

INSTRUCTION MANUAL

DRAKE
MODEL
TC-6
**6M TRANSMITTING
CONVERTER**



PRICE OF INSTRUCTION MANUAL.....\$2.00

R. L. DRAKE COMPANY • MIAMISBURG, OHIO

TABLE OF CONTENTS

I.	INSTALLATION	PAGE
	A. Unpacking	1
	B. Location	1
	C. Cabling	1
	D. Transmitter Modifications	3
	1. T-4X Modifications	3
	2. L-4 Modifications	6
	E. Transceiver Modifications	6
	F. Interconnection with other Equipment	7
II.	OPERATION	
	A. Bias Adjustment	10
	B. Tune Up	10
	C. Television Interference	11
III.	PRINCIPLES OF OPERATION	12
IV.	SERVICE INSTRUCTIONS	13
	A. Top Cover Removal	13
	B. Bottom Cover Removal	13
	C. Tube Replacement	13
	D. Trouble Shooting	13
	E. Alignment	16
V.	SPECIFICATION	21
	A. General Specification	21
	B. Controls	21
	C. Power Requirements	21
	D. Dimensions	21
	E. Tube and Semiconductor Complement	22

CHARTS AND ILLUSTRATIONS

Fig. 1	Rear View of TC-6	2
Fig. 2	Rear View of T-4XB	3
Fig. 3	Pictorial Diagram of T-4 Modifications	4
Fig. 4	T-4 Modifications	5

Fig. 5	TR-3/4 Modifications	7
Fig. 6	Interconnection with T-4XB, R-4B, and SC-6	8
Fig. 7	Interconnection with TR-3/4 and SC-6	9
Fig. 8	Block Diagram of TC-6	12
Fig. 9	Top View of TC-6	18
Fig. 10	Bottom view of TC-6	19
Fig. 11	Schematic Diagram	20
	Voltage Chart	14
	Resistance Chart	15

I. INSTALLATION

A. UNPACKING

Carefully remove the TC-6 from the packing carton and examine it for signs of shipping damage. Should any be apparent, notify the delivering carrier immediately.

Fill out and mail the enclosed registration card so that the warranty will be effective.

Save the packing material. It may be needed later for reshipment or storage. Inspect the packing material closely to be sure that no accessory hardware has been overlooked.

B. LOCATION

The location of the TC-6 is not critical. However, care should be taken to insure that space is provided around the unit to allow adequate air circulation. Extremely hot locations, such as near radiators or heating units should be avoided. Do not cover the top of the cabinet with books, paper, or other equipment or over heating may result.

C. CABLING

The location of jacks provided for external connections are shown in Fig. 1. Basic input-output functions and requirements are as follows:

1. J1 connects to the jumper cable which supplies power to the exciter.
2. P1 connects to the AC-3, AC-4, DC-3, DC-4, or DC-24 power supply cable.
3. RCVR ANT, J6, mates with the N connector on the cable which connects to SC-6 ANT connector.
4. ANT, J7, connects to the 6 meter antenna.
5. Ry, J8, connects to a relay contact in the exciter which supplies a ground connection on transmit. This connection is made automatically when the TC-6 and any Drake transmitter are used with a single power supply. When separate AC-4 power supplies are used, a cable must be used to connect the VOX RLY connectors on the power supplies together.
6. AUX Ry, J9, provides a ground connection on transmit for controlling a linear amplifier.
7. AGC, J10, provides AGC output for controlling the HF transmitter gain. When the TC-6 and a Drake transmitter are used with a single power supply this connection is made automatically through the power cable.

If separate AC-4 power supplies are used, the AGC jack on transmitter power supplies must be connected to the TC-6 AGC jack with a phono cable. A connector is available for AC-3 power supplies that brings out the vox contacts and a transmitting AGC connector from the transmitter that the AC-3 is powering.

8. INJ, J11, connects to the 36 MHz oscillator in the SC-6 converter.
9. PA DIS. B, J12, connects to the screen grid supply voltage of the exciter.
10. PA DIS. A, J13, connects to the screen grid of the exciter. If the TC-6 is used with a TR-4 corresponding PA DIS JACKS must be connected so that screen grid modulation will be obtained.
11. EXC. Out, J15, provides 14 MHz output to drive another transmitting converter such as the TC-2 when the TC-6 function switch is in the off position.
12. EXC. IN, J14, connects to low level drive from the transmitter.
13. Cal, J5, connects to the external switch jack of the SCC-1 VHF calibrator.
14. AUX, J16, connects to external accessories such as a coax relay J16 and J17 are connected together in all positions of the function switch except the off position. Switch contacts are rated at 23 V. - 1 A. or 120 V - 1/2 A.
15. AUX, J17, is the same as J16.
16. CONV IF, J4, connects to the IF jack of the SC-6 converter.
17. HF RCVR, J3, connects to the antenna jack of the HF receiver.
18. HF ANT, J2, connects to the receiver antenna terminal on the HF transmitter.



FIG. 1

REAR VIEW TC-6

D. TRANSMITTER MODIFICATIONS

Some simple modification must be made in the transmitter so that the TC-6 may be integrated into the station. First, the screen grid circuit of the final amplifier must be disabled for six meter operation. In addition, low level output (0.25 V) must be added. Equipment manufactured by the R.L. Drake Company may be returned to the factory where it will be modified for a nominal charge.

1. T-4X Modifications

Although the following instructions are intended for the T-4 series of transmitters, the principles should be applicable to other transmitters.

Carefully drill three 1/4 inch holes in the rear of the chassis in the location shown in Fig. 2. Three holes are provided in the T-4B and T-4XB chassis and need not be added. Mount the phono fittings in the holes with nuts, lockwashers, and lugs.

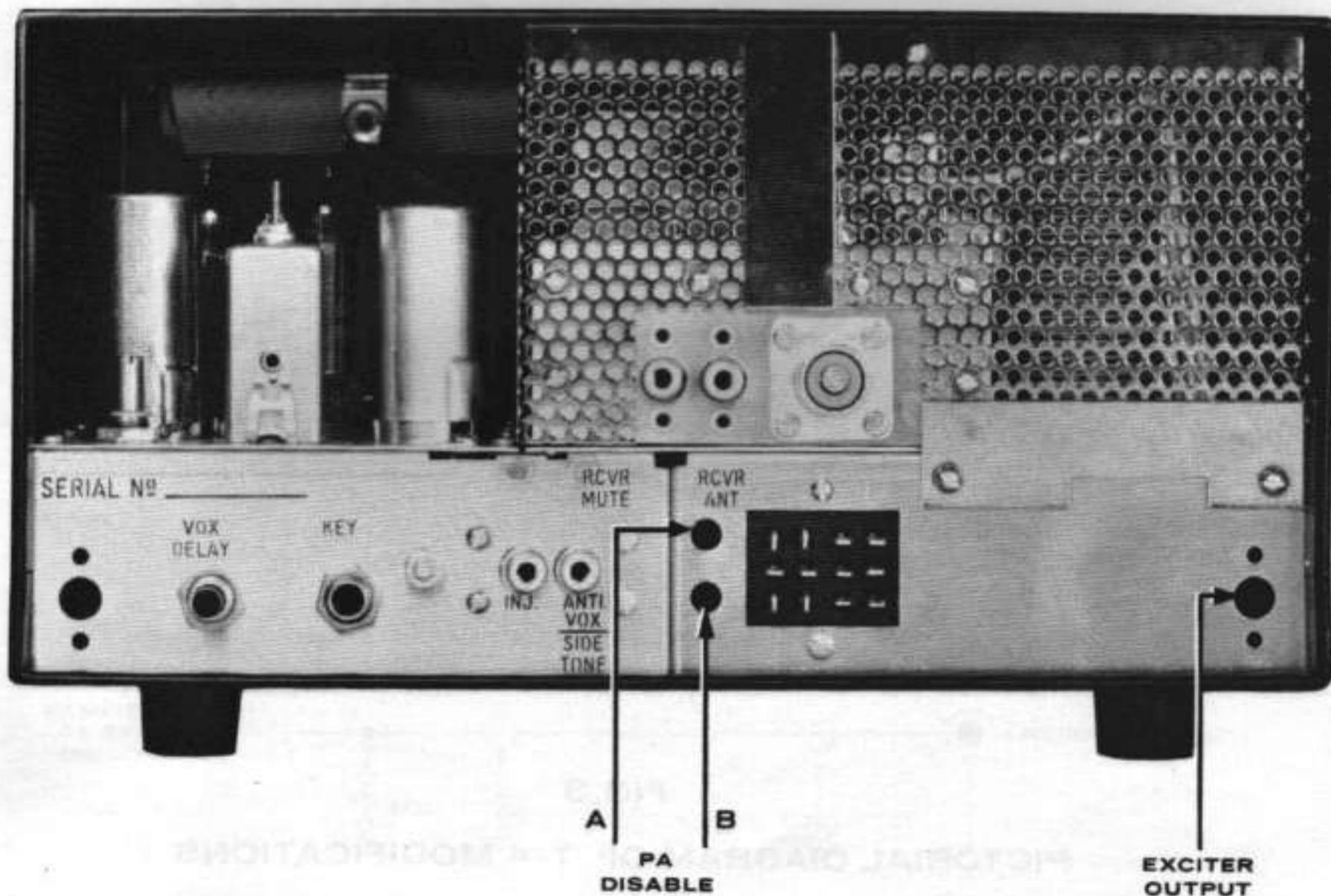


FIG.2

Hole Locations for VHF Modifications

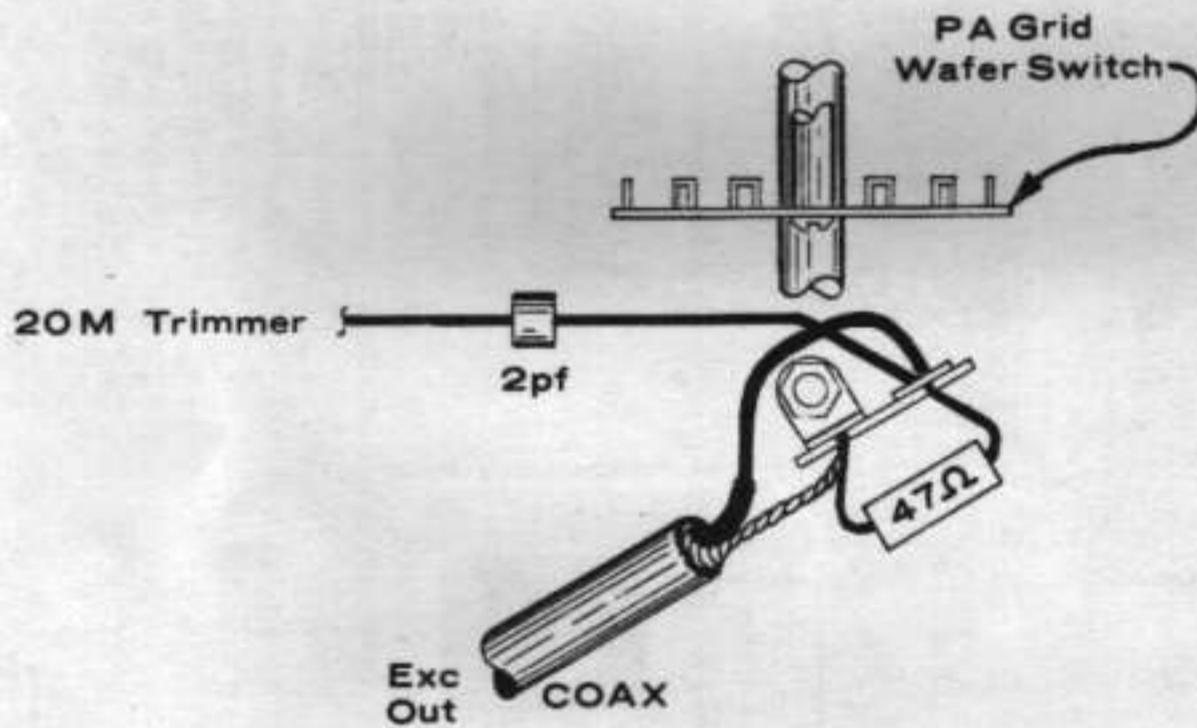
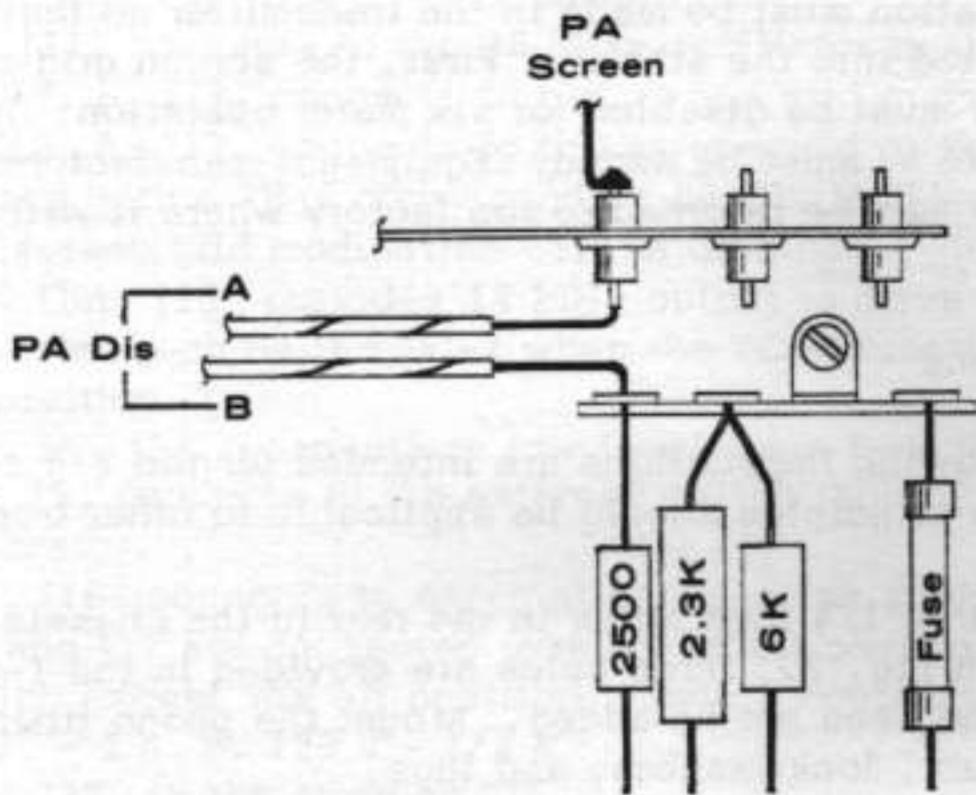


FIG. 3
 PICTORIAL DIAGRAM OF T-4 MODIFICATIONS

Replace the two lug terminal strip adjacent to the P.A. Grid compartment with a three lug terminal strip as shown in Fig. 3. The correct terminal strip is already installed in T-4B and T-4XB exciters. Disconnect the wires from the feed-thru capacitor which supplies screen voltage to the P.A. and connect them to the rear lug of the terminal strip. Also, connect a wire from the rear lug to a phono jack (P.A. disable B). Install a .001 MF disc capacitor from the phono jack to ground. Similarly, connect a wire from the screen voltage feed-thru capacitor to the "P.A. disable A" phono jack. Install a .001 MF disc capacitor from the phono jack to ground. Reconnect the wires to the two remaining lugs on the terminal strip.

Locate the nut under the bandswitch shaft near the P.A. grid wafer switch. Install a two lug terminal strip (one lug grounded) under this nut. Connect a 2.0 pF capacitor from the twenty meter grid trimmer capacitor to the ungrounded lug of the terminal strip.

Connect a 47 ohm 1/2 W resistor between the two lugs of the terminal strip. Connect a length of coax cable between the terminal strip and the remaining phono jack. The braid should be grounded at both ends of the cable. Retune the twenty meter trimmer according to the instructions in the transmitter manual.

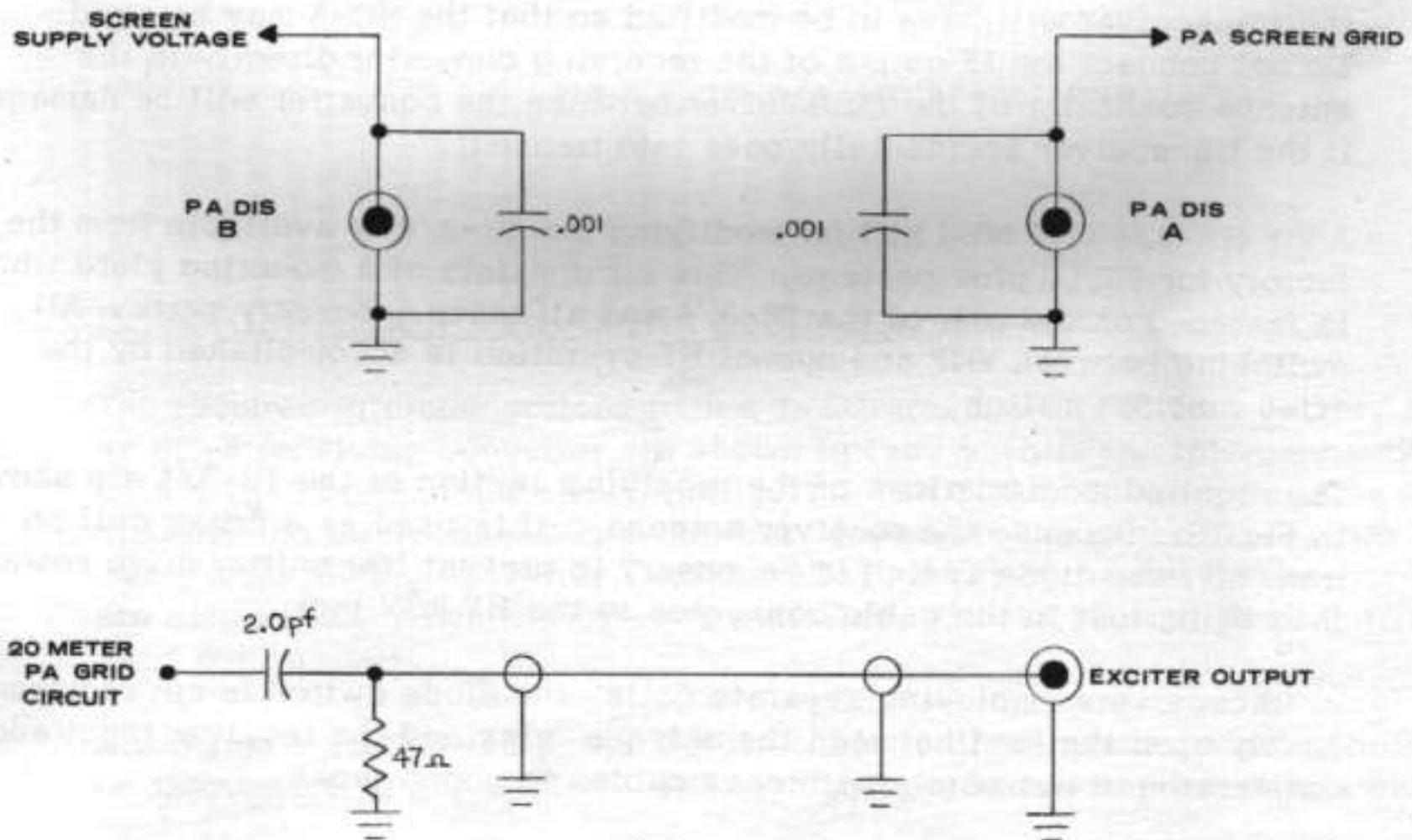


FIG. 4 T-4 MODIFICATIONS

2. L-4 Modifications

When an L-4 is connected to the T-4 transmitter, the relay of the TC-6 will be energized by current flowing through the bleeder resistor in the L-4 relay power supply. However, when the L-4B AGC/STANDBY switch is placed in STANDBY the connection to the bleeder resistor is opened and the TC-6 will operate normally. Late model L-4B amplifiers have been modified to eliminate this difficulty

Older model L-4B and L-4 amplifiers may be modified by the following procedure. Mount a two lug terminal strip (one lug grounded) with one of the screws which mounts the VOX RELAY SOCKET. Disconnect the wire from the ungrounded terminal of the vox relay socket and connect it to the ungrounded lug of the terminal strip. Connect a 1/2 A. 400 PIV silicon diode between the ungrounded lug of the vox relay socket and the ungrounded lug of the terminal strip. The cathode of the diode should be connected to the vox relay socket.

E. TRANSCEIVER MODIFICATIONS

Although the following instructions are intended for the TR-3/4 transceiver, the principles should be applicable to other transceivers. In addition to the transmitter modifications already described, the receiver section of the transceiver will have to be modified so that the SC-6 may be used. Do not connect the IF output of the receiving converter directly to the antenna connector of the transceiver because the converter will be damaged if the transceiver accidentally goes into transmit.

A kit (TR-3/4 VHF Mod Kit) for modifying the TR-3/4 is available from the factory for \$6.50 plus postage. This kit consists of a mounting plate which is fastened on the rear of the TR-3/4 and all other necessary parts. All switching between VHF and normal HF operation is accomplished by the TC-6 function switch.

The required modifications of the receiving section of the TR-3/4 are shown in Fig. 5. Because the receiver antenna coil is used as a driver coil on transmit, the diode switch is necessary to prevent transmitter drive power from being lost in the cable connected to the HF RCV jack.

In transceivers employing separate coils the diode switch is not required. Simply open the lead between the antenna relay and the receiver input and connect these two points with coax cables to phono jacks.

Some transceivers may not have a D.C. path for the switching diode, and it will be necessary to connect a 4.7 K 1/2 W resistor between the cathode of the 1N4148 diode and ground.

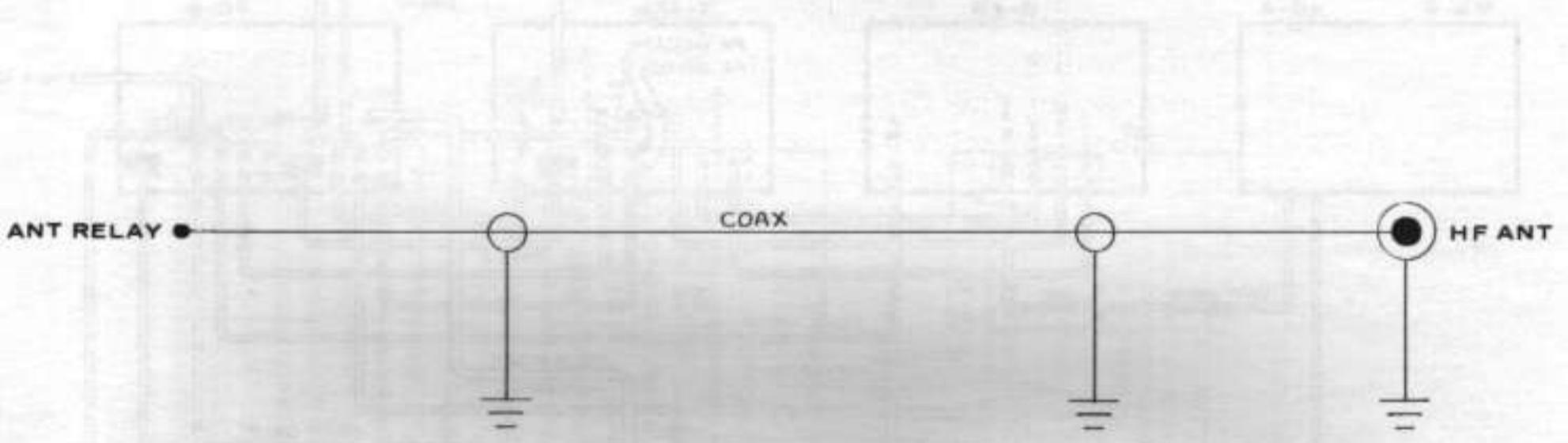
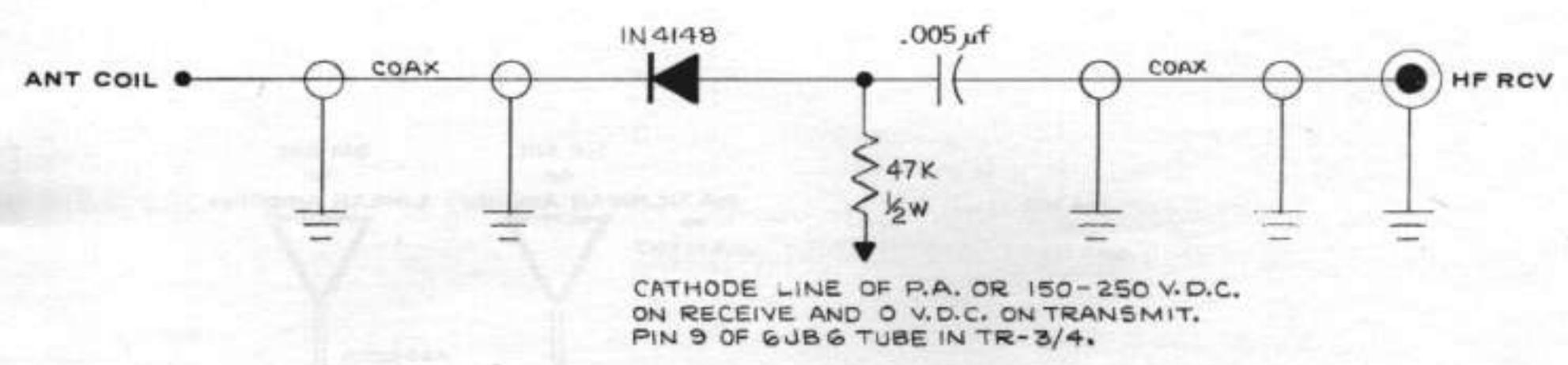


FIG.5 TR-3/4 MODIFICATIONS

F. INTERCONNECTION WITH OTHER EQUIPMENT

The required interconnections with a T-4XB transmitter, R-4B receiver, and an SC-6 receiving converter are shown in Fig. 6 while the interconnections with a TR-3 or TR-4 are shown in Fig. 7. The CC-1 converter console will simplify the interconnection somewhat, especially when the TC-2, two meter transmitting converter, and the SC-2, two meter receiving converter, are also used. When the CC-1 is installed, J2, J3, J4, and J5 on the TC-6 need not be used.

Always be sure that the power supply cable is disconnected when connecting or disconnecting any cables. The high voltage which is present is a shock hazard.

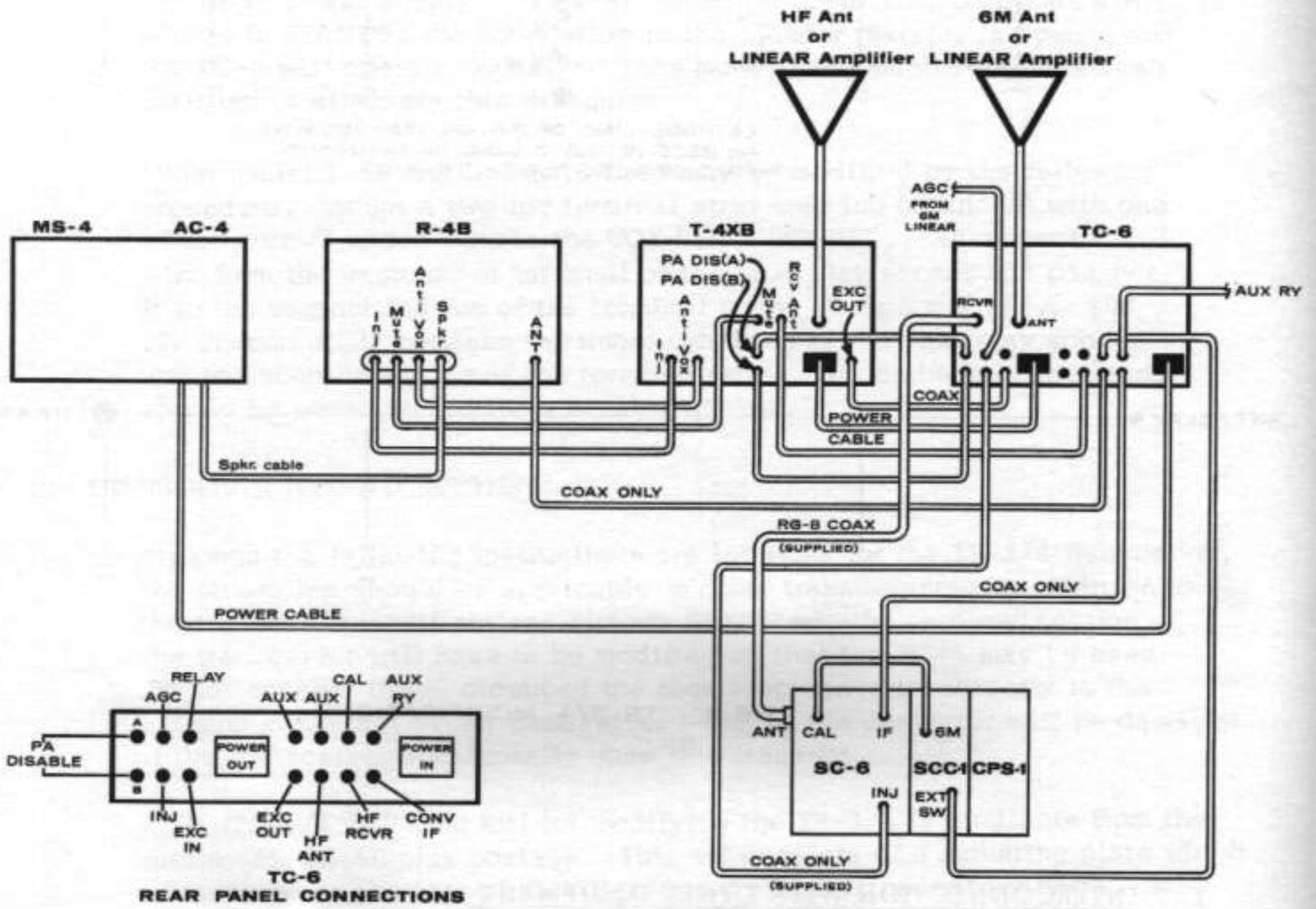


Fig -6

INTERCONNECTION WITH T-4XB, R-4B AND SC-6

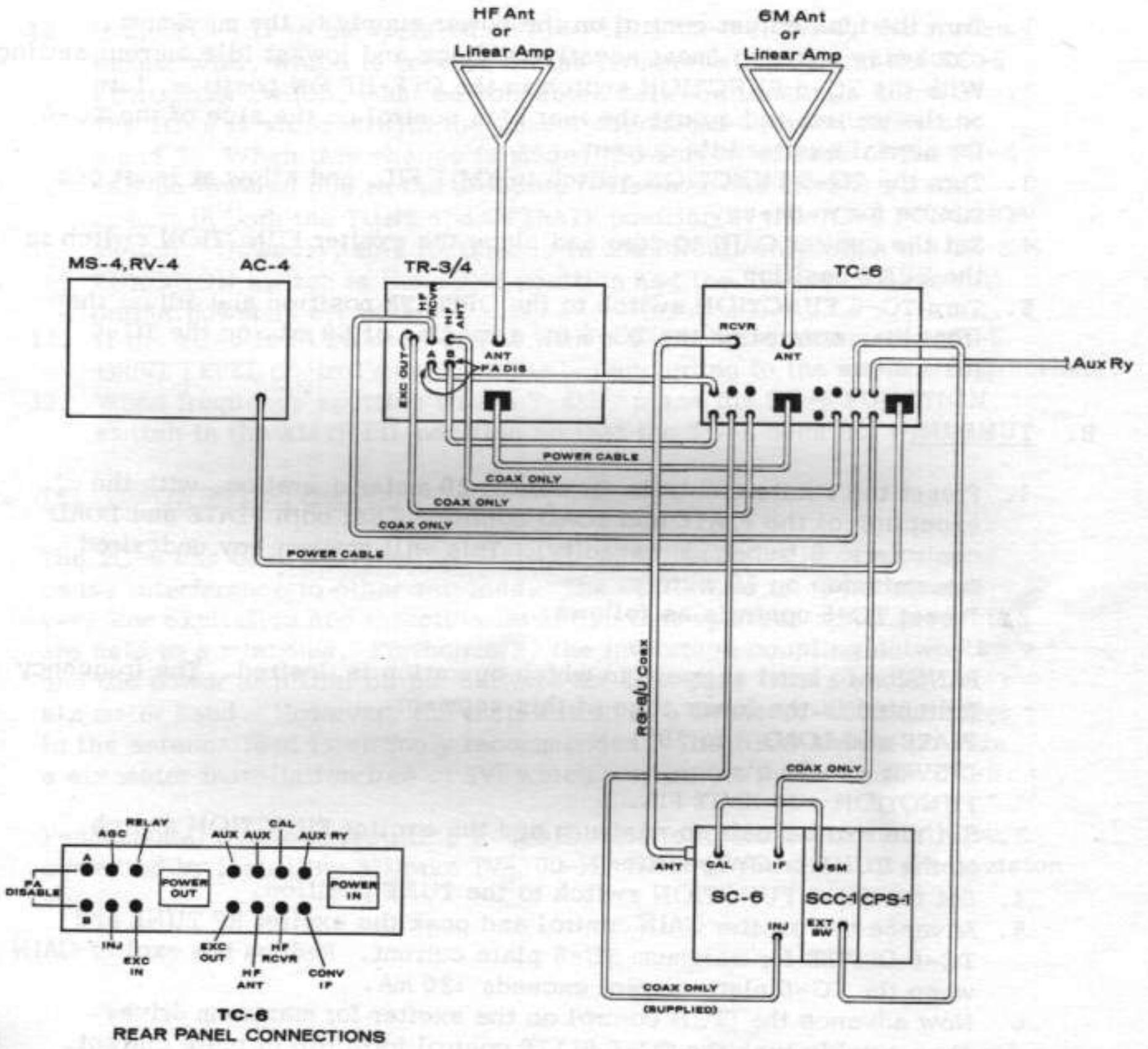


Fig. 7
INTERCONNECTION WITH TR-3/4 AND SC-6

II. OPERATION

A. BIAS ADJUSTMENT

Before any type of operation is attempted, it will be necessary to set the bias to the correct value. Proceed as follows:

1. Turn the bias adjust control on the power supply to the maximum clockwise position (most negative voltage and lowest idle current setting).
2. With the TC-6 FUNCTION switch in the OFF-HF ON position, turn on the exciter and adjust the rear bias control on the side of the TC-6 for normal exciter idle current.
3. Turn the TC-6 FUNCTION switch to XMIT FIL, and allow at least one minute for warm-up.
4. Set the exciter GAIN to zero and place the exciter FUNCTION switch in the TUNE position.
5. Turn TC-6 FUNCTION switch to the OPERATE position and adjust the front bias control on the TC-6 for a reading of 60 mA. on the TC-6 plate meter.

B. TUNE UP

1. Preset the exciter controls for normal 20 meter operation, with the exception of the PLATE and LOAD controls. Set both PLATE and LOAD controls to 0 (maximum capacity). This will prevent any undesired transmission on 20 meters.
2. Preset TC-6 controls as follows:

RANGE - to band segment in which operation is desired. The frequency indicated is the lower edge of this segment.
PLATE and LOAD - to "0".
DRIVER - to 12 o'clock.
FUNCTION - to XMIT FIL.
3. Set the exciter gain to minimum and the exciter FUNCTION switch to the TUNE or CW position.
4. Set the TC-6 FUNCTION switch to the TUNE position.
5. Advance the exciter GAIN control and peak the exciter RF TUNE and TC-6 DRIVER for maximum TC-6 plate current. Reduce the exciter GAIN when the TC-6 plate current exceeds 120 mA.
6. Now advance the GAIN control on the exciter for maximum drive. Then quickly tune the TC-6 PLATE control for a dip in plate current.
7. Depress the OUTPUT METER control and observe the relative output, or observe the output on an RF wattmeter, or SWR bridge. Alternately tune the TC-6 LOAD and PLATE controls in small increments for maximum RF output.
8. Reduce drive level and make sure the DRIVER is still peaked for maximum drive.
9. Turn the FUNCTION switch to the OPERATE and touch up the PLATE and LOAD controls for maximum output with full drive applied. The PLATE current should be between 380 and 500 mA depending on line voltage, antenna match, drive, tube conditions, etc.

The TC-6 is now tuned and ready for operation. When changing frequency more than 50 KHz, it is recommended that the tuning be rechecked. The exciter RF TUNE may need repeaking with even smaller frequency changes.

10. If the TC-6 is to be operated on AM with a TR-3 or TR-4, the screen jumper wire, which is located on the terminal strip behind the TC-6 FUNCTION switch, must be connected between terminals 1 and 3. The TC-6 is shipped with the jumper connected between terminals 1 and 2. When this change is made, the screen voltage of the TC-6 will be lowered due to the dropping resistor in the TR-3/4 screen circuit in both the TUNE and OPERATE position of the TC-6 FUNCTION switch. However, this resistor is in the circuit only when the TR-3/4 FUNCTION switch is the TUNE position and the TC-6 will have full output power in all modes.
11. If the TC-6 is to be used on AM with a T-4XB transmitter, the TC-6 DRIVE LEVEL control must be adjusted according to the service instructions.
12. When frequency spotting with a T-4XB, place the TC-6 FUNCTION switch in the XMTR FIL position so that the TC-6 does not transmit.

C. TELEVISION INTERFERENCE

The TC-6 has been designed to minimize spurious radiation that may cause interference to other services. The 6EJ7 mixer is operated with very low excitation and injection levels so that spurious mixer products are held to a minimum. Furthermore, the interstage coupling networks and the power amplifier output network are low-pass filters above the six meter band. However, the installation of a Drake TV-1000-LP filter in the antenna lead is strongly recommended. The filter should provide a six meter installation free of TVI which may be attributed to the TC-6.

Fundamental overload resulting from six meter operation can usually be corrected by installing a Drake TV-300-HP filter at the tuner of a television set.

III. PRINCIPLES OF OPERATION

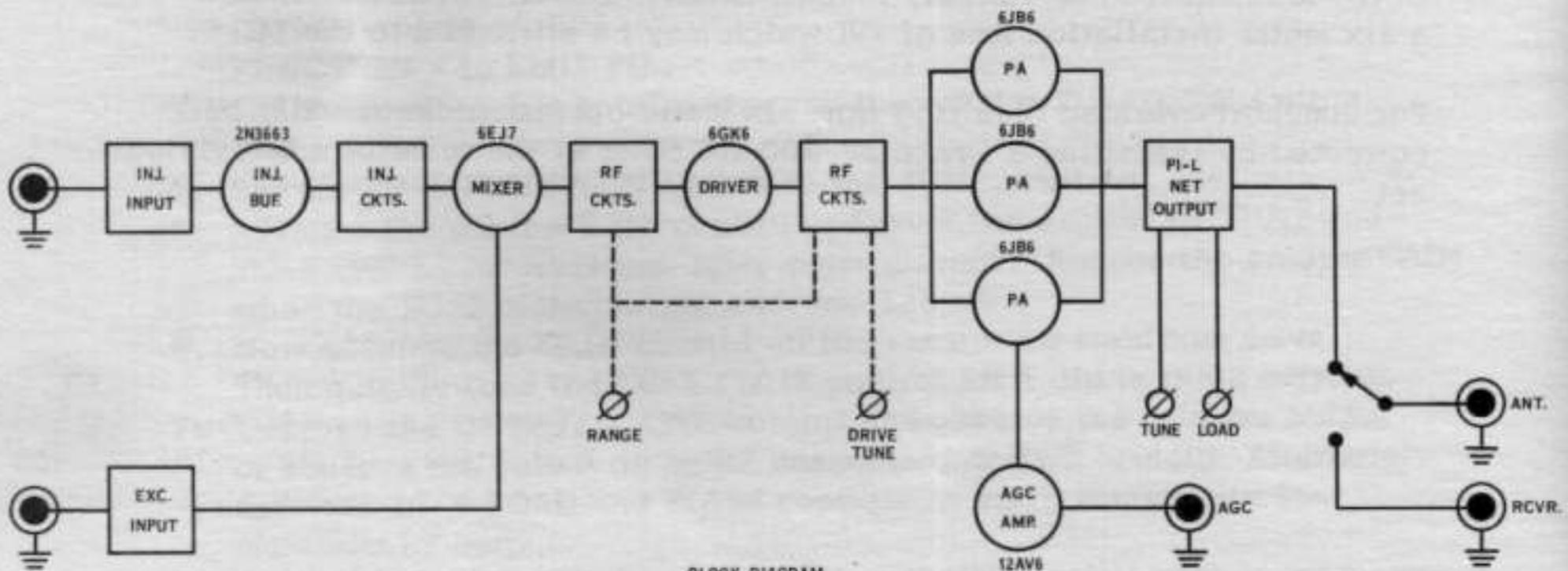
The TC-6 is a transmitting converter which converts the low level output (13.5 - 17.5 MHz) from an H.F. exciter to the six meter band (49.5 - 54 MHz) by mixing with the crystal oscillator output (36.0 or 36.5 MHz) of the Drake SC-6 receiving converter. The output frequency of the TC-6 is the sum of the exciter output frequency and the crystal frequency of the SC-6.

The low level output from the exciter is coupled into the control grid of the 6EJ7 mixer by a 13.5 - 17.5 MHz bandpass network consisting of L2, L3, and associated capacitors. The injection (36.0 or 36.5 MHz) from the receiving converter is amplified by the injection buffer (2N3663) and coupled into the control grid of the 6EJ7 mixer.

The 49.5 to 54.0 MHz signal generated in the mixer is filtered by a double tuned circuit (L4 and L5) and coupled into the grid of the 6GK6 driver. The output of the driver is coupled, with a pi network, into the grids of the three power amplifiers (6JB6). The output of the power amplifiers is matched into a 50 ohm antenna by a pi-L network.

Amplified AGC, which is provided by a type 12AV6 tube, is available for controlling the gain of the H.F. exciter. Diodes CR3 and CR4 provide an indication of relative power output from the TC-6.

Envelope feedback is provided by diodes CR1 and CR2. Envelope feedback reduces crossover distortion and allows the idling plate current to be substantially reduced.



BLOCK DIAGRAM
TC-6
TRANSMITTING CONVERTER

FIG. 8

IV. SERVICE INSTRUCTIONS

If you have technical questions or wish factory service, write to the R.L. Drake Company, Customer Service Department. Before returning equipment, please write for authorization.

A. Top Cover Removal

Extreme caution should be exercised when the top and bottom covers of the TC-6 are removed. High voltage which is present at several points can cause a lethal electrical shock. Remove the three top screws on each side of the TC-6 and remove the cover by first pulling up on the rear and then on the front of the cabinet.

B. Bottom Cover Removal

Remove the six bottom screws from the sides of the TC-6 and lift the chassis out of the bottom cover.

C. Tube Replacement

In general, most trouble in electronic equipment of good design is due to tube failure. The best method of finding defective tubes is by direct substitution. It is best not to rely on tube checkers. In most cases replacement of tubes will not require realignment. However, P.A. neutralization should be checked when the 6JB6 tubes are replaced. The TC-6 is shipped with a matched set of 6JB6 tubes. Matched sets of 6JB6 tubes are available from the factory for \$9.00 (U.S. Funds) plus postage at the time of this printing.

To replace the 6JB6 tubes, it will be necessary to remove only the top of the final amplifier cage. This can be accomplished by removing the front and rear sheet metal screws holding the top of the cage and then lifting the top out of the two side clips. To replace the cage simply reverse the process. Be sure that the parasitic suppressors do not short to the top of the cage.

D. Trouble-Shooting

If some problem arises which cannot be cured by tube substitution, it is suggested that the TC-6 be either returned to the dealer or you may write to the Customer Service Department. Be sure to describe the problem in detail. Include full information concerning external connections, control settings, etc. Always include the serial number when requesting service information. Before returning equipment, it is advisable to get prior authorization.

In case of malfunction, first check the power supply fuse and filament fuse (a short piece of 26 gauge wire connected to the rear terminal strips) in the TC-6. The voltage and resistance charts, which are shown on the following

VOLTAGE CHART

TUBE NUMBER	TYPE	1	2	3	4	5	6	7	8	9
V1	6EJ7	2.4	0	2.4	6.3VAC	0	0	230	140	0
V2	6GK6	8	0	0	0	6.3VAC	0	250	245	0
V3	12AV6	-72	-66	0	12.6AC	-66	-66	0	-	-
V4	6JB6	250	-66	0.25	6.3VAC	12.6VAC	-66	250	0	0
V5	6JB6	250	-66	0.25	6.3VAC	12.6VAC	-66	250	0	0
V6	6JB6	250	-66	0.25	6.3VAC	0	-66	250	0	0

NOTE: FUNCTION Switch in operate position. Idle current set at 60 mA., and no excitation.

RESISTANCE CHART

TUBE NUMBER	TYPE	1	2	3	4	5	6	7	8	9
V1	6EJ7	∞	4 ohms	∞	1 ohm	0	0	56 K	76 K	0
V2	6GK6	∞	10 K	0	1 ohm	0	0	54 K	55 K	0
V3	12AV6	29 K	46 K	0	1.5 ohms	45.7 K	45.7 K	1 M	-	-
V4	6JB6	∞	45 K	∞	1 ohm	1.5 ohms	45 K	∞	0	∞
V5	6JB6	∞	45 K	∞	1 ohm	1.5	45 K	∞	0	∞
V6	6JB6	∞	45 K	∞	1 ohm	0	45 K	∞	0	∞

NOTES:

All measurements were made from ground with the TC-6 disconnected from the power supply and the FUNCTION Switch in the OFF position.

pages, should be valuable in isolating minor problems. However, no attempt should be made to service the TC-6 unless you are thoroughly familiar with electronic circuitry and service techniques. Care should be taken not to disturb the lead dress in the TC-6 since some circuits are critical in this regard.

E. Alignment

1. 36 MHz INJ COIL ALIGNMENT

- a. Tune up on any output frequency using 36.0 MHz oscillator injection.
- b. Reduce exciter drive level until power output drops to about 50% of full output.
- c. Tune L1 for maximum output.

2. 13.5 - 17.5 MHz BANDPASS ALIGNMENT

- a. Tune up TC-6 with exciter drive at 15.0 MHz.
- b. Reduce exciter drive until output power drops to about 75% of full output. Connect a swamping tool (a 1K 1/2 W. resistor and a .001 disc capacitor in series) across L2. Tune L3 for maximum output.
- c. Connect the swamping tool across L3 and tune L2 for maximum output.

3. INCREMENT COIL ALIGNMENT

- a. Tune up at 53.750 MHz (Range switch at 53.5 MHz position). Reduce exciter drive level until output power drops to 50% of full output.
- b. Tune L4 and L5 for maximum output.
- c. With the Driver tuning at 12 o'clock, adjust L9 for maximum output. Keep the output power at about 50% of full output by adjusting the exciter drive level.
- d. Tune up at 49.750 MHz (Range switch at 49.5 MHz position) with the Driver tune set at 12 o'clock. Adjust the increment coils on each of the three switch wafers for maximum. Adjust all increment coils on each wafer the same amount.
- e. Repeat steps a through c until no appreciable improvement at either 49.750 or 53.750 MHz can be obtained.

4. DRIVER NEUTRALIZATION

- a. Tune up on any frequency in the 49.5 - 54.0 MHz range.
- b. Unsolder the 680 ohm screen grid resistor and plate choke of the 6GK6 driver from the feedthru capacitor.
- c. With full drive applied, adjust C18 for minimum output voltage at the antenna terminal as measured with an RF voltmeter.
- d. Reconnect the resistor and choke.

5. P.A. NEUTRALIZATION

- a. Tune up for maximum output at 50.250 MHz.
- b. Reduce the exciter drive level until plate current begins to decrease.
- c. Adjust C29 so that the plate current dip and maximum output power occur at the same setting of the PLATE control. Each time C29 is adjusted, repeat the DRIVE control for maximum output before checking neutralization.

6. DRIVE LEVEL

- a. If the TC-6 is not used on AM with a T-4X, adjust the drive level control for maximum output power (full clockwise). See Fig. 10.
- b. If the TC-6 is used on AM with the T-4X, tune up normally with the T-4X FUNCTION Switch in the TUNE position. With the T-4X FUNCTION Switch in the AM position and the T-4X GAIN control at minimum, activate the T-4X push-to-talk circuit and adjust the DRIVE LEVEL control until the TC-6 plate current is 180 mA. This control need not be reset for SSB operation.

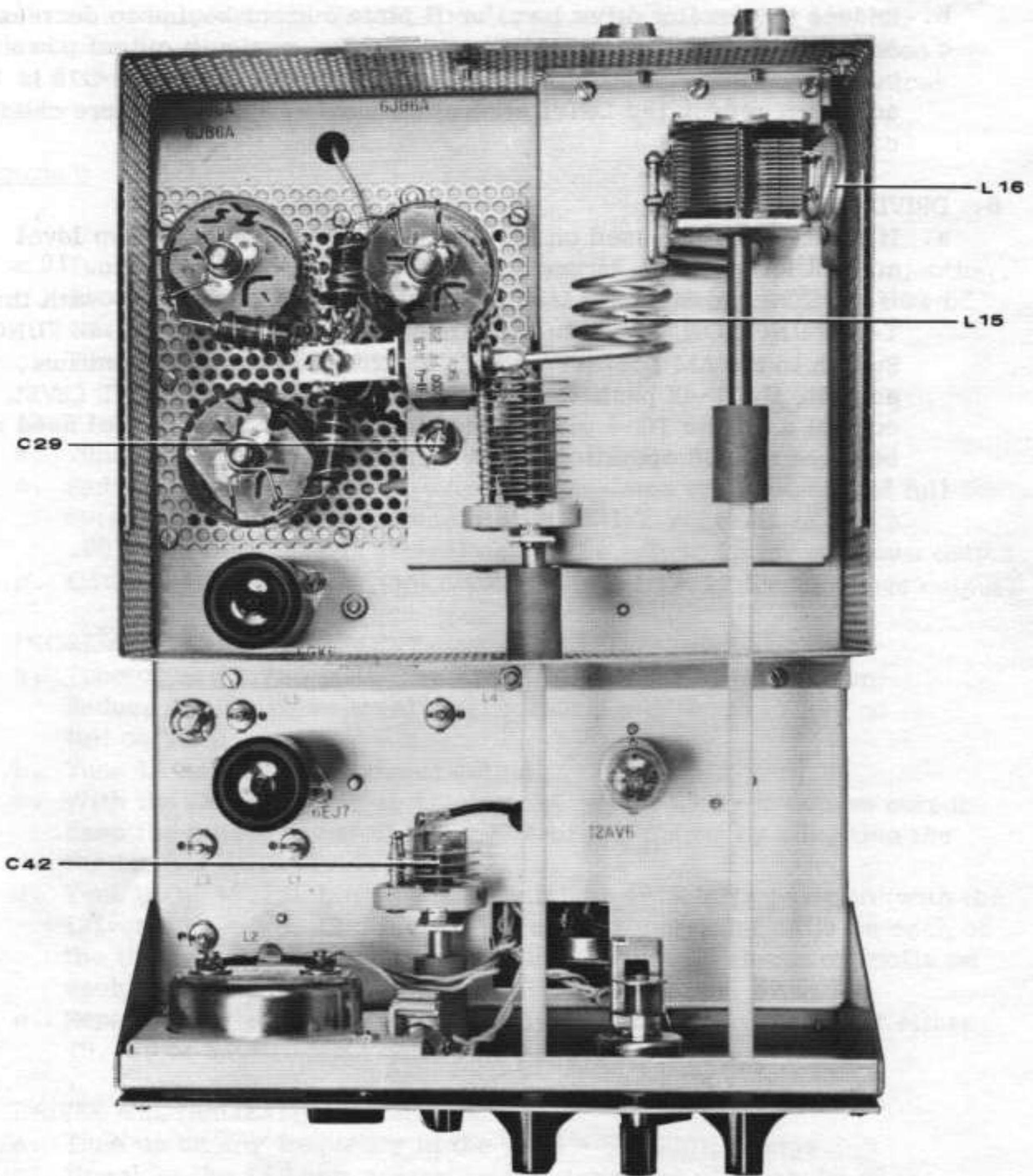


FIG. 9

TC-6 Top View

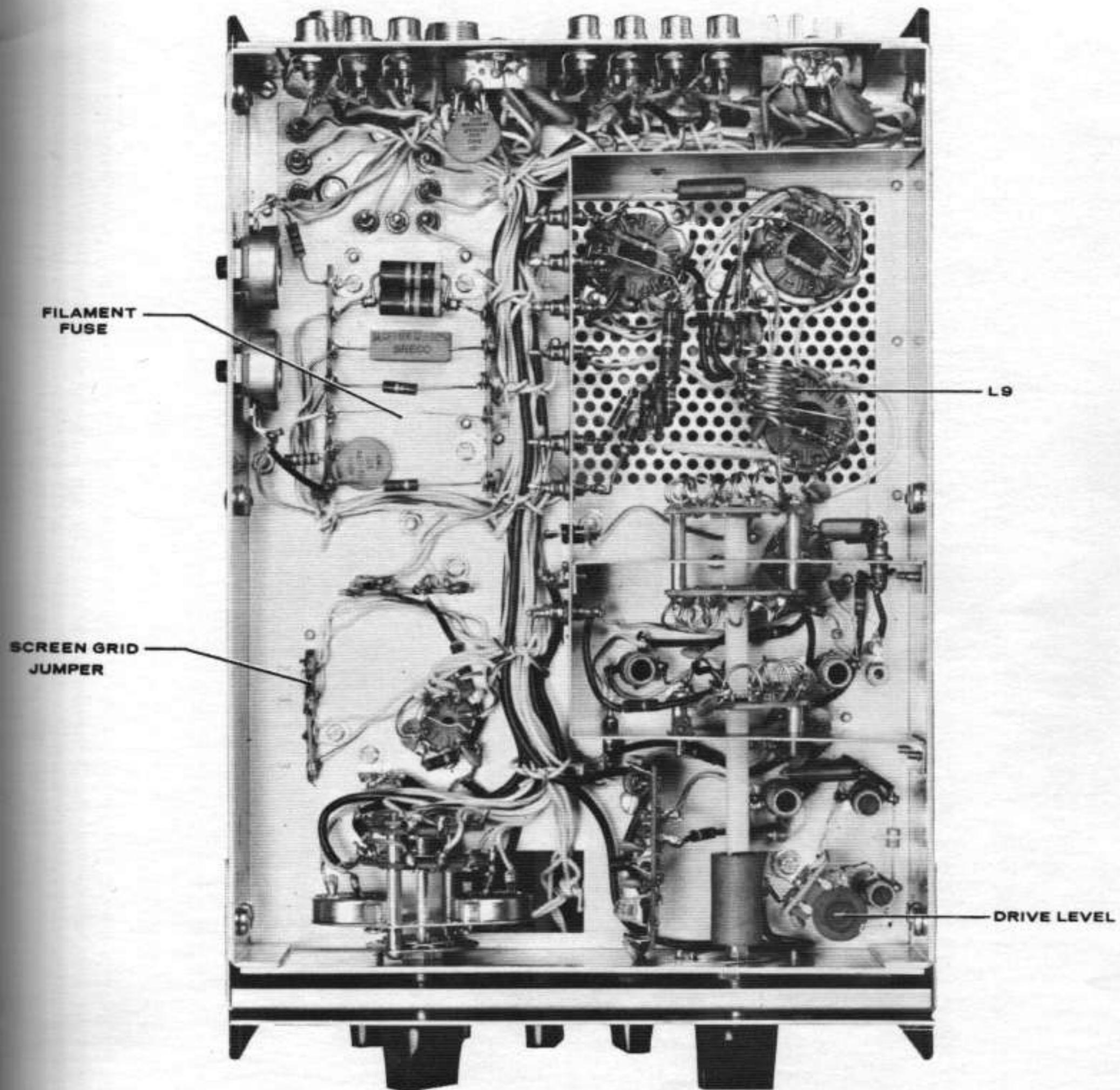


FIG.10

TC-6 Bottom View

V. SPECIFICATIONS

A. General Specifications

1. FREQUENCY COVERAGE: 49.5 to 54.0 MHz.
2. MODES OF OPERATION: SSB, CW, AM, and RTTY: determined by exciter.
3. AVERAGE DISTORTION PRODUCTS: The odd order are at least 35 dB below PEP.
4. INPUT POWER: 300 watts of CW and RTTY. 300 watts PEP on SSB and AM.
5. OUTPUT IMPEDANCE: Nominal 52 ohms with adjustable Pi-L network. (SWR less than 2:1).
6. Injection Required: 0.25 V. at 36.0 and 36.5 MHz (from SC-6).
7. EXCITATION REQUIRED: 0.25 V. at 13.5-17.5 MHz.

B. Controls

Front: Plate, load, driver, function switch, range switch, and meter.

Side: TC-6 bias adj. and exciter bias adj.

Rear: 1) Type SO-239 Antenna Connector.

1) Type N Connector, receiving converter antenna out.

1) Male power connector for power supply.

1) Female power connector for power cable to H.F. exciter.

14) Phono jacks for all other necessary interconnections between various station equipment.

Inside: 14 MHz drive adj.

C. Power Requirements:

12.6 VAC or DC

@ 2.4 A.

250 VDC

@ 100 mA. no more than 1/4% ripple

650 VDC

@ 540 mA max., 300 mA ave., less than 1% ripple

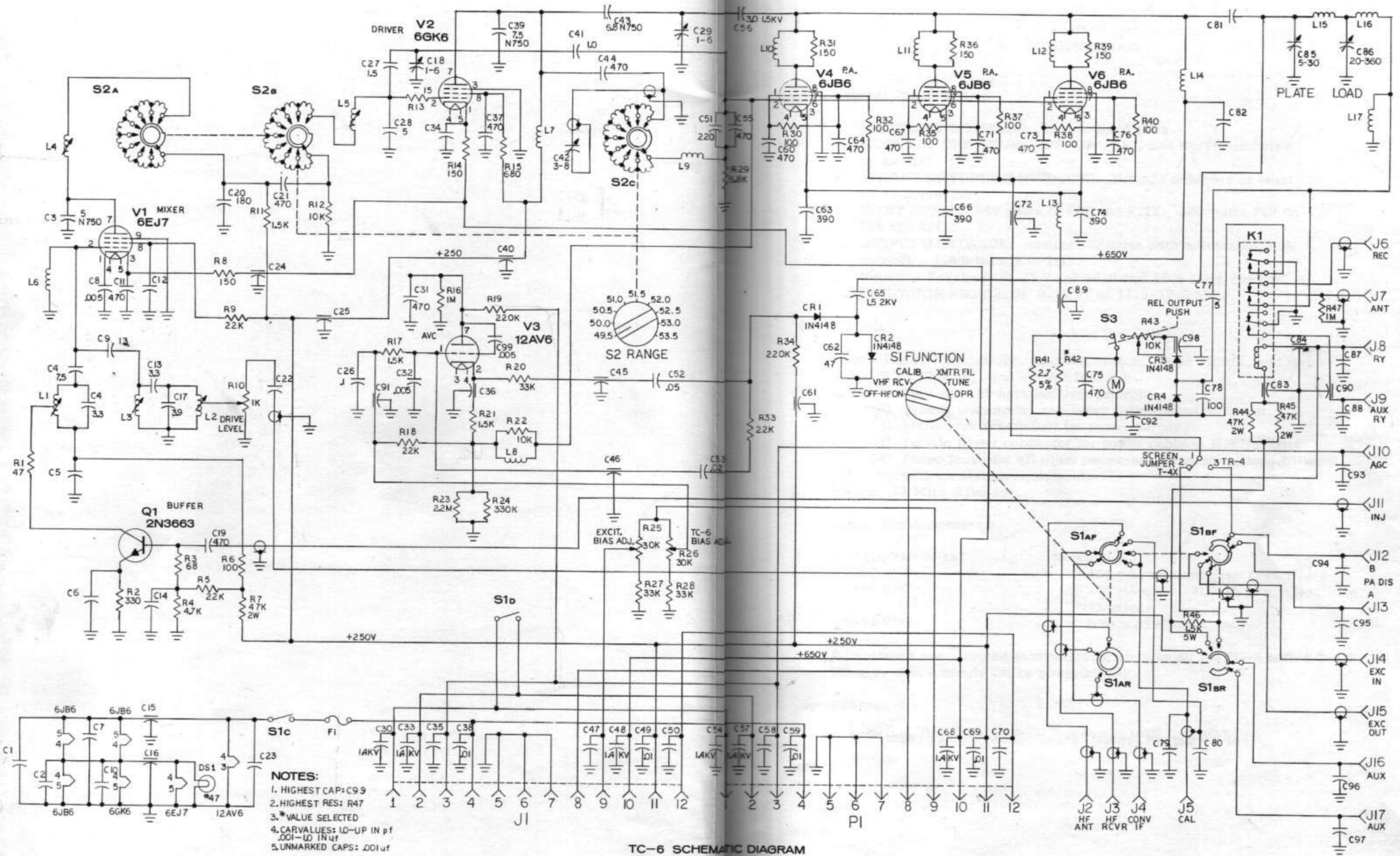
-75 VDC

Into a 33 K load.

All voltages are obtained automatically when using the TC-6 with a T-4XB, or TR-3/4, with a single Drake power supply.

D. Dimensions:

5-1/2" high, 11-5/8" deep, 7-5/8" wide. Weight - 9 lb.



- NOTES:**
1. HIGHEST CAP: C99
 2. HIGHEST RES: R47
 3. *VALUE SELECTED
 4. CAP VALUES: 10-UP IN pF
.001-10 IN μ F
 5. UNMARKED CAPS: .001 μ F

TC-6 SCHEMATIC DIAGRAM