

Model 602A
FM Transmitter



TECHNICAL MANUAL

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Model 602A
FM Transmitter



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A DIVISION OF COMPUTER EQUIPMENT CORPORATION

WARNING

**THIS UNIT CONTAINS HIGH
VOLTAGE, HIGH CURRENT
POWER SUPPLIES.**

Potentials up to **8000 volts*** at lethal current levels are present and exposed to maintenance personnel working with power on and interlocks defeated.

When maintenance requires working with power on and unit open, exercise extreme caution. Stand on insulated surface. Work with only one hand inside unit. Use only high voltage insulated tools. Have second person standing by at all times.

* Depending upon transmitter being used.



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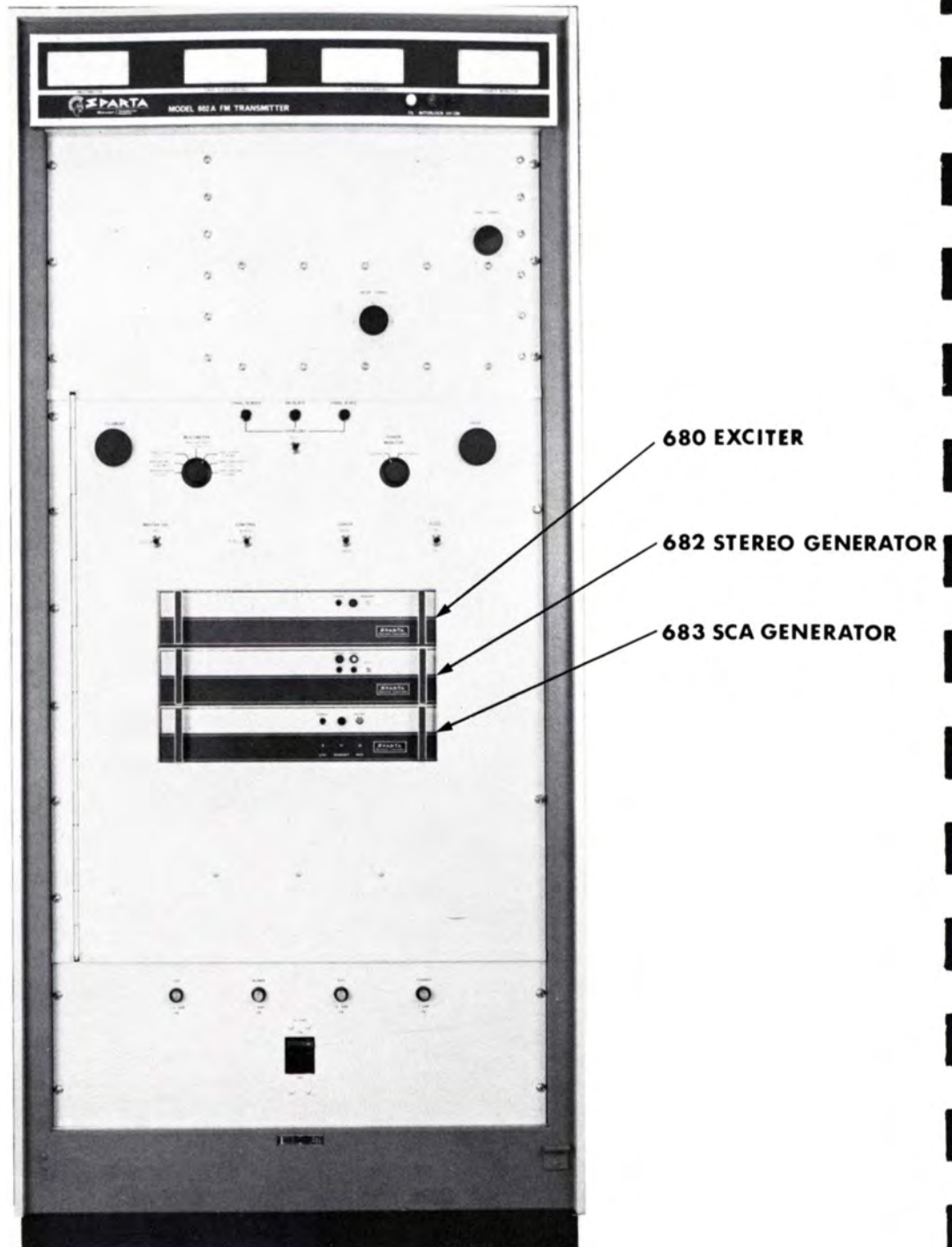
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Model 602A. Front View
(Front door removed)

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains information required to install, operate, and maintain the Model 602A FM Transmitter. Section I describes the transmitter and lists its specifications, Section II provides installation instructions, Section III contains operating procedures, and Section IV describes the principles of operation. Maintenance procedures and troubleshooting diagrams are contained in Section V, and replaceable parts are identified and listed in Section VI. A complete operating and servicing manual covering the Model 680 FM Exciter is separate from this publication.

1-2. GENERAL DESCRIPTION

The Model 602A FM Transmitter (figure 1-1) is composed of a Model 680 FM Exciter, an RF amplifier and power supply, a low-pass harmonic filter, and an RF directional coupler. The transmitter provides an output of 1000 to 2500 watts in the frequency range from 88 to 108 MHz, and is type-accepted by the Federal Communications Commission under Part 73, Broadcast Services.

The Model 680 FM Exciter is an all-solid-state unit that provides monaural, stereo (w/Model 682) and Subsidiary Communications Authorization (w/Model 683) modes of operation in accordance with FCC and international standards. The modulation method is "direct FM" with no mixers or multipliers after the modulated oscillator.

1-2.1. Physical Characteristics

Physical characteristics of the Model 602A, are given in table 1-1.

Table 1-1. Physical Characteristics

Cabinet Dimensions:	75 inches high, 34 inches wide, 25.5 inches deep
Weight:	1000 pounds (450 kilograms)
Cabinet Style:	Enclosed steel cabinet; access provided through hinged front panel and rear door.
Input/Output Connections:	
a. RF Output:	1-5/8 inch coaxial line flange
b. Sampled RF Output to Station Monitor:	Type BNC female
c. Audio Inputs:	Barrier strip
Cooling Provisions:	Self-contained blower provides forced air at 530 cfm (approximately)

Table 1-1. Physical Characteristics (Continued)

Ambient Temperature:	0°C to +45°C (+32°F to +113°F); continuous duty at rated power output.
Altitude:	0 to 7500 feet; continuous duty at rated power output.
Humidity:	0 to 95%

1-2.2. Functional Characteristics

Functional characteristics of the Model 602A, are given in table 1-2.

Table 1-2. Functional Characteristics

Frequency Range:	88 to 108 MHz
RF Power Output:	1000 to 2500 watts
RF Power Output Capability:	2500 watts
Output Impedance:	50 ohms
VSWR:	1.4:1 maximum
Frequency Stability:	±1 KHZ
Modulation Capability:	±75 KHZ minimum (100% modulation) from carrier frequency
RF Bandwidth:	750 KHZ at -db points
Harmonic Attenuation:	80 db minimum below carrier amplitude
FM Noise:	At least 65 db below 100% modulation at 400 HZ
AM Noise:	At least 50 db below referenced to 100% amplitude modulated carrier
Input Line Voltage:	200 to 240 vac, single phase, 50 to 60 HZ
Permissible Line Voltage Variation:	± 5% from nominal
Power Factor:	0.9
Power Consumption:	5.4 kilowatts at full RF power output
Tube Complement:	One 4X150 (driver); one 5CX1500A (power amplifier)

Table 1-2. Functional Characteristics (Continued)

Controls and Indicators:	See table 3-1
Remote Control:	Terminal board provided for remote control connections
Overload Protection:	
NOTE	
The following conditions will cause the transmitter high voltage (plate and screen voltages) to be shut down.	
a. Circuit Breaker Operation:	<ol style="list-style-type: none"> 1. PA HV filter component fault 2. Driver HV filter component fault 3. HV rectifier fault 4. HV transformer fault 5. Screen supply filter component fault
b. Overload Relay Operation:	<ol style="list-style-type: none"> 1. Excessive PA plate current 2. Excessive driver plate current 3. Excessive PA screen current
Overload Indicators:	Tally lights on front panel identify the overloaded circuit.

1-3. OPTIONAL EQUIPMENT

Terminals are provided for connection to an optional overload recycle unit (part number 001-8127-01). This unit automatically recycles the transmitter to normal operation following a momentary current overload in the driver or PA stage. Consecutive recycling is limited to four (but not less than three) times within eight seconds following the operation of any overload relay. If the overload exists after a maximum of four recycles, the transmitter plate and screen voltages will remain off until the overload is reset manually.

SECTION II INSTALLATION

2-1. INSTALLATION PLANNING

Dimensions essential to know for proper installation of the Model 602A FM Transmitter are shown in figure 2-1.

2-1.1. Environmental Requirements

Location of the Model 602A must be within the following environmental requirements:

- a. Maximum altitude: 7500 feet
- b. Maximum temperature: +45°C (113°F)
- c. Minimum temperature: 0°C (32°F)
- d. Maximum humidity: 95%

2-1.2. Space Requirements

When installing the Model 602A it is important that sufficient space be left at the front and rear to permit full opening of the hinged front access panel and rear cabinet door. As shown in figure 2-1, at least 30 inches of space must be provided in front of the cabinet and the unit should be placed with the rear no closer than 29 inches from the wall.

Adequate overhead space must also be provided to permit the RF output connections to be made and to allow for adequate dispersal of cooling air discharged through the cabinet top. A minimum distance of two feet from the cabinet top to the ceiling is recommended.

2-1.3. Power Requirements

Requirements for input power and power consumption are provided in table 1-2, functional characteristics, in Section I.

2-1.4. Cooling Requirements

There are no external cooling requirements for the Model 602A. The unit is cooled by a internal blower which draws filtered air in through openings on the rear cabinet door. Blower B2, the main centraxial blower, draws air in at a rate of 530 cubic feet a minute. Space provisions for opening of the rear door will ensure sufficient intake of cooling air. A minimum overhead space of 2 feet will normally be adequate for dispersing air exhausted through the cabinet top.

2-2. UNPACKING AND INSPECTION

Inspect the equipment for shipping damage as soon as it is unpacked. Check for broken knobs, tubes, meter faces, and connectors. Inspect surfaces for dents and scratches. If the equipment is damaged in any way, notify the carrier immediately and report the damage.

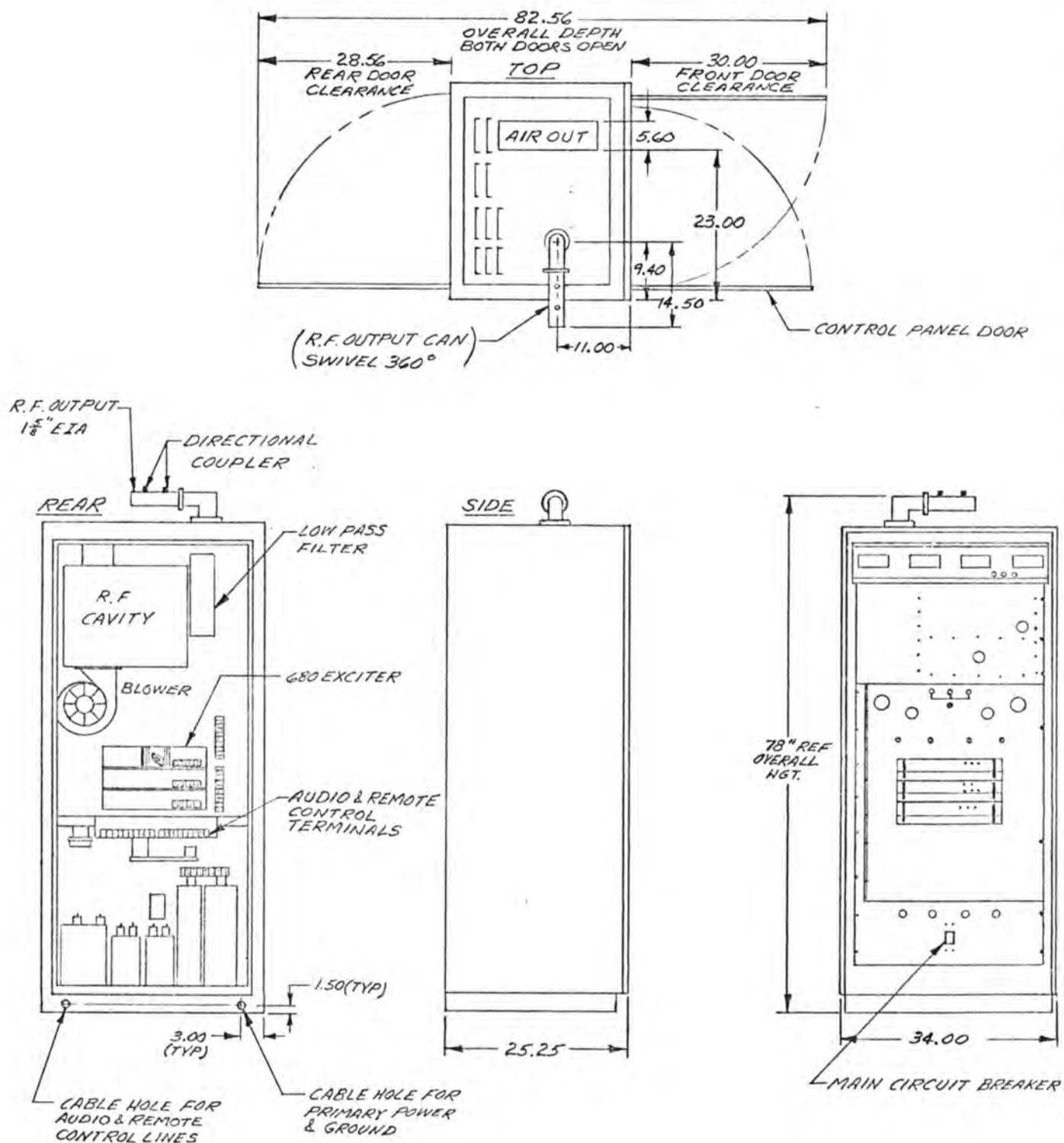


Figure 2-1. Model 602A Outline Installation

2-3. INPUT AND OUTPUT CONNECTIONS

With the exception of the RF output to the transmitting antenna and the sampled RF output to the station monitor, all inputs and outputs to the Model 602A are routed into the unit at one of two places: (1) through the two holes cut into the rear of the cabinet, one to the left and one to the right, on the cabinet base; or (2) through the base of the cabinet if an open pit installation is planned. The RF output termination is a 1-5/8 inch coaxial flange located on top of the cabinet. The sampled RF output is via a BNC receptacle located on the outside wall of the RF cavity.

2-3.1. RF Input/Output Connections

The RF input and output connections are made to the Model 602A as follows:

- a. A short length of RG-58/U coaxial cable with BNC connectors at each end is connected between the exciter RF OUT jack and RF INPUT jack J4 located on underside of RF amplifier cavity. Ensure that these connectors are firmly in place.
- b. Using 1-5/8 inch coaxial waveguide, connect the output of directional coupler DC1 to transmitting antenna.
- c. Using RG-58/U coaxial cable, connect station monitor to jack J3 located on right-hand side of RF amplifier cavity as viewed from the rear.

2-3.2. Primary Power and Grounding Connections

Primary mains power connections are made in the Model 602A cabinet at TB2, which is located on the base of the cabinet at the extreme right-hand side as viewed from the rear. (See figure 5-3.) The safety disconnect switch supplying mains power to the transmitter should be rated at 100 amperes.

Using AWG No. 6 copper wire, connect the mains voltage to terminals 1 and 2 of TB2. Connect the neutral lead, if used, to TB2-3, which is connected to the main frame grounding lug on the baseplate assembly.

NOTE

It is essential that the exact mains voltage be determined before connecting the primary windings of filament transformer T2 and high-voltage transformer T3. Filament transformer T2 is located inside the RF cavity and high-voltage transformer T1 is located on the baseplate assembly. (See figures 6-3 and 6-9).

The primary winding of filament transformer T2 is tapped to allow operation from a 200 vac or a 220 vac source. If the available mains voltage is between 200 and 220 vac, connect the input to terminals 1 and 2 of TB10 inside the RF cavity. If the available mains voltage is above 220 vac, connect the input to terminals 1 and 3 of TB10.

The configuration of high-voltage transformer T3 is illustrated in figure 2-2. Connect one side of the mains voltage to terminal 1 and the other side to that terminal representing the closest value to the available mains voltage. If the licensed RF output of the Model 602A is 1500 watts or less, ensure that terminal 6 and terminal 11 (3400 volt RMS tap) are connected across high-voltage rectifier CR1-CR2. (See figures 5-1 and 6-7.) If the licensed RF output is greater than 1500 watts, ensure that terminal 6 and terminal 7 are connected across the high-voltage rectifier.

2-3.3 Exciter Input Signal Connections

All input signal connections to the exciter are made at TB-1, which is a 10-terminal barrier strip located on the exciter rear panel. See exciter instruction manual.

2-4. REMOTE CONTROL CONNECTIONS

2-4.1 Exciter Remote Control

There are no exciter remote control connections required. If a model 682 stereo generator is used consult the 682 instruction book for pilot on/off connections. Should a 683 SCA generator be used consult the 683 instruction book for sub-carrier on/off connections.

2-4.2. RF Amplifier Remote Control

As shown in figure 2-4, remote connections for the RF amplifier are made at TB1 to provide the following functions:

- a. Filament on and off (transmitter start and stop)
- b. High voltage on and off
- c. Power raise and lower
- d. Power amplifier plate voltage readout
- e. Power amplifier plate current readout

NOTE

If it is desired to operate the amplifier before making the remote connections, a jumper must be connected between TB1-4 and TB1-5 to complete the high-voltage control circuit.

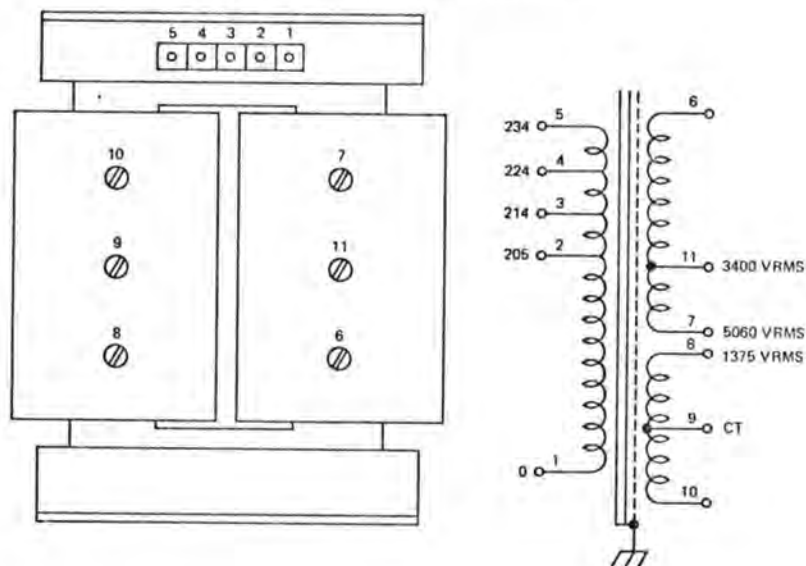


Figure 2-2. High-Voltage Transformer T3 Connections

2-5. INITIAL TURN-ON PROCEDURES

2-5.1 Exciter Initial Turn-On

There are no preliminary adjustments or checks necessary before placing the model 680 FM Exciter in operation. It will come on at the time the master switch is turned on and will lock on frequency within 10 seconds after power is applied.

2-5.2 RF Amplifier Initial Turn-On

Protective devices and circuitry incorporated in the Model 602A provide maximum safety to operating personnel and minimize the occurrence of component damage during operation. High-voltage circuitry cannot be energized unless all access door interlocks are closed. A time delay prevents plate and screen voltages from being applied to the tubes until the filament voltage has been applied to the tubes for a warmup period of 45 seconds.

To energize the Model 602A proceed as follows:

WARNING

This unit contains high-voltage, high-current power supplies.

Potentials up to 5000 volts at lethal current levels are present and exposed to maintenance personnel working with power on and interlocks defeated.

When maintenance requires working with power on and unit open, exercise extreme caution. Stand on insulated surface. Work with only one hand inside unit and the other hand in your pocket. Use only high-voltage insulated tools. Have second person standing by at all times.

- a. Check for full closure of hinged front access panel and rear cabinet door and set LOCAL/REMOTE CONTROL switch A10 to LOCAL.
- b. Set AC LINE circuit breaker CB1 to ON and check for no glow of fuses F1 through F4.
- c. Set MASTER SW control A1 to ON. When blower B2 builds up sufficient air flow, air interlock switch S2 will close and apply primary power to filament transformer T2 and time delay relay K7. The time delay will start and prevent the application of plate and screen voltages for 45(\pm 5) seconds. Verify that air interlock switch S2 Operates by glow of FIL indicator lamp DS1.
- d. Rotate DRIVE control R2 fully counterclockwise.
- e. Open rear cabinet door so that the wiper arm position of R13 can be observed. (See figure 6-1.)

- f. Press and hold POWER switch S5 in the LOWER position until motor B3 drives wiper arm of R13 fully counterclockwise.
- g. Close rear cabinet door.
- h. After 45-second time delay has elapsed, note that INTERLOCK indicator lamp DS2 lights.
- i. Set MULTIMETER selector switch S3 to FINAL FIL VOLTS and adjust FILAMENT potentiometer R26 for an indication of 5 vac on MULTIMETER M1. If the 5 vac indication cannot be obtained by the adjustment of R26, change the primary tap on transformer T2 as required. (See paragraph 2-3.2.)
- k. Rotate DRIVE control R2 and exciter OUTPUT POWER ADJUST control AIR16 fully counterclockwise.
- m. Set PLATE switch S4 to ON and then release; note that HV ON indicator lamp DS3 lights. FINAL PLATE CURRENT meter M4 should indicate near zero and, if transformer T3 has been connected for a transmitter RF output of 2500 watts, FINAL PLATE VOLTAGE meter M3 should indicate slightly above full scale (greater than 5000 volts). If transformer T3 has been connected for a transmitter RF output of 1000 watts, FINAL PLATE VOLTAGE meter should indicate 3400 volts.
- n. Set MULTIMETER selector switch S3 to DR PLATE VOLTS. MULTIMETER M1 should indicate approximately 2000 volts.

This completes the initial turn-on sequence. The transmitter can now be tuned to the assigned operating frequency as described in Section III.

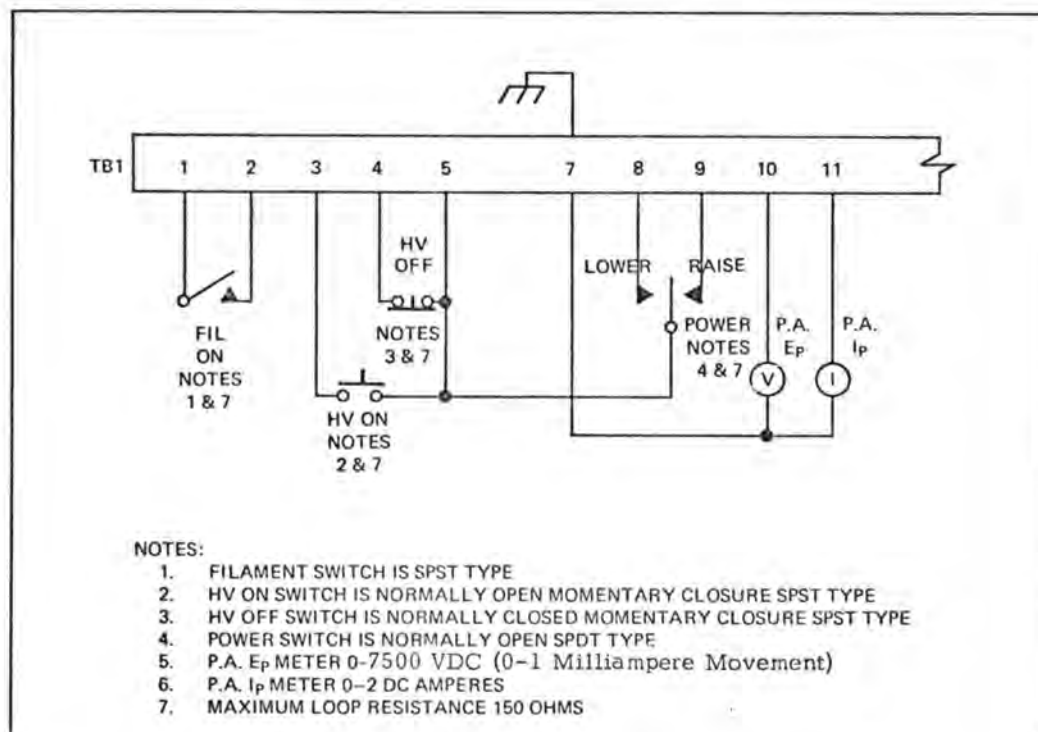


Figure 2-4. RF Amplifier Remote Control Connections

SECTION III OPERATION

3-1. FRONT PANEL CONTROLS AND INDICATIONS

As shown in figures 3-1 through 3-3, all operational controls and indicators for the Model 602A are located on the front of the unit. Table 3-1 lists these operating controls and indicators and gives their reference designators and a brief functional description of each.

3-2. OPERATION

Perform the initial turn-on procedure as outlined in paragraph 2-5 and allow approximately 15 minutes for the exciter to warm up and stabilize.

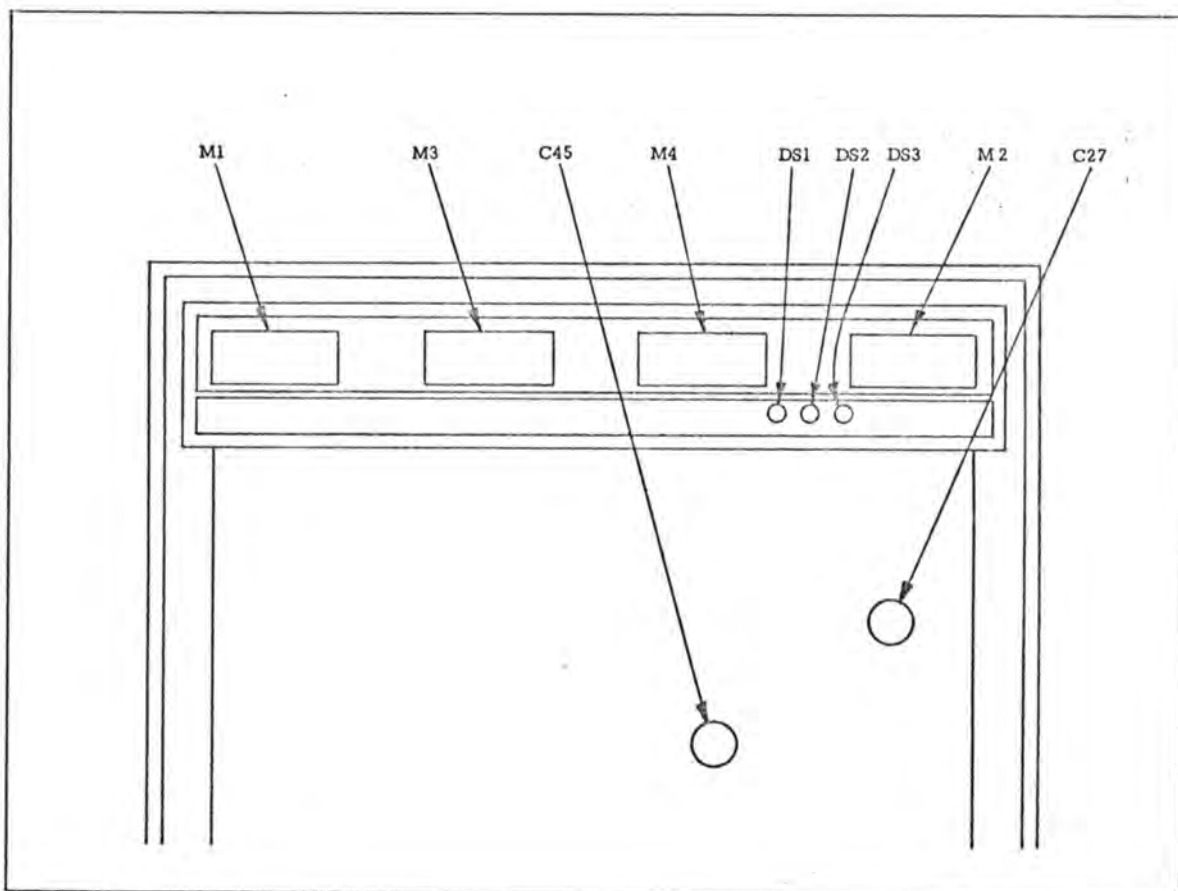


Figure 3-1. Meter Panel and RF Amplifier Tuning Controls

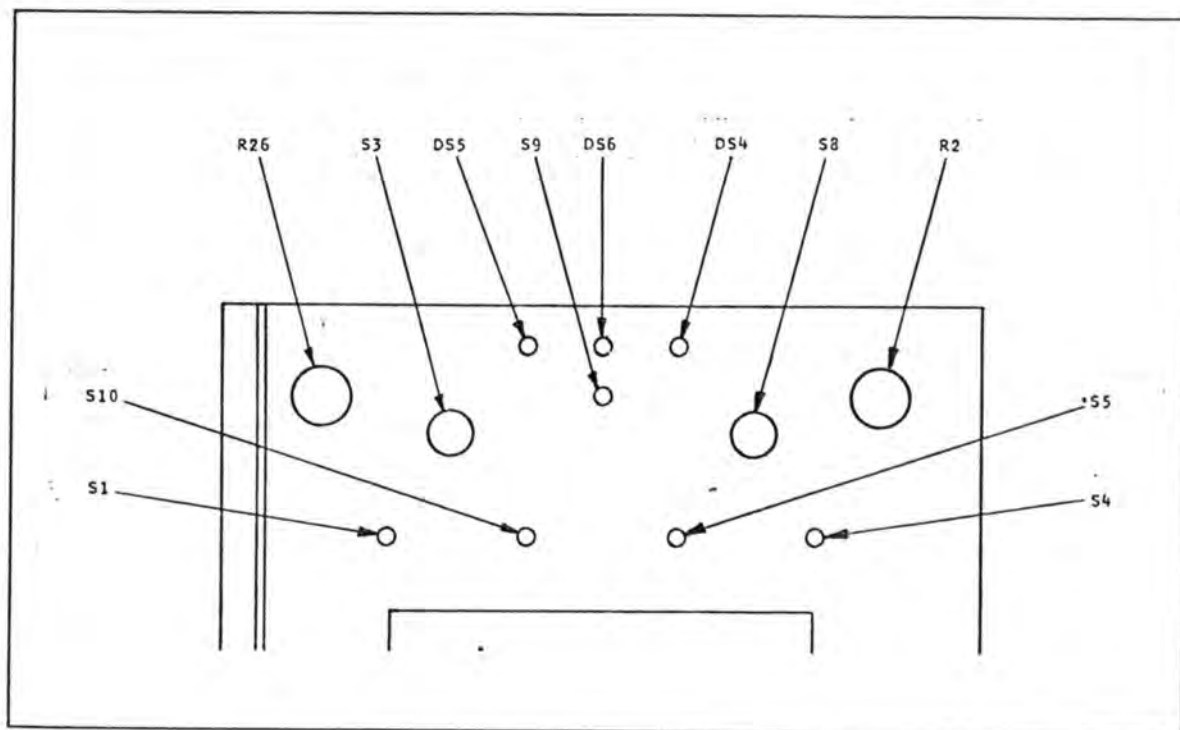


Figure 3-2. Front Access Panel

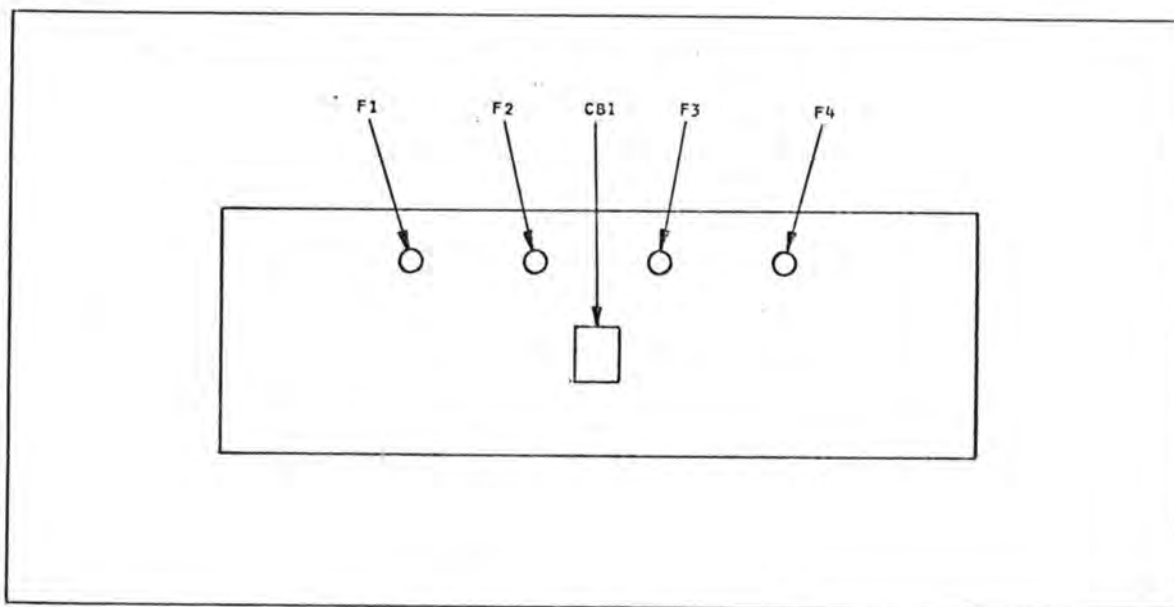


Figure 3-3. Fuse and Circuit Breaker Panel

Table 3-1. Operating Controls and Indicators

Ref. Des	Panel Nomenclature	Function
MODEL 680 FM EXCITER		
S1	POWER ON	Switches on AC power to unit.
DS-1	NONE	Indicates AC power is on.
IR35	FREQUENCY	Provides fine adjustment of frequency.
RF AMPLIFIER, POWER, AND CONTROL		
CB1	AC LINE	Switches on main input power to unit and provides line overload protection.
C27	FINAL TUNING	Tunes V2 plate circuit to resonance.
C45	DRIVER TUNING	Tunes V1 plate circuit to resonance.
DS1	FIL	Indicates air interlock switch closed and filament voltage on when lit.
DS2	INTERLOCK	Indicates interlock switch loop complete when lit.
DS3	HV ON	Indicates high voltage on when lit.
DS4	FINAL PLATE	Indicates final plate current overload when lit.
DS5	DR PLATE	Indicates driver plate current overload when lit.
DS6	SCREEN	Indicates final screen current overload when lit.
F1	EXCITER 1/2 AMP S.B.	Provides protection from overloads in exciter power; illuminates to indicate blown fuse.
F2	BLOWER 2 AMP S.B.	Provides protection from overloads in blower B2 power; illuminates to indicate blown fuse.
F3	BIAS 1/4 AMP S.B.	Provides protection of bias transformer T1; illuminates to indicate blown fuse.
F4	FILAMENT 2 AMP S.B.	Provides protection of control circuits and filament transformer T2; illuminates to indicate blown fuse.

Table 3-1. Operating Controls and Indicators (Continued)

Ref. Des.	Panel Nomenclature	Function
RF AMPLIFIER, POWER, AND CONTROL (con't)		
M1	MULTIMETER	As selected by S3, provides readout of driver plate voltage and plate current; final filament, grid, and screen voltages; and final grid and screen currents.
M2	POWER MONITOR	As selected by S8, provides readout of forward power and reflected power.
M3	FINAL PLATE VOLTAGE	Provides readout of V2 plate voltage.
M4	FINAL PLATE CURRENT	Provides readout of V2 plate current.
R2	DRIVE	Adjusts driver grid bias voltage.
R26	FILAMENT	Adjusts driver and final filament voltage.
S1	MASTER SW	Controls application of power to filament and transmitter control circuits.
S3	MULTIMETER	Selects functions for readout on M1.
S4	PLATE	Switches high-voltage circuits on and off.
S5	POWER RAISE/LOWER	Adjusts final screen voltage.
S8	POWER MONITOR	Selects forward and reflected power functions for readout on M2.
S9	QVERLOAD RESET	Resets tally lamps to off; resets optional overload recycle unit if installed.
S10	CONTROL LOCAL/ REMOTE	Allows transmitter to be started and stopped from a remote point.

When operating power is initially applied, the FM exciter begins to warm up and the modulated oscillator circuit searches for phase lock; after a short interval, the oscillator will lock to the crystal reference frequency.

Operating power should be applied continuously to the exciter. At the end of the broadcast period, set the Model 602A PLATE switch (momentary closure) to OFF but leave the AC LINE circuit breaker in the ON position. In this manner, the station can resume operation after an approximate delay of 45 seconds.

3-3. TUNING PROCEDURE

Preliminary adjustment of the driver plate inductor (figure 3-4), final amplifier stripline height (figure 3-5), and antenna coupling (figure 3-6) have been performed at the factory with the transmitter operating on its assigned frequency into a dummy load.

Perform the initial turn-on procedures given in paragraphs 2-5.1 and 2-5.2, and proceed as follows:

- a. Set MULTIMETER selector switch S3 to FINAL SCR MA and slowly adjust DRIVER TUNING control C45 until resonance is indicated by a slight increased reading on MULTIMETER M1 or on FINAL PLATE CURRENT meter M4.

NOTE

If there is no response indicated in the preceding step, set MULTIMETER selector switch S3 to DRIVER PLATE MA and rotate DRIVE control R2 clockwise until MULTIMETER M1 indicates approximately 50 milliamperes and a response is clearly indicated on FINAL PLATE CURRENT meter M4 when DRIVER TUNING control C45 is adjusted to resonance.

- b. Set POWER MONITOR switch S8 FORWARD.
- c. Adjust FINAL TUNING control C27 for resonance as indicated by a dip on FINAL PLATE CURRENT meter M4.

NOTE

FINAL PLATE CURRENT meter M4 should at this point be indicating approximately 300 milliamperes, and a moderate amount of RF output power should be indicated on POWER MONITOR METER M2.

All subsequent adjustment of the FINAL TUNING control should be made on the basis of peaking the final screen current as indicated on MULTIMETER M1 with MULTIMETER selector switch S3 in the FINAL SCR MA position. Normally, a final screen current of 80 milliamperes should be indicated at maximum RF output, and should never be allowed to exceed 125 milliamperes.

For all desired levels of RF output, DRIVE control R2 should be adjusted to provide a final grid voltage of approximately 190 vdc as indicated on MULTIMETER M1 with MULTIMETER selector switch S3 in the FINAL GRID VOLTS position. If necessary, advance the exciter OUTPUT POWER ADJUST control from its fully counterclockwise position to maintain the final grid voltage at 190 vdc with the driver plate current between 60 and 85 milliamperes indicated on MULTIMETER M1 with MULTIMETER selector switch S3 in the DRIVER PLATE MA position. The corresponding driver plate voltage should be between 1600 and 1700 vdc as indicated on MULTIMETER M1 with MULTIMETER selector switch S3 in the DRIVER PLATE VOLTS position.

Set MULTIMETER selector switch S3 to the FINAL SCR MA position. The final amplifier screen voltage can now be increased to the desired RF output level. If the licensed RF output of the Model 602A is 2500 watts, proceed with the power output adjustment instructions in paragraph 3-3.1. If the licensed RF output of the Model 602A is 1000 watts, proceed with the instructions in paragraph 3-3.2.

3-3.1. Power Output Adjustment (2500 Watts)

If the licensed RF output is 2500 watts, press and hold POWER switch S5 in the RAISE position until MULTIMETER M1 indicates between 65 and 85 milliamperes. FINAL PLATE CURRENT meter M4 should indicate between 0.75 and 0.85 ampere FINAL PLATE VOLTAGE meter M3 should indicate 4500 vdc, and POWER MONITOR meter M2 should indicate an RF output of 2500 watts. Set MULTIMETER selector switch S3 to FINAL SCR VOLTS position. MULTIMETER M1 should indicate between 450 and 490 vdc.

If the final screen current is higher than 85 milliamperes, the load coupling to the final amplifier plate circuit must be increased. Conversely, if the final screen current is lower than 65 milliamperes, the load coupling must be decreased. To adjust the load coupling (L-7), set PLATE switch S4 and MASTER SW control S1 to OFF, open the rear cabinet door, and proceed as follows:

WARNING

Even if the transmitter is completely shut down, be extremely cautious whenever adjustment or maintenance is required to be conducted in the vicinity of components that are normally energized with high potentials. To ensure safety, use an insulated shorting bar (of a dead man's stick) and ground all high-voltage capacitors, plate lines, etc.

- a. Remove RF amplifier cavity cover.
- b. Loosen the nuts that lock load coupling L7 shorting bar in place. (See figure 6-9)
- c. To decrease the load coupling, move the shorting bar to a position closer to the RF output connector.
- d. To increase the load coupling, move the shorting bar to a position farther away from RF output connector.
- e. Tighten the shorting bar nuts and replace RF amplifier cavity cover.
- f. Close rear cabinet door and set MASTER SW control S1 to ON. After INTERLOCK lamp DS2 lights, Set PLATE switch S4 momentarily to ON.
- g. Recheck resonance setting of DRIVER TUNING and FINAL TUNING controls.

Typical meter indications at an output of 2500 watts are listed below. If meter indications deviate more than $\pm 10\%$ from these values, an irregularity may be present.

MULTIMETER M1

DR PLATE VOLTS:	1650 vdc
DR PLATE MA:	82 ma
FINAL GRID VOLTS:	190 vdc
FINAL GRID MA:	22 ma

MULTIMETER M1 (con't)

FINAL SCR VOLTS:	450 vdc
FINAL SCR MA:	85 ma
FINAL FIL VOLTS:	5 vac

POWER MONITOR meter M2

FORWARD:	2500 watts
REVERSE:	Less than 70 watts

FINAL PLATE VOLTAGE meter M3: 4500 vdc

FINAL PLATE CURRENT meter M4: 0.80 ampere

If it is desired to have the FINAL TUNING control dial be at its midrange position when tuned to resonance, readjust the height of the stripline inductor (L5), as necessary, to achieve this objective. (See figures 3-5 and 6-9.)

3-3.2. Power Output Adjustment (1000 Watts)

If the licensed RF output is 1000 watts, press and hold POWER switch S5 in the RAISE position until MULTIMETER M1 indicates approximately 55 milliamperes. FINAL PLATE CURRENT meter M4 should indicate approximately 0.45 ampere, FINAL PLATE VOLTAGE meter M3 should indicate approximately 3100 vdc, and POWER MONITOR meter M2 should indicate an RF output of 1000 watts. Set MULTIMETER selector switch S3 to FINAL SCR VOLTS position; MULTIMETER M1 should indicate approximately 300 vdc.

POWER switch S4 should allow some range of control both below and above the desired power level to allow for subsequent line voltage variation. If an output of substantially less than 1000 watts cannot be obtained, the coupling of the load circuit must be decreased. To adjust the load coupling (L7), set PLATE switch S4 and MASTER SW control S1 to OFF, open the rear cabinet door, and proceed per steps A-E of 3-3.1.

Typical meter indications at an output of 1000 watts are listed below. If meter indications deviate more than $\pm 10\%$ from these values, an irregularity may be present.

MULTIMETER M1

DR PLATE VOLTS:	1680 vdc
DR PLATE MA:	65 ma
FINAL GRID VOLTS:	200 vdc
FINAL GRID MA:	23.5 ma
FINAL SCR VOLTS	275 vdc
FINAL SCR MA:	52 ma
FINAL FIL VOLTS :	5 vac

POWER MONITOR meter M2

FORWARD:	1000 watts
REVERSE:	Less than 28 watts
FINAL PLATE VOLTAGE meter M3:	3100 vdc
FINAL PLATE CURRENT meter M4:	0.46 ampere

If it is desired to have the FINAL TUNING control dial at its midrange position when tuned to resonance, readjust the height of the stripline inductor (L5), as necessary, to achieve this objective. (See figures 3-5 and 6-9)

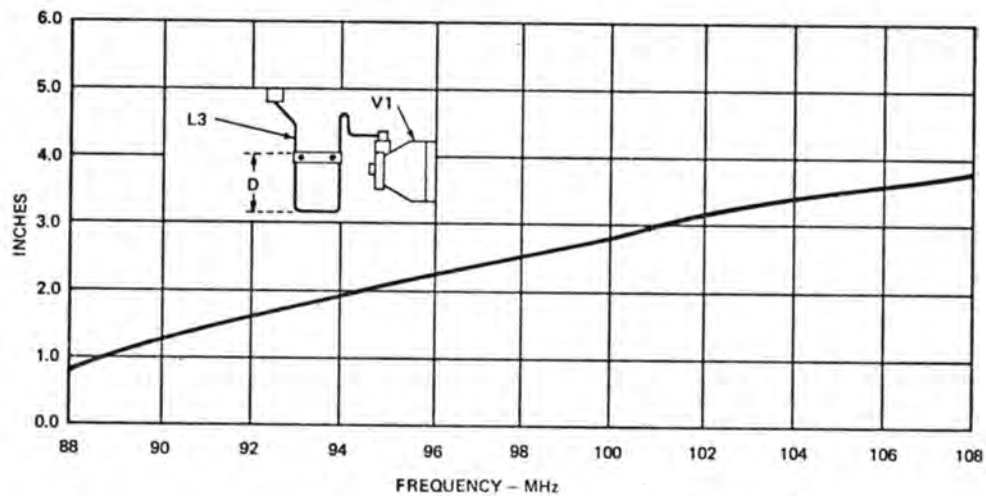


Figure 3-4 Driver Plate Line Length VS Frequency

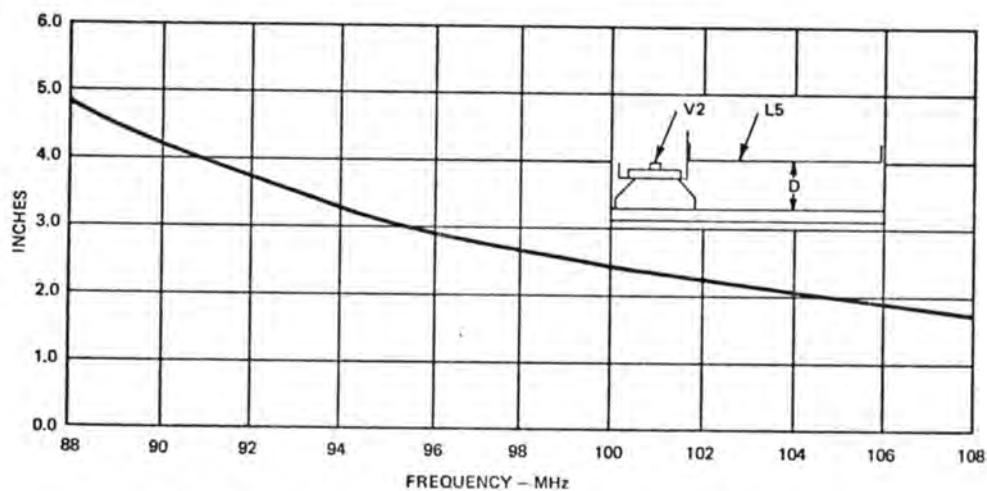


Figure 3-5 Final Amplifier Stripline Height VS Frequency

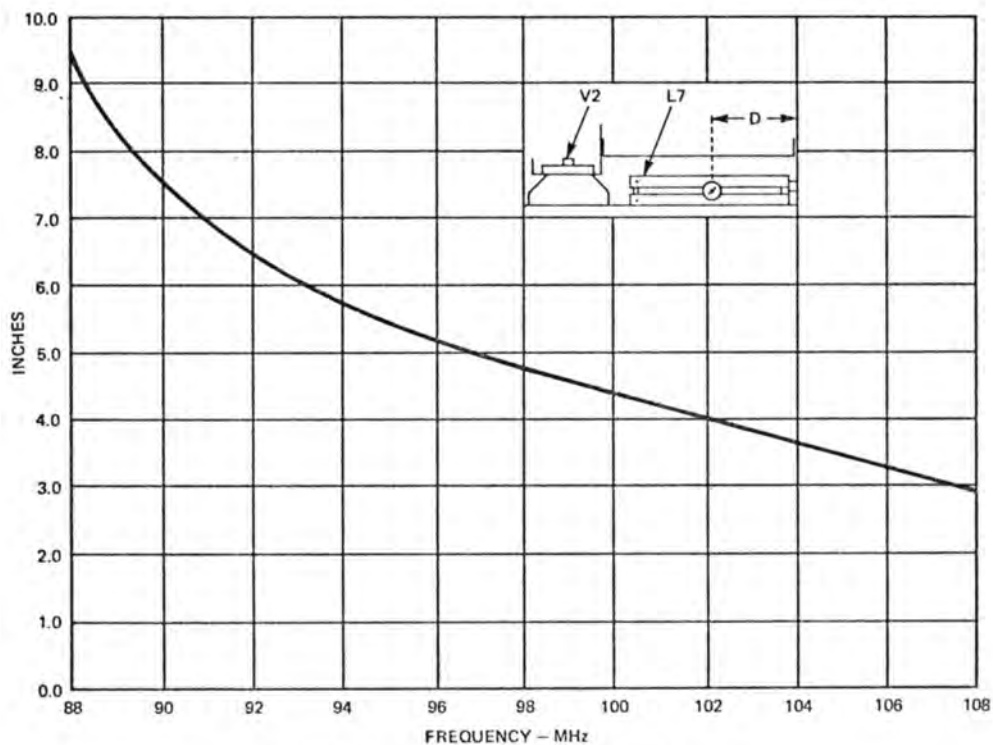
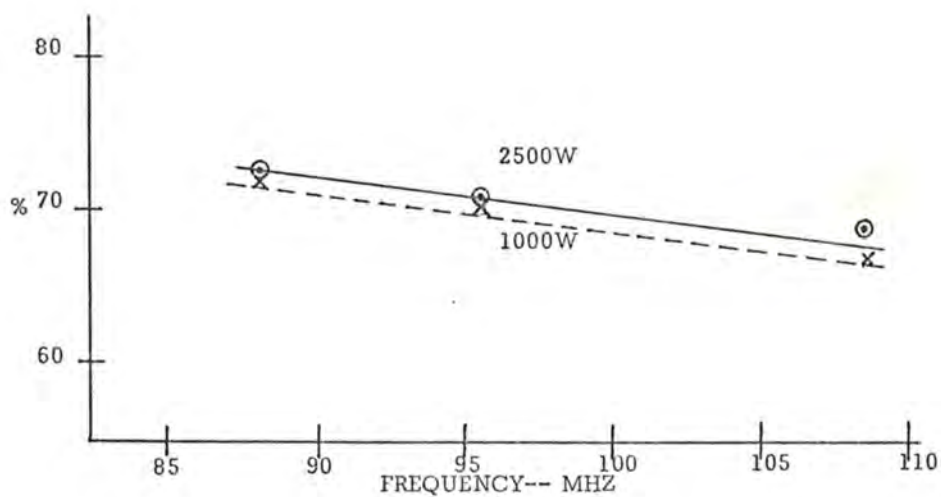


Figure 3-6 Antenna Coupling Length Adjustment

Figure 3-7 Curve Of Efficiency
VS Frequency - Model 602A

SECTION IV PRINCIPLES OF OPERATION

4-1. GENERAL

The Model 602A is divided functionally into the following: (1) control and interlock circuits, (2) power supplies, (3) RF amplifier section, and (4) overload and automatic recycle circuits. The Model 680 FM Exciter is discussed in detail in its operating and servicing manual.

4-2. CONTROL AND INTERLOCK CIRCUIT ANALYSIS

A simplified circuit diagram of the control, overload, and automatic overload recycle unit circuits is shown in figure 4-1. With AC LINE circuit breaker CBI in the ON position, primary power is applied to the Model 680 exciter and to MASTER SW control S1. When MASTER SW control S1 is set to ON, relay K1 energizes and applies primary power to bias transformer T1, the blower B2, and air interlock switch S2. When blower B2 reaches normal running speed, air interlock switch S2 closes and completes the application of primary power to FIL indicator lamp DS1, filament transformer T2, and thermal time delay relay K7.

After 15 seconds of heating time, contacts 1 and 8 of relay K7 open and contacts 5 and 7 close. Contacts 5 and 7 complete the primary power circuit to energize relay K2. Contacts 3 and 9 of K2 open and remove heater voltage from K7, and contacts 6 and 9 close and supply latching voltage to maintain K2 energized. Contacts 5 and 8 of K2 provide an interlock function to apply power to the exciter RF amplifier module. Thirty seconds after heater INTERLOCK indicator lamp DS2 and to the plate and screen voltage control circuit through contacts 4 and 7 of K2 and door interlock switches S6 and S7. The total elapsed time delay is 45 seconds.

When PLATE switch S4 is set to ON (momentary closure of contacts S4A), primary power to the coil of relay K3 is completed through the normally closed contacts of the remote HV OFF switch, the normally closed contacts of S4B, and the momentarily closed contacts of S4A. Relay K3 energizes and remains latched after S4A is released by the voltage supplied to the coil through K3C contacts 1 and 2. Closed contacts 1 and 2 of K3B and K3A apply mains power to the primary winding of high-voltage transformer T3 and to HV ON indicator lamp DS3.

4-3. POWER SUPPLY CIRCUIT ANALYSIS

4-3.1. Bias Power Supply

Power is applied to the primary winding of bias transformer T1 through the closed contacts of relay K1 and BIAS fuse F3. (See figure 5-1.) The secondary voltage of T1 is rectified by a full-wave silicon rectifier stack, CR1; filtered by the combination of L1, C1 and C39; and applied across the voltage divider composed of R1, R2, and R38. The full -100 vdc bias developed across the voltage divider is applied to the control grid circuit of final amplifier V2 through resistors R5 and R7. DRIVE potentiometer R2 provides the means of adjusting the grid bias voltage of driver V1.

4-3.2. Filament Power Supply

Power is applied to the primary winding of filament transformer T2 through the closed contacts of relay K1, air interlock switch S2, FILAMENT fuse F4, and FILAMENT control R26. The primary winding of T2 is tapped to allow operation from a 200 to 220 vac source, or from a 220 to 240 vac source. Transformer T2 has two secondary windings, one of which provides 6.0 vac to the filament of driver V1; the other secondary winding provides 5.0 vac to the filament of power amplifier V2. FILAMENT potentiometer R26 provides the means of setting the filament voltage of V2 to precisely 5.0 vac as monitored by MULTIMETER M1.

4-3.3. Plate and Screen Power Supply

Power is applied to the primary winding of high-voltage transformer T3 through contacts K3A and K3B of relay K3. Transformer T3 has two secondary windings, one of which has a rated supply of 5060 volts RMS at 1.0 ampere; this winding has a 3400-volt RMS tap. The 5060-volts RMS supply is used when the Model 602A is licensed for an RF output greater than 1500 watts; the 3400-volts RMS supply is used when the licensed RF output is 1500 watts or less. The output voltage of this secondary is full-wave rectified by silicon diode stacks (CR3-CR4) and applied through a two-section LC filter (L8-C32 and L9-C33) to provide plate potential for final amplifier V2. The output voltage of the other secondary winding is full-wave rectified by silicon diode stacks (CR5-CR6) and applied through the pi-filter (C34-L10-C35) to provide plate potential for driver V1.

Screen voltages for both V1 and V2 are developed from the rectified output appearing at the secondary winding center tap of T3. The filtering action provided by choke L11 and capacitor C37 is common to both screen supplies. Additional filtering of the +250 vdc screen voltage to driver V1 is supplied by the combination of C46 and R11. Additional filtering of the variable screen voltage to final amplifier V2 is supplied by the combination of C36, R13, and R16. The wiper arm of potentiometer R13 is mechanically coupled to shaft of motor B3, the rotation direction of which is controlled by the application of primary power through POWER RAISE/LOWER switch S5. (See figure 4-1.) The adjustable output taken from the wiper arm of R13 is applied to the screen circuit of V2 through the coil of final screen current overload relay K6.

4-4. RF AMPLIFIER CIRCUIT ANALYSIS

A detailed circuit analysis of the Model 680 FM Exciter is provided in Section IV of its individual operating and servicing manual.

Driver V1 and power amplifier V2 are housed in an aluminum enclosure, of cavity, in the upper section of the transmitter cabinet. RF radiation leakage is prevented by the use of capacitor type feedthrough connections to the cavity interior. RF gasketing is used to seal the removable rear cover.

The 4X150 driver tube plate line is inductively coupled to the final amplifier, which is a single-ended 5CX1500A pentode. The plate line inductor (L3) of V1 is adjustable by a sliding shorting bar and is tuned to resonance by DRIVER TUNING capacitor C45.

Power amplifier V2 uses a stripline concept in the plate circuit for stability and simplicity. The stripline (L7) is adjustable in height and, in conjunction with FINAL TUNING capacitor C27, tunes the final tank circuit to resonance.

Output coupling is adjustable by inductor L7, which consist of a movable shorting bar. This arrangement allows the electrical length of L7 to be easily adjusted. The RF output coupled out of the cavity at jack J2 is fed to the antenna through low-pass harmonic filter FL1 and directional coupler DC1. Inductor L12 is a pickup loop which couples a sample of the RF output to the station monitor via jack J3.

4-5. OVERLOAD AND AUTOMATIC RECYCLE CIRCUIT ANALYSIS

The RF amplifier is protected against plate current overloads of V1 and V2, and against screen current overloads of V2. (See figure 5-1). Relays associated with these protective functions are as follows:

- a. Final plate current overload relay K4.
- b. Driver plate current overload relay L5.
- c. Final screen current overload relay K6.

The threshold current at which these relays actuate is adjustable by a potentiometer shunted across the coil winding. Relay K4 is adjusted to trip at a V2 plate current threshold of 1.2 amperes, relay K5 is adjusted to trip at V1 plate current threshold of 150 milliamperes, and relay K6 is adjusted to trip at a V2 screen current threshold of 150 milliamperes.

Refer to figure 4-1 and note that normally open contacts 4 and 7 of each overload relay are connected in parallel across the coil of relay K3; normally open contacts 5 and 8 of each overload relay are connected in parallel and in series with one side of the ac line to terminal 4 of TB6; and normally closed contacts 6 and 9 of each overload relay are connected in the gate circuit of an associated silicon-controlled rectifier (CR9, CR10, and CR11).

Assume a final screen current overload occurs and trips relay K6. Contacts 4 and 7 of K6 close and place a direct short across the coil of relay K3, causing relay K3 to deenergize and remove the 200/240 vac power input to the primary of transformer T3. Contacts 6 and 9 of K6 close and forward bias (ground) the gate of CR11, causing it to fire. Current flow is now completed from the -110 vdc source to ground through CR11, SCREEN OVERLOAD tally light DS6, and the normally closed contacts of RESET switch S9. If the Model 601A does not contain an optional automatic overload recycle unit, the transmitter must manually be reset after each overload by setting PLATE switch S4A momentarily to the ON position. SCREEN OVERLOAD tally light DS6 will remain lighted until RESET switch S9 is actuated.

If the optional automatic overload recycle unit is installed, the transmitter will be automatically recycled to normal operation following a momentary current overload. Consecutive recycling is limited to four (but not less than three) times within eight seconds following the operation of any overload relay. If the overload exists after a maximum of four recycles, the transmitter plate and screen voltage will remain off until the overload is manually reset.

Refer again to figure 4-1, which shows the -110 vdc bias line connected to terminal 6 of TB6. During normal transmitter operation, parallel-connected capacitors C1, C2 and C3 in the automatic overload recycle unit charge up to the full voltage through resistor R1 and normally closed contacts 2 and 8 of relay K1. Note that one side of the K1 coil is connected to one side of the ac line through the normally closed contacts of relay K2, switch S4B, and the remote HV OFF switch.

Now, assume that a final screen current overload occurs and trips relay K6. The operation of relay K6 contacts 4 and 7 and 6 and 9 is the same as described previously; they cause relay K3 to deenergize and CR11 to fire. Closed contacts 5 and 8 of K6 complete the application of ac power to the coil of relay K1, causing it to energize and remain latched by the ac power supplied to its coil through TB6-5 and closed contacts 4 and 7. Closed contacts 6 and 9 of K1 remove ground from the cathode of CR2, and closed contacts 5 and 8 connect capacitors C1, C2, and C3 across capacitor C4 through resistor R2.

When capacitor C2 is charged to approximately 39 vdc, zener diode CR1 is reverse-biased into breakdown, and ground (+39 vdc) is applied through R3 to the gate of CR2, causing it to fire and energize relay K2. Contacts 2 and 7 of K2 open, causing relay K1 to deenergize.

and contacts 5 and 7 of K2 complete the application of ac power to the coil of K3, causing it to close and reconnect the 200/240 vac power input to the primary of T3. With relay K1 deenergized, contacts 3 and 9 ground the cathode circuit of CR2, causing it to cut off and deenergize relay K2.

The foregoing sequence of events is repetitive up to a maximum of four times within eight seconds, after which the charge across capacitors C1, C2, and C3 is depleted to the point where it is insufficient to charge C4 to the 39 vdc level required to avalanche CR1. Therefore, the ac voltage supplied through contacts 5 and 7 of K2 will maintain K1 energized. In this circumstance, the transmitter overload must be manually reset.

4-6. METERING CIRCUIT ANALYSIS

4-6.1. Multimeter Circuits

As shown in figure 5-1, when MULTIMETER selector switch S3 is in the DR PLATE VOLTS position, MULTIMETER M1 is connected across shunt resistor R34. Resistor R34 (10 kilohms) and resistor R9 (2.5 megohms) are connected in series across bleeder resistor R24 in the +1650 vdc power supply. Since resistor R34 is connected near the ground end of the power supply, only a representative sample (approximately 6.5 vdc) of the +1650 vdc output is applied to the multimeter. M1 has a full-scale indication of 2500 vdc with S3 in this position.

When S3 is in the DR PLATE MA position, M1 is connected directly across the 0.24 ohm resistor (R4) in the cathode circuit of driver V1. Since the total plate current of V1 flows through the cathode circuit, R4 is used to develop a small voltage drop (typically 20 millivolts) to represent the plate current drawn by V1. M1 has a full-scale indication of 250 milliamperes with S3 in this position.

When S3 is in the FINAL GRID VOLTS position, M1 is connected in series with resistor R8 to the control grid of V2. Under static operation conditions (i.e., without RF drive), approximately -100 vdc will be developed at the junction of R7 and R8. The series resistance of R8 provides M1 with a full-scale indication of 250 vdc with S3 in this position.

When S3 is in the FINAL GRID MA position, M1 measures the voltage drop developed across the 1.2 ohm resistor (R7) in the grid circuit of V2. Under normal operation at an RF output of 2500 watts, the control grid current of V2 will be approximately 25 milliamperes. In this case, the voltage drop across R7 will be approximately 25 millivolts, which represents the control grid current drawn by V2. M1 has a full - scale indication of 50 milliamperes in this position of S3.

When S3 is in the FINAL SCR VOLTS position, M1 is connected in series with resistor R11 to the screen grid circuit of V2. The series current-limiting resistance of R8 provides M1 with a full-scale indication of 500 vdc in this position of S3.

When S3 is in the FINAL SCR MA position, M1 is connected directly across the 0.24 ohm resistor (R12) in the screen return line. Under normal operating conditions at an RF output of 2500 watts, the screen current will be approximately 85 milliamperes. In this case, the voltage drop across R12 will be approximately 0.2 vdc, which represents the screen grid current drawn by V2. M1 has a full-scale indication of 250 milliamperes in this position.

When S3 is in the FINAL FIL VOLTS position, M1 is connected through potentiometer R10 and resistor R35 to the junction of diodes CR2 and CR13 connected back-to-back across the filament of V2. Potentiometer R10 is used in this position of S3 to calibrate the full-scale indication of M1 at 5 vdc.

4-6.2 Power Monitor

POWER MONITOR meter M2 provides a readout of both forward and reflected power as sensed by directional coupler DC1 and selected by POWER MONITOR switch S8. Forward power is coupled out of DC1 via jack J5 and reflected power is coupled out via jack J6.

4-6.3. Final Plate Voltage

FINAL PLATE VOLTAGE meter M3 is connected to stripline L5 in the plate circuit of V2 through R19, L6, and C42. The current through M3 is limited by R19, which has a resistance of 5 megohms. The voltage drop developed across R20 is representative of the V2 plate voltage and is used for remote metering functions.

4-6.4. Final Plate Current

FINAL PLATE CURRENT meter M4, which is connected in series with the V2 plate current return line, is held 5 ohms above ground by the resistance of R22. The small voltage drop developed across R22 is representative of the V2 plate current and is used for remote metering functions. Diode CR12 is connected across M4 to protect the meter in the event of a shorted high-voltage filter capacitor.

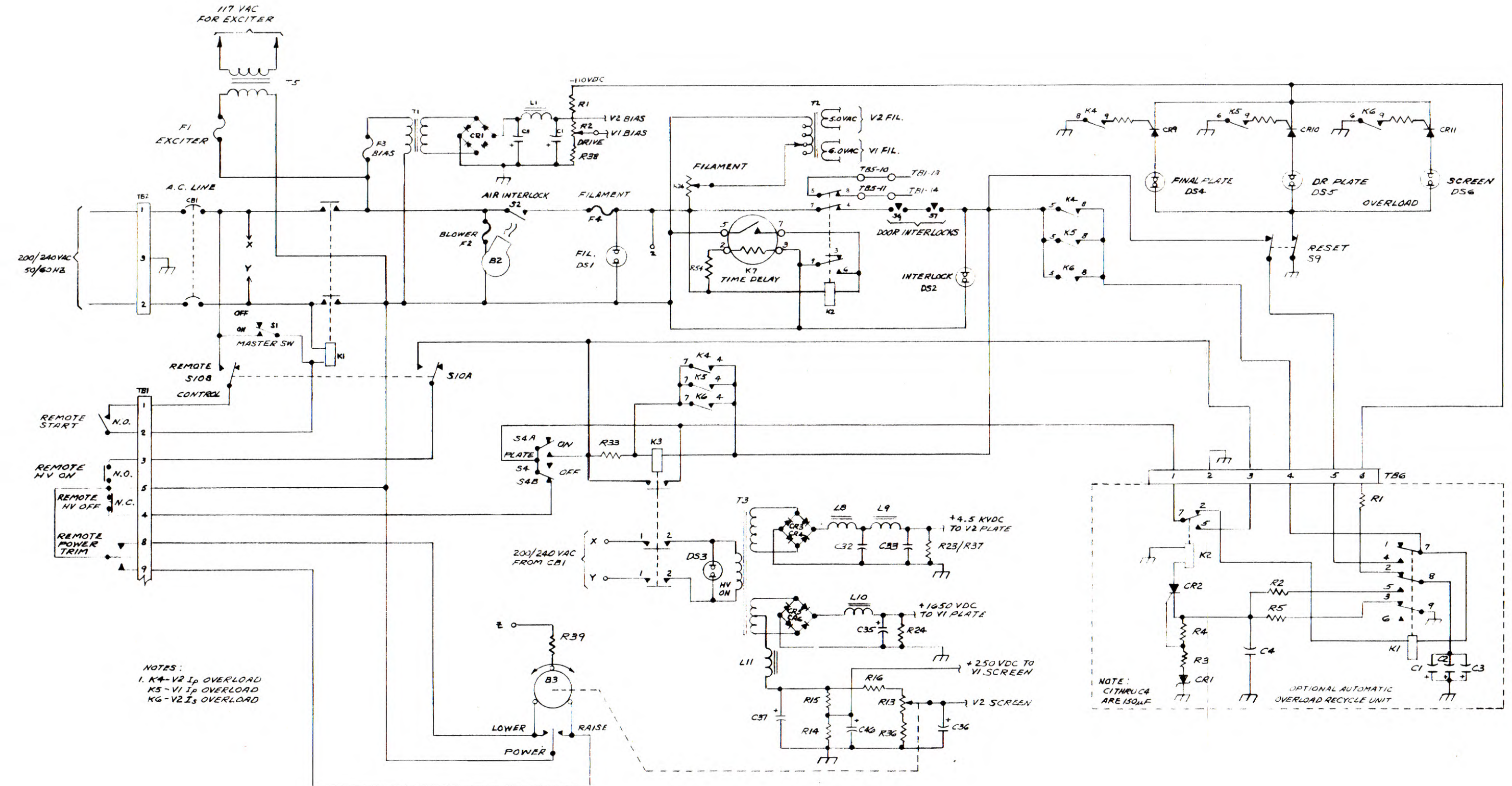


FIGURE 4-1 MODEL 602A CONTROL, OVERLOAD AND AUTOMATIC OVERLOAD RECYCLE SIMPLIFIED DIAGRAM

SECTION V MAINTENANCE

5-1. PERIODIC INSPECTION AND MAINTENANCE

WARNING

Even if the transmitter is completely shut down, be extremely cautious whenever adjustment or maintenance is required to be conducted in the vicinity of components that are normally energized with high potential. To ensure safety, use an insulated shorting bar (or a dead man's stick) and ground all high-voltage capacitors plate lines, etc.

Only the cabinet cooling air filters and the tube anode coolers require periodic special attention. Otherwise, periodic inspection, cleaning, and maintenance requirements for the Model 602A are in accordance with standard practice for maintaining any communications equipment to provide optimum performance with minimum failures.

5-1.1. Air Filters

The cabinet cooling air filters for the Model 602A are located on the rear door of the unit. If permitted to become clogged with dust and dirt particles, the flow of air to B2 may become so restricted that air flow interlock switch S2 will not close, rendering the unit inoperative. Periodically, as determined by their condition, the filters should be cleaned to ensure a free flow of clean air through the unit. Remove the filters and immerse and agitate them in hot, soapy water. When clean, rinse filters and allow to dry before replacing them in the unit.

5-1.2. Anode Coolers

To ensure proper cooling of amplifier tubes V1 and V2, the anode coolers of these tubes should be periodically inspected for particles of dirt or dust that might interfere with effective cooling. To remove and replace V1 and V2, refer to paragraph 5-2 of this section. Once removed from the RF amplifier cavity, the anode cooler of these tubes may be cleaned by simply blowing a jet of air through the cooling elements

5-2. REMOVAL AND REPLACEMENT OF AMPLIFIER TUBES

Certain precautionary steps should be taken to ensure the safety of maintenance personnel when removing and replacing the amplifier tubes as well as to ensure proper handling of the tubes. To remove and replace the amplifier tubes, proceed as follows:

- a. Set PLATE switch S4 momentarily to the OFF position.
- b. Set MASTER SW control S1 to OFF and open rear cabinet door.
- c. Remove V1 (figure 6-9) as follows:
 - (1) Remove screw and nut that secure C15 and L2 to V1 anode clamp; swing inductor L2 out of the way.

- (2) Remove anode clamp and chimney.
- (3) Pull V1 straight out of its socket
- e. Remove V2 (figure 6-9) as follows:
 - (1) Loosen anode clamp
 - (2) Rotate V2 counterclockwise 1/4 turn so that tube flanges are free from socket blade contacts.
 - (3) Lift V2 straight out of its socket
- f. Replace V1 as follows:
 - (1) Insert tube in socket and rotate slightly to align tube base keyway with socket keyway. Press tube firmly until seated all the way into socket.
 - (2) Replace chimney and anode clamp.
 - (3) Replace screw and nut, making sure to reconnect L2 and C15 to anode clamp.
- g. Replace V2 as follows:
 - (1) Lower tube into socket. Rotate tube slightly so that flanges clear blade contacts and tube seats fully into socket.
 - (2) Rotate tube clockwise 1/4 turn so that tube flanges engage socket blade contacts.
 - (3) Tighten anode clamp.
- h. Replace back cover of RF amplifier cavity and close rear cabinet door.

5-3. OVERLOAD RELAY ADJUSTMENT

The following test equipment is required to set the overload threshold of relays K4 (final plate current), K5 (driver plate current), and K6 (final screen current), and to check the operation of the associated overload tally light:

- a. Adjustable power supply (0 to 25 vdc at 3 amperes)
- b. Power supply (110 vdc)
- c. Accurate load current meter
- d. Standard ohmmeter

If it is not desired to check the tally light circuit in the following paragraphs, the 110 vac power supply is not required and the procedural steps referring to its use should be ignored.

5-3.1. Final Plate Current Overload

To adjust the overload threshold of relay K4 (figure 6-4), proceed as follows:

- a. Set PLATE switch S4 momentarily to the OFF position.
- b. Set MASTER SW control S1 and AC LINE circuit breaker CB1 to OFF.
- c. Open front access door and connect negative lead of 110 vdc power supply to TB6-6 and connect positive lead to TB6-2. (See figure 6-2.) Energize power supply.

- d. Connect 0 to 25 vdc power supply with load current meter in series across the coil of relay K4 (terminals A and B).
- e. Set ohmmeter in RX1 scale and connect across contacts 6 and 9 of relay K4.
- f. Energize 0 to 25 vdc power supply and adjust its output for load current meter indication of 1.2 amperes.
- g. Adjust potentiometer R32 to the point where K4 actuates (ohmmeter will indicate continuity). FINAL PLATE OVERLOAD tally light DS4 should be lighted.
- h. Disconnect ohmmeter from contacts 6 and 9 and connect, in turn, across contacts 4 and 7 and across contacts 5 and 8. Multimeter should indicate continuity. Disconnect 0 to 25 vdc power supply.
- i. Activate OVERLOAD RESET switch S9. FINAL PLATE OVERLOAD tally light should extinguish. Disconnect 110 vdc power supply.

5-3.2. Driver Plate Current Overload

To adjust the overload threshold of relay K5 (figure 6-4), proceed as follows:

- a. Set PLATE switch S4 momentarily to the OFF position.
- b. Set MASTER SW control S1 and AC LINE circuit breaker CBI to OFF.
- c. Open front access door and connect negative lead of 110 vdc power supply to TB6-6 and connect positive lead to TB6-2. (See figure 6-2.) Energize power supply.
- d. Connect 0 to 25 vdc power supply with load current meter in series across the coil of relay K5 (terminal A and B).
- e. Set ohmmeter in RX1 scale and connect across contacts 6 and 9 of relay K5.
- f. Energize 0 to 25 vdc power supply and adjust its output for load current meter indication of 150 milliamperes.
- g. Adjust potentiometer R51 to the point where K5 actuates (ohmmeter will indicate continuity). DR PLATE OVERLOAD tally light DS5 should be lighted.
- h. Disconnect ohmmeter from contacts 6 and 9 and connect, in turn, across contacts 4 and 7 and across contacts 5 and 8. Multimeter should indicate continuity. Disconnect 0 to 25 vdc power supply.
- i. Activate OVERLOAD RESET switch S9. DR PLATE OVERLOAD tally light should extinguish. Disconnect 110 vdc power supply.

5-3.3. Final Screen Current Overload

To adjust the overload threshold of relay K6 (figure 6-4), proceed as follows:

- a. Set PLATE switch S4 momentarily to the OFF position.
- b. Set MASTER SW control S1 and AC LINE circuit breaker CBI to OFF.
- c. Open front access door and connect negative lead of 110 vdc power supply to TB6-6 and connect positive lead to TB6-2. (See figure 6-2.) Energize power supply.
- d. Connect 0 to 25 vdc power supply with load current meter in series across the coil of relay K6 (terminal A and B).

- e. Set ohmmeter in RX1 scale and connect across contacts 6 and 9 of relay K6.
- f. Energize 0 to 25 vdc power supply and adjust its output for load current meter indication of 150 milliamperes.
- g. Adjust potentiometer R18 to the point where K6 actuates (ohmmeter will indicate continuity. SCREEN OVERLOAD tally light DS6 should be lighted.
- h. Disconnect ohmmeter from contacts 6 and 9 and connect, in turn, across contacts 4 and 7 and across contacts 5 and 8. Multimeter should indicate continuity. Disconnect 0 to 25 vdc power supply.
- i. Activate OVERLOAD RESET switch S9. SCREEN OVERLOAD tally light should extinguish. Disconnect 110 vdc power supply.

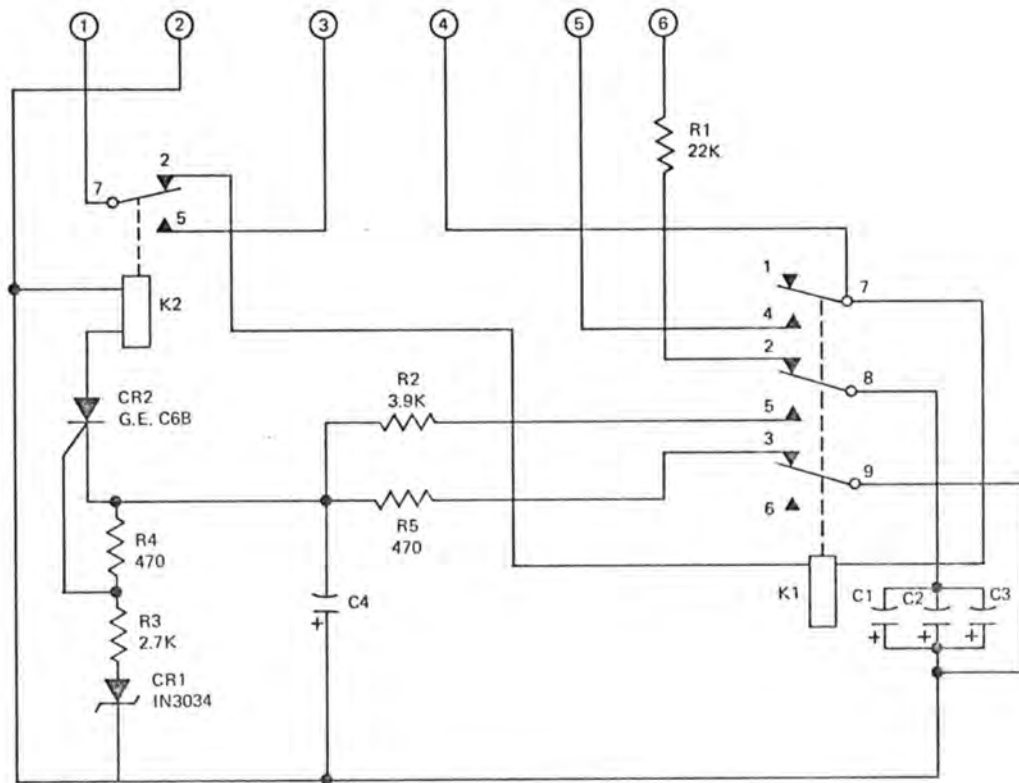
5-4. FILAMENT VOLTAGE READOUT CALIBRATION

The following procedures requires and accurate ($\pm 1\%$) ac voltmeter to calibrate the filament voltage readout of MULTIMETER M1:

- a. Set PLATE switch S4 momentarily to the OFF position.
- b. Leave MASTER SW control S1 in the ON position.
- c. Open rear cabinet door and remove RF amplifier cavity cover.
- d. Connect ac voltmeter leads across filament terminals on V2 tube socket. (See figure 6-9.)
- e. Adjust FILAMENT control R26 for indication of 5.0 vac on ac voltmeter.
- f. Rotate MULTIMETER selector S3 to FINAL FIL VOLTS. Adjust potentiometer R10 (figure 6-6) for an indication of exactly 5.0 on MULTIMETER M1.
- g. Disconnect ac voltmeter, replace RF amplifier cavity cover, and close rear cabinet door.

5-5. SCHEMATIC DIAGRAMS

Figure 5-1 is the wiring diagram of the power supply and control circuits, figure 5-2 is the overall schematic diagram of the Model 602A, and figure 5-3 is the schematic diagram of the optional automatic overload recycle unit. Schematic diagrams of the Model 680 FM Exciter are contained in its individual operating and servicing manual.



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
ALL RESISTANCES ARE IN OHMS
ALL RESISTORS ARE 1/2 WATT
2. C1 THROUGH C4 ARE 150 μ F

Figure 5-3. Automatic Overload Recycle Unit Schematic Diagram

098-7030

5-6

SECTION VI REPLACEABLE PARTS

6-1. ORDERING INFORMATION

When ordering parts for the Model 602A FM Transmitter, give the model number and the serial number of the equipment and the reference designation, part number, manufacturer's part number, and name of manufacturer. To order a part not listed in paragraph 6-3 of this section, give a complete description of the part including function and location. A complete parts listing for the Model 680 FM Exciter is contained in its individual operating and servicing manual.

All parts may be ordered from:

Sparta Electronic Corporation
5851 Florin-Perkins Road
Sacramento, CA 95828
Telephone: (916) 383-5353
Telex: 377-488 Sparta Sac
Cable Address: Sparta

6-2. PARTS LOCATION

The location of parts listed in tables 6-2 and 6-3 is shown in figures 6-1 through 6-10.

6-3. TABLES OF REPLACEABLE PARTS

A list of manufacturers of the component parts of the Model 602A FM Transmitter is provided by table 6-1. Table 6-2 contains a listing of replaceable parts for the Model 602A, and table 6-3 contains a listing of replaceable parts for the optional automatic overload recycle unit. The manufacturer of the particular part listed in tables 6-2 and 6-3 is indicated by a code number, which is used to identify the manufacturer as listed in table 6-1.

Table 6-1. List of Manufacturers

Code. No.	Manufacturer	Address
QUAL	Quality Transformer Co.	San Jose, CA
TELCO	Telegraph Condenser Co., Ltd.	North Acton, London
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
02295	General Electric Co., General Purpose Control Dept.	Bloomington, Ill
02660	Amphenol Corporation	Broadview, Ill
03508	General Electric	Syracuse, N.Y.
03522	McLean Engineering Laboratories	Princeton, N.J.
04713	Motorola Semiconductor Products Inc.	Phoenix, Ariz.
06980	Varian Associates Eimac Division	San Carlos, Calif
10108	Hurst Manufacturing Corp.	East Princeton, Ind.
23265	SPARTA ELECTRONIC CORPORATION	SACRAMENTO, CA
27264	Molex Products Co.	Downers Grove, Ill
16727	Condenser Products Corp.	Brookville, Ill.
32171	Modutec Inc.	Norwalk, CT.
CADDOCK	Caddock Electronics	Riverside, CA.

Table 6-1. List of Manufacturers (con't)

Code No.	Manufacturer	Address
44655	Ohmite Manufacturing Co.	Skokie, Ill.
52090	Rowan Controller Co.	Westminister, MD
53021	Sangamo Electric Co.	Springfield, Ill.
56289	Sprague Electric Co.	N. Adams, Mass.
71400	Bussman Mfg. Division of McGraw-Edison Co.	St. Louis, Mo
71590	Globe-Union Inc., Centralab Division	Milwaukee, Wis.
71785	Cinch Mfg. Co. and Howard B. Jones Division	Chicago, Ill.
72 619	Dialight Corporation	Brooklyn, N.Y.
72982	Erie Technological Products	Erie, Pa.
73680	Garlock Inc.	Palmyra, N.Y.
77342	American Machine and Foundry Co., Potter and Brumfield Division	Princeton, Ind.
80131	Electronic Industries Association	Washington, D.C.
8134 9	Military Specification	
82389	Switchcraft Inc.	Chicago, Ill
82877	Rotron Manufacturing Co., Inc.	Woodstock, N.Y.
89020	Buchanan Electrical Products Corp.	Union, N.J.
91637	Dale Electronics Inc.	Columbus, Neb.
91929	Honeywell Inc. Building Controls and Components Group, Micro Switch Division	Freeport, Ill
93929	G-V Controls Inc.	Livingston, N.J.
94990	Motorola Inc., Government Electronics Division Aerospace Center	Scottsdale, Ariz
97965	Essex Wire Corp., Electronic Marketing Division	Chicago, Ill

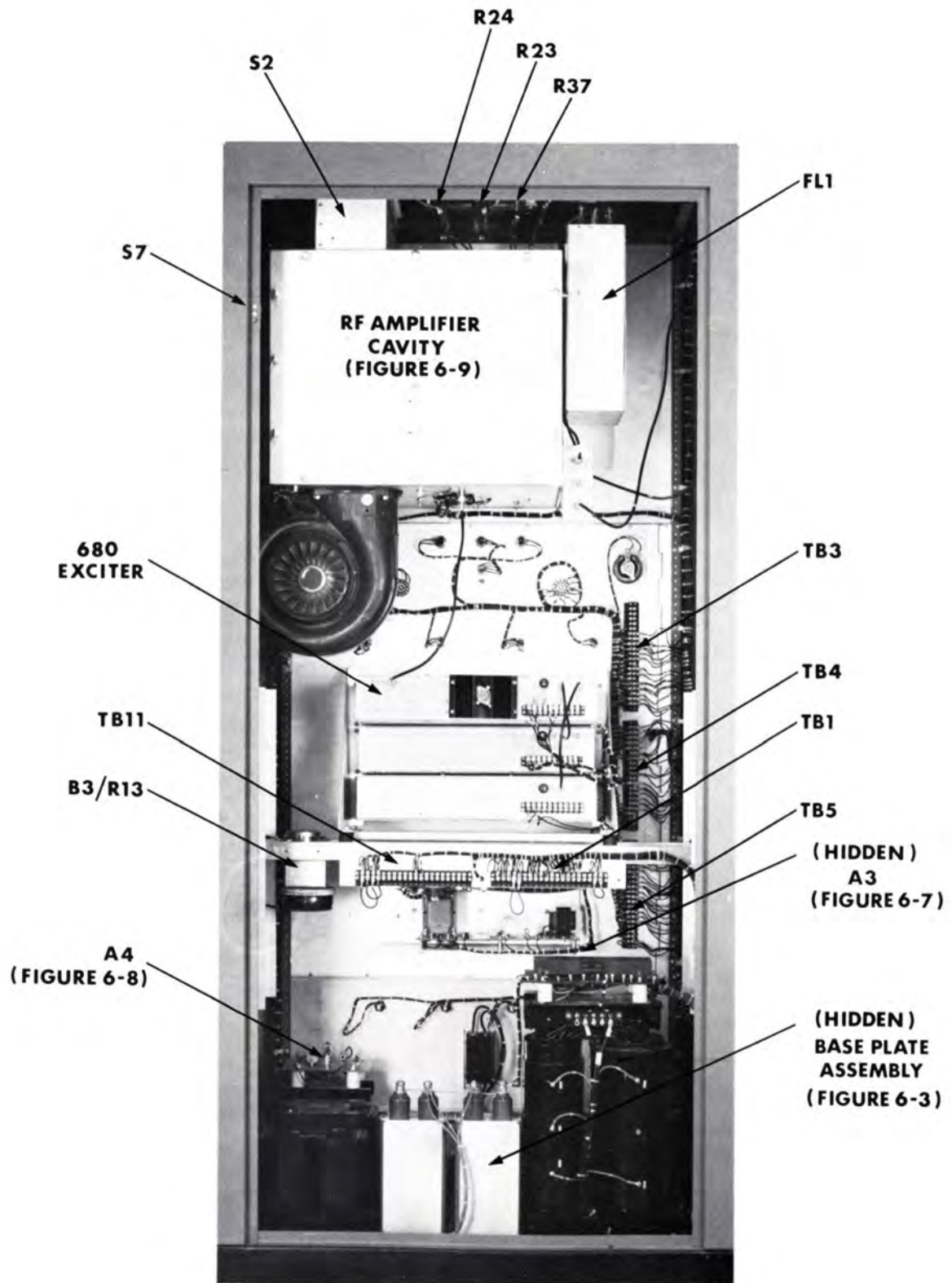


Figure 6-1. Model 602A Rear View
(Rear door removed)

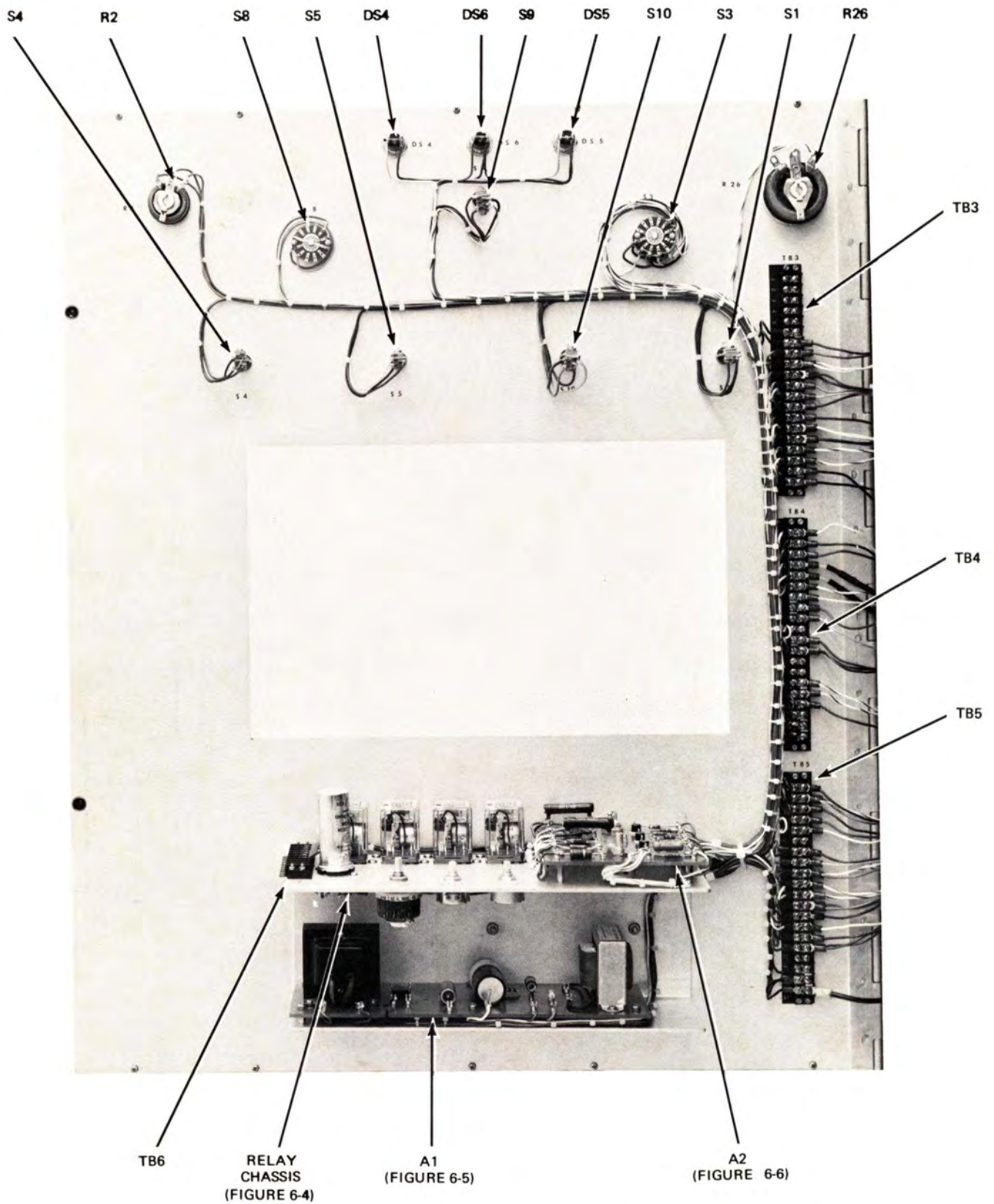


Figure 6-2. Access Panel Rear View

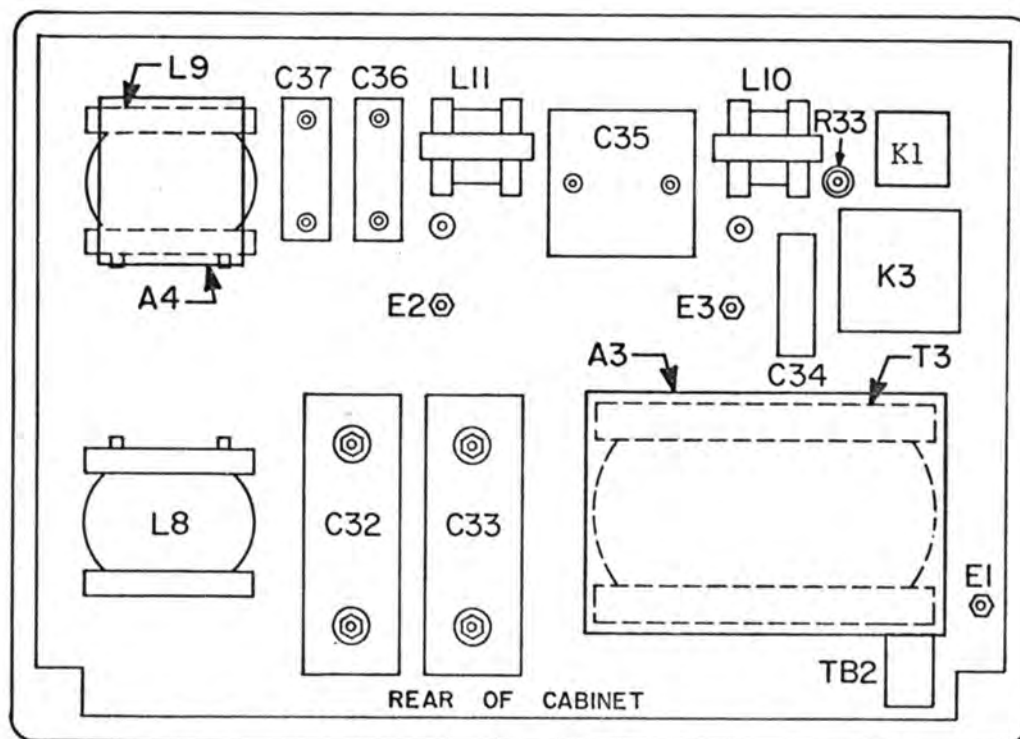


Figure 6-3. Baseplate Assembly

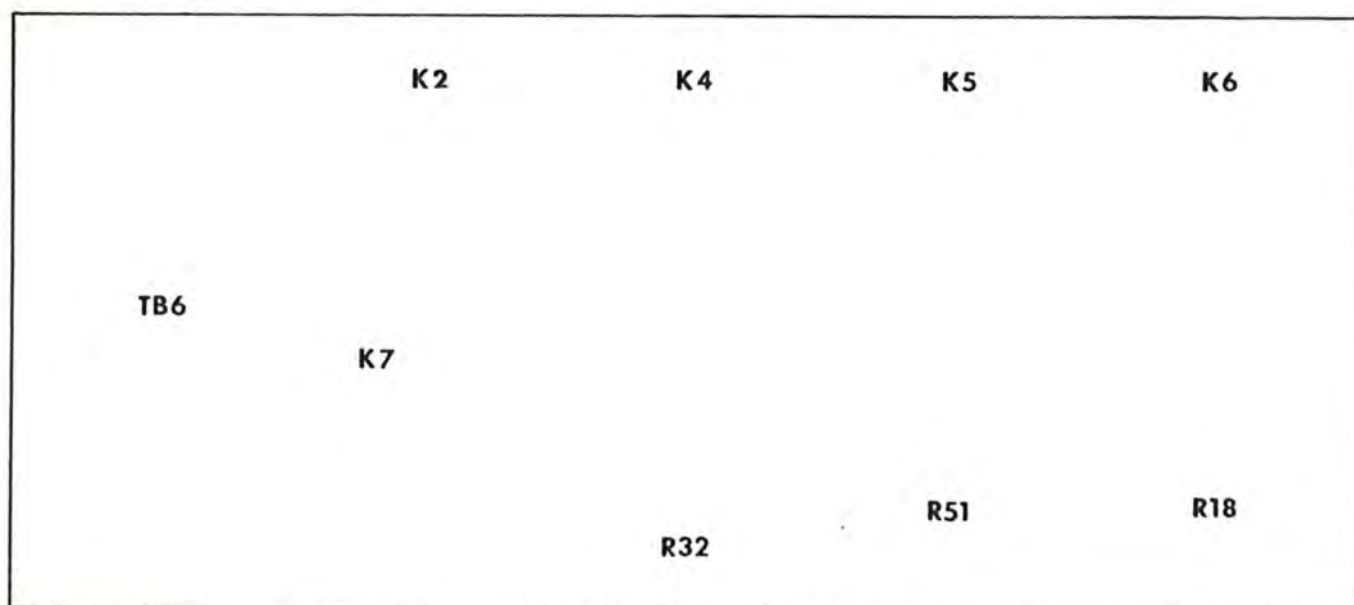


Figure 6-4. Relay Chassis

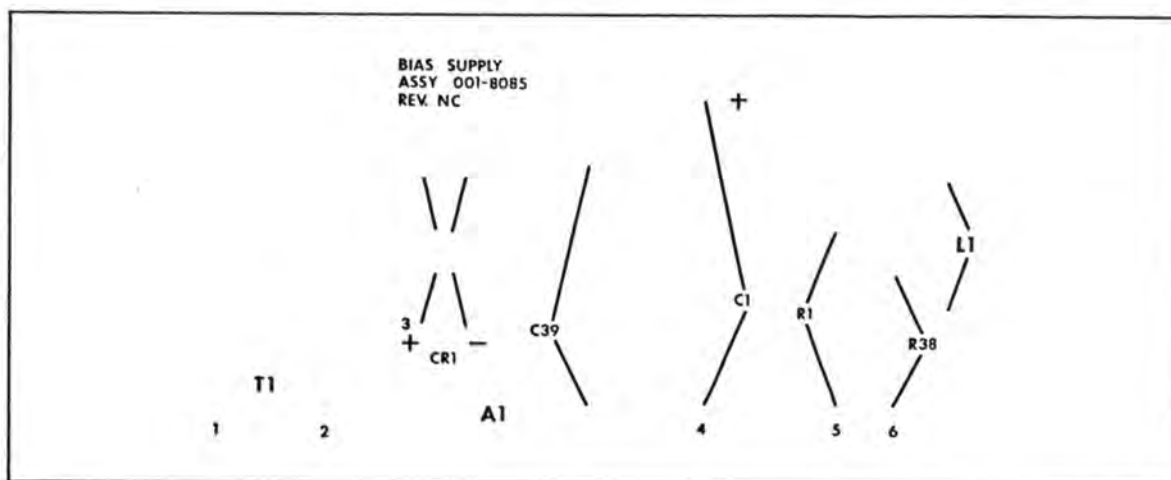


Figure 6-5. Bias Supply Assembly (A1)

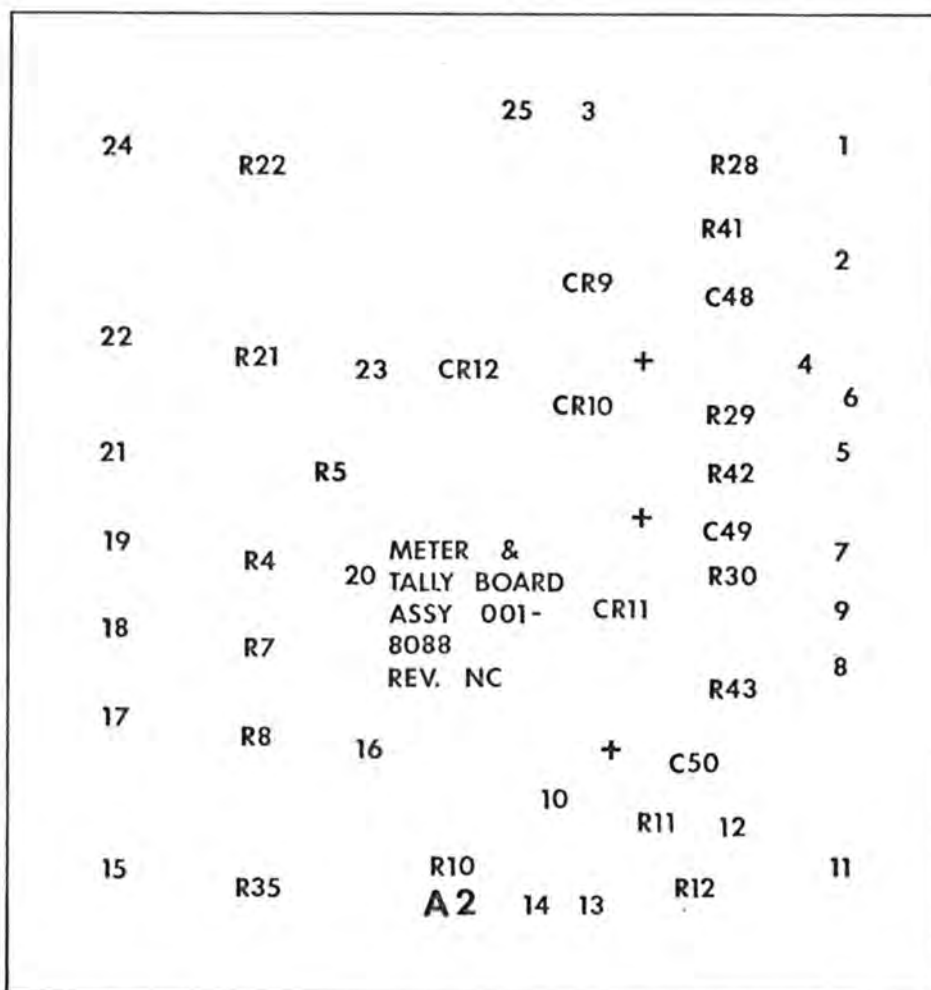


Figure 6-6. Meter and Tally Board Assembly (A2)

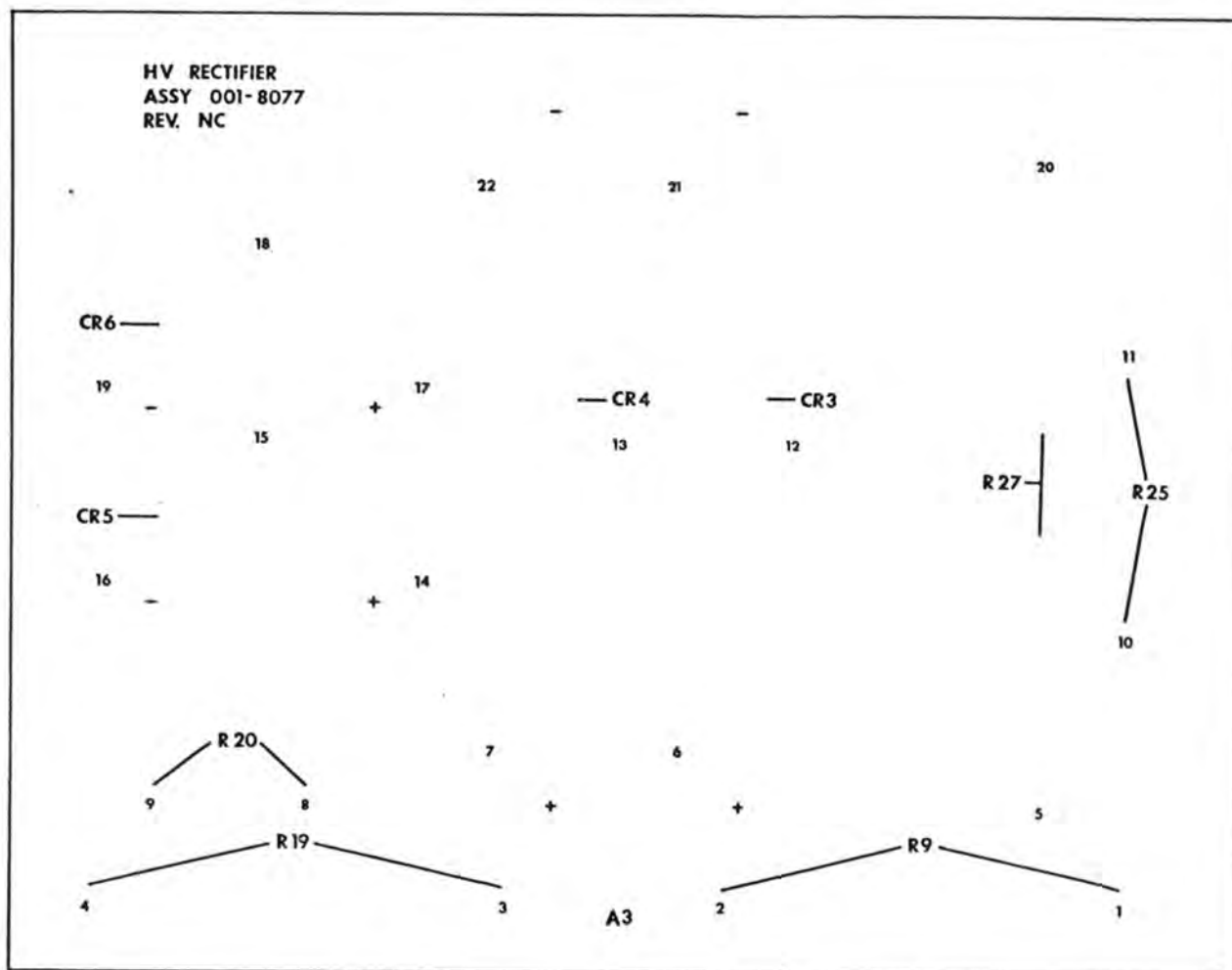


Figure 6-7. High-Voltage Rectifier Board Assembly (A3)

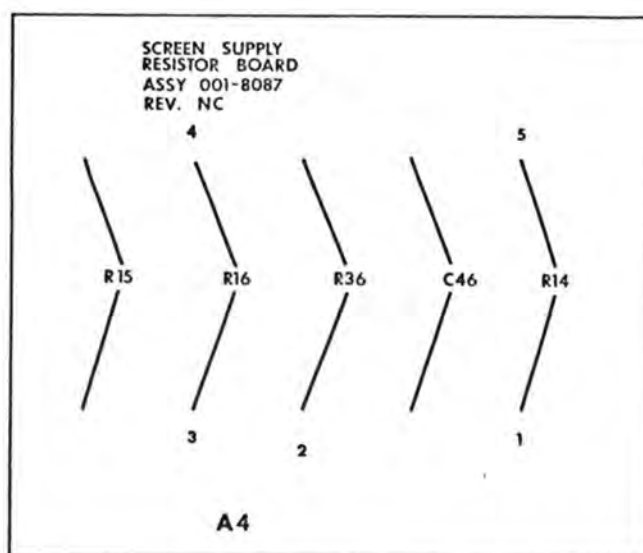


Figure 6-8. Screen Voltage Resistor Board Assembly (A4)

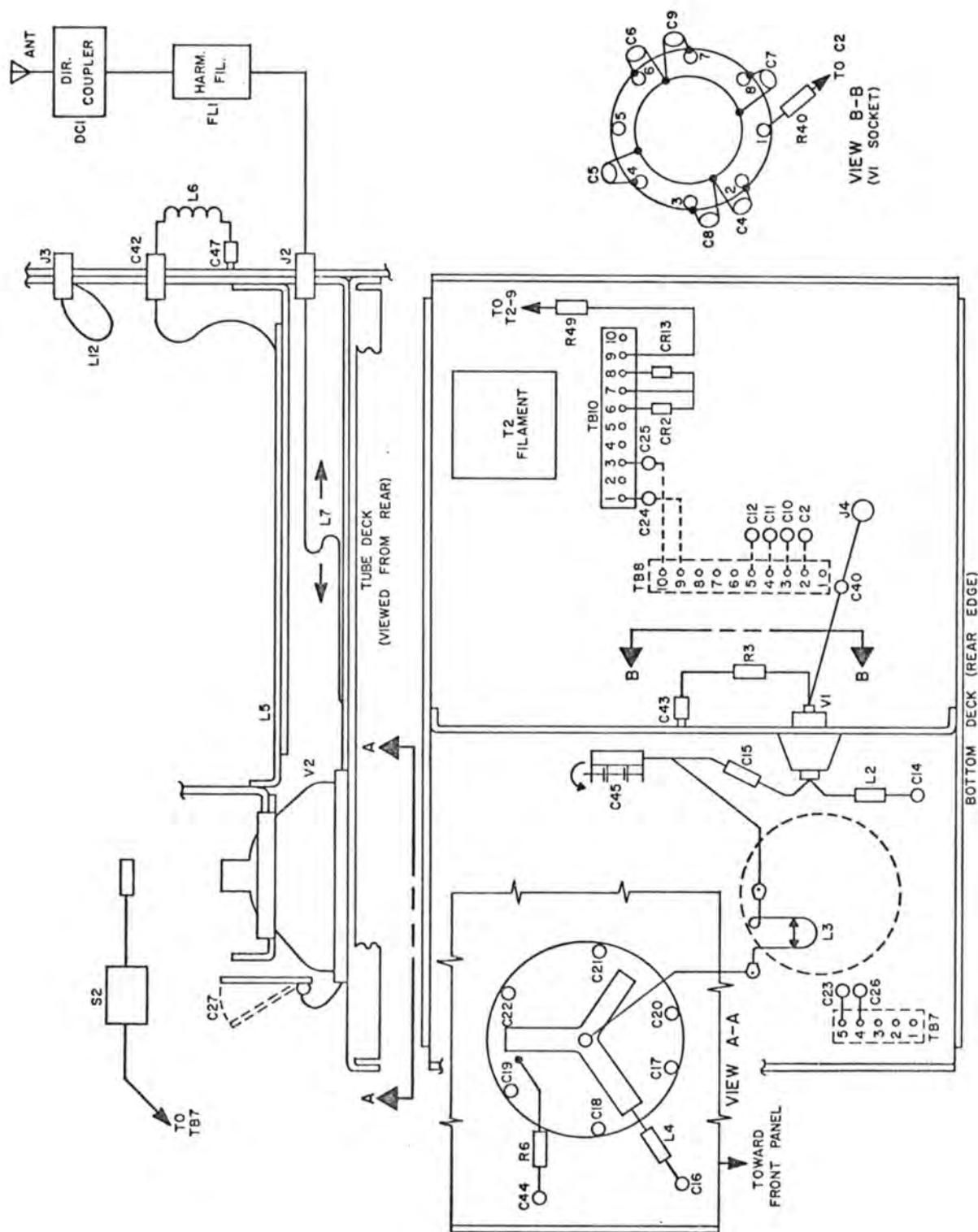


Figure 6-9. RF Amplifier Cavity Assembly

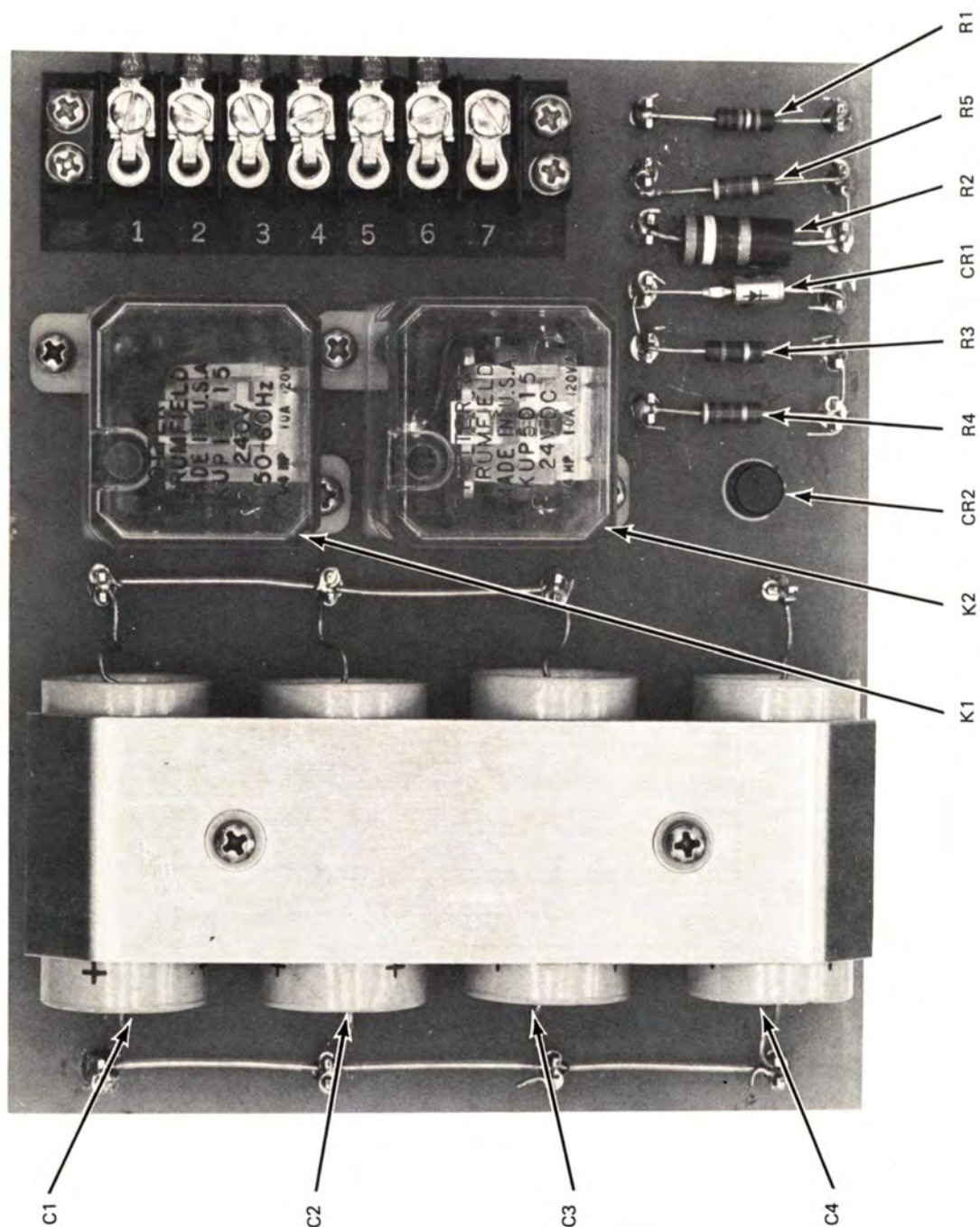


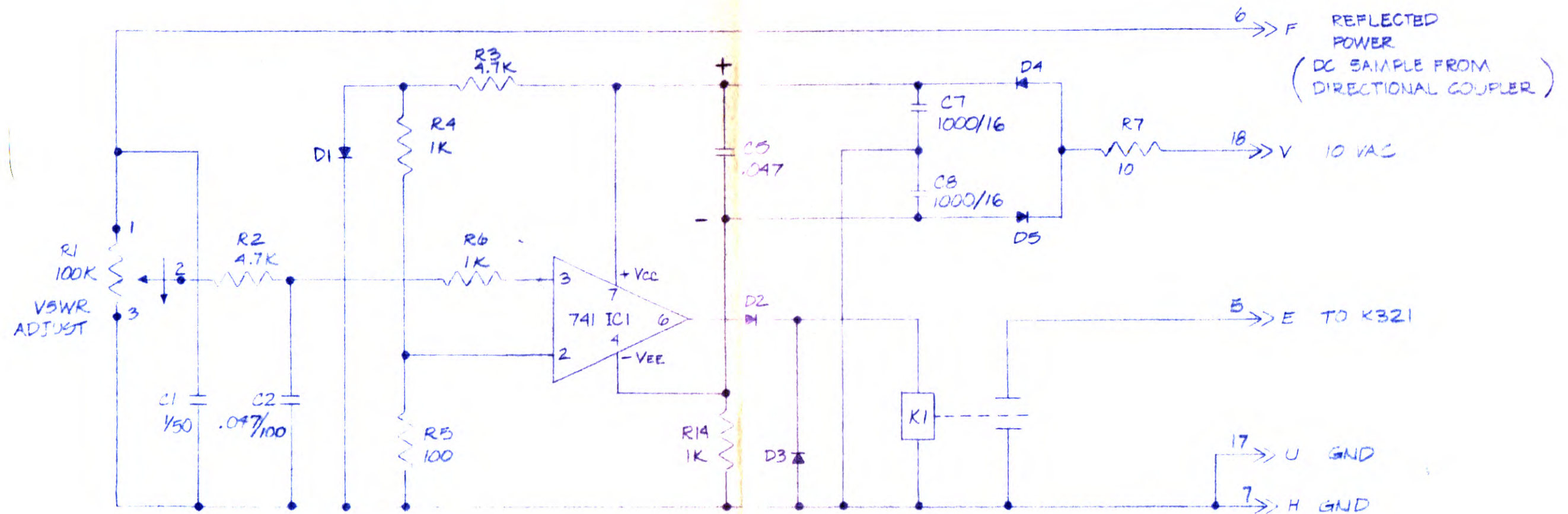
Figure 6-10. Optional Automatic Overload Recycle Unit

Table 6-2. Model 602 Replaceable Parts List

Desig	Description	Part No.	Mfr.	Mfr Part No.	Total
A1	Assy, Bias and Control Board	001-8085	23265	001-8085	1
A2	Assy, Meter and Tally Board	001-8088	23265	001-8088	1
A3	Assy, HV Rectifier Board	001-8077	23265	001-8077	1
A4	Assy, Screen Rectifier Board	001-8087	23265	001-8087	1
A5	Assy, Rheostat	001-8131	23265	001-8131	1
B1	Not used				
B2	Blower	231-0080	82877	CXH33A03B	1
B3	Motor, power control	238-1001	10108	PC-DA	1
C1	Capacitor, 100uf, 250v	112-1365-10	56289	45D10198	1
C2	Capacitor, feedthru, 1000pf	110-1070	81349	CK70AW102M	6
C3	N/A				
C4-C9	Capacitor, .001uf	110-0068	56289	5HK-D10	6
C10-C12	Same as C2				
C13	N/A				
C14	Capacitor, feedthru, .01uf	110-1092	72982	2498,10,000pf	1
C15-C22	Capacitor, 1000pf	110-0390	71590	858S-1000	10
C23	Same as C2				
C24-C25	Filter, feethru, 2000pf	268-0016	72982	1202-005	2
C26	Same as C2				
C27	Capacitor, flapper	022-1158	23265	022-1158	1
C28-C31	Capacitor, .01uf, 100v	110-0006-02	56289	TGS-10	4
C32-C33	Capacitor, 5uf, 6kv	103-2013-06	16727	AUC6M5	2
C34	Not used				
C35	Capacitor, 20uf, 2kv	103-1924	01002	23F1100	1
C36-C37	Capacitor, 8uf, 1kv	103-2015	56289	CR-81	2
C38	N/A				
C39	Capacitor, 4uf, 250v	112-1365-03	56289	45D10183	1
C40-C41	N/A				
C42	Capacitor, feedthru, 1000pf	110-1114	TELCO	HLC 2014/U	1
C43-C44	Same as C15				

REVISIONS

REV.	DESCRIPTION	DATE	APPR.
A	REVISED ORIGINAL C SIZE DWG.	8-28-79	LB
B	ECN 1459	6-12-80	11/11/80



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UNLESS OTHERWISE SPECIFIED
INTERPRET DRAWING PER ANSI Y14
DIMENSIONS ARE IN INCHES AND APPLY
AFTER PLATING
BREAK SHARP EDGES

XX ± X° ±

XXX ± J

MATERIAL

FINISH

DWN.

LB

DATE

8-28-79

CHECK

11/11/80

8-30-79

PROJ.

11/11/80

8-30-79

APPR.

11/11/80

8-23-79

NEXT ASSY

USED ON

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SCHEMATIC VSWR PROTECTION

SIZE

B

S-273

DRAWING NUMBER

071-0273

REV

B

SCALE —

SHEET 1 OF 1

1. RESISTORS IN OHMS, 1/2 W, 5%.
2. CAPACITORS IN MICROFARADS/VOLTS
3. DIODES ARE IN4004

NOTES: UNLESS OTHERWISE SPECIFIED

Desig	Description	Part No.	Mfr	Mfr Part No.	Total
C45	Capacitor, var, air	109-0086	71313	MCD-35 5X(MOD)	1
C46	Capacitor, 30uf, 450v	112-1365-08	56289	45D10268	1
C47	Capacitor, 75pf, 7.5kv	110-0387	71590	850S-75N	1
C48-C50	Capacitor, 50uf, 25v	112-1388	56289	30D506G025CC4	3
CB1	Circuit breaker, 40 amps	280-0071	02295	TQC214OWL	1
CR1	Diode, bridge 1.5 amps	161-0289	04713	MDA942-5	1
CR2	Diode, 1N4002	161-0293	94990	1N4002	2
CR3-CR4	Diode, bridge	161-0348	13327	K802	2
CR5-CR6	Diode, bridge	161-0348-02	13327	K803	2
CR7-CR8	Diode, 1N4005	161-0269	04713	1N4005	2
CR9-CR11	SCR, Type C6B	161-0354	03508	C6B	3
CR12	SCR, Type 40 HF5R	161-0353	81483	HF5R	1
CR13	Same as CR2				
DC-1	Directional coupler	433-0327	71628	44-158-50	1
DS1-DS6	Lamp, neon	244-0095	71744	NE 51H	
F1	Fuse, 1/2 amp, Slo-Blo	261-0064	71400	MDL1/2	1
F2	Fuse, 2 amp, Slo-Blo	261-0073	71400	MDX2	2
F3	Fuse, 1/4 amp, Slo-Blo	261-0001	71400	MDL1/4	1
F4	Same as F2				
FL1	Filter, low-pass	433-4250	23265	433-4250	1
J1	Connector, Molex	286-1378	27264	1375R	1
J2	N/A				
J3-J4	Connector, BNC	287-0034	81349	UG1094A/U	2
K1	Relay, power, DPST	180-0398-02	77342	PR7AY 240AC	1
K2	Relay, 3PDT, 240 vac	180-0391-02	77342	KUP14A15-240	1
K3	Relay, power, 3PST	180-0412-02	52090	EBC430BA	1
K4-K6	Relay, 3PDT, 12 vdc	180-0391-05	77342	KUP14D15-12	3
K7	Relay, time delay	180-0400	93929	115N030	1
L1	Choke, 3hy, 150 ma	317-0022	97965	C2309	1
L2	Choke, 7 uhy	186-0594	44655	Z-50	1
L3	Loop, grid coupling	022-1188	23265	022-1188	1

Desig	Description	Part No.	Mfr.	Mfr Part No.	Total
L4	Choke, 1.8 uhy	186-0595	44655	Z-144	2
L5	Assy, plate line	001-8126	23265	001-8126	1
L6	Same as L4				
L7	Assy, output coupling	001-8176	23265	001-8176	1
L8-L9	Choke, 10hy, 0.95 adc	317-0023	Qual	1712	2
L10-L11	Choke, 8.5hy, 200ma	317-0022-02	97965	C1721	2
L12	Loop, sampling	022-1135	23265	022-1135	1
M1	Meter, 0-1 ma, Multimeter	368-9121	32171	4S-DMA-001	1
M2	Meter, 0-1 ma, % power	368-9169	32171	841-206	1
M3	Meter, 7.5kv	368-9123-02	32171	4S-DMA-001	2
M4	Meter, 0-2 amps	368-9102	32171	4S-DAA-002	1
P1	Plug, Molex	286-1377	27264	1375P-2	1
R1	Resistor, 800 ohms, 8w	131-1382	44655	200-8-1530	1
R2	Resistor, var, 1000, 25w	137-0252-05	44655	0158	1
R3	Resistor, 50 ohms, 10%, 30w	136-1650-02	72819	885SP	1
R4	Resistor, 0.24 ohms	131-1375-02	Schmidt		2
R5	Resistor, 4K, 1/2w	131-0120	44655	1747	1
R6	Resistor, 100, 5%, 3w	131-0618	44655	4392	2
R7	Resistor, 1.2 ohms	131-1375-07	Schmidt		1
R8	Resistor, 250K, 1%, 1/2w	134-3002	91637	DCS1/2	1
R9	Resistor, 2.5M, 1%, 5w	134-2902-02	Caddock	MG-750	1
R10	Resistor, var, 500, 5w	137-0054	71590	WN-302	1
R11	Resistor, 500K, 1%, 1w	134-3001	Caddock	MG-715	1
R12	Same as R4				
R13	Resistor, var, 4.5K, 150w	137-0321	44655	0547	1
R14-R15	Resistor, 15K, 12w	131-0134	44655	1761	2
R16	Resistor, 300 ohms, 20w	131-0160	44655	1812	1
R17	Resistor, 82 ohms, 3w	131-0630	44655	4389	2
R18	Resistor, var, 100, 5w	137-0053	71590	WN-101	1
R19	Resistor, 7.5m, 1%, 5w	134-2902-05	Caddock	MG-750	1
R20	Resistor, 10K, 10%, 2w	136-1572	81349	RC42GF103K	1

Desig	Description	Part No.	Mfr	Mfr Part No.	Total
R21	Resistor, 0.3 ohms, 3w	131-1382	91637	CW-2	1
R22	Resistor, 5 ohms, 5%, 12w	131-0081	44655	1708	1
R23	Resistor, 40K, 160w	131-0360	44655	0721	2
R24	Resistor, 75K, 160w	131-0363	44655	0724	1
R25	Resistor, 50 ohms, 10%, 12w	131-0091	44655	1718	1
R26	Resistor, var, 50 ohms, 50w	137-0245	76289	0449	1
R27	Resistor, 50 ohms, 100w	131-0303	44655	0602	1
R28-R30	Resistor, 33K, 10%, 2w	136-1584	81349	RC42GF333K	3
R31	Resistor, 5 ohms, 12w	131-0081	44655	1708	1
R32	Resistor, var, 3 ohms, 25w	137-0252-07	44655	0142	1
R33	Resistor, 100 ohms, 12w	131-0093	44655	1720	1
R34	N/A				
R35	Resistor, 1.5K, 10%, 2w	136-1552	81349	RC42GF152K	1
R36	Resistor, 5K, 25w	131-0231	44655	0212	1
R37	Same as R23				
R38	Resistor, 600 ohms, 3w	131-0640	44655	4414	1
R39	Resistor, 1K, 5%, 5w	131-0748	44655	4623	1
R40	Same as R6				
R41-R43	Resistor, 560 ohms, 10%, 1/2w	136-1142	81349	RC20GF561K	3
R44-R46	Resistor, 22K, 1/2w	136-1180	81349	RC20GF223K	3
R47-R48	Resistor, 100K, 10%, 1/4w	136-1056	81349	RC07GF104K	2
R49	Resistor, 100K, 1/2w	136-1196	81349	RC20GF104K	1
R50	Resistor, 10K, 1/2w	136-1172	81349	RC20GF103K	1
R51	Same as R18				
R52	Same as R17				
S1	Switch, lever	296-0421-02	82389	13001L	1
S2	Switch, air	305-0001	03522	S1278	1
S3	Switch, rotary	295-0027	71590	PA-1005	1
S4	Switch, lever	296-0421-04	82389	13036	1
S5	Switch, lever	296-0421-08	82389	13033	1
S6-S7	Switch, interlock	296-0311	91929	2AC6	2

Desig	Description	Part No.	Mfr	Mfr Part No.	Total
S8	Switch, rotary	295-0026	71590	PA-1003	1
S9	Switch, lever	296-0421-07	82389	13005	1
S10	Switch, lever	296-0421-06	82389	13004L	1
T1	Transformer, power	326-0388	97965	PCF 2025	1
T2	Transformer, filament, 240 vac	316-0152	Qual	1713	1
T3	Transformer, plate	326-0389	08935	E17642	1
T4	Not used				
T5	Transformer, isolation	326-0505	Qual	1907	1
TB1	Board, 20 terminal	477-0020	71785	20-164	5
TB2	Terminal, block	477-0178	89020	222	3
TB3-TB5	Same as TB1				
TB6	Board, 7 terminal	477-0007	71785	7-164	1
TB7	Board, 5 terminal	477-0005	71785	5-164	2
TB8	Board, 10 terminal	477-0010	71785	10-164	2
TB9	Same as TB7				
TB10	Same as TB8				
TB11	Same as TB1				
V1	Tube, 4X150A	353-0120	06980	4X150A	1
V2	Tube, 5CX1500A	353-0448	06980	5CX1500	1
XCR9- XCR11	Socket, SCR	395-0052	69012-0423		3
XDS1	Lampholder, w/lens, white	247-1415-07	72619	135-5863-1435- 361	1
XDS2	Lampholder, w/lens, amber	247-1415-10	72619	135-5863-1433- 361	1
XDS3	Lampholder, w/lens, red	247-1415-09	72619	135-5863-1431- 361	4
XF1-XF4	Fuseholder, indicator	261-0039	71400	HKL-X	4
XK1	N/A				
XK2	Socket, relay	396-0057	77342	27E043	4
XK3	N/A				
XK4-XK6	Same as XK2				
XK7	Socket, relay	396-1005	02660	77M1P-8T	1

Desig	Description	Part No.	Mfr	Mfr Part No.	Total
XV1	Socket, tube, 4X150A	396-0194	06980	SK620A	1
XV2	Socket, tube, 5CX1500A	022-1192	23265	022-1192	1
Optional Overload Recycle Unit Replaceable Parts List					
C1-C4	Capacitor, elect, 150 uf, 150v	112-1365	56289	45D10262	4
CR1	Diode, Zener, 1N3034B	161-0352	94990	1N3034B	1
CR2	SCR, C6B	161-0354	03508	C6B	1
K1	Relay, 3PDT, 240vac	180-0391-02	77342	KUP14A15-240	1
K2	Relay, SPDT, 24vdc	180-0391	77342	KUP5D15-24	1
R1	Resistor, 22K, 10%, 1/2w	136-1180	81349	RC20GF223K	1
R2	Resistor, 3.9 ohms, 10%, 1/2w	136-1162	81349	RC20GF392K	1
R3	Resistor, 2.7K, 1/2w	136-1158	81349	RC20GF272K	1
R4-R5	Resistor, 470, 10%, 1/2w	136-1140	81349	RC20GF471K	2
XCR1	Socket, SCR	395-0052	73680	69012-0423	1
XK1-XK2	Socket, relay	396-0057	77342	27E043	2



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