

**DRAKE**

MODEL

# C-4

**STATION  
CONSOLE**



INSTRUCTION MANUAL

PRICE **\$2.00**

**INSTRUCTION MANUAL**

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## 1. GENERAL DESCRIPTION

### 1.1 FEATURES

The Drake C-4 STATION CONSOLE is designed to make the Amateur Radio Station more efficient and easier to operate. It integrates many features into one package, making it a unique piece of equipment.

It includes a DIGITAL CLOCK, a POWER MASTER providing complete station power control, a motor driven REMOTE ANTENNA SWITCH with five antenna capability, a PHONE PATCH designed around the new regulations regarding phone line attachments, a TIMER to indicate identification intervals, through line WATTMETER, unique EQUIPMENT CONTROL switching function, and a ROTOR CONTROL compatible with the popular Ham-M Rotor.

### 1.2 SPECIFICATIONS

#### 1.2.1 DIGITAL CLOCK

24 hour type

Motor: 120 VAC 60 Hz. 5W (50 Hz model available on special order.)

#### 1.2.2 POWER MASTER

Outlets: Four 120 VAC, 15A duplex outlets, three of which are controlled by a heavy duty contactor. One 240 VAC, 20A duplex outlet also controlled by the contactor.

Contacting Rating: Switchable load current - 25 amp., inductive load; 30 amp., resistive load.

Maximum carrying current - 150 amp.

All ratings are per pole. Contactor controls one side of the 120 VAC line and both sides (not neutral) of the 240 VAC line.

#### 1.2.3 REMOTE ANTENNA SWITCH

Selects remotely up to five antennas, grounds all unused antennas. GND position grounds all antennas when leaving station. "Rain-Hat" construction shields motor and switches.

Motor: 24 VAC, 2 amp. Lubricant good to -40° F.

Switch RF Capability: Maximum legal limit.

#### 1.2.4 PHONE PATCH

Designed to operate with type 30 or 30A QKT voice coupler now available from most phone companies. It may also be connected direct to phone lines where regulations permit. Transmitter driven by Compression Amplifier on PATCH/XMIT for constant drive regardless of phone line level. PTT operation only. Complete recording capability.

Phone line terminal impedance: 900 ohms resistive.  
Frequency Response: Sharp notch in response at 2600 Hz to meet new tariff requirements. Rolloff correct when used with Drake receivers.  
Record level available: 20-30 mv. nominal.  
Record jack output impedance: approx. 5 K ohms.

#### 1.2.5 TIMER

Period: 9-10 minutes nominal, adjustable.

#### 1.2.6 WATTMETER

Through line type.  
Frequency Coverage: 1.8-54 MHz  
Line Impedance: 50 ohms resistive  
Accuracy:  $\pm$  (5% of reading + 2 watts) on 200 watt scale;  
Accuracy:  $\pm$  (5% of reading + 20 watts) on 2000 watt scale.  
VSWR Insertion: Insertion of wattmeter in line changes VSWR no more than 1.05:1.  
Power Capability: 2000 watts RF, continuous duty.

#### 1.2.7 EQUIPMENT CONTROL

Phono socket capability: 200 watts RF continuous duty. The EQUIPMENT CONTROL switches will carry (not switch) 2 amp. DC. Four pole, 11 position with 3 positions (A, B, and C) available by phono sockets. Poles 1, 2, and 3 (COM 1, COM 2, and COM 3) shielded from each other.

#### 1.2.8 ROTOR CONTROL

Compatible with Series III and IV HAM-M Rotors.  
Indication independent of normal line voltage changes.

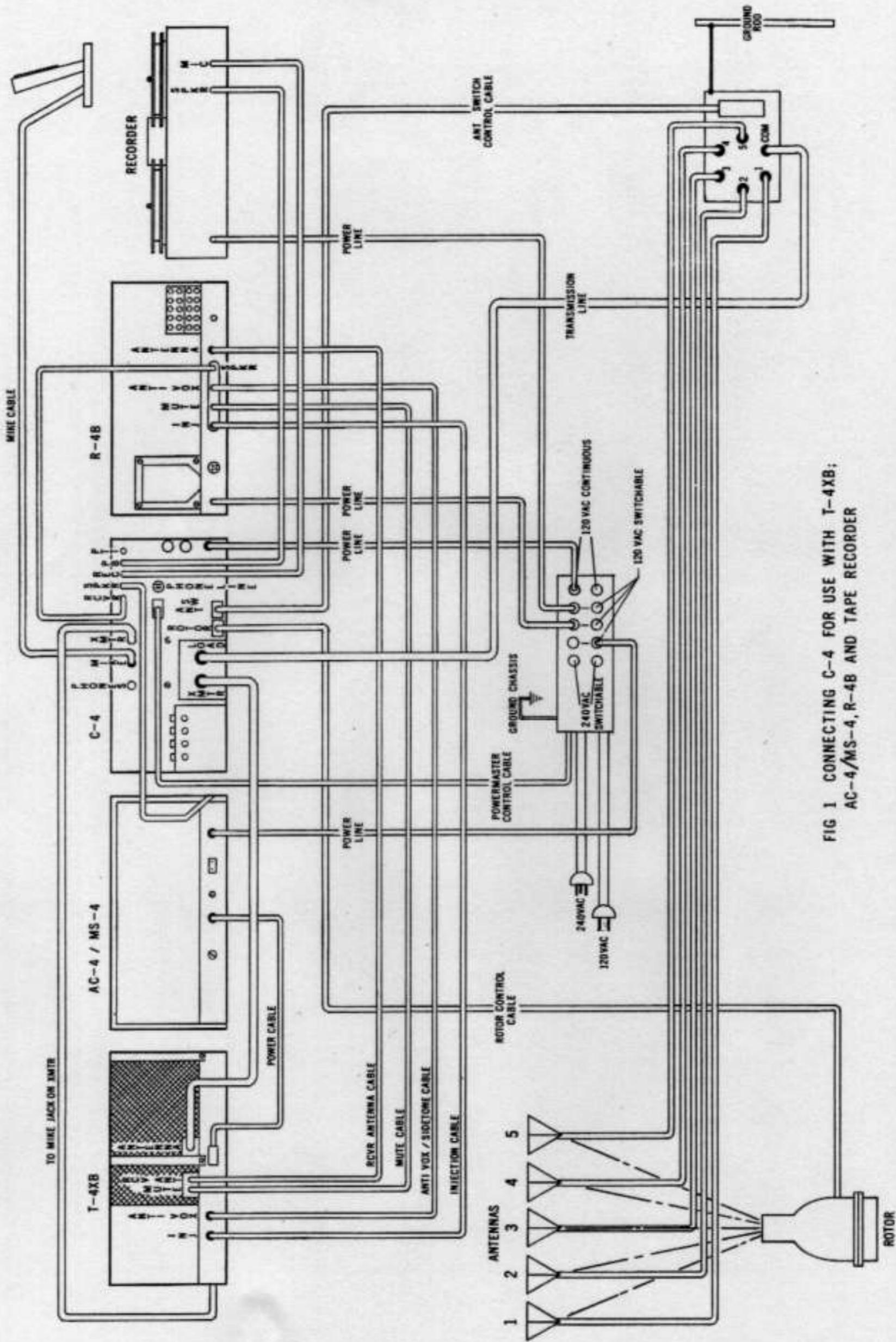


FIG 1 CONNECTING C-4 FOR USE WITH T-4XB;  
AC-4/MS-4, R-4B AND TAPE RECORDER

## 2. INSTALLATION

### 2.1 UNPACKING

Carefully remove your C-4 and its accessories from its packing carton and examine it closely for signs of shipping damage. Should any be apparent, notify the delivering carrier immediately, stating the full extent of the damage.

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

Save the packing material. You may need it later for reshipment or storage.

Inspect the packing material closely before putting it away to be sure you have not overlooked the hardware shipped with your C-4. The following should be included in the hardware:

1 - 4' length of Belden Cable #8734

2 - S-230 plugs

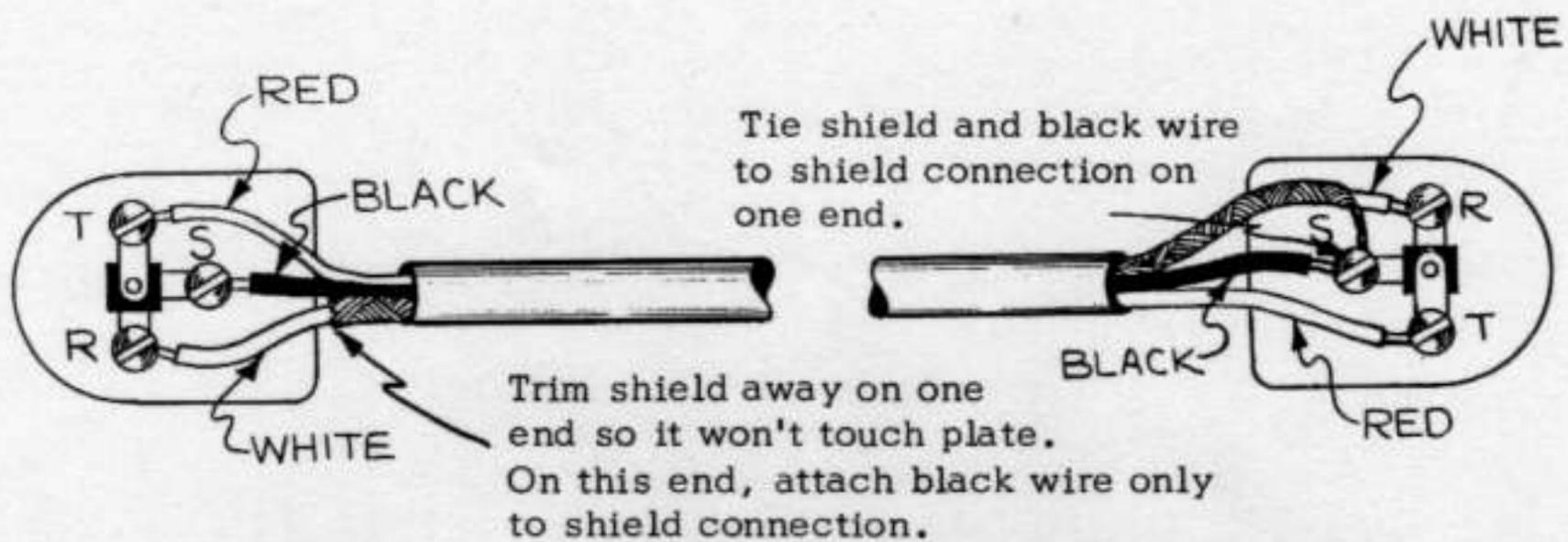
8 - Phono plugs

2 - 3' molded patch cables

1 - Two conductor Jones socket

1 - Eight conductor Jones plug

1 - Ten conductor Jones plug



NOTE: Cut cable furnished (Belden #8734) to length needed.

FIG. 2 C-4 to Transmitter Cable Assembly

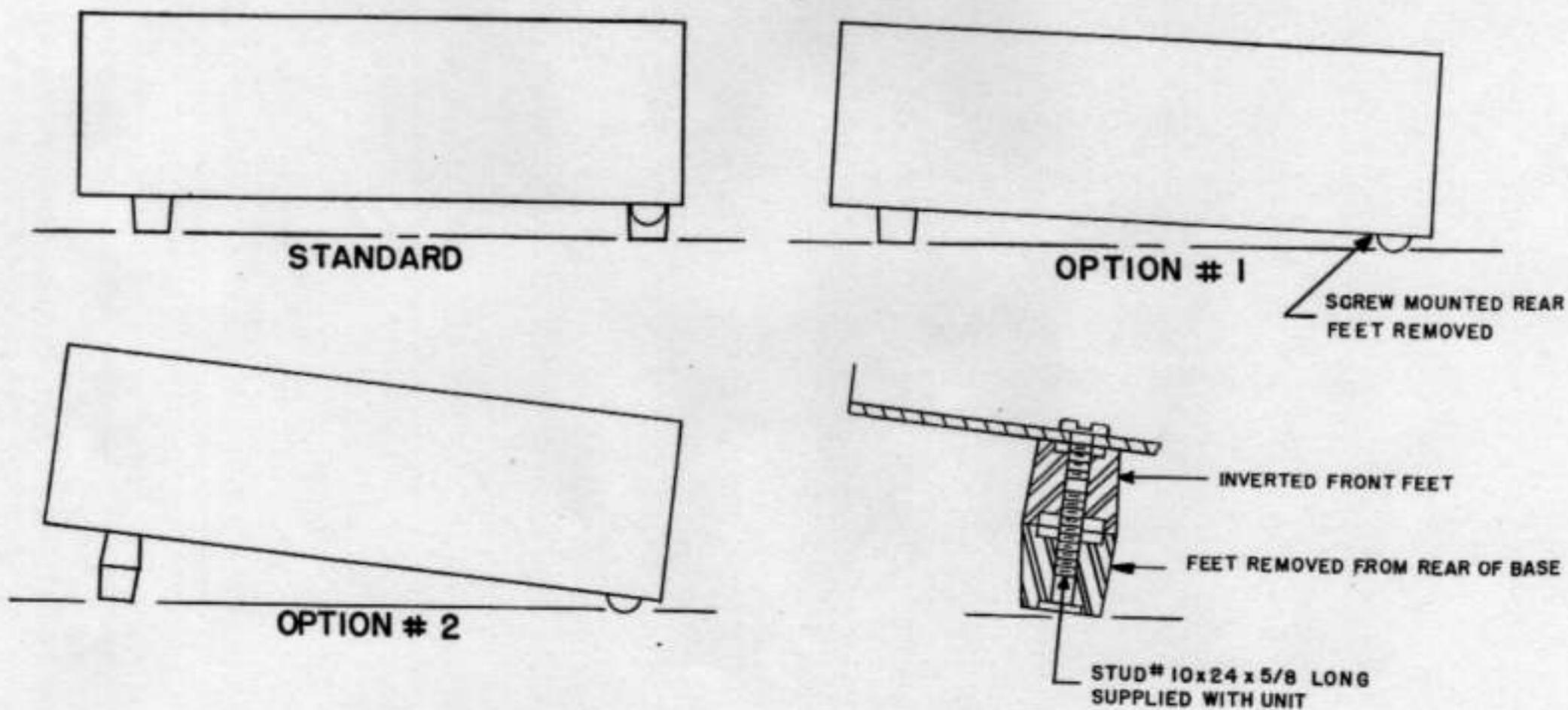


FIG. 3 Viewing Angle Options

## 2.2 LOCATION AND CABLING

### 2.2.1 CONSOLE

The CONSOLE should be placed so its front panel controls are easily accessible from the operator position. Most of the cables for interconnection of the C-4 and other equipment are provided. Use cables provided when possible. Refer to Fig.4 during cabling.

Connect the RCVR phono socket to the receiver audio output. Connect the SPKR phono socket to the station speaker.

NOTE: If a T-4X/T-4XB or R-4A/R-4B combination is used in conjunction with the C-4, the SPOT function cannot be used. To overcome this, a modification in the interconnection must be used. Instead of connecting the receiver audio output to the RCVR phono socket, connect it to COM 1 on the EQUIPMENT CONTROL box. Instead of connecting the station speaker to the SPKR phono socket, connect it to COM 2 on the EQUIPMENT CONTROL box. Now connect a short patch cable from A1 on the EQUIPMENT CONTROL box to the RCVR phono socket. Connect a short patch cable from A2 to the SPKR phono socket. Finally, jumper B1 and B2 together using a short patch cable. These patch cables can be constructed using the phono plugs furnished.

For normal operation of the C-4, the EQUIPMENT CONTROL switch should be left in the "A" position. Whenever the SPOT function is desired, rotate the EQUIPMENT CONTROL switch to the "B" position. This connects the receiver audio output directly to the station speaker, bypassing the C-4. Be sure to return the EQUIPMENT CONTROL switch to the "A" position for normal operation.

Interconnection using the EQUIPMENT CONTROL box as described above will also prove useful if the Receiver is often used alone. (Transmitter is not used.) If the Transmitter is off, or not connected to the C-4, relay K1 will be energized when the C-4 is on. This shorts the RCVR phono socket to ground. If connected using the EQUIPMENT CONTROL box, the Receiver can be used when the Transmitter is off by rotating the EQUIPMENT CONTROL switch to the "B" position.

This again connects the Receiver output directly to the speaker, bypassing the C-4.

If a tape recorder is to be included in the installation, connect the REC and PB phono sockets to the recorder's input and output respectively. If a foot switch is to be used in any mode to control the transmitter, connect to the PTT phono socket so the center conductor is grounded when the transmit function is desired.

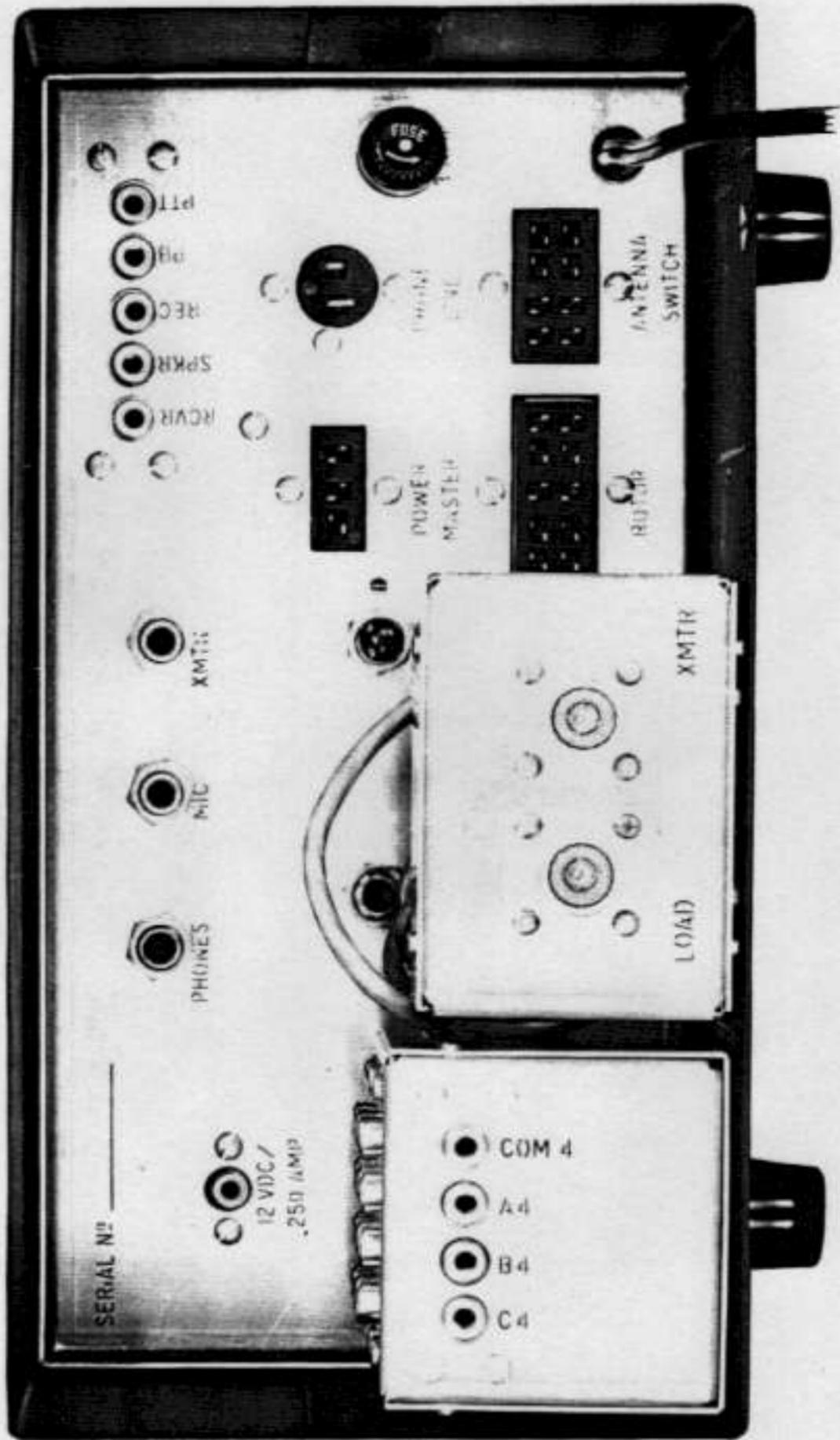


FIG. 4 REAR VIEW

A cable terminated in a 2-conductor Jones socket and a Switchcraft type 229 phone plug are required for connection of the C-4 PHONE LINE terminals to the type 30 or 30A voice coupler now available from most phone companies. If not familiar with this new device, contact your local phone company for further information. The phone company furnished device is also referred to as a "QKT". The 2-conductor Jones socket is included with the hardware.

It is advisable to strap all equipment together by a braided strap and then connect the strap to a good earth ground. This will eliminate or reduce problems that might result from an installation involving such extensive cabling.

Connect the station MIKE to the jack labeled MIKE using a Switchcraft S-230 plug. Connect the jack labeled XMTR to the MIKE jack on the transmitter using a cable terminated in a Switchcraft S-230 plug on one end, and the required connector on the other end for the transmitter in use. Refer to Fig. 2 for construction of a C-4 to transmitter cable using the cable and S-230 plugs provided. This will enable the C-4 to be connected to all Drake transmitters and transceivers.

**NOTE:** The C-4 is shipped wired to operate with transmitters and transceivers whose PTT line is negative on receive; and then is grounded on transmit. (All Drake transmitters and transceivers manufactured as of January 1, 1970, operate in this manner.) If the C-4 is to be used with a transmitter or transceiver whose PTT line is positive on receive, a modification is necessary. The modification involves changing the location of two jumpers on the large P.C. board in the C-4. Refer to Fig. 11 for a pictorial description of this modification.

When wired for either case, the PTT line voltage should not exceed  $\pm 25$  VDC on receive..

The PHONES jack requires a Switchcraft type 229 plug if used.

To utilize the HAM-M compatible Rotor control, connect pins #1 through #8 on the HAM-M Rotor to pins #1 through #8 on the 10 pin Jones plug provided. Pins #9 and #10 are not used. Use a suitable cable such as Belden #8448. Be sure the two heavier conductors in the 8 conductor Belden #8448 cable are connected to pins #1 and #2.

**CAUTION:** THE ROTOR CONTROL CIRCUIT IN THE C-4 IS DESIGNED TO OPERATE WITH THE SERIES III AND SERIES IV HAM-M ROTORS ONLY. THIS CORRESPONDS TO THE "B" WIRING IN THE LATER HAM-M ROTOR CONTROL SCHEMATICS. AN EASY CHECK TO SEE IF YOUR ROTOR IS COMPATIBLE IS TO INSPECT THE CONTROL UNIT OR THE SCHEMATIC THAT ACCOMPANIED IT TO SEE IF CONDUCTOR #1 IN THE CONTROL CABLE IS GROUNDED AND CONNECTED TO THE ARM OF THE POT STRIP IN THE ROTOR. DO NOT ATTEMPT OPERATION UNTIL YOU ARE SURE YOUR HAM-M ROTOR IS COMPATIBLE WITH THE C-4 ROTOR CONTROL CIRCUITRY.

Connect the 10 pin assembled Jones connector to the connector on the rear of the C-4 chassis labeled ROTOR.

### 2.2.2 POWER MASTER

Locate the POWER MASTER at a convenient place on the floor so all line cords of equipment to be controlled by it including C-4's line cord, and the control cable, will reach.

Connect the 240 VAC main line cord on the POWER MASTER to a suitable 240 VAC source using a suitable plug. A plug is not furnished for this line cord since many different configurations are popular. A conduit "knock-out" is available on the POWER MASTER chassis if a more "heavy-duty" or permanent installation is desired. If a 240 VAC source is not needed, merely coil this line cord up, as it is not used.

Connect the 120 VAC main line cord to a suitable 120 VAC source.

CAUTION: BEFORE OPERATION OF THE POWER MASTER IS ATTEMPTED:

- 1) CONNECT POWER MASTER CHASSIS TO A GOOD EARTH GROUND USING GROUND LUG PROVIDED.
- 2) BE SURE TOTAL LOAD ON POWER MASTER DOES NOT EXCEED CAPABILITY OF SOURCE OR CONTACTOR RATING AND CIRCUITS SUPPLYING POWER MASTER ARE PROPERLY FUSED.
- 3) IF THE TOTAL LOAD ON THE 120 VAC OR 240 VAC CIRCUITS EXCEEDS 15 AMP. CONTINUOUS DUTY, IT IS SUGGESTED THE POWER MASTER BE FED BY HEAVIER LINES BY WAY OF THE CONDUIT "KNOCK-OUT", RATHER THAN THE LINE CORDS FURNISHED.

Plug all line cords of equipment to be controlled by POWER MASTER into the brown 120 VAC and 240 VAC receptacles on the POWER MASTER. The 240 VAC outlets will except either a 15 amp. or 20 amp. type plug. Plug the C-4 line cord into one of the ivory outlets. (These outlets are "on" if main power is applied to the POWER MASTER and are not switched on and off by the contactor as the brown outlets are.) After the C-4 is plugged in, one ivory outlet is available for supplying something that it is not desirable to control by the POWER MASTER (such as a lamp, tape recorder, etc.).

Connect the POWER MASTER control cable to connector labeled POWER MASTER on rear of C-4 chassis.

Before proceeding with operation, refer to OPERATION section since the C-4 has a "hidden" safety switch which disables the "ON" control that controls the POWER MASTER.

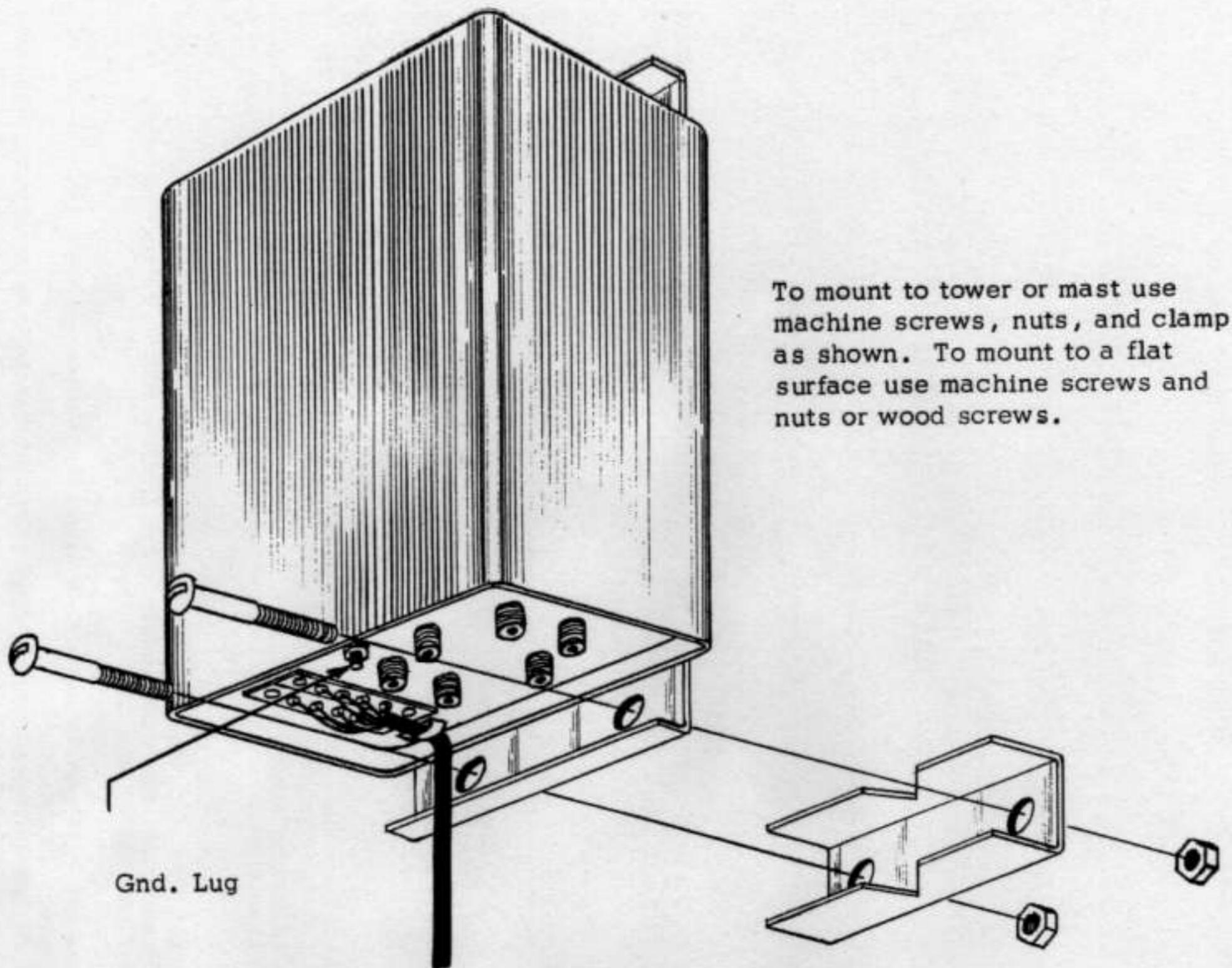


FIG. 5 ANTENNA SWITCH Installation

### 2.2.3 REMOTE ANTENNA SWITCH

The universal mounting bracket on the ANTENNA SWITCH allows it to be easily mounted to the side of a tower or to a flat surface if desired. It's "Rain-Hat" construction makes it capable of operating in adverse weather conditions.

After mounting as shown in Fig. 5 , connect terminals #1 through #8 on the ANTENNA SWITCH to terminals #1 through #8 on the 8 pin Jones connector provided using a good grade of 8 conductor cable. Belden #8448 cable recommended for the ROTOR control cable is also well suited for the ANTENNA SWITCH control cable. Be sure to use the cable clamp on the ANTENNA SWITCH to relieve strain on terminal strip connections.

It is advisable, even if ANTENNA SWITCH is mounted to a tower, to connect strap from the ground lug on ANTENNA switch to a good earth ground or to tower if this type of installation is used. This will assure good grounding of antennas. Grounding of ANTENNA SWITCH is absolutely necessary to assure good grounding of antennas if ANTENNA SWITCH is mounted to structure which is not a good earth ground.

Connect antennas to coax receptacles on ANTENNA SWITCH using a good grade of 50 ohm coaxial cable and PL-259 connectors. Connect single transmission line to be used to coax receptacle labeled "C" using PL-259 connector. Make a record of the number of the coax receptacle used for each specific antenna. These numbers will correspond to the markings on the ANTENNA control switch on the console.

At the station end of the transmission line, connect the coax, using PL-259 connectors to the coax receptacle labeled LOAD on the WATT-METER coupler mounted at the rear of the C-4 case. Connect the transmitter output to the coax receptacle labeled XMTR on the WATT-METER coupler. The WATTMETER coupler can be removed from the C-4 case by removing the four screws securing it, and located at a more convenient spot if desired. Connect the assembled 8 pin Jones connector to the connector labeled ANTENNA SWITCH.

It is advisable to use the ANTENNA SWITCH even if only one antenna is used, as it provides easy grounding of the antenna when leaving the station and future antenna installations are then easily accomplished.

### 3. OPERATION

#### 3.1 POWER MASTER

After complete installation of the C-4 and its accessories, as described in the preceding section, the C-4 is now ready to operate as the control center of the complete station.

Place all front-panel switches in the following positions: (See Fig.6)

1. ANTENNA - Rotate ANTENNA control switch to number corresponding to antenna to be used.
2. PHONE PATCH - MIKE position.
3. TRANSMITTER CONTROL SWITCH - RCV
4. TIMER - OFF
5. METER FUNCTION - 2000 FWD.
6. EQUIP. CONTROL - If C-4 is connected as described under 2.2.1 for use with a T-4X/T-4XB and R-4A/R-4B combination, place EQUIP. CONTROL switch in position "A".  
IF C-4 is connected as described under 2.2.1 without using EQUIP. CONTROL box, EQUIP. CONTROL switch can be in any position.
7. ROTOR - Neutral position

To energize the contactor in the POWER MASTER, which is now supplying primary power to the complete station, momentarily depress the black STATION POWER "ON" push-button. A dull "thump" will be heard as the power contactor in the POWER MASTER latches in. Power is now applied to the C-4 and all other equipment being controlled by the POWER MASTER. Notice that the DIGITAL CLOCK pilot lamp is on continuously, and the pilot lamp illuminating the meter is on only when the STATION POWER is on.

Immediately after the STATION POWER "ON" button is depressed, the dual function indicator above the clock will light indicating the motor driven switches in the ANTENNA SWITCH are seeking the position selected. (Refer to REMOTE ANTENNA SWITCH in this section for complete operating details of the REMOTE ANTENNA SWITCH.) When this position is reached, the indicator will go out and the antenna corresponding to the number selected is now terminating the transmission line. All other antennas connected to the ANTENNA SWITCH are grounded.

The POWER MASTER's contactor can now be controlled using the STATION POWER "ON" and "OFF" push-buttons. Momentarily depressing the red "OFF" button de-energizes the contactor in the POWER MASTER and removes power to all equipment. Momentarily depressing the "ON" button will again energize contactor in the POWER MASTER if ANTENNA control switch is in some position other than GND. Refer to next section for explanation of "safety feature" used in conjunction with the STATION POWER controls.

### 3.2 REMOTE ANTENNA SWITCH

With STATION POWER on, as described in the previous section, the ANTENNA control switch determines what antenna is terminating the transmission line. To change antennas, merely rotate the ANTENNA control switch to the number corresponding to the desired antenna. The dual function indicator above the clock will light showing the motor driven switches are turning. When light goes out, antenna selected is terminating the transmission line.

**CAUTION:** BE SURE TRANSMITTER IS IN THE "OFF-THE-AIR" CONDITION WHEN DUAL FUNCTION INDICATOR LIGHT IS LIT CONTINUOUSLY, INDICATING MOTOR DRIVEN SWITCHES ARE TURNING. DURING THIS INTERVAL THE TRANSMISSION LINE IS IMPROPERLY TERMINATED.

When leaving the station, rotate the ANTENNA control switch to the GND position. Indicator light will light indicating motor driven switches are turning. After indicator goes out, assuring all antennas are grounded, disable STATION POWER by momentarily depressing the red "OFF" push-button.

In the GND position of the ANTENNA control switch, the black STATION POWER "ON" push-button is inoperative. This added safety feature makes it more difficult for the STATION POWER to be activated by children, which in turn encourages the operator to return the ANTENNA control switch to the GND position when leaving the station.

If the ANTENNA SWITCH control cable is disconnected, or not used at all, the safety feature of the ANTENNA switch in relation to the STATION POWER controls is retained. Simply place the ANTENNA control switch in the GND position when leaving the station, and return it to one of the other five positions to make the STATION POWER "ON" button operable.

### 3.3 DIGITAL CLOCK

The DIGITAL CLOCK and its pilot lamp are on continuously regardless of the state of the STATION POWER. (Assuming C-4's line cord is plugged into one of the ivory outlets on the POWER MASTER and the 120 VAC main line cord supplying the POWER MASTER is connected to a suitable source.)

### 3.4 NORMAL MIKE OPERATION

After complete installation as described in Section 2, normal operation with a MIKE is accomplished as follows.

With the PHONE PATCH switch in the MIKE position, normal VOX or PTT operation can be used with the Transmitter Control rocker switch in the VOX position. Either a PTT MIKE or foot switch (sometimes preferred for CW) can be used for transmitter control when PTT operation is used.

If VOX operation is used, and a sudden increase in room noise upsets VOX operation, the Transmitter Control switch can be placed in the RCV position on receive (grounding transmitter input) and in the XMIT position to transmit (PTT line is grounded) allowing operation to continue by PTT without having to upset the VOX control settings on the transmitter. To resume normal VOX operation, merely return transmitter control rocker switch to the VOX position.

**IMPORTANT: BE SURE TRANSMITTER CONTROL SWITCH IS IN THE VOX POSITION FOR PTT OPERATION BY EITHER A MIKE EQUIPPED WITH A PTT SWITCH OR A FOOT SWITCH. LEAVING TRANSMITTER CONTROL SWITCH IN THE RCV POSITION MUTES THE TRANSMITTER.**

If a recording is to be made of a QSO, merely turn on the tape recorder connected as described in Section 2 and adjust record level. The level available at the REC phono socket should be appropriate to drive most recorders properly (20-30 mv). For a normal setting of the volume control on the receiver, the level available at the REC phono socket on receive will be nearly equal to that available on transmit if a ceramic cartridge mike is being used. A crystal mike will probably give a little higher level since the MIKE is connected to the REC phono socket by a unity gain buffer amplifier.

It is advisable to operate PTT using the Transmitter Control rocker switch when recording a QSO. This mutes the MIKE during receive.

### 3.5 PHONE PATCH

With the C-4 connected as described in Section 2, the PHONE PATCH is ready to operate.

**IMPORTANT: BE SURE C-4 IS MODIFIED AS EXPLAINED IN SECTION 2 IF USED WITH TRANSMITTERS OR TRANSCEIVERS WHOSE PTT LINE IS POSITIVE ON RECEIVE.**

Before attempting operation of the PATCH, be familiar with the regulations and limits applying to use of the Voice Coupler furnished by your local telephone company. Hold line levels within limits specified using the level meter in the C-4. The meter is calibrated with respect to 900 ohms, the input impedance of the PATCH and the nominal output impedance of the Voice Coupler, so accurate levels are indicated.

The C-4 meets all the new regulations within itself, except frequency response rolloff. This is dependent upon the receiver used and is more than adequate if used with selective receivers with IF bandwidths of 2.1 kHz to 2.4 kHz and good shape factors. See Fig. 8

When the PATCH is to be used, place the METER FUNCTION switch in the dBm position, the Transmitter Control rocker switch in the RCV position, and the PHONE PATCH switch in the PATCH position. In the PATCH position the mike and speaker are inoperative, and the telephone handset is used exclusively. This makes the optional "cut-off" key available with installation of the Voice Coupler unnecessary, as it is used to disconnect the telephone handset.

After the "land-line" connection is established, and necessary instructions are given to the party involved, pull up on the "exclusion key", part of the Voice Coupler installation on your telephone, which completes the connection to the phone line. If the C-4 PHONE LINE terminals are connected directly to the Phone Line, and no voice coupler is used, rotating the PHONE PATCH switch to the PATCH position completes the connection.

The PATCH is now operative, and the operator now controls the XMIT/RCV mode using the Transmitter Control rocker switch. The instructions given to both parties should inform them to indicate when they have completed their comments by saying "over". This indicates to the "listening" party that it is his turn to talk, and also signals the operator to change modes.

On XMIT, you automatically put the transmitter "on-the-air", driving it from the telephone line. Any comments you might make are now made using the telephone handset. The C-4 is factory adjusted to provide a normal drive level for normal phone line levels, so readjustment of the Transmitter Gain Control from some other than its normal position should be minimized.

The C-4 is factory adjusted to provide a transmitter drive level comparable to that obtained from a ceramic cartridge mike. If a crystal mike is normally used, the transmitter gain may have to be set somewhat higher on PATCH/XMIT than normal with regular MIKE operation. The drive level can be increased by adjustment of the XMTR DRIVE control in the C-4. Refer to Section 5.3.3 if this is to be attempted.

To RCV, switch the Transmitter Control rocker switch to the RCV position, the receiver audio output is now transferred to the phone line. Adjust the receiver volume control for a good phone line level. For long distance connections, be sure the level is set to provide an adequate signal to the party on the "land-line" end of the PATCH, although this might be a little higher than normal level on the operator's side of the PATCH. Be sure the dBm meter peaks are within limits specified by regulations. A nominal level for local patches will be on the order of -12 dBm to -9 dBm.

When the PATCH is completed, return the PHONE PATCH switch to the MIKE position and the Transmitter Control switch to the RCV position. When the telephone handset is replaced in the cradle, the "exclusion key" is pushed down disconnecting the Voice Coupler.

If the PATCH is controlled using a footswitch connected to the PTT phono socket as described in Section 2, the Transmitter Control switch should remain in the RCV position during PATCH operation.

Audio is available at the REC phono socket during the complete PATCH. However, recording of telephone conversations is not permitted by most telephone companies without the use of a "beep" signal every 15 seconds to indicate such a recording is being made.

Check with your local telephone company for specific regulations and requirements regarding recording of telephone conversations.

### 3.6 TAPE TRANSMISSION

To transmit a prerecorded tape, rotate PHONE PATCH switch to the XMIT TAPE position. The position of the Transmitter Control rocker switch is unimportant as the PTT line is automatically grounded in this position of the PHONE PATCH switch.

In this mode the transmitter is again driven by the Compression Amplifier, keeping transmitter drive constant. Turn tape recorder on, and adjust tape recorder for normal listening level. Touch up transmitter Gain Control on transmitter if required. (Speaker is still connected for monitoring.)

At end of tape, return PHONE PATCH switch to the MIKE position and Transmitter Control switch to the RCV or VOX position (depending on transmitter control method), and normal operation can be resumed.

### 3.7 TIMER

To use the TIMER, place the TIMER control switch in the "ON" position. At an interval determined by the setting of the TIMER control on the rear of the chassis, the dual function indicator above the clock will flash indicating it is time to identify the station. This is particularly useful during long Phone Patches, signaling the operator to break in and identify the station.

The FCC Regulations require identification at 10 minute intervals making 9 minutes the most convenient interval for the TIMER. This gives the operator 1 minute to identify the station after the signal originates. The Identify signal will continue to flash until it is extinguished by depressing the TIMER control switch to the spring-loaded RESET position or returned to the OFF position. A new interval will start from the instant the switch is depressed to the RESET position. For adjustment of the TIMER interval, refer to the ALIGNMENT Section.

The dual function indicator above the clock functions as the Identify signal as well as the ANTENNA SWITCH indicator simultaneously.

### 3.8 WATTMETER

After the WATTMETER coupler is installed as described in the INSTALLATION Section, forward power can be measured by rotating the METER FUNCTION switch to the 200 FWD or 2000 FWD position, depending on the range required. Reflected power can be measured in the 200 REFL or 2000 REFL positions of the METER FUNCTION switch.

VSWR can be calculated using the forward and reflected power measurements in conjunction with the Nomogram supplied with the C-4.

### 3.9 EQUIPMENT CONTROL

The EQUIP. CONTROL is a four pole, eleven position switch with the first three poles (COM 1, COM 2, and COM 3) shielded from each other. The first three positions (marked A, B, and C) are accessible by phono sockets on the EQUIPMENT CONTROL box on the rear of the main chassis. The remaining eight positions can be utilized if desired by running a cable through a hole in the EQUIP. CONTROL box and terminating it in a home-brew junction box or whatever the application calls for. No provision is made for access to these remaining eight positions (not marked on the front panel), since the EQUIP. CONTROL function is completely free to be used as the operator wishes.

A 12 VDC @ .250 amp. supply is available above the EQUIP. CONTROL box for patching into the EQUIP. CONTROL box should it be needed for relay operation, etc.

If desired, the EQUIP. CONTROL function can be used to switch Exciters, Receivers, or both.

### 3.10 ROTOR CONTROL

After connection as described in Section 2, and making sure your ROTOR is compatible with the C-4 ROTOR control circuitry, place the ROTOR control switch in either the extreme left-hand or right-hand position, depending upon direction of rotation desired. Notice the ROTOR control switch is not spring-loaded freeing the operator when rotating the antenna through a wide arc.

Remember never to leave the ROTOR control switch in either of the extreme positions for a long period of time, as damage could occur to the brake. The ROTOR motor is protected by limit switches.

When the ROTOR control switch is in either of the extremes, the meter in the C-4 indicates direction, overriding the function selected by the METER FUNCTION switch. When returned to the neutral position, the meter again functions as determined by the METER FUNCTION switch.

## 4. CIRCUIT DESCRIPTION

### 4.1 POWER MASTER

The POWER MASTER consists of the power contactor and the outlets it controls. Besides the three power poles, the contactor has a set of side mounted contacts used for latching. One side of the 120 VAC line is connected directly to one side of the contactor's coil through conductor #1 in the control cable. When depressing the STATION POWER "ON" control, the other side of the 120 VAC line is connected to the other side of the contactor's coil through the STATION POWER "OFF" control, the STATION POWER "ON" control, and a set of contacts on the ANTENNA switch by way of conductor #2 in the control cable. This pulls in the contactor and closes the latching contacts which are in parallel with the STATION POWER "ON" control and the contacts on the ANTENNA control switch, sustaining power to the contactor through conductor #3 in the control cable after the STATION POWER "ON" control is released. Momentarily depressing the STATION POWER "OFF" control interrupts power to the contactor's coil causing it to drop out.

The set of contacts on the ANTENNA control switch are closed in the five positions corresponding to selectable antennas, and open in the GND position. This makes the STATION POWER "ON" control inoperative in the GND position of the ANTENNA control switch. In this position, the STATION POWER can be turned off, but not on..

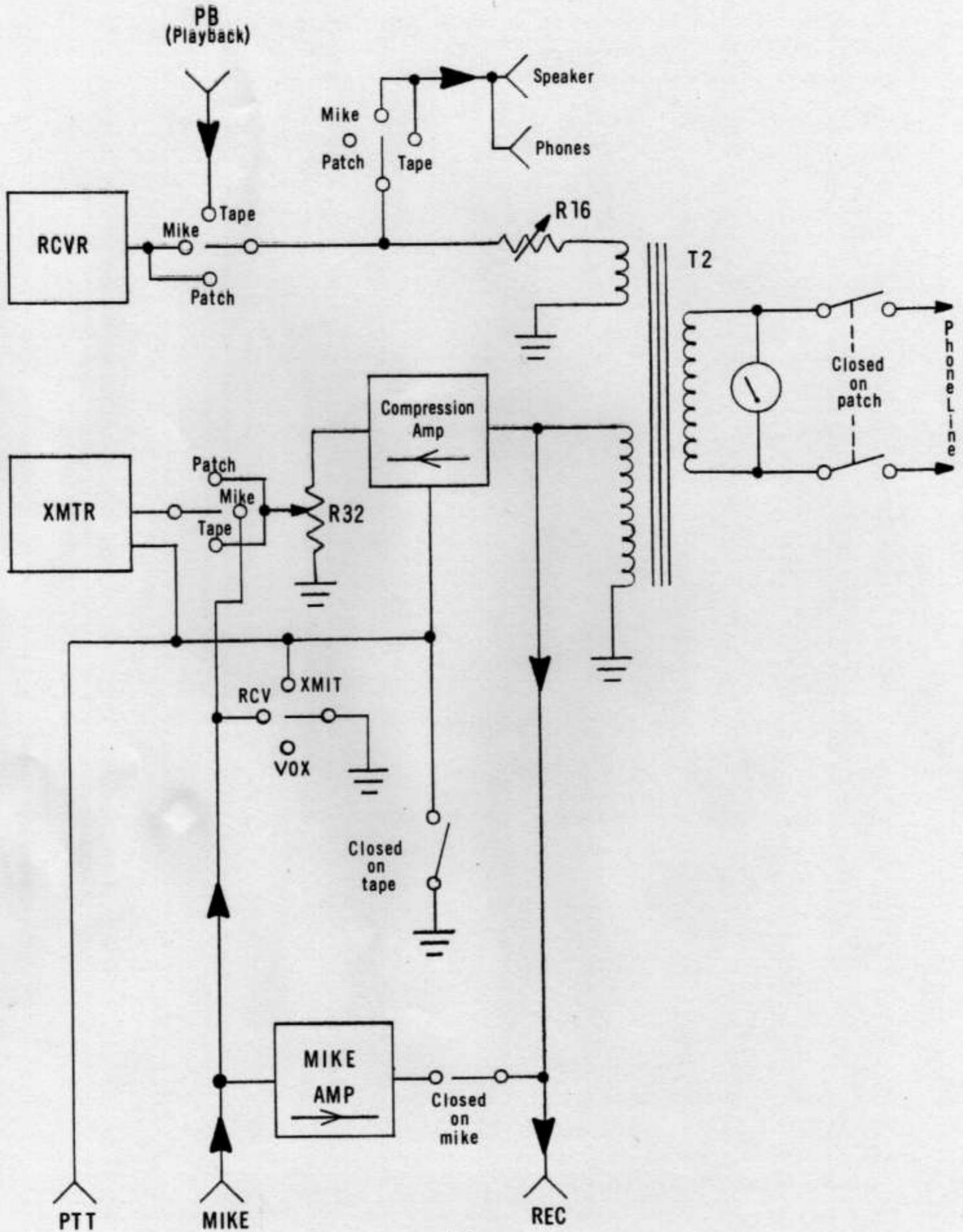
### 4.2 REMOTE ANTENNA SWITCH

The REMOTE ANTENNA SWITCH consists of two rotary switches on a common shaft, driven by a motor controlled from the console's front panel. One switch is a high grade ceramic type that does the actual antenna switching, and the other is used for control. It acts as the slave switch in a homing circuit controlled by the master switch on the front panel. Rotating the ANTENNA control switch to a new position applies power to the motor through the slave switch. The switches are driven to a position corresponding to that selected on the front panel. When this position is reached, power to the motor is interrupted. The indicator above the clock and its driving circuitry are connected in parallel with the motor by conductor #7 in the control cable causing the indicator to be lit when the motor is energized.

### 4.3 PHONE PATCH

The PHONE PATCH consists of transformer T-2, a volume compression amplifier, a level meter, and all necessary switching.

FIG:7 Block Diagram of PHONE PATCH



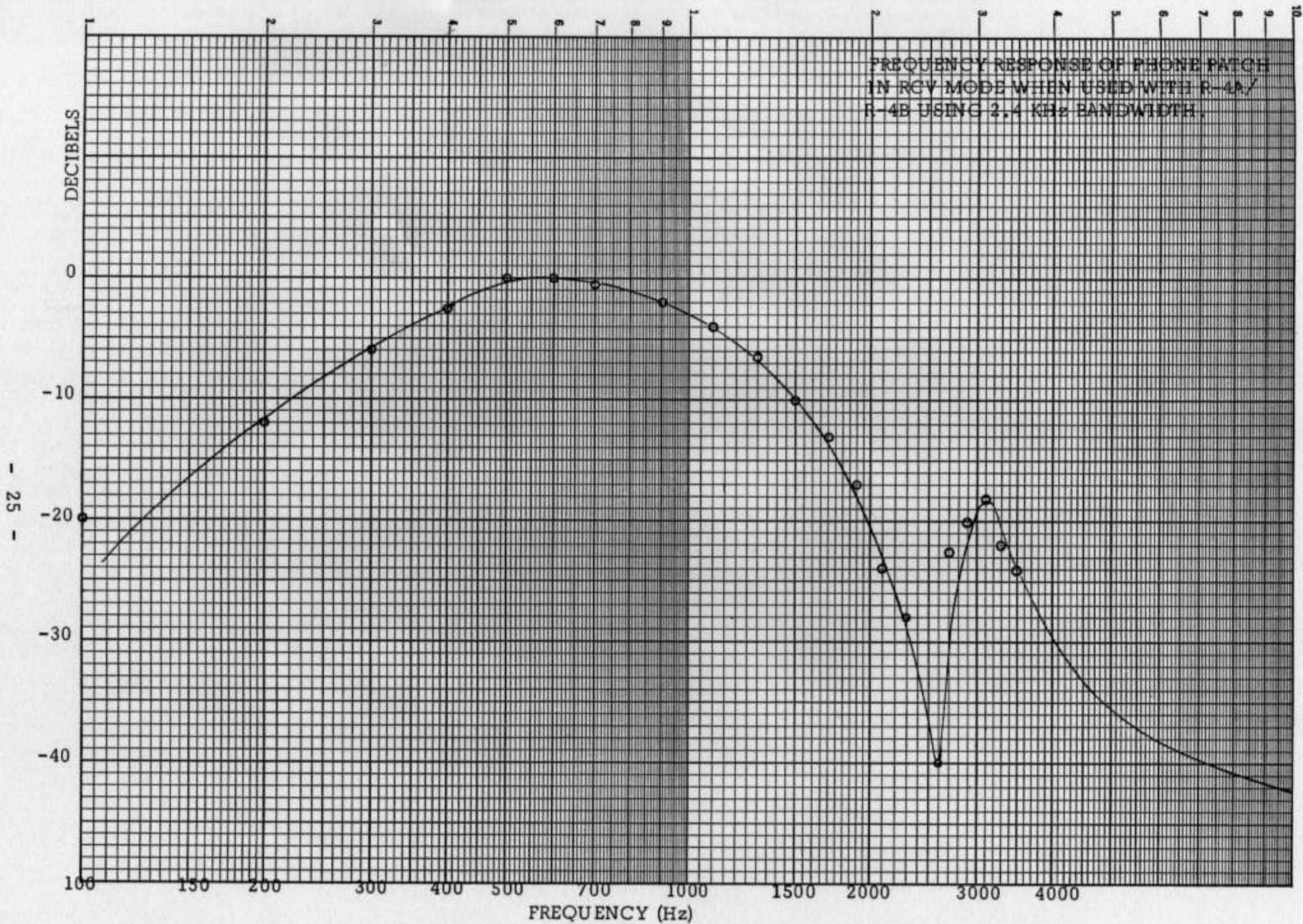


Fig.8 Frequency Response showing effect of notch at 2600 Hz.

A voltage proportional to the line voltage is developed at the junction of the voltage divider C33 and C34 and is applied to the center tap of L1. With a 50 ohm resistive load on the line, a voltage is developed at the junction of D11 and L1 and no voltage is developed at the junction of L1 and D12. If the load changes in magnitude (still resistive), the voltage and current magnitudes change and a voltage is developed at the junction of D12 and L1 because the voltages developed by L1 and C33/C34 no longer cancel each other. This voltage developed at L1/D12 is read as "reflected" power. The voltage at L1/D11 is read as forward power.

If the load becomes reactive, the voltages produced by C33/C34 and L1 will not be in phase and a voltage will be developed at both L1/D11 and L1/D12.

The "reflected" power is zero only when the load is 50 ohm resistive.

#### 4.6 ROTOR CONTROL

The ROTOR control circuit consists of a floating supply voltage applied to two equal series resistances with their common point grounded. In one leg is R23 and in the other is the meter, R39, R67 and R38. The pot strip in the ROTOR is connected in parallel with this series combination. With the ROTOR control cable disconnected, the current in the two legs is equal and the meter will read near mid scale. With the ROTOR control cable connected, the leg containing the meter is shunted by a portion of the pot strip, since the arm of the pot is grounded, and the resistance in the other leg, R23, is shunted by the remaining portion of the pot strip. Values are such that the meter reads full scale and zero for the two extreme positions of the rotor pot strip (if calibrated).

The ROTOR control circuit operates from a regulated supply voltage making frequent recalibration due to line voltage changes unnecessary.

Switch S-8 operating in conjunction with the ROTOR CAL control, R38, makes calibration at any position possible by connecting the full pot strip across the leg containing the meter. This corresponds to running the rotor to the end where the meter reads full scale and the antenna was installed so as to be pointing toward the direction specified by full scale indication. (South in the case of the C-4 and most Ham-M ROTOR CONTROL units).

In the PATCH/RCV mode, receiver audio is applied to the PHONE LINE and the dBm meter circuitry by one winding of T-2 and to the REC phono socket through a voltage divider network by another winding of T-2. The compression amplifier is muted on RCV by K1 making it unnecessary to disturb VOX control settings on the transmitter during a Patch.

In the PATCH/XMIT mode, the PTT line is grounded causing Q5 to conduct energizing K1. K1 grounds the receiver output, assuring absolute muting, and unmutes the compression amplifier. Audio from the telephone line is now applied to transformer T-2 where it is transferred to the REC phono socket through a voltage divider network and to the compression amplifier. The output of the compression amplifier is connected to the XMTR jack through XMTR DRIVE control R32.

In the MIKE/RCV mode of the PHONE PATCH switch, receiver audio is applied to the speaker and to the REC phono socket by way of T-2.

In the MIKE/XMIT mode, the MIKE is connected directly to the XMTR jack and to the REC phono socket by way of a buffer amplifier.

In the XMIT TAPE mode of the PHONE PATCH switch, the PTT line is grounded turning the transmitter on, and the tape recorder output, connected to the PB phono socket, is driving the compression amplifier by way of T-2. The XMTR is connected to the output of the compression amplifier through XMTR DRIVE control R32. The speaker is connected for monitoring purposes.

#### 4.4 TIMER

The TIMER consists of an astable multivibrator Q13/Q15, a bistable multivibrator Q14/Q16, constant current source Q17, programmable unijunction transistor Q20, lamp driver Q19, and electronic switch Q18.

The astable multivibrator Q13/Q15 turns the constant current source Q17 on and off, thus charging C-35 only during the interval when Q17 is on. C-35 charges linearly and its time constant is multiplied by approximately ten since the duty cycle of Q17 is approximately 10%.

C-35 charges to a point determined by R-64 where Q20 fires turning Q16 on disabling Q18 which allows Q19 to be pulsed on and off by astable multivibrator Q13/Q15. The indicator will flash until the TIMER control switch is RESET or returned to the OFF position. In both the RESET and OFF positions C-35 is shorted and Q16's emitter opened. Opening Q16's emitter causes the bistable multivibrator to return to its original state disabling the lamp driver.

#### 4.5 WATTMETER

Basically the wattmeter samples the line voltage and the line current and compares the current and voltage for magnitude and phase difference. A voltage is developed across the toroid L1 proportional to the line current.

A voltage proportional to the line voltage is developed at the junction of the voltage divider C33 and C34 and is applied to the center tap of L1. With a 50 ohm resistive load on the line, a voltage is developed at the junction of D11 and L1 and no voltage is developed at the junction of L1 and D12. If the load changes in magnitude (still resistive), the voltage and current magnitudes change and a voltage is developed at the junction of D12 and L1 because the voltages developed by L1 and C33/C34 no longer cancel each other. This voltage developed at L1/D12 is read as "reflected" power. The voltage at L1/D11 is read as forward power.

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The ROTOR control circuit operates from a regulated supply voltage making frequent recalibration due to line voltage changes unnecessary.

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## 5. SERVICE DATA

### 5.1 REMOVING FROM CABINET

Remove the six screws securing the chassis and EQUIP. CONTROL box to the cabinet. Remove the four screws securing the wattmeter coupler to the cabinet. Slide the unit out of rear of cabinet. Remove sheet metal screws securing the cover to the chassis.

### 5.2 TROUBLE SHOOTING

Careful consideration has been given in the design of the C-4 to keep maintenance problems to a minimum. If any problems do arise, we suggest that you either return your unit to your dealer, or write direct to our Customer Service Department describing your problem in detail.

Include full information concerning external connections, control settings, etc. Do not return equipment to the factory without prior authorization. In case of malfunction, first check all fuses before any further action is taken. No attempt should be made to service the C-4 unless you are thoroughly familiar with electronic circuitry.

### 5.3 ALIGNMENT INSTRUCTIONS

#### 5.3.1 DIGITAL CLOCK

Remove the Clock glass assembly using a small screwdriver in one of the small notches in the side of the frame. It is advisable to place a piece of masking tape on the panel along the edge where the screw driver is used to protect the panel from scratching.

Once the Clock glass is removed, merely rotate the drums to the correct time.

The Clock glass merely snaps back into place.

#### 5.3.2 ROTOR CONTROL

The ROTOR CONTROL calibration pot and switch combination is accessible on the rear of the main chassis. Normal calibration procedure is to run the rotor to the limit corresponding to the full scale SOUTH position and calibrate meter with the calibration pot. "INSTANT" calibration can be accomplished with the rotor set at any position by pushing in on the calibration control and then set the meter indication by rotating the control while holding in on it. Pushing in on the control accomplishes the same thing as running the rotor to the extreme corresponding to full scale indication. An error of a few degrees may exist between the indication given at the full scale extreme of rotation and that given when pushing in on the ROTOR CAL. control for the same setting of the pot. This is due to voltage drop in the control cable and will be negligible for most common cable lengths.

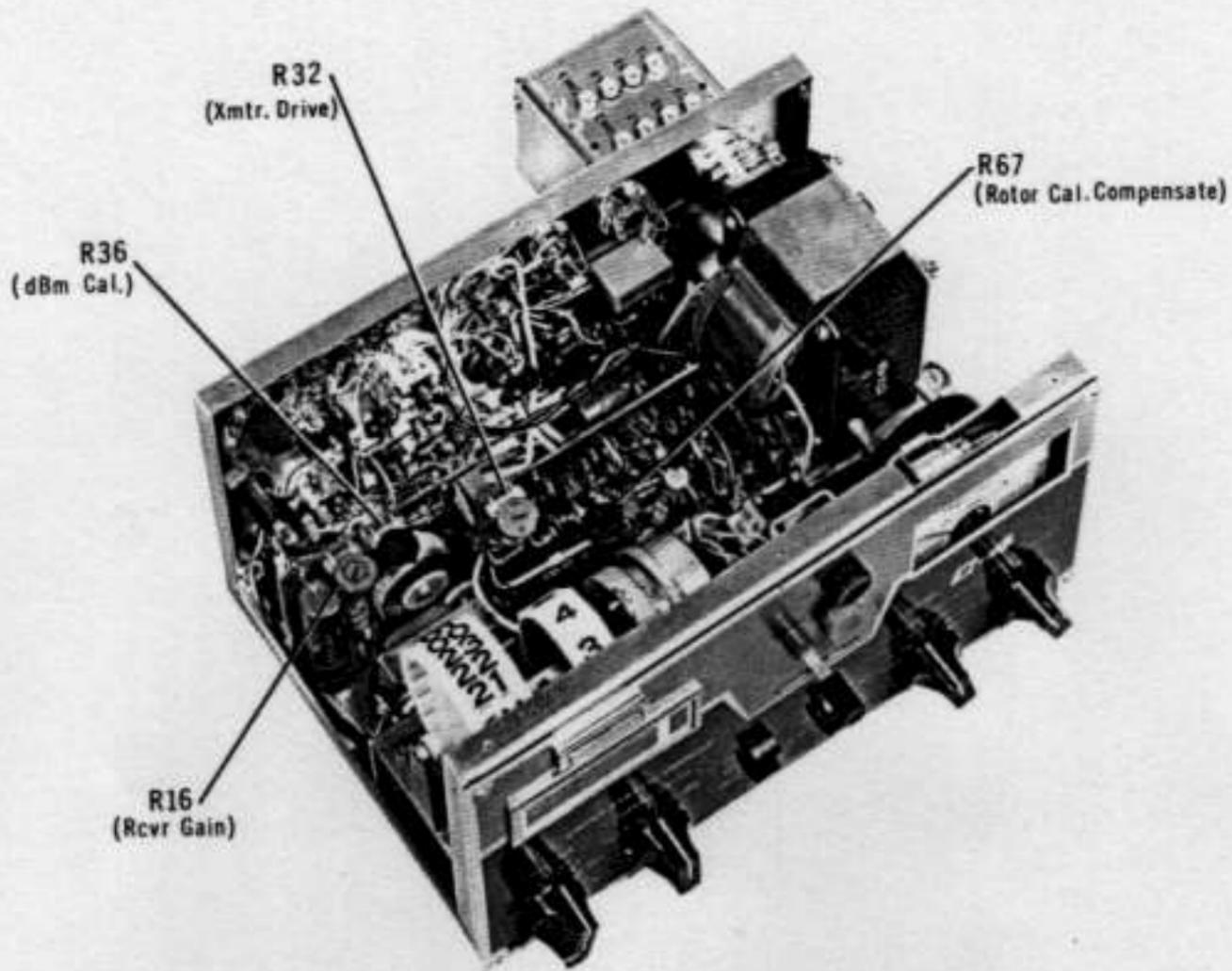
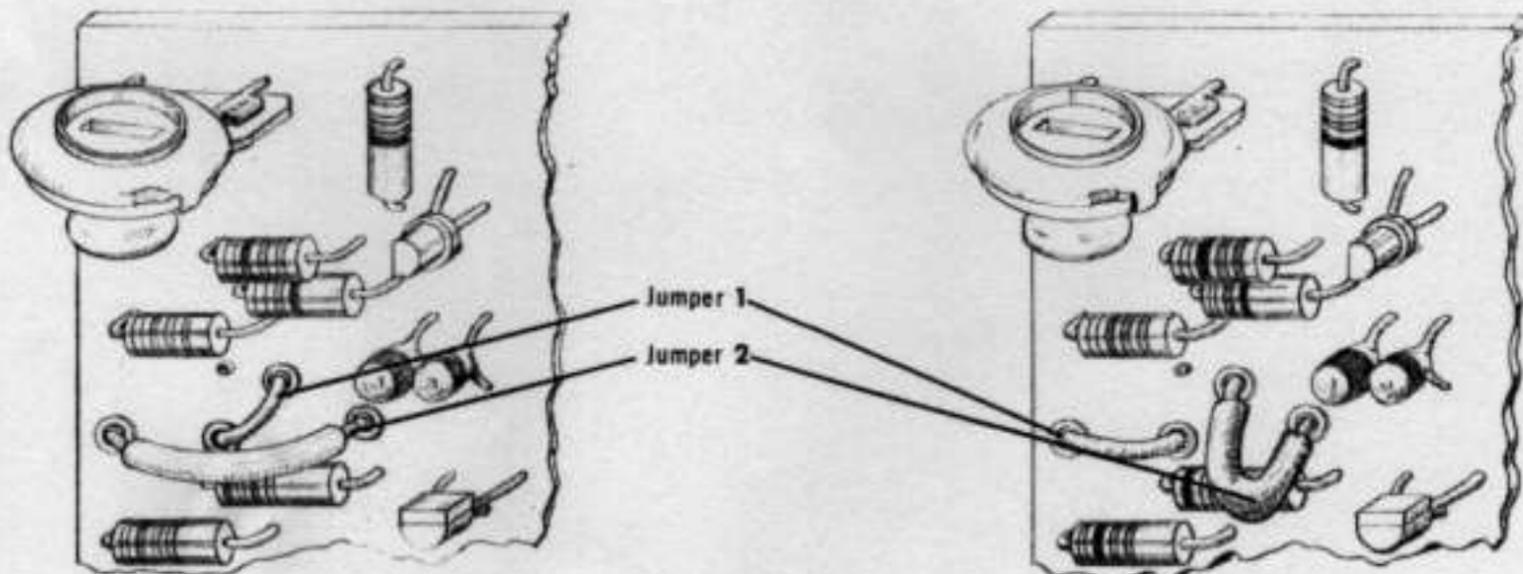


FIG. 10 Top View

View shown is upper left hand corner of large PC board.



C-4 shipped with jumpers 1 and 2 wired as shown.

Rewire jumpers 1 and 2, as shown, if C-4 is to be used with transmitter or transceiver with PTT lines which are positive on receive.

FIG. 11 PC Board Modification for Positive PTT Line

If the ROTOR CAL. control has insufficient range, adjustment of the CAL COMPENSATE control, R-67, will be necessary. R-67 is the black trim pot on the large P.C. board. With the Rotor all the way to the full scale SOUTH extreme, set the ROTOR CAL control on the rear of the chassis to its mid-position, then calibrate the meter using R-67.

### 5.3.3 PHONE PATCH

The three trim pots in the PHONE PATCH circuitry are factory aligned and should need no adjustment. If adjustment is indicated, the following procedure should be used.

#### A. dBm Calibrate

1. Terminate the PHONE LINE connector on the rear of the chassis with a 910 ohm, 5% resistor. Connect a voltmeter capable of measuring low level R.M.S. voltages or an accurately calibrated scope across the PHONE LINE terminals.
2. With the Station Power "ON", place the METER FUNCTION function switch in the dBm position, the Transmitter Control rocker switch in the RCV position, and the PHONE PATCH switch in the MIKE position.
3. Tune in a 1 kHz beat note on the receiver using the crystal calibrator and adjust the volume control for a normal listening level.
4. Rotate the PHONE PATCH switch to the PATCH position and adjust the green RCVR GAIN trim pot, R16, for 240 mv., or 680 mv. peak-to-peak if using a scope, across the Phone Line terminals. R16 is the green trim pot on the P.C. board with the toroid on it.
5. Adjust the black dBm Calibrate trim pot, R36, for a reading of -12 dBm on the C-4's meter.

If necessary, alternately touch-up R16 and then R36 until both 240 mv. R.M.S. and -12 dBm readings are obtained.

The preceding alignment procedure is based on providing a nominal phone line level for normal receiver audio levels. If your area requires a higher level, the green trim pot, R16, can be adjusted to provide more phone line signal.

#### B. XMTR DRIVE

Adjust the XMTR DRIVE in the PATCH/XMIT mode as follows.

1. Remove the 910 ohm, 5% resistor and reconnect the C-4 to the phone line.

2. With the PHONE PATCH switch in the PATCH position and the "Exclusion-Key" on the telephone pulled up (if used with the type 30 or 30A voice couplers), depress the Transmitter Control switch to the XMIT position (all controls on the transmitter set in their normal positions) and adjust the XMTR DRIVE trim pot, R32, clockwise from its extreme counter-clockwise position while talking into telephone handset, just until the transmitter is being driven normally (ALC is being developed).

#### 5.3.4 TIMER

To decrease or increase the TIMER interval, rotate the TIMER control on the rear of the chassis counter-clockwise or clockwise respectively. (As viewed from rear.)

#### 5.3.5 WATTMETER

NOTE: The internal coupler adjustments were preset at the factory. Since these controls set the accuracy and null points, their adjustment is quite critical. No attempt should be made to disturb the settings unless precision laboratory equipment is available.

The following Equipment will be necessary for alignment:

1. A 50 ohm dummy load with an SWR of no more than 1.05:1 at 14 megahertz and capable of handling 1 kw.
2. An accurate RF voltmeter such as the HP410B or Boonton 91CA.
3. A transmitter with variable output to 1 kw at 14.00 megahertz.
4. A short piece (3") of 50 ohm coax such as RG8U or double male PL259 connector.
5. One insulated alignment tool.
6. T-connector to attach voltmeter without upsetting line impedance.

Remove the coupler from the cabinet and carefully remove the screws and cover from the coupler exposing the printed circuit board.

##### A. Null Adjustment

With the transmitter and dummy load connected to the respective connectors on the coupler, and METER FUNCTION switch in the 200 REFL. position, apply about 200 watts to the load. If any reflected power is visible, using the insulated alignment tool inserted through the hole in the side of the coupler, adjust the piston trimmer for minimum reflected power. If the load is purely resistive, this will be essentially zero. This correctly adjusts the 50 ohm reference level and no further adjustment of the piston trimmer will be required.

## B. Forward Power Adjustment

Remove the power from the load, switch the METER FUNCTION switch to the 200 FWD position. With the RF voltmeter connected across the dummy load, apply power until exactly 100 volts RMS is across the load. Adjust the miniature calibration pot on the outside of the board (near the brown wire) so the C-4 meter reads exactly 200 watts. Remove the power from the load. The 200 watt forward range is now correctly adjusted and care should be taken not to disturb the setting.

Switch the METER FUNCTION switch to the 2000 FWD position. Increase the power of the transmitter until 224 volts RMS is across the dummy load. Adjust the 2000 watt calibration potentiometer (near the green wire) until the C-4 meter reads 1000 watts. Remove the power from the load. The 2000 FWD range is now correctly adjusted and care should be taken not to disturb the setting.

## C. Reflected Power Adjustments

Disconnect the dummy load from the coupler. With the METER FUNCTION switch in the 200 FWD position, apply enough power to the coupler for the C-4 meter to read 100 watts.

NOTE: The transmitter is operating without a load when calibrating the reflected ranges. Although very little power is required for calibration, it is important the transmitter tank circuit be resonated to avoid damage to the final amplifiers. Leave the transmitter on no longer than is required to make the adjustments.

Switch the METER FUNCTION switch to the 200 REFL position and adjust the 200 watt reflected calibration potentiometer (near the red wire) until the meter reads 100 watts. Remove the power from the coupler. The 200 watts reflected range is now calibrated and care should be taken not to disturb the setting.

Switch the METER FUNCTION switch to the 2000 FWD position and apply enough power to the coupler for the wattmeter to read 1000 watts.

Switch the METER FUNCTION switch to the 2000 REFL position and adjust the 2000 watts reflected calibration potentiometer (near the white wire) until the meter reads 1000 watts. Remove the power from the coupler. This completes the calibration of the wattmeter, and the coupler cover should be carefully replaced.

**CAUTION!**

DO NOT OPERATE THIS UNIT WITHOUT CHASSIS CONNECTED TO GOOD EARTH GROUND.

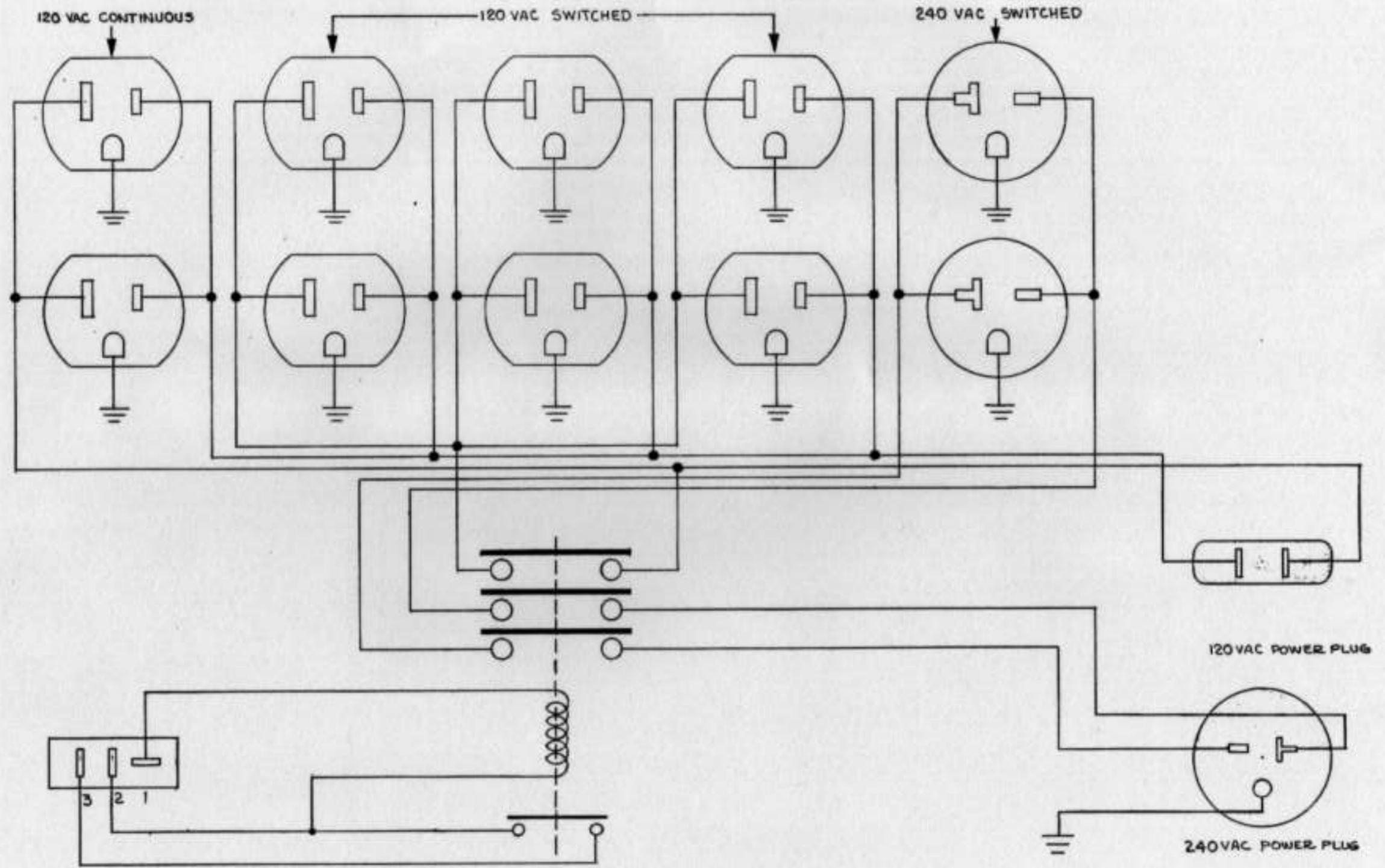


FIG. 12 POWERMASTER Schematic

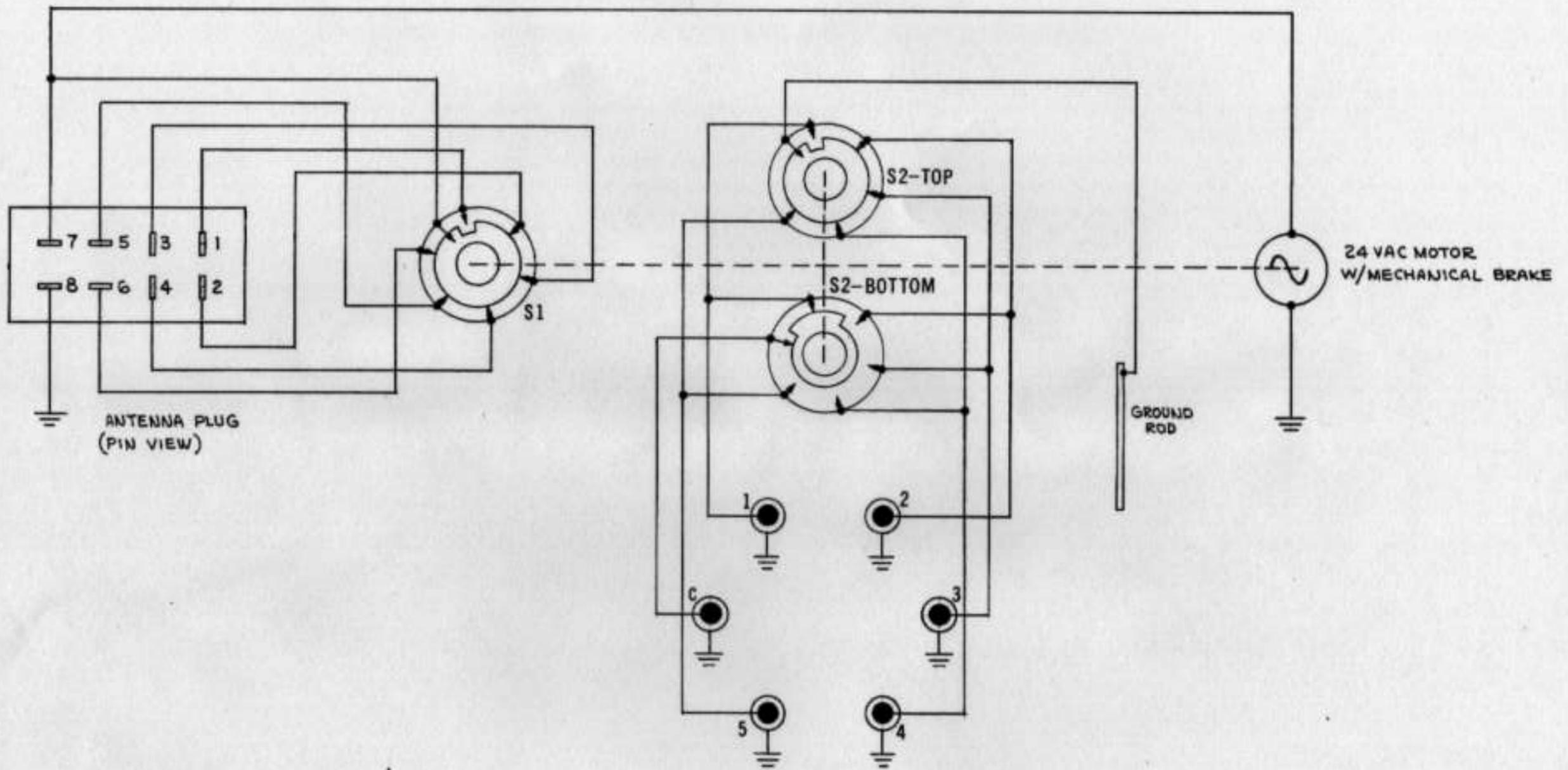
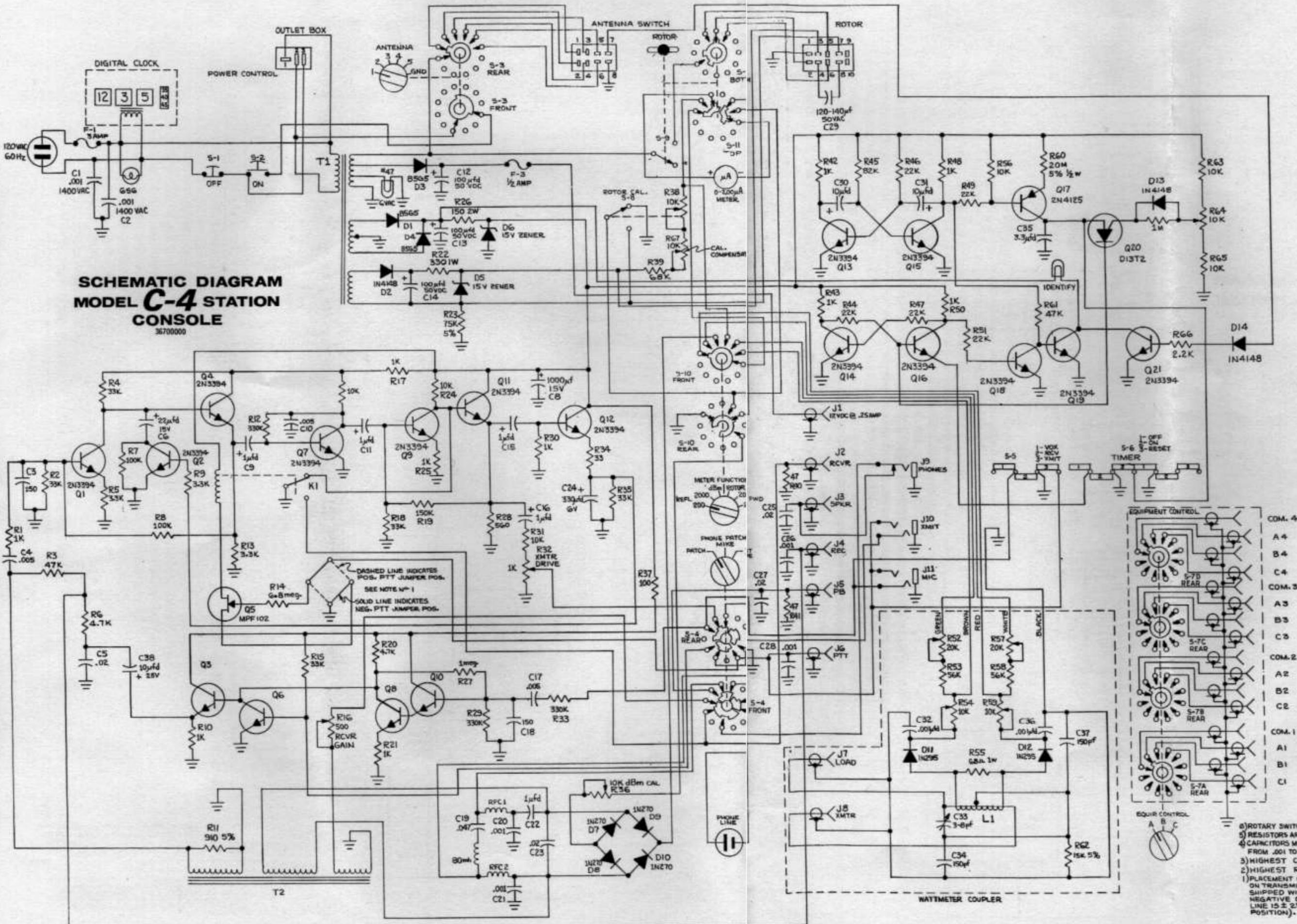


FIG. 13 ANTENNA SWITCH Schematic



**SCHEMATIC DIAGRAM  
MODEL C-4 STATION  
CONSOLE**  
36700000

8) ROTARY SWITCHES VIEWED FROM FRONT IN CCW POSITION  
 9) RESISTORS ARE 1/4 WATT, 10% UNLESS OTHERWISE NOTED  
 4) CAPACITORS MARKED 10 TO 5000 ARE IN µF AND CAPACITORS FROM .001 TO .47 ARE IN pF UNLESS OTHERWISE NOTED  
 3) HIGHEST CAPACITOR - C 38  
 2) HIGHEST RESISTOR - R 67  
 1) PLACEMENT OF JUMPERS ON P.C. BOARD DEPENDS ON TRANSMITTER TO BE USED. UNITS ARE SHIPPED WIRED FOR PTT LINES WHICH ARE NEGATIVE ON RCVR. MAXIMUM VOLTAGE ON PTT LINE IS ± 2.5 VDC (DEPENDS ON JUMPER POSITION).