short period of time, can and will destroy the tubes. If grid current limits are not exceeded, the 811A tubes will deliver many years of trouble free service. In the CENTAUR amplifier, the grid

current should not exceed 150 mA under normal CW/SSTV/RTTY conditions, nor should the grid current peak swings ever exceed 75 mA during SSB voice modulation. If the grid current reaches these limits before the desired value of plate current is obtained, the drive should NOT be increased further.

WARNING!! Do not allow the plate current to exceed 550 milliamperes for more than 5 seconds. Do not allow the grid current to exceed 150 mA.

2.5.3 SUGGESTED TUNE UP PROCEDURE: Following is the recommended procedure for safe and proper tune up of the CENTAUR.

A) Set the BAND switch for the desired operating frequency.

B) Set the METER switch to the IG position. Always monitor the grid current, while using the multimeter. Use FWD temporarily for FWD power peaking.

C) For initial tune up you can set the TUNE and LOAD controls in the center of their ranges. Alternately, you can refer to the suggested set tings for each band shown in FIGURE 2-4. Keep in mind that these settings are for operation into an ideal 50 ohm load.

D) Turn the transceiver drive or RF output control to minimum.

E) Place the OPR/STBY switch in the OPERATE position.

IF AT ANY TIME YOUR AMPLIFIER DOES NOT RESPOND AS EXPECTED, REMOVE DRIVE IMMEDIATELY AND CORRECT THE PROBLEM BEFORE CONTINUING.

F) Key the transceiver and slowly increase the drive power until you see the plate current increase.

NOTE: For a quicker and easier way to tune up the amplifier, use a keyer at approximately 30 wpm in step F.

G) Adjust the TUNE control for a dip in plate current (Ip). Next adjust the LOAD control for maximum amplifier output power and minimum grid current. You will find that these values are not always synchronized. Always choose the lower grid current adjustment even if the power output is slightly less. Readjust the TUNE control for a plate-current dip each time you adjust the LOAD control. There will be some interaction between these controls.

H) Gradually increase the drive level from the transceiver until you obtain the desired amplifier power output and plate current while carefully touching up the LOAD and TUNE controls for minimum grid current and maximum output power.

I) Once you have the amplifier tuned up and operating on the desired frequency, you can log the LOAD and TUNE settings in the chart provided on page 2-8. These settings will be repeatable for the same frequency, antenna and SWR when used in the future.

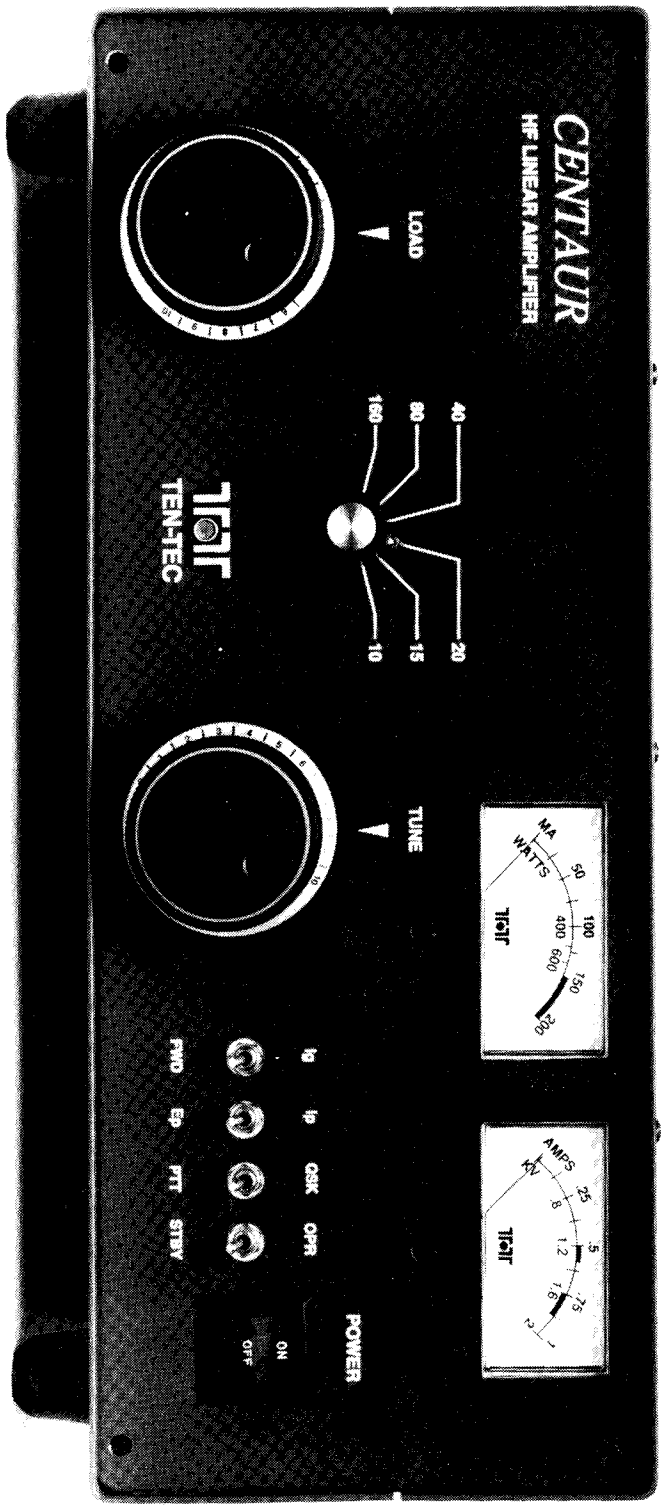


FIGURE 2-1. MODEL 411 FRONT PANEL

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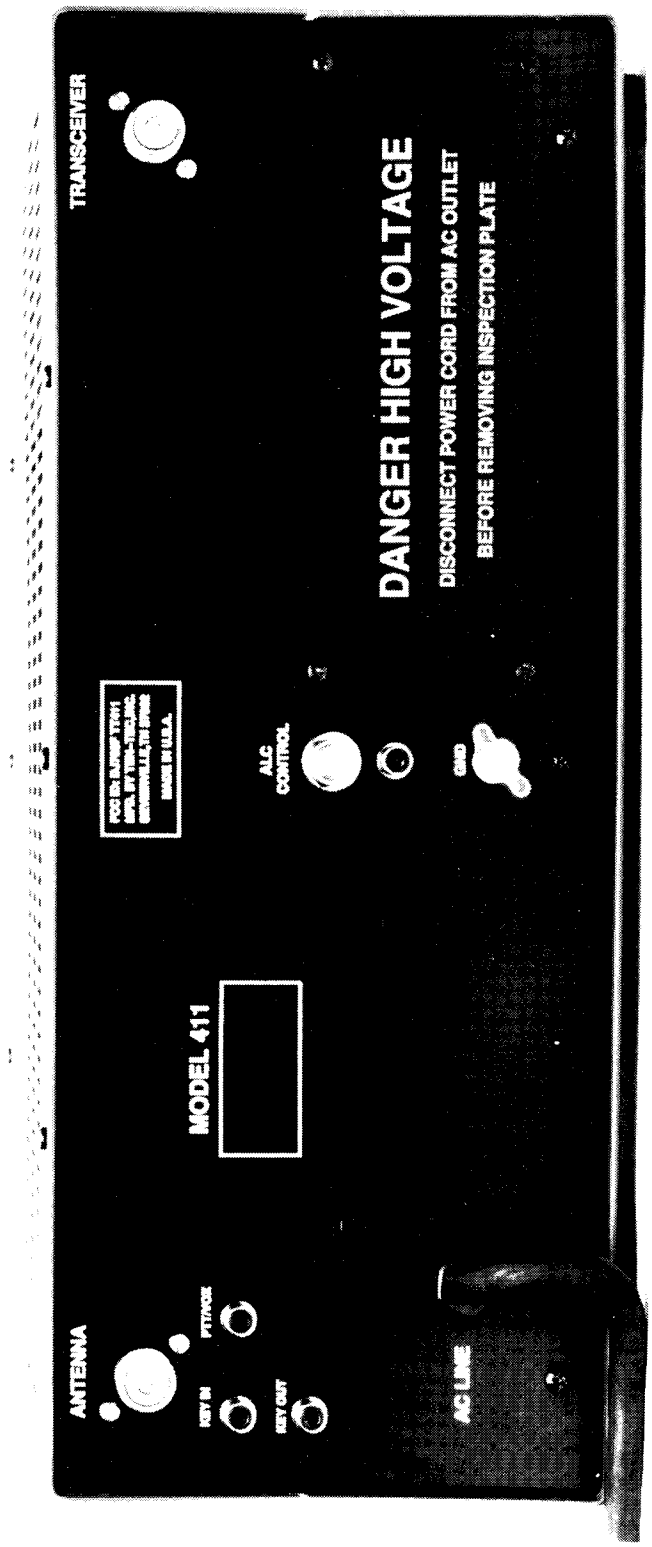


FIGURE 2-2. MODEL 411 REAR PANEL

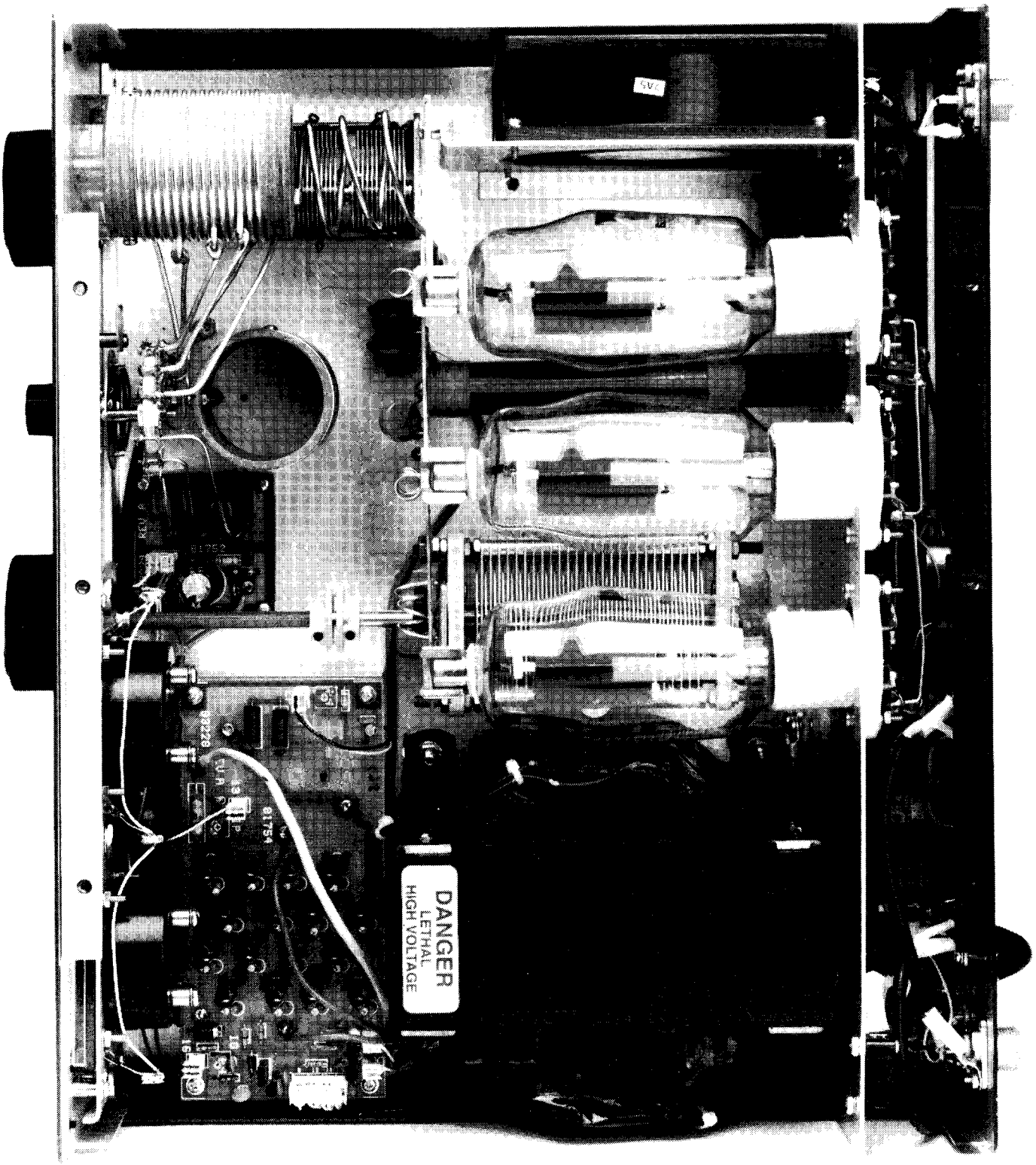


FIGURE 2-3. MODEL 411 TOP VIEW

BAND	FREQ-MHz	LOAD	TUNE	
160 METERS	1.800	8.5	8	
	1.900	1	1	
80 METERS	3.500	6	5	
75 METERS	4.000	1	3	
40 METERS	7.000	7	2.5	
	7.300	6	2	
30 METERS	10.000	10	1	
20 METERS	14.000	6.5	2	
	14.350	5	2	
17 METERS	18.000	7	2	
	21.000	6	2	
15 METERS	21.450	6	2	
12 METERS	24.900	7	1.5	
10 METERS	28.500	4	2	
	29.000	4	1.5	
	29.700	4	1.5	

FIGURE 2-4. MODEL 411 TUNING CHART FOR AN IDEAL 50 OHM LOAD.

BAND	FREQUENCY	LOAD	TUNE	ANTENNA	NOTES

FIGURE 2-5. MODEL 411 TUNING LOG

CHAPTER 3

OPERATING HINTS

3.1 INTRODUCTION: The following paragraphs provide additional information for getting the best performance from your CENTAUR amplifier.

3.1.1 TUBES: The 811A triode tubes are very rugged and normally operate with a large margin of safety in the CENTAUR amplifier. They will deliver outstanding service for many years if not damaged by abuse – especially excessive grid current (which leads to excessive grid dissipation) or blockage of the cooling airflow, causing envelope heating and possible seal failure.

KEEP THE AIR INTAKE AND EXHAUST VENT AREAS COMPLETELY CLEAR!

WARNING!!! DO NOT ALLOW the PLATE CURRENT to ever exceed 550 milliamperes for more than 5 seconds.

DO NOT ALLOW the GRID CURRENT to ever exceed 150 mA.

3.1.2 INTERLOCKS: The CENTAUR is equipped with interlock switches intended to shut off the power and to short out the high voltage power supply when the cabinet cover is not securely fastened in place. These protective interlocks are provided to protect you from a **POTENTIALLY FATAL ELECTRIC SHOCK** resulting from accidental contact with lethal voltages inside the amplifier cabinet. **HOWEVER**, you should <u>never</u> depend on the interlock switches alone to protect you by removing dangerous voltages.

ALWAYS DISCONNECT THE AC LINE CABLE TO THE CENTAUR AMPLIFIER BEFORE REMOVING THE TOP COVER.

W A R N I N G !!

The amplifier **SHOULD NEVER BE ENERGIZED WITH THE COVER REMOVED** except by thoroughly knowledgeable service personnel!
DO NOT DEFEAT THE INTERLOCK SWITCH!

3.1.3 FUSES: Except in rare instances of component failure, blowing one or both primary line fuses indicates that the maximum safe average power capability of the amplifier has been exceeded.

3.1.4 TRANSFORMER RATINGS: The transformer used in the CENTAUR is rated at 1.5 KVA CCS (continuous commercial service). It weighs 21 lbs. The weight of a transformer is directly proportional to the capacity of the transformer. A 15 pound transformer of the same type may be rated higher by another manufacturer but only if different standards are applied, such as "heat rise". Just for comparison, if our transformer were rated for IVS (intermittent voice service) or SSB operation only, it would be a 3 KVA unit. In summary, the CENTAUR power supply is more than adequate.

3.1.5 OPERATION ON 120 VAC: The CENTAUR is normally shipped from the factory wired for operation on 120 VAC. The power supplies in the CENTAUR can be

modified for operation on 240 VAC. To change the CENTAUR for operation on 240 VAC you will need the following tools:

1 - medium size phillips screwdriver
1 - short straight blade screwdriver
1 - pair long nose pliers

To perform the modification refer to Figure 3-1 and proceed as follows:

A) Make sure that the AC line cord is unplugged and that all other cables are disconnected.

B) Remove the rear inspection plate of the CENTAUR amplifier. This cover is secured with four screws.

C) Locate the 81751 Input Board. There should be two jumper wires already installed on the terminal block at the top of this board. For 120-VAC operation, terminals 1-4 and 2-5 are jumpered.

D) Remove the jumper connecting 1 and 4. This jumper is not used for 240 VAC operation.

E) Move the connector at terminal 5 to terminal 4. This jumper should now join terminals 2 and 4.

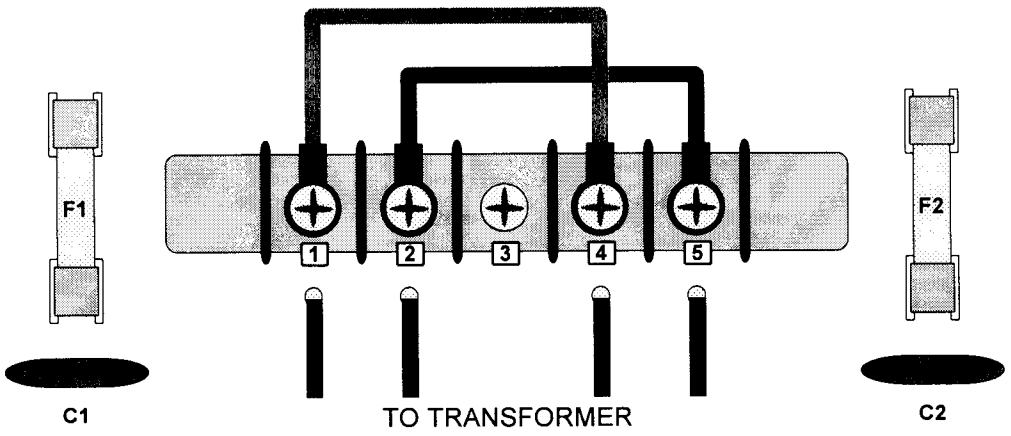
F) Tighten all screws.

G) Replace the two (2) 12 A fuses (located in the fuseholders) with 6A fuses (not supplied).

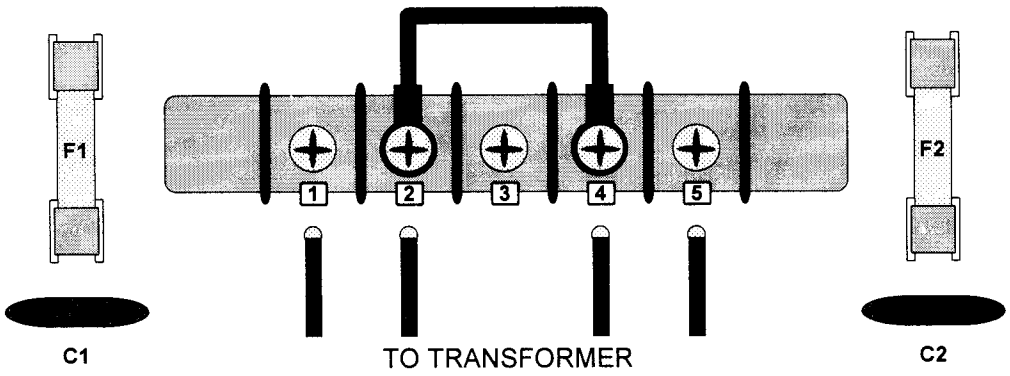
H) Replace the inspection plate and secure with the screws removed previously.

3.1.6 AMPLIFIER CONTROL FROM TRANSCEIVER: The external relay-control line in most transceivers, other than those manufactured by TEN-TEC, is accessible at the rear apron of those transceivers. This line is used to actuate the T-R relays in most amplifiers during VOX or PTT operation. If you do not intend to operate full break-in with the CENTAUR amplifier you may choose the PTT/VOX or the KEY-IN jacks at the rear of the CENTAUR for connection to your other-brand transceiver. The PTT circuit in the CENTAUR has -1.5 volts present until key-down. Also it exhibits a DC resistance to ground until the line is keyed. This may cause a malfunction of certain other equipment being activated from the external-relay line, such as the W1FB QRN Squasher or similar commercial units.

The CENTAUR PTT/VOX jack/control circuit may be used for amplifier control (panel switch in PTT position) if only the amplifier T-R circuit is being actuated by the transceiver. However, the CENTAUR KEY-IN jack may be preferred for non-QSK operation (panel switch in QSK position). This circuit uses two diodes that ensure zero voltage and infinite DC resistance at the KEY-IN jack. Positive voltages, present on external equipment control lines that may also be keyed in parallel with the KEY-IN line, cannot pass through the two internal gating diodes to cause possible damage to the CENTAUR T-R circuits.



120 VAC WIRING



240 VAC WIRING

FIGURE 3-1. WIRING CHANGE FOR 240 VAC OPERATION

CHAPTER 4

TROUBLESHOOTING

4.1 INTRODUCTION: If you encounter a problem, the troubleshooting hints listed in table 4-1 below will help isolate the nature of the problem.

4.2 MAINTENANCE: The amplifier compartment, particularly the areas around the high-voltage components and the RF compartment, should be cleaned frequently. Use a soft bristle brush and vacuum cleaner to remove any accumulation of dust.

DO NOT blow air directly into the fan blades: You can over-rev the fan and damage the bearings. If extremely dusty conditions prevail, it may be advisable to secure a thin plastic foam air filter (of the type commonly used in air conditioners) across the air inlet on the left hand side of the amplifier. Make sure the filter does not restrict the air flow into the amplifier.

FIGURE 4-1 TROUBLESHOOTING HINTS

SYMPTOM	POSSIBLE CAUSE/CURE
1) Unit will not turn on; nothing happens when the POWER-ON switch is pressed.	A) Blown AC line fuse. B) Interlock switch open, top cover not on tight C) House wiring incorrect or breaker open.
2) Meter lamps light but no high voltage is indicated on HV meter.	A) Defective meter. **CAUTION: Never trust high voltage indicators! There may still be high voltage present in the amplifier.** B) Ep/Ip switch in wrong position.
3) Line fuses blow immediately at turn on	A) High voltage short, at crowbar, a shorted tube, diode bridge or filter capacitor.
4) Amplifier won't drive. Zero grid and plate current.	A) Input cable shorted. B) Input filter board loose (81550).
5) Amplifier drives with high plate current but no RF output indicated on meter.	A) Band switch in wrong position. B) Shorted output coax line. C) Defective meter.
6) Distorted output with possible TVI.	A) Arcing in antenna, coax or balun connections. B) Defective bias circuit.
7) High plate current in receive mode.	A) Shorted D22 on HV/bias board (81754). B) Defective bias circuit.
8) High input SWR indicated by transceiver.	A) Input cable shorted. B) Input filter board loose (81550). C) Defective bias circuit (81754).

CHAPTER 5

CIRCUIT DESCRIPTIONS AND ILLUSTRATIONS

5.1 INTRODUCTION: The following sections contain detailed circuit descriptions for all of the printed circuit board subassemblies used in the Model 411 Linear Amplifier. Also included are circuit trace drawings and detailed component layout diagrams. These drawings are followed by schematic diagrams for each circuit board subassembly. In addition, there is an overall wiring diagram for the Model 411 Amplifier.

5.2 INPUT BOARD: This board contains both AC-line input and RF-input circuits.

AC-line inputs are routed through fuses, then to interlock switches and the main power switch to a terminal block that allows selecting AC-line configurations of either 120 or 240 VAC operation. Capacitors C1 and C2 bypass the AC line to help prevent unwanted RF energy from entering the AC power cord and the mains.

RF energy from the transceiver enters the board at J-19 and is switched by Relay 1, either to the input of the amplifier or around the amplifier directly to the antenna. When switched to the amplifier input, the RF energy passes through a low pass filter and impedance-matching network 81550 and R1. This matching network consists of a 25-W load resistor and a capacitive divider in the tube cathode circuit. This network ensures a low input SWR on all bands without the need for the common band-switched L-C matching networks found in other amplifiers. The low input SWR enables SWR-protected solid-state transmitters and transceivers to deliver full recommended driving power to the CENTAUR amplifier.

The 81550 board must be replaced for operation on 10 meters. Modification to the plate-tank circuit is also required. Contact our factory service department for a replacement board and detailed modification instructions.

5.3 15M INPUT FILTER BOARD (81550): This board contains the standard factory supplied 15 meter low-pass filter circuit. This is a five pole elliptic filter consisting of L1, L2, L3, C1, C2, and C3. This filter provides increased attenuation at frequencies above the 15 meter band.

5.4 POWER AMPLIFIER TUBES: The CENTAUR linear amplifier uses three 811A glass envelope tubes. These tubes are compact power triodes intended for use as cathode-driven Class-AB2 amplifiers in RF applications. They exhibit high gain with low intermodulation distortion characteristics. They are very rugged and will deliver outstanding service for many years if not damaged by abuse – especially excessive grid current (which leads to excessive grid dissipation). Care must also be taken not to block or restrict the cooling air flow to the tubes.

KEEP THE AIR INTAKE AND EXHAUST VENT AREAS COMPLETELY CLEAR

Failure to observe this precaution can lead to anode overheating and possible seal failure. The tube grids are the weakest points in the system. Excess drive power always causes elevated grid current to flow. Either reduce the drive or increase the loading to take advantage of the extra drive to produce more output power.

STANDARD OF COMPARISON

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For 35 years, Ten-Tec has been the development pioneer in amateur radio. Our long tradition of 'firsts' continues into the 21st century with the Orion, Jupiter and our other transceivers plus a superb line of accessories. Come and see for yourself why more and more amateurs are choosing us over the competition.

ORION
$3,300

The New Standard in HF Performance!

MADE IN USA

This sophisticated HF transceiver uses a combination of selectable I-F roofing filters and DSP filtering to deliver unparalleled performance. ORION features dual 32-bit Analog Devices SHARC DSP's, high dynamic range and third order intercept numbers at very close signal spacing, two completely independent receivers, 3 antenna connectors, programmable AGC, Panoramic Stereo receive, real-time spectrum scope, 590 built-in DSP bandwidth filters, DSP noise reduction and voice and CW keyers. Flash-ROM upgradeable; download the latest version of the radio at any time from our website. The serious weak signal DXer and contester has all the tools necessary to hear and work the weak ones, even in the presence of the loudest signals. No other transceiver can top it!

JUPITER
$1,269

Awesome Audio—Superb RX Performance

MADE IN USA

ORION'S little brother is JUPITER, and it shares some of the same DSP receiver circuitry used in the ORION. JUPITER is the standard for great sounding audio on the HF bands. 18 selectable SSB transmit bandwidths to a maximum of 3.9 kHz deliver the finest sounding audio in amateur radio. Connect your favorite microphone and listen to the compliments roll in. On the receive side, 90 dB of dynamic range, 34 built-in receive filters, DSP noise reduction and DSP auto notch allow the operator maximum flexibility for suppression of offending QRM. Like Orion, Jupiter is Flash-ROM upgradeable; download the latest version of the radio at any time from our website. Jupiter owners everywhere were ready for 60 meters the day the band opened!

Looking for a compact, low power rig with great receiver performance? ARGONAUT V at $795 fits the bill. Call us or see our website for more information

TEN-TEC

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Monday - Friday 8:00 - 5:30 EST • *We accept VISA, Mastercard, Discover, and American Express*
Office: (865) 453-7172 • FAX: (865) 428-4483 • Repair Dept.: (865) 428-0364 (8 - 5 EST)
Shipping is additional. TN residents add 9.5% TN sales tax.

WARNING!! Do not allow the plate current to exceed 550 milliamperes for more than 5 seconds. Do not allow the grid current to exceed 150 mA.

The manufacturer's **absolute maximum ratings** for three 811As in AB2 service are:

DC PLATE VOLTAGE:	+1800V
DC PLATE CURRENT: (single tone)	550 mA
PLATE DISSIPATION:	195 WATTS
GRID CURRENT:	150 mA

Listed below is the pinout of an 811A tube:

Pin no. 1	-	FILAMENT
Pin no. 2	-	N/C
Pin no. 3	-	GRID
Pin no. 4	-	FILAMENT
Cap	-	Plate (anode)

5.5 HV POWER SUPPLY & BIAS MODULE (81752 AND 81754): The 81754 board contains the HV bridge rectifier, grid bias circuit and relay controls. Diodes D1 - D16 rectify the HV AC from the transformer to supply 1800 VDC to the tube plates. Filter Board (81753) supplies the HV filtering via C14 - C18. R25 - R27 form a voltage divider to sample the HV at a level acceptable for the HV meter on the front panel. This level is adjusted by R28 to read 1800 V at no load.

Q2 and Q3 develop the relay control voltage sent to the input and output relays during key down. C21 tailors this voltage to keep the relays closed after the transceiver is unkeyed to insure the input RF energy is removed before the relays open.

Q1, Q4 and D20 pull the grid bias to operating level on key down. R31 connects the grids to +14 DC to cutoff the tube bias on key up.

In the event of a HV short to ground, D22 provides a current path to the negative side of the HV bridge rectifier, thereby protecting the bias circuit from excessive currents.

R29 and R30 provide plate current sampling. This circuit is adjusted for 550 mA with 0.55 volt applied across R30.

R35 and R36 provide Grid current sampling. This circuit is adjusted to 150 mA with 495 mV applied across R35.

5.6 OUTPUT BOARD 81750: This board contains the output antenna switching and key out circuits. Relay 2 switches the antenna to the output of the amplifier on key down, and to the input relay on the input board (81751) on key up. In addition, Relay 2 provides a ground path for Relay 3 on key down. This ensures closure of Relay 2 before the transceiver is keyed. After all relay closures and bias circuits are in the transmit mode, Relay 3 closes and gives a 47 ohm key down state to the transceiver through the key-out jack on the rear panel. Q1 and Q2 are part of the tailoring circuit described in 5.5 to ensure hot-switch protection.

L3, D2 and R3 provide RF output sampling for the FWD Power meter. This is adjusted via R3 during comparison to an external wattmeter connected to a 50 ohm resistive load.

5.7 LOAD CAP SHUNT BOARD (81752): This board contains shunt capacitance for the board capacitor.

C1 - C4 are factory selected and may vary in individual values. The total value will be approximately 1830 pF. This value is switched in parallel with the LOAD capacitor on 160M only.

C5 - C8 are factory selected to total 820 pF. They are paralleled with the LOAD capacitor on 80 and 160M.

C9 - C11 are factory selected to total 400 pF and are paralleled with the LOAD capacitor on 40, 80 and 160M.

5.8 PLATE CONNECTOR BOARD (81755): This board is used to route the high voltage DC to the plates of triode tubes V1, V2 and V3. High voltage DC through the plate choke, RFC1, is applied to terminal K. R1/L1, R2/L2 and R3/L3 parallel combinations are connected between the high voltage DC bus and the tube plate connectors of V1, V2, and V3, respectively. These components act as parasitic suppressors in the plate circuit of the tubes. RF power from the plates of V1, V2 and V3 is coupled through C1 and C2 to the TUNE capacitor, C4, via terminal L.

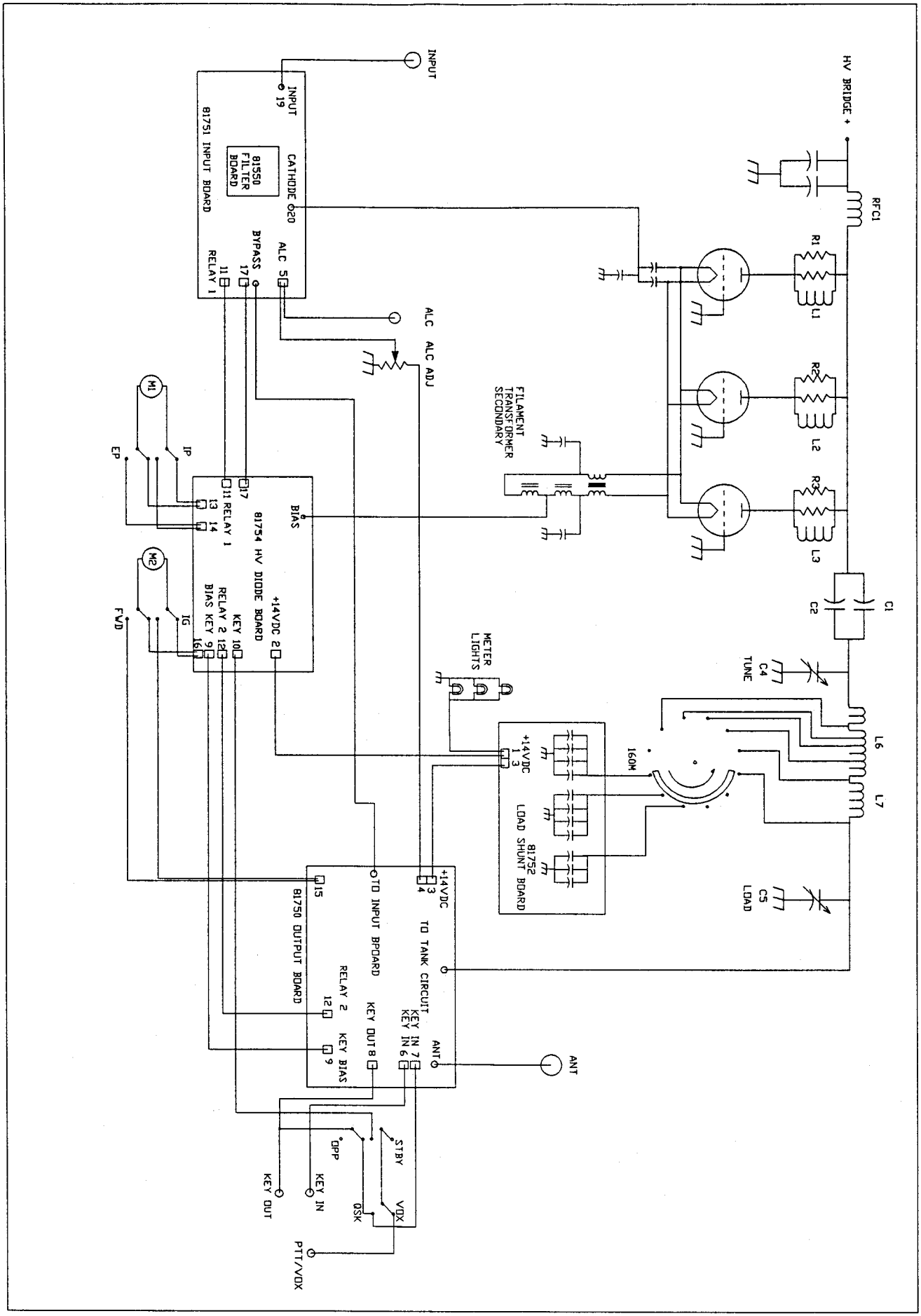


FIGURE 5 - 1 MAIN WIRING DIAGRAM FOR MODEL 411

Part No. 74400
August, 1996

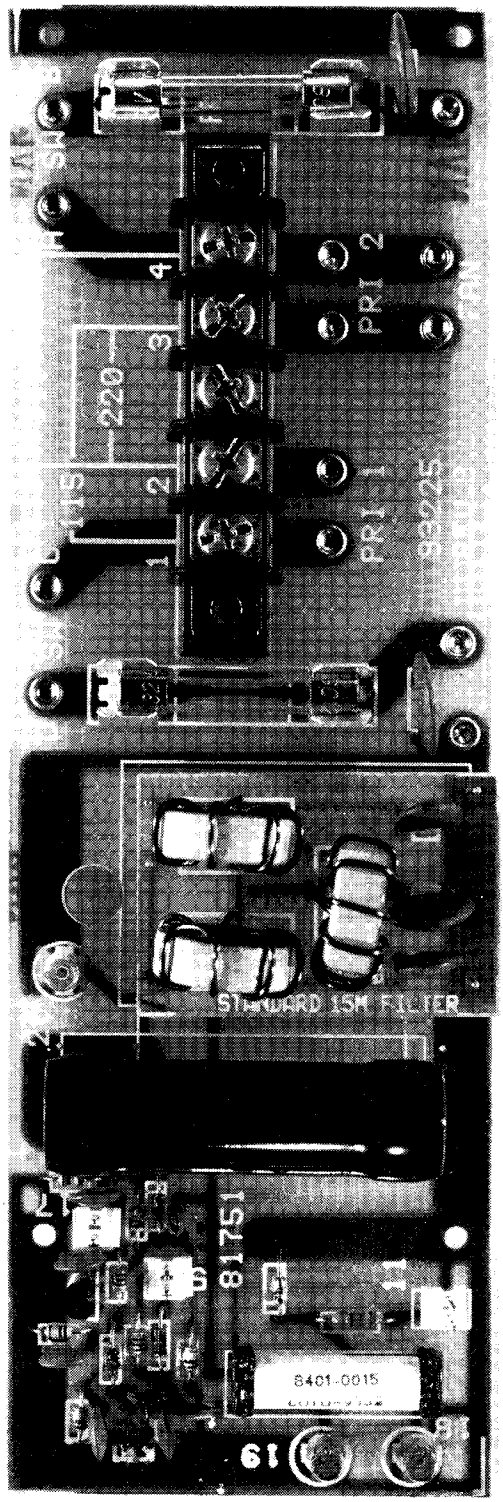


FIGURE 5 - 2 INPUT BOARD (81751)

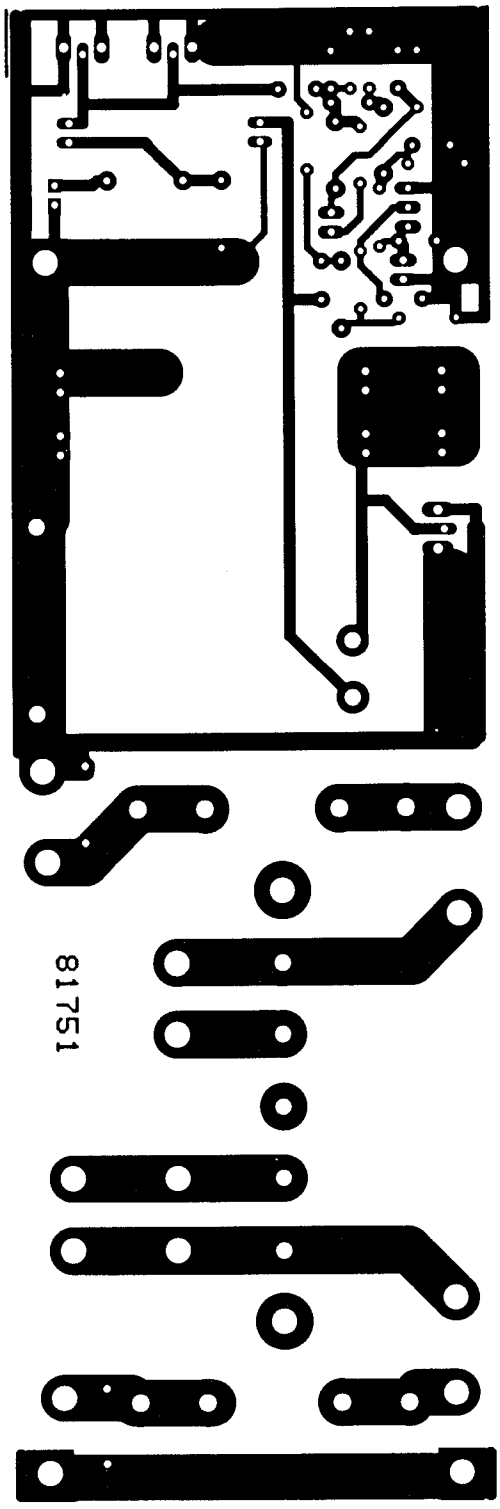


FIGURE 5 - 3 INPUT BOARD CIRCUIT TRACE (81751)

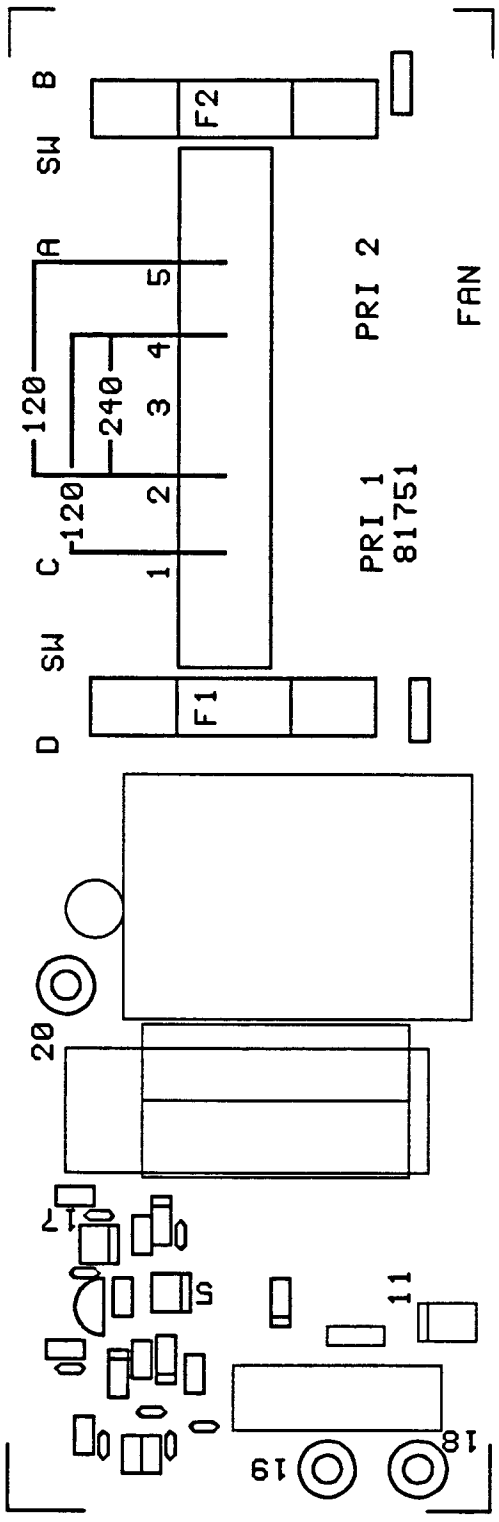


FIGURE 5 - 4 INPUT BOARD COMPONENT LAYOUT (81751)

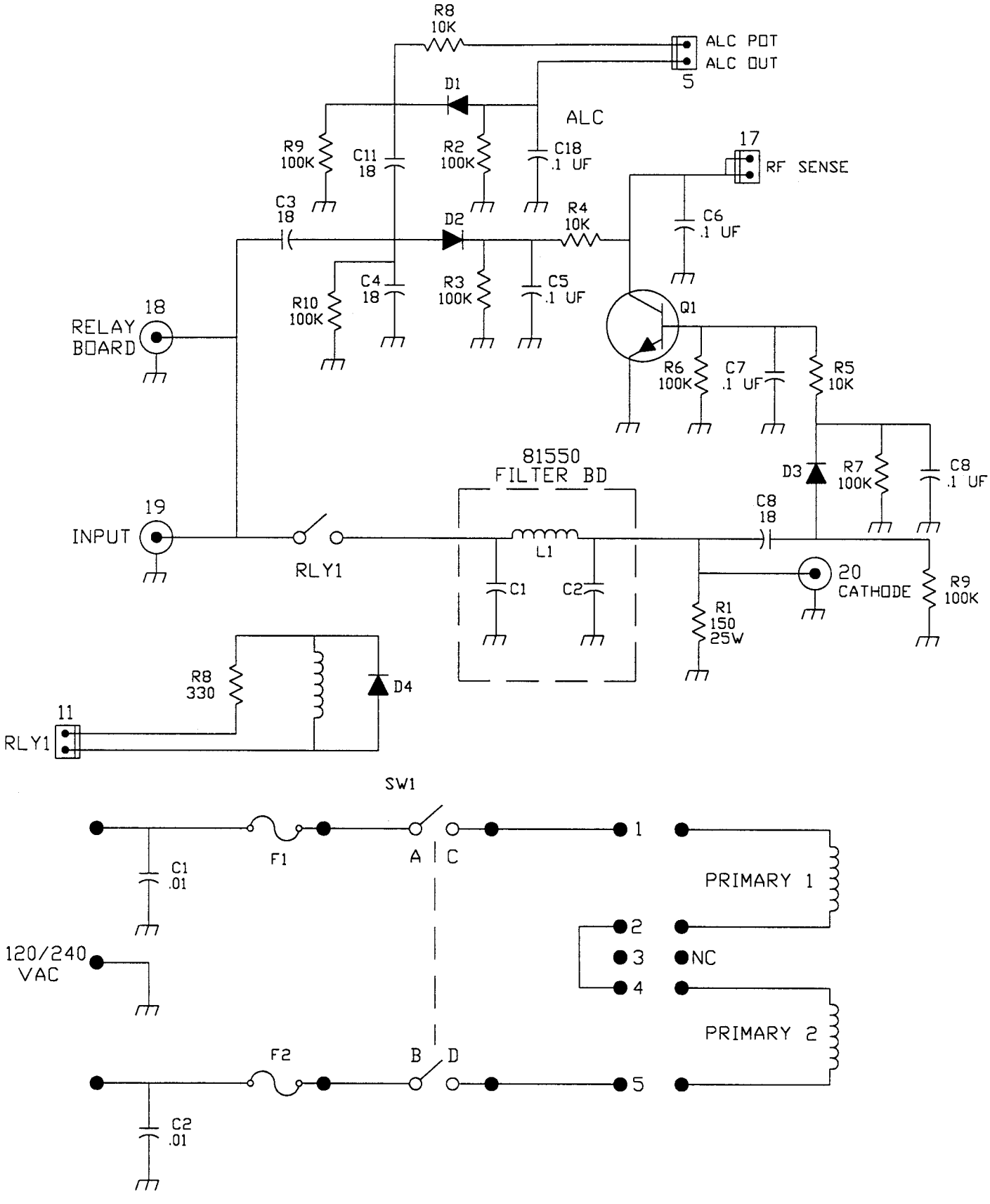


FIGURE 5 - 5 INPUT BOARD SCHEMATIC (81751)

Part No. 74400
August, 1996

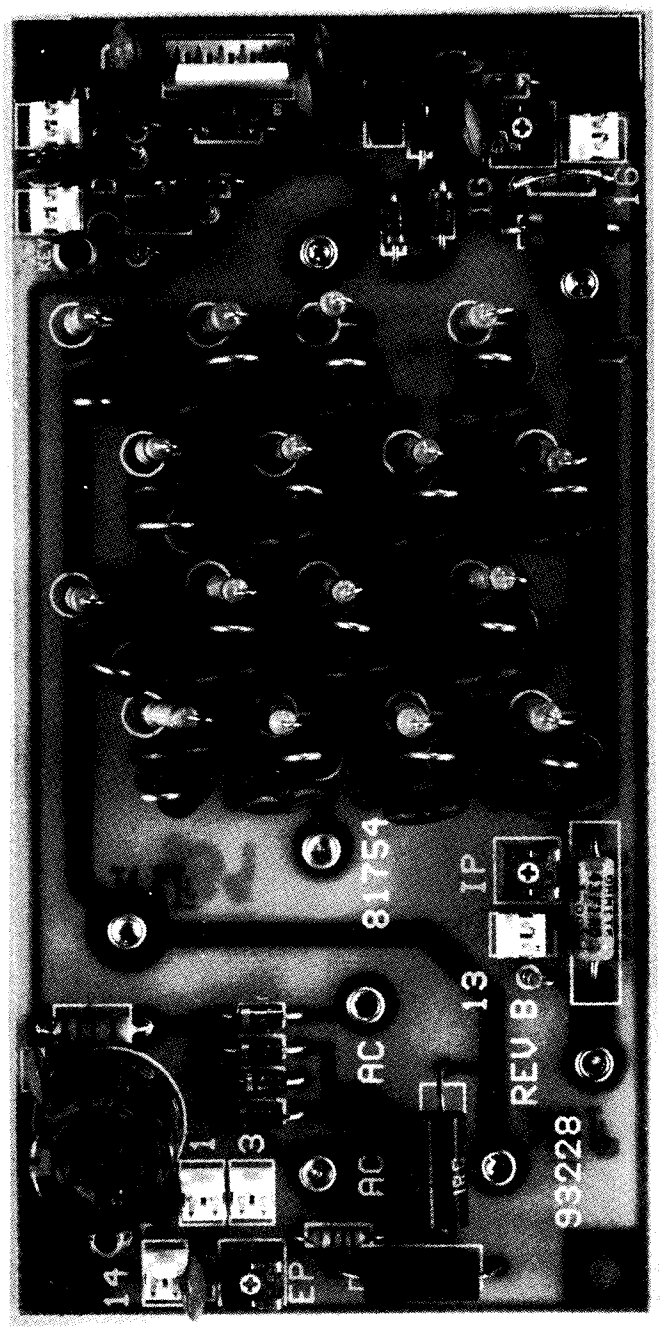


FIGURE 5 - 6 HV RECTIFIER BOARD (81754)

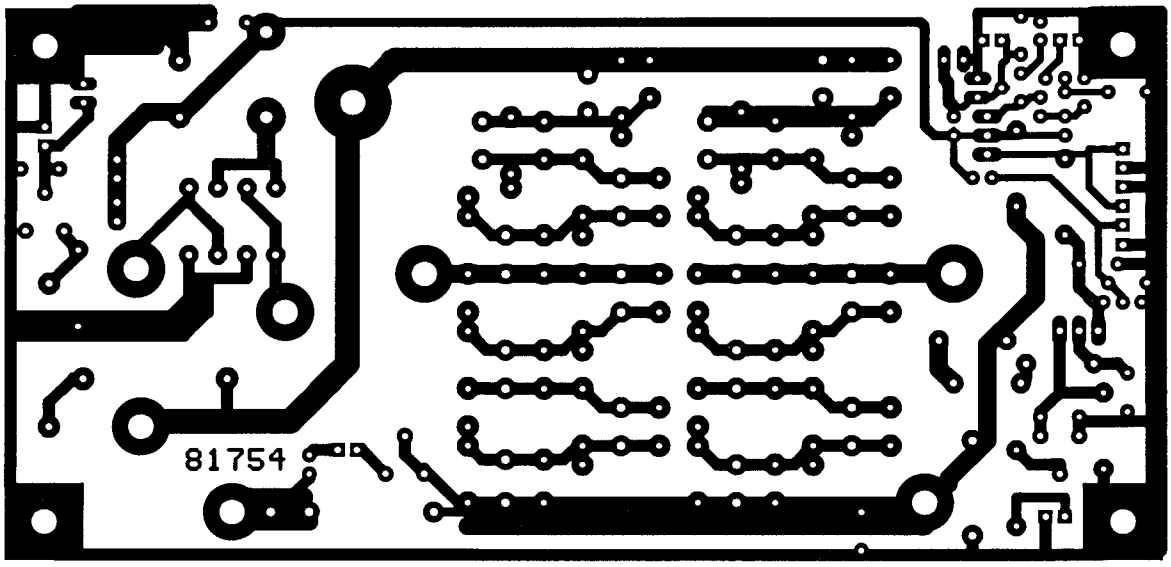


FIGURE 5 - 7 HV RECTIFIER BOARD CIRCUIT TRACE (81754)

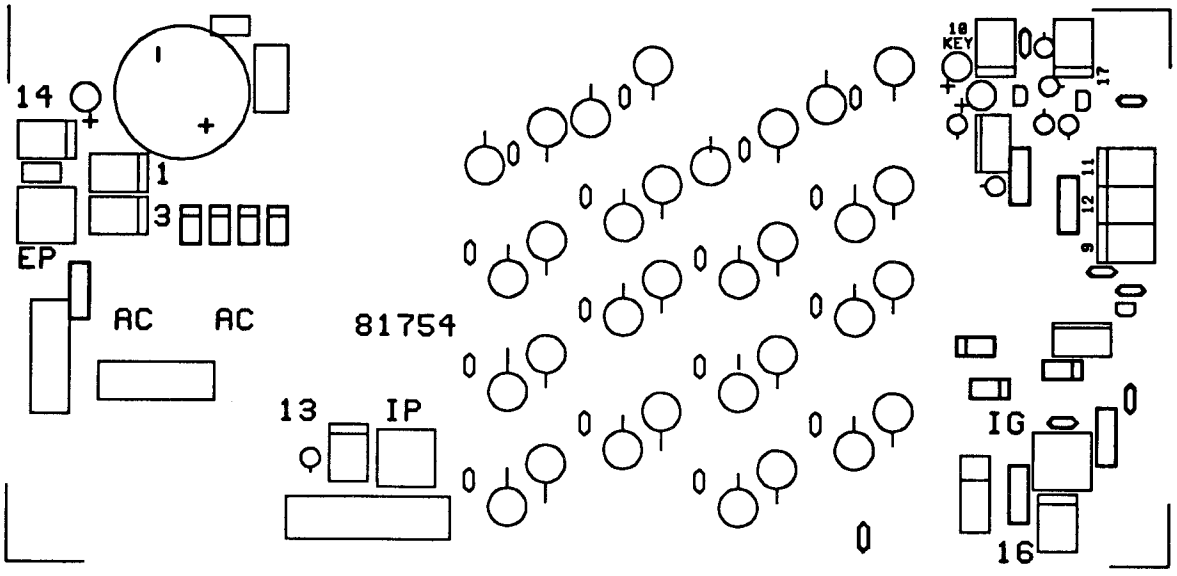


FIGURE 5 - 8 HV RECTIFIER BOARD COMPONENT LAYOUT (81754)

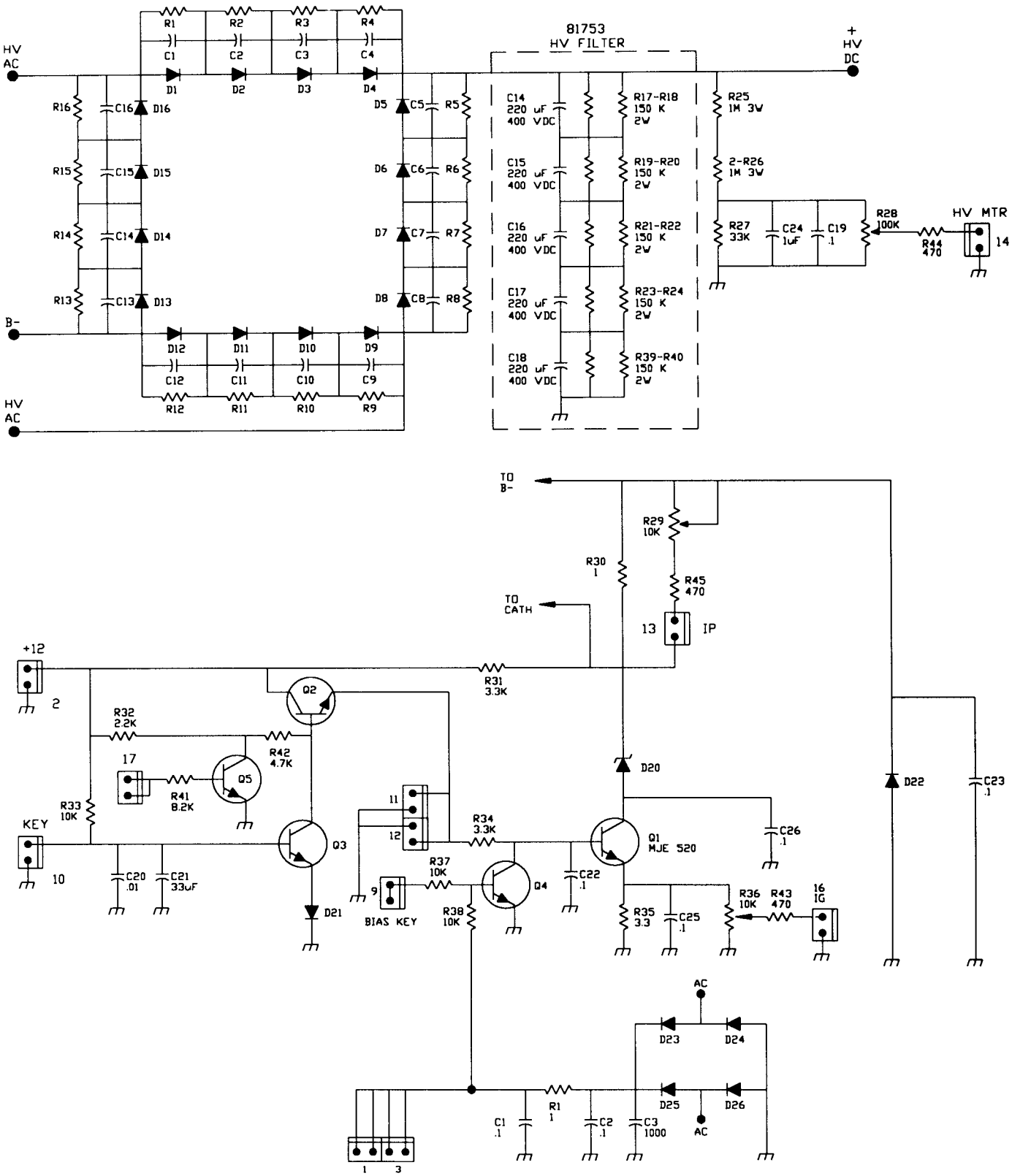


FIGURE 5 - 9 HV RECTIFIER BOARD SCHEMATIC (81754)

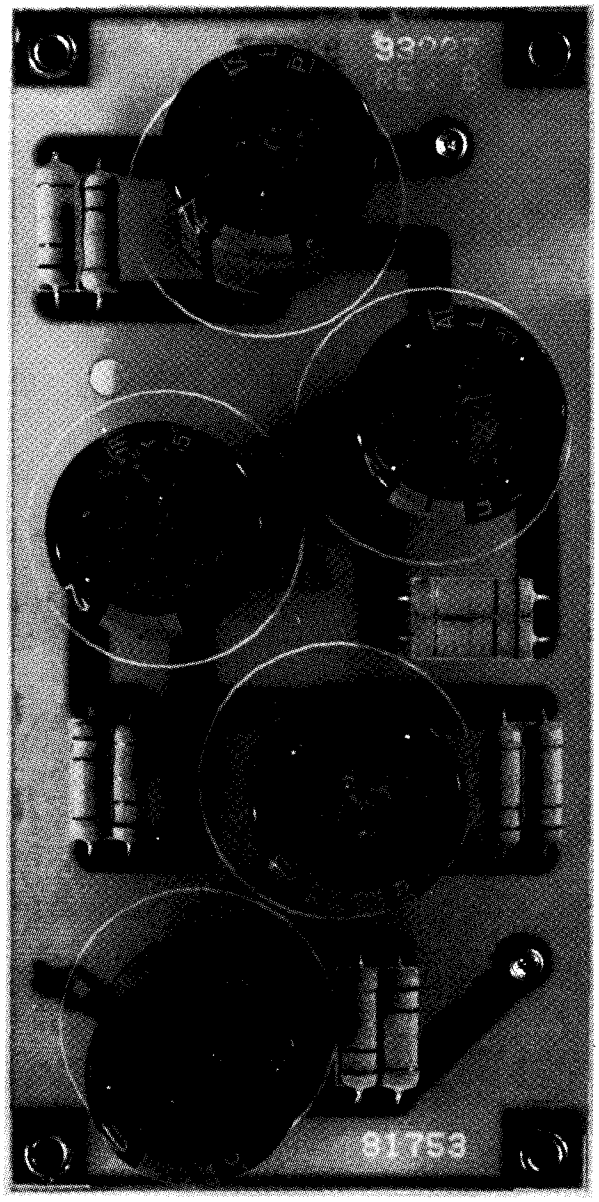


FIGURE 5 - 10 HV FILTER BOARD (81753)

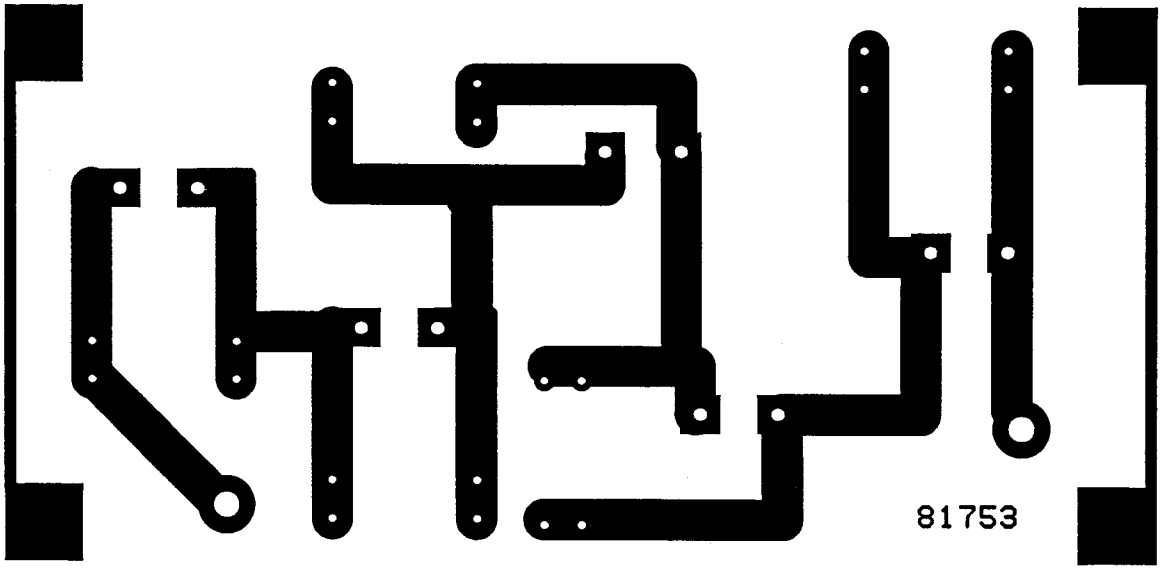


FIGURE 5 - 11 HV FILTER BOARD CIRCUIT TRACE (81753)

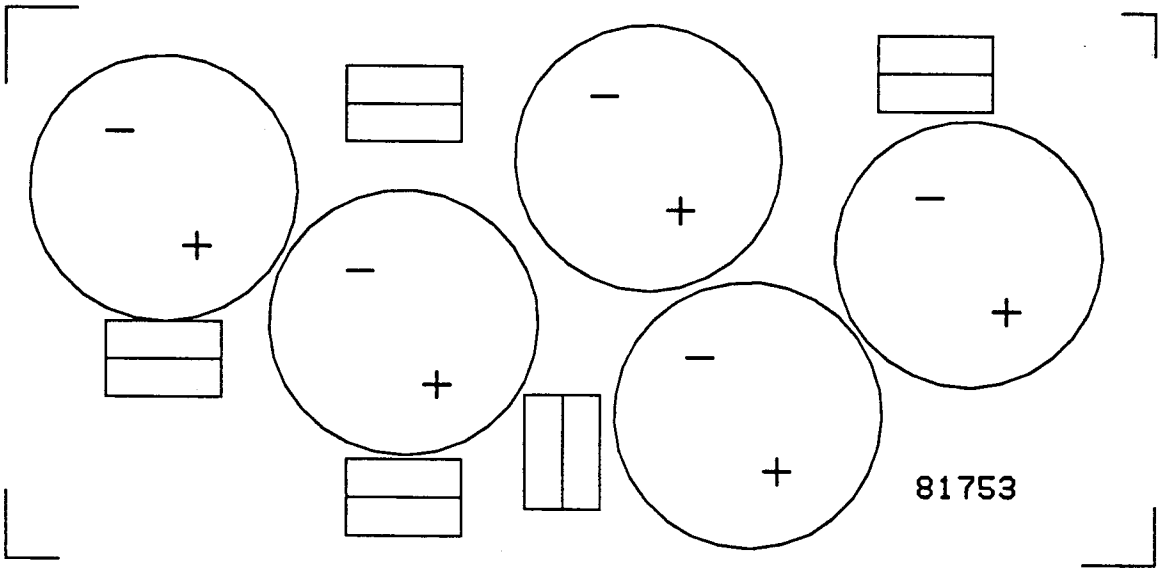


FIGURE 5 - 12 HV FILTER BOARD COMPONENT LAYOUT (81753)

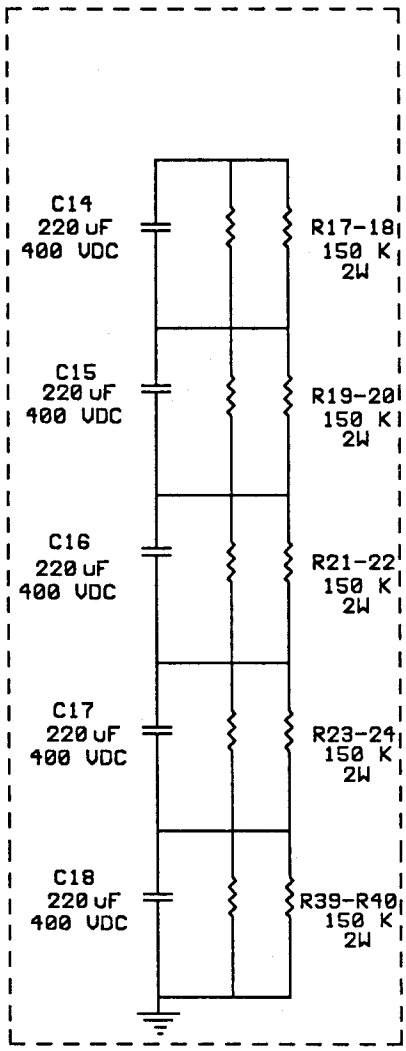


FIGURE 5 - 13 HV FILTER BOARD SCHEMATIC (81753)

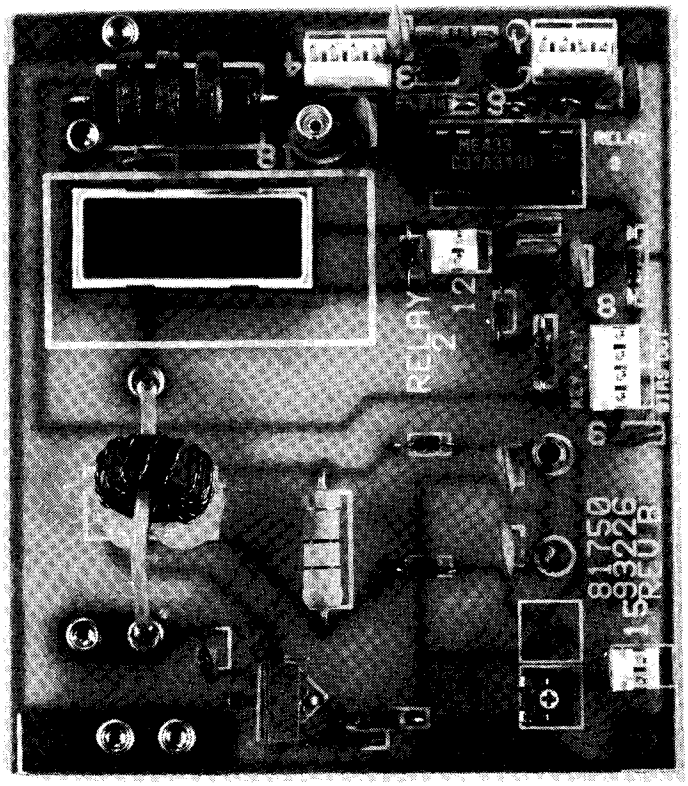
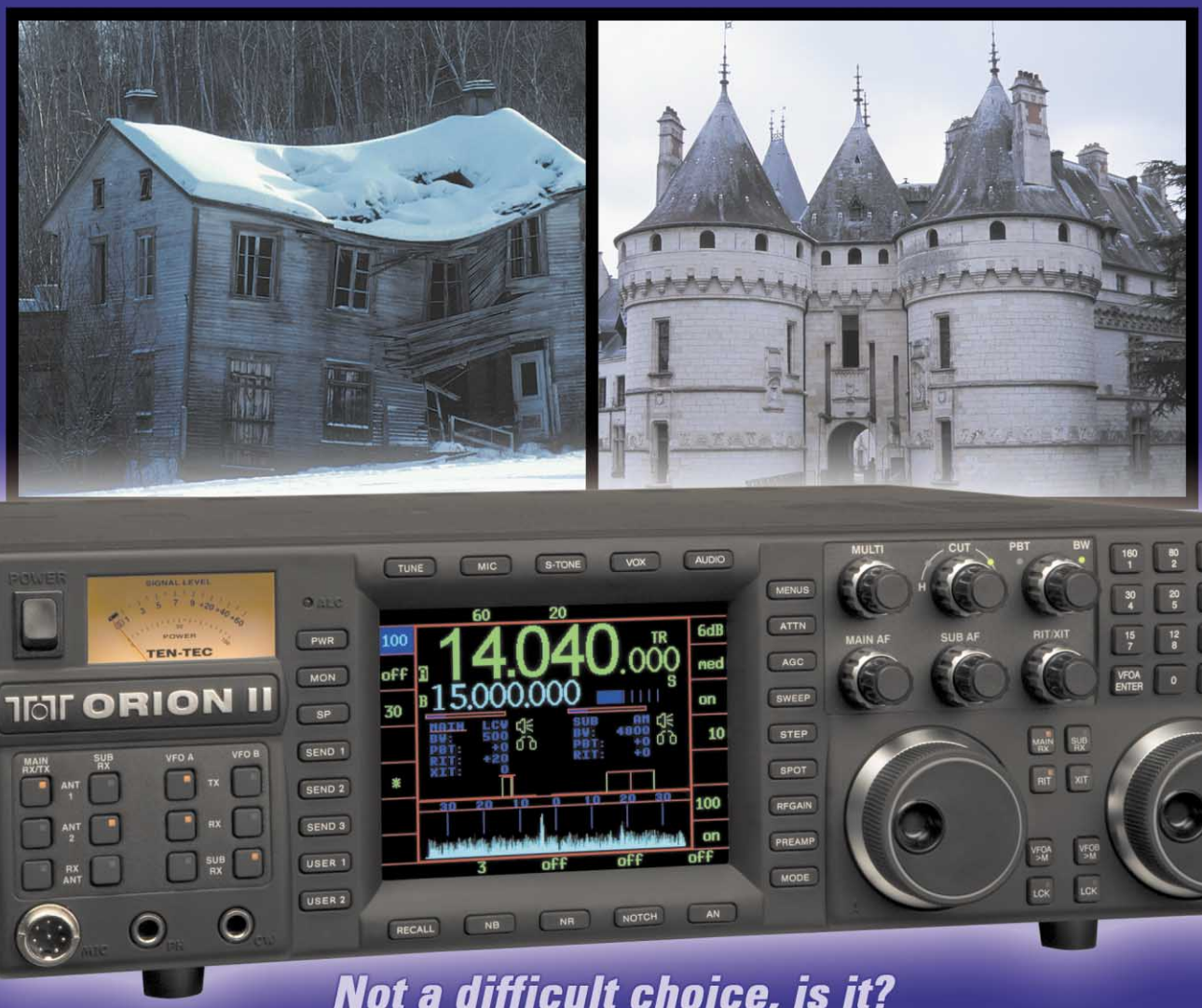


FIGURE 5 - 14 OUTPUT BOARD (81750)

WHICH ROOF WOULD YOU PREFER OVER YOUR HEAD?



Not a difficult choice, is it?

A rig with a good roof, roofing filters that is, keeps out the riffraff.

ORION II's selectable roofing filters let in only the signal you want. Hear the weakest signals under the most crowded band conditions and keep out those 40-over-9 guys sitting just down the band.

Most modern rigs have respectable dynamic range, 90 dB or greater, when measured at 20 kHz tone spacing. This simulates two signals in the real world separated by 20 kHz. Recent product reviews make a second measurement with the tones only 5 kHz apart. Now is when the roof starts to cave in! Precious few rigs hold up to this test, their dynamic range drops like a rock. But let's not stop there. Move the tones to within 500 Hz of each other, now that's more like an actual crowded band. Dynamic range on ORION II only drops 2½ dB!

No other rig at any price can withstand such grueling band conditions. It's all made possible by ORION II's seven selectable, mode-appropriate roofing filters (20, 6, 2.4 and 1 kHz standard; 1.8 kHz, 600 and 300 Hz optional). In fact, synthesizer phase noise in virtually all other rigs makes it impossible to even make the test measurements.

ORION II keeps the roof over your head and the weakest signals coming through loud and clear. Call us today at (800) 833-7373 to place your order. ORION II is $3995*, $4295* with automatic antenna tuner. Ask about our 4-month finance plan.

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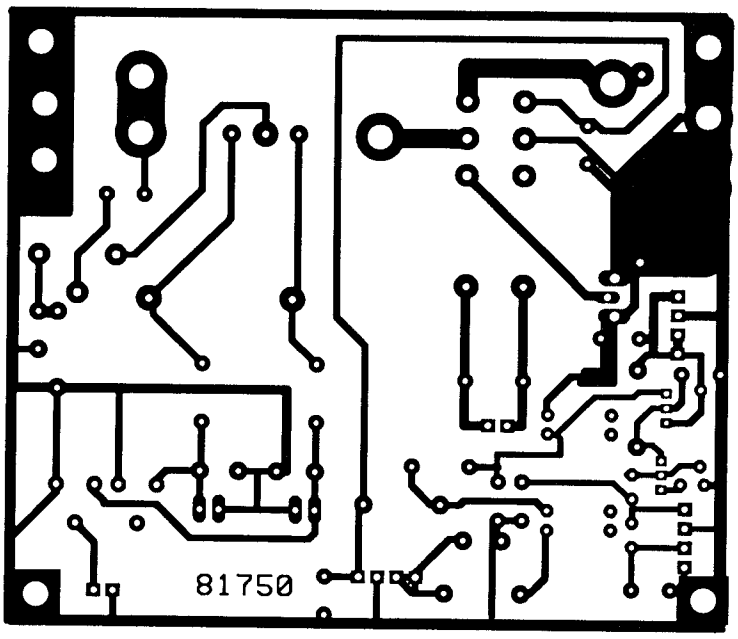

FIGURE 5 - 15 OUTPUT BOARD CIRCUIT TRACE (81750)

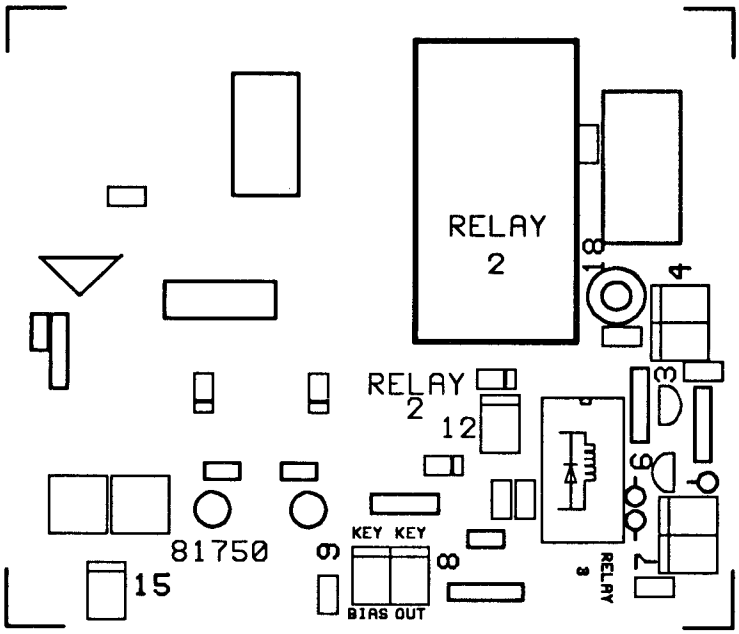

FIGURE 5 - 16 OUTPUT BOARD COMPONENT LAYOUT (81750)

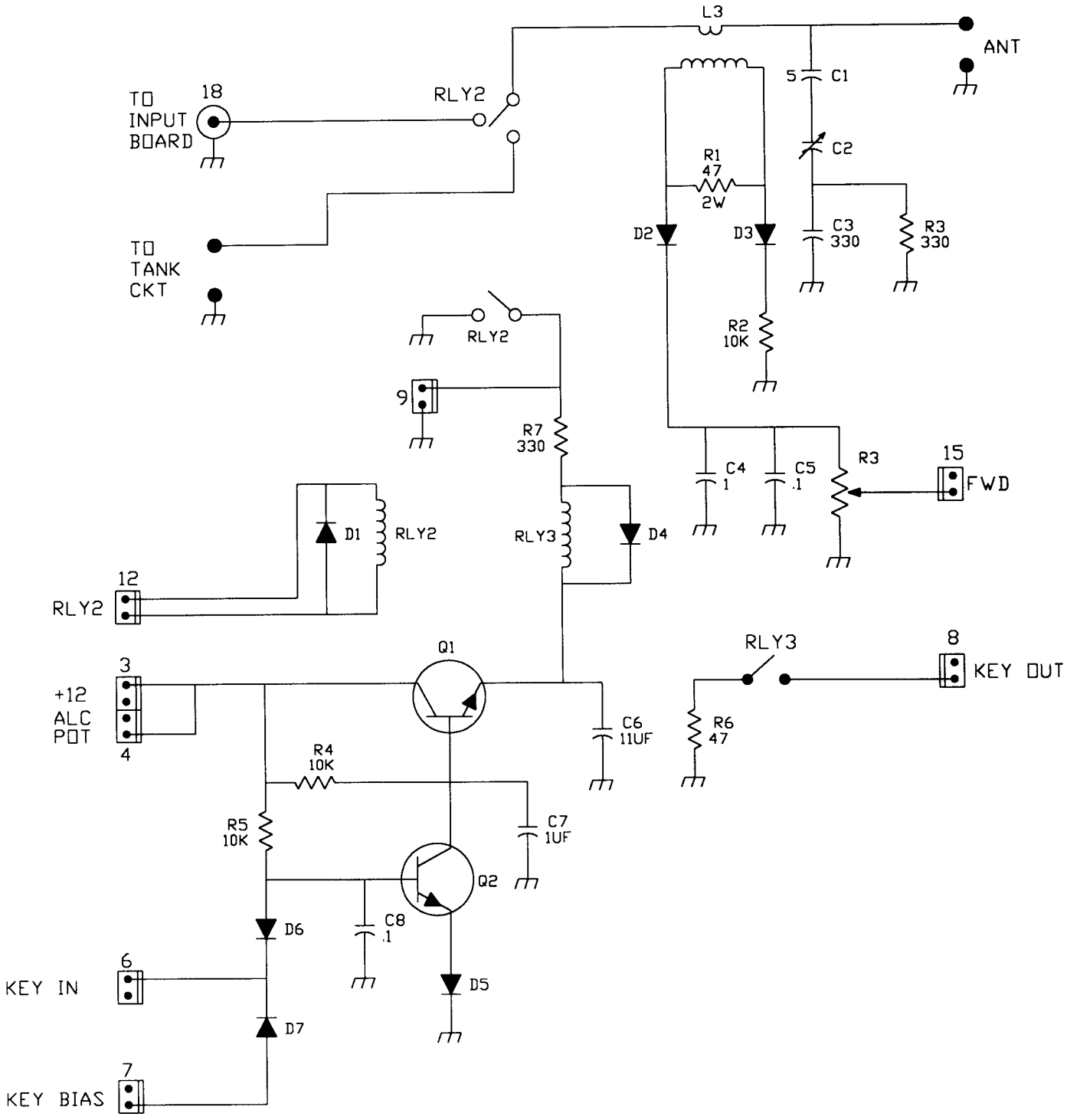

FIGURE 5 - 17 OUTPUT BOARD SCHEMATIC (81750)

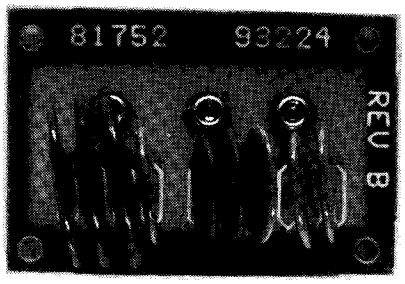

FIGURE 5 - 18 LOAD CAP SHUNT BOARD (81752)

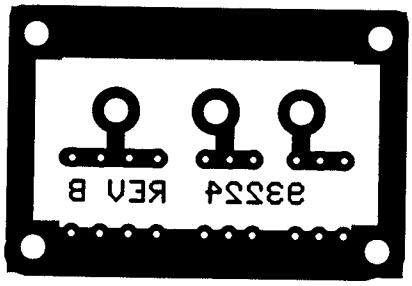

FIGURE 5 - 19 LOAD CAP SHUNT BOARD CIRCUIT TRACE (81752)

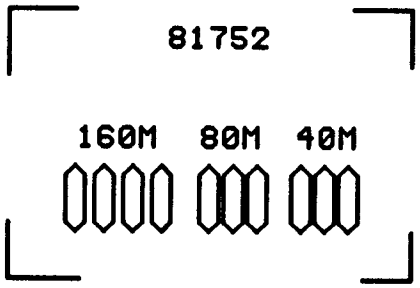

FIGURE 5 - 20 LOAD CAP SHUNT BOARD COMPONENT LAYOUT (81752)

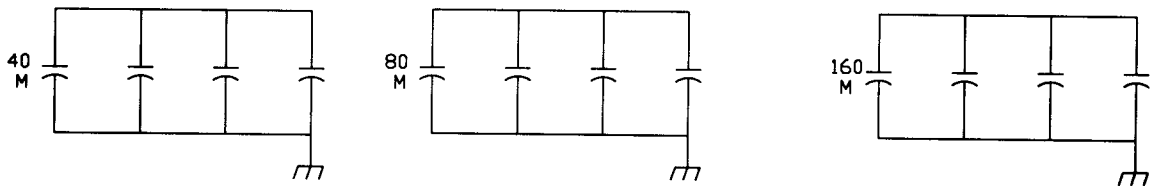

FIGURE 5 - 21 LOAD CAP SHUNT BOARD SCHEMATIC (81752)

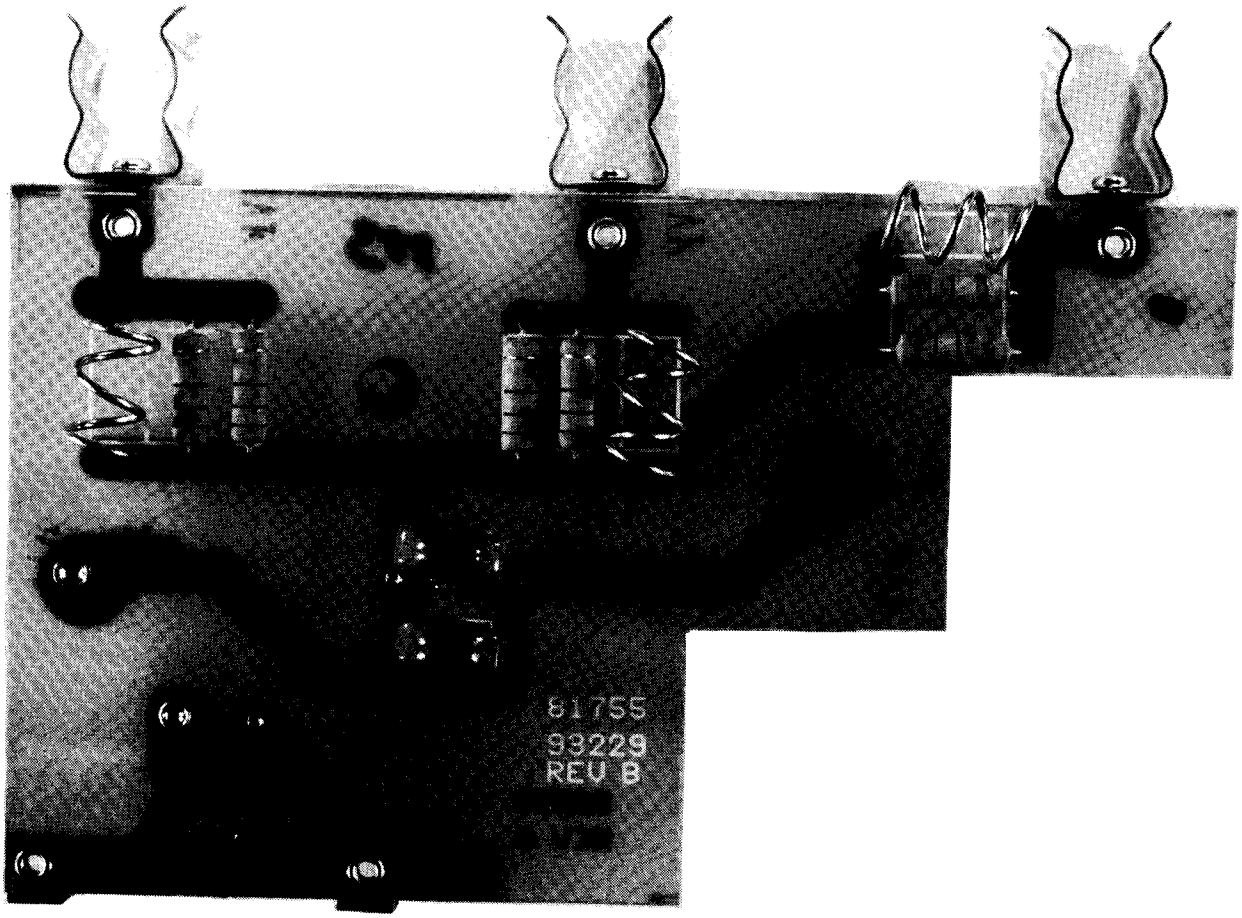

FIGURE 5 - 22 PLATE CONNECTOR BOARD (81755)

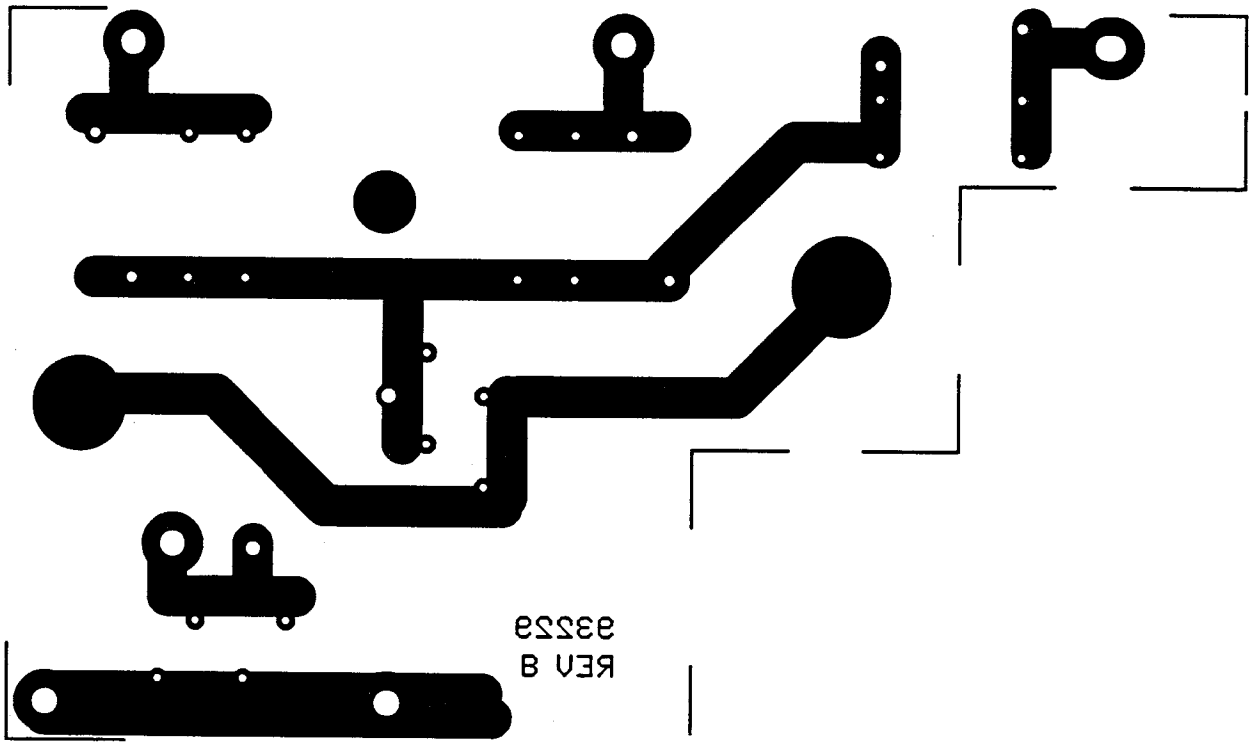

FIGURE 5 - 23 PLATE CONNECTOR BOARD CIRCUIT TRACE (81755)

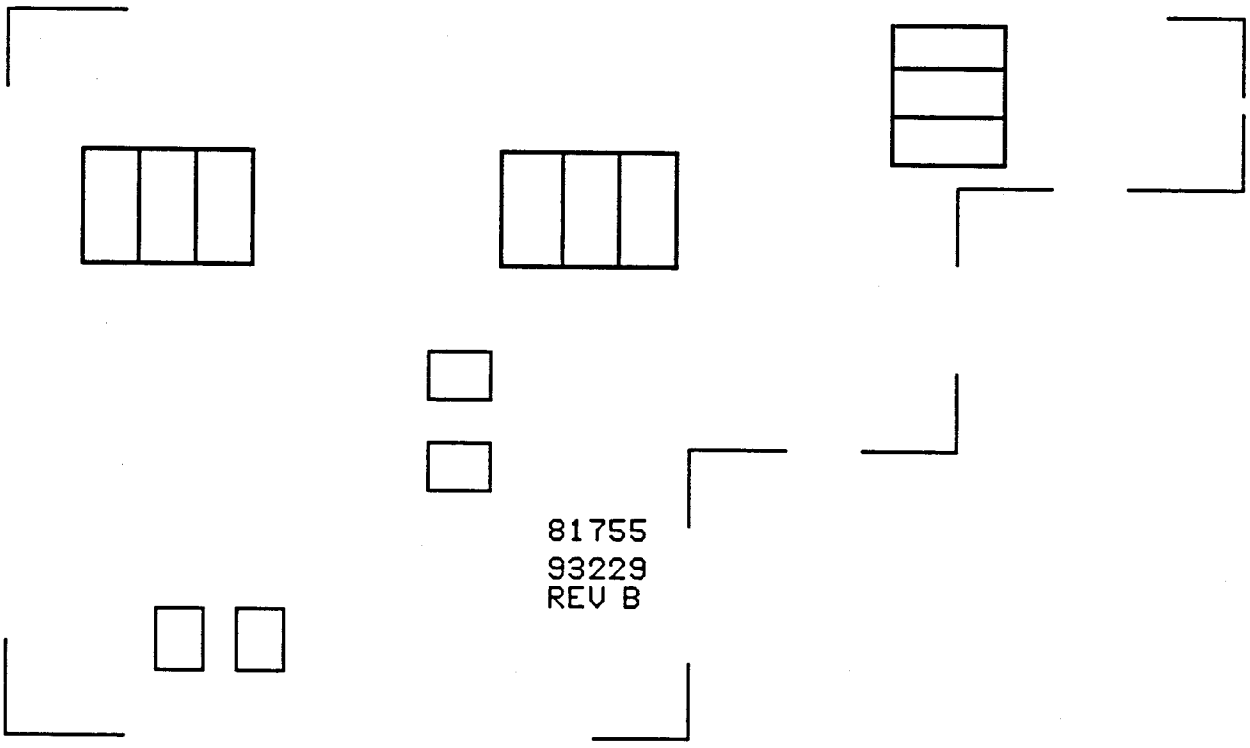

FIGURE 5 - 24 PLATE CONNECTOR BOARD COMPONENT LAYOUT (81755)

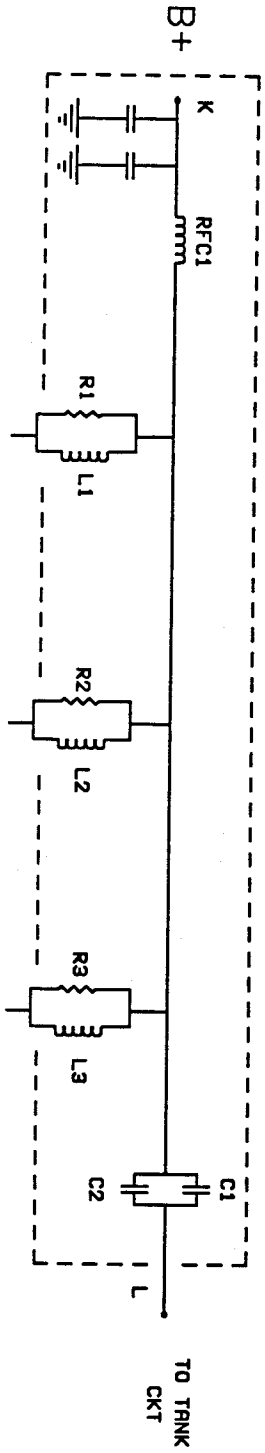

FIGURE 5 - 25 PLATE CONNECTOR BOARD SCHEMATIC (81755)

TEN-TEC, Inc.
1185 Dolly Parton Parkway
Sevierville, TN 37862

CUSTOMER SERVICE TELEPHONE
423-428-0364

LIMITED WARRANTY AND SERVICE POLICY, U.S.A.

TEN-TEC, Inc. warrants this product to be free from defects in material and workmanship for a period of one year from the date of purchase, under these conditions:

1. THIS WARRANTY APPLIES ONLY TO THE ORIGINAL OWNER. It is important that the warranty registration card be sent to us promptly to establish you as the owner of record. This will also insure that any bulletins pertaining to this equipment will be sent to you.

2. READ THE MANUAL THOROUGHLY. This warranty does not cover damage resulting from improper operation. Developing a thorough understanding of this equipment is your responsibility.

3. IF TROUBLE DEVELOPS we recommend that you contact our customer service group direct. The selling dealer is not obligated by us to perform service in or out of warranty. It has been our experience that factory direct service is expeditious and usually results in less down-time on the equipment. Some dealers do offer warranty service and of course, have our complete support.

4. WE ENCOURAGE SELF HELP. Taking the covers off does not void the warranty. In many cases our customer service technicians, with your help, can identify a faulty circuit board. In these cases we will send you a replacement board which you can change out. This will be shipped on a 30 day memo billing and when the defective board is returned, we will issue credit.

5. EQUIPMENT RETURNED TO THE FACTORY must be properly packaged, preferably in the original shipping carton. You pay the freight to us and we prepay surface freight back to you.

6. EXCLUSIONS. This warranty does not cover damage resulting from misuse, lightning, excess voltages, polarity errors or damage resulting from modifications not recommended or approved by Ten-Tec. In the event of transportation damage a claim must be filed with the carrier. Under no circumstances is Ten-Tec liable for consequential damages to persons or property caused by the use of this equipment.

7. TEN-TEC RESERVES the right to make design changes without any obligation to modify equipment previously manufactured.

8. THIS WARRANTY is given in lieu of any other warranty, expressed or implied.

SERVICE OUTSIDE OF THE U.S.A.

Many of our dealers provide warranty service on the equipment they sell. Many of them also provide out of warranty service on all equipment whether they sold it or not. If your dealer does not provide service or is not conveniently located, follow the procedure outlined above. Equipment returned to us will be given the same attention as domestic customers but all freight expense, customs and broker fees will be paid by you.

Part No. 74244

CAUTION!!!

- Before powering up your CENTAUR for the first time, carefully inspect the three amplifier tubes. They are visible through the ventilation holes in the top cover. Check to make sure they are centered in the opening and have not been jarred loose during shipment. If they are loose or out of position, remove the 10 screws that secure the top cover. As you lift the cover up, note the safety shorting bar that drops on the left-most plate cap. Be certain it stays in position as you carefully reinstall the tubes in their sockets.

- The plate caps are delicate and easily broken when removing or installing tubes. Do not hold the tube only by the glass envelope but support both glass envelope and plate cap to minimize chance of breakage.

- The 811A tubes in this Centaur amplifier MUST be used in matched sets. Do NOT replace one tube in the set without confirming its compatibility with the other two tubes.

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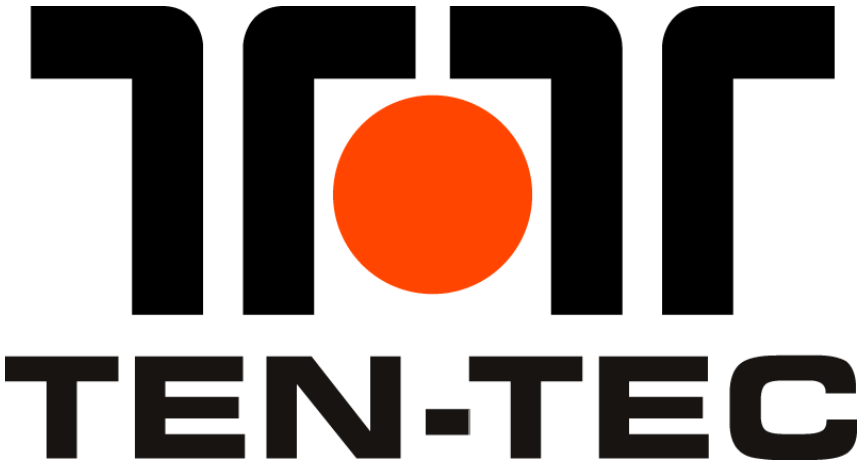

This obsolete manual file is provided as a courtesy to you by Ten-Tec, Inc.

Ten-Tec's service department can repair and service virtually everything we have built going back to our first transceivers in the late 1960's. It is our ability to continue offering service on these rigs that has led to their re-sale value remaining high and has made a major contribution to our legendary service reputation.

Printed and bound copies of all manuals are available for purchase through our service department if you would prefer not to use this copy as your transceiver manual.

We can repair or service your Ten-Tec equipment at our facility in Sevierville, TN. We also offer support via telephone for all products via during usual business hours of 8 a.m. to 5 p.m. USA Eastern time, Monday through Friday. We have a large supply of parts for obsolete products. Repairing a transceiver or amplifier yourself? Contact us for parts pricing information.

Service department direct line: (865) 428-0364
Ten-Tec office line: (865) 453-7172
Service department email: service@tentec.com
Address: 1185 Dolly Parton Parkway, Sevierville, TN 37862 USA

We have found it is most effective for us to help you troubleshoot or repair equipment with a consultation via telephone rather than by email.

Suggested contact methods are:

Troubleshooting or repairing equipment – call (865) 428-0364
Other inquiries – call (865) 428-0364 or email service@tentec.com

THANK YOU AND 73 FROM ALL OF US AT TEN-TEC