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instruction book

820D-2
1-kW AM Transmitter

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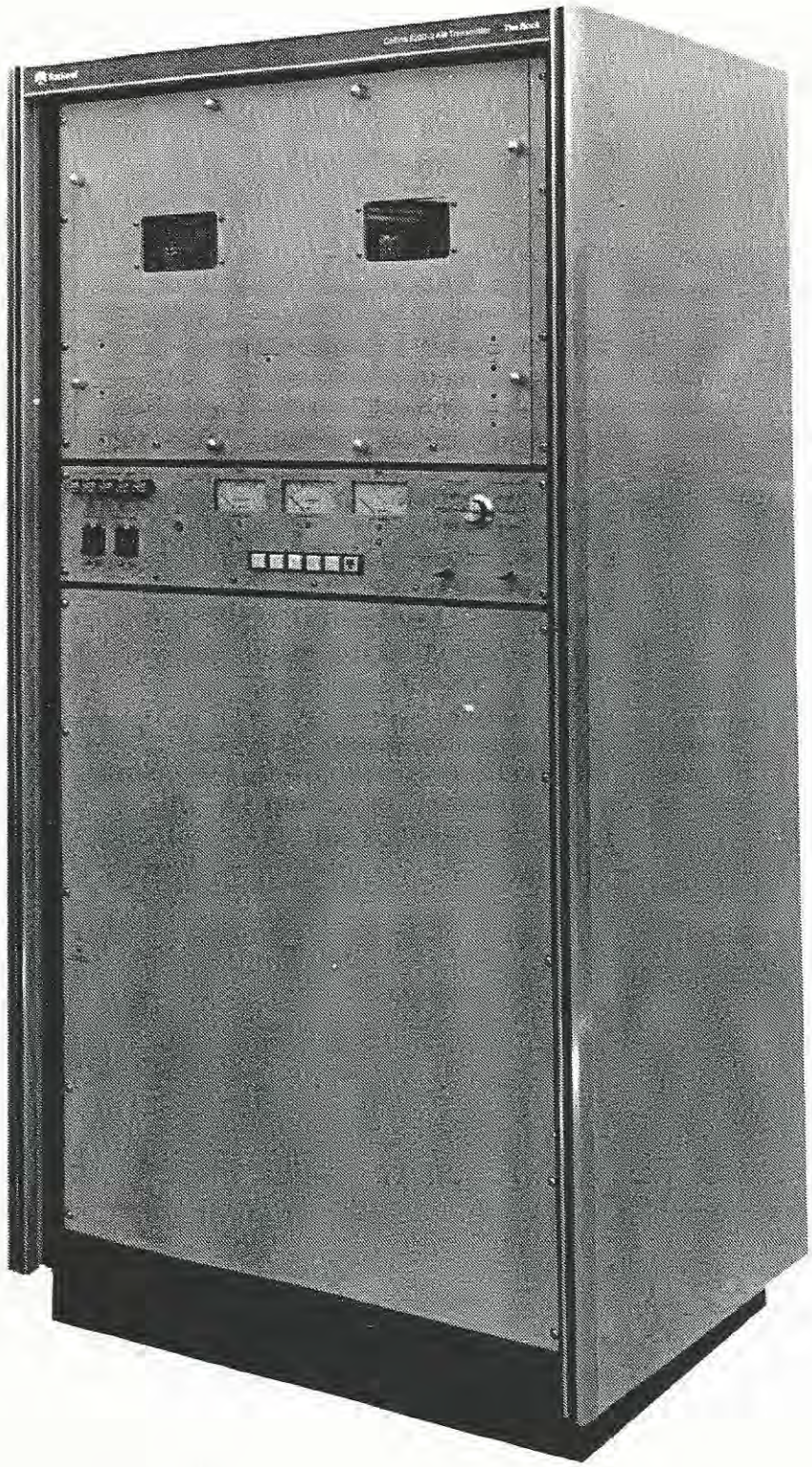


Figure 1-1. 820D-2 1-kW AM Transmitter.

1.1 INTRODUCTION

The 820D-2 1-kW AM Transmitter is an amplitude-modulated standard broadcast transmitter (figure 1-1) that operates in the 540- to 1600-kHz frequency range. The 820D-2 has two output power operating modes - high and low. The nominal power output in each mode is controlled by tap connections on the plate transformer and a fixed attenuator in the audio input circuit. Three nominal power options are available and are listed in table 1-1. Both the high and low power modes are adjustable by 10 percent using the power control on the control panel.

Table 1-1. Nominal Power Output Options.

OPTION	NOMINAL POWER OUTPUT	
	LOW POWER MODE	HIGH POWER MODE
1	250 watts	500 watts
2	250 watts	1000 watts
3	500 watts	1000 watts

1.2 PHYSICAL DESCRIPTION

The 820D-2 transmitter is completely self-contained in a steel-framed, sheet metal cabinet. The cabinet is structured for front and rear access with all access panels interlocked to remove high voltages upon opening. Compartments where sceen and plate voltages are exposed are equipped with high-voltage grounding switches that short-circuit the appropriate power supplies as panels are removed. An optional front door is available to enhance transmitter appearance. The front door is not interlocked.

The 820D-2 transmitter is divided into four major assemblies - RF Compartment A1, Power Supply Assembly A2, Control Circuits Assembly A3, and Control Panel A4. Each assembly is accessible by removing one or more of the access panels. The windowed upper front panel provides access to the rf and modulator compartment tubes and circuit cards. The lower front panel and rear cabinet panel provide access to the power supply assembly, power transformers, and control circuits assembly. An additional cover at the upper rear portion of the cabinet provides access to the rf output network.

One blower, mounted beneath the rf compartment, cools the RF and modulator tubes. A flushing fan draws air through the air filter mounted on the rear cabinet panel and blows the air through the rf compartment. All air outlets are located in the cabinet top cover.

1.3 TECHNICAL DESCRIPTION

Except for the high-voltage power supply transformers, filters, and large control components mounted on the 820D-2 transmitter cabinet floor (A5), all functional circuits are contained on the four major assemblies described in paragraph 1.2. The various components and assemblies are interconnected as shown in the block diagram, figure 5-1, and the overall schematic, figure 5-8. Functional descriptions of the individual circuits are provided in the following paragraphs.

1.3.1 RF Compartment A1

1.3.1.1 Audio Driver

The 820D-2 transmitter receives a +10 dBm ±2 dB, 150/600-ohm audio input signal at audio driver A1A1. The solid-state audio driver uses two stages of class A, push-pull amplification to drive the modulator tubes without an interstage transformer. The first stage uses 2N3053 transistors. The second stage, the audio driver output amplifier, uses 2N3585 transistors with outputs directly into the modulator grids. This final driver stage is supplied 290 volts dc to ensure ample collector swing capability. Feedback voltage (10 dB at 1 kHz) is derived from the modulator plates via resistor-capacitor ladder networks and is applied to the audio driver input to reduce distortion.

1.3.1.2 Modulator

The modulator for the 820D-2 consists of a circuit using two, push-pull, 5-500A pentode tubes that operate class AB_1. The circuit is a conventional modulation transformer/reactor circuit with the tubes operating at a nominal plate voltage of 3100 volts (for 1.1-kW power output). Individual controls are provided for adjustment of the modulator fixed bias, and for dynamic adjustment of the grid drive and filament voltage.

1.3.1.3 RF Exciter

A dual oscillator card, A1A3, with two independent crystal oscillator circuits is the rf excitation source for the 820D-2 transmitter. A selector switch determines which oscillator is used to excite the transmitter. The dual oscillator circuit provides backup support to reduce transmitter downtime in case of an oscillator failure.

For stability, both oscillators operate at four times the carrier frequency from 540 kHz to 1020 kHz or at two times the carrier frequency from 1080 kHz to 1600 kHz. The oscillator output is divided, amplified, and shaped in A1A3. The final output is transformer coupled to the rf driver. A potentiometer controls the duty cycle of the signal applied to the rf driver and determines the drive level to the power amplifier.

1.3.1.4 RF Driver

A single 2N5039 transistor on card A1A2 is the rf driver. This transistor operates class C and supplies drive to the power amplifier grids through a transformer with a tuned secondary.

1.3.1.5 Power Amplifier

The power amplifier (pa) consists of two parallel 5-500A tubes connected as tetrodes and operated class C with conventional plate modulation. The screen is self-modulated using dropping resistors in the screen voltage supply lead. Power output is controlled by the

voltage supplied to the pa plate. For a maximum carrier power level of 1.1 kilowatts at the antenna terminal, a nominal voltage of 3100 volts is supplied to the pa plate. Proportionate voltage levels are supplied for reduced maximum power outputs of 275 watts and 550 watts. Nominal plate impedance is 3250 ohms regardless of the power level.

The pa tubes operate with the cathodes grounded and the screens near rf ground potential. The -155-volt bias supply provides protective voltage during drive loss and combines with the grid operating bias of the tubes to supply the -200-volt grid voltage.

1.3.1.6 Output Network

The 820D-2 transmitter output network is a 3-node bandpass filter. All components, except for the pa tuning capacitor, are fixed tuned. The pa tuning capacitor, a vacuum variable capacitor adjusted from the control panel, varies the plate tuning. Filter nodes one and two are bottom coupled by an inductor. Nodes two and three are top coupled by an inductor that serves as a fixed loading adjustment. All nodes are tuned to the operating frequency with the coupling circuits providing 90° phase delay between nodes.

1.3.2 Power Supply Assembly A2

The power supply assembly contains most small circuit components for each of the 820D-2 transmitter power supplies. Large power supply components, including the power transformer, are mounted on the cabinet floor. All power transformers are provided with primary taps for transmitter operation at nominal input voltages of 208 to 240 volts ac.

1.3.2.1 28-Volt DC Power Supply

The 28-volt dc power supply supplies +28 volts to the control circuits, pilot lamps, oscillator, rf driver, and the first audio driver stages. Primary power from the low-voltage circuit breaker and fuse A4F1 is stepped down by a transformer, rectified by silicon rectifiers, and regulated by conventional series regulators.

1.3.2.2 PA and Modulator Filament Voltage Supplies

Separate transformers receive primary power from the low-voltage circuit breaker, reduce the voltage, and supply the pa and modulator tubes with filament voltage. The filament voltage is adjusted by transformer taps and series rheostats. An optional constant voltage transformer may be added at A3TB5 to improve tube life.

1.3.2.3 Bias Supply

The bias supply provides -155-volt bias for the pa and modulator control grids. A stepdown transformer receives primary power via the low-voltage circuit breaker and fuse A4F2, and supplies the bias voltages to full-wave silicon rectifiers and a conventional filter.

1.3.2.4 Screen Power Supply

The screen power supply receives primary power from the high-voltage circuit breaker and fuse A4F3, and employs a step-up transformer, silicon rectifier, and LC filter. Zener diodes connected across the screen supply provide the +290 volts required by the audio driver.

1.3.2.5 Plate Power Supply

The plate power supply uses a step-up transformer and a full-wave silicon rectifier with an L-section filter to provide the 3100 volts required (for 1.1-kW power output) at the pa plate. Since power output in the 820D-2 transmitter is controlled by varying the plate voltage, transformer taps are provided to reduce maximum power output to 550 or 275 watts. In addition, a 10-percent variation of power output is provided by a motor-driven rheostat in the power amplifier plate supply circuit. This rheostat is controlled by the RAISE/LOWER POWER CONTROL switch on the control panel or by the optional Automatic Power Control Assembly.

1.3.3 Control Circuit Assembly A3

The control circuit assembly contains a printed circuit board and relays used for 820D-2 transmitter control. Other circuits on the A3 assembly allow overload shutdown and pushbutton control of the filament and plate voltage. Overloads in the pa or modulator tubes are monitored by relays in the cathode circuit return. These relays remove transmitter control voltage in the A3 assembly. Automatic recycling of temporary overloads is provided to shorten transmitter downtime. The main control sequences for filament and plate voltages are pushbutton controlled from the control panel or a remote control system.

1.3.4 Control Panel A4

The control panel, mounted in the front center of the transmitter, contains all meters, operating controls, and status indicators. See section 3 of this instruction book for a description of operating controls.

1.4 820D-2 TRANSMITTER OPTIONS

1.4.1 Remote Control

The 820D-2 transmitter is suitable for installation at an unattended site and for operation from a remote control system in a studio. Optional remote control relays provide the following switching functions:

Filament ON/OFF

High Power ON/Plate OFF

Low Power ON/Plate OFF

Power Adjust Raise/Lower

Remote Control Failsafe

Manual/Automatic Power Control

The optional 8-relay assembly required is mounted on control circuits assembly A3. Each relay will operate with control voltages of 115 volts ac, 115 volts dc, 28 volts dc, or 48 volts dc.

Each transmitter contains built-in meter shunts for remote samples of plate voltage and current. Also, the modulation monitor sampling coil has two adjustable taps that are switched to a common output lead for equal-level sampling during reduced power operation.

1.4.2 Automatic Power Control

An optional automatic power control (APC) assembly provides unattended control of the power output. The APC assembly consists of a servo amplifier and a power output sensing unit. The sensing unit rectifies and filters a sample of rf output current and supplies the sample as a dc voltage to the servo amplifier. The servo amplifier determines the difference between the sample dc voltage and a reference voltage. This difference voltage becomes the servo input error signal. The error signal activates relays in the APC assembly that control the power adjust rheostat motor. (See paragraph 1.3.2.5.) The relays raise or lower power output until the error signal reduces to 0 ±10 millivolts dc.

Two potentiometer adjustments control the level of the reference input voltage. One potentiometer controls the reference voltage in the low power mode; the other controls the reference voltage in the high power mode. These potentiometers allow exact adjustment of the output power. Switching between the two potentiometers occurs automatically with mode change in the transmitter. The APC power is turned off when plate voltage is off to prevent the motor from running to a limit in the absence of an output sample. Automatic or manual power control is selected by a power control switch on control panel A4 or by a remote automatic power adjust control function.

1.5 TECHNICAL SPECIFICATIONS

Maximum Output Power Capability:	1100 watts
Output Impedance:	50 ohms, unbalanced
Frequency Range:	540 to 1600 kHz
Frequency Stability:	±5 Hz, 0° to +35°C (+32 to +95°F) ±10 Hz, -10° to +45°C (+14° to +113°F) ±20 Hz, -25° to +45°C (-13° to +113°F)
Audio Input Impedance:	150/600 ohms, balanced
Audio Input Level:	+10 dBm, ±2 dB
Audio Frequency Response:	±1 dB, 50 to 10,000 Hz
Audio Harmonic Distortion:	Less than 2%, 50 to 10,000 Hz (Typically 1% or less)
Carrier Shift	Less than 3%, 0% to 100% modulation, 400 Hz reference
Noise, Unweighted:	60 dB below 100% modulation at 1 kHz
Modulation Type:	High level plate
Ambient Temperature Range:	-25 to +45 C (-13 to +113 F)
Ambient Humidity Range:	95% maximum
Altitude:	7,500 ft (2,286 m) maximum

Power Source:	208/ 230/240 volts, single phase, 50/60 Hz
Permissible Combined Voltage Variation and Regulation :	5%
Power Requirement at 1100 Watts, 0% Modulation:	3500 watts maximum, 0.9 power factor
30% Modulation:	3600 watts maximum, 0.9 power factor
100% Modulation:	4400 watts maximum, 0.9 power factor

2.1 UNPACKING AND INSPECTING

2.1.1 Domestic Shipments

The uncrated transmitter is shipped on a shipping skid via a commercial air-ride van. Unpack the transmitter as follows:

CAUTION

Use care in moving the transmitter. Use appropriate lifting and moving equipment with at least 1250-lb (567-kg) capacity. Some components may be damaged if the transmitter is dropped or severely jarred.

a. Remove the transmitter from the van to a position near its installation site.

b. Lift the transmitter from the shipping skid.

c. Remove the two screws from the bottom of the rear access panel. Lift the panel from the transmitter.

d. Inspect the transmitter for loose hardware. Ensure that all controls operate freely. Examine the cabinet for dents and scratches.

e. Remove the four modulator and power amplifier tubes and chimneys from their separate containers. Inspect for damage.

f. File any damage claims properly with the transportation company. Retain all packing material if a claim is filed.

2.1.2 Foreign Shipments

The transmitter is shipped in a skid-type crate via a commercial transportation company. Unpack the transmitter as follows:

CAUTION

Use care in unpacking and moving the transmitter. Use appropriate lifting and moving equipment with at least 1250-lb (567-kg) capacity. Some components may be damaged if the transmitter is dropped or severely jarred.

a. Position the crated transmitter near its installation site.

b. Refer to the instructions stenciled on the side of the shipping crate and carefully uncrate the transmitter.

c. Remove the two screws from the bottom of the rear access panel. Lift the panel from the transmitter.

d. Inspect the transmitter for loose hardware. Ensure that all controls operate freely. Examine the cabinet for dents and scratches.

e. Remove the four modulator and power amplifier tubes and chimneys from their separate containers. Inspect for damage.

f. File any damage claims properly with the transportation company. Retain all packing material if a claim is filed.

2.2 LOCATION AND SPACING REQUIREMENTS

The 820D-2 transmitter may be installed in either an attended or, with remote control options installed, unattended location. Refer to figure 2-1 for transmitter dimensions and cable entry information. Observe the following siting practices to ensure optimum transmitter operation.

a. Allow at least 3.5 feet (1.1 m) of clearance at front and rear for servicing access.

b. Ascertain that environmental conditions are within the temperature, humidity, and altitude limits listed in paragraph 1.5.

c. Make certain that the transmitter site is clean and that the air is not excessively dusty or dirty.

NOTE

The air flow is approximately 500 CFM. If ducted to the outside, an equivalent volume of cool clean air must be provided to the transmitter to prevent air starvation and overheating.

The heat load to the room (if it is not ducted) is approximately 7200 BTU/HOUR for a transmitter output of 1100 watts, modulated at a 30% average level.

WARNING

HIGH VOLTAGE is used in this equipment.

DEATH ON CONTACT may result if you fail to observe safety precautions.

When working inside the equipment, be sure that all circuit breakers are OFF and that primary power is disabled at the wall disconnect or circuit breaker unless otherwise directed. If a procedure requires transmitter operation with access panels removed, do not allow bodily contact with any electrical component, tap, or terminal. Use heavily insulated tools to adjust variable components.

2.3 PRIMARY POWER

2.3.1 General

The 820D-2 transmitter requires a 208-, 230-, or 240-volt ±5-percent, single-phase, 50- or 60-Hz ac power source that delivers a minimum of 4500 watts of power at a 0.9 power

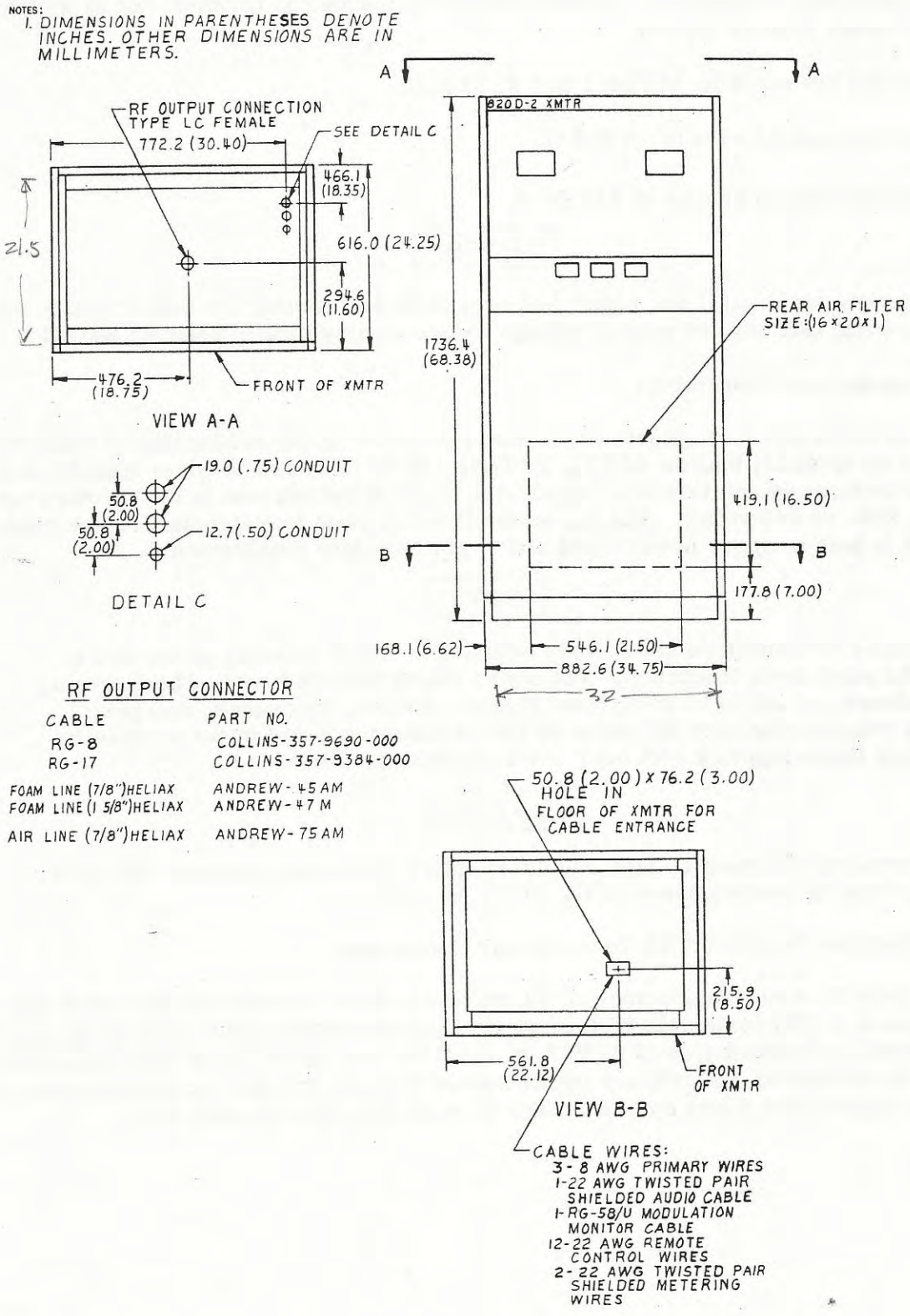


Figure 2-1. 820D-2 1-kW AM Transmitter Outline and Installation Diagram.

factor. Make provisions for a fused main power disconnect switch or circuit breaker capable of handling 50 amperes. Connect the primary power to terminal board A3TB6 with no. 8 AWG gauge wire as follows:

a. Connect the hot wires to A3TB6-1 and A3TB6-2.

b. Connect the neutral wire to A3TB6-3.

c. Connect the station ground to A3TB6-4.

CAUTION

Voltage between neutral and either hot wire must be between 110 and 125 volts ac. Measure and confirm the proper voltage before closing circuit breaker A4CB1.

2.3.2 Transformer Connections

The range of allowable voltage sources is made possible by the availability of different tap connections on terminal boards A1TB1, A1TB2, and A2TB1, and on plate transformer T1. The tap connections on the terminal boards are made to correspond to the primary power input (208, 230, or 240 volts). The tap connections on plate transformer T1 are made to correspond to both primary power input and rf power output requirements.

NOTE

All 830D-2 transmitters are factory adjusted at 240 V primary power and to specific customers frequency, and power output requirements. The following procedures are not to be performed if power source, frequency, and power output requirements are the same as the parameters listed in the production test data sheet supplied with each new transmitter.

CAUTION

If the constant filament voltage regulator option is factory installed, DO NOT change taps on transformers A1T1, A1T2, or A2T2.

2.3.2.1 Terminal Board A1TB1 Transformer Connections

Modulator tube filament transformer A1T2 tap connections are wired to the front side of terminal board A1TB1 terminals 33 through 36. Tap adjustments are made by moving the wires attached to the back side of A1TB1 terminal 34, 35, or 36. (The wire connected to A1TB1-33 is not moved.) If primary power source changes require tap adjustments, disconnect the tap adjustment wires and reconnect them as described in table 2-1.

Table 2-1. Terminal Boards A1TB1 and A2TB1 Transformer Connections.

TRANSFORMER	TERMINAL BOARD CONNECTIONS			
	COMMON	208	230	240
A1T1	NA	A1TB2-1	A1TB2-2	A1TB2-3
A1T2	A1TB1-33	A1TB1-34	A1TB1-35	A1TB1-36
A2T1	A2TB1-1	A2TB1-2	A2TB1-3	A2TB1-3
A2T2	A2TB1-6	A2TB1-5	A2TB1-4	A2TB1-4
A2T3	A2TB1-9	A2TB1-8	A2TB1-7	A2TB1-7

2.3.2.2 Terminal Board A1TB2 Transformer Connections

Power amplifier tube filament transformer A1T1 tap connections are wired to the front side of terminal board A1TB2 terminals 1, 2, and 3. Tap adjustments are made by moving the wire attached to the back side of A1TB2-1, 2, or 3. If primary power source changes require tap adjustments, disconnect the tap adjustment wire and reconnect it as described in table 2-1.

2.3.2.3 Terminal Board A2TB1 Transformer Connections

Screen power supply transformer A2T1 tap connections are wired to the top side of terminal board A2TB1 terminals 1, 2, and 3. Tap adjustments are made by moving the wire attached to the bottom side of A2TB1 terminal 2 or 3. (The wire connected to A2TB1-1 is not moved.) If primary power source changes require tap adjustments, disconnect the tap adjustment wire and reconnect it as described in table 2-1.

Bias supply transformer A2T2 tap connections are wired to the top side of terminal board A2TB1 terminals 4, 5, and 6. Tap adjustments are made by moving the wire attached to the bottom side of A2TB1 terminal 4 or 5. (The wire attached to A2TB1-6 is not moved.) If primary power source changes require tap adjustments, disconnect the tap adjustment wire and reconnect it as described in table 2-1.

The 28-volt power supply transformer, A2T3, tap connections are wired to the top side of terminal board A2TB1 terminals 7, 8, and 9. Tap adjustments are made by moving the wire attached to the bottom side of A2TB1 terminal 7 or 8. (The wire connected to A2TB1-9 is not moved.) If primary power source changes require tap adjustments, disconnect the tap adjustment wire and reconnect it as described in table 2-1.

2.3.2.4 Plate Transformer T1 Tap Connections

There are three tap connections on plate supply transformer T1. One connection is a common connection to terminal 1, 2, or 3. Another connection is a low power connection to terminal 5, 6, 7, 8, 9, or 10. The last connection is a high power connection to terminal 4, 5, 6, or 7. These tap connections are made to correspond to the primary source voltage and the desired nominal output option. (See paragraph 1.1.) If primary power source changes or output changes are required, adjust the T1 tap connections as follows:

a. Disconnect the three wires attached to the T1 terminals.

b. Use an ohmmeter to determine which of the three wires is connected to terminal board A3TB3 terminal 9. Label this wire HIGH POWER.

c. Use an ohmmeter to determine which of the two remaining wires is connected to terminal board A3TB3 terminal 10. Label this wire COMMON.

d. Label the last wire LOW POWER.

e. Refer to table 2-2 and reconnect the wires to the appropriate terminals.

2.4 AF INPUT AND RF OUTPUT CONNECTIONS

2.4.1 AF Input Terminal Board Connections

The 820D-2 transmitter accepts audio input at a level of +10 dBm ±2 dB from a source requiring a 150- or 600-ohm input impedance. Use no. 22 AWG gauge, shielded, twisted-pair wire (Belden 8451, or equivalent) to connect the audio input source to terminal board TB1. The audio "high" wire connects to terminal 1; the "common" wire connects to terminal 2; and, the shield connects to terminal 3.

Table 2-2. Transformer T1 Connections.

SOURCE VOLTAGE	LOW POWER OUTPUT	HIGH POWER OUTPUT	COMMON WIRE	LOW POWER WIRE	HIGH POWER WIRE
208	250 watts	500 watts	3	8	5
	250	1000	3	8	4
	500	1000	3	5	4
230	250	500	2	9	6
	250	1000	2	9	4
	500	1000	2	6	4
240	250	500	1	10	7
	250	1000	1	10	4
	500	1000	1	7	4

2.4.2 AF Input Strapping Connections

NOTE

All 820D-2 transmitters are factory adjusted at 240V primary power and to specific customer's frequency, and power output requirements. The following procedures are not to be performed if power source, frequency, and power output requirements are the same as the parameters listed in the production test data sheet supplied with each new transmitter.

a. Remove the upper front access panel.

b. Refer to the parts list in section 6 and locate resistors R6, R7, and R8 on audio driver card A1A1.

c. Check the values of the resistors and compare them with the values listed in table 2-3.

d. If the resistor values are different from the tabulated values, replace the resistors with 1/4-watt, 5-percent resistors with values equal to the tabulated values.

e. If the audio input source requires a 600-ohm impedance, strap A1A1-E2 to A1A1-E3.

2.4.3 RF Output Connection

Output connector A1J1 for the 820D-2 transmitter is a 50-ohm, type LC, female connector. Use standard 50-ohm coax to connect A1J1 to a balanced, 50-ohm antenna or dummy load capable of dissipating at least 1.5 kilowatts.

Table 2-3 Audio Attenuator Values.

LOW POWER OUTPUT	A1A1R6	A1A1R7	A1A1R8
500 watts	100 ohms	100 ohms	1800 ohms
250 watts	160 ohms	160 ohms	680 ohms

CAUTION

Do not operate the transmitter unless output connector A1J1 is properly connected.

2.5 MODULATOR AND POWER AMPLIFIER TUBE INSTALLATION

a. Remove the upper front access panel.

b. Insert the four 5-500A modulator and power amplifier tubes (V1 through V4) into sockets A1V1 through A1V4.

c. Install the four tube chimneys.

d. Connect the four tube caps to the four tubes.

e. Replace the upper front access panel.

2.6 OPTION INSTALLATION

2.6.1 Remote Control and Remote Monitoring

NOTE

If the remote control option was factory installed, skip to paragraph 2.6.1.2.

2.6.1.1 Remote Control Assembly A7 Installation

a. Remove the 820D-2 lower front access panel and the rear access cover.

b. Remove the straps between the following A3TB2 terminals: 1 and 2, 5 and 6, 7 and 8, 9 and 10, 21 and 22.

c. Refer to figure 5-6 and table 2-4. Strap the Remote Control Assembly, CPN 627-9721-001, for the control voltage provided by the customer-supplied remote control system.

d. Mount remote control assembly A7 to control circuits assembly A2.

e. Refer to figures 5-6 and 5-8. Connect the wires from the remote control assembly relays to the appropriate terminals on A3TB2.

Table 2-4. Optional Remote Control Assembly Control Voltage Strapping Connections.

SOURCE CONTROL VOLTAGE	STRAPPING CONNECTION	
	FROM	TO
24 Vdc, positive common	E1	E3
24 Vdc, negative common	E1	E4
48 Vdc, positive common	E1	E2
48 Vdc, negative common	E2	E4
115 Vac	E3	E4

2.6.1.2 Remote Control and Monitoring External Connections

Refer to figure 5-7 and make the remote control and monitoring external connections as follows:

a. Remove the lower front access panel and the rear access cover (if installed).

b. Connect the customer-supplied remote control panel to the remote control assembly terminal board (A7TB1).

c. Connect the customer-supplied remote plate voltage monitor to A1TB1-4 and 5.

d. Connect the customer-supplied remote plate current monitor to A1TB1-6 and 5.

e. Connect the customer-supplied modulation monitor to MOD MON connector A1J2.

f. Connect the customer-supplied frequency monitor to FREQ MON connector A1J3.

g. Replace all access panels.

2.6.2 Automatic Power Control A6

NOTE

If the APC option was factory installed, do not perform this procedure.

a. Remove the lower front access panel, the rear cabinet panel, and the output network access panel.

b. Remove the wire connected between A1L7 and rf output connector A1J1.

c. Mount APC sensor A6A2 to the rf output network chassis directly behind A1L5. (Refer to the silk-screened diagram on the output network access panel.)

d. Mount transformer A6T1 to control circuits assembly A3 just below the front end of A3TB2. (Refer to the silk-screened diagram on the lower front access panel.)

e. Mount APC servo board A6A1 to control circuits assembly A3 just behind A3TB2. (Refer to the silk-screened diagram on the lower front access panel.)

f. Refer to table 2-5 and connect the APC assembly as instructed.

g. Replace all access panels.

2.6.3 Filament Voltage Regulator Transformer Assembly A8

NOTE

If the constant filament voltage option was factory installed, do not perform this procedure.

a. Remove the lower front access panel and the rear cabinet cover.

b. Mount transformer T3 to transmitter floor with the hardware supplied.

c. Remove the jumpers between A3TB5-1 and 3, and A3TB5-2 and 4.

d. Connect the transformer terminals as described in table 2-6 using the 16 gauge wire supplied with the assembly.

e. Set tap connections on A1TB1 and A1TB2 for A1T1 and A1T2 at the 230-volt terminal. (See table 2-1.)

f. Replace all access panels.

2.7 INITIAL TURN-ON PROCEDURE

a. Ensure that all required installation procedures in paragraphs 2-1 through 2-6 are complete.

b. Ensure that all access panels are secured in place.

c. Apply primary power to transmitter.

d. Turn on the LOW VOLTAGE and HIGH VOLTAGE circuit breakers.

e. Press the FIL ON (filament on) pushbutton.

f. Set the AUTO/MANUAL POWER CONTROL to MANUAL.

g. Press the LP ON (low power on) pushbutton.

h. Adjust PA TUNE control (on control panel A4) for a minimum indication of PLATE CURRENT.

i. Readjust the PA TUNE control until PLATE CURRENT exceeds minimum current of step h. by 20 mA.

NOTE

Allow a 5-minute warmup period.

Table 2-5. Optional APC Assembly Connections.

WIRE COLOR	TO	FROM
Black	A2TB2-1	A6T1-1
Brown	A2TB2-2	A6T1-4
Red	A6T1-2	A6T1-3
Orange	A6T1-6	A6A1-12
Yellow	A6T1-5	A6A1-11
Shielded, Twisted Pair		
Red	A2TB2-16	A6A1-15
Black	A2TB2-15	A6A1-17
Shield	A2TB2-17	A6A1-16
Green	A2TB2-10	A6A1-13
Blue	A2TB2-11	A6A1-14
Violet	A2TB2-12	A6A1-1
Gray	A2TB2-17	A2TB2-12
White	A2TB2-13	A6A1-2
White/Black	A2TB2-14	A6A1-3
White/Brown	A2TB2-4	A6A1-6

Table 2-5. Optional APC Assembly Connections (cont).

WIRE COLOR	TO	FROM
White/Red	A2TB2-5	A6A1-4
White/Orange	A2TB2-6	A6A1-5
White/Green	A2TB2-7	A6A1-7
White/Blue	A2TB2-3	A6A1-10
White/Black/Red	A2TB2-8	A6A1-9
White/Black/Orange	A2TB2-9	A6A1-8
Shielded, Twisted Pair		
Red	A6A2-3	A1C20
Black	A6A2-4	A1C21
Shield	Ground	
1/2-in. Copper Strap	A1L7	A6A2-1
1/2-in. Copper Strap	A1J1	A6A2-2

Table 2-6. Optional Filament Voltage Regulator Connections.

WIRE COLOR	TO	FROM
Black	T3-H2	T3-H4
Brown	T3-H1	T3-H3
Red	A3TB5-1	T3-H1
Orange	A3TB5-2	T3-H4
Yellow	A3TB5-3	T3-X3
Green	A3TB5-4	T3-X1

j. Adjust the RAISE/LOWER POWER CONTROL until the desired low power output (250 or 500 watts) is indicated on the customer-supplied antenna or common point rf ammeter.

k. Compare the control panel meter readings with the values listed in table 3-2.

l. Press the HP ON (high power on) pushbutton.

m. Adjust the RAISE/LOWER POWER CONTROL until the desired high power output (500 or 1000 watts) is indicated on the customer-supplied antenna rf ammeter or wattmeter.

n. Compare the control panel meter readings with the values listed in table 3-2.

o. If the optional automatic power control option is installed, switch the AUTO/MANUAL POWER CONTROL switch to AUTO.

p. The 820D-2 is ready for normal operation.

3.1 CONTROLS AND INDICATORS

All controls and indicators required for normal transmitter operation are contained on control panel assembly A4. Refer to figure 3-1 and table 3-1 for locations and descriptions.

3.2 NORMAL TURN-ON PROCEDURE

Initial (first-time) turn-on for the transmitter is accomplished by performing the procedures in paragraph 2.7. All subsequent transmitter turn-ons are accomplished by the following procedure:

a. Press FIL ON pushbutton. FIL ON indicator will light.

b. Press LP ON or HP ON pushbutton to allow low power or high power transmission. Appropriate indicator will light.

c. If manual power control is used, adjust POWER CONTROL RAISE/LOWER switch until the desired rf output is displayed on the customer-supplied rf ammeter or rf wattmeter. No power adjustment is necessary if the APC is installed and the POWER CONTROL AUTO/MANUAL switch is set to AUTO.

d. Compare control panel meter readings with those listed in table 3-2.

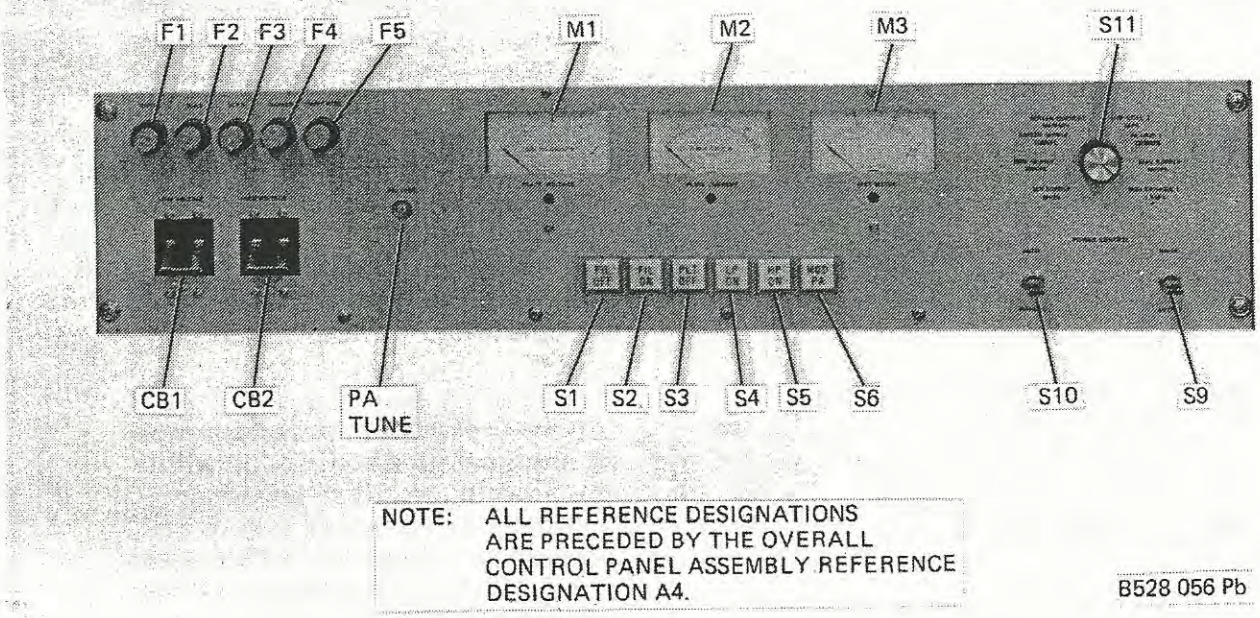


Figure 3-1. 820D-2 1-kW AM Transmitter Controls and Indicators.

Table 3-1. 820D-2 1-kW AM Transmitter Controls and Indicators.

REF DES	CONTROL OR INDICATOR NAME	FUNCTION
A2F1	28 VDC FUSE	3.0-ampere slow-blow fuse mounted internally, protects 28-volt power supply.
A4F1	CNTRL	0.5-ampere control fuse protects 28-volt power supply
F2	BIAS	0.5-ampere fuse protects bias power supply
F3	SCRN	1.0-ampere fuse protects screen power supply
F4	BLOWER	2.0-ampere fuse protects blower motors
F5	PWR CNTRL	1.0-ampere fuse protects power adjust rheostat motor
M1	PLATE VOLTAGE	Dc voltmeter displays amount of voltage across the pa plate
M2	PLATE CURRENT	Dc ammeter displays amount of current applied to pa plate
M3	TEST METER	Dc meter monitors one of eight internal voltage or current levels as selected by the test meter select switch
CB1	LOW VOLTAGE	6.0-ampere circuit breaker controls power applied to low voltage power supplies
CB2	HIGH VOLTAGE	30.0-ampere circuit breaker controls power applied to high voltage power supplies
S1	FIL OFF	Filament off indicator switch turns off the low voltage power supplies and shuts down the transmitter
S2	FIL ON	Filament on indicator switch turns on the low voltage power supplies and activates transmitter

Table 3-1. 820D-2 1-kW AM Transmitter Controls and Indicators (Cont).

REF DES	CONTROL OR INDICATOR NAME	FUNCTION
A4S3	PLT OFF	Plate off indicator switch turns off the high voltage power supplies and plate voltage
S4	LP ON	Low power on indicator switch activates the high voltage power supplies and places transmitter in low power output mode
S5	HP ON	High power on indicator switch activates the high voltage power supplies and places transmitter in high power output mode
S6	MOD PA	Modulator/power amplifier fault indicator/reset switch alerts operator that a fault has occurred and resets overload indicator circuits
S9	POWER CONTROL RAISE/LOWER	3-position spring-loaded toggle switch controls power adjust rheostat when AUTO/MANUAL switch is set to MANUAL
S10	POWER CONTROL AUTO/MANUAL	3-position spring-loaded toggle switch selects manual or optional automatic power control
S11	Test meter select switch	Selects one of eight voltages or currents to be displayed on TEST METER M3. Value listed under each switch position is the full-scale test meter value for that position.
NA	PA TUNE	Screwdriver control adjusts pa tuning capacitor A1C11.

Table 3-2. Normal Control Panel Meter Readings at Maximum Power Outputs.

METER	POWER OUTPUT		
	275 WATTS	550 WATTS	1100 WATTS
PLATE VOLTAGE	1550 V	2200 V	3000 V
PLATE CURRENT	235 mA	338 mA	490 mA
TEST METER			
28 V SUPPLY	28 ±2 V	28 ±2 V	28 ±2 V
290 V SUPPLY	290	290	290
SCREEN SUPPLY	750 V	750 V	750 V
SCREEN CURRENT	200 mA	175 mA	150 mA
DVR COLL I	1.0 to 1.5A, maximum	1.0 to 1.5A, maximum	1.0 to 1.5A, maximum
PA GRID I	50 to 75 mA	50 to 75 mA	50 to 75 mA
BIAS SUPPLY	-155 V	-155 V	-155 V
MOD CATHODE I	130 to 240 mA	150 to 340 mA	300 to 500 mA

Note: Except where specific tolerances are given, the above are approximations. The individual transmitters will vary with source voltage and installation.

3.3 EMERGENCY SHUTDOWN

Turn off LOW VOLTAGE and HIGH VOLTAGE circuit breakers or turn off primary power at source.

3.4 NORMAL SHUTDOWN

Make normal transmitter shutdowns as follows:

a. Press PLT OFF switch.

b. Press FIL OFF switch.

3.5 OVERLOAD RESETTING

The MOD PA overload indicator/reset switch on the control panel indicates a fault in either the modulator or pa circuits. The 820D-2 transmitter contains a recycle circuit that re-applies plate voltage for a maximum of three restarts in 10 seconds. The MOD PA indicator

will light to alert the transmitter operator that a fault has occurred and that the recycle circuits have restarted the transmitter. Pressing the MOD PA switch resets the indicator and turns the lamp off. If the transmitter recycle circuits do not restart the transmitter (more than three restarts in 10 seconds are required), the transmitter may be restarted by pressing the LP ON or HP ON pushbutton. Repeated complete transmitter shutdown indicates a transmitter malfunction.

3.6 FREQUENCY CHANGE

All 820D-2 transmitters are factory adjusted for the specific customer's frequency requirements. Frequency change requires test equipment not normally available to broadcast station technicians or engineers. Certain preliminary adjustment graphs and tables are provided in section 4 for reference. Do not make any frequency adjustments without consulting your Collins Broadcast Sales Engineer or:

Collins Commercial Telecommunications Division
Rockwell International
Broadcast Field Service Dept.
Dallas, Texas 75207
Phone: (214) 690-5055

3.7 POWER OUTPUT MODE CHANGE

The 820D-2 transmitter output power mode is switched by pressing the appropriate LP ON or HP ON switch. If MANUAL power control is used, adjust the POWER CONTROL RAISE/LOWER switch until the desired rf output is displayed on the customer-supplied rf ammeter or rf wattmeter. No POWER CONTROL adjustment is necessary if the optional automatic power control is installed and the POWER CONTROL AUTO/MANUAL switch is set to AUTO.

4.1 GENERAL

The 820D-2 has been carefully designed, inspected, and adjusted at the factory to reduce maintenance to a minimum. However, to ensure peak performance, adhere to a regular schedule of inspection and cleaning procedures. Refer to the parts list, section 6, for the location of components in the 820D-2.

WARNING

HIGH VOLTAGE is used in this equipment.

DEATH ON CONTACT may result if you fail to observe safety precautions.

When working inside the equipment, be sure that all circuit breakers are OFF and that primary power is disabled at the wall disconnect or circuit breaker unless otherwise directed. If a procedure requires transmitter operation with access panels removed, do not allow bodily contact with any electrical component, tap, or terminal. Use heavily insulated tools to adjust variable components.

CAUTION

Make certain all meters and test equipment are switched to appropriate measuring scales before connecting them to the transmitter. Connect test equipment only to the terminals designated in the procedure.

4.2 INSPECTION

Perform a periodic visual inspection of the 820D-2 at least once each week. Inspect all metal parts for rust, corrosion, and general deterioration. Check wiring and components for signs of overheating. Check the blower for normal operation. Check all operating controls for smoothness of operation. Check all connections and tighten loose nuts, bolts, or screws.

4.3 CLEANING

Clean the 820D-2 whenever dust accumulates at any point inside the equipment. A solvent consisting of the following mixture by volume may be used as a cleaning material: methylene chloride, 25 percent; perchloroethylene, 5 percent; and drycleaning solvent, 70 percent.

4.3.1 General Cleaning Procedure

a. Remove dust from chassis, panels, and components with a soft-bristled brush.

b. Remove any foreign matter from flat surfaces and accessible areas with a lintless cloth moistened with solvent. Dry with a clean, dry, lintless cloth.

c. Wash switch contacts and the less accessible areas with solvent lightly applied with a small soft-bristled brush.

d. Clean accumulated dust from the modular and power amplifier tubes with a lintless cloth moistened with solvent. Dry with a clean, dry, lintless cloth.

4.3.2 Air Filter

The air filter on the 820D-2 transmitter is a 16- by 20- by 1-inch disposable commercial filter. Replace the air filter whenever a noticeable quantity of dust or dirt restricts air flow. Replace the filter as follows:

a. Remove the two screws retaining the louvered filter panel to the rear cabinet panel.

b. Extract the filter from its holder and discard.

c. Install a new 16- by 20- by 1-inch disposable commercial filter.

d. Replace the louvered panel and two screws.

4.4 LUBRICATION

The 820D-2 transmitter requires no lubrication. All motor bearings are permanently lubricated and sealed.

4.5 TROUBLESHOOTING

If the transmitter fails to operate properly, isolate the malfunction to a particular circuit using the TEST METER readings (table 3-2), maintenance checks in paragraph 4.7, and diagrams in section 5. Check each circuit in the order that it is made operative. If a malfunctioning circuit has an adjustment procedure provided in paragraph 4.8, perform the adjustment. Refer to the circuit descriptions in section 1 for aid in troubleshooting. Refer to the parts list in section 6 for parts locations.

4.6 TEST EQUIPMENT

Table 4-1 lists test equipment necessary for transmitter maintenance checks and adjustments. The reference column lists the paragraph number of the maintenance check or adjustment procedure that requires the equipment.

4.7 MAINTENANCE CHECKS

WARNING

HIGH VOLTAGE is used in this equipment.

DEATH ON CONTACT may result if you fail to observe safety precautions.

When working inside the equipment, be sure that all circuit breakers are OFF and that primary power is disabled at the wall disconnect or circuit breaker unless otherwise directed. If a procedure requires transmitter operation with access panels removed, do not allow bodily contact with any electrical component, tap, or terminal. Use heavily insulated tools to adjust variable components.

Table 4-1. Test Equipment.

ITEM	RECOMMENDED MANUFACTURER/MODEL	REFERENCE
Dummy load, 50 ohms, 2.5-kW	Bird Model 8720	4.7, 4.8
Rf ammeter	Weston 743-60	4.7, 4.8
Multimeter	Triplett Model 630 N/A	4.7.1, 4.7.2, 4.7.3, 4.8.1, 4.8.5
Audio signal generator	Hewlett Packard Model 206A	4.8.3
Audio voltmeter	Hewlett Packard Model 403B	4.8.3
Modulation monitor	Belar Model AMM-1	4.8.3
Oscilloscope	Tektronix Model 545	4.8.3
Distortion analyzer	Hewlett-Packard Model 334A	4.8.3

CAUTION

Make certain all meters and test equipment are switched to appropriate measuring scales before connecting them to the transmitter. Connect test equipment only to the terminals designated in the procedure.

NOTE

(1) Initial control panel switch settings for all maintenance checks are as follows:

LOW VOLTAGE - ON

HIGH VOLTAGE - ON

PLT OFF

FIL OFF

(2) RF output jack A1J1 must be connected through an rf ammeter to a 50-ohm dummy load, or to the normal 50-ohm antenna system.

4.7.1 28-Volt DC Power Supply and Metering Circuit Check

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove lower front access panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a multimeter (30-Vdc scale) positive lead to A2TB1-14 and negative lead to chassis ground.

d. Set primary power and LOW VOLTAGE circuit breaker ON. Note that FIL OFF indicator/switch lights.

e. Check multimeter for an indication of 28 ±2 volts dc.

f. Set the test meter select switch to 28V SUPPLY 30 VFS.

g. Compare the TEST METER indication with the multimeter indication. Note that the indications do not differ by more than 10 percent.

h. Set LOW VOLTAGE circuit breaker and primary power OFF. Short all high voltage terminals with ground stick.

i. Disconnect the multimeter. Replace the lower front access panel.

j. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.7.2 Bias Power Supply and Metering Circuit Check

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove lower front access panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a multimeter (300-Vdc scale) negative lead to A2TB1-10 and positive lead to chassis ground.

d. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON pushbutton.

e. Check the multimeter for an indication of -155 ±10 volts dc.

f. Set the test meter select switch to BIAS SUPPLY 300 VFS.

g. Compare the TEST METER indication with the multimeter indication. Note that the indications do not differ by more than 5 percent.

h. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short all high voltage terminals with grounding stick.

i. Disconnect the multimeter. Replace the lower front access panel.

j. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.7.3 Screen Power Supply and Metering Circuits Check

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove lower front access panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a multimeter (1200-Vdc scale) positive lead to A2E1 and negative lead to A3E1.

d. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON and LP ON pushbuttons.

e. Check the multimeter for an indication of 750 ±20 volts dc.

f. Set the test meter select switch to SCREEN SUPPLY 1500 VFS.

g. Compare the TEST METER indication with the multimeter indication. Note that the indications do not differ by more than 5 percent.

h. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short all high voltage terminals with grounding stick.

i. Disconnect the multimeter. Replace lower front access panel.

j. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.8 ADJUSTMENTS

All 820D-2 transmitters are factory adjusted to provide optimum transmitter operation at the specific customer's power output and frequency. All 820D-2 transmitters are factory adjusted at 240 VAC power input. Do not perform adjustments unless components are replaced, the transmitter fails to operate properly, power input or output requirements change, or frequency requirements change.

WARNING

HIGH VOLTAGE is used in this equipment.

DEATH ON CONTACT may result if you fail to observe safety precautions.

When working inside the equipment, be sure that all circuit breakers are OFF and that primary power is disabled at the wall disconnect or circuit breaker unless otherwise directed. If a procedure requires transmitter operation with access panels removed, do not allow bodily contact with any electrical component, tap, or terminal. Use heavily insulated tools to adjust variable components.

CAUTION

Make certain all meters and test equipment are switched to appropriate measuring scales before connecting them to the transmitter. Connect test equipment only to the terminals designated in the procedure.

NOTE

(1) Initial control panel switch settings for all adjustments are as follows:

LOW VOLTAGE - ON

HIGH VOLTAGE - ON

PLT OFF

FIL OFF

(2) Rf output jack A1J1 must be connected through an rf ammeter to a 50-ohm dummy load.

4.8.1 Filament Voltage Adjustment

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove the rear access panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a multimeter (12-Vac scale) from A1T1-5 to A1T1-7.

d. Set LOW VOLTAGE circuit breaker and primary power ON. Press FIL ON pushbutton.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed.

DEATH ON CONTACT may occur if you fail to observe safety precautions.

e. Adjust A1R7 until 9.5 Vac is indicated on the multimeter.

f. Press FIL OFF pushbutton. Set LOW VOLTAGE circuit breaker and primary power OFF.

g. Move multimeter (12-Vac scale) leads to A1T2-5 and A1T2-7.

h. Set LOW VOLTAGE circuit breaker and primary power ON. Press FIL ON pushbutton.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed.

DEATH ON CONTACT may occur if you fail to observe safety precautions.

i. Adjust A1R8 until 9.5 Vac is indicated on the multimeter.

j. Press FIL OFF pushbutton. Set LOW VOLTAGE circuit breaker and primary power OFF. Short all high voltage terminals with grounding stick.

k. Remove multimeter and replace access door.

l. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.8.2 RF Tuning Adjustment

a. Press FIL ON and LP ON pushbuttons.

b. Set test meter select switch to PA GRID I 150 MAFS.

c. Adjust P. A. GRID TUNING capacitor A1C47 (at upper front access panel) until maximum grid current is displayed on the TEST METER. Note the grid current value.

NOTE

The P. A. GRID TUNING capacitor must be tuned at some point within its adjustment range and not at a fully open or fully closed position.

d. If the current value (noted in step c.) is 50 to 75 mA, skip the remainder of this procedure. If the grid current is not within the specified limits, adjust A1A3R17 as described in steps e. through k.

e. Press PLT OFF and FIL OFF pushbuttons. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

f. Remove the upper front access panel. Short all high voltage terminals with grounding stick.

g. Adjust A1A3R17 counterclockwise to lower the grid current or clockwise to raise the grid current.

h. Replace the upper front access panel.

i. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON and LP ON pushbuttons.

j. Check grid current displayed on the TEST METER.

k. Repeat steps f. through j. until grid current is 50 to 75 mA.

l. Press PLT OFF and FIL OFF pushbuttons.

4.8.3 Modulator Adjustments

4.8.3.1 Modulator Static Adjustments

NOTE

Access holes for the modulator adjustments are located on the upper front access panel.

a. Set L MOD BIAS and R MOD BIAS controls fully counterclockwise.

b. Set L MOD DRIVE and R MOD DRIVE controls fully clockwise.

c. Press FIL ON and HP ON pushbuttons.

d. Set test meter select switch to MOD CATHODE I 1.5AFS. Record TEST METER reading (I_o). 4-400→ 60-80mA each @140 Volts bias

e. Adjust L MOD BIAS clockwise until 0.150 + $I_o/2$ amperes is displayed on the TEST METER.

f. Adjust R MOD BIAS clockwise until 0.300 ampere is displayed on the TEST METER.

g. Press PLT OFF and FIL OFF pushbuttons.

4.8.3.2 Modulation Monitor Voltage Adjustment

NOTE

Procedures in paragraph 4.8.3.1 must be performed before beginning this procedure.

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove the rear cabinet panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a distortion analyzer, modulation monitor, and an oscilloscope with a X10 isolation probe to modulation monitor jack A1J2.

d. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON and HP ON pushbuttons.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed.

DEATH ON CONTACT may occur if you fail to observe safety precautions.

e. Observe the oscilloscope and determine the peak-to-peak voltage displayed. If the voltage is 12 ±2 volts peak-to-peak, skip to step j. If the voltage is not within acceptable limits, adjust A1L8 pin 4 as described in steps f. through i.

f. Press PLT OFF and FIL OFF pushbuttons. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

g. Remove the rf output network access cover. Short all high voltage terminals with grounding stick.

h. Pin 4 is the adjustable slide on the A1L8 shaft nearer the front of the transmitter. Slide pin 4 down to reduce the peak-to-peak voltage observed in step e.; slide pin 4 up to increase the voltage.

i. Replace the rf output network access cover. Repeat steps d. and e., and, if necessary, steps f. through h.

j. Press the LP ON pushbutton.

k. Observe the oscilloscope and determine the peak-to-peak voltage displayed. If the voltage is 12 ±2 volts peak-to-peak, skip to step q. If the voltage is not within acceptable limits adjust A1L8 pin 3 as described in steps l. through o.

l. Press PLT OFF and FIL OFF pushbuttons. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

m. Remove the rf output network access cover. Short all high voltage terminals with grounding stick.

n. Pin 3 is the adjustable slide on the A1L8 shaft nearer the rear of the transmitter. Slide pin 3 down to reduce the voltage in step k.; slide pin 3 up to increase the voltage.

o. Replace the rf output network access cover. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON pushbutton.

p. Repeat steps j. and k., and, if necessary, steps l. through n.

q. Press PLT OFF and FIL OFF pushbuttons.

4.8.3.3 Audio Frequency Distortion Adjustment and Audio Frequency Response Check

NOTE

Procedures in paragraph 4.8.3.2 must be performed before beginning this procedure.

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short all high voltage terminals with grounding stick.

b. Connect an audio signal generator and an audio voltmeter to audio input terminals A1TB1-1, 2, and 3. Set the audio oscillator to 7500 Hz.

c. Set the LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press the FIL ON and HP ON pushbuttons.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed.

DEATH ON CONTACT may occur if you fail to observe safety precautions.

d. Adjust the audio frequency generator level until 95-percent modulation is indicated on the modulation monitor.

e. Adjust the L MOD DRIVE control for minimum distortion as indicated on the distortion analyzer. Record the distortion level and return the L MOD DRIVE control fully clockwise.

f. Adjust the R MOD DRIVE control for minimum distortion as indicated on the distortion analyzer. Record the distortion level and return the R MOD DRIVE control fully clockwise.

g. Compare the distortion levels recorded in steps e. and f. Readjust the control with the lower recorded distortion level for minimum distortion as indicated on the distortion analyzer. Leave the remaining control fully clockwise.

h. Adjust the audio oscillator at 1.0 kHz to produce 25-percent modulation as indicated on the modulation monitor.

i. Record the input level (V_o) indicated on the audio voltmeter in decibels.

j. Readjust the audio oscillator to 50 Hz and 25-percent modulation. Record the input level (V_1) indicated on the audio voltmeter in decibels.

k. Calculate the audio response in decibels using the following formula:

$$\text{Audio Response (dB)} = V_1 - V_o$$

l. Repeat steps c. and d. at frequencies of 100, 400, 5000, 7500, and 10,000 Hz.

m. Repeat steps a. through e. at 50- and 100-percent modulation.

n. Note that the frequency response does not deviate more than ±1.0 dB in the 50-Hz to 10-kHz range.

o. Press the PLT OFF and FIL OFF pushbuttons. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short all high voltage terminals with grounding stick.

p. Disconnect all test equipment. Replace all access panels.

q. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.8.4 PA Efficiency Adjustment

a. Press FIL ON and HP ON pushbuttons.

b. Adjust the PA TUNE control on the control panel for minimum indication on PLATE CURRENT meter. Record this plate current.

c. Readjust the PA TUNE control in the direction of maximum antenna or common point current until the PLATE CURRENT meter indication exceeds the recorded plate current by 20 milliamperes.

d. Press PLT OFF and FIL OFF pushbuttons.

4.8.5 Optional Automatic Power Control Adjustment

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove the lower front access panel. Short all high voltage terminals with grounding stick.

c. Connect a multimeter between A2TB2 terminals 16 and 17.

d. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON and LP ON pushbuttons. Set POWER CONTROL AUTO/MANUAL to MANUAL.

e. Adjust the POWER CONTROL RAISE/LOWER until the transmitter output is at the customer's normal low power output requirement.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed.

DEATH ON CONTACT may occur if you fail to observe safety precautions.

f. Adjust A6A1R2 on the APC assembly for a zero indication on the multimeter.

g. Press the HP ON pushbutton.

h. Adjust the POWER CONTROL RAISE/LOWER until the transmitter output is at the customer's normal high power output requirement.

i. Adjust A6A1R3 on the APC assembly for a 0-millivolt indication on the multimeter.

j. Adjust SENSE adjustment A6A1R7 to approximately 3/4 full clockwise, to decrease dead zone (carrier null).

k. Press the PLT OFF and FIL OFF pushbuttons. Set the LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short high voltage terminals with grounding stick.

l. Disconnect the multimeter. Replace the lower front access panel.

m. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.9 FREQUENCY CHANGE AND FREQUENCY DEPENDENT COMPONENT DATA

All 820D-2 transmitters are factory adjusted for the specific customer's frequency requirements. Frequency change requires test equipment not normally available to broadcast station technicians or engineers. Do not make any frequency adjustments without consulting your Collins Broadcast Sales Engineer or:

Collins Commercial Telecommunications Divisions
Rockwell International
Broadcast Field Service Dept.
Dallas, Texas 75207
Phone: (214) 690-5055

Figures 4-1 through 4-9 and tables 4-2 through 4-5 provide frequency change and frequency dependent component data. This data is required for frequency change and may be required for replacement of damaged frequency dependent components. Refer to the output network simplified schematic in figure 4-1 for strap and node identification.

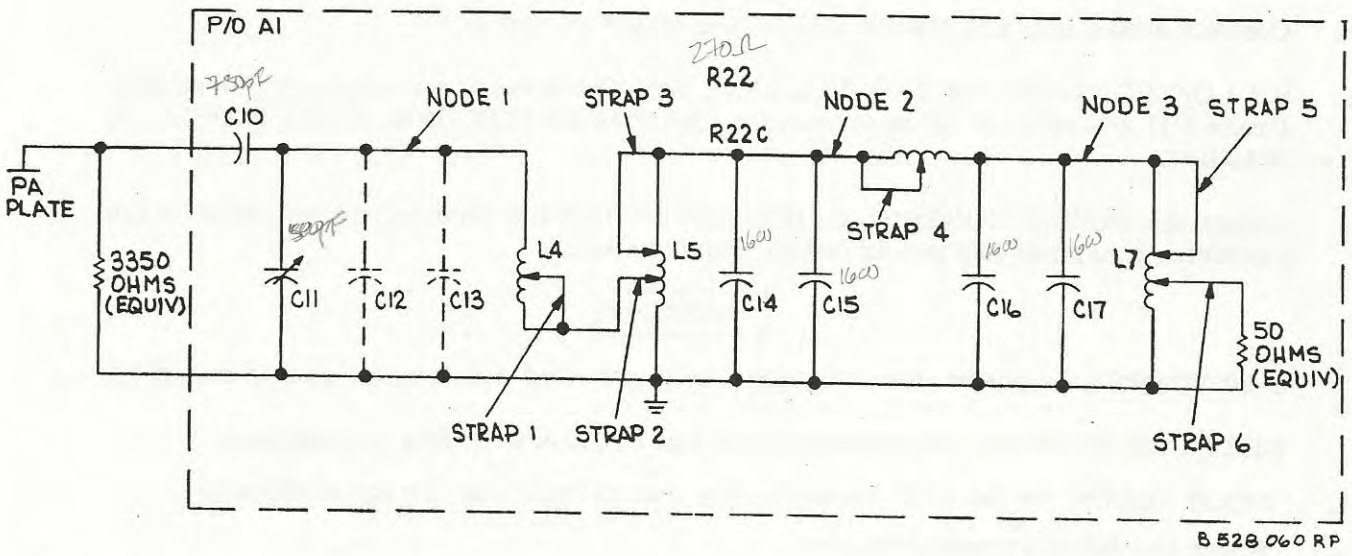
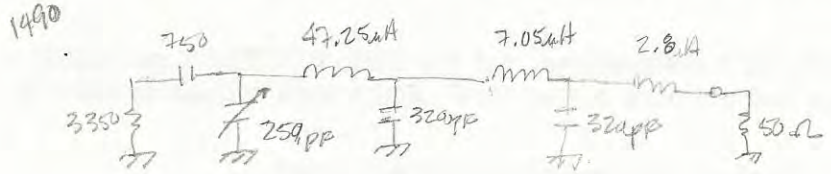


Figure 4-1. 820D-2 1-kW AM Transmitter Output Network Simplified Schematic.



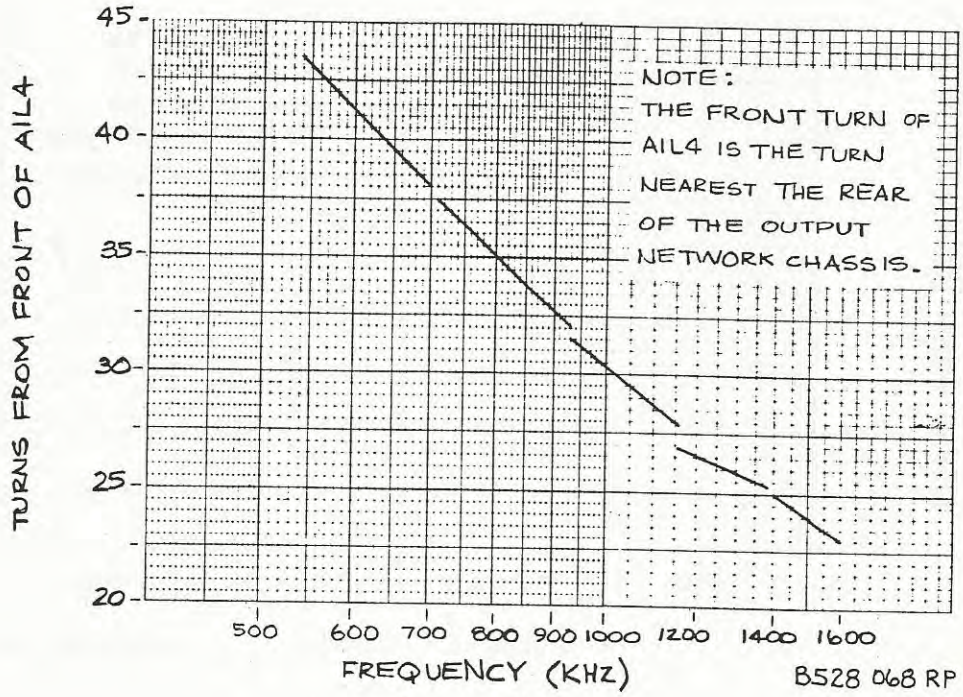


Figure 4-2. Approximate Settings for Output Network Strap 1 on A1L4.

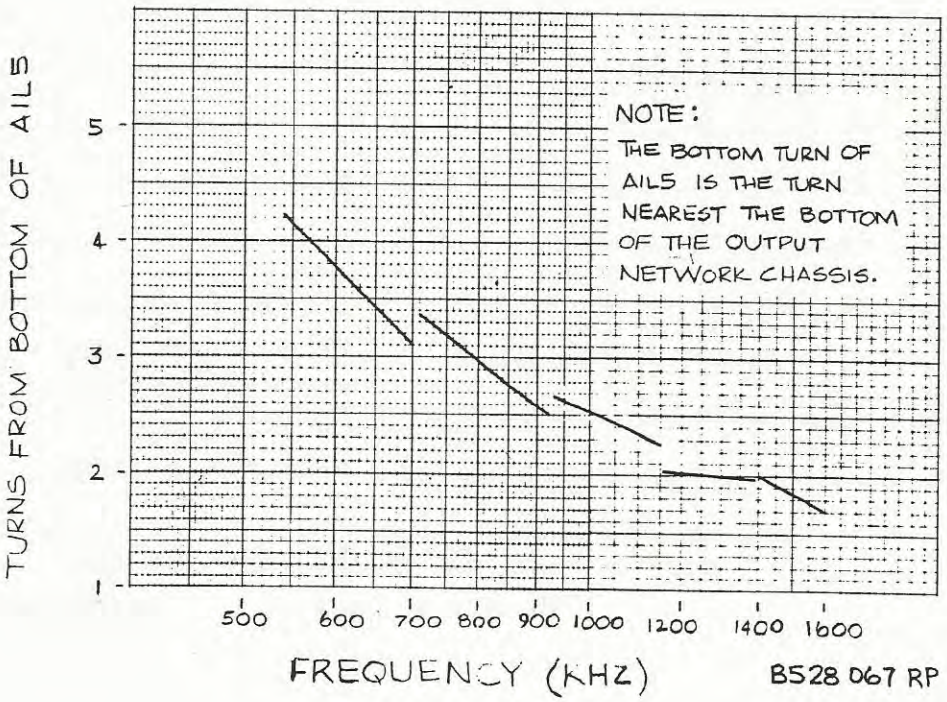


Figure 4-3. Approximate Settings for Output Network Strap 2 on A1L5.

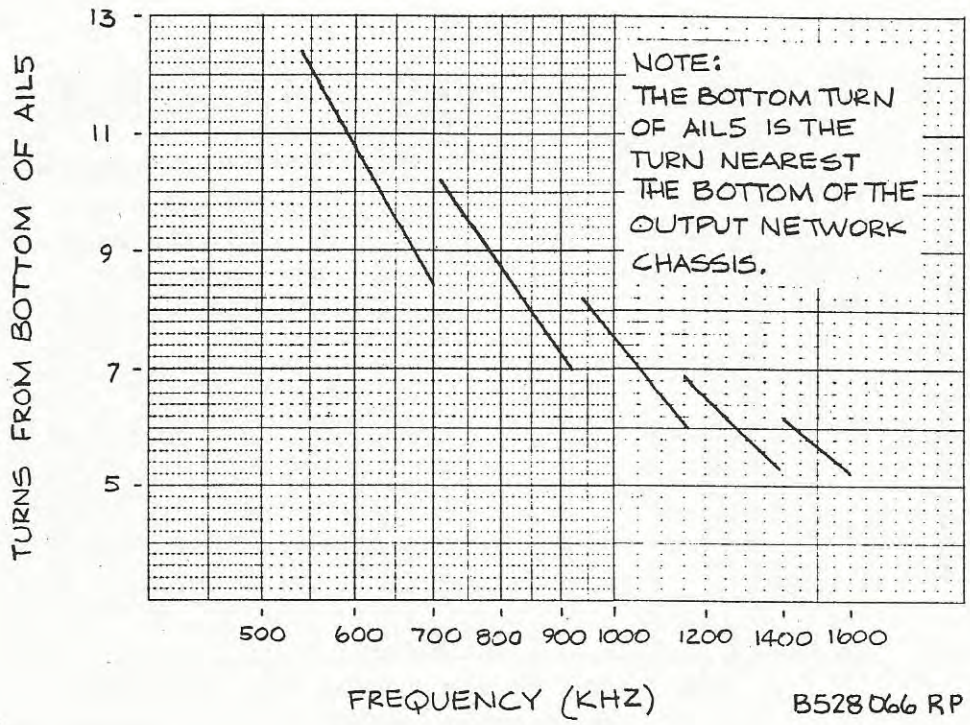


Figure 4-4. Approximate Settings for Output Network Strap 3 on A1L5.

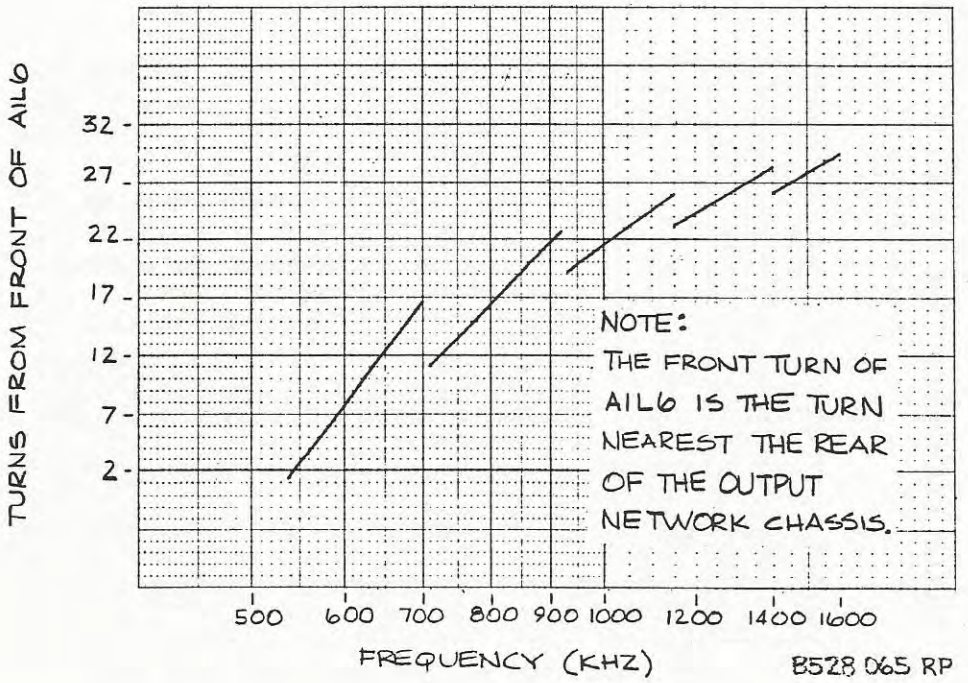


Figure 4-5. Approximate Settings for Output Network Strap 4 on A1L6.

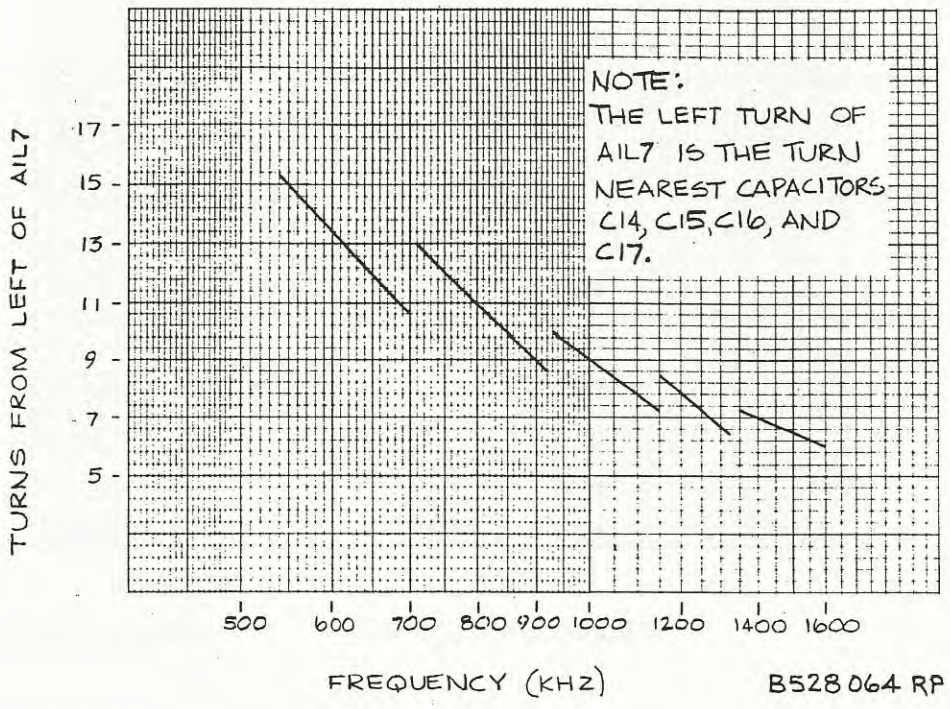


Figure 4-6. Approximate Settings for Output Network Strap 5 on A1L7.

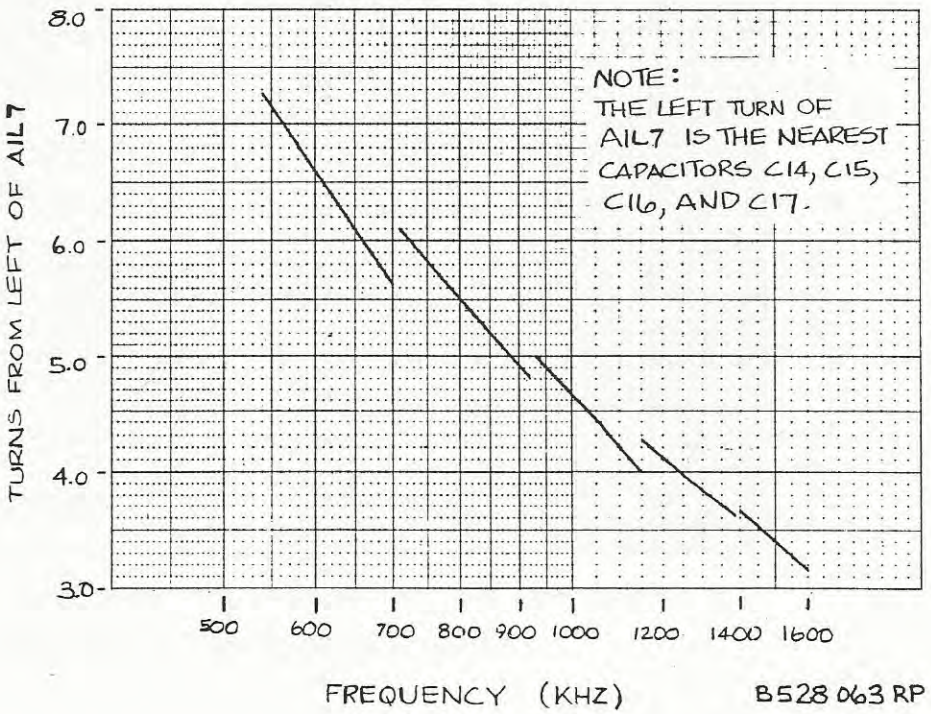


Figure 4-7. Approximate Settings for Output Network Strap 6 on A1L7.

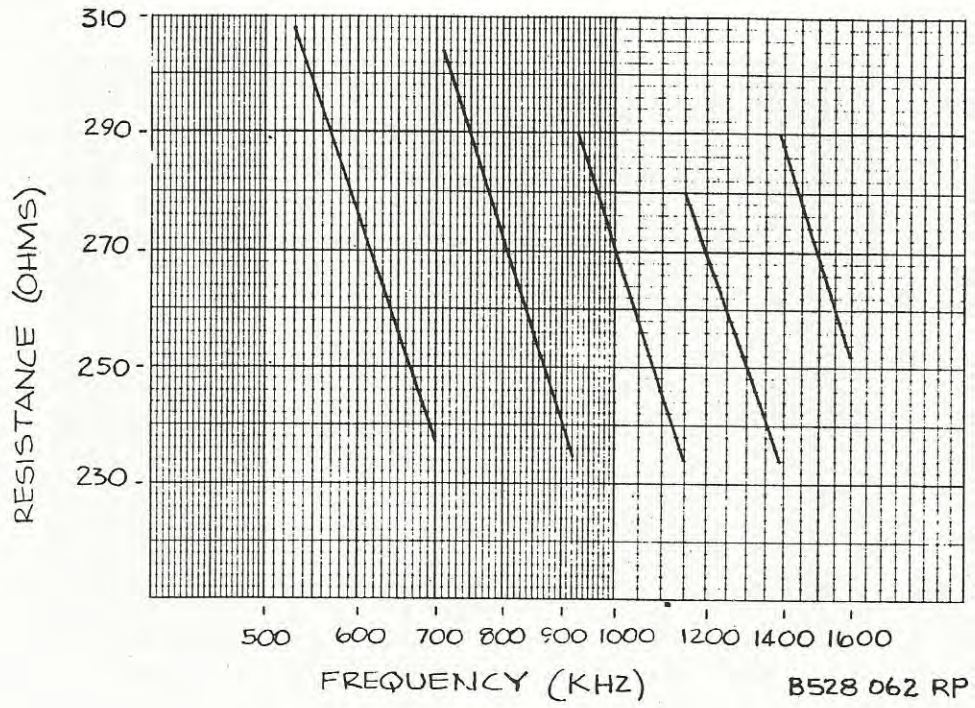


Figure 4-8. Resistance $R_{22} = R_{22c}$ Values.

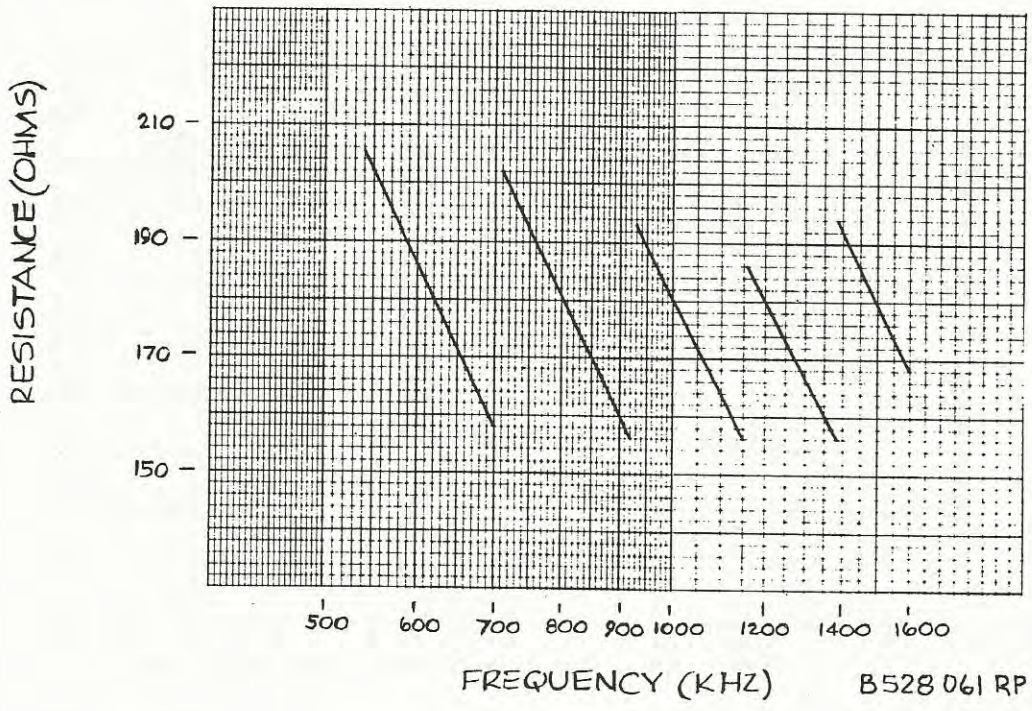


Figure 4-9. Resistance R_{33} Values.

Table 4-2. Crystal Part Numbers.

OPERATING FREQUENCY	COLLINS PART NUMBER	OPERATING FREQUENCY	COLLINS PART NUMBER	OPERATING FREQUENCY	COLLINS PART NUMBER
540	289-7021-010	960	289-7021-690	1380	289-7021-310
550	289-7021-030	970	289-7021-700	1390	289-7021-320
560	289-7021-050	980	289-7021-710	1400	289-7021-330
570	289-7021-070	990	289-7021-720	1410	289-7021-340
580	289-7021-090	1000	289-7021-730	1420	289-7021-350
590	289-7021-110	1010	289-7021-740	1430	289-7021-360
600	289-7021-130	1020	289-7021-750	1440	289-7021-370
610	289-7021-150	1030	289-7021-760	1450	289-7021-380
620	289-7021-170	1040	289-7021-770	1460	289-7021-390
630	289-7021-190	1050	289-7021-780	1470	289-7021-400
640	289-7021-210	1060	289-7021-790	1480	289-7021-410
650	289-7021-230	1070	289-7021-800	1490	289-7021-420
660	289-7021-250	1080	289-7021-810	1500	289-7021-430
670	289-7021-270	1090	289-7021-020	1510	289-7021-440
680	289-7021-290	1100	289-7021-030	1520	289-7021-450
690	289-7021-310	1110	289-7021-040	1530	289-7021-460
700	289-7021-330	1120	289-7021-050	1540	289-7021-470
710	289-7021-350	1130	289-7021-060	1550	289-7021-480
720	289-7021-370	1140	289-7021-070	1560	289-7021-490
730	289-7021-390	1150	289-7021-080	1570	289-7021-500
740	289-7021-410	1160	289-7021-090	1580	289-7021-510
750	289-7021-430	1170	289-7021-100	1590	289-7021-520
760	289-7021-450	1180	289-7021-110	1600	289-7021-530
770	289-7021-470	1190	289-7021-120		
780	289-7021-490	1200	289-7021-130		
790	289-7021-510	1210	289-7021-140		
800	289-7021-530	1220	289-7021-150		
810	289-7021-540	1230	289-7021-160		
820	289-7021-550	1240	289-7021-170		
830	289-7021-560	1250	289-7021-180		
840	289-7021-570	1260	289-7021-190		
850	289-7021-580	1270	289-7021-200		
860	289-7021-590	1280	289-7021-210		
870	289-7021-600	1290	289-7021-220		
880	289-7021-610	1300	289-7021-230		
890	289-7021-620	1310	289-7021-240		
900	289-7021-630	1320	289-7021-250		
910	289-7021-640	1330	289-7021-260		
920	289-7021-650	1340	289-7021-270		
930	289-7021-660	1350	289-7021-280		
940	289-7021-670	1360	289-7021-290		
950	289-7021-680	1370	289-7021-300		

Table 4-3. Frequency Dependent Capacitor List.

FREQUENCY RANGE	CAPACITOR					
	A1C12	A1C13	A1C14	A1C15	A1C16	A1C17
540 to 620 kHz	C	A	D	D	D	D
630 to 700 kHz	B	None	D	D	D	D
710 to 920 kHz	C	None	E	E	E	E
930 to 1150 kHz	A	None	F	F	F	F
1160 to 1380 kHz	G	None	H	H	H	H
1390 to 1600 kHz	None	None	I	I	I	I

Note: Capacitor values and part no. are as follows:

A-240 pF, 10 kV, 912-4126-100
B-390 pF, 10 kV, 912-4126-110
C-430 pF, 10 kV, 912-4126-150
D-3900 pF, 6 kV, 912-4140-180
E-3000 pF, 6 kV, 912-4140-170
F-2400 pF, 6 kV, 912-4140-160
G-180 pF, 10 kV, 912-4126-090
H-2000 pF, 6 kV, 912-4140-150
I-1600 pF, 6 kV, 912-4140-140

Table 4-4. RF Driver A1A2 Frequency Strapping.

FREQUENCY RANGE (kHz)	STRAPPING CONNECTION	
	FROM	TO
540 to 550	E5	E6
	E13	E14
560 to 580	E5	E6
	E7	E8
	E9	E10
	E11	E12
590 to 600	E7	E8
	E9	E10
	E11	E12
610 to 625	E5	E6
	E9	E10
	E11	E12
635 to 645	E9	E10
	E11	E12
655 to 675	E5	E6
	E7	E8
	E11	E12

Table 4-4. RF Driver A1A2 Frequency Strapping (Cont).

FREQUENCY RANGE (kHz)	STRAPPING CONNECTION	
	FROM	TO
685 to 710	E7 E11	E8 E12
720 to 735	E5 E11	E6 E12
745 to 780	E11	E12
790 to 850	E7 E9	E8 E10
860 to 890	E5 E9	E6 E10
900 to 965	E9	E10
975 to 1100	E5 E7	E6 E8
1110 to 1250	E7	E8
1260 to 1420	E5	E6
1430 to 1600	None	

Table 4-5. Dual Oscillator Card A1A3 Frequency Strapping.

FREQUENCY RANGE (kHz)	STRAPPING CONNECTION	
	FROM	TO
540 to 720	E1 E3 E5 E6	E2 E4 E6 E7
730 to 1080	E1 E3 E5	E2 E4 E6
1090 to 1200	E1 E5	E4 E6
1210 to 1600	E1	E4

Diagrams

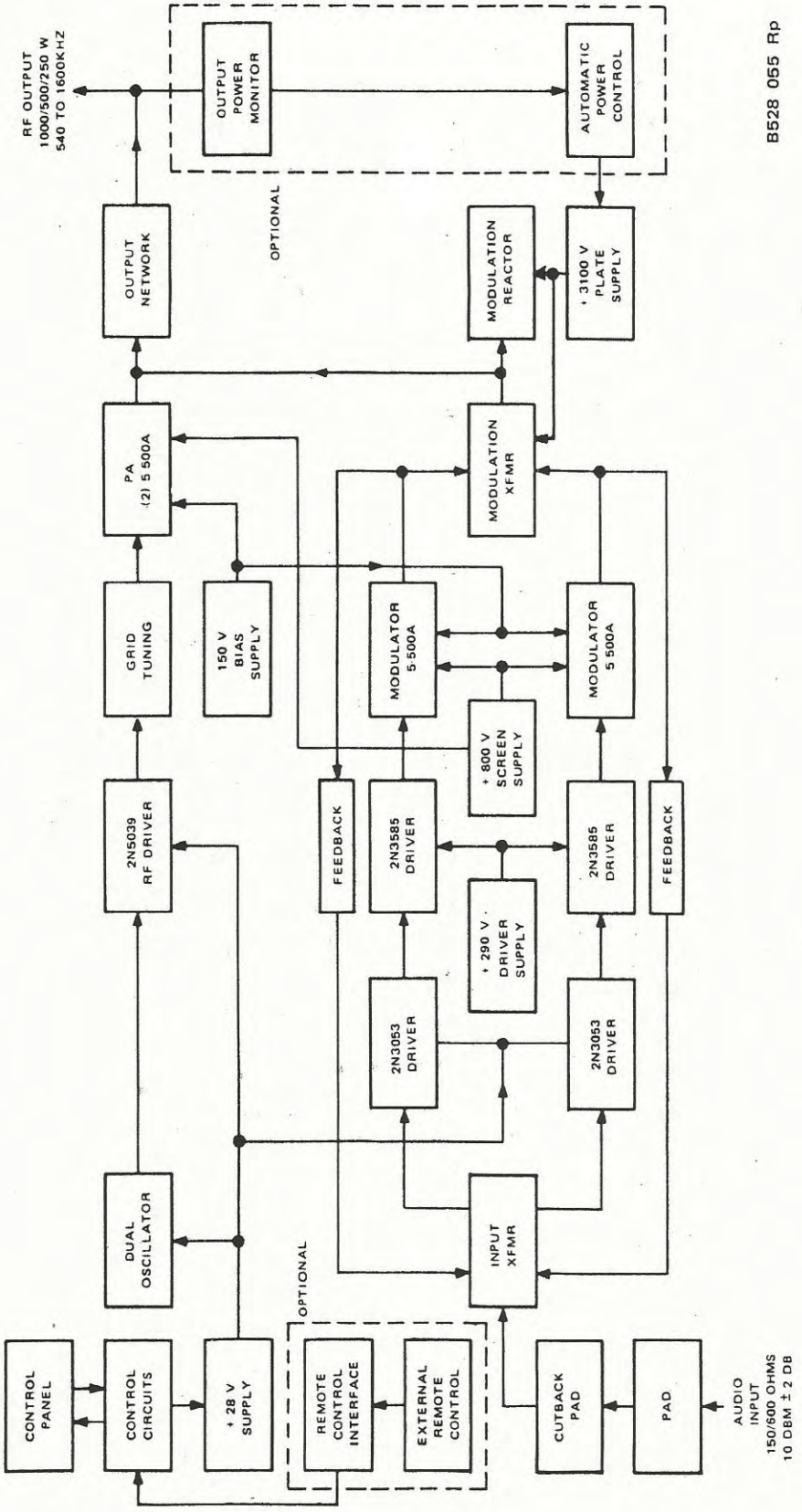


Figure 5-1. 820D-2 1-kW AM Transmitter Overall Block Diagram.

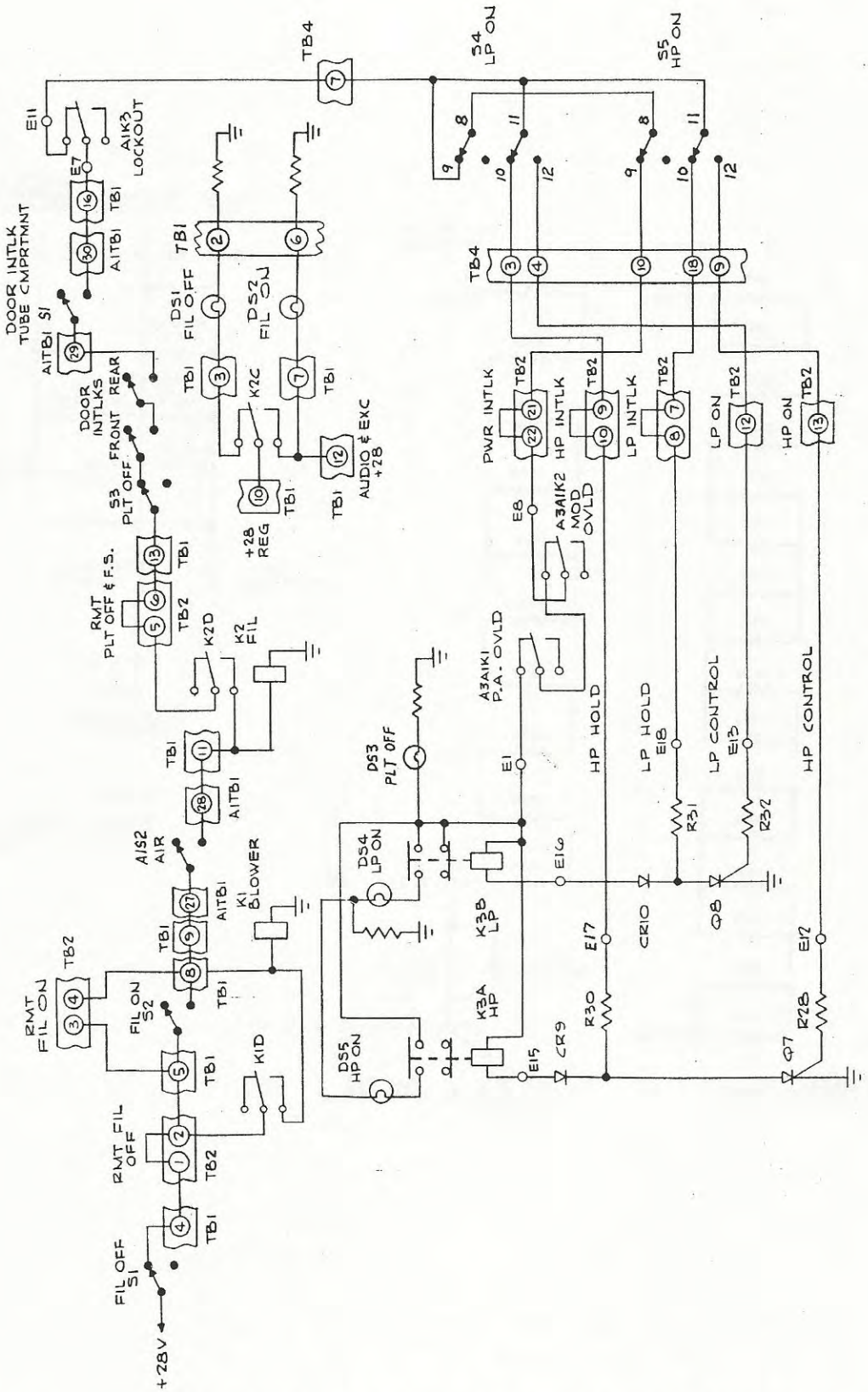


Figure 5-2. 820D-2 1-kW AM Transmitter Simplified Control Circuits Schematic Diagram.

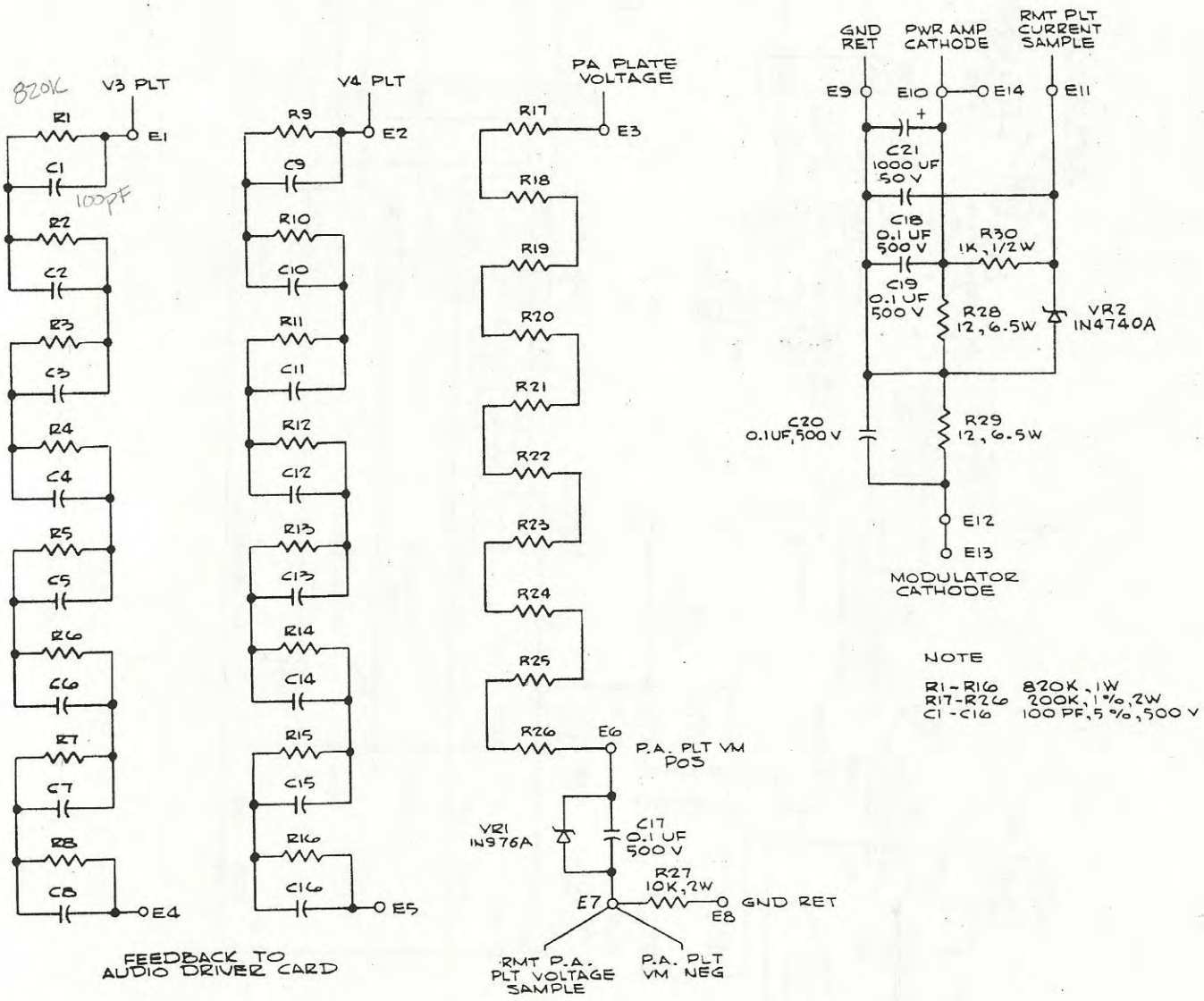


Figure 5-3. Feedback/Divider Board A1A4 Schematic Diagram.

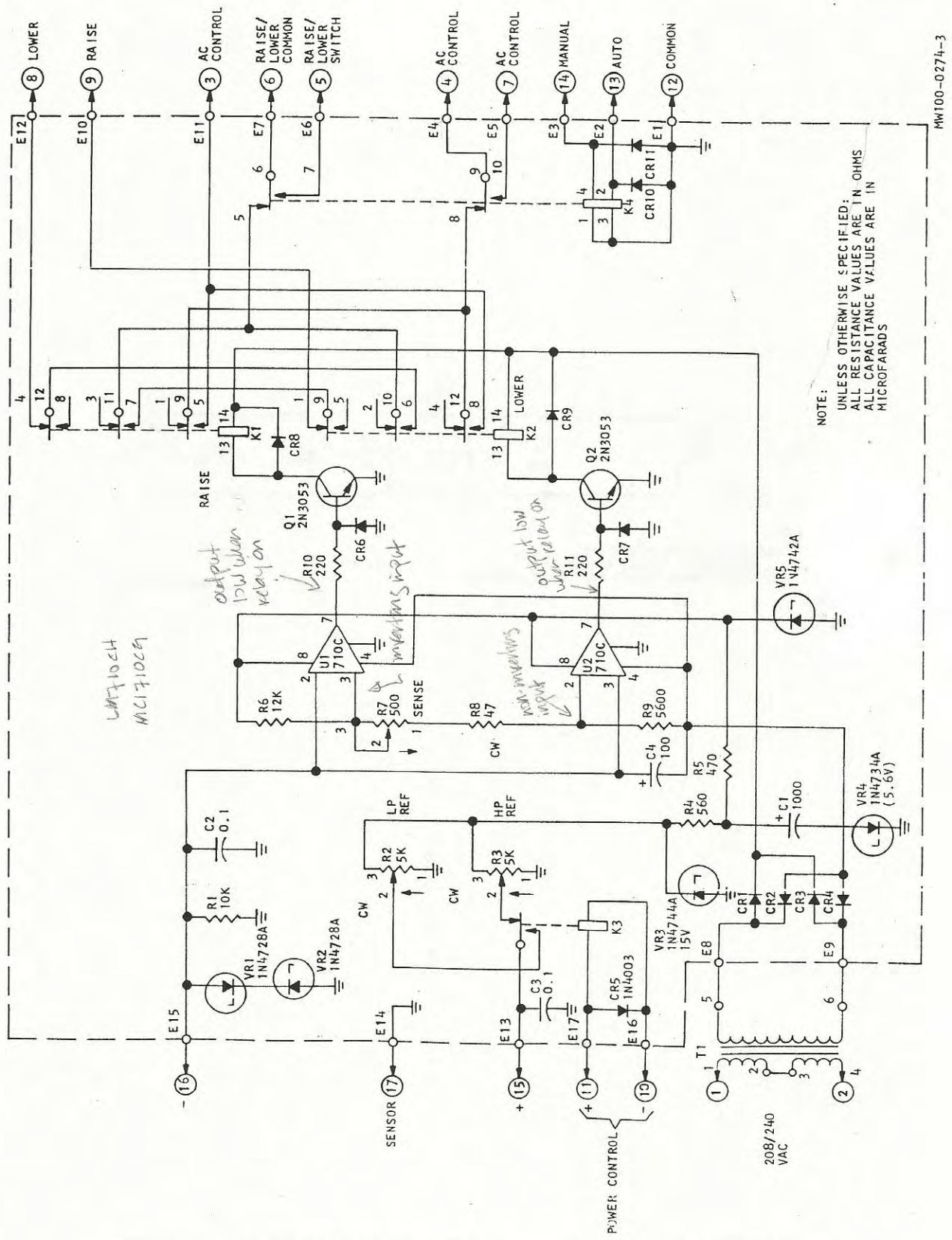
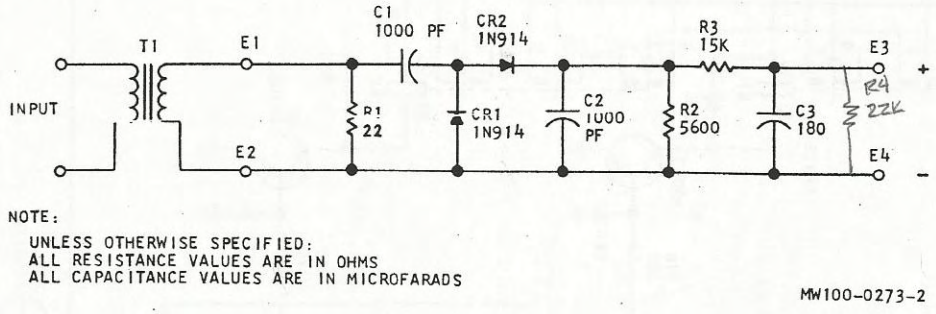


Figure 5-4. Optional Automatic Power Control Servo Card A6A1 Schematic Diagram.



NOTE:
UNLESS OTHERWISE SPECIFIED:
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROFARADS

MW100-0273-2

Figure 5-5. Optional Automatic Power Control RF Sensor A6A2 Schematic Diagram.

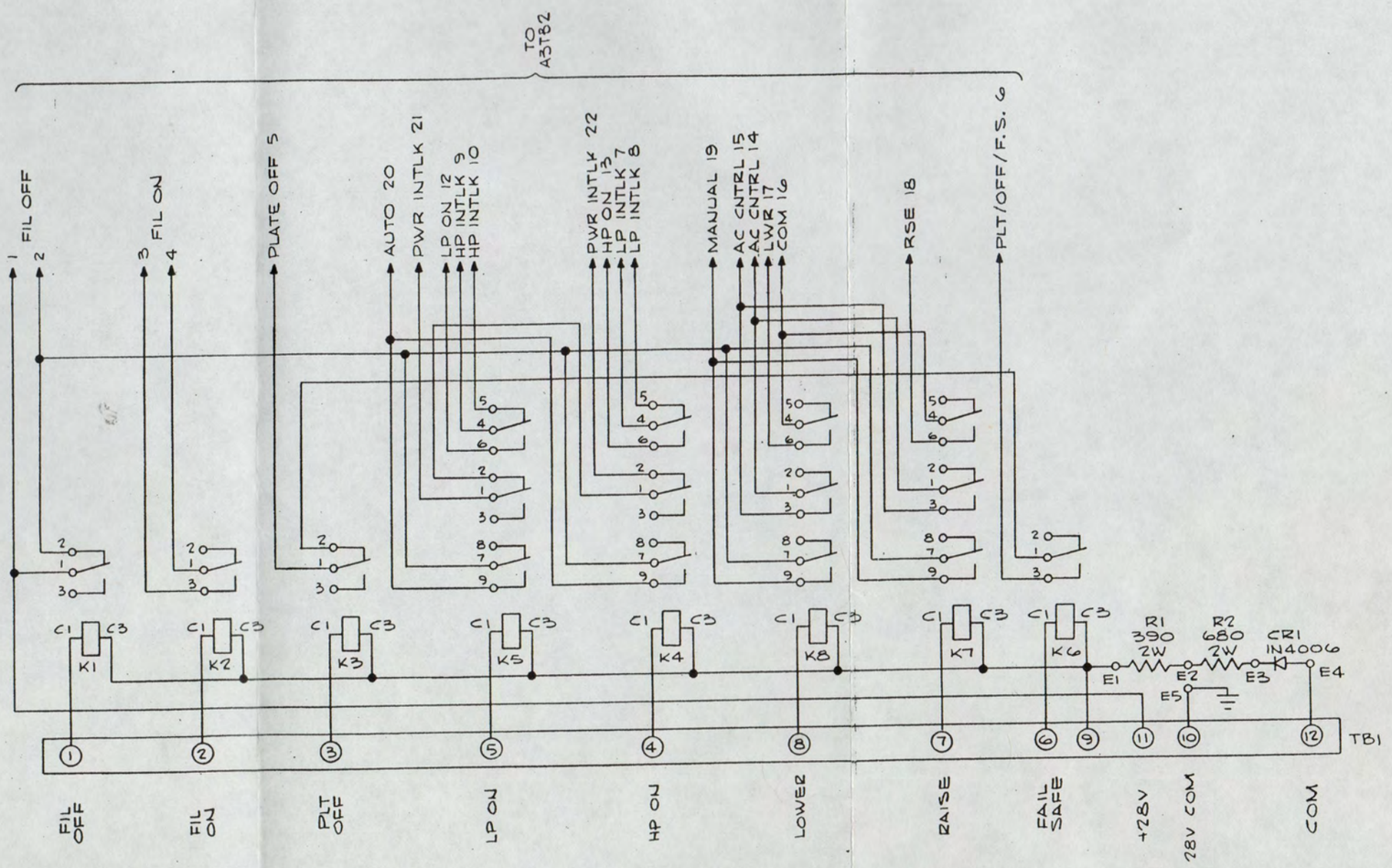


TABLE 1. STRAPPING CONNECTIONS

SOURCE CONTROL VOLTAGE	STRAPPING CONNECTION	
	FROM	TO
24 VDC, POSITIVE COMMON	E1	E3
24 VDC, NEGATIVE COMMON	E1	E4
48 VDC, POSITIVE COMMON	E1	E2
48 VDC, NEGATIVE COMMON	E2	E4
115 VAC	E3	E4

Figure 5-6. Optional Remote Control Assembly A7 Schematic Diagram.

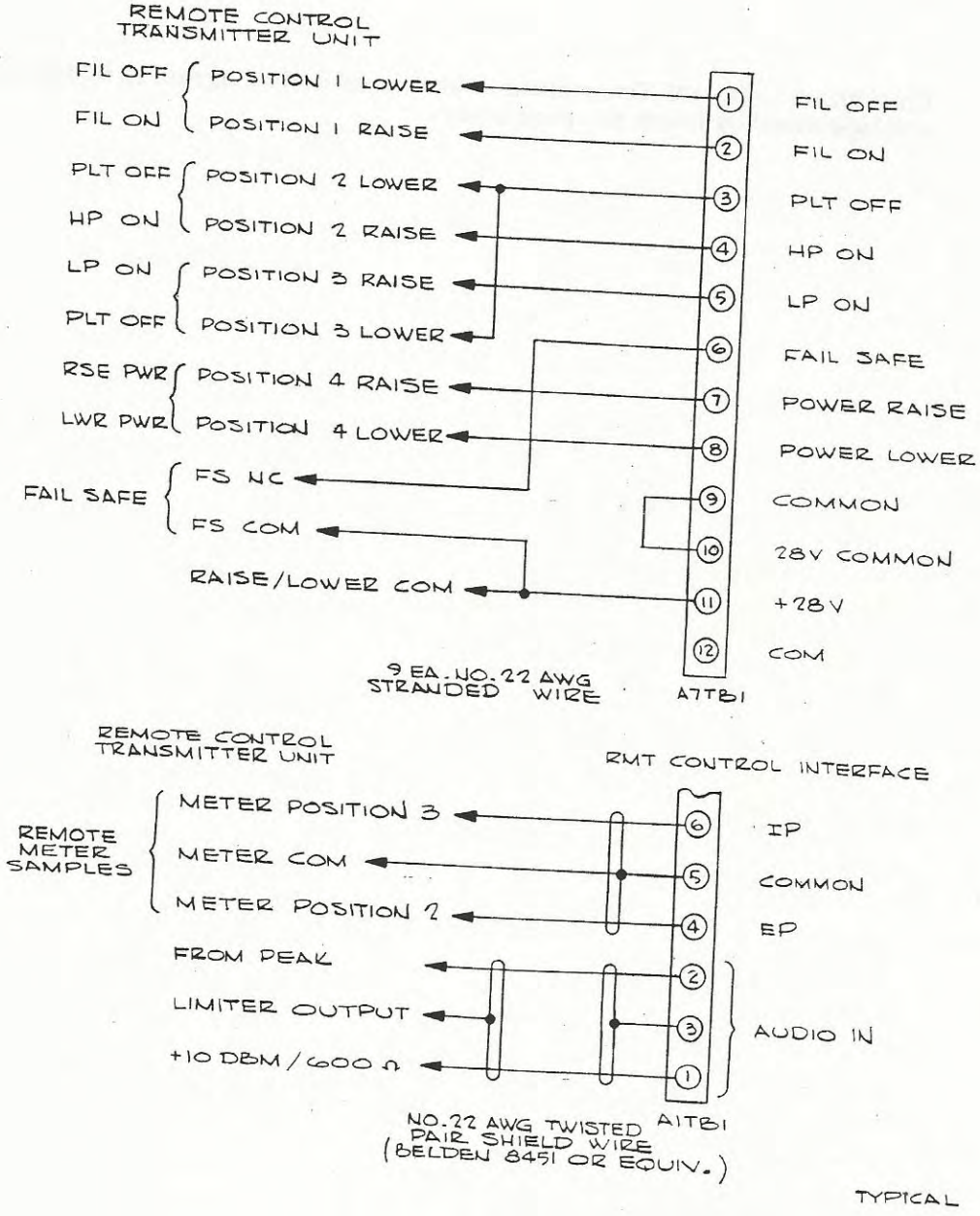


Figure 5-7. Optional Remote Control External Connections Schematic Diagram.

The 820D-2 1-kW AM Transmitter overall schematic diagram is folded and inserted in an envelope attached inside the back cover.

Figure 5-8. 820D-2 1-kW AM Transmitter Overall Schematic Diagram.

6.1 GENERAL

This section provides parts lists and parts locations for all electrical components of the 820D-2 transmitter. Figures 6-1 through 6-8 provide general views of the 820D-2 transmitter with various access panels removed. The remaining figures with their corresponding parts lists identify all electrical components. These figures and parts lists are in order according to assembly reference designation.

6.2 ORDERING REPLACEMENT PARTS

Refer to the information inside the front cover for instructions on how to order replacement parts.

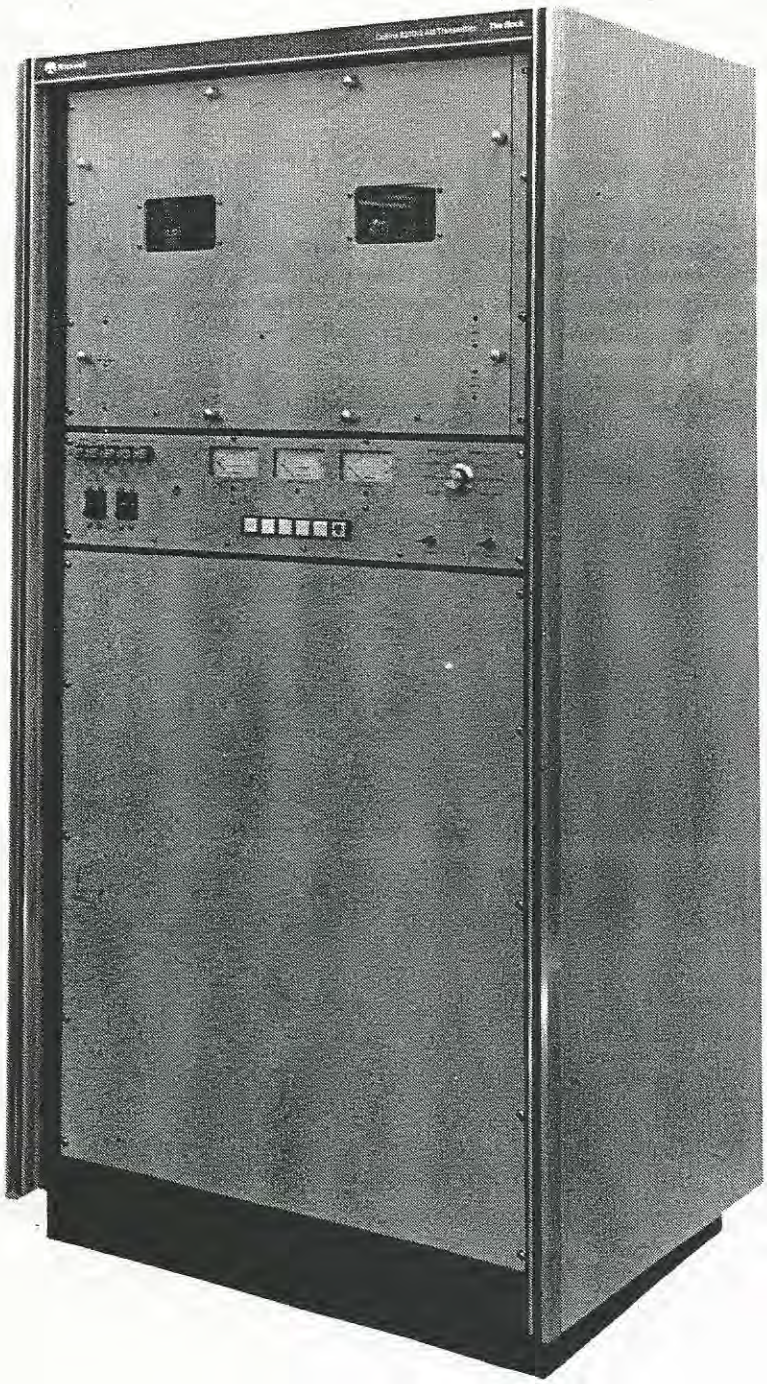


Figure 6-1. 820D-2 1-kW AM Transmitter, Front View.

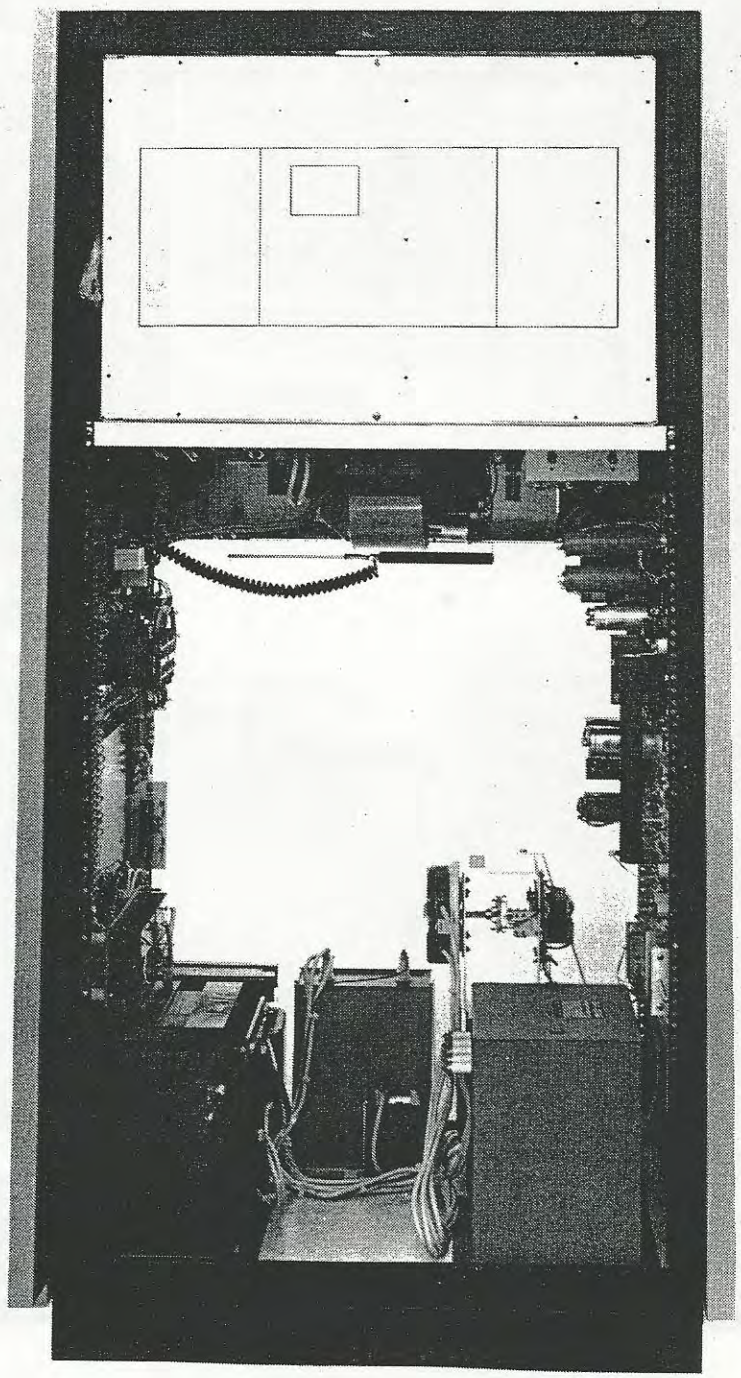


Figure 6-2. 820D-2 1-kW AM Transmitter, Rear View With Access Panel Removed

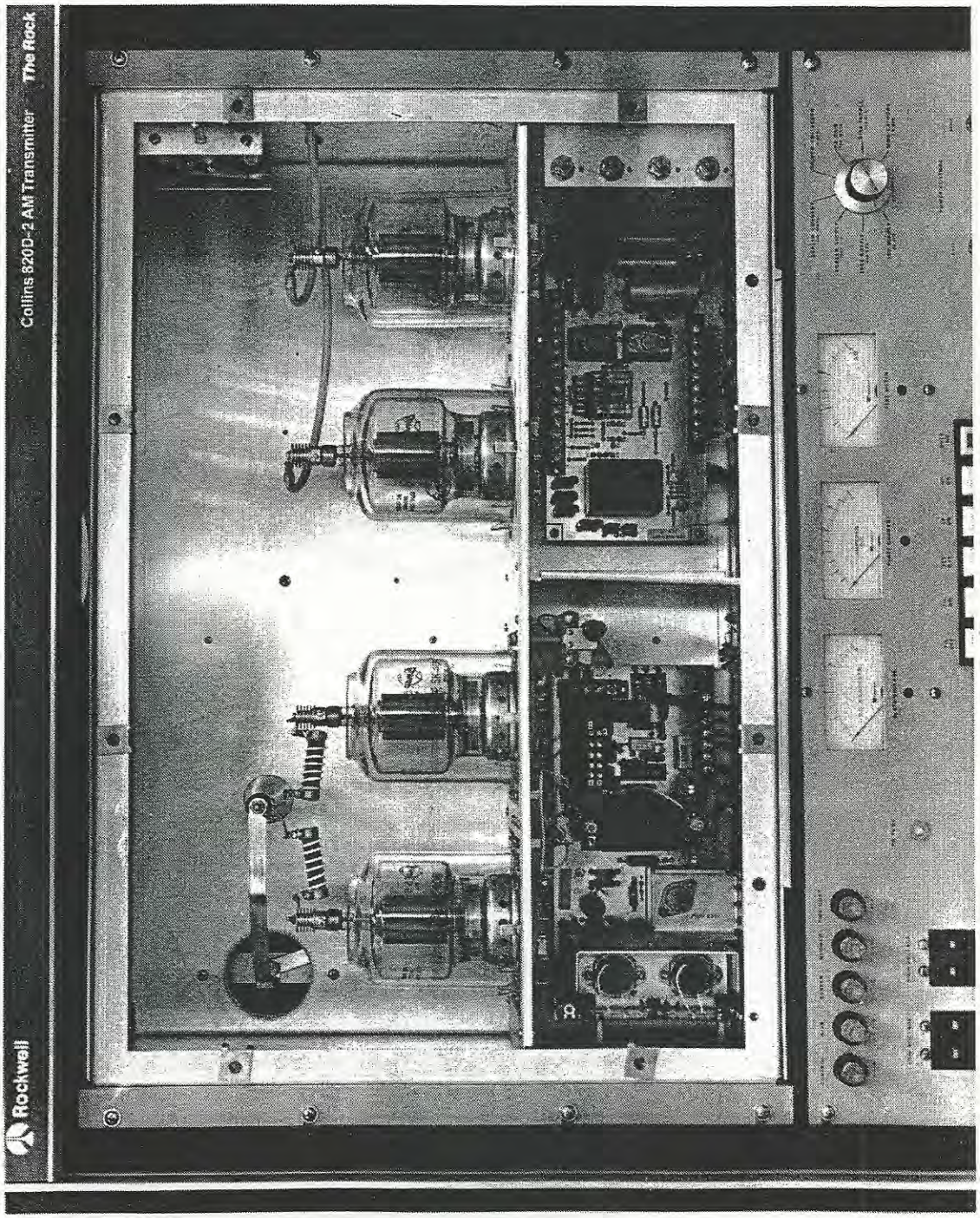


Figure 6-3. 820D-2 1-kW AM Transmitter, Top Front View With Access Panel Removed.

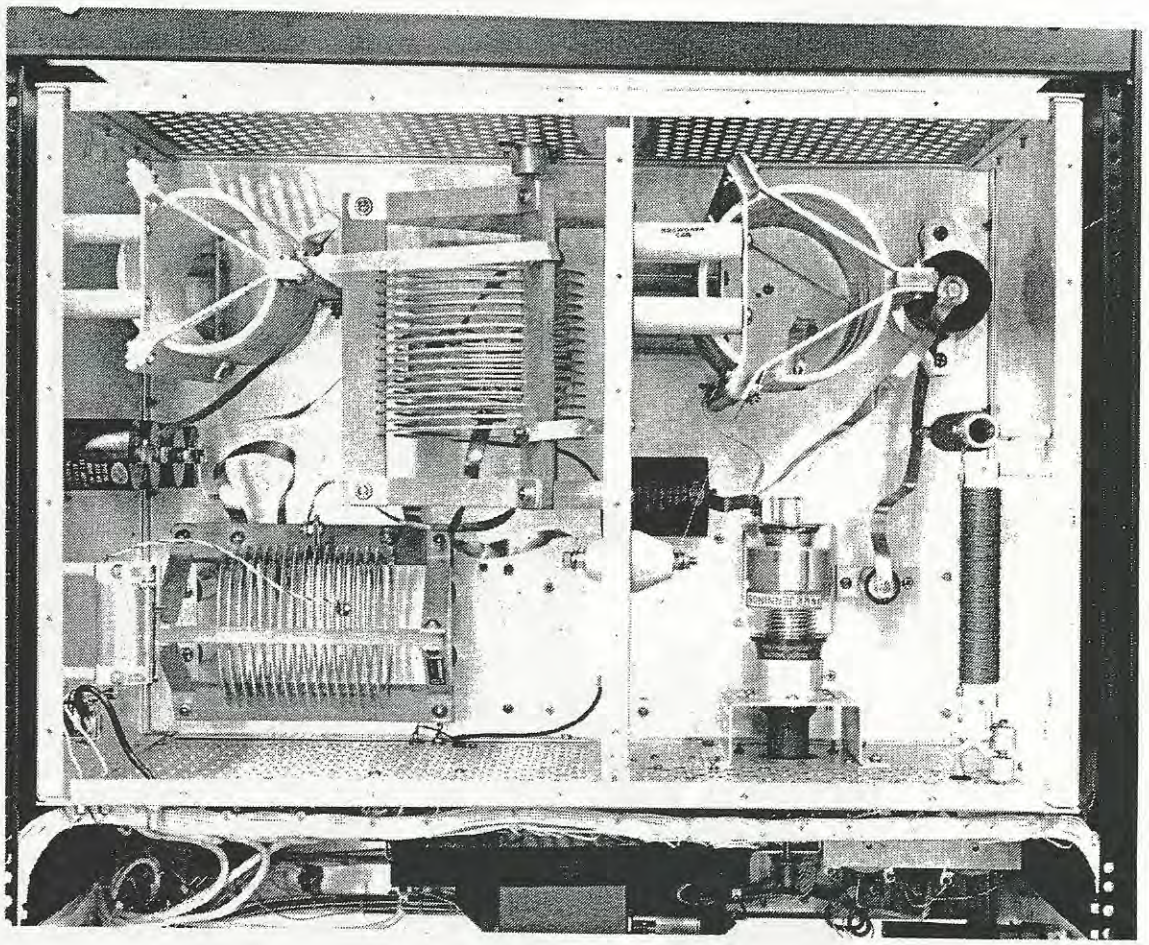


Figure 6-4. RF Output Network.

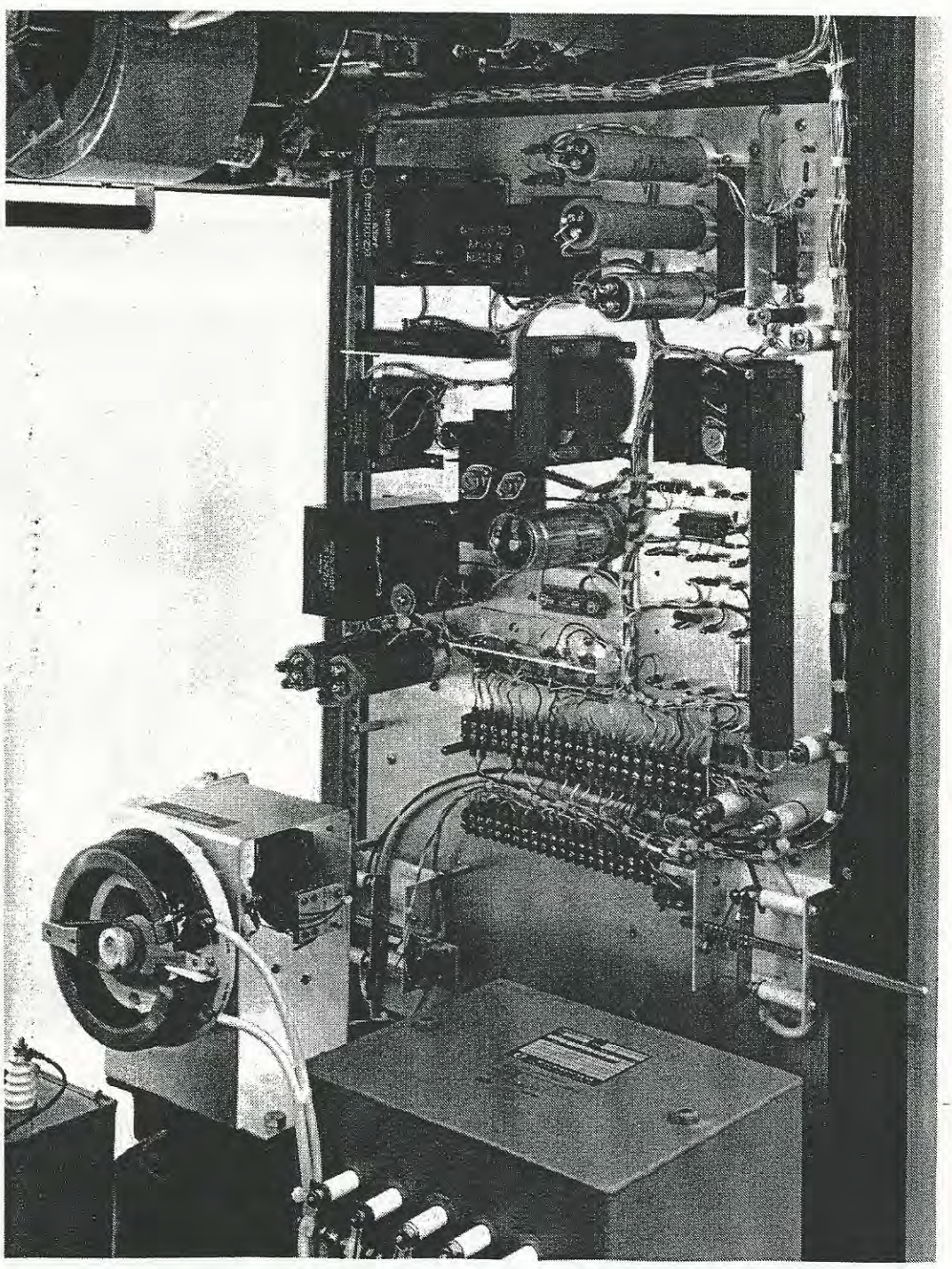


Figure 6-5. Low Voltage Power Supply Assembly A2.

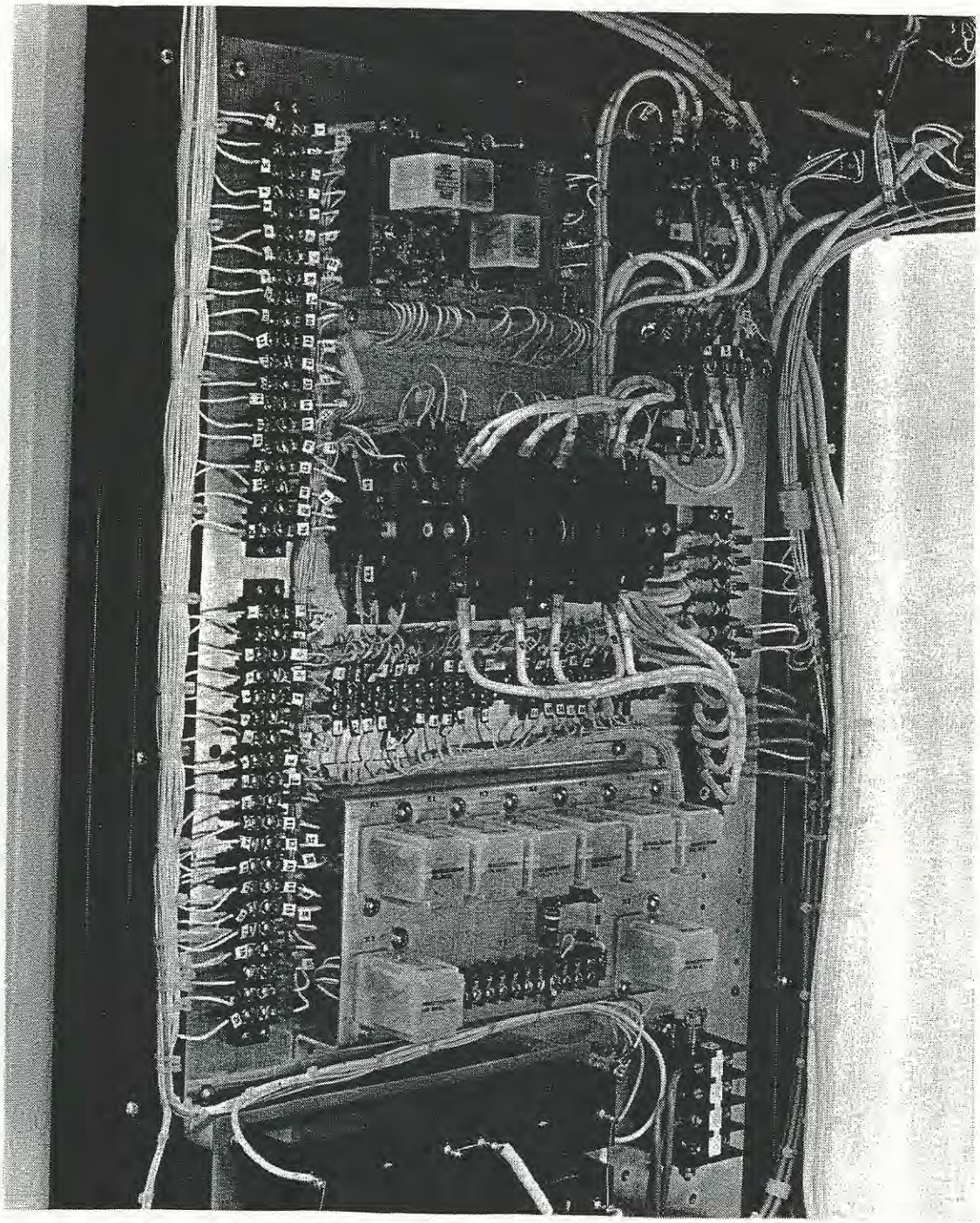


Figure 6-6. Control Circuits Assembly A3.

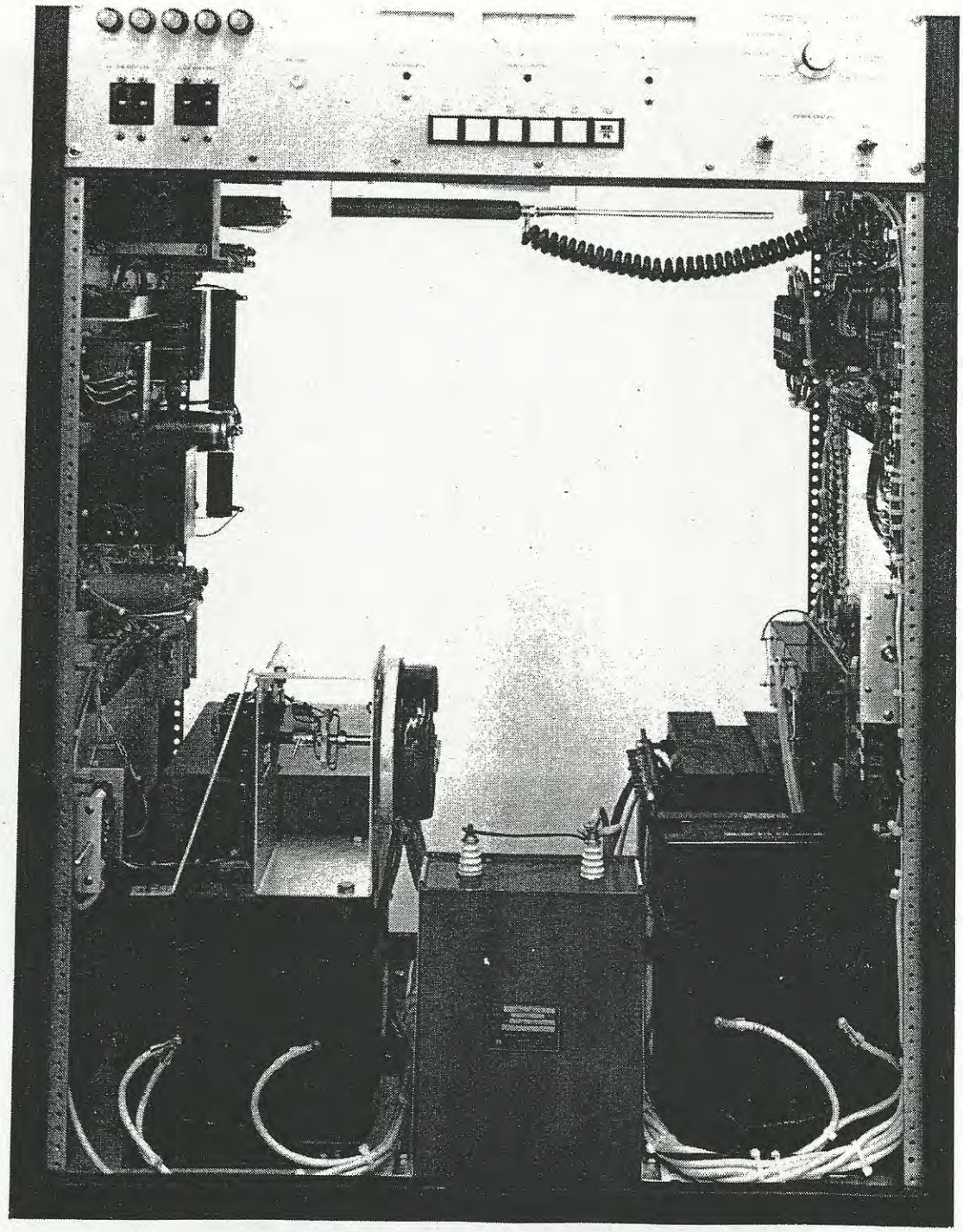


Figure 6-7. High Voltage Power Supply A5.

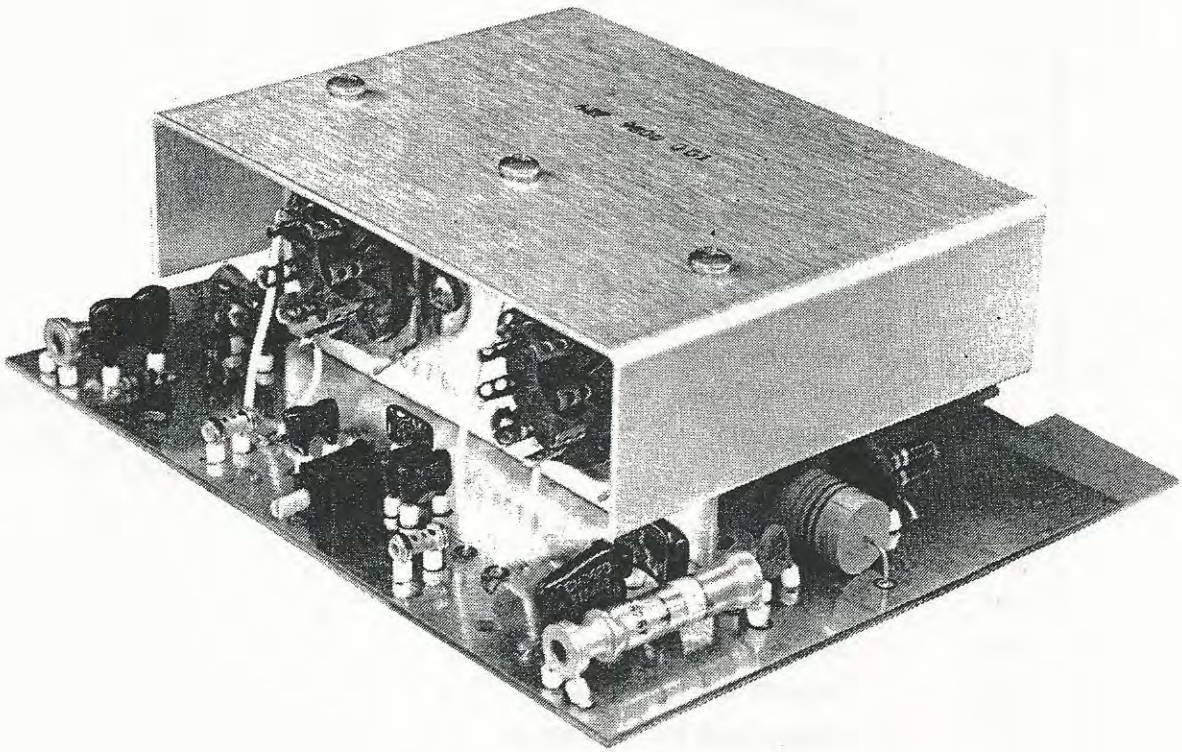


Figure 6-8. Oscillator Card A1A3.

parts list

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY:	A1 - TUBE COMPARTMENT			
A1A1	Audio Driver Circuit Board			627-6621-001
A1A2	RF Driver Circuit Board			627-6637-001
A1A3	Oscillator Circuit Board			627-6608-001
A1A4	Meter/Feedback Circuit Board			627-6568-001
B1	Blower			009-0209-000
C1	Capacitor	0.01µf	1.6 KV	913-3522-000
C2	Same As C1			
C3	Capacitor	1000 PF	5 KV	913-0101-000
C4	Capacitor	25 PF	10 KV	913-5113-020
C5	Capacitor	1000 PF	500 V	913-1292-000
C6	Same As C3			
C7	Same As C1			
C8	Same As C1			
C9	Same As C5			
C10	Capacitor	750 PF	10 KV	912-4126-130
C11	Capacitor	500 PF	Vacuum Variable	919-0129-000
C12	Determined by Frequency			
C13	Determined by Frequency			
C14	Determined by Frequency			
C15	Determined by Frequency			
C16	Determined by Frequency			
C17	Determined by Frequency			
C18	Capacitor	330 PF	500 V	912-2852-000
C19	Same As C18			
C20 THROUGH C27	Same as C5			
C28	Same As C1			
C29	Same As C1			
C30	Same As C3			

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
C31	Same as C1			
C32	Same As C1			
C33	Same as C3			
C34	Same As C3			
C35	Same As C3			
C36	Capacitor	0.1 µf	600 V	241-0006-000
C37 THROUGH C43	Same As C37			
C44	Capacitor	1000 PF	2000 V	913-3120-020
C45	Capacitor	1500 PF	500 V	912-2741-000
C46	Not Used			
C47	Capacitor Var	13-320 PF		922-1400-000
CR1	Diode	1N4003		353-6442-030
CR2	Same As CR1			
J1	Connector Output			357-9385-000
J2	Connector Mod Mon			357-9112-000
J3	Connector Freq Mon			356-9112-000
K1	Relay			970-2437-080
K2	Same As K1			
L1	Inductor	10 MHY		240-2720-010
L2	Inductor	2.5 MHY		571-0460-100
L3	Same As L2			
L4	Inductor	120 µHY		980-0048-000
L5	Inductor	22 µHY		980-0133-000
L6	Inductor	82 µHY		980-0047-000
L7	Inductor	15 µHY		980-0132-000
L8	Inductor	17 MHY		549-5099-004
R1	Resistor	47	2 W	745-5596-000
R2	Resistor	2 K	25 W	710-4777-000
R3	Same As R2			
R4	Resistor	47	2 W	745-5596-000

parts list

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
R5	Same As R4			
R6	Same As R4			
R7	Resistor Var	50	75 W	735-0363-100
R8	Same As R7			
R9	Resistor	1	14 W	710-5076-010
R10	Resistor	2.5 K	55 W	710-3374-000
R11	Resistor	10	3 W	747-5320-000
R12	Resistor	82 K	210 W	746-6837-000
R13	Resistor Var	5 K	2 W	380-5793-000
R14	Same As R13			
R15	Resistor Var	10 K	2 W	380-5782-000
R16	Same As R15			
R17	Same As R15			
S1	Switch			260-0025-000
T1	Transformer, Filament			662-0361-010
T2	Same As T1			
TB1-A	Terminal Board			367-4200-000
TB1-B	Same As TB1-A			
TB2	Terminal Board			367-4030-000
V1	Tube	5-500 A		257-0600-020
V2	Same As V1			
V3	Same As V1			
V4	Same As V1			
XV1	Socket Tube			220-1016-000
XV2	Same As XV1			
XV3	Same As XV1			
XV4	Same As XV1			
YV1	Chimney, Tube	SK 406		192-1024-000
YV2	Same As YV1			
YV3	Same As YV1			
YV4	Same As YV1			
	Clip, Tube			192-1006-010

SYMBOL	DESCRIPTION	COLLINS PART NUMBER
Z1	Parasitic Suppressor	762-8820-001
Z2	Parasitic Suppressor	762-8820-001

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
RF OUTPUT	NETWORK FREQUENCY DETERMINING PARTS			
*C12/13	Capacitor	430 PF	10 KV	912-4126-150
	Capacitor	390 PF	10 KV	912-4126-110
	Capacitor	240 PF	10 KV	912-4126-100
	Capacitor	180 PF	10 KV	912-4126-090
*C14/C15 *C16/C17	Capacitor	3900 PF	6 KV	912-4140-180
	Capacitor	3000 PF	6 KV	912-4140-170
	Capacitor	2400 PF	6 KV	912-4140-160
	Capacitor	2000 PF	6 KV	912-4140-150
	Capacitor	1600 PF	6 KV	912-4140-140

* Select values from Table 1. below.

TABLE 1. OUTPUT NETWORK CAPACITOR VALUES

FREQUENCY	C12	C13	C14	C15	C16	C17
540-700	390 or 430 PF	240 PF	3900 PF	3900 PF	3900 PF	3900 PF
710-920	430 PF	NONE	3000 PF	3000 PF	3000 PF	3000 PF
930-1150	240 PF	NONE	2400 PF	2400 PF	2400 PF	2400 PF
1160-1380	180 PF	NONE	2000 PF	2000 PF	2000 PF	2000 PF
1390-1600	NONE	NONE	1600 PF	1600 PF	1600 PF	1600 PF

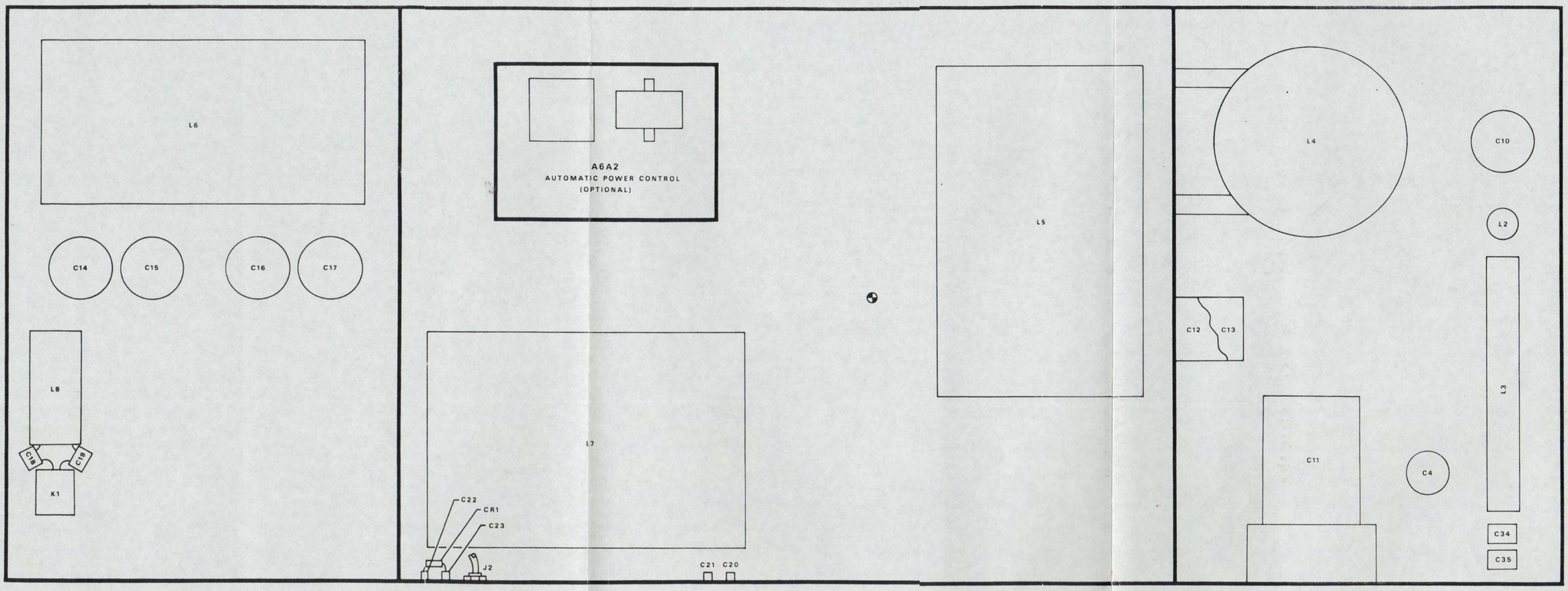


Figure 6-9. RF (Tube) Compartment A1
(Sheet 1 of 3).

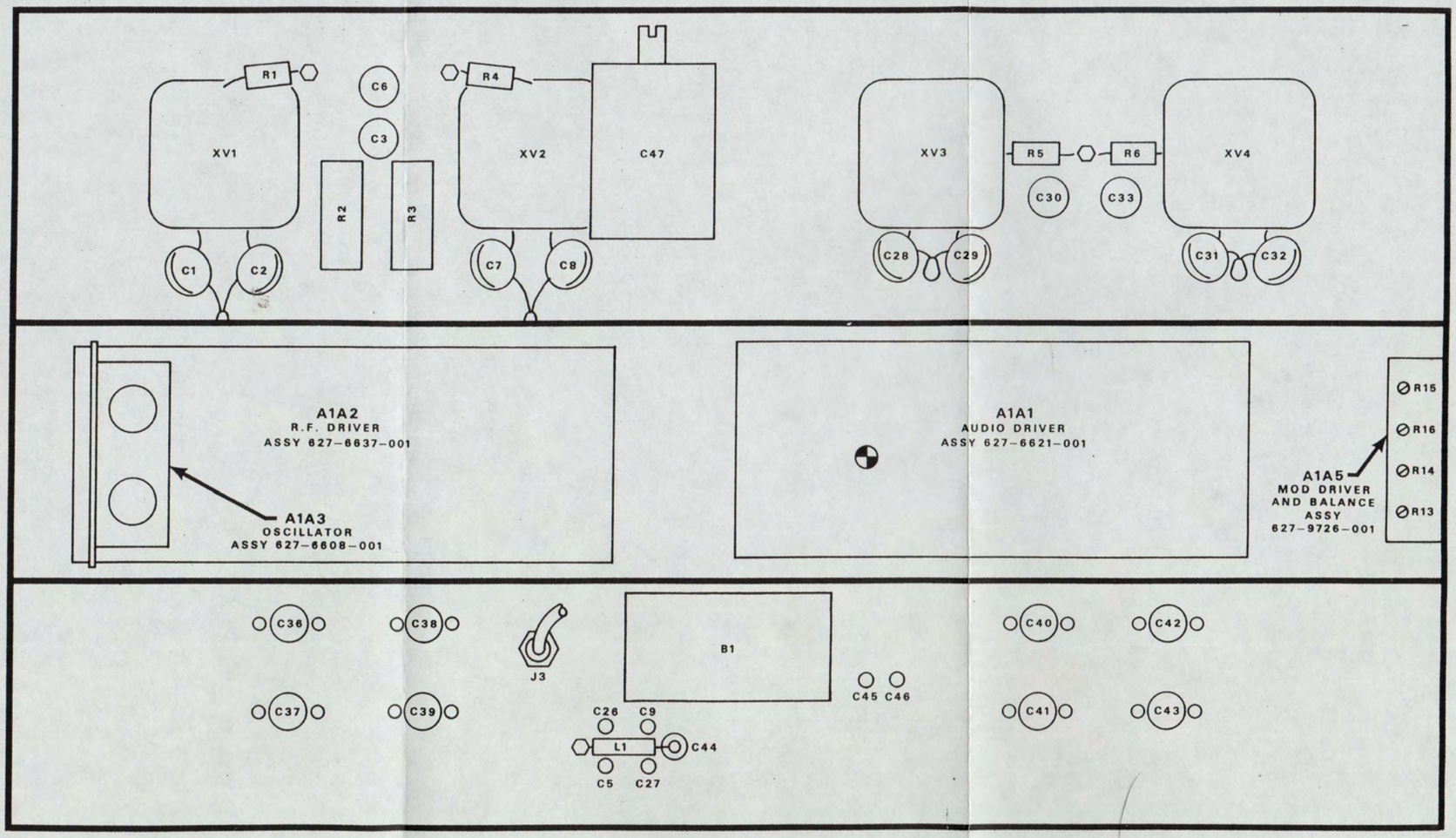
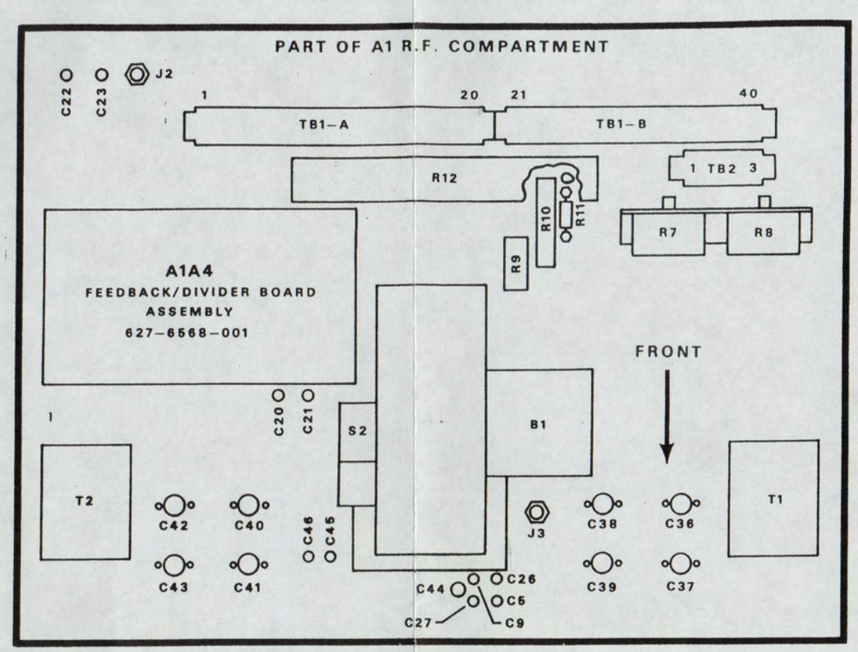


Figure 6-9. RF (Tube) Compartment A1 (Sheet 2 of 3).



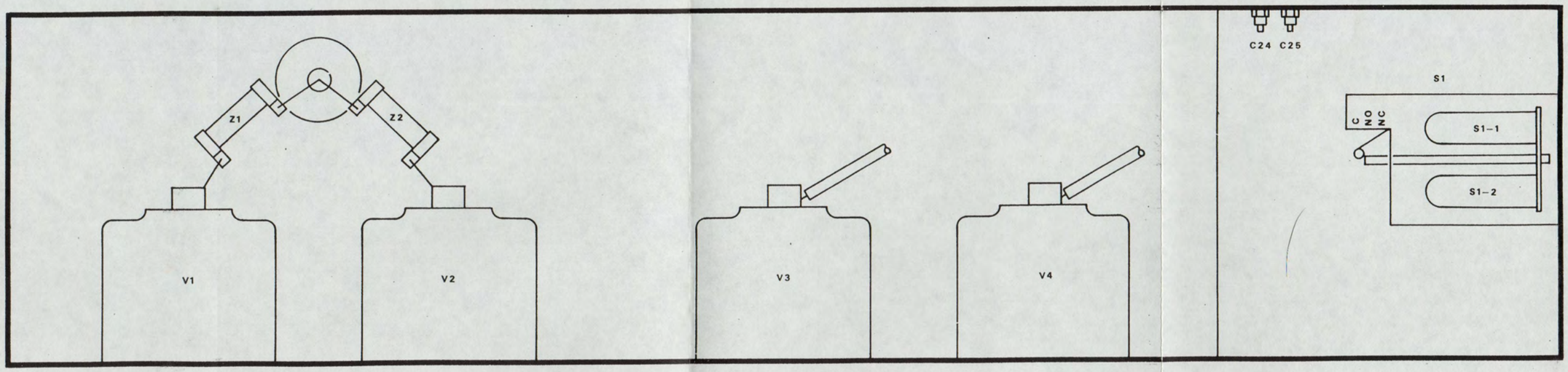


Figure 6-9. RF (Tube) Compartment A1 (Sheet 3 of 3).

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY:	A1A1 - AUDIO DRIVER CARD			
C1	Capacitor	20000µf	500 V	912-2747-000
C2	Capacitor	2.2µf	25 V	913-3812-000
C3	Same As C1			
C4	Same as C2			
C5	Capacitor	25µf	50 V	184-8677-000
C6	Same As C1			
C7	Same As C1			
C8	Same As C5			
C9	Capacitor	120 PF	500 V	912-2822-000
C10	Same As C9			
C11	Capacitor	2µf	600 V	951-1071-000
C12	Capacitor	.33µf	600 V	951-1066-000
C13	Capacitor	3µf	200 V	951-1045-000
C14	Same As C13			
C15	Same As C12			
C16	Same As C2			
C17	Same As C2			
CR1	Diode	1N4003		353-6442-030
K1	Relay			970-2420-040
Q1	Transistor	2N3053		352-0613-010
Q2	Same As Q1			
Q3	Transistor	2N3585		352-0711-030
Q4	Same As Q3			
R1	Resistor	180	1/4 W	745-0722-000
R2	Same As R1			
R3	Same As R1			
R4	Same As R1			
R5	Resistor	330	1/4 W	745-0731-000
R6	Resistor (250W Operation)	160	1/4 W	745-0720-000
R6	Resistor (500W Operation)	100	1/4 W	745-0712-000
R7	Same As R6			

parts list

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
R8	Resistor (250W Operation)	~~1 K~~ 680	1/4 W	745-0748-000
R8	Resistor (500W Operation)	1.8 K	1/4 W	745-0757-000
R9	Not Used			
R10	Resistor	10 K	1/4 W	745-0785-000
R11	Not Used			
R12	Same As R10			
R13	Resistor	1.2 K	1/4 W	745-0752-000
R14	Resistor	2.2 K	1/4 W	745-0761-000
R15	Resistor	47 K	1/4 W	745-0809-000
R16	Same As R14			
R17	Same As R15			
R18	Same As R13			
R19	Resistor	120	1/4 W	745-0716-000
R20	Same As R19			
R21	Resistor	3.9 K	1/4 W	745-0770-000
R22	Not Used			
R23	Resistor	4.7 K	1/4 W	745-0773-000
R24	Resistor	270 K	1/2 W	745-1454-000
R25	Resistor	510	1/2 W	745-1864-420
R26	Same As R21			
R27	Not Used			
R28	Same As R23			
R29	Same As R24			
R30	Same As R25			
R31	Resistor	15 K	2 W	745-5701-000
R32	Same As R31			
R33	Resistor	100 K	1 W	745-3436-000
R34	Resistor	47	1 W	745-3296-000
R35	Resistor	2.7 K	1 W	745-3370-000
R36	Same As R33			
R37	Same As R34			
T1	Transformer, Audio Input			667-0187-030

SYMBOL	DESCRIPTION	COLLINS PART NUMBER
TB1	Terminal Board	367-0812-140
TB2	Terminal Board	367-0812-100
XK1	Socket, Relay	220-0027-010
XQ3	Socket, Transistor	220-0965-020
XQ4	Same As XQ3	

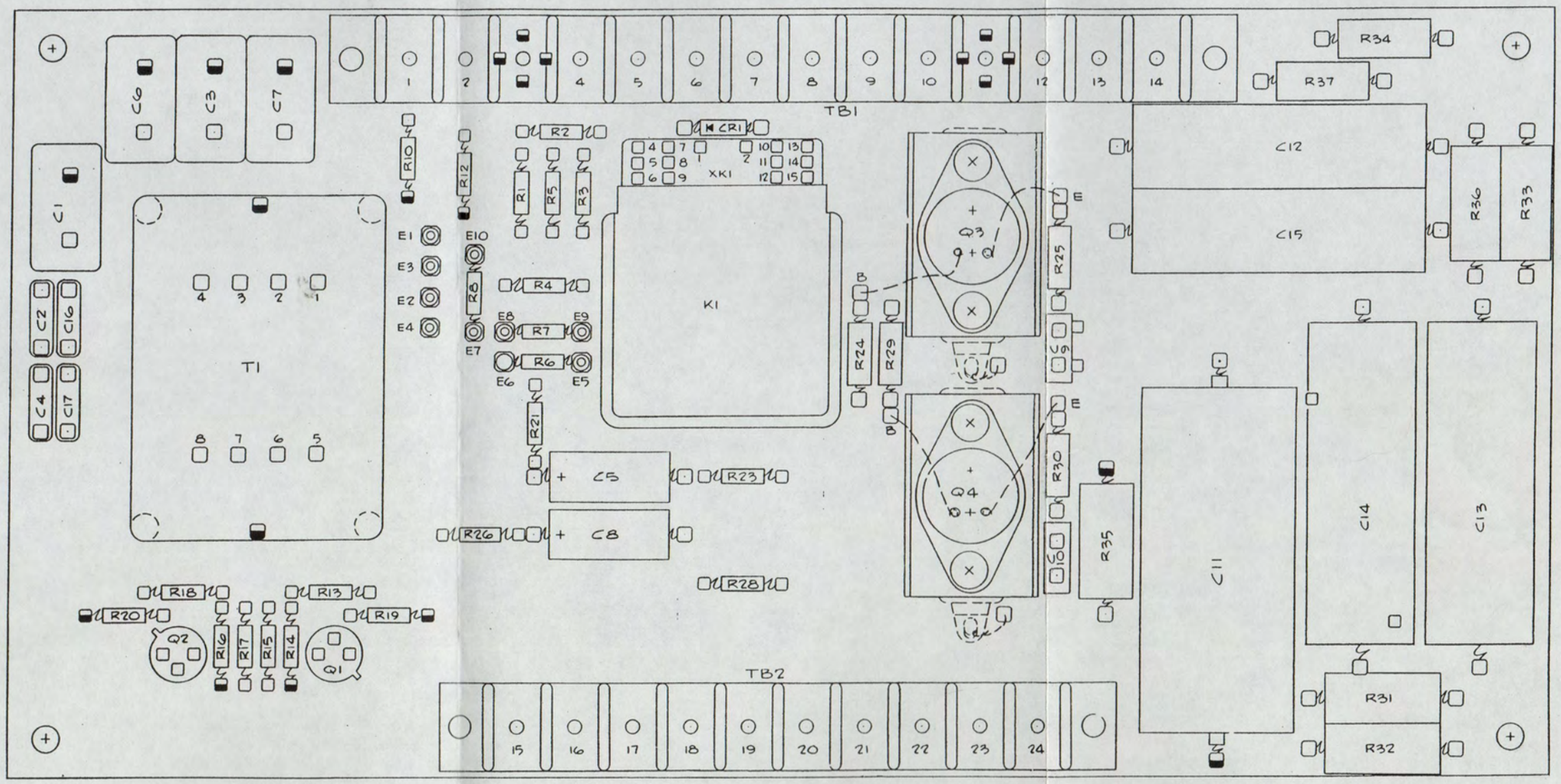


Figure 6-10. Audio Driver Assembly A1A1.

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY: A1A2 - RF DRIVER CARD				
C1	Capacitor	0.1µf	500 V	913-3681-000
C2 THROUGH C9	Same As C1			
C10	Capacitor	1.0µf	200 V	933-1059-050
C11	Capacitor	200 PF	1000 V	912-4143-020
C12	Capacitor	200 PF	1 KV	912-4143-030
C13	Capacitor	390 PF	1 KV	912-4143-050
C14	Capacitor	820 PF	1 KV	912-4143-010
C15	Capacitor	1500 PF	1 KV	912-4143-170
C16	Same as C15			
C17	Not Used			
C18	Capacitor	5600 PF	500 V	912-2717-000
C19	Capacitor	10,000 PF	500 V	912-3068-000
C20	Capacitor	1000 PF	500 V	912-3001-000
C21	Not Used			
C22	Same As C10			
C23	Capacitor	300 PF	500 V	912-2849-000
CR1	Diode	1N914		353-2906-000
CR2	Same As CR1			
CR3	Same As CR1			
CR4	Same As CR1			
CR5	Diode	1N5615		353-6496-020
J1	Connector			372-2425-010
J2	Same As J1			
L1	Inductor	150µHY		240-0760-000
L2	Inductor	10 MHY		240-2720-010
Q1	Transistor	2N2102		352-0646-010
Q2	Same As Q1			
Q3	Transistor	2N5039		352-0749-040

parts list

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
R1	Resistor	1 K	1/4 W	745-0749-000
R2	Resistor	10	1/2 W	745-1268-000
R3	Resistor	2.2 K	1/4 W	745-0761-000
R4	Resistor	3.9 K	1/4 W	745-0770-000
R5	Same As R1			
R6	Same As R2			
R7	Same As R2			
R8	Resistor	10	1 W	745-3268-000
R9	Resistor	47	1 W	745-3296-000
R10	Resistor	270	2 W	745-5628-000
R11	Resistor	18	2 W	745-5579-000
R12	Same As R10			
R13	Resistor	22	2 W	745-5582-000
R14	Resistor	0.5	10 W	747-8587-000
R15	Resistor	220	1 W	745-3324-000
R16	Same As R8			
R17	Resistor	100	2 W	745-5610-000
R18	Resistor	0.68	6.5 W	747-5555-000
T1	Transformer RF Coupling			758-0328-002
T2	Transformer RF Driver			771-9118-001
TB1-A	Board Terminal			367-0812-040
TB1-B	Board Terminal			367-0812-070
XQ3	Socket, Transistor			220-0968-010

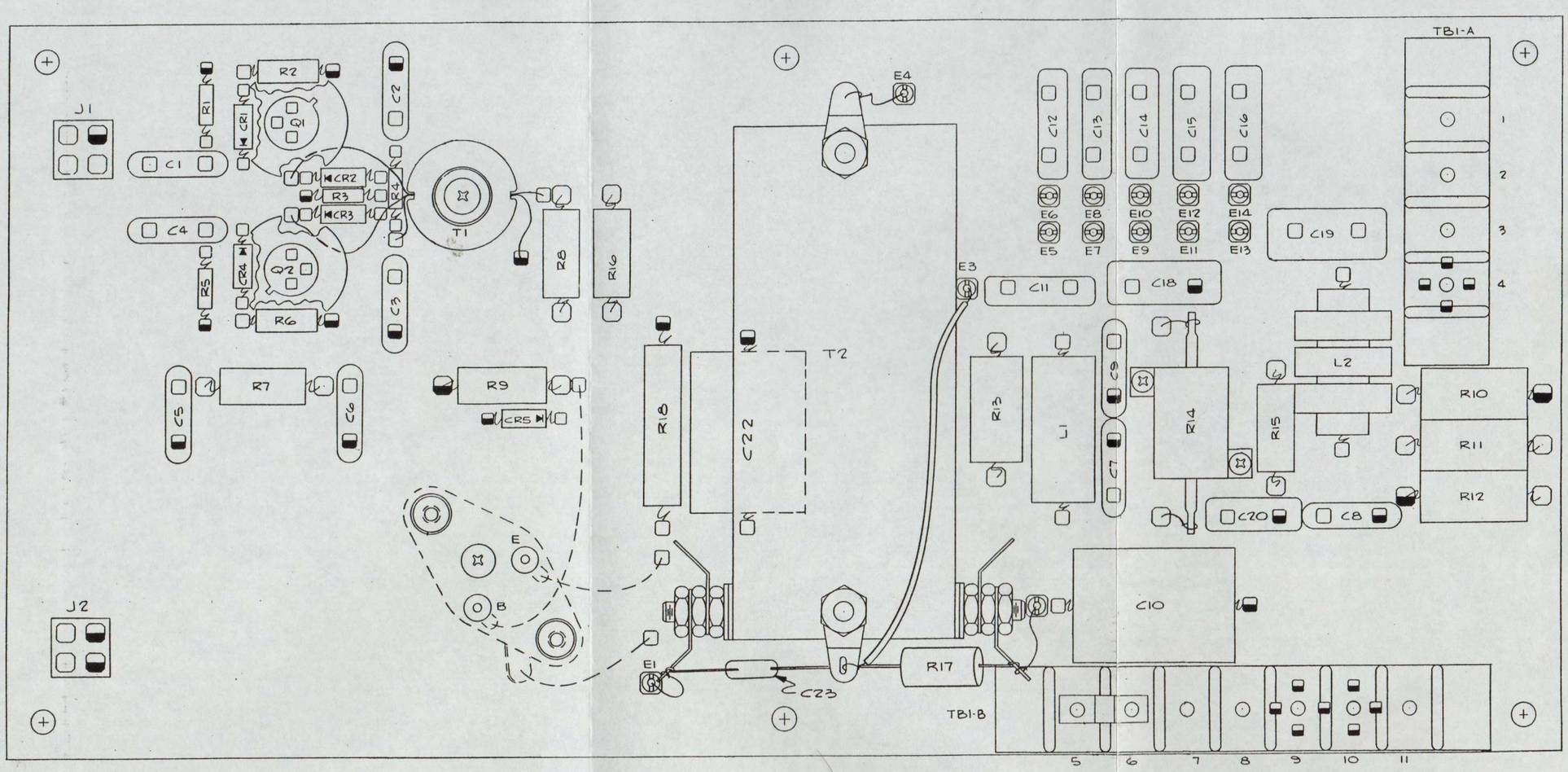


Figure 6-11. RF Driver Assembly A1A2.

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY:	A1A3 - OSCILLATOR CARD			
C1	Capacitor Var	1-60 PF		922-0609-000
C2	Not Used			
C3	Capacitor	15 PF	500 V	916-0671-000
C4	Capacitor	2200 PF	500 V	913-3011-000
C5	Capacitor	510 PF	500 V	912-2980-000
C6	Same As C5			
C7	Capacitor	.01µf	500 V	913-3013-000
C8	Capacitor	100 PF	500 V	912-2816-000
C9	Same As C1			
C10	Not Used			
C11	Same As C3			
C12	Same As C4			
C13	Same As C5			
C14	Same As C5			
C15	Same As C7			
C16	Same As C8			
C17	Same As C8			
C18	Same As C8			
C19	Same As C4			
C20	Same As C4			
C21	Capacitor	0.1µf	25 V	913-3806-000
C22	Same As C21			
C23	Capacitor	33 PF	500 V	912-2780-000
C24	Capacitor	10 PF	500 V	912-2754-000
C25	Same As C24			
L1	Inductor	10 MHY		240-0844-000
L2	Same As L1			
Q1	Transistor	2N3564		352-0631-010
Q2	Same As Q1			
Q3	Same As Q1			

parts list

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
R1	Resistor	22 K	1/4 W	745-0797-000
R2	Resistor	6.8 K	1/4 W	745-0779-000
R3	Resistor	10 K	1/4 W	745-0785-000
R4	Resistor	1.2 K	1/2 W	745-1356-000
R5	Resistor	5.6 K	1/4 W	745-0776-000
R6	Same As R1			
R7	Same As R2			
R8	Same As R3			
R9	Same As R4			
R10	Same As R5			
R11	Resistor	39 K	1/4 W	745-0806-000
R12	Same As R3			
R13	Same As R3			
R14	Resistor	2.2 K	1/4 W	745-0761-000
R15	Same As R14			
R16	Resistor	330	6.5 W	747-5525-000
R17	Resistor Var	10 K		380-3761-070
R18	Same As R5			
S1	Switch			266-7511-010
U1	Integrated Circuit	SN7473N		351-7640-010
U2	Integrated Circuit	SN74121N		351-7645-010
VR1	Zener Diode	1N4742A		353-6481-290
VR2	Same As VR1			
VR3	Zener Diode	IN4733A		353-6481-110
XY1	Socket, Crystal			220-1121-000
XY2	Same As XY1			

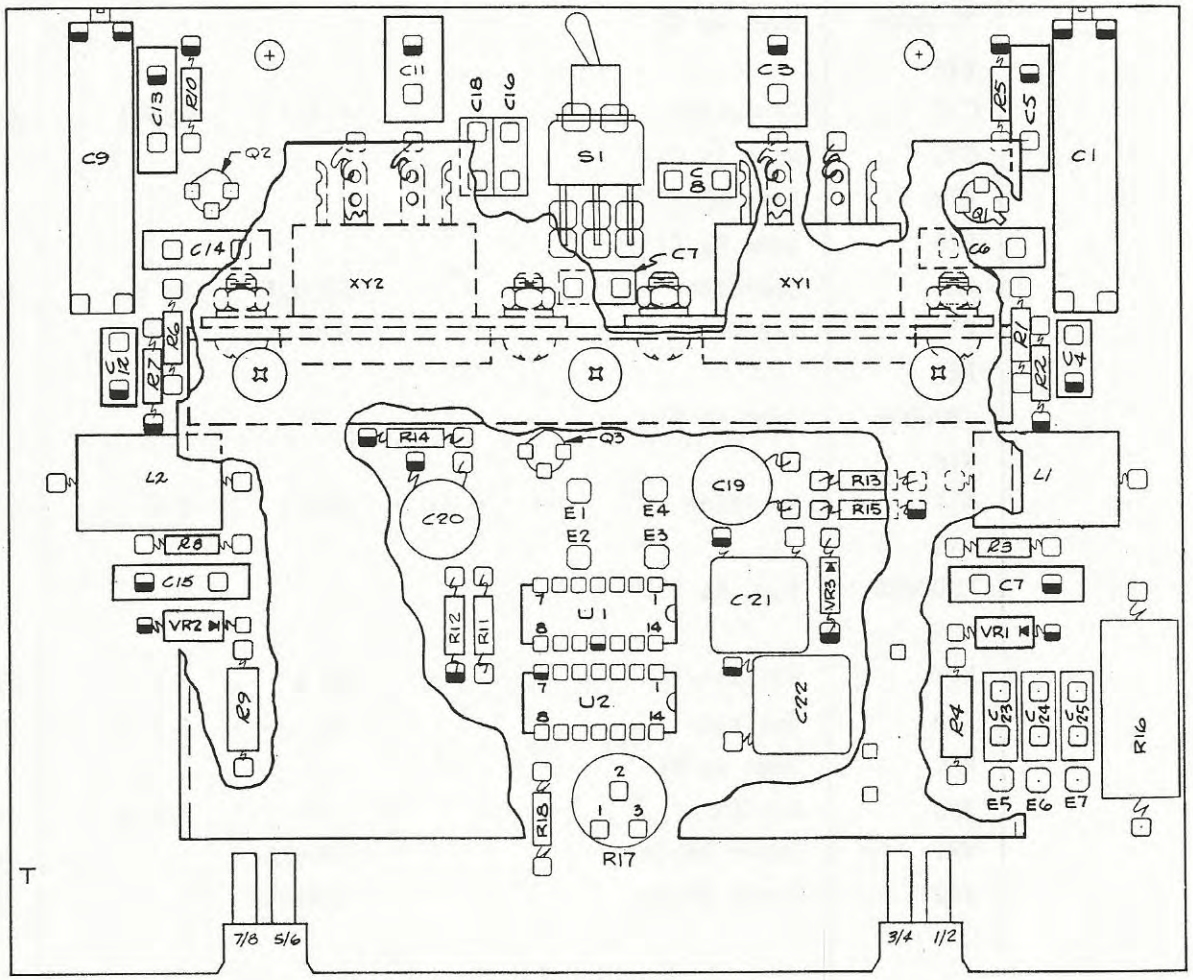


Figure 6-12. Oscillator Assembly A1A3.

SYMBOL	DESCRIPTION				COLLINS PART NUMBER
ASSEMBLY:	A1A4 - METER/FEEDBACK CARD				
C1	Capacitor		100 PF	500 V	912-2816-000
C2 THROUGH C16	Same As C1				
C17	Capacitor		0.1µf	500 V	913-3681-000
C18	Same As C17				
C19	Same As C17				
C20	Same As C17				
C21	Capacitor		1000µf	50 V	183-1282-140
R1	Resistor		820 K	1 W	745-3475-000
R2 THROUGH R16	Same As R1				
R17	Resistor	1%	200 K	2 W	705-1493-050
R18 THROUGH R26	Same As R17				
R27	Resistor		10 K	2 W	745-5694-000
R28	Resistor		12	6.5 W	747-5422-000
R29	Same As R28				
R30	Resistor		1 K	1/2 W	745-1352-000
VR1	Zener Diode		1N967A		353-3236-000
VR2	Zener Diode		1N4740A		353-6481-250

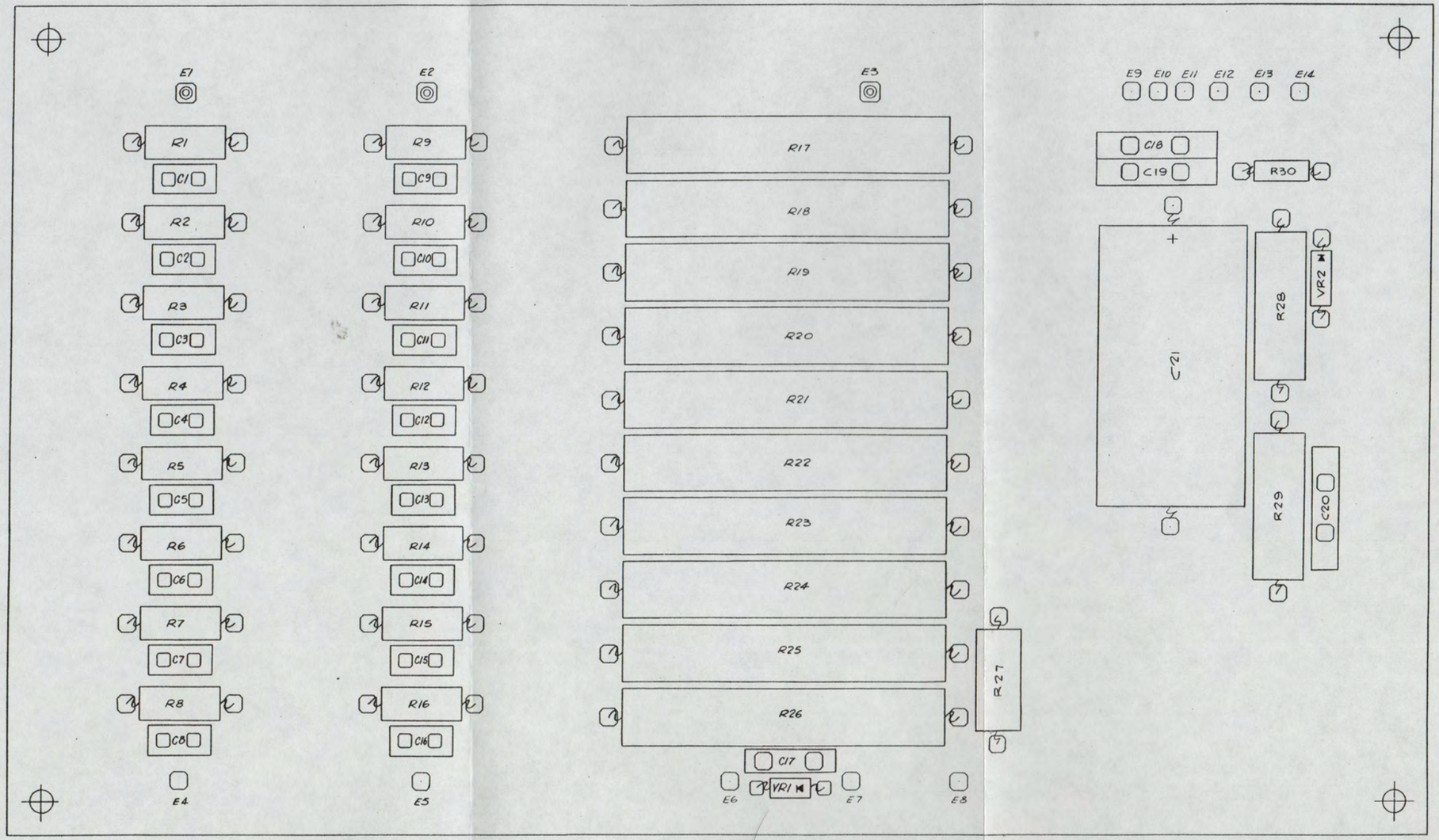


Figure 6-13. Feedback/Divider (Meter/Feedback) Board Assembly A1A4.

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY: A2 - LOW VOLTAGE POWER SUPPLY				
C1	Capacitor	.05µf	500 V	913-3153-000
C2	Capacitor	140µf	450 V	183-1278-530
C3	Same As C2			
C4	Capacitor	200µf	350 V	184-2540-000
C5	Same As C1			
C6	Capacitor	750µf	200 V	183-1297-060
C7	Capacitor	3900µf	50 V	183-1278-370
C8	Capacitor	100µf	50 V	183-1281-080
C9	Same As C7			
C10	Capacitor	0.1µf	200 V	913-3681-000
C11	Not Used			
C12	Same As C10			
CR1	Diode	5PF30		353-3655-020
CR2	Diode	6RS21SA15D15		353-0418-010
CR3	Diode	5CBR8		353-0420-060
CR4	Diode	6RS20AP5B2		353-6504-010
CR5	Diode	1N4384		353-6467-020
CR6	Diode	1N1184		353-6023-000
CR7	Same As CR6			
CR8	Same As CR6			
CR9	Same As CR6			
CR10	Diode	1N5552		353-3718-060
CR11	Same As CR10			
CR12	Same As CR10			
CR13	Same As CR10			
E1	Standoff Insulator			190-0025-000
E2	Same As E1			
E3	Terminal			306-0976-000
E4 THROUGH E39	Same As E3			

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parts list

SYMBOL	DESCRIPTION				COLLINS PART NUMBER
F1	Fuse		3ASB		264-0306-000
L1	Inductor		8 HY@265 mA DC 10 VRMS 60CPS		668-0155-020
L2	Inductor		10 HY		668-0156-010
Q1	Transistor		2N3054		352-0581-010
Q2	Transistor		2N3772		352-0690-020
R1	Resistor		180	2 W	745-5621-000
R2	Same As R1				
R3	Resistor		5.6 K	55 W	747-2762-000
R4	Resistor		15 K	25 W	710-3139-470
R5	Resistor		1.5 K	11 W	746-6161-000
R6	Resistor	1%	750 K	2 W	705-1493-020
R7	Resistor		1.54 K	1/2 W	705-7105-000
R8	Resistor		3 K	210 W	746-6811-000
R9	Resistor		47	2 W	745-5596-000
R10	Resistor	1%	150 K	1/2 W	705-7272-000
R11	Same As R7				
R12	Resistor		10	3 W	747-5320-000
R13	Resistor		4	100 W	710-5076-060
R14	Resistor		330	6.5 W	747-5525-000
R15	Resistor		0.12	3 W	747-5117-000
R16	Resistor		150	1/2 W	745-1317-000
R17	Resistor	1%	28.7 K	1/2 W	705-7166-000
R18	Same As R12				
R19	Not Used				
R20	Resistor	1%	200 K	2 W	705-7314-000
R21	Resistor	1%	3.01 K	1/2 W	705-7119-000
S7	Switch, Interlock				627-9743-002
S3	Same As S7				
T1	Transformer, Screen Pwr Supply				662-0316-020
T2	Transformer, Bias Pwr Supply				662-0348-020
T3	Transformer, Control Pwr Supply				662-0290-020
TB1	Terminal Board				367-4200-000

SYMBOL	DESCRIPTION		COLLINS PART NUMBER
TB2	Terminal Board		367-0131-000
VR1	Zener Diode	1N2842B	353-1447-000
VR2	Zener Diode	1N2844B	353-1443-000
VR3	Zener Diode	1N2989B	353-1369-000
XF1	Socket, Fuse		265-1265-010
XQ1	Socket, Transistor		220-0968-020
XQ2	Socket, Transistor		220-0966-010

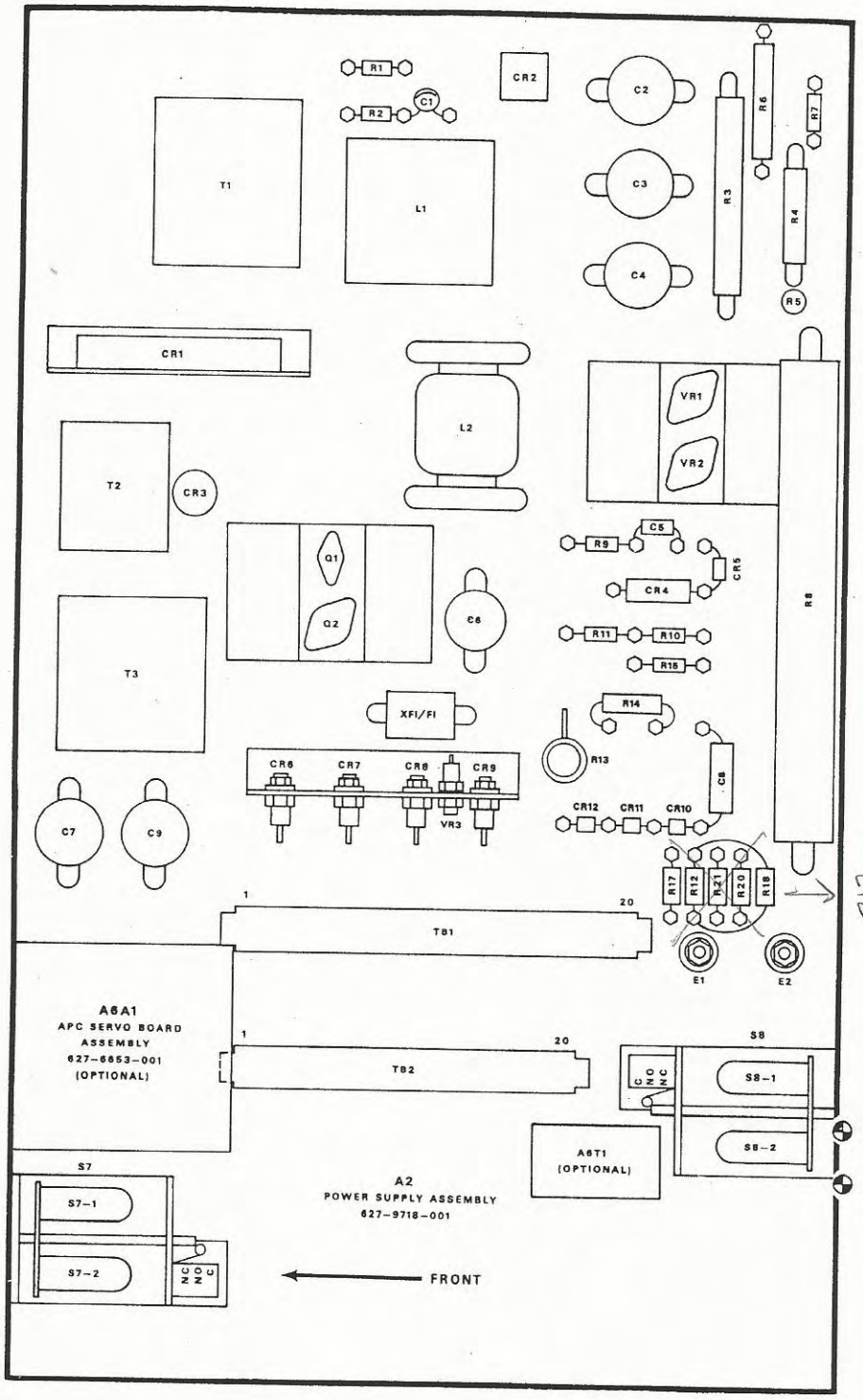


Figure 6-14. Low Voltage Power Supply Assembly A2.

SYMBOL	DESCRIPTION		COLLINS PART NUMBER
ASSEMBLY:	A3 - CONTROL CIRCUITS		
A3A1	Control Circuit Board		627-6564-001
CR1	Diode	1N4003	353-6442-030
CR2	Same As CR1		
CR3	Same As CR1		
CR4	Same As CR1		
CR5	Diode HV Rectifier		353-0413-010
CR6	Same As CR5		
CR7	Same As CR5		
CR8	Same As CR5		
K1	Relay, Blower		970-2426-070
K2	Relay, Filament		970-2426-070
K3	Relay, HV Contactor		401-0015-010
TB1	Terminal Board		367-4200-000
TB2A	Terminal Board		367-0124-000
TB2B	Same As TB2A		
TB3	Terminal Board		367-5120-000
TB4	Same As TB1		
TB5	Terminal Board		367-4040-000
TB6	Terminal Board		306-0778-000

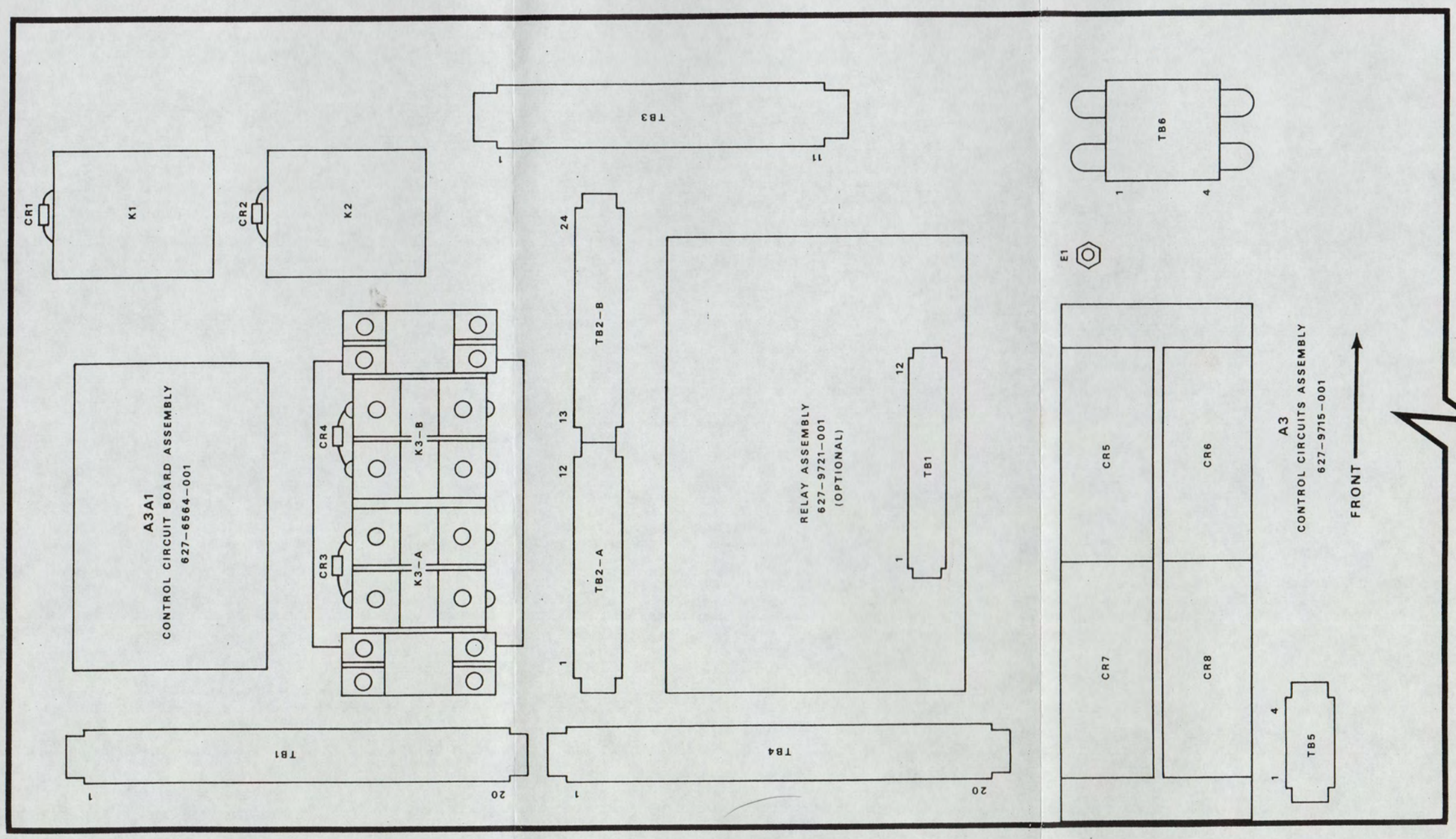


Figure 6-15. Control Circuits Assembly A3.

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY: A3A1 - CONTROL CIRCUIT BOARD				
C1	Capacitor	100µf	50 V	183-1281-080
C2	Capacitor	0.1µf	25 V	913-3806-000
C3	Same As C1			
C4	Same As C2			
C5	Same As C2			
C6	Same As C1			
C7 THROUGH C10	Same As C2			
C11	Capacitor	1000µf	50 V	183-1282-140
CR1	Diode	1N4003		353-6442-030
CR2 THROUGH CR8	Same As CR1			
CR9	Diode	1N1202A		353-1889-000
CR10	Same As CR9			
K1	Relay, PA Overload			970-0002-030
K2	Relay, Mod Overload			970-0002-030
K3	Relay, Overload Lockout			970-0002-030
Q1	Transistor	2N3053		352-0613-010
Q2	Same As Q1			
Q3	SCR	C6F		353-6468-010
Q4	Same As Q1			
Q5	Same As Q3			
Q6	Same As Q3			
Q7	SCR	2N1771A		353-1989-000
Q8	Same As Q7			
R1	Resistor	47	1/2 W	745-1296-000
R2	Resistor	2.2 K	1/2 W	745-1366-000
R3	Resistor	1 K	1/2 W	745-1352-000

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
R4	Resistor	470	1/2 W	745-1338-000
R5	Same As R4			
R6	Resistor Var	500		380-3761-180
R7	Resistor	270	1/2 W	745-1328-000
R8	Same As R1			
R9	Same As R2			
R10	Same As R3			
R11	Same As R4			
R12	Same As R4			
R13	Same As R6			
R14	Same As R7			
R15	Resistor	10	1/2 W	745-1268-000
R16	Resistor	27	1/2 W	745-1286-000
R17	Same As R3			
R18	Same As R2			
R19	Same As R4			
R20	Resistor	47 K	1/2 W	745-1422-000
R21	Same As R20			
R22	Same As R4			
R23	Resistor	4.7 K	1/2 W	745-1380-000
R24	Resistor	100	1/2 W	745-1310-000
R25	Same As R4			
R26	Same As R23			
R27	Same As R24			
R28	Same As R3			
R29	Same As R3			
R30	Resistor	1 K	3 W	745-3352-000
R31	Same As R30			
R32	Same As R3			
R33	Resistor	1 K	1/2 W	745-1352-000
R34 THROUGH	Same As R24			

SYMBOL	DESCRIPTION		COLLINS PART NUMBER
R37			
VR1	Zener Diode	1N4733A	353-6481-110
VR2	Same As VR1		
VR3	Same As VR1		
XK1	Socket, Relay		220-1582-010
XK2	Same As XK1		
XK3	Same As XK1		

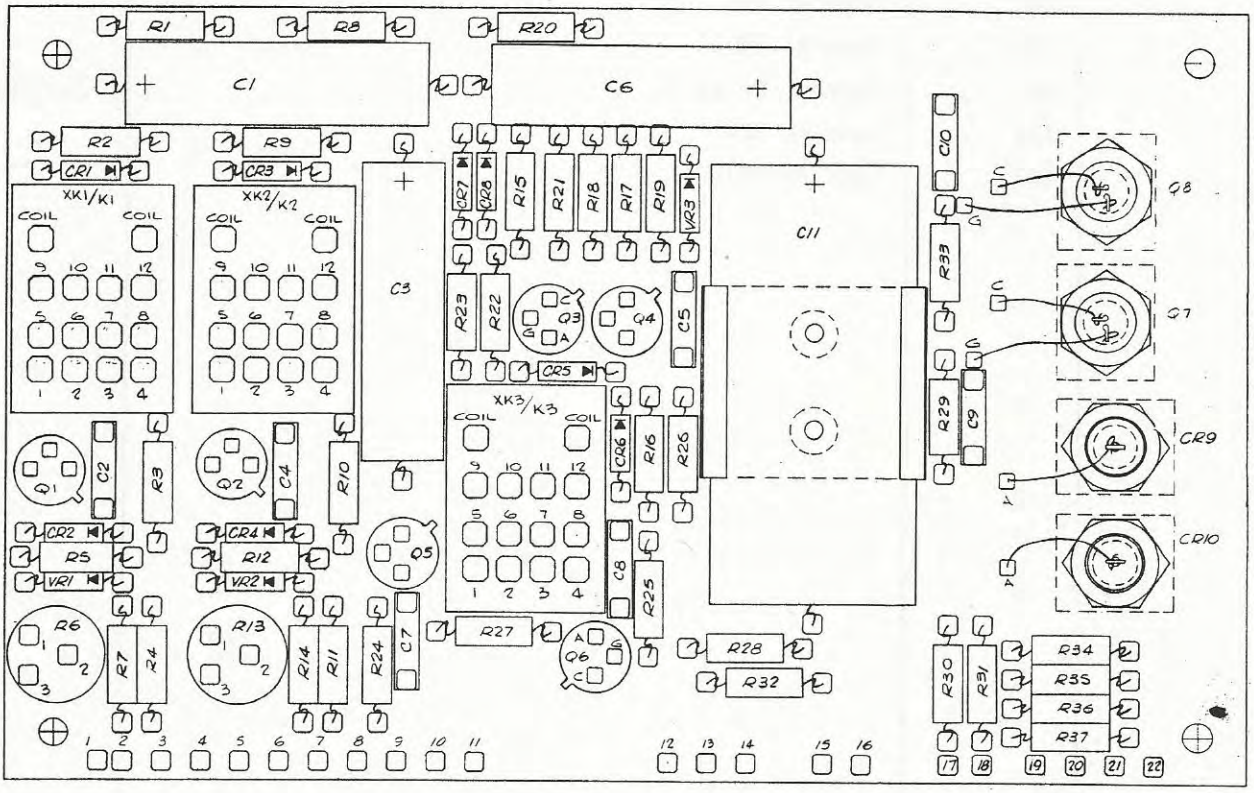


Figure 6-16. Control Circuit Board Assembly A3A1.

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY:	A4 - CONTROL PANEL			
C1	Capacitor	.01μf	500 V	913-3013-000
C2	Same As C1			
C3	Same As C1			
CB1	Circuit Breaker L.V.	6 Amps		260-4052-040
CB2	Circuit Breaker H.V.	50 Amps		260-4052-020
DS1	Lamp			262-0179-010
DS2				
THROUGH	Same As DS1			
DS7				
F1	Fuse	2.0 ASB		264-1172-000
F2	Fuse	0.5 ASB		264-1164-000
F3	Same As F1			
F4	Same As F1			
F5	Fuse	1.0 ASB		264-1168-000
M1	Meter, Plate Voltage			458-0783-110
M2	Meter, Plate Current			458-0783-190
M3	Meter, Test			458-0783-050
S1	Switch, Filament Off			266-7509-010
S2	Switch, Filament On			266-7509-010
S3	Switch, Plate Off			266-7509-010
S4	Switch, Low Power Plate			266-7509-010
S5	Switch, High Power Plate			266-7509-010
S6	Switch, Overload Indicator Reset			266-7509-010
S7	Switch, Interlock			260-0025-000
S8	Same As S7			
S9	Switch, Power Adjust			375-0199-010
S10	Switch, Power Control			375-0199-020
S11	Switch, Test Meter			295-2673-120
XF1	Fuse Holder			265-1241-090

SYMBOL	DESCRIPTION	COLLINS PART NUMBER
XF2 THROUGH XF5	Same As XF1	

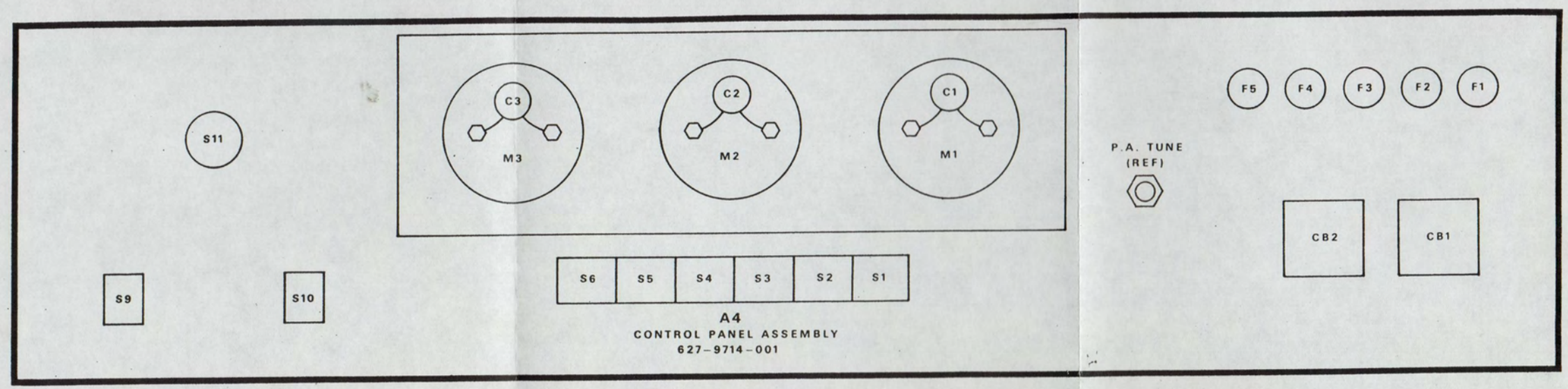
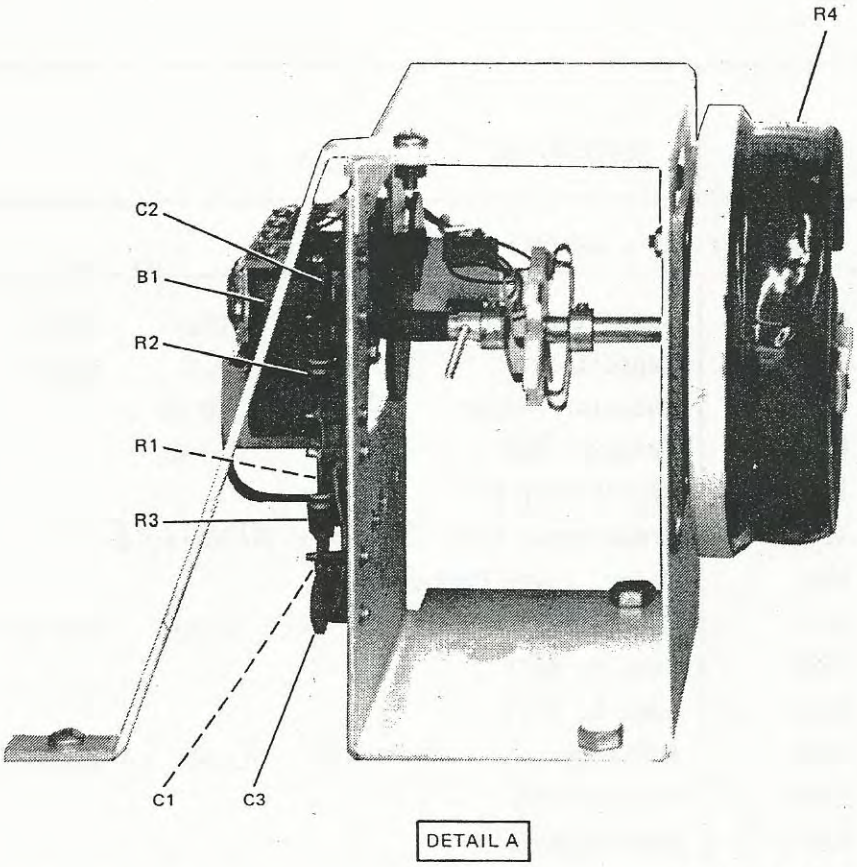


Figure 6-17. Control Panel A4.

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY:	A5 - CABINET FLOOR			
C1	Capacitor	20µf	4 KV	930-0774-030
C2	Capacitor	1µf	4 KV	930-0333-000
L1	Inductor Filter 550 OΩ	10 HY		678-0625-000
L2	Inductor Mod 1450 Ω	50 HY		678-0591-000
T1	Transformer Plt			662-0285-010
T2	Transformer Mod - 50CPS - 10000 CPS -			667-0497-020
A5B1	Motor, Power Control			230-0517-000
A5C1	Capacitor	0.1µf	600 V	913-3234-000
A5C2	Same As A5C1			
A5C3	Same As A5C1			
A5R1	Resistor	100	2 W	745-5610-000
A5R2	Same As A5R1			
A5R3	Same As A5R1			
A5R4	Rheostat, Power Control	700	300 W	735-5200-010
	Electro Engineering Works type E17475 serial 77 0.8 KVA 50-10KHz 1 phase 55°C rise term 1-2-3 4240.4 CT (1160Ω?) (1.24 turns ratio) 4-5 3394.2 (730Ω @ 3.1KV?) max primary inbalance 0.05A DC Collins 667-0497-050			
	Peter Dawe Xformer 915-751 2300			
T3	Filament Voltage Regulator			627-9733-001



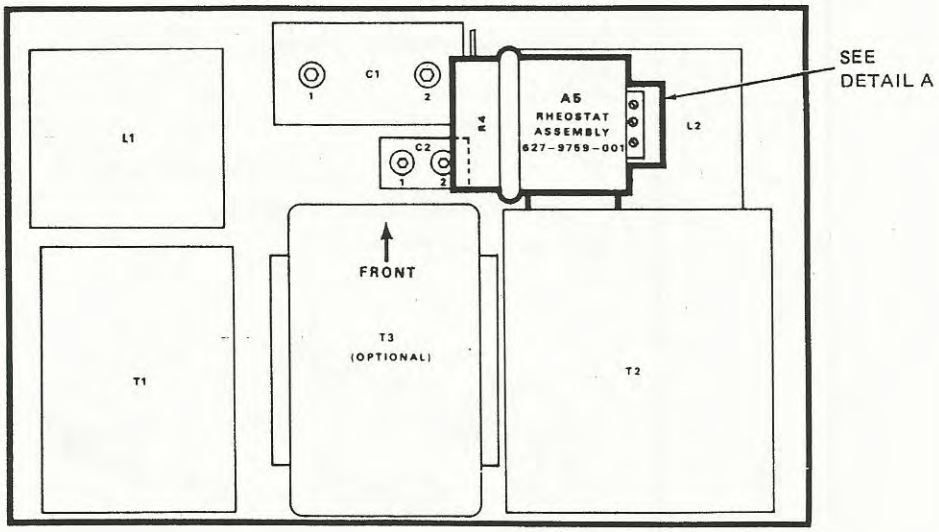


Figure 6-18. Cabinet Floor A5.

SYMBOL	DESCRIPTION	COLLINS PART NUMBER
ASSEMBLY:	A6 - AUTOMATIC POWER CONTROL	
A6A1	Board Assy - Servo Amp	627-6653-001
A6A2	Power Sensor Assembly	771-9207-001
T1	Transformer, Power	662-0057-000

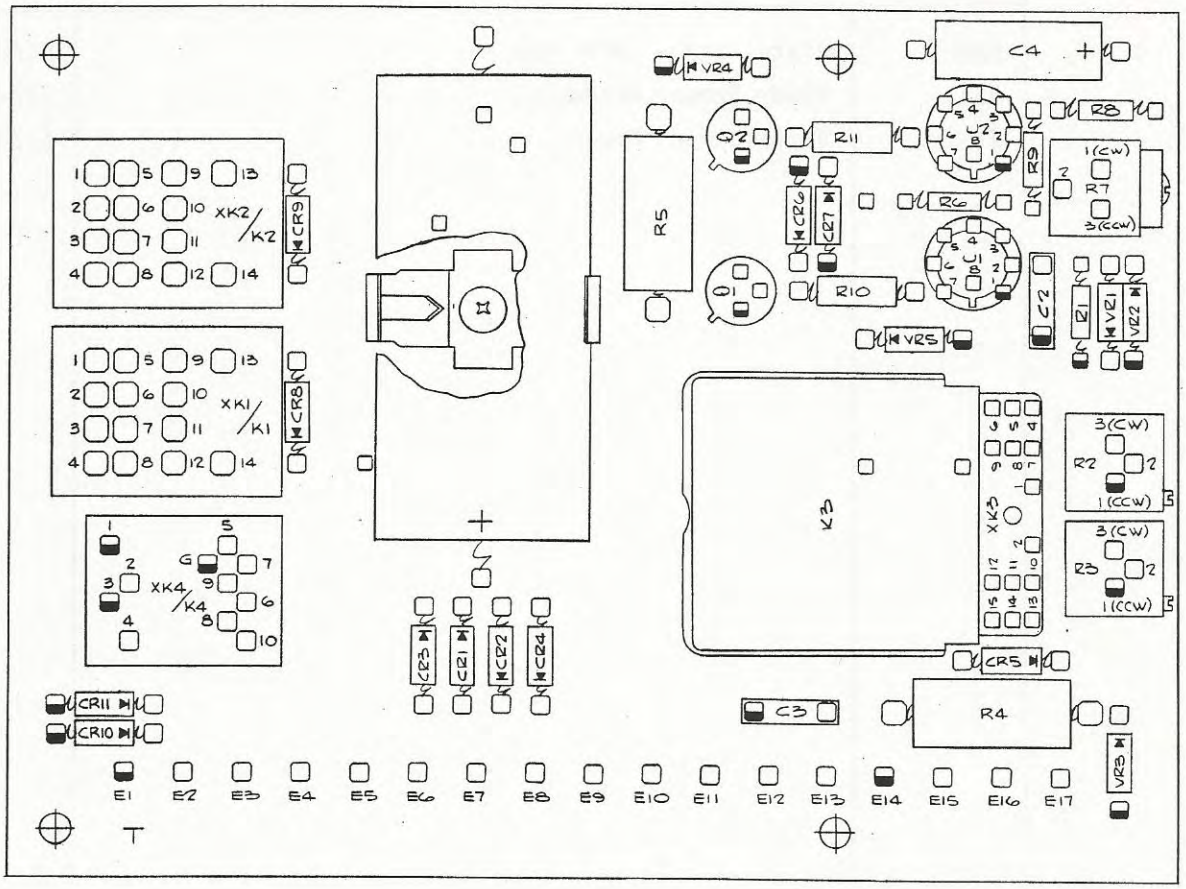


Figure 6-19. Automatic Power Control Servo Board Assembly A6A1.

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY:	A6A1 - AUTOMATIC POWER CONTROL CARD			
C1	Capacitor	1000μf	50 V	183-1282-140
C2	Capacitor	0.1μf		913-3806-000
C3	Same As C2			
C4	Capacitor	100μf	10 V	184-9086-210
CR1	Diode	1N4003		353-6442-030
CR2 THROUGH CR11	Same as CR1			
K1	Relay			970-0002-030
K2	Same As K1			
K3	Relay			970-2420-040
K4	Relay			970-0004-030
Q1	Transistor	2N3053		352-0613-010
Q2	Same As Q1			
R1	Resistor	10 K	1/4 W	745-0785-000
R2	Resistor, Var	5 K	10 Turn	381-1721-060
R3	Same As R2			
R4	Resistor	560	2 W	745-5642-000
R5	Resistor	470	2 W	745-5638-000
R6	Resistor	12 K	1/4 W	745-0788-000
R7	Resistor, Var	500		376-0254-030
R8	Resistor	47	1/4 W	745-0701-000
R9	Resistor	5.6 K	1/4 W	745-0775-000
R10	Resistor	220	1/2 W	745-1324-000
R11	Same As R10			
U1	Integrated Circuit	UA710C		351-7189-010
U2	Same As U1			
VR1	Zener Diode	1N4728A		353-6481-010
VR2	Same As VR1			
VR3	Zener Diode	1N4744A		353-6481-330

parts list

SYMBOL	DESCRIPTION		COLLINS PART NUMBER
VR4	Zener Diode	1N4734A	353-6481-130
VR5	Zener Diode	1N4742A	353-6481-290
XK1	Socket, Relay		220-1582-010
XK2	Same As XK1		
XK3	Socket, Relay		220-0027-010
XK4	Socket, Relay		220-1518-000

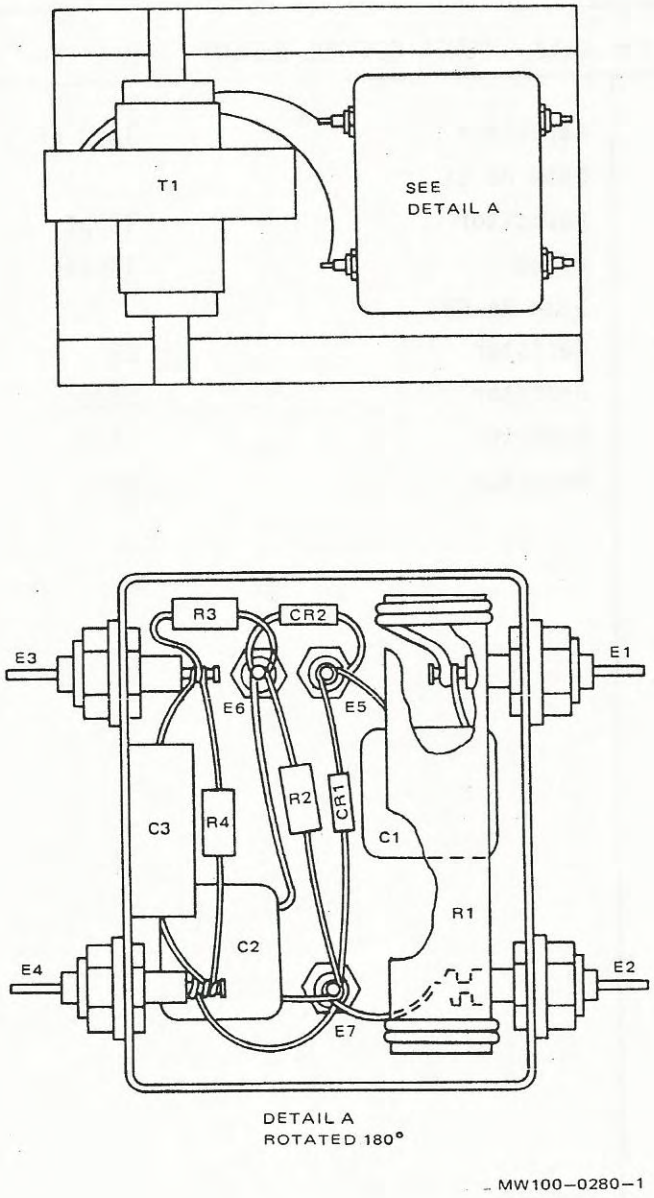
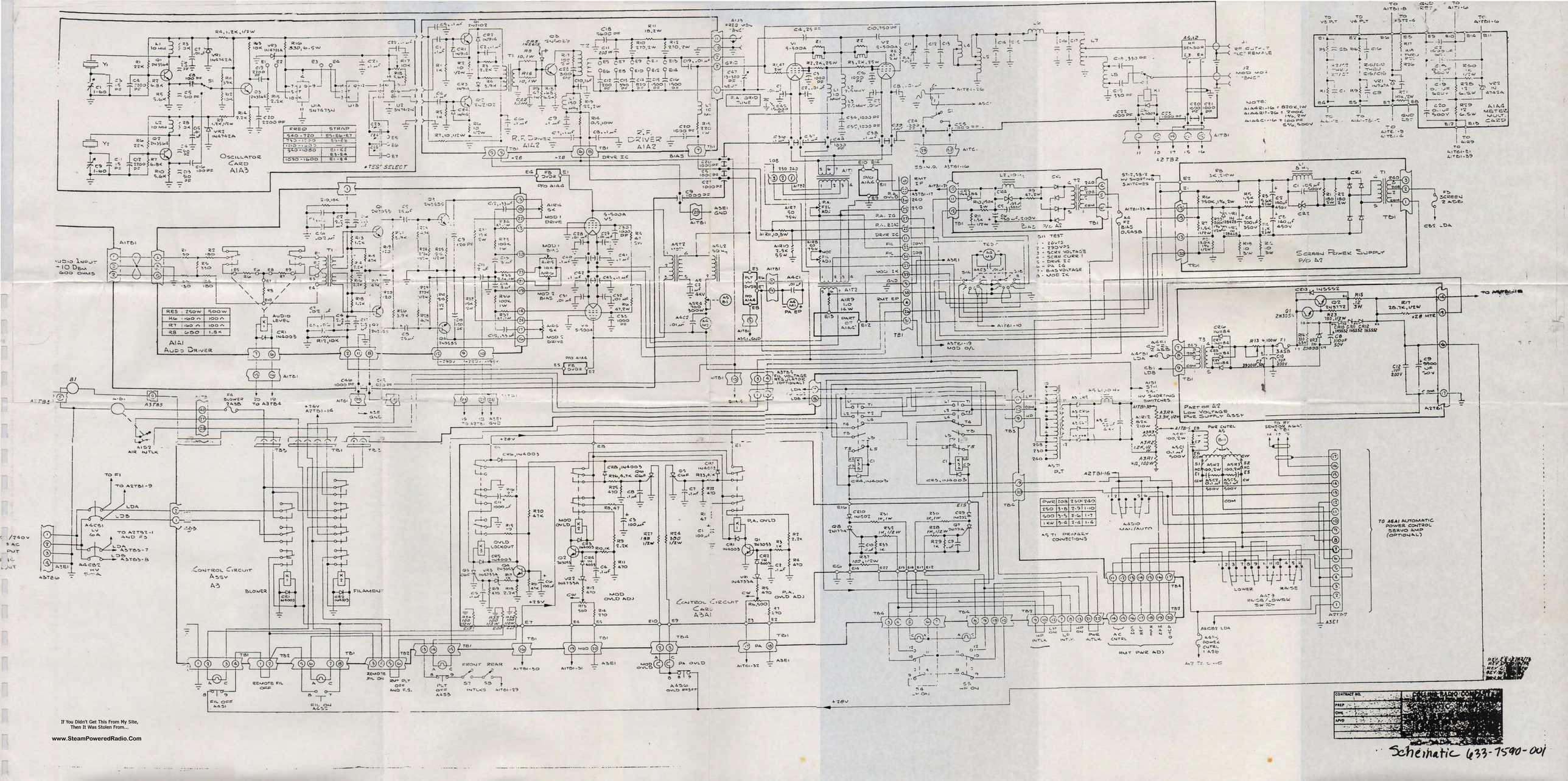


Figure 6-20. Power Control Sensor A6A2.

parts list

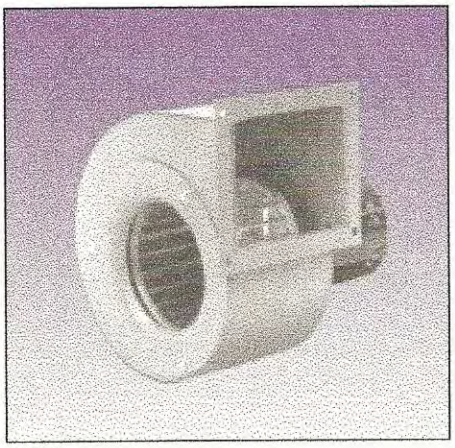
SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY : A6A2 - POWER CONTROL SENSOR				
C1	Capacitor	1000 PF	500 V	912-3001-000
C2	Same As C1			
C3	Capacitor	180µf	25 V	184-8664-000
CR1	Diode	1N914		353-2906-000
CR2	Same As CR1			
R1	Resistor	22	15 W	712-0011-000
R2	Resistor	5600	1/2 W	745-1384-000
R3	Resistor	15 K	1/2 W	745-1401-000
R4	Resistor	22 K	1/2 W	745-1408-000

SYMBOL	DESCRIPTION			COLLINS PART NUMBER
ASSEMBLY:	A7 - REMOTE CONTROL INTERFACE			
CR1	Diode	1N4006		353-6442-000
K1	Relay, Filament Off			970-2454-270
K2	Relay, Filament On			970-2454-270
K3	Relay, Plate Off			970-2454-270
K4	Relay, LP On			970-2454-270
K5	Relay, HP On			970-2454-270
K6	Relay, Fail Safe			970-2454-270
K7	Relay, Raise			970-2454-270
K8	Relay, Lower			970-2454-270
R1	Resistor	390	2 W	745-5635-000
R2	Resistor	680	2 W	745-5645-000
TB-1	Terminal Board			367-0020-000
XK1	Socket, Relay			220-1399-010
XK2 THROUGH XK8	Same As XK1			
	Contacts, Relay Socket			304-0019-000

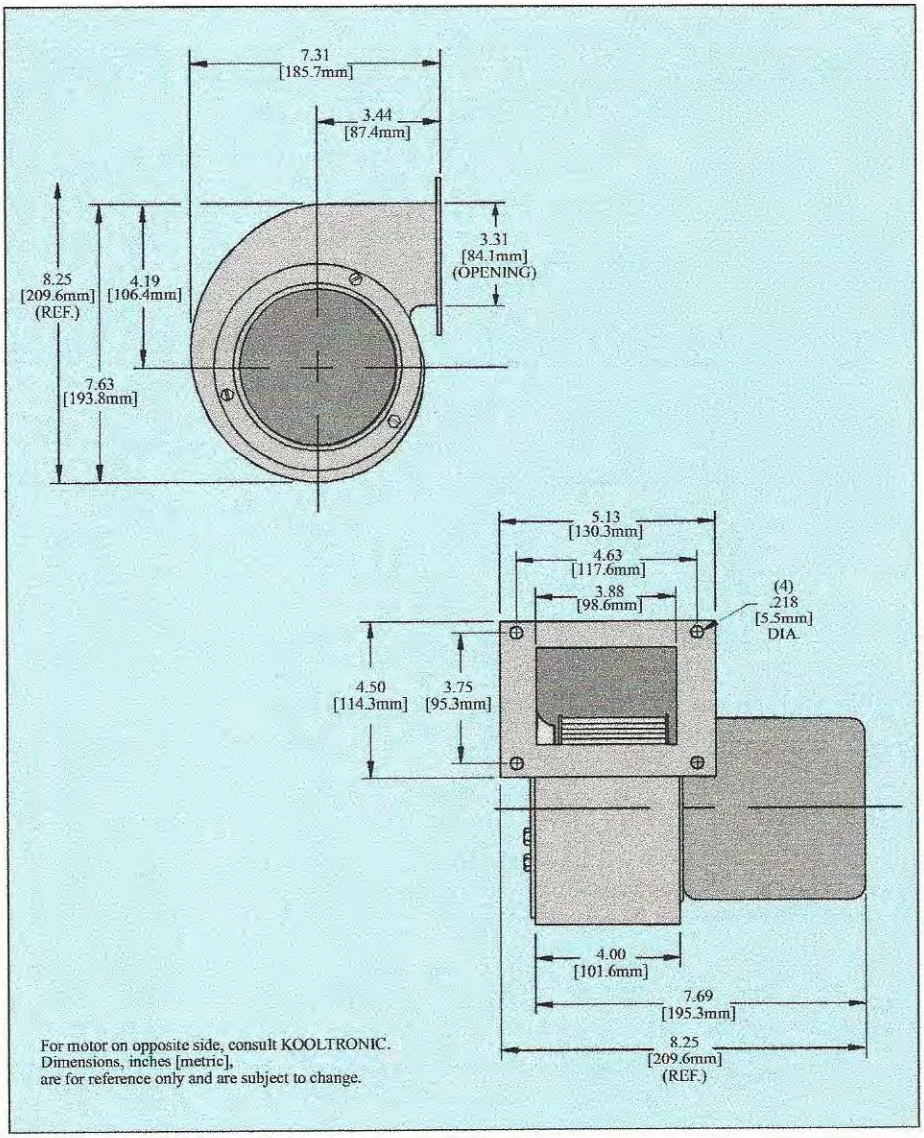


KBB43 SINGLE CENTRIFUGAL BLOWERS

KOOLTRONIC
COOLING EXCELLENCE FOR ELECTRONICS



KBB43



STANDARD FEATURES

Baked Powder Finish
320 CFM Capacity
Full performance in any mounting position
Rugged construction
UL/CSA precision ball-bearing motors
12" [304.8mm] (minimum) power and ground leads

ACCESSORIES AND OPTIONS*

- Airflow Switch
- Other voltages and frequencies
- Special external paint finishes
- Special line cords or connectors

*See opposite side for more information.

APPROXIMATE WEIGHT

9 lbs. [4.1 kg]

TECHNICAL DATA**

Model	CFM@ 0" S.P.	Cutoff S.P.	RPM Nominal	Amps Run.	Amps L.R.	Watts
KBB43	320	2.00	3300	1.6	3.1	180

**115V, 60 Hz. operation

HOW TO ORDER

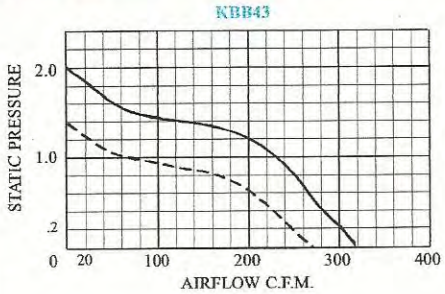
Specify model number. For 230 VAC operation, add a 2 after the K. Example: K2BB43.

For assistance in model selection, refer to the Blower and Fan Selection Guides, contact KOOLTRONIC, or use one of our design aid software programs, available FREE.

CALL 1-800-321-KOOL (5665)
or FAX 609-466-1114

POPULAR MODELS ARE STOCKED AND READY TO SHIP

PERFORMANCE CHART



Airflow vs. static pressure curves are shown for 60 Hz and 50 Hz (broken line) inputs. Static pressure is in inches of water.

Kooltronic, Inc., 30 Pennington-Hopewell Road, P.O. Box 240, Pennington, NJ 08534-0240
Tel: (609) 466-3400 Fax: (609) 466-1114 Internet: www.kooltronic.com E-Mail: techserv@kooltronic.com

kbb43.qxd
7/18/00

DESCRIPTION

KOOLTRONIC ***Single Centrifugal Blowers*** are designed for performance against low to moderate static pressures. They are available in seven sizes and capacities. Easily installed, they can be mounted in any orientation for maximum cooling efficiency.

These popular blowers are a low cost alternative for a multitude of applications. They are the workhorses of electronics cooling and are widely used in other non-electronic applications.

STANDARD FEATURES

RUGGED CONSTRUCTION: Precision-engineered heavy-gauge steel construction insures blowers stand up under tough applications.

BAKED POWDER FINISH: Durable, baked-on gray powder finish is standard. Other finishes are available.

PRECISION BALL-BEARING MOTORS: All motors, whether permanent split capacitor or shaded pole, are UL/CSA Recognized and include automatic-reset thermal overload protection. Designed for low temperature rise, KOOLTRONIC motors are also cooled by the blowers' intake air, for maximum motor life. All motors meet Federal Specification CC-M-1807A, and include double-sealed or double-shielded precision ball bearings, which meet Federal Specification FF-B-171A. Special permanent lubricants perform over a broad temperature range: -20°F (-28.9°C) to 250°F (121.1°C). Consult KOOLTRONIC for motors designed to meet military or extreme environmental specifications.

POWER: 115 VAC or 230 VAC, 50/60 Hz is standard. For multi-phase power, other voltages and frequencies or brushless DC applications, consult KOOLTRONIC.

LEADS: 12"[304.8mm] (minimum) power and ground leads. Special lengths and/or plugs available.

ACCESSORIES AND OPTIONS*

AIRFLOW SWITCH: See accompanying literature for more information.

OTHER VOLTAGES AND FREQUENCIES

SPECIAL EXTERNAL PAINT FINISHES

SPECIAL LINE CORDS OR CONNECTORS

***Contact KOOLTRONIC for information.**

KOOLTRONIC also designs and manufactures a variety of Blowers to meet *unique* specifications. We invite your inquiries about our modification and custom-design capabilities.

AIRFLOW SWITCH

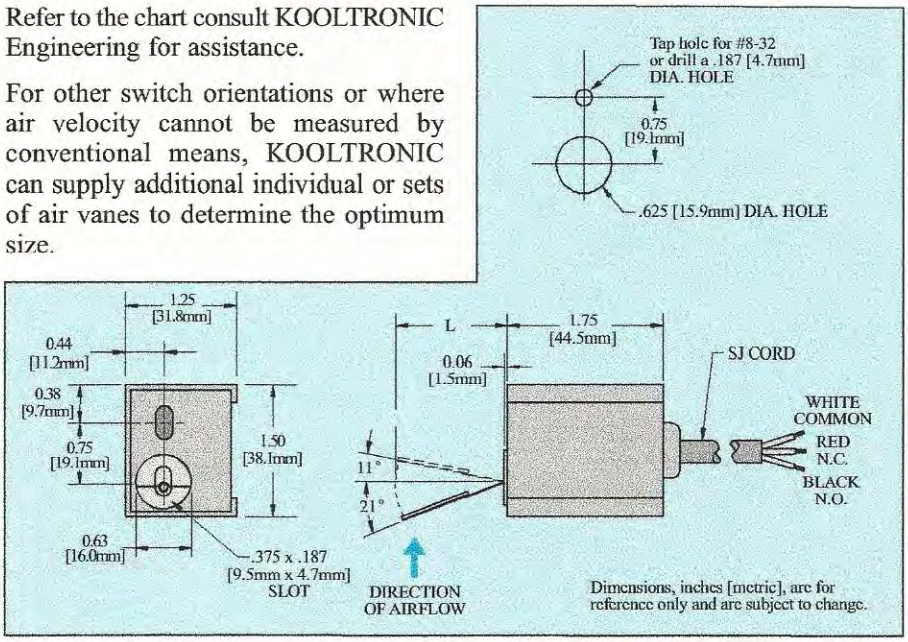
KOOLTRONIC
COOLING EXCELLENCE FOR ELECTRONICS

Protects equipment against damage caused by loss of cooling airflow, by activating an alarm or turning off power. The switch can be mounted on any suitable surface which allows the stainless steel air vane to be placed in the critical airstream. This switch is a single-pole double-throw type, with normally open and normally closed contacts.

The UL rating for the rotary snap action switch is 5 amps at 250 volts AC. A 36″ [914.4mm], three wire SJT power cord is provided, allowing connection to normally open or normally closed circuits.

The choice of air vanes is determined by location and orientation in the airstream, and the normal operating air velocity at the point of installation. Refer to the chart consult KOOLTRONIC Engineering for assistance.

For other switch orientations or where air velocity cannot be measured by conventional means, KOOLTRONIC can supply additional individual or sets of air vanes to determine the optimum size.



TECHNICAL DATA

Model	Dim. "L" Max. Inches [metric]	Vane Length Inches [metric]	Orientation of Airflow Switch							
			Vertical Airstream				Horizontal Airstream			
			Airstream Up		Airstream Down		Arm Horizontal		Arm Vertical Vane Down	
			Increasing Air	Decreasing Air	Increasing Air	Decreasing Air	Increasing Air	Decreasing Air	Increasing Air	Decreasing Air
			Actuate ft/min	Deactuate ft/min	Actuate ft/min	Deactuate ft/min	Actuate ft/min	Deactuate ft/min	Actuate ft/min	Deactuate ft/min
KV-1	3.38 [85.9]	2.88 [73.2]	660	590	-	-	620	530	630	520
KV-2	2.75 [69.9]	2.25 [57.2]	840	750	-	-	790	670	800	660
KV-3	2.44 [62.0]	1.94 [49.3]	980	870	-	-	860	750	860	770
KV-4	2.19 [55.6]	1.69 [42.9]	1010	960	640	610	980	870	980	820
KV-5	1.94 [49.3]	1.44 [36.6]	1180	1130	880	720	1070	930	1050	960
KV-6	1.56 [39.6]	1.06 [26.9]	1520	1370	1210	1050	1370	1260	1410	1290
KV-7	1.44 [36.6]	0.94 [23.9]	1670	1520	1380	1290	1570	1430	1600	1430
KV-8	1.25 [31.8]	0.75 [19.1]	2020	1880	1940	1780	2010	1710	2080	1780
KV-9	1.13 [28.7]	0.63 [16.0]	2360	2180	2350	1930	2340	2060	2510	2150

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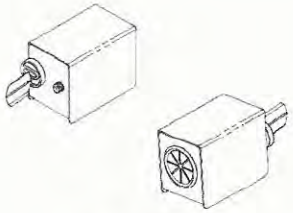
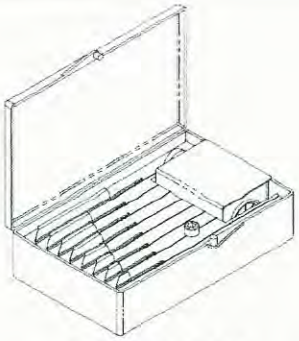
Airflow Switches



AIRFLOW SWITCH
WITH VANE



DETERMINATOR KIT

FEATURES

- 8 air velocity ratings
- Interchangeable actuating vanes
- Weight: 4.5 oz (0.13 Kg)
- SPDT 5 amp 250 VAC
- Mounts on round and flat ducts with single screw
- Life expectancy – 500,000 Operations

APPLICATION

The Rotron model 2C airflow switch is actuated by air velocity rather than air pressure. It is designed for easy mounting on the outside of an air duct with a small lightweight stainless steel vain protruding through a hole in the duct into the airstream. A snap action switch is actuated when the velocity pressure against the vane moves it in the direction of the air flow. As the velocity of the airstream decreases the vane moves back towards its original position and the switch deactuates.

The switch can be used as an interlock for on-off purposes or as a marginal safety device where the electrical contacts are operated at a predetermined minimum flow air. The switch is designed for commercial application but has been used satisfactorily on certain military projects. Its acceptability on military projects is left to the evaluation of the purchaser.

Ambient temperature range of -40 ° C to +85 ° C.

ELECTRICAL RATING

The contact arrangement of the switch is single pole double throw. No other contacts are available. An opening or closing contact can therefore be obtained when the switch actuates.

The UL recognized component rating is 5 amps at 250 volt AC. The life expectancy of the contacts at this full load figure is 500,000 operations.

DETERMINATOR KIT

In order to determine the best sensitivity rating (that is, vane type number) of the Rotron model 2C airflow switch required for any application, use the Rotron "Determinator Kit". The kit consists of a model 2C switch together with a complete set of 8 actuating vanes. By interchanging these vanes on the switch it is possible to quickly determine which vane size has the sensitivity rating required in any particular experimental set-up.

APPLICATION NOTES

In order to select the proper rating of a velocity operating switch, it is necessary to determine the velocity of the air in the duct at the point of insertion of the switch. This can be done by experiment or calculation. The cubic feet per minute (CFM) value of air which passes through the duct is a volume figure and should not be confused with the ft/min. value which is a velocity figure. The relation is:

$$\frac{\text{CFM}}{\text{Area}} = \text{ft / min.}$$

Whereby the area is expressed in square feet. Therefore, if the CFM delivery of the fan or blower can be estimated accurately, the air velocity in the duct at the point of insertion can be calculated.

CONSTRUCTION

- Switch frame and cover are made of aluminum
- Actuating arm and lightweight vane are made of stainless steel
- The snap action switch mechanism is housed in a phenolic enclosure
- Solder terminals of silver plated brass
- The spring material in the switch is stainless steel and the remaining contacts are of silver alloy

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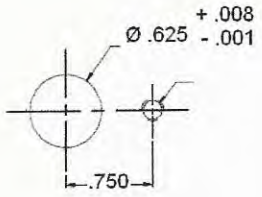
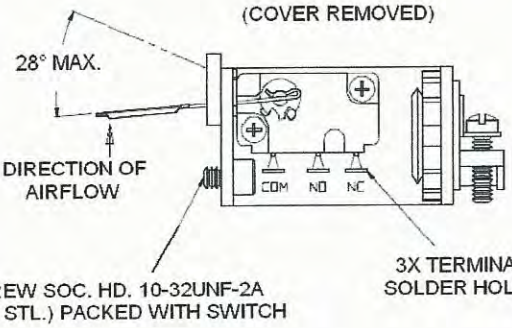
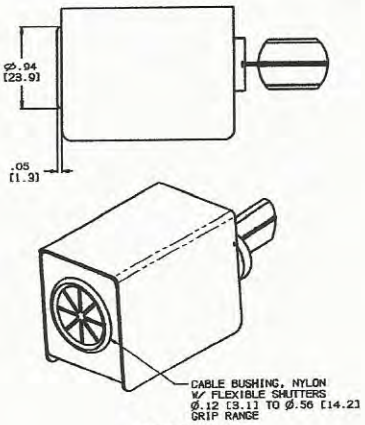
Specifications subject to change without notice

AIRFLOW SWITCH DIMENSIONS

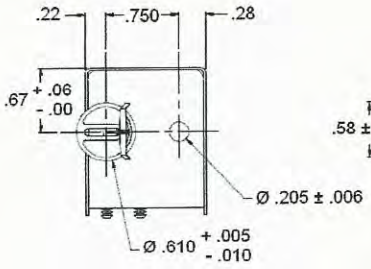


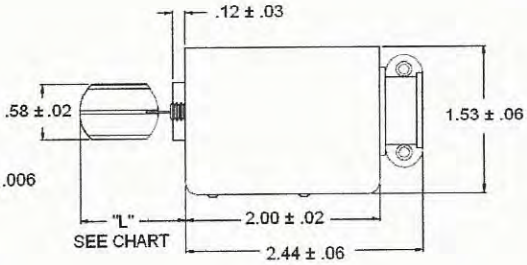
DRILLING PLAN FOR CUSTOMER MOUNTING

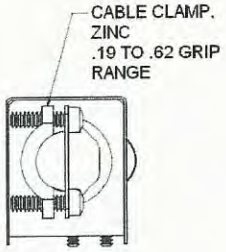


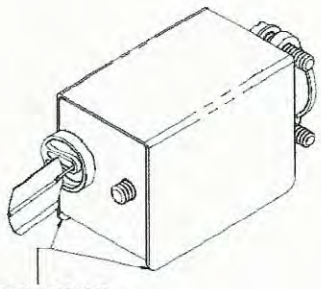


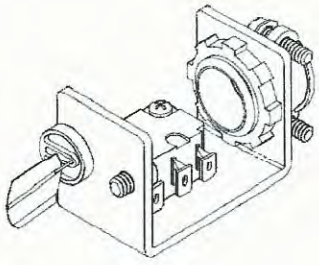
DETAIL-A











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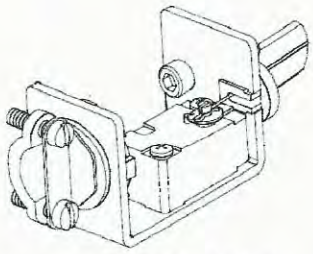

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Specifications subject to change without notice

ROTRON MODEL 2C AIRFLOW SWITCHES WILL ACTUATE AND DE-ACTUATE IN AN AIRSTREAM OF THE FOLLOWING VELOCITY IN FT/MIN FOR "STANDARD" AIR (29.9 INCH Hg, 70°F)

PART NUMBER				VERTICAL-UP AIR STREAM		HORIZONTAL AIR STREAM				VERTICAL-DOWN AIR STREAM	
						ARM HORIZONTAL		ARM VERTICAL VANE DOWN			
W/ ZINC CABLE CLAMP	W/ NYLON CABLE BUSHING PER DETAIL-A	TYPE NO.	"L" DIM	INCREASE AIR FT/MIN ACTUATE	DECREASE AIR FT/MIN DEACTUATE	INCREASE AIR FT/MIN ACTUATE	DECREASE AIR FT/MIN DEACTUATE	INCREASE AIR FT/MIN ACTUATE	DECREASE AIR FT/MIN DEACTUATE	INCREASE AIR FT/MIN ACTUATE	DECREASE AIR FT/MIN DEACTUATE
041111	041101	1003	2.50	950	850	850	650	750	615	N/A	N/A
041112	041102	1353	1.91	1125	1030	1200	970	1200	890	1000	685
041113	041103	1603	1.63	1340	1212	1400	1095	1400	1130	1200	865
041114	041104	1803	1.41	1550	1450	1600	1335	1500	1375	1400	1115
041115	041105	2003	1.09	1800	1675	2000	1580	2000	1580	1850	1425
041116	041106	2453	0.91	2340	2120	2400	1867	2270	2035	2300	1950
041117	041107	3003	0.78	2925	2500	2800	2420	2880	2570	2800	2395
041118	041108	4003	0.72	3050	3000	3500	3000	3500	3000	3500	3000

NOTES:

1 - AIRFLOW FIGURES LISTED ARE TYPICAL AS RECORDED IN A LABORATORY TEST SET-UP FOR CONTROLLED LAMINAR FLOW CONDITIONS AND ARE USED ONLY AS A GUIDE. FOR ACTUAL REQUIREMENTS IN A SPECIFIC APPLICATION, IT IS RECOMMENDED THAT THE "DETERMINATOR KIT" BE USED TO DETERMINE EXACT REQUIREMENTS

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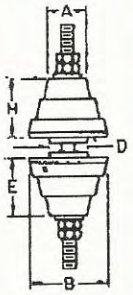
Thru-panel insulators

These high quality steatite and porcelain insulators have heavily
faces and are furnished with heavy nickel-plated brass hardwar
exposed applications. Types designated —2 have jack to accomm
son or other standard banana plugs.

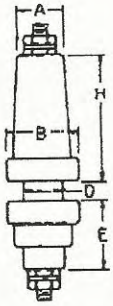
135-50
135-51
135-52

135-55



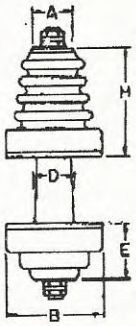
135-40*
135-42*
135-44*
135-46†
135-47†

135-40-2*
135-42-2*
135-46-2†



135-45
135-48

135-45-2
135-48-2

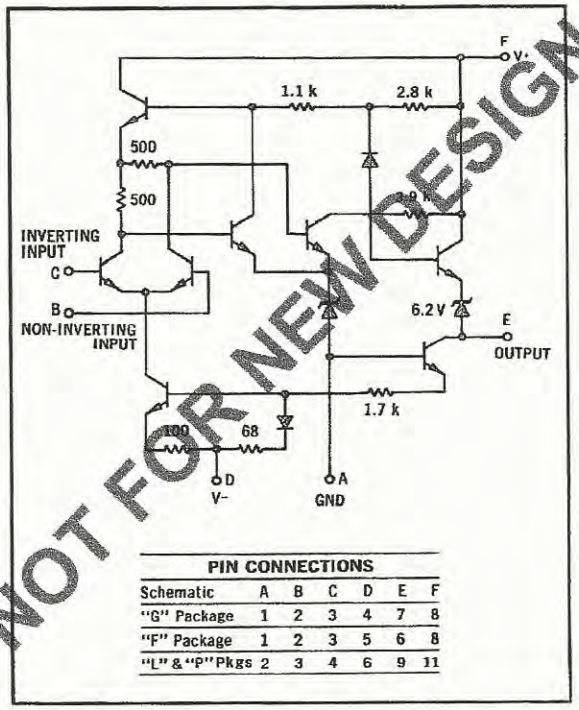


TOTAL P.01

MC1710CF,G,L,P (0 to +75°C)
MC1710F,G,L (−55 to +125°C)

. . . the MC1710 and MC1710C are identical circuits specified over different temperature ranges. These devices are differential voltage comparators for use in level detection, low-level sensing, and memory applications. Features:

- Differential Input Characteristics:
  Input Offset Voltage = 1 mV
  Offset Voltage Drift = 3 μV/°C
- Fast Response Time — 40 ns
- Low Output Impedance — 200 ohms
- Output Compatible with All Saturating Logic Forms — +3.2 V to −0.5 V typical



PIN CONNECTIONS						
Schematic	A	B	C	D	E	F
"G" Package	1	2	3	4	7	8
"F" Package	1	2	3	5	6	8
"L" & "P" Pkgs	2	3	4	6	9	11

F SUFFIX
CASE 606
(Formerly Case 72)
TO-91

G SUFFIX
CASE 601
(Formerly Case 96)
TO-99

L SUFFIX
CERAMIC PACKAGE
CASE 605C
TO-116

P SUFFIX
PLASTIC PACKAGE
CASE 605
(Formerly Case 93)
TO-116

MAXIMUM RATINGS (T_A = 25°C UNLESS OTHERWISE NOTED)

RATING	SYMBOL	VALUE	UNIT
Power Supply Voltage	V+ V−	+14 −7.0	Vdc Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing	CMV_{in}	±7.0	Volts
Peak Load Current	I_L	10	mA
Power Dissipation (Package Limitation) Metal Can Derate above 25°C Flat Package Derate above 25°C Ceramic Dual In-Line Package Derate above 25°C Plastic Package Derate above 25°C	P_D	 680 4.6 500 3.3 600 4.8 400 3.3	 mW mW/°C mW mW/°C mW mW/°C mW mW/°C
Operating Temperature Range MC1710C MC1710	T_A	0 to +75 −55 to +125	°C
Storage Temperature Range G, F, & L Pkgs. P Pkg.	T_{stg}	−65 to +150 −65 to +125	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

TYPE	V+ (Vdc)	V− (Vdc)	V_{io} (mV)	A_{VOL} (V/V)	V_{OH} (Vdc)	V_{OL} (Vdc)	t_R (ns)	CMV_{in} (Vdc)	TCV_{io} (μV/°C)
MC1710	+12	−6.0	1.0	1700	3.2	−0.5	40	±5.0	3.0
MC1710C	+12	−6.0	1.5	1500	3.2	−0.5	40	±5.0	5.0

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TECHNICAL DATA SHEET

50 WATT ZENER DIODES

Qualified per MIL-PRF-19500/114

DEVICES

1N2804B thru 1N2846B & RB
and
1N4557B thru 1N4564B & RB

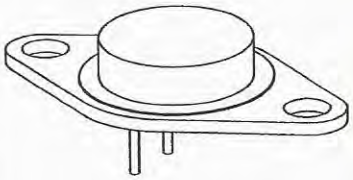
B = Standard Polarity: RB = Reverse Polarity

LEVELS

JAN
JANTX
JANTXV

DESCRIPTION

These high power 50W Zener diodes represented by the JEDEC registered 1N2804B thru 1N2846B and 1N4557B thru 1N4564B series provide voltage regulation in a selection over a 3.9V to 200V broad range of voltages. They may be operated up to 50W with adequate mounting and heat sinking with their low thermal resistance. These Zeners are also available in JAN, JANTX, JANTXV military qualifications. Microsemi also offers numerous other Zener products to meet higher and lower power applications.



TO-3 (DO-204AD)

FEATURES

- JEDEC registered 1N2804 thru 1N2846B and 1N4557 thru 1N4564B
- Internal solder bond construction
- Hermetically sealed (welded)
- Zener Voltage 3.9V to 200V
- Also available in JAN, JANTX, and JANTXV qualifications per MIL-PRF-19500/114 by adding the JAN, JANTX, or JANTXV prefixes to part numbers for desired level of screening; (e.g. JANTX1N2804B, etc.
- Standard polarity is anode to case
- Reverse polarity with cathode to case by designating R suffix in part number, e.g. 1N28 factory for surface mount equivalents 04RB, etc
- Consult factory for surface mount equivalents

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50 WATT ZENER DIODES

Qualified per MIL-PRF-19500/114

APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range
- Standard voltage tolerances are +/- 5% with B suffix
- Consult factory for +/-10% with an A suffix, +/-20% with no suffix, +/-2% with a C suffix and +/-1% with a D suffix respectively
- Reverse polarity available
- Nonsensitive to ESD per MIL-STD-750 Method 1020
- Inherently radiation hard as described in Microsemi MicroNote 050

MAXIMUM RATINGS

- Junction Temperatures: -65°C to +175°C
- Storage Temperatures: -65°C to +200°C
- DC Power Dissipation: 50 watts at $T_C < 75°C$
- Power Derating: 0.5W/°C above 75°C
- Forward Voltage @ 10A: 1.5 Volts
- THERMAL RESISTANCE: 2.0°C/W maximum junction to base (1.5°C/W typical)
- Solder temperatures: 260°C for 10 s (max)

MECHANICAL AND PACKAGING

- CASE: Industry Standard TO-3 (TO-204AD), hermetically sealed, 0.052 inch diameter pins.
- FINISH: All external surfaces are corrosion resistant and terminal solderable.
- POLARITY: Standard Polarity units are connected anode to case. Reverse polarity (cathode to case) is indicated by suffix R. In either example, both pins are common with one another as anode or cathode (see circuit on last page).
- WEIGHT: 15 grams.
- MOUNTING HARDWARE: Consult factory for optional insulator and sheet metal screws
- See package dimensions on last page

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TECHNICAL DATA SHEET

50 WATT ZENER DIODES

Qualified per MIL-PRF-19500/114

ELECTRICAL CHARACTERISTICS @ 30°C Case Temperature

JEDEC TYPE NO. (Note 1)	NOMINAL ZENER VOLTAGE V_Z @ I_{ZT} (Note 2)	ZENER TEST CURRENT (I_{ZT})	MAX. DYNAMIC IMPEDANCE (Note 3)		MAX. DC ZENER CURRENT (I_{ZM}) @ 75°C Stud Temp. (Note 4)	TYPICAL TEMP. COEFF. α_{VZ}	MAX** REVERSE CURRENT I_R @ V_R		POLARITY
			Z_{ZT} @ I_{ZT} OHMS	Z_{ZK} @ 1mA (I_{ZK}) OHMS					
	Volts	mA			mA	%/°C	µA	Volts	
†1N4557B	3.9	3200	0.16	400	11,900	-0.046	150	0.5	
†1N4558B	4.3	2900	0.16	500	10,650	-0.033	150	0.5	
†1N4559B	4.7	2650	0.12	600	9,700	-0.015	100	1	
†1N4560B	5.1	2450	0.12	650	8,900	+/-0.010	20	1	
†1N4561B	5.6	2250	0.12	900	8,100	+0.03	20	1	
†1N4562B	6.2	2000	0.14	1000	7,300	+0.049	20	2	
1N4563B	6.8	1850	0.16	200	6,650	+0.053	10	2	
1N4564B	7.5	1650	0.24	100	6,050	+0.057	10	3	
†1N2804B	6.8	1850	0.2	70	7,400	.040	150	4.5	
†1N2805B	7.5	1700	0.3	70	6,600	.045	100	5	
†1N2806B	8.2	1500	0.4	70	5,800	.048	50	5.4	
†1N2807B	9.1	1370	0.5	70	5,300	.050	25	6.1	
†1N2808B	10	1200	0.6	80	4,800	.055	25	6.7	
†1N2809B	11	1100	0.8	80	4,300	.060	10	8.4	
†1N2810B	12	1000	1.0	80	4,000	.065	10	9.1	
†1N2811B	13	960	1.1	80	3,700	.065	10	9.9	
1N2812B	14	890	1.2	80	3,400	.070	10	10.6	
†1N2813B	15	830	1.4	80	3,100	.070	10	11.4	
†1N2814B	16	780	1.6	80	2,950	.070	10	12.2	
1N2815B	17	740	1.8	80	2,750	.075	10	13.0	
†1N2816B	18	700	2.0	80	2,550	.075	10	13.7	
1N2817B	19	660	2.2	80	2,450	.075	10	14.4	
†1N2818B	20	630	2.4	80	2,350	.075	10	15.2	
†1N2819B	22	570	2.5	80	2,100	.080	10	16.7	
†1N2820B	24	520	2.6	80	1,950	.080	10	18.2	
1N2821B	25	500	2.7	90	1,850	.080	10	19	
†1N2822B	27	460	2.8	90	1,650	.085	10	20.6	
†1N2823B	30	420	3.0	90	1,550	.085	10	22.8	
†1N2824B	33	380	3.2	90	1,450	.085	10	25.1	
†1N2825B	36	350	3.5	90	1,300	.085	10	27.4	
†1N2826B	39	320	4.0	90	1,175	.090	10	29.7	
†1N2827B	43	290	4.5	90	1,075	.090	10	32.7	
1N2828B	45	280	4.5	100	1,030	.090	10	34.2	
†1N2829B	47	270	5.0	100	980	.090	10	35.8	
1N2830B	50	250	5.0	100	935	.090	10	38	
†1N2831B	51	245	5.2	100	925	.090	10	38.8	
†1N2832B	56	220	6	110	825	.090	10	42.6	
†1N2833B	62	200	7	120	735	.090	10	47.1	
†1N2834B	68	180	8	140	670	.090	10	51.7	
†1N2835B	75	170	9	150	600	.090	10	56	
†1N2836B	82	150	11	160	550	.090	10	62.2	
†1N2837B	91	140	15	180	470	.090	10	69.2	
†1N2838B	100	120	20	200	450	.090	10	76	
1N2839B	105	120	25	210	430	.095	10	79.8	
†1N2840B	110	110	30	220	410	.095	10	83.6	
†1N2841B	120	100	40	240	375	.095	10	91.2	
*†1N2842B	130	95	50	275	345	.095	10	98.8	
†1N2843B	150	85	75	400	300	.095	10	114.0	
*†1N2844B	160	80	80	450	285	.095	10	121.6	
†1N2845B	180	68	90	525	250	.095	10	136.8	
†1N2846B	200	65	100	600	220	.100	10	152.0	

290V

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50 WATT ZENER DIODES

Qualified per MIL-PRF-19500/114

* JEDEC Registered Data.

** Not JEDEC Data.

† Have JAN, JANTX and JANTXV Qualifications to MIL-S-19500/114.

See further notes on following page.

NOTES:

1. The JEDEC type numbers shown (B suffix) have a +/- 5% tolerance on nominal zener voltage. If other tolerance is required consult factory. The suffix A is used to identify +/-10% tolerance; no suffix or just R indicates +/-20% tolerance: C suffix indicates +/-2% tolerance; and D suffix indicates +/-1%.
2. Standard polarity units have the anode connected to the case. Reverse polarity (cathode-to-case) units are available and are indicated by suffix R in the part number.
3. Zener Voltage (VZ) is measured with junction in thermal equilibrium with 30°C base temperature. The test currents (IZT) have been selected so that at nominal voltages the dissipation is a constant 12.5 watts. This results in a nominal junction temperature rise of 18.75°C.
4. The zener impedance is derived from the 60 cycle ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current (IZT or IZK) is superimposed on IZT or IZK. Zener impedance is measured at 2 points to ensure a sharp knee on the breakdown curve and to eliminate unstable units. A curve showing the variation of zener impedance vs. zener current for six representative types is shown in Figure 3. Also see MicroNote 202 for further information.
5. The values of IZM are calculated for a +/-5% tolerance on nominal zener voltage. Allowance has been made for the rise in zener voltage above VZT that results from zener impedance and the increase in junction temperature as power dissipation approaches 50 watts. In the case of individual diodes, IZM is that value of current that results in a dissipation of 50 watts.

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TECHNICAL DATA SHEET

50 WATT ZENER DIODES

Qualified per MIL-PRF-19500/114

GRAPHS

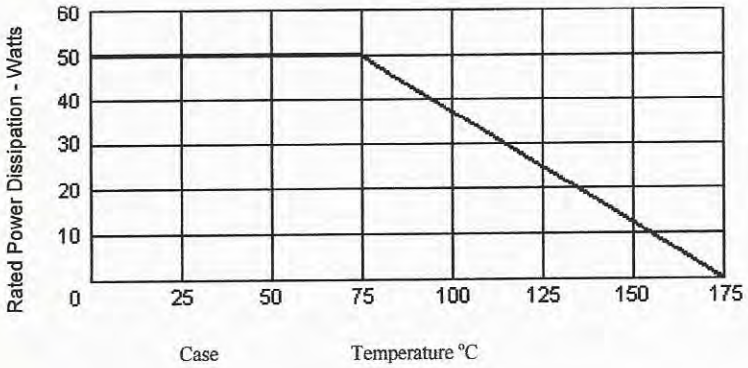
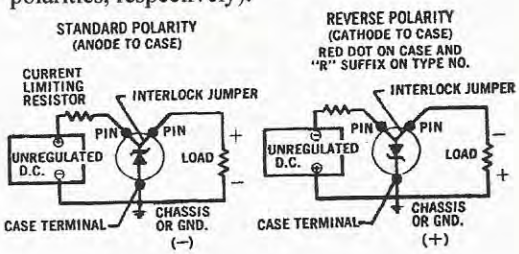
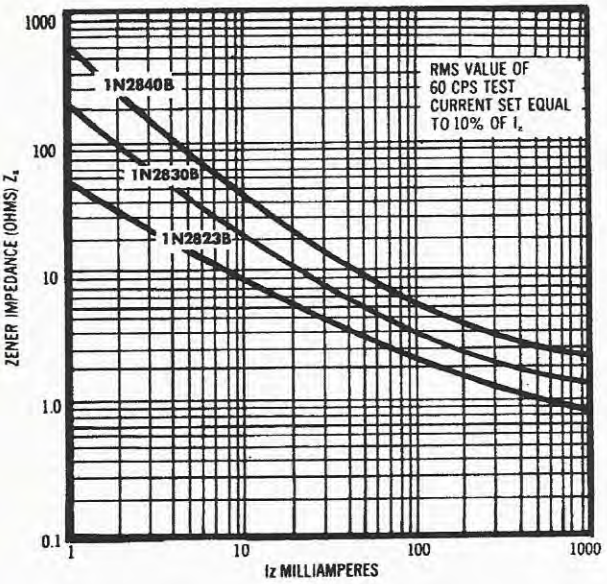


FIGURE 2
POWER DERATING CURVE

Typical circuit connections for anode-to-case and cathode-to-case polarities (standard and reverse polarities, respectively).





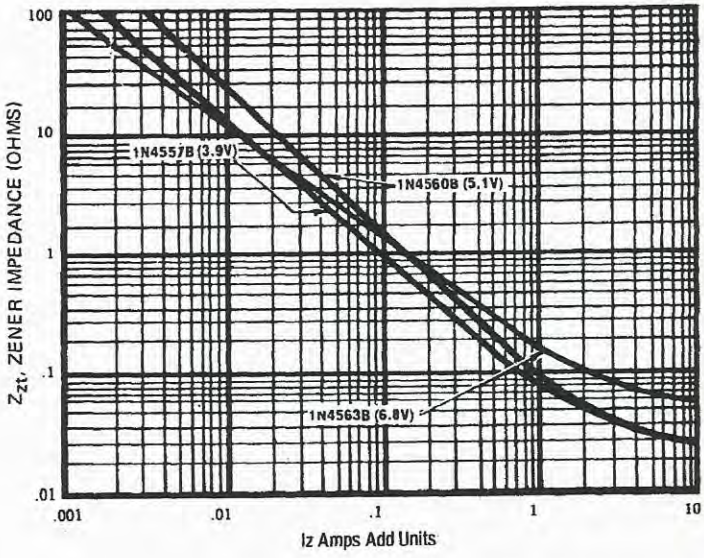


FIGURE GROUP 3
TYPICAL ZENER IMPEDANCE vs. ZENER CURRENT FOR TYPES SHOWN

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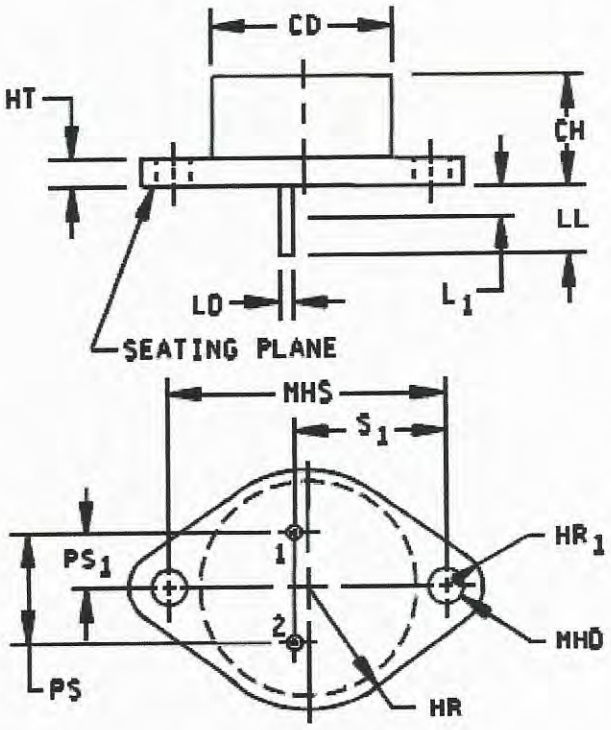
50 WATT ZENER DIODES

Qualified per MIL-PRF-19500/114

PACKAGE DIMENSIONS



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CH	.270	.380	6.86	9.65	
LD	.048	.053	0.97	1.35	
CD		.875		22.23	
PS	.420	.440	10.67	11.18	3
PS_1	.205	.225	5.21	5.72	3
HT	.060	.135	1.52	3.42	
LL	.312	.500	7.92	12.70	
L_1		.050		1.27	
MHD	.151	.165	3.84	4.09	
MHS	1.177	1.197	29.90	30.40	
HR	.495	.525	12.57	13.34	
HR_1	.131	.188	3.33	4.78	
S_1	.655	.675	16.64	17.15	

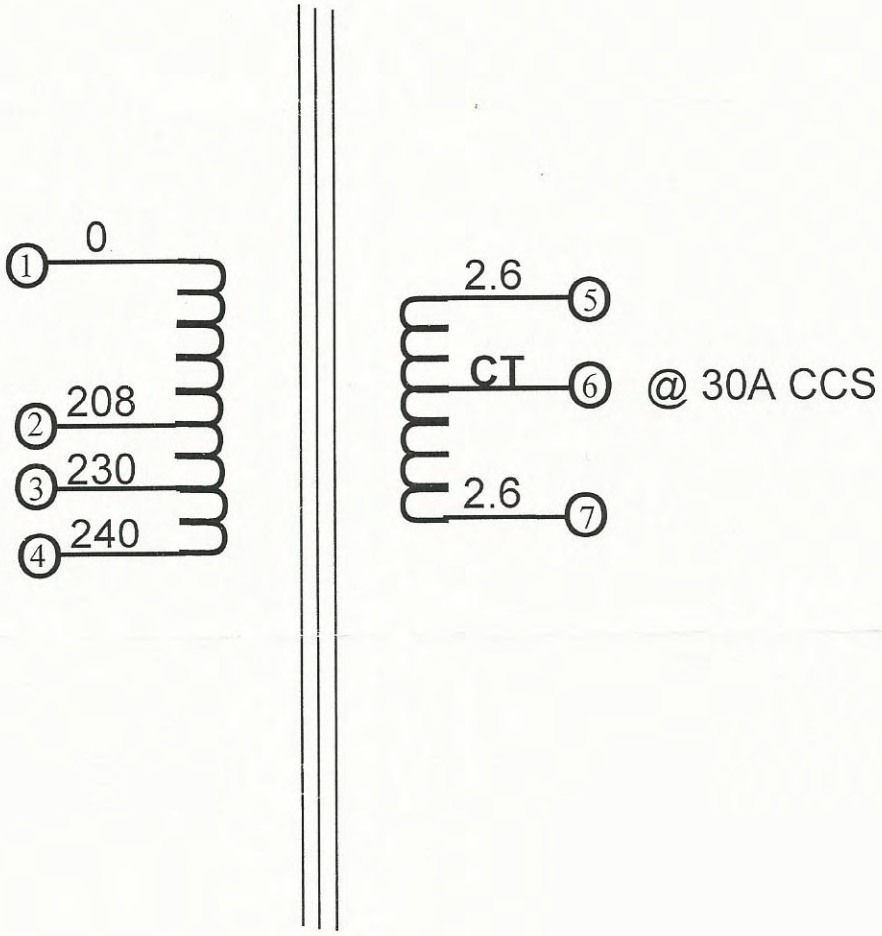
NOTES:

1. Dimensions are in inches.
2. Milimeter equivalents are given for general information only.
3. These dimensions should be measured at points .050 inch (1.27mm) + .005 inch (0.13mm) -.000 inch (0.00mm) below seating plane.
4. The seating plane of the header shall be flat within .001 (0.03mm) concave to .004 inch (0.10mm) convex .001 inch (0.003mm) cocave to .006 inch (0.15mm) convex overall.
5. Pins 1 and 2 are internally connected with an internal jumper.
6. Devices wih B suffix have the anode internally connected to the case and devices with RB suffix (reverse polarity) have the cathode internally connected to the case.
7. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 1. Physical dimensions (similar to TO-3)

MADE IN THE USA

COLLINS 820D-1 4-400A FIL XF



CVS Hardwired Series – Constant Voltage Transformers

Superior voltage regulation of ±1% sets the CVS series apart from other power conditioning technologies on the market. Extremely tight regulation is accomplished by SolaHD's ferroresonant transformer technology. The CVS recreates a well regulated sinusoidal waveform that is well isolated from input disturbances including:

- Impulses
- Brownouts
- Severe waveform distortion
- Swells
- Sags

No other power conditioning technology provides as complete a solution against these power quality disturbances. The CVS series is ideal for applications where even a small change in voltage level can lead to unscheduled downtime, misoperation, incorrect data or scrapped production.

c UL us E47379 RoHS

Applications

- Industrial automation and control equipment PLCs
- Analytical laboratory and factory automating equipment
- Photo processing equipment
- Sound/recording systems
- Photographic enlargers
- Broadcast equipment

Features

- Superior voltage regulation of ±1%
- Surge protection tested to ANSI/IEEE C62.41, Class A & B waveform
- Harmonic filtering
- Hardwired
- Acts as a step-up/step-down transformer
- Galvanic isolation provides exceptional circuit protection
- 25 year typical mean time between failure
- No maintenance required

Certifications and Compliances

- c UL us Listed
  - UL 1012
  - CSA C22.2 No. 66
- RoHS Compliant

Related Products

- On-line UPS (S4K Industrial)
- Surge Protection
- Three Phase Power Conditioners
- Active Tracking® Filters

Selection Tables: Single Phase

Group 1 – CVS Series, 60 Hz

VA	Catalog Number	Voltage Input	Voltage Output	Height in (mm)	Width in (mm)	Depth in (mm)	Ship Weight lbs (kg)	Design Style	Elec Conn
30	**23–13–030–2**	120	120	7.00 (177.8)	4.00 (101.6)	5.00 (127.0)	9.0 (4.08)	1	J
60	**23–13–060–2**	120	120	7.00 (177.8)	4.00 (101.6)	5.00 (127.0)	9.0 (4.08)	1	J
120	**23–22–112–2**	120, 240	120	8.00 (203.2)	4.00 (101.6)	5.00 (127.0)	13.0 (5.90)	1	J
250	**23–23–125–8**	120, 240, 480	120	11.00 (279.4)	6.00 (152.4)	8.00 (203.2)	29.0 (13.15)	1	G
500	**23–23–150–8**	120, 208, 240, 480	120, 240	13.00 (330.2)	9.00 (228.6)	7.00 (177.8)	42.0 (19.05)	1	H
1000	**23–23–210–8**	120, 208, 240, 480	120, 240	17.00 (431.8)	9.00 (228.6)	7.00 (177.8)	65.0 (29.48)	1	H
2000	**23–23–220–8**	120, 208, 240, 480	120, 240	18.00 (457.2)	13.00 (330.2)	10.00 (254.0)	111.0 (50.35)	1	H
3000	**23–23–230–8**	120, 208, 240, 480	120, 240	19.00 (482.6)	13.00 (330.2)	10.00 (254.0)	142.0 (64.41)	1	H
5000	**23–23–250–8**	120, 208, 240, 480	120, 240	28.00 (711.2)	13.00 (330.2)	10.00 (254.0)	222.0 (100.70)	1	H
7500 *	**23–28–275–6**	240, 480	120, 240	27.00 (685.8)	25.00 (635.0)	9.00 (228.6)	365.0 (165.56)	2	J

* This unit is UL Listed only.

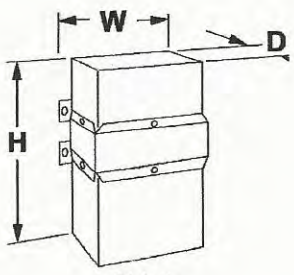
Specifications

Parameter	Condition	Value
	Input	
Voltage	Continuous at full load (lower input voltage possible at lighter load)	+10% to -20% of nominal
	For temporary surge or sags	+20% to -35% of nominal
Current [1]	at Full Load & 80% of nominal input voltage	$I_{in} \cong (VA/.87)/(V_{in} \times 80\%)$
Frequency	See Operating Characteristics section for details.	60 Hz
	Output [2]	
Line Regulation	V_{in} >80% and <110% of nominal	±1%
Overload Protection	At Nominal Input Voltage	Current limited at 1.65 times rated current
Output Harmonic Distortion	At Full Load within Input Range	3% total RMS content
Noise Attenuation	-Common Mode -Transverse Mode	40 dB 40 dB
	General	
Efficiency	At Full Load	Up to 92%
Storage Temperature	Humidity <95% non-condensing	-20° to 80°C
Operating Temperature	Humidity <95% non-condensing	-20° to 50°C
Audible Noise	Full Resistive Noise	32 dBA to 65 dBA
Warranty	10 year limited warranty	

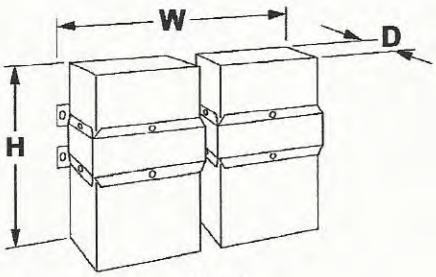
Notes:

1 - Consult user manual for fuse sizing.
2 - It is recommended that the unit run at a minimum of 40-50% load.
See the Operating Characteristics section for more details.

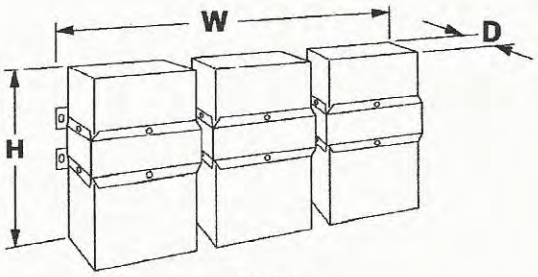
Design Styles (CVS and MCR Hardwired)



Style 1



Style 2



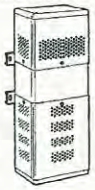
Style 3

These styles are single phase only.

Constant Voltage Sinusoidal Transformers Operating and Service Manual

Introduction

This operating and service manual has been prepared to ensure that your Sola/Hevi-Duty Constant Voltage Transformer can be operated and serviced with minimal effort and involvement. This manual covers Sola/Hevi-Duty Constant Voltage Sinusoidal (CVS) Transformers.



Installation - Mechanical Position

All stock sizes with end housings are intended to be mounted with the silk-screened this side up legend facing upwards. This will place the ventilated capacitor compartment downward, thus providing cooler operation of the capacitor(s). However, all units will give satisfactory performance if mounted in a horizontal position. In either case, the unit should be mounted in an area where it is unlikely that anyone will come into contact with the core surface of the unit.

Mounting Considerations

If a unit is to be wall mounted, the mounting hardware should be sized as in Table 1 below. All mounting holes provided must be used.

Table 1. Mounting Screw/Bolt Sizing

Rated VA of Regulator	Min. Diameter of Steel Mounting Screw
30-120	#10 Machine Screws
250	1/4" bolts
500 to 1000	5/16" bolts
1500 to 10000	3/8" bolts
15000	1/2" bolts

All ratings depend on natural draft air circulation for cooling. They should not be mounted in confined or enclosed spaces unless special provisions have been made for ventilation. Technical Services is available for assistance in doubtful situations (see note on Operating Temperature). Table 2 and Figure 1 show model number with their weight and physical dimensions.

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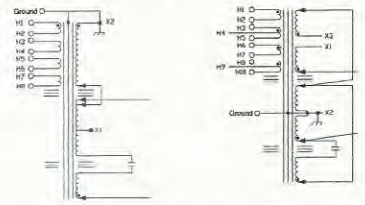
Installation – Electrical

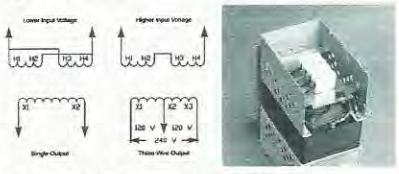
On 60VA or smaller units, screw-type lugs in the outlet box are marked "input" and "output", and no connection diagram is necessary. Units rated 120 to 15000 VA are provided with multiple inputs for any one, two, three, or four different line voltages, and some have provision for three-wire output. With all units, a connection diagram is attached to the inside lid of the box cover, or inserted in the outlet box. Figure 2 shows typical connections for –8 models, and Figure 3 shows multiple input connections for all other models. Figure 4 shows the output connections for all models.

Figure 2: Electrical Connections for -8 models



All Except 250 VA *250 VA only*

Figure 3: Electrical Connections for Non-8 models



Note: *Secondaries are not grounded. Ground X2 per Code.*

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Three-Phase Power Wiring

If operation from a three-phase source is required, three hardwired regulators may be wired in delta as shown in Figure 4.

Other Considerations

It is desirable to have a switch in the input circuitry for turning off power to the unit when it is not in use. While all CVS transformers are designed for continuous duty, they draw appreciable current regardless of output loading.

The outputs of all Sola/Hevi-Duty standard CVS transformers are isolated from the input lines. Voltage generated by internal leakage currents will occur with respect to ground. This can have undesirable effects in many pieces of electronic equipment. Therefore, if Figure 4 circuit "B" is used, it is suggested that the installer remove X2 grounding on –8 units, then connect all X2 from each phase to one location and ground at that location only. This is not required for circuit "A". This will not affect regulation or the ability to reject power line noise or transients.

Any three stock units having a tap for 190-260 input connections may be connected in delta to a 240-volt, three-phase power supply. Those units equipped with primary tap for 175-235 volts may also be connected in delta to a 208-volt supply. (Terminals to be used are identified on the connection diagram located on the inside face of the outlet box cover.)

All stock production, harmonic-free units now have uniform terminal polarity. This eliminates the need for "phasing out" either input or output connections.

Output must serve three, independent, single-phase loads of the same total volt-ampere rating. Connections should be made in one of two ways shown in Figure 4.

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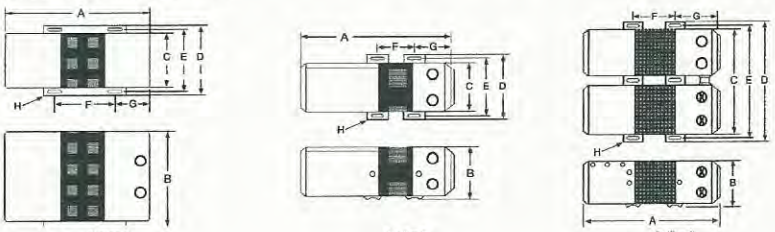
Table 2: CVS Weights and Physical Dimensions, 60 Hz Single Phase

VA	Catalog Number	Outline Drawing	Dimensions								Approx. Shipping Weight (lbs)
			A (in)	B (in)	C (in)	D (in)	E (in)	F (in)	G (in)	H (in)	
30	23-13-030-2	A	6.12	5.19	3.47	4.00	3.50	3.00	1.75	.22 x .59	7
60	23-13-060-2	A	6.94	5.19	3.47	4.00	3.50	3.00	1.75	.22 x .59	9
120	23-22-112-2	A	8.12	5.19	3.47	4.00	3.50	3.00	2.44	.22 x .59	13
250	23-23-125-8	A	10.50	7.56	4.75	5.63	4.75	4.12	3.03	.39 x .69	28
500	23-23-150-8	A	13.00	6.50	8.12	9.00	8.12	5.62	3.06	.38 x .81	37
1000	23-23-210-8	A	17.25	6.81	8.12	9.00	8.12	5.62	5.25	.38 x .81	63
2000	23-23-220-8	B	17.58	9.44	10.56	12.75	11.75	3.88	5.19	.44 x .69	109
3000	23-23-230-8	B	18.96	9.44	10.56	12.75	11.75	5.25	5.19	.44 x .69	142
5000	23-23-250-8	B	28.53	9.44	10.56	12.75	11.75	8.25	8.88	.44 x .69	222
7500	23-26-275-6	C	26.91	9.27	23.55	25.81	24.81	6.62	8.88	.44 x .69	365

Figure 1: Mounting Holes and Dimensions



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Input & Output Connections – All except 250 VA

Volts	Input	Jumper	Volts	Output
95-130	H1-H2	(H1 + H3 + H6 + H8) (H2 + H5 + H7 + H10)	120	X1 – X2 or X2 – X3
175-235	H1-H4	(H2 + H3) (H7 + H8) (H1 + H6) (H4 + H9)	240	X1 – X3
190-260	H1-H5	(H2 + H3) (H7 + H8) (H1 + H6) (H5 + H10)		
380-520	H1-H10	(H2 + H3) (H5 + H6) (H7 + H8)		

*Note: *The entire load up to the rated capacity of the unit can be drawn from either half of the 240 volt winding. It is not necessary to divide or balance the load.*

Input Connections - 250 VA Only

Volts	Input	Jumper	Volts	Output
95-130	H1-H2	(H1 + H3 + H5 + H7) (H2 + H4 + H6 + H8)	120	X1 – X2
190-260	H1-H4	(H2 + H3) (H6 + H7) (H1 + H5) (H4 + H8)		
380-520	H1-H8	(H2 + H3) (H4 + H5) (H6 + H7)		

Primary Voltage			Interconnect	Connect Lines To
30 & 60 VA	120 VA	7500 VA		
120	N/A	N/A	Note: H3 & H4 are not used	H1 & H2
N/A	120	240	H1 to H3 H2 to H4	H1 & H4
N/A	240	480	H2 to H3	H1 & H4
Secondary Voltage			Interconnect	Connect Lines To
30 & 60 VA	120 VA	7500 VA		
120	120	N/A		X1 & X2
N/A	N/A	120		X1 & X2 or H3 & X2
N/A	N/A	240		X1 & X3

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Table 3. Recommended Wire Sizes and Fusing

CVS	Input			Output	
VA Rating	Rated Volts	Req. Circuit Protection (In Amps.)	Min. Gauge 90°C Wire	Rated Volts	Min. Gauge 90°C Wire
30	95-130	1	14	120	14
60		2			
120	95-130	3	14	120	14
	190-260				
250	95-130	6	14	120	14
	190-260	3			
	380-520	1			
500	95-130	10	14	120 208 240	14
	175-235	6			
	190-260	6			
	380-520	3			
1000	95-130	15	14	120 208 240	14
	175-235	10			
	190-260	10			
	380-520	6			
2000	95-130	30	10	120 208 240	10 14 14
	175-235	20	12		
	190-260	15	14		
	380-520	10	14		
3000	95-130	45	8	120 208 240	8 12 12
	175-235	25	10		
	190-260	25	10		
	380-520	15	14		
5000	95-130	80	4	120 208 240	8* 10 10
	175-235	40	8		
	190-260	40	8		
	380-520	20	12		
7500	190-260	60	6	120 208 240	4 8
	380-520	30	10		

** Leads in the wiring department must be sleeved with 105°C sleeving.*

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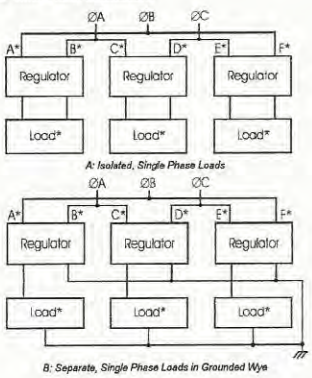
Use With Switchmode Power Supplies

If a CVS transformer is used as a source for a switchmode power supply, a slight amount of ringing may be noticed on the sinewave output of the CVS at half cycle intervals for a short duration. This ringing occurs at the point when the switchmode power supply current demand drops to zero. The ringing should not be a cause for concern since it is of relatively low magnitude and frequency. The CVS has been tested with a variety of switchmode power supplies and it has been determined that the ringing never affects the D outputs, nor has it been found to degrade the components of any switchmode power supply.

Figure 4. Three Phase Connections



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Multiple Operation

Two CVS transformers with the same rating may be connected with their inputs and outputs in parallel. The regulating action will usually be excellent although the standard ±1% cannot be guaranteed. Series connection of either input or output is not recommended.

Use With Rectifier Loads

The ratio of crest to rms values is approximately 1.3 at rated load, and slightly lower at fractional loads. This factor must be considered when all or a portion of the voltage is rectified. The rectified voltage will now be 10 – 15% lower than if connected directly to a sinewave source.

Operation With Motor Loads

Because of the current limiting effect described later, special attention should be given to motor applications. In general, the CVS must have a load rating nearly equal to the maximum power drawn during the starting cycle. This may run from two to eight times the normal running rating of the motor. In doubtful cases, it is advisable to measure the actual starting current.

Cascade Operation

For applications requiring close regulation, two CVS transformers may be operated in "cascade". The output of the combination will show little or no detectable change arising from supply line variations of up to ±15%. However, the combined units will still be frequency sensitive (as discussed under Effect of Frequency, page 15). Since even good power systems may vary in frequency by 0.1% or more, the output of a Sola/Hevi-Duty cascade combination may vary by up to 0.25% from this cause alone. In actual practice, then, a cascade combination is highly recommended for special applications requiring regulation in the general region of ±0.25%. If the tandem setup is to be operated at near full rating, then the Type CVS "driver" unit should be one standard size larger than the driven unit, in order to overcome the losses in the latter.

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Physical Characteristics of Operation

Operating Temperature

Standard units are designed to operate in ambient temperatures of minus 20°C to plus 50°C. In operation, a temperature rise will occur whether or not the transformer is serving load. Normally, this rise may fall anywhere in the range of 45°C to 110°C, depending on the type and rating. In any case, the maximum operating temperature at an ambient of 50°C is always within safe operating limits for the class of insulating material used. (Special units can be designed for lower heat rise or wider ambient temperature range.)

External Magnetic Fields

In almost all applications, this effect may be disregarded. On critical applications, care should be exercised in the orientation of the core with respect to critical circuits, in order to minimize the effect of the field.

In certain rare cases in which the transformer is connected to, or mounted near, high gain audio frequency circuits, special attention may need to be given to adequate physical spacing and/or orientation of the CVS transformer to avoid interaction with the audio circuits. Sola/Hevi-Duty's Technical Service Department (800-377-4384) may be able to offer suggestions for such problems.

Electrical Characteristics of Operation

Checking With Voltmeters

All checks on output voltages should be made with a true RMS voltmeter such as a Fluke model 8020 A. Rectifier-type voltmeters will not give accurate readings due to the small amount of harmonics present in CVS output.

Load Regulation

Changes in output voltage resulting from changes in resistive loads are usually small - running one percent or less in the larger units. Table 4 shows average values for output voltages.

Table 4: Output Voltage Changes – 20% Load to Full Load (100% Power Factor – Nominal Input Voltage)

Transformer VA	%Change - Output Voltage
31-120	approximately 3%
121-150	approximately 2%
151-over	approximately 1%

Phase Shift

The phase difference that exists between input voltage and output voltage is in the range of about 120° to 140° at full load. This phase difference varies with the magnitude of the load and, to a lesser extent, with changes in line voltage.

Output Wave Shape

The CVS transformers all include harmonic-neutralizing circuitry. These units typically have less than 3% total harmonic distortion at full load and less than 4.5% at no load.

Response Time

An important advantage of the Sola/Hevi-Duty principle of static magnetic regulation is its exceedingly fast response time compared with other types of AC regulators. Transient changes in supply voltage are usually corrected with a Sola/Hevi-Duty CVS with 1 1/2 cycles or less, the output voltage will not fluctuate more than a few percent during this interval.

Isolation

Since the input and output are separated not only electrically, but also physically, by a magnetic shunt, the Sola/Hevi-Duty CVS has a stronger isolating effect than a conventional transformer. This may often eliminate the need for static shields.

Factors Affecting Operation

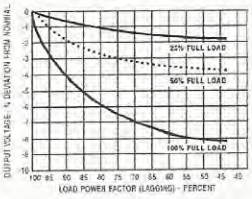
Input Characteristics

As the Sola/Hevi-Duty CVS transformer includes a resonant circuit that is fully energized whether or not a load is present, the input current at no load or light loads may run 50% or more of the full-load primary current. As a result, the temperature of the unit may rise to near full-load levels, even at light or nonexistent loads. Input power factor will average 90-100% at full load, but may drop to approximately 75% at half load and 25% at no load. In any case, it is always leading.

Effect of Load Power Factor

The median value of output voltage will vary from the nameplate rating of the load if a power factor other than that for which the unit was designed is used. Load regulation will also be relatively greater as the inductive load power factor is decreased (see Figure 5). However, the resulting median values of the output voltage will be regulated against supply line changes at any reasonable load or power factor.

Figure 5: Median Output Voltage vs. Load Power Factor



Change in "Median" Output Voltage vs. Load Power Factor at various loads

Servicing

Routine Maintenance

As the Sola/Hevi-Duty CV Transformer is a simple rugged device without moving parts or manual adjustments, no servicing or maintenance is needed in the ordinary sense. The percentage of possible poor performance or failure is exceedingly low. In any case of apparent poor performance, the user is urged to check the following points immediately:

Checklist on Factors Affecting Performance

A. Nominal Voltage Too High
   1. The load may be considerable less than full rating. (See "Load Regulation").
   2. The load may have a leading power factor.

B. Nominal Voltage Too Low
   1. Load power factor may be lagging. (See Load Regulation).
   2. Unit may be slightly overloaded. (See Current Limitation).

C. Does Not Regulate Closely
   1. Unit may be slightly overloaded. (See Current Limitation).
   2. Actual line voltage swings may be outside the rated coverage of unit, particularly on the low side.
   3. On varying loads, a certain amount of load regulation may be mixed with the line voltage regulating action. (See Load Regulation).

D. Output Voltage Very Low (20-60V)
   1. Unsuspected or unplanned overloads of substantial size may occur intermittently (motor-starting currents, solenoid inrush currents, etc.). (See Current Limitation).
   2. One or more capacitor units in the CVS transformer may be defective. (See Field Replacement of Capacitors)

Checklist on Factors Affecting Performance - continued

E. No Output Voltage At All
   1. Check power source breakers or fuses.
   2. Check continuity between input terminals, and also between output terminals.

G. Transformer Operating Temperature
   1. These transformers are designed to operate at high flux density, and hence, relatively high temperatures (see Operating Temperature). After connection to line for a half hour or so, the exposed core structure may be too hot to touch with bare hand, but this is normal and need give no concern. However, if there is any indication of oil or compound leakage, unit should be returned to factory (see below).

Note

In case the transformer is operating but does not appear to have the correct output, it is very helpful to apply the following test:

1. Disconnect the working load.
2. Connect a dummy load of lamps, heaters, or other resistive load substantially equal to the full load rating of transformers, directly across its output terminals.
3. Measure the output voltage of the CVS using a true RMS type voltmeter directly across its output terminals.

This test will usually establish whether the apparent poor performance is due to a fault in the CVS transformer or to some peculiarity of the working load. Sola/Hevi-Duty's Technical Service Department will then be in far better position to give helpful service advice or suggest factory test or service as indicated.

Factory Test and Inspection

If the field test suggested earlier indicated that the CVS transformer itself may be faulty, a full report of the difficulty should be communicated to the place of purchase, with a request for permission for return. The Authorized Sola/Hevi-Duty Distributor may then suggest further helpful field tests, or authorize return for inspection at once. A Return Authorization Number will be issued. This number must appear on the outside of the shipping container. Otherwise the shipment will not be accepted.

Field Replacement of Capacitors

Capacitors used in all CVS transformers are of the highest commercial grade available. Nevertheless, there is a certain small percentage of failure. Sola/Hevi-Duty's guarantee includes free replacement at the factory of any capacitor unit that fails within one year from date of purchase. Older units can be replaced at moderate charge.

It may be possible to test and identify defective capacitors in the field, and to make field replacement with new units shipped from the factory. In all such cases, factory advice and cooperation should be requested in advance.

Warranties

Sola/Hevi-Duty warrants its standard catalog products to be free from defects in materials and workmanship and agrees to correct by repair or replacement, at the option of Sola/Hevi-Duty, products that may fail in service provided the product has been installed, operated and maintained in accordance with accepted industry practice.

Warranty begins at the date of manufacture and is according to the following schedule:

1. Standard catalog transformer and single phase, power conditioning products – 10 years plus an additional 2 years if online registration (http://www.solahevidutv.com/support/Warranty.htm) is completed within 14 days after installation.
2. Products manufactured to a purchaser's specifications – 1 year.

Return Policy

Most instances of initial failure to operate properly can be remedied through a telephone conversation between the user and Technical Service. If it is determined that a product must be returned, contact your local Sola/Hevi-Duty distributor for a Return Authorization. If the distributor is unknown, contact Customer Service at (877) 999-7652 or customer.service@sola-hevi-duty.com for instructions.

All returns to the Sola/Hevi-Duty factory must have a Return Authorization (R.A.#). The following information required for a Return Authorization (R.A.#):

1. Sola catalog number and/or model number.
2. Serial number.
3. Company name, address, phone number and contact person.
4. Proof of purchase from Distributor.
5. Description of problem.

For proper handling upon receipt at Sola/Hevi-Duty, the R.A.# must be clearly placed in several locations on the outside of the package. Sola/Hevi-Duty is not responsible for damage on returned goods not packaged properly or customer-abused units.

Constant Voltage Sinusoidal Transformers
Operating and Service Manual

SOLA/ HEVI-DUTY
Electrical Group

Sola/Hevi-Duty – The Power Quality Experts

Toll-Free (800) 377-4384
FAX: (800) 367-4384
www.solaheviduty.com

P/N 299-35206-1
Rev. 4 (June 2003)

5-500A

The 5-500A is intended for use as an amplifier, oscillator or modulator. The high plate current rating, low grid-plate capacitance and low driving power requirements permit maximum power capability to be combined with circuit simplicity and economic driver requirements.

The suppressor element of the 5-500A terminates at the tube base shell, and is designed to be operated at ground (zero) potential. The base shell must be grounded by means of suitable spring clips.

CHARACTERISTICS

Plate Dissipation (Max.) ..... 500 watts
Screen Dissipation (Max.) ..... 35 watts
Suppressor Dissipation ..... 10 watts
Grid Dissipation (Max.) ..... 12 watts
Cooling ..... Radiation & Forced Air
Filament .....Thoriated Tungsten
  Voltage ..... 10.0 volts
  Current ..... 10.2 amperes
Capacitances (Gnd. Cath. Connection):
  Input ..... 17.0 pF
  Output ..... 10.8 pF
  Feed-through ..... 0.1 pF
Base ..... 5-Pin Special
Recommended Air System Socket SK-410
Recommended Air Chimney SK-426
Recommended Heat Dissipating Connector HR-6
Maximum Plate Seal Temperature ..... 225°C
Maximum Base Seal Temperatures ..... 200°C
Maximum Length: ..... 7.00 in; 177.80 mm
Maximum Diameter: ..... 3.56 in; 90.40 mm
Weight (approximate) ..... 11 oz; 312 gm
Operating Position ..... Vertical, base up or down

Class of Operation	Type of Service	MAXIMUM RATINGS		TYPICAL OPERATION				
		Plate Voltage (volts)	Plate Current (amps)	Plate Voltage (volts)	Screen Voltage (volts)	Plate Current (amps)	Drive Power (watts)	Output Power (watts)
C	RF Amplifier	4000	0.45	4000	500	0.45	14	1300
C	RF Amplifier Plate Modulated	3200	0.35	3100	470	0.26	6	580
AB_1	RF Linear Amplifier	4000	0.45	4000	750	0.32	—	832
AB_1	AF Amplifier or Modulator	4000	0.45	4000	750	0.65*	—	1664*

*Two tubes.

Eimac®

EIMAC

5-500A

RADIAL-BEAM POWER PENTODE

•

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 5-500A is a compact, ruggedly constructed radial-beam power pentode having a maximum plate dissipation rating of 500 watts. It is intended for use as an amplifier, oscillator or modulator. The high plate current rating, low grid-plate capacitance and low driving power requirements permit maximum power capability to be combined with circuit simplicity and economic driver requirements.

The Eimac 5-500A is cooled by radiation from the plate and by circulation of forced-air through the base, around the envelope and over the plate seal. Cooling may be greatly simplified by the use of the Eimac SK-400 or SK-410 Air System Socket and the accompanying Eimac SK-426 glass chimney. These sockets are designed to maintain the correct balance of cooling air between the component parts of the tube.

The suppressor element of the 5-500A terminates at the tube base shell, and is designed to be operated at ground (zero) potential. The base shell must be grounded by means of suitable spring clips.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten, balanced			
Voltage		10.0	volts
Current		10.2	amperes
Grid-Screen Amplification Factor (Average)		5.5	
Direct Interelectrode Capacitances, Grounded Cathode	*Min.*	*Max.*	
Grid-Plate	—	.10	pf
Input	15.0	19.0	pf
Output	9.5	12.0	pf

MECHANICAL

Base	see drawing
Basing	see drawing
Mounting Position	Vertical, base up or down
Cooling	Radiation and forced air
Recommended Heat Dissipating Connector	Eimac HR-6
Recommended Socket	Eimac SK-400 or SK-410 Air System Socket
Recommended Chimney	Eimac SK-426
Maximum Overall Dimensions	
Length	7.00 inches
Diameter	3.56 inches
Net Weight	11 ounces
Shipping Weight	2.5 pounds

NOTE: Typical operation data are based on conditions of adjusting the r-f grid drive to a specified plate current, maintaining fixed conditions of grid bias and screen voltage. It will be found that if this procedure is followed there will be little variation in power output between tubes even though there may be some variation in grid and screen currents. Where grid bias is obtained principally by means of a grid resistor, to control plate current it is necessary to make the resistor adjustable.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4000 Max. Volts
D-C SCREEN VOLTAGE	600 Max. Volts
D-C SUPPRESSOR VOLTAGE	100 Max. Volts
D-C PLATE CURRENT	450 Max. ma
PLATE DISSIPATION	500 Max. Watts
SCREEN DISSIPATION	35 Max. Watts
GRID DISSIPATION	12 Max. Watts

TYPICAL OPERATION

D-C Plate Voltage	2500	3000	4000 Volts
D-C Screen Voltage	500	500	500 Volts
D-C Grid Voltage	—210	—220	—240 Volts
D-C Suppressor Voltage	0	0	0 Volts
D-C Plate Current	405	432	450 ma
D-C Screen Current	55	65	65 ma
D-C Grid Current	28	35	38 ma
Screen Dissipation	27.5	32.5	33 Watts
Grid Dissipation	2.8	3.8	5.0 Watts
Peak R-F Grid Input Voltage	310	330	365 Volts
MF Driving Power*	8.7	12	14 Watts
Plate Power Input	1015	1300	1800 Watts
Plate Dissipation	265	495	500 Watts
Plate Power Output	750	805	1300 Watts

*Driving Power increases as frequency is increased.

RADIO-FREQUENCY LINEAR AMPLIFIER

Class AB_1, Grounded Cathode, one tube

MAXIMUM RATINGS

DC PLATE VOLTAGE	4000 Max. Volts
DC SCREEN VOLTAGE	1000 Max. Volts
DC SUPPRESSOR VOLTAGE	100 Max. Volts
DC PLATE CURRENT	450 Max. ma
PLATE DISSIPATION	500 Max. Watts
SCREEN DISSIPATION	35 Max. Watts

TYPICAL OPERATION (Frequencies below 30 Mc.)
Peak-Envelope or Modulation-Crest Conditions.
Adjusted for minimum distortion.

DC Plate Voltage	2000	3000	4000 Volts
DC Screen Voltage	750	750	750 Volts
DC Suppressor Voltage	0	0	0 Volts
DC Control Grid Voltage*	—100	—112	—121 Volts
Zero-Signal DC Plate Current	150	100	80 mA
Single-Tone DC Plate Current	338	320	322 mA
Two-Tone DC Plate Current	252	221	212 mA
Single-Tone DC Screen Current	31	26	24 mA
Two-Tone DC Screen Current	15	12	10 mA
Peak RF Grid Voltage	100	112	121 Volts
Useful Output Power	395	612	832 Watts
Resonant Load Impedance	3600	5800	7700 Ohms
Third Order Intermodulation Products**	—52	—33	—28 db
Fifth Order Intermodulation Products**	—49	—41	—37 db

*1. Adjust to the specified zero-signal plate current.

**2. Equal or better than stated for all signal levels up to indicated useful output power. Reference to one tone of a two-tone test signal.

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony
(Carrier conditions unless otherwise specified.)

MAXIMUM RATINGS

DC PLATE VOLTAGE	4000 Volts
DC SCREEN VOLTAGE	600 Volts
DC SUPPRESSOR VOLTAGE	100 Volts
DC GRID VOLTAGE	—500 Volts
DC PLATE CURRENT	340 ma
PLATE DISSIPATION	330 Watts
SCREEN DISSIPATION	35 Watts
GRID DISSIPATION	12 Watts

TYPICAL OPERATION

DC Plate Voltage	2700	3100	3500 Volts
DC Screen Voltage	450	470	500 Volts
DC Grid Voltage	—270	—310	—300 Volts
DC Suppressor Voltage	0	0	0 Volts
DC Plate Current	285	260	305 ma
DC Screen Current	68	50	55 ma
DC Grid Current	20	15	18 ma
Screen Dissipation	31	23	27 Watts
Peak A-F Screen Voltage Approx. (100% Modulation)	350	330	350 Volts
Peak R-F Grid Voltage	355	385	375 Volts
MF Grid Driving Power	7	6	7 Watts
Plate Dissipation	160	220	280 Watts
Plate Power Output	580	580	780 Watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class AB

MAXIMUM RATINGS (Per Tube)

D-C PLATE VOLTAGE	4000 Max. Volts
D-C SCREEN VOLTAGE	1000 Max. Volts
D-C SUPPRESSOR VOLTAGE	100 Max. Volts
MAX-SIGNAL D-C PLATE CURRENT	450 ma
PLATE DISSIPATION	500 Max. Watts
SCREEN DISSIPATION	35 Max. Watts
GRID DISSIPATION	12 Max. Watts

TYPICAL OPERATION CLASS AB_1
(Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	3000	4000 Volts
D-C Screen Voltage	750	750 Volts
D-C Suppressor Voltage	0	0 Volts
D-C Grid Voltage (approx.)*	—112	—121 Volts
Zero-Signal D-C Plate Current	200	160 ma
Max-Signal D-C Plate Current	640	645 ma
Zero-Signal D-C Screen Current	0	0 ma
Max-Signal D-C Screen Current	52	48 ma
Effective Load, Plate-to-plate	11,600	15,400 Ohms
Peak A-F Grid Input Voltage (per tube)	112	121 Volts
Driving Power	0	0 Watts
Max-Signal Plate Power Output	1224	1664 Watts

*Adjust to give stated zero-signal plate current. The D-C resistance in series with the control grid of each tube should not exceed 250,000 ohms.

If it is desired to operate this tube under conditions widely different from those given under "Typical Operation," possibly exceeding the maximum ratings given for CW service, write Eimac, A Division of Varian Associates, for information and recommendations.

APPLICATION

MECHANICAL

MOUNTING—The 5-500A must be mounted vertically, base up or base down. The socket must be constructed so as to allow an unimpeded flow of air through the holes in the base of the tube and must also provide clearance for the glass tip-off which extends from the center of the base. The metal tube-base shell should be grounded by means of suitable spring fingers. The above requirements are met by the Eimac SK-400 and SK-410 Air-System Sockets. A flexible connecting strap should be provided between the Eimac HR-6 cooler on the plate terminal and the external plate circuit. The tube must be protected from severe vibration and shock.

COOLING—Adequate forced-air cooling must be provided to maintain the base seals at a temperature below 200°C., and the plate seal at a temperature below 225°C.

When the Eimac SK-400 or SK-410 Air-System Sockets and SK-426 chimney are used, a minimum air flow of 14 cubic feet per minute at a static pressure of 0.25 inches of water, as measured in the socket at sea level, is required to provide adequate cooling under all conditions of operation. Seal temperature limitations require that cooling air be supplied to the tube even when the filament alone is on during standby periods.

In the event an Air-System socket is not used, provision must be made to supply equivalent cooling of the base, the envelope, and the plate lead.

Tube temperatures may be measured with the aid of "Tempilaq," a temperature-sensitive laquer manufactured by the Tempil Corporation, 132 West 22nd Street, New York 11, N.Y.

ELECTRICAL

FILAMENT VOLTAGE—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated voltage of 10.0 volts. Variations in filament voltage must be kept within the range of 9.5 to 10.5 volts.

The 5-500A features a balanced filament structure to help the designer meet FCC hum and noise specifications in AM service.

BIAS VOLTAGE — The d-c bias voltage for the 5-500A should not exceed 500 volts. If grid leak bias is used, suitable means must be provided to prevent excessive plate or screen dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired values from tube to tube. In operation above 50 Mc., it is advisable to keep the bias voltage as low as is practicable.

SCREEN VOLTAGE—The d-c screen voltage for the 5-500A should not exceed 800 volts in r-f applications. In audio applications a maximum d-c screen voltage of 1,000 volts may be used. The screen voltages shown under "Typical Operation" are representative voltages for the type of operation involved.

PLATE VOLTAGE—The plate-supply voltage for the 5-500A should not exceed 4000 volts in CW and audio applications. In plate-modulated telephony service the d-c plate-supply voltage should not exceed 3200 volts, except below 30 Mc., intermittent service, where 4000 volts may be used.

GRID DISSIPATION — Grid dissipation for the 5-500A should not be allowed to exceed 12 watts. Grid dissipation may be calculated from the following expression,

$$Pg = \varepsilon cmp Ic$$

where Pg = Grid Dissipation

εcmp = Peak positive grid to cathode voltage, and

Ic = D-C grid current

εcmp may be measured by means of a suitable peak voltmeter connected between filament and grid.

SCREEN DISSIPATION — The power dissipated by the screen of the 5-500A must not exceed 35 watts. Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit screen dissipation to 35 watts in event of circuit failure.

PLATE DISSIPATION—Under normal operating conditions, the plate dissipation of the 5-500A should not be allowed to exceed 500 watts.

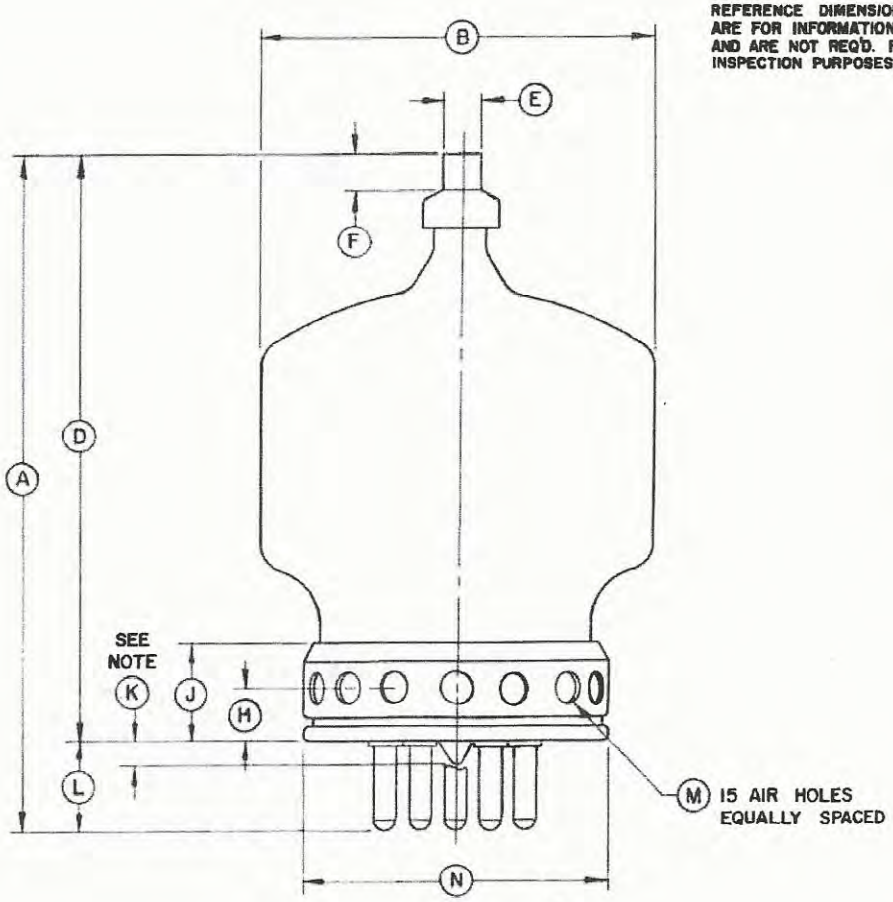
In plate modulated amplifier applications, the maximum allowable carrier-condition plate dissipation is 330 watts. The plate dissipation may rise to 500 watts under 100% sinusoidal modulation.

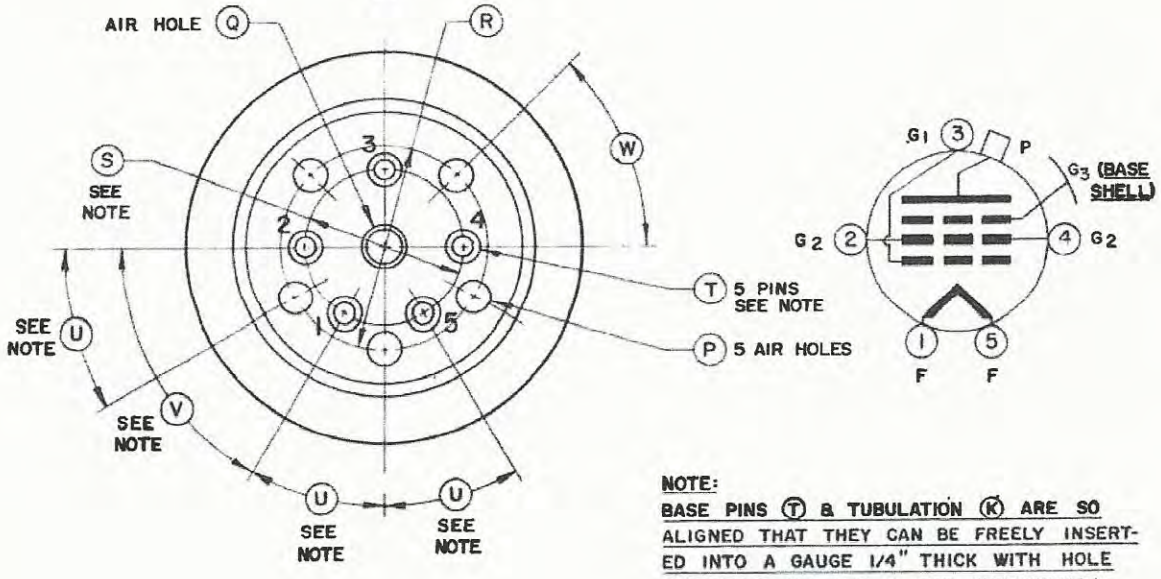
Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

General information pertaining to the operation of the 5-500A may be found in Application Bulletin No. 8, "The Care and Feeding of Power Tetrodes." This Bulletin is available upon request.

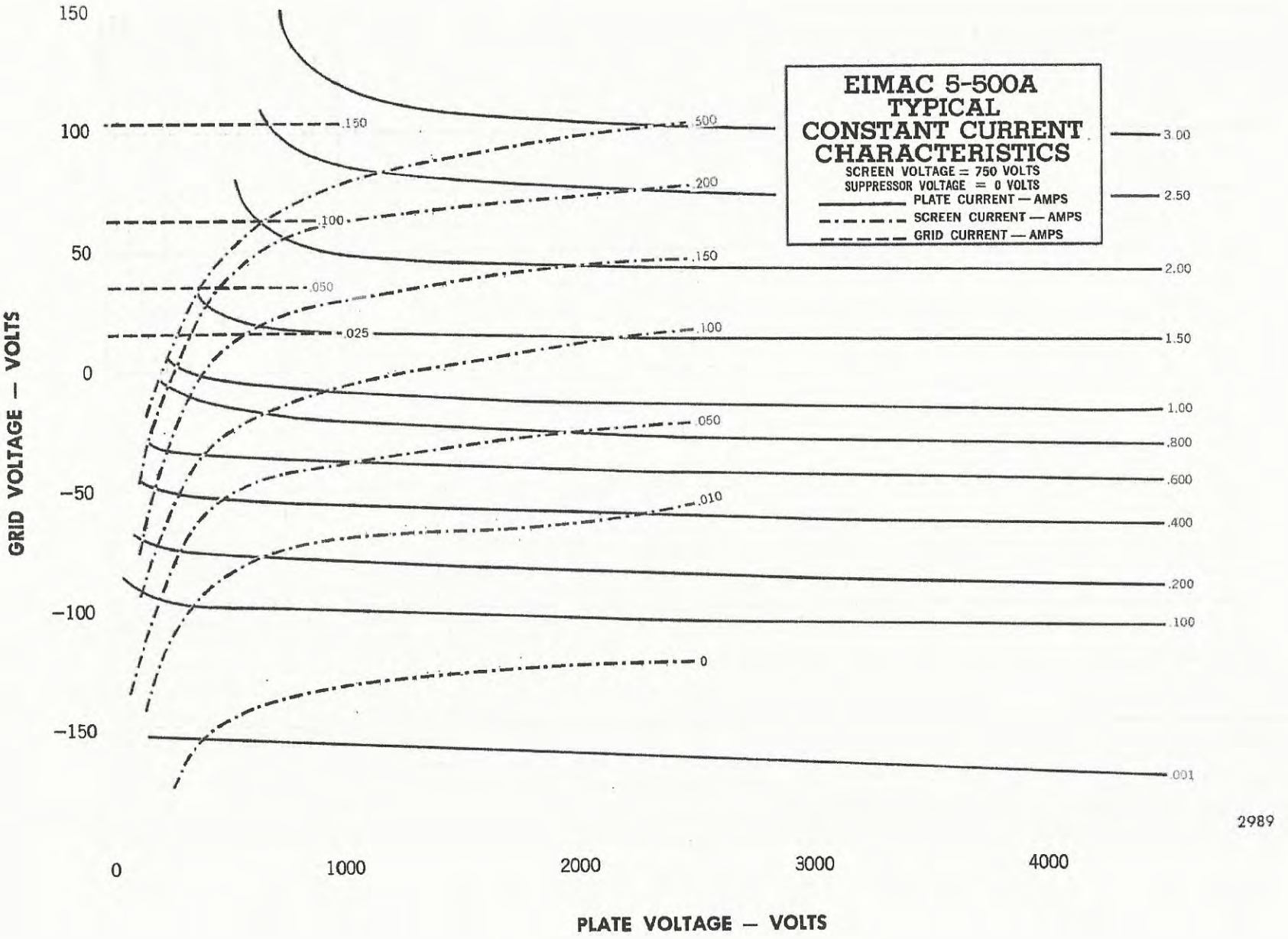
REFERENCE DIMENSIONS ARE FOR INFORMATION ONLY AND ARE NOT REQ'D. FOR INSPECTION PURPOSES.

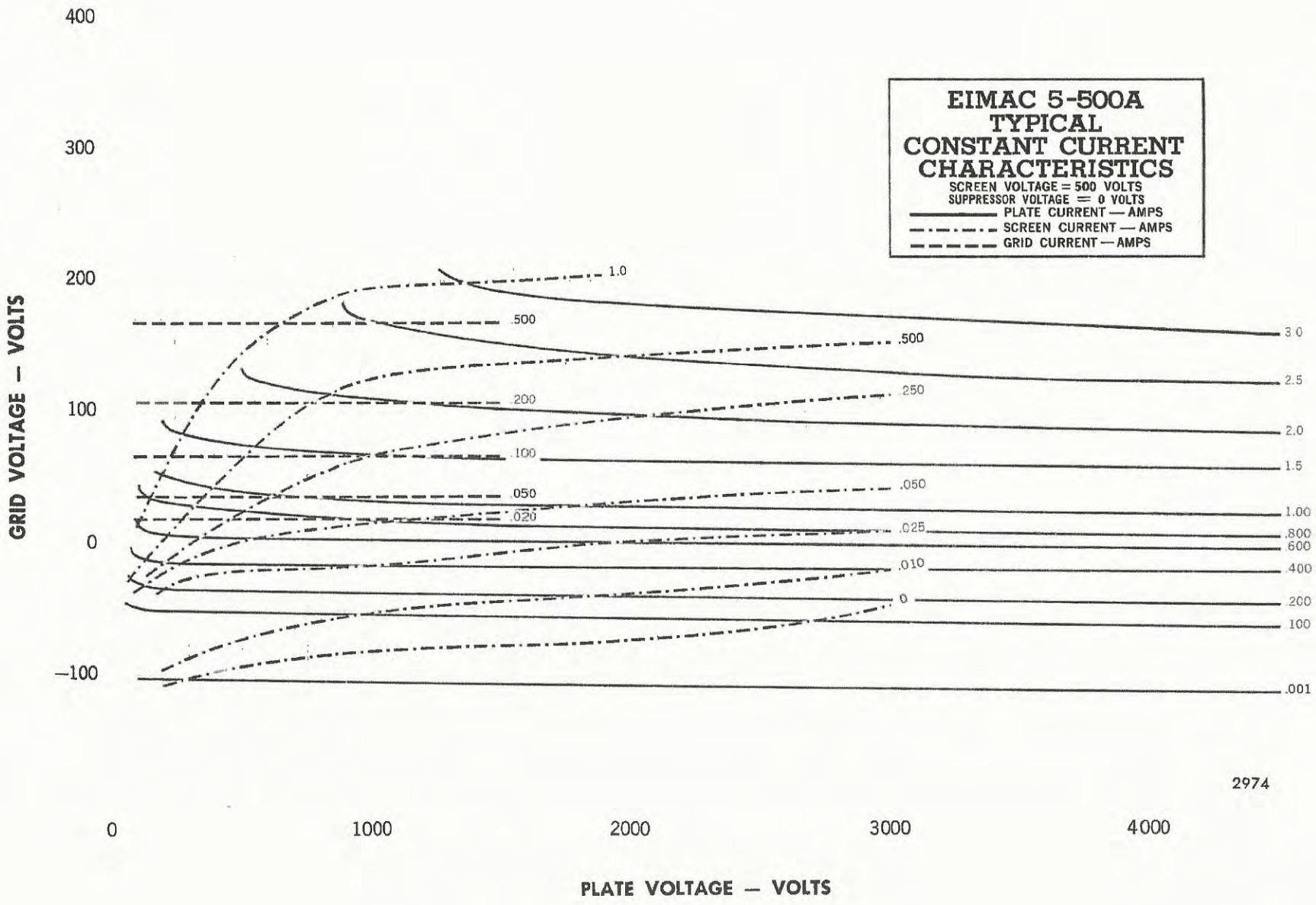
DIMENSIONS IN INCHES			
DIMENSIONAL DATA			
DIM.	MIN	MAX.	REF.
A	6.500	7.000	
B		3-9/16 D.	
D	5.750	6.250	
E	.350 D.	.365 D.	
F	21/64		
H			7/16
J			31/32
K		1.1/4	
L			3/4
M			1/4 D.
N		2-3/4 D.	
P			5/16 D.
Q			1/2 D.
R			1-5/8 D
S			1-1/4 D.P.C.
T	.185 D.	.191 D.	
U			30°
V			60°
W			45°





NOTE:
BASE PINS (T) & TUBULATION (K) ARE SO ALIGNED THAT THEY CAN BE FREELY INSERTED INTO A GAUGE 1/4" THICK WITH HOLE DIAMETERS OF .204 & .500 RESPECTIVELY LOCATED ON THE TRUE CENTERS BY THE GIVEN DIMENSIONS (V), (U), (S).





EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

4-400A

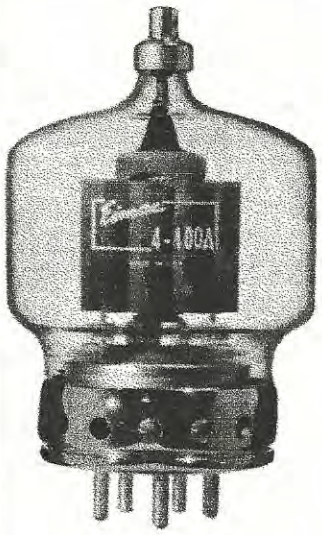
RADIAL-BEAM POWER TETRODE

•

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 4-400A is a compact, ruggedly constructed power tetrode having a maximum plate dissipation rating of 400 watts. It is intended for use as an amplifier, oscillator or modulator. The low grid-plate capacitance of this tetrode coupled with its low driving-power requirement allows considerable simplification of the associated circuit and driver stage.

The 4-400A is cooled by radiation from the plate and by circulation of forced-air through the base, around the envelope, and over the plate seal. Cooling can be greatly simplified by using an Eimac 4-400A/4000 Air-System Socket and its accompanying glass chimney. This socket is designed to maintain the correct balance of cooling air between the component parts of the tube.†



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	5.0 volts
Current	14.5 amperes
Grid-Screen Amplification Factor (Average)	5.1
Direct Interelectrode Capacitances (Average)	
Grid-Plate	0.12 $\mu\mu$fd
Input	12.5 $\mu\mu$fd
Output	4.7 $\mu\mu$fd
Transconductance (I_b=100ma., E_b=2500V., E_{c2}=500V.)	4,000 μmhos
Frequency for Maximum Ratings	110 Mc.

MECHANICAL

Base	See drawing
Basing	See drawing
Mounting Position	Vertical, base down or up
Cooling	Radiation and forced air
Recommended Heat Dissipating Plate Connector	Eimac HR-6
Recommended Socket	Eimac 4-400A/4000 Air-System Socket
Maximum Over-all Dimensions	
Length	6.38 inches
Diameter	3.56 inches
Net Weight	9 ounces
Shipping Weight	2.5 pounds

If an Air-System Socket is used, mounted on a 1/4 inch deck, the over-all dimensions of the system including chimney and HR-6 Heat Dissipating Plate Connector are:

Length	8.0 inches
Diameter	5.5 inches

▶ **Note:** Typical operation data are based on conditions of adjusting the r-f grid drive to a specified plate current, maintaining fixed conditions of grid bias and screen voltage. It will be found that if this procedure is followed, there will be little variation in power output between tubes even though there may be some variation in grid and screen currents. Where grid bias is obtained principally by means of a grid resistor, to control plate current it is necessary to make the resistor adjustable.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony

MAXIMUM RATINGS (Key-down conditions, per tube to 110 Mc.)

D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C SCREEN VOLTAGE	600 MAX. VOLTS
D-C PLATE CURRENT	350 MAX. MA
PLATE DISSIPATION	400 MAX. WATTS
SCREEN DISSIPATION	35 MAX. WATTS
GRID DISSIPATION	10 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc., one tube)

D-C Plate Voltage	2500	3000	4000	volts
D-C Screen Voltage	500	500	500	volts
D-C Grid Voltage	—200	—220	—220	volts
D-C Plate Current	350	350	350	ma
D-C Screen Current	46	46	40	ma
D-C Grid Current	18	19	18	ma
Screen Dissipation	23	23	20	watts
Grid Dissipation	1.8	1.9	1.8	watts
Peak R-F Grid Input Voltage	300	320	320	volts
Driving Power*	5.4	6.1	5.8	watts
Plate Power Input	875	1050	1400	watts
Plate Dissipation	235	250	300	watts
Plate Power Output	640	800	1100	watts

*Driving Power increases as frequency is increased. At 75 Mc. the driving power required is approximately 12 watts.

TYPICAL OPERATION (110 Mc., two tubes)

D-C Plate Voltage	3500	4000	volts
D-C Screen Voltage	500	500	volts
D-C Grid Voltage	—170	—170	volts
D-C Plate Current	500	540	ma
D-C Screen Current	34	31	ma
D-C Grid Current	20	20	ma
Driving Power (approx.)	20	20	watts
Plate Power Output (approx.)	1300	1600	watts
Useful Power Output	1160	1440	watts

†Guarantee applies only when the 4-400A is used as specified with adequate air in the 4-400A/4000 Air-System Socket or equivalent.

▶ Indicates change from sheet dated 1-30-53.

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions unless otherwise specified. One tube)

MAXIMUM RATINGS (Frequencies below 75 Mc. Continuous Service)

D-C PLATE VOLTAGE	3200 MAX. VOLTS
D-C SCREEN VOLTAGE	600 MAX. VOLTS
D-C GRID VOLTAGE	—500 MAX. VOLTS
D-C PLATE CURRENT	275 MAX. MA
PLATE DISSIPATION	270 MAX. WATTS
SCREEN DISSIPATION	35 MAX. WATTS
GRID DISSIPATION	10 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc. Continuous Service)

D-C Plate Voltage	2000	2500	3000	volts
D-C Screen Voltage	500	500	500	volts
D-C Grid Voltage	—220	—220	—220	volts
D-C Plate Current	275	275	275	ma
D-C Screen Current	30	28	26	ma
D-C Grid Current	12	12	12	ma
Screen Dissipation	15	14	13	watts
Grid Dissipation	1.1	1.1	1.1	watts
Peak A-F Screen Voltage (100% modulation)	350	350	350	volts
Peak R-F Grid Input Voltage	290	290	290	volts
Driving Power	3.5	3.5	3.5	watts
Plate Power Input	550	688	825	watts
Plate Dissipation	170	178	195	watts
Plate Power Output	380	510	630	watts

▶ MAXIMUM RATINGS (Frequencies below 30 Mc., Intermittent Service)

D-C Plate Voltage	4000 MAX. VOLTS
D-C Screen Voltage	600 MAX. VOLTS
D-C Grid Voltage	—500 MAX. VOLTS
D-C Plate Current	275 MAX. MA
Plate Dissipation	270 MAX. WATTS
Screen Dissipation	35 MAX. WATTS
Grid Dissipation	10 MAX. WATTS

TYPICAL OPERATION (Frequencies below 30 Mc., Intermittent Service)

D-C Plate Voltage	2000	2500	3000	3650	volts
D-C Screen Voltage	500	500	500	500	volts
D-C Grid Voltage	—220	—220	—220	—225	volts
D-C Plate Current	275	275	275	275	ma
D-C Screen Current	30	28	26	23	ma
D-C Grid Current	12	12	12	13	ma
Screen Dissipation	15	14	13	12	watts
Grid Dissipation	1.1	1.1	1.1	1.2	watts
Peak A-F Screen Voltage (100% modulation)	350	350	350	350	volts
Peak R-F Grid Input Voltage	290	290	290	315	volts
Driving Power	3.5	3.5	3.5	4.0	watts
Plate Power Input	550	688	825	1000	watts
Plate Dissipation	170	178	195	235	watts
Plate Power Output	380	510	630	765	watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS AB

MAXIMUM RATINGS (PER TUBE)

D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C SCREEN VOLTAGE	800 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	350 MAX. MA.
PLATE DISSIPATION	400 MAX. WATTS
SCREEN DISSIPATION	35 MAX. WATTS
GRID DISSIPATION	10 MAX. WATTS

TYPICAL OPERATION CLASS AB_1

(Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	2500	3000	3500	4000	volts
D-C Screen Voltage	750	750	750	750	volts
D-C Grid Voltage (approx.)*	—130	—137	—145	—150	volts
Zero-Signal D-C Plate Current	190	160	140	120	ma
Max-Signal D-C Plate Current	635	635	610	585	ma
Zero-Signal D-C Screen Current	0	0	0	0	ma
Max-Signal D-C Screen Current	28	26	32	40	ma
Effective Load, Plate-to-Plate	6800	8900	11,500	14,500	ohms
Peak A-F Grid Input Voltage (per tube)	130	137	145	150	volts
Driving Power	0	0	0	0	watts
Max-Signal Plate Dissipation (per tube)	370	400	400	400	watts
Max-Signal Plate Power Output	850	1110	1330	1540	watts

*Adjust to give stated zero-signal plate current. The D-C resistance in series with the control grid of each tube should not exceed 250,000 ohms.

TYPICAL OPERATION CLASS AB_2

(Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	2500	3000	3500	4000	volts
D-C Screen Voltage	500	500	500	500	volts
D-C Grid Voltage (approx.)*	—75	—80	—85	—90	volts
Zero-Signal D-C Plate Current	190	160	140	120	ma
Max-Signal D-C Plate Current	700	700	700	638	ma
Zero-Signal D-C Screen Current	0	0	0	0	ma
Max-Signal D-C Screen Current	50	40	38	32	ma
Effective Load, Plate-to-Plate	7200	9100	10,800	14,000	ohms
Peak A-F Grid Input Voltage (per tube)	133	140	145	140	volts
Max-Signal Peak Driving Power	8.6	9.0	10.2	7.0	watts
Max-Signal Nominal Driving Power	4.3	4.5	5.1	3.5	watts
Max-Signal Plate Dissipation (per tube)	320	363	400	400	watts
Max-Signal Plate Power Output	1110	1375	1650	1750	watts

*Adjust for stated zero-signal plate current.

Pulse Service—For information on Pulse Service Ratings, "Application Bulletin No. 3, Pulse Service Notes", will be furnished free on request.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

APPLICATION

MECHANICAL

Mounting—The 4-400A must be mounted vertically, base up or base down. The socket must be constructed so as to allow an unimpeded flow of air through the holes in the base of the tube and must also provide clearance for the glass tip-off which extends from the center of the base. The metal tube-base shell should be grounded by means of suitable spring fingers. The above requirements are met by the Eimac 4-400A/4000 Air-System Socket. A flexible connecting strap should be provided between the Eimac HR-6 cooler on the plate terminal and the external plate circuit. The tube must be protected from severe vibration and shock.

Cooling—Adequate forced-air cooling must be provided to maintain the base seals at a temperature below 200°C., and the plate seal at a temperature below 225°C.

When the Eimac 4-400A/4000 Air-System Socket is used, a minimum air flow of 14 cubic feet per minute at a static pressure of 0.25 inches of water, as measured in the socket at sea level, is required to provide adequate cooling under all conditions of operation. Seal temperature limitations may require that cooling air be supplied to the tube even when the filament alone is on during standby periods.

In the event an Air-System Socket is not used, pro-

▶ Indicates change from sheet dated 1-30-53.

vision must be made to supply equivalent cooling of the base, the envelope, and the plate lead.

▶ Tube temperatures may be measured with the aid of "Tempilaq", a temperature-sensitive lacquer manufactured by the Tempil Corporation, 11 West 25th Street, New York 10, N. Y.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated voltage of 5.0 volts. Variations in filament voltage must be kept within the range from 4.75 to 5.25 volts.

Bias Voltage—The d-c bias voltage for the 4-400A should not exceed 500 volts. If grid leak bias is used, suitable means must be provided to prevent excessive plate or screen dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired values from tube to tube. In operation above 50 Mc., it is advisable to keep the bias voltage as low as is practicable.

Screen Voltage—The d-c screen voltage for the 4-400A should not exceed 600 volts in r-f applications. In audio applications a maximum d-c screen voltage of 800 volts may be used. The screen voltages shown under "Typical Operation" are representative voltages for the type of operation involved.

Plate Voltage—The plate-supply voltage for the 4-400A should not exceed 4000 volts in CW and audio applications. In plate-modulated telephony service the d-c plate-supply voltage should not exceed 3200 volts, except below 30 Mc., intermittent service, where 4000 volts may be used.

Grid Dissipation—Grid dissipation for the 4-400A should not be allowed to exceed 10 watts. Grid dissipation may be calculated from the following expression,

$$P_g = e_{cmp} I_c$$

where P_g = Grid Dissipation
e_{cmp} = Peak positive grid to cathode voltage, and
I_c = D-c grid current

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. (For suitable peak v.t.v.m. circuits see Eimac Application Bulletin Number 6, "Vacuum Tube Ratings." This bulletin is available on request.)

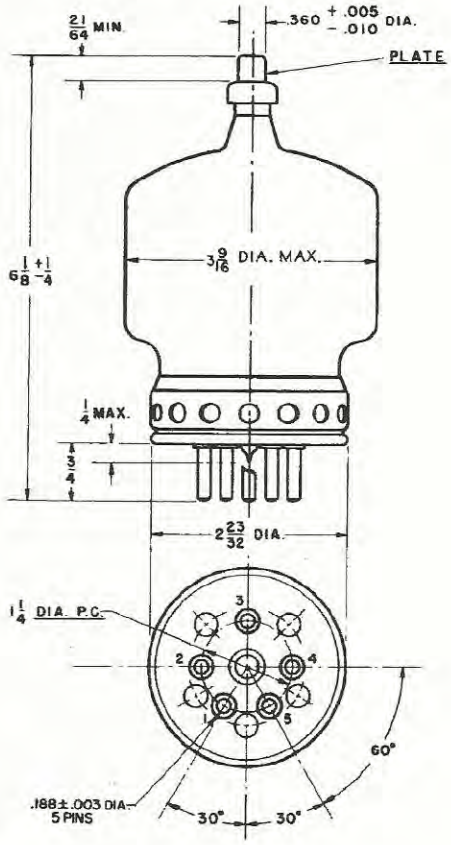
Screen Dissipation—The power dissipated by the screen of the 4-400A must not exceed 35 watts. Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit screen dissipation to 35 watts in event of circuit failure.

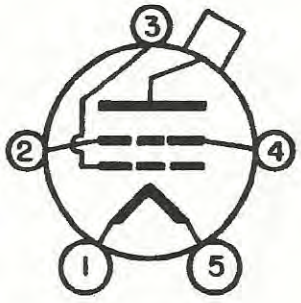
Plate Dissipation—Under normal operating conditions, the plate dissipation of the 4-400A should not be allowed to exceed 400 watts.

In plate modulated amplifier applications, the maximum allowable carrier-condition plate dissipation is 270 watts. The plate dissipation will rise to 400 watts under 100% sinusoidal modulation.

Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

GENERAL INFORMATION PERTAINING TO THE OPERATION OF THE 4-400A MAY BE FOUND IN APPLICATION BULLETIN NO. 8, "THE CARE AND FEEDING OF POWER TETRODES." THIS BULLETIN IS AVAILABLE UPON REQUEST.





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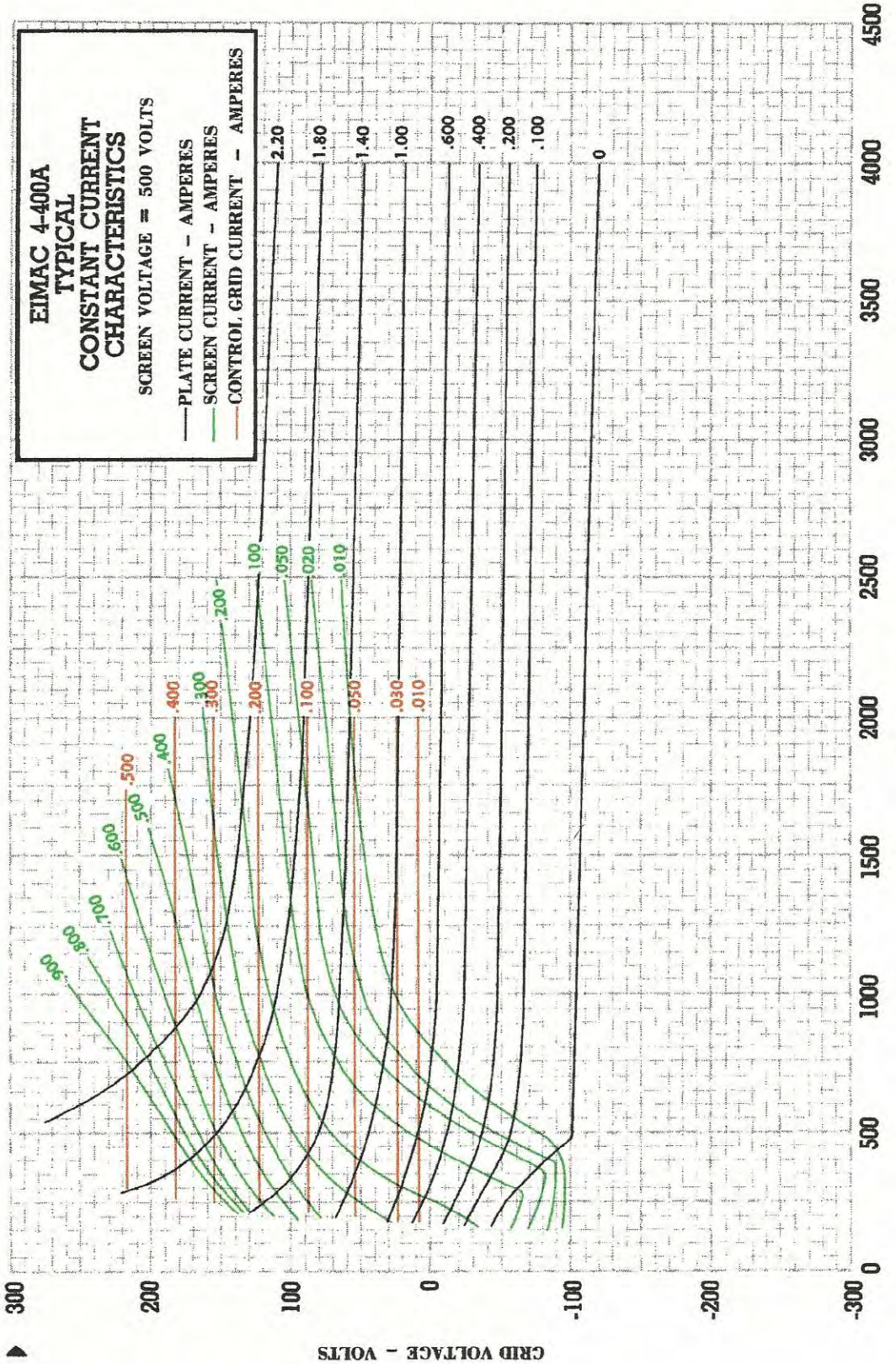

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PULSE MODULATORS

4PR60A

A high-vacuum, radial-beam tetrode intended for pulse-modulator service in circuits employing resistive loads. This tube unilaterally replaces the 715C and the 5D21.

MAXIMUM PLATE VOLTAGE
20 kilovolts

MAXIMUM PULSE PLATE CURRENT
18 amperes

COOLING
Radiation & Convection

CHARACTERISTICS

Cathode: Oxide-coated, unipotential

Heater:
- Voltage: 26.0 volts
- Current: 1.95 to 2.35 amperes

Capacitances (Grounded Cathode):
- Input: 35.0 to 50.0 uufd
- Output: 6.0 to 11.0 uufd
- Feed-through: 2.0 uufd

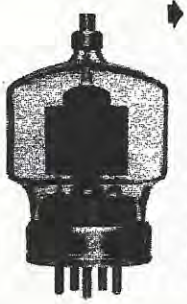
Socket: E. F. Johnson Co. No. 122-234
Maximum Seal Temp.: 200 °C
Maximum Envelope Temp.: 200 °C
Maximum Length: 6.0 inches
Maximum Diameter: 3.063 inches
Net Weight: 12 ounces

MAXIMUM RATINGS

D-C PLATE VOLTAGE	20 kilovolts
D-C SCREEN VOLTAGE	1.5 kilovolts
PEAK PLATE CURRENT	18 amperes
PLATE DISSIPATION	60 watts
SCREEN DISSIPATION	8 watts

TYPICAL OPERATION

D-C Plate Voltage	20 kilovolts
D-C Screen Voltage	1.25 kilovolts
Pulse Plate Voltage	19 kilovolts
Pulse Plate Current	18 amperes
Peak Drive Power	770 watts
Peak Output Power	342 kilowatts
Duty	0.1 percent



4PR400A

A compact, high-vacuum, radial-beam tetrode incorporating a pyrovac plate and non-emitting grids, intended for pulse-modulator service. A new pulse modulator in the Eimac line, it is recommended for use in new equipments whenever long pulse lengths, high duty factors, or high voltages preclude the use of tubes employing oxide-coated cathodes.

MAXIMUM PLATE VOLTAGE
20 kilovolts

MAXIMUM PULSE PLATE CURRENT
4 amperes

COOLING
Radiation & Forced Air

CHARACTERISTICS

Filament: Thoriated tungsten
- Voltage: 5.0 volts
- Current: 13.5 to 14.7 amperes

Capacitances (Grounded Cathode):
- Input: 10.7 to 14.5 uufd
- Output: 4.2 to 5.6 uufd
- Feed-through: 0.17 uufd

Base: 5-pin metal shell
Socket: Eimac SK-400
Max. Base-Seal Temp.: 200 °C
Max. Plate-Seal Temp.: 225 °C
Maximum Length: 8.0 inches
Maximum Diameter: 5.5 inches
Net Weight: 9 ounces

MAXIMUM RATINGS

D-C PLATE VOLTAGE	20 kilovolts
D-C SCREEN VOLTAGE	2.5 kilovolts
PEAK PLATE CURRENT	4 amperes
PLATE DISSIPATION	400 watts
SCREEN DISSIPATION	35 watts
GRID DISSIPATION	10 watts

TYPICAL OPERATION

D-C Plate Voltage	20 kilovolts
D-C Screen Voltage	1.5 kilovolts
Pulse Plate Voltage	19 kilovolts
Pulse Plate Current	4 amperes
Peak Drive Power	40 watts
Peak Output Power	76 kilowatts
Duty	1.5 percent

4PR1000A

A compact, high-vacuum, radial-beam tetrode incorporating a pyrovac plate and non-emitting grids, intended for pulse-modulator service. New to the Eimac line, this heavy-duty pulse modulator is recommended for use in new equipments where high voltage, high current, or high duty prevent the use of tubes employing oxide-coated cathodes.

MAXIMUM PLATE VOLTAGE
30 kilovolts

MAXIMUM PULSE PLATE CURRENT
8 amperes

COOLING
Radiation & Forced Air

CHARACTERISTICS

Filament: Thoriated tungsten
- Voltage: 7.5 volts
- Current: 20.0 to 22.7 amperes

Capacitances (Grounded Cathode):
- Input: 23.8 to 32.4 uufd
- Output: 6.8 to 9.4 uufd
- Feed-through: 0.35 uufd

Base: 5-pin metal shell
Socket: Eimac SK-500
Max. Base-Seal Temp.: 150 °C
Max. Plate-Seal Temp.: 200 °C
Maximum Length: 9.63 inches
Maximum Diameter: 5.25 inches
Net Weight: 1.5 pounds

MAXIMUM RATINGS

D-C PLATE VOLTAGE	30 kilovolts
D-C SCREEN VOLTAGE	2.5 kilovolts
PEAK PLATE CURRENT	8 amperes
PLATE DISSIPATION	1000 watts
SCREEN DISSIPATION	75 watts
GRID DISSIPATION	25 watts

TYPICAL OPERATION

D-C Plate Voltage	30 kilovolts
D-C Screen Voltage	1.5 kilovolts
Pulse Plate Voltage	29.4 kilovolts
Pulse Plate Current	8 amperes
Peak Drive Power	900 watts
Peak Output Power	235 kilowatts
Duty	1.0 percent

6C21

A high-vacuum triode designed for pulse-modulator service and incorporating a pyrovac plate and a non-emitting grid. It is recommended for use where long-pulse requirements rule out the use of tubes employing oxide-coated cathodes.

MAXIMUM PLATE VOLTAGE
30 kilovolts

MAXIMUM PULSE PLATE CURRENT
15 amperes

COOLING
Radiation & Forced Air

CHARACTERISTICS

Filament: Thoriated tungsten
- Voltage: 8.2 volts
- Current: 15.9 to 17.7 amperes

Capacitances:
- Grid-Plate: 3.0 to 5.6 uufd
- Grid-Filament: 7.0 to 12.0 uufd
- Plate-Filament: 2.0 uufd

Base: 50-watt jumbo 4-pin
Socket: E. F. Johnson Co. No. 123-211 or National Co. XM-50
Maximum Seal Temp.: 225 °C
Maximum Length: 12.625 inches
Maximum Diameter: 5.125 inches
Net Weight: 1.3 pounds

MAXIMUM RATINGS

D-C PLATE VOLTAGE	30 kilovolts
PEAK PLATE CURRENT	15 amperes
PLATE DISSIPATION	300 watts
GRID DISSIPATION	50 watts

TYPICAL OPERATION

D-C Plate Voltage	28 kilovolts
Pulse Plate Voltage	25 kilovolts
Pulse Plate Current	15 amperes
Peak Drive Power	7.5 kilowatts
Peak Output Power	375 kilowatts
Duty	0.2 percent

EIMAC PRODUCTS ARE STOCKED BY DISTRIBUTORS IN EVERY MAJOR CITY THROUGHOUT THE COUNTRY.

820D-2 1-kW AM Transmitter

The entirely new 820D-2 1-kW AM Transmitter offers many new and innovative features to improve AM performance and reliability. By utilizing effective cost-control methods, Collins is now able to offer a new transmitter, of superior design, at a lower price than ever before. In addition to a lower price, the new transmitter performs up to specifications that used to apply to FM broadcasting only.

An all new cabinet design places every component within easy reach for maintenance. The modulator and final rf tubes are at shoulder height, making removal as trouble free as possible.

By using straightforward design concepts, Collins has been able to build a 1-kW AM transmitter that will operate many trouble-free hours, at a very low cost. In addition, maintenance costs have been reduced by the use of standard components and conservative ratings.

820D-2 AM Transmitter

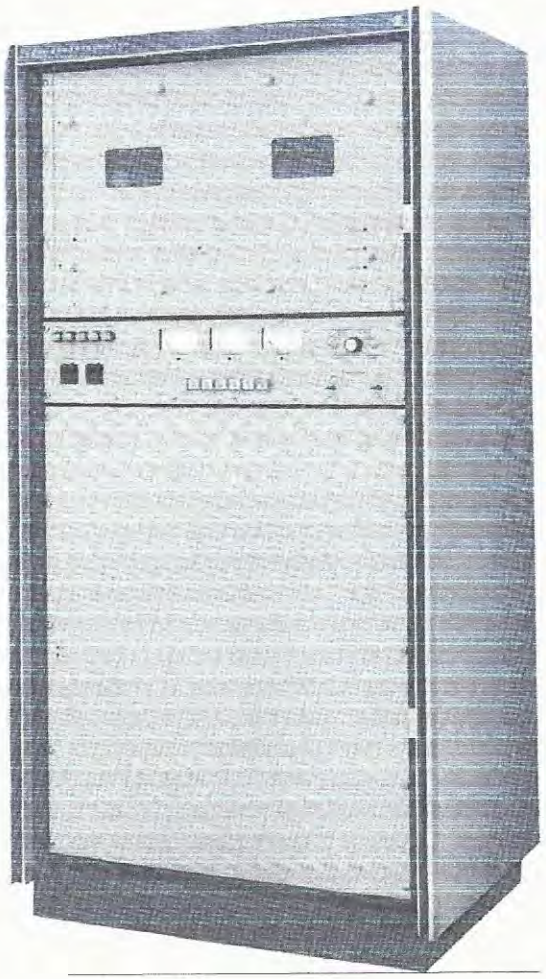
Exciter. The exciter for the 820D-2 AM Transmitter consists of a dual oscillator to develop the necessary input to the rf driver. A two-position switch enables the operator to select the oscillator that is to be used on the air. At any point in time, the other oscillator may be used, providing a ready standby in the event of failure. The frequency of both oscillators may be adjusted from the front panel. Since quartz crystals are most stable at frequencies above the broadcast band, Collins operates them in that range, and then divides with an integrated circuit multivibrator to derive the station's frequency.

RF Driver. The rf driver is completely solid state, utilizing one 2N5039 transistor operating in Class C. To achieve the high gain that is necessary to drive the PA, the transistor circuit employs a common emitter configuration, driving a matching network consisting of a tuned secondary rf transformer.

Power Amplifier. The power amplifier is designed to deliver 1100 watts nominal output into a 50Ω load. Two long-life 5-500A pentodes are operated in parallel Class C, and are modulated in a conventional manner by a transformer-coupled modulator. Bridge neutralization is used to reduce rf intermodulation products. Power cutback to either 500 or 250 watts is possible by reducing plate voltage. The power output of the 820D-2 is controlled automatically to within 2-1/2%.

Output Network. The output network is a bandpass filter consisting of three nodes. The first node is tuned by a vacuum variable capacitor. Nodes one and two are bottom coupled by an inductor. Nodes two and three are top coupled with an inductor which serves as the fixed adjustment for loading. Coupling circuits provide a 90° phase delay between nodes. Q distribution is such as to provide a symmetrical passband response for reduction of audio distortion at the higher modulation frequencies. Harmonic attenuation exceeds FCC requirements.

Audio Driver. Two push-pull driver stages amplify audio to drive the modulator. The relatively low voltage required by the modulator eliminates the necessity of stepping up the audio signal by means of an interstage transformer. The final stage of the audio driver is a regulated 290 Vdc, ensuring ample collector swing capability. Both driver stages operate Class A, common emitter, to achieve high gain.

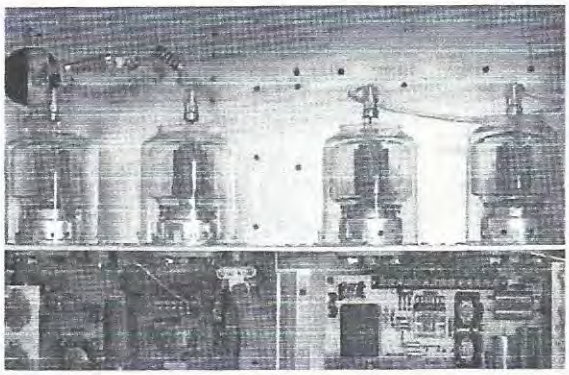


820D-2 AM Transmitter

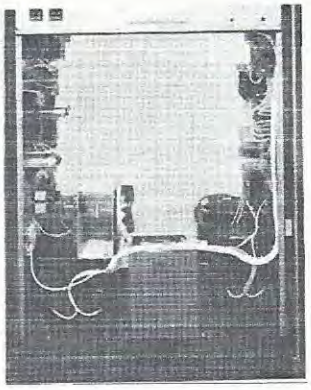
Modulator. Two 5-500A pentodes are operated Class AB_1 push-pull, to supply a modulating signal to the PA. Transformer coupling provides correct impedance matching, while a reactor is employed in series with the plate supply to provide a path for the dc PA plate current. This transformer is a special low distortion design. At transmitter power cutback, the modulator plate voltage is reduced simultaneously with the PA plate voltage. The modulator screens are coupled together through stabilizing resistors to the screen supply. Rf bypassing is used to prevent high frequency oscillations. Modulation capability of 125% on positive peaks is assured, allowing high average modulation with a minimum of distortion. Use of the 5-500A pentodes lengthens tube life and reduces operating costs.

Metering Circuits. Individual meters are provided for measuring PA plate voltage and PA plate current. Accuracy of measurement is within 2% of full scale. An eight-position multimeter is also provided to meter additional parameters, including screen voltage, PA grid current, bias voltage, rf driver collector current, 28-Vdc supply voltage, screen current, modulator cathode current, and the 290 V supply voltage.

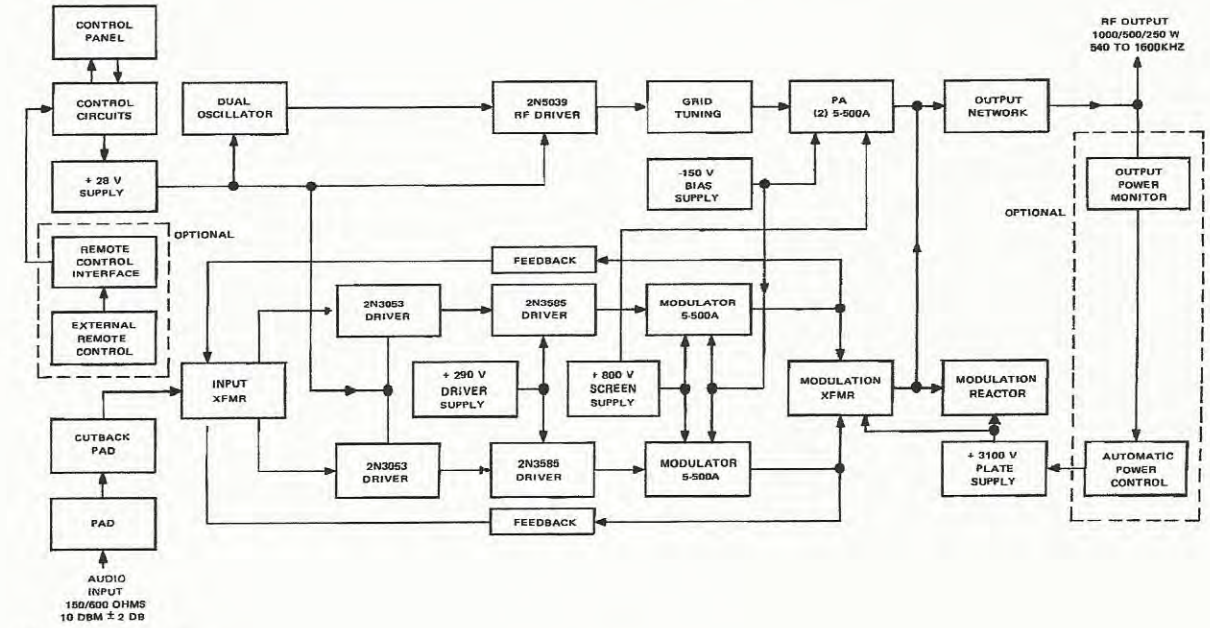
Power Supplies. 28-Vdc Supply: The 28-Vdc supply provides power to the control circuits, pilot lamps, and rf and audio drivers. Power to the supply is routed via the low voltage circuit breaker through a protective fuse to the transformer primary. A full wave bridge is used for rectification, while the output is filtered and regulated to reduce ripple.



820D-2 PA Compartment



820D-2 Lower Compartment



820D-2 Block Diagram

Filament Supply: PA and modulator filament voltages are regulated by an optional constant voltage transformer. Adjustment is provided for each pair of tubes by rheostats on the two filament transformer primaries.

Bias Supply: A bias voltage of -150 Vdc is developed for the PA and modulator control grids. Full-wave rectification and filtering follow transformer voltage conversion to the proper level. The bias supply is fed through the low voltage breaker, and is also fused for further protection.

Audio Driver Supply: The audio driver final stage voltage of 290 Vdc is obtained from the screen supply.

Screen Supply: The screen transformer derives its power through the high voltage breaker, and is further protected by a separate fuse.

Plate Supply: The plate supply consists of a power transformer full-wave bridge rectifier, and filter components. The transformer is equipped with taps on the primary for switching to low power operation. Transmitter power output is adjusted by a motor-driven rheostat in the power amplifier plate supply circuit. Overload protection is provided by the high voltage breaker, and by overload relays in the power amplifier and modulator circuits.

Control Circuits. Control circuits have been simplified as much as possible for safety and reliability. Complete remote control facilities are designed into the transmitter for rapid interface with any remote control unit.

Control Functions. Five pushbutton switches are provided for transmitter control. These include filament off, filament on, plate off, high power on, and low power on. Power change between full and reduced power is accomplished by depressing the proper button. Sequencing is completely automatic, requiring no plate deenergizing before change. Depressing the FILAMENT OFF switch powers down the entire transmitter, including the filaments and cooling air. No postoperative tube cooling is necessary.

Overload Protection. Excessive current in either the PA or the modulator causes a current sensitive relay to energize, removing both plate and screen voltage. Automatic recycling is included to return the transmitter to the air, while indicator lamps for both modulator and PA sections pinpoint trouble areas, and expedite troubleshooting.

Remote Control. The following functions may be remote controlled: Filament off, filament on, high power on, low power on, power increase/decrease, manual/auto power control, and remote failsafe. Also provided, are samples of plate voltage and plate current that appear on a terminal board for remote metering.

Accessibility. Accessibility on the 820D-2 is among the best available today. Component layout is straightforward and uncluttered. Tubes are at shoulder height, easing removal and replacement. All other components are accessible by removing one front panel. The 820D-2 is truly an improved version of the 820D-1, already a leader in its class!

820D-2 specifications

R-F Output	Power output capability is 1.1 kW into a 50-ohm unbalanced load. Facilities for reduced power operation are provided at either 550 or 275 watts. Other unbalanced output impedances can be supplied on special order.
Emission	Amplitude modulation (A3).
Harmonics	75 db below carrier or better.
Frequency Range	540 to 1,600 kHz.
Frequency Stability	±5 Hz, 0°C to +35°C. ±10 Hz, −10°C to +45°C. ±20 Hz, −25°C to +45°C.
Audio Input	+10 dbm ±2 db.
Response	±1 db from 50 to 10,000 Hz.
Distortion	Less than 2% from 50 to 10,000 Hz for 95% modulation.
Carrier Shift	Less than 3% from 0 to 100% modulation.
Hum and Noise	Sixty db below 100% modulation
Type of Service	Continuous duty, attended or unattended, local or remote control.
Service Conditions	Designed for continuous duty operation.
Ambient Temperature Range	−25°C to +45°C.
Ambient Humidity	Up to 95% R.H.
Altitude	Up to 7500 feet.
Power Source	208/230/240 volts, 50/60 Hz, single phase. Filaments .4 kw 90% PF Carrier 2.2 kw 90% PF 30% Mod 2.5 kw 90% PF 100% Mod 3.4 kw 90% PF
Size	68-3/8" H x 35-7/8" W x 24-3/8" D 173.6 cm H x 91.1 cm W x 62.6 cm D
Weight	Approximately 1100 lb (500 kg)
Part No: 622-2017-001	820D-2 Transmitter
Part No: 627-9734-001	Automatic Power Control-optional
Part No: 627-9721-001	Remote Control Relay System-optional
Part No: 627-9733-001	Filament Voltage Regulator-optional
Part No: 627-9735-001	50 Hz Conversion Kit-optional