

instruction book

Collins Radio Company | Dallas, Texas

830F-1A

10-Kw FM Broadcast Transmitter

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- (E) Nature of trouble
- (F) Cause of trouble if known
- (G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
- (H) Item or symbol number of same obtained from parts list or schematic
- (I) Collins' number (and name) of unit sub-assemblies involved in trouble
- (J) Remarks

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INFORMATION NEEDED:

- (A) Quantity required
- (B) Collins' part number (9 or 10 digit number) and description
- (C) Item or symbol number obtained from parts list or schematic
- (D) Collins' type number, name, and serial number of principal equipment
- (E) Unit sub-assembly number (where applicable)



instruction book

830F-1A 10-Kw FM Broadcast Transmitter

This manual includes:

A830F-1A	10-Kw FM Broadcast Transmitter	523-0755452
A830-2	10-Watt Wide Band FM Broadcast Exciter	523-0755303
B830-1	250-Watt FM Power Amplifier	523-0755596
786M-1	Stereo Generator (Optional)	523-0755304
F830-1	10-Kw FM Power Amplifier	523-0755345

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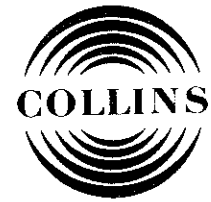
CONTINENTAL ELECTRONICS

8-9-82

214-327-4532 PARTS
214-327-4533 SERVICE

24hrs service

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Printed in U. S. A.



system instructions

830F-1A
10-Kw FM Broadcast Transmitter

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unit instructions

TD No.	Title
536	A830-2 10 W Wide-Band FM Broadcast Exciter
538	B830-1 250-Watt FM Power Amplifier
580	F830-1 10-Kw Power Amplifier

1.1 Purpose of Instruction Book.

This instruction book is a guide for installing, adjusting, operating, and maintaining 830F-1A 10-Kw FM Broadcast Transmitter.

1.2 Purpose of Equipment.

The 830F-1A 10-Kw FM Broadcast Transmitter is used for continuous monophonic or optional stereophonic FM broadcast service on a single frequency in the range from 88 to 108 megahertz with a maximum output power of 10,000 watts.

1.3 Description of Equipment.

1.3.1 PHYSICAL DESCRIPTION.

The 830F-1A 10-Kw FM Broadcast Transmitter, shown in figure 1-1, is contained in two interconnected cabinets that, together, are 76 inches wide, 76 inches high, 27 inches deep, and weigh approximately 1900 pounds. All transmitter operating controls are located behind the doors on the front of the cabinets. The filament and plate on-off controls and eight monitoring meters are located at the top front of the cabinets. The meters may be observed easily while operating the tuning controls. A monitoring meter is also provided with the

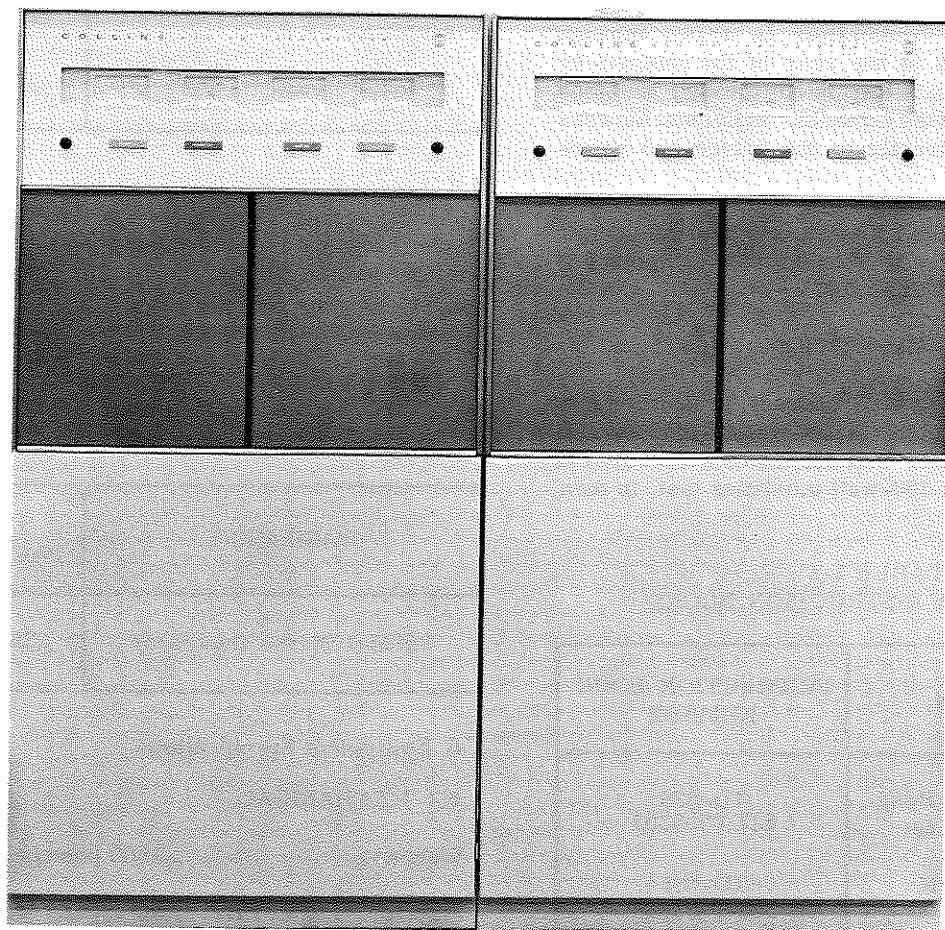


Figure 1-1. 830F-1A 10-Kw FM Broadcast Transmitter, Over-all View

wide-band exciter. The transmitter uses a maximum of 15 tubes (10-kw power amplifier may use optional silicon diode rectifiers in the plate supply instead of mercury-vapor tubes) and 20 transistors, most of which are accessible from the front of the transmitter. The bottom front of the transmitter cabinets are removable to allow access to components on the bottom of the inside panels.

The large doors at the upper rear of the cabinets allow access to the upper part of the transmitter for servicing and maintenance. The lower rear half of the transmitter cabinets are covered by removable panels that contain ventilating fans and permanent air filters. Operating personnel are protected by both electrical and mechanical interlocks on the rear doors and panels. These interlocks ground the transmitter high-voltage circuits when the doors are opened or the panels are removed. The power amplifier plate-tuning resonator is located in an interlocked compartment at the front of the transmitter.

Inside the transmitter, heavy iron-core components are at the bottom of the cabinets. The exciter portion of the transmitter and the 250-watt driver are contained in one cabinet. The other cabinet contains a 10,000-watt power amplifier and harmonic filter.

Cooling air for the transmitter is drawn through permanent air filters at the rear of the cabinets by high-volume fans and exhausted through shielded openings in the tops of the cabinets. Individual blowers supply cooling air directly to the driver and power amplifier tubes.

Room is provided in the 250-watt amplifier cabinet for mounting a stereo generator and SCA equipment if multiplex operation is desired.

1.3.2 ELECTRICAL DESCRIPTION.

The 830F-1A 10-Kw FM Broadcast Transmitter is composed of three electrically-connected subunits: (1) a wide-band exciter that furnishes a 10-watt FM output to drive (2) a 250-watt amplifier that, in turn,

TABLE 1-1
SUBASSEMBLY INSTRUCTION BOOKS

PUBLICATION	INSTRUCTION BOOK NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	TD-536 523-0755303
B830-1 250-Watt FM Power Amplifier	TD-538 523-0755596
F830-1 10-Kw FM Power Amplifier	TD-580 523-0755345

drives (3) a 10,000-watt power amplifier. Instruction books covering the exciter and power amplifiers used in the transmitter are listed in table 1-1. These three books are supplied following section V of this system instruction book. The unit instruction books contain detailed descriptions of the three transmitter subunits.

1.4 Equipment Supplied.

Table 1-2 lists equipment that is supplied as part of 830F-1A 10-Kw FM Broadcast Transmitter.

TABLE 1-2
EQUIPMENT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	522-2714-000
B830-1 250-Watt FM Power Amplifier	549-2008-000
F830-1 10-Kw FM Power Amplifier	522-2981-000
5/10-Kw Harmonic Filter	549-2192-004

1.5 Accessory Equipment.

Table 1-3 lists accessory equipment that is available for use with 830F-1A 10-Kw FM Broadcast Transmitter. Information on 786M-1 Stereo Generator will be found in Unit Instructions, TD-537, CPN 523-0755304.

TABLE 1-3
ACCESSORY EQUIPMENT

EQUIPMENT	COLLINS PART NUMBER
786M-1 Stereo Generator	522-2914-000

1.6 Equipment Specifications.

1.6.1 MECHANICAL.

- Weight 1900 pounds maximum.
- Size 76 inches wide, 76 inches high, 27 inches deep.
- Ventilation Two ventilating fans, two blowers.

Ambient temperature range +20°C (68°F) to 45°C (113°F) with mercury vapor rectifiers or +10°C (50°F) to +45°C (113°F) with optional silicon diode rectifiers.

Ambient humidity range Up to 95 percent relative humidity.

Altitude Up to 6000 feet.

Shock and vibration. . . Normal handling and transportation.

1.6.2 ELECTRICAL.

Power source 200 to 250 volts, 60 hertz, 3-phase.

Maximum power requirements 20.25 kilowatts.

Power range 3 to 10 kilowatts.

Power output 10,000 watts nominal.

Output impedance . . . 50 ohms, unbalanced. Maximum swr 2:1.

Frequency range . . . 88 to 108 MHz. Exact operating frequency determined by frequency of exciter.

Excitation source . . . Crystal-controlled high-stability oscillator using a plated, nontemperature-controlled crystal, controlling an LC modulation oscillator to provide automatic frequency control. Modulation oscillator output is then heterodyned up to operating frequency of station by a second high-stability crystal-controlled oscillator.

Carrier-frequency stability. Within ±2000 Hz of specified carrier frequency over ambient temperature range from +10°C (50°F) to +45°C (113°F) and line-voltage variations of ±15 percent.

Harmonic and spurious radiation Any emission appearing on a frequency removed from the carrier by between 120 kHz and 240 kHz, inclusive, is at least 30 db below the level of the unmodulated carrier.

Any emission appearing on a frequency removed from the carrier by more than 240 kHz and up to and including 600 kHz is at least 40 db below the level of the unmodulated carrier.

Any emission appearing on a frequency removed from the carrier by more than 600 kHz is at least 80 db below the level of the unmodulated carrier.

Modulation characteristics Direct frequency modulation. Standard audio pre-emphasis is incorporated in modulator.

Audio input impedance . 600 ohms balanced.

Audio input level +10 dbm ±2 db.

Audio frequency distortion 50 to 15 kHz, 1.0 percent maximum.

FM noise level Not less than 65 db below 100 percent modulation (±75 kHz.)

AM noise level (rms) . . Not less than 55 db below equivalent 100 percent AM.

section **2**

installation

2.1 Unpacking and Inspection.

Be careful when uncrating the transmitter and components to avoid damaging the equipment. Inspect the transmitter carefully for scratches, dents, or other physical damage. Check for loose screws and bolts. Inspect all controls, such as switches, for proper operation as far as can be determined without applying power to the transmitter. Examine cables and wiring, making sure that all connections are tight and clear of each other and the chassis. File any damage claims promptly with the transportation company. If such claims are to be filed, retain all packing material.

2.2 Transmitter Location.

Plan transmitter and wiring placement carefully before starting installation work. Refer to figure 2-1. This

diagram shows the location of all wiring openings in the transmitter cabinets. As will be noted in figure 2-1, several alternate wiring arrangements can be used. Select the combination that most nearly suits the station requirements.

Allow adequate clearance both in front and back of the transmitter. There should be a minimum clearance of 3-1/2 feet behind the transmitter to provide sufficient room for service work.

If desired, an air duct may be placed over the exhaust-air opening in the top of the 10-kw amplifier cabinet to carry heat away from the transmitter.

2.3 Intercabinet Connections.

Place the two transmitter cabinets beside each other in their permanent location so that, when viewed from

TABLE 2-1. CABINET INTERCONNECTIONS

WIRE CODE	10-KW POWER AMPLIFIER TERMINAL BOARD CONNECTIONS (from)	250-WATT DRIVER TERMINAL BOARD CONNECTIONS (to)
RE2	TB402-1	TB301-1
RE5	TB402-2	TB301-2
RE9	TB402-3	TB301-3
RC90	TB403-1	TB304-1
RC923	TB403-2	TB304-2
RC91	TB403-3	TB304-3
RC4	TB403-5	TB304-5
RC93	TB403-6	TB304-6
RC92	TB403-7	TB304-7
RC935	TB403-8	TB304-8
RC0	TB403-9	TB304-9
VE9	TB403-10	TB304-10
RC91	TB403-11	TB304-11

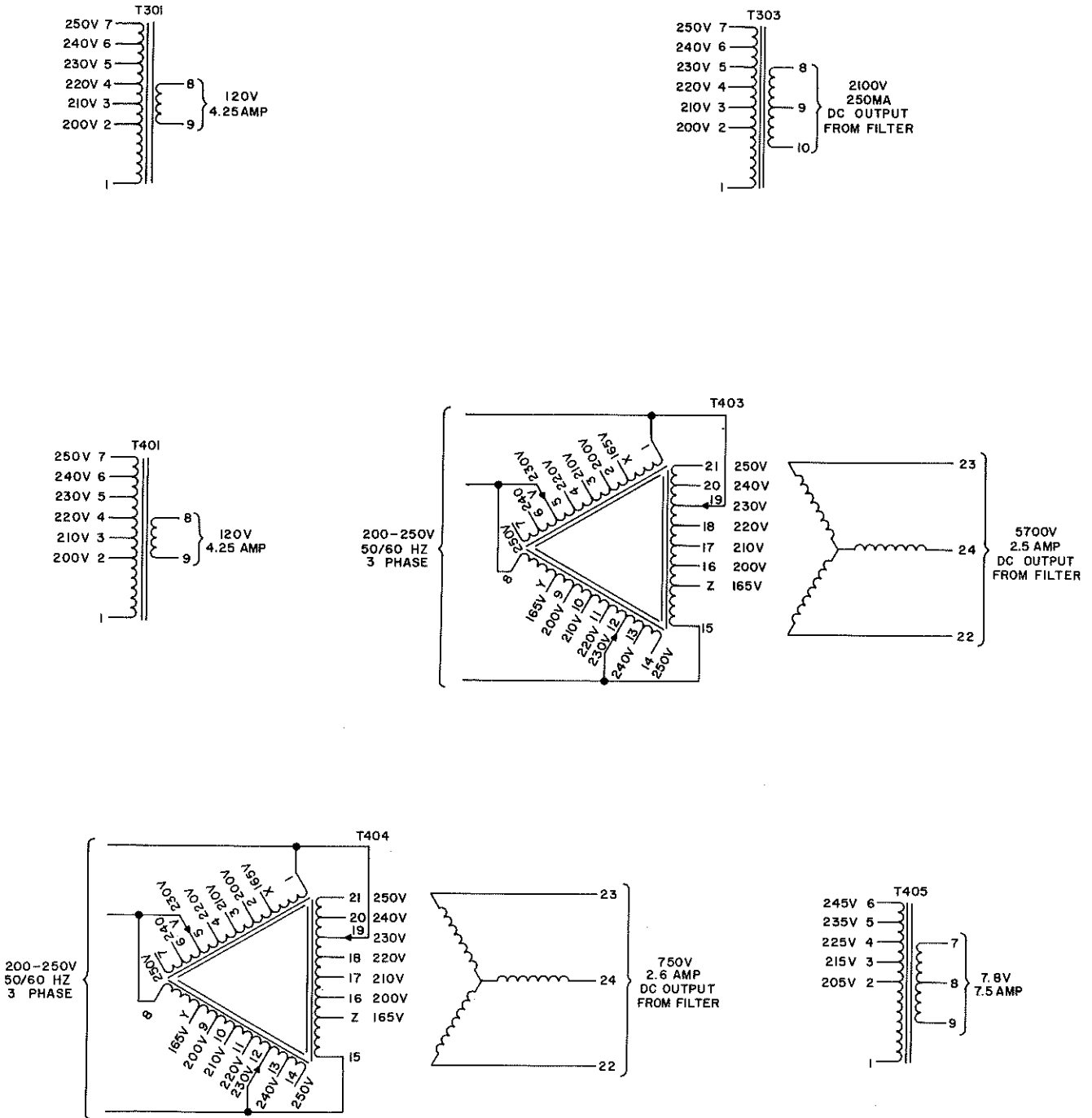


Figure 2-2. Transformer Details

whose voltage rating most closely corresponds to the voltage measured in step a. Refer to figure 2-2 for transformer terminal numbers and the input voltage which should be applied to each terminal. Do not move the solder lug from transformer terminal 5 of T301 or T401 as this terminal supplies 230 volts to the cabinet fans, the grid bias supply, and the high-voltage power supply filaments.

c. Tighten all transformer terminal connections.

NOTE

The three F830-1 Power Amplifiers with serial numbers 1, 2 and 3 have power amplifier plate and screen transformers with connections numbered differently than in figure 2-2.

TABLE 2-2. PLATE SUPPLY TRANSFORMER CONNECTIONS FOR REDUCED POWER OPERATION

AUTHORIZED TRANSMITTER OUTPUT POWER									
LINE VOLTAGE	3-4 KILOWATTS			4-5 KILOWATTS			5-10 KILOWATTS		
	TYPE CONNECTION	CONNECT TO TRANSFORMER VOLTAGE TAP	PLATE VOLTS OUT	TYPE CONNECTION	CONNECT TO TRANSFORMER VOLTAGE TAP	PLATE VOLTS OUT	TYPE CONNECTION	CONNECT TO TRANSFORMER VOLTAGE TAP	PLATE VOLTS OUT
200	Delta	250	4500	Delta	240	4800	Delta	200	5700
210	Y	165	4500	Delta	250	4800	Delta	210	5700
220	Y	165	4400	Delta	250	5000	Delta	220	5700
230	Y	165	4600	Y	165	4600	Delta	230	5700
240	Y	200	4000	Y	165	4800	Delta	240	5700
250	Y	200	4100	Y	165	5000	Delta	250	5700

TABLE 2-3. SCREEN GRID SUPPLY TRANSFORMER CONNECTIONS FOR REDUCED POWER OPERATION

LINE VOLTAGE	AUTHORIZED TRANSMITTER OUTPUT POWER					
	3-7 KILOWATTS			7-10 KILOWATTS		
	TYPE CONNECTION	CONNECT TO TRANSFORMER VOLTAGE TAP	SCREEN VOLTS OUT	TYPE CONNECTION	CONNECT TO TRANSFORMER VOLTAGE TAP	SCREEN VOLTS OUT
200	Delta	240	625	Delta	200	750
210	Delta	250	630	Delta	210	750
220	Delta	250	660	Delta	220	750
230	Y	165	630	Delta	230	750
240	Y	165	650	Delta	240	750
250	Y	165	680	Delta	250	750

Check that a jumper wire is installed from TB404-7 to TB404-8 to ensure that 115-volt power will be applied to the transmitter control circuitry.

If the optional stereo generator is installed any time after the initial 830F-1A installation, the 18-db audio pad will have to be removed from the audio circuitry of the exciter. Refer to Unit Instructions TD-536 for the location of the 18-db audio pad.

2.7 Reduced Power Operation.

If the authorized transmitter power output is below 10 kilowatts, the plate and screen voltage and the power amplifier drive will have to be reduced accordingly. Refer to tables 2-2 and 2-3 for the plate and screen power supply transformer hookup for reduced output. The tables refer to the transformer primary windings in each case. Figures 2-3 and 2-4 show the recommended control grid and screen grid currents for output power ratings from 3 to 10 kilowatts of transmitter output power.

For example, if the authorized transmitter power is 4.5 kilowatts, and the measured line voltage is 230 volts, table 2-2 shows the plate supply transformer primary will be connected in a wye configuration. To obtain a wye connected primary, connect transformer terminals 1, 8, and 15 together and remove the adjustable jumpers. As the measured line voltage is 230 volts, connect the 3-phase line to the 165-volt terminals X, Y, and Z as shown in table 2-2. (The 165 terminology is only for reference. The actual winding voltage is less than 165 volts.) This will give a plate supply output voltage of approximately 4600 volts. The actual transformer tap number for the given tap voltage may be obtained by referring to figure 2-2. As the authorized power output is 4.5 kw and the

line voltage 230 volts, the screen supply transformer will also be connected in a wye configuration. (Refer to table 2-3.) The screen supply transformer wye primary is obtained by connecting together transformer terminals 1, 8, and 15, and removing the adjustable jumpers. Connect the 3-phase line input to 165-volt terminals X, Y, and Z. This will give a screen voltage of approximately 630 volts.

With the plate and screen transformer now connected correctly for a 3-phase input of 230 volts and a 4.5-kw output, the transmitter may be tuned according to the tuning procedure given in paragraph 2.11. When tuning for reduced power operation, substitute drive and screen currents taken from figures 2-3 and 2-4 for those given in the tuning procedure.

NOTE

If, when tuning the power amplifier, sufficient power output cannot be obtained by adjusting the POWER OUTPUT ADJUST potentiometer, connect the plate and screen transformers as shown in the next lower line voltage column of tables 2-2 and 2-3.

2.8 Remote Control.

Direct-wired remote control of 830F-1A 10-KW FM Broadcast Transmitter may be accomplished by connection to terminal boards. Refer to figure 2-5. Terminal boards TB302, TB303 and TB304 are in the B830-1 driver cabinet. Terminal boards TB403, TB404, TB405, TB407, and TB410 are in the F830-1 power amplifier cabinet. Remote ON switches are normally open, momentary type. Remote OFF switches

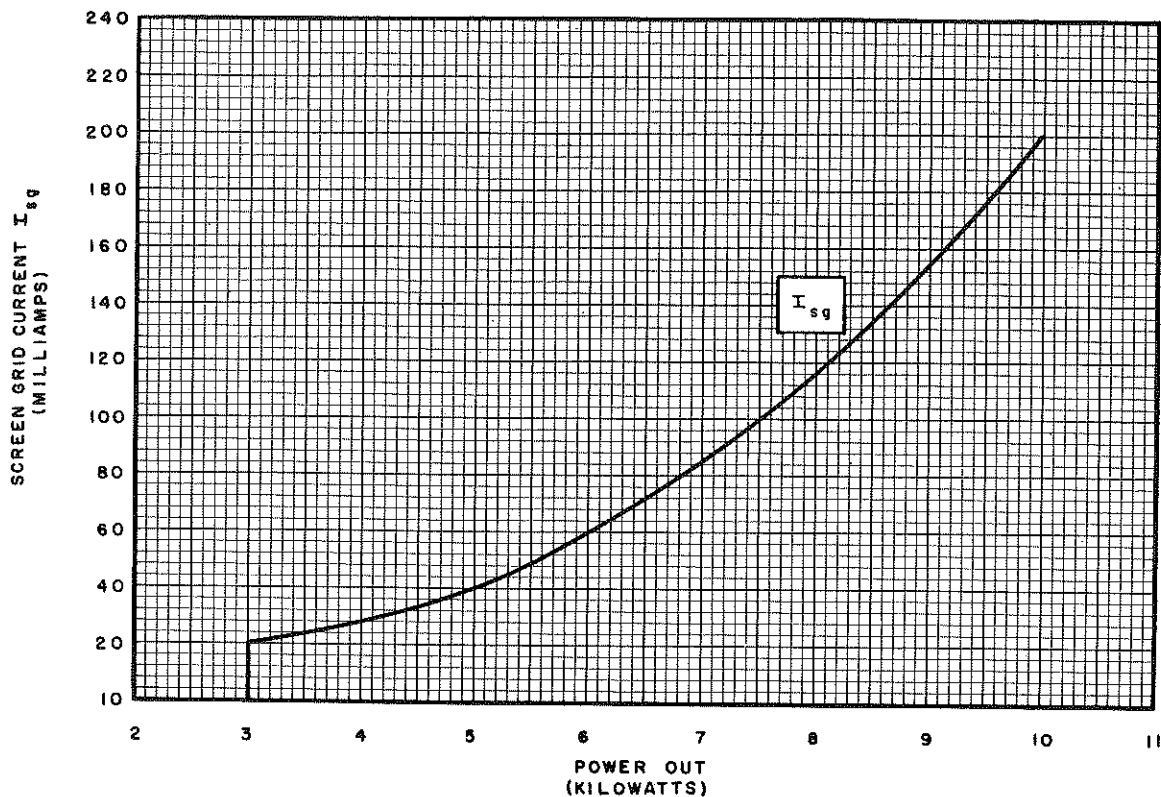


Figure 2-3. Recommended Screen Grid Current for Reduced Power Operation

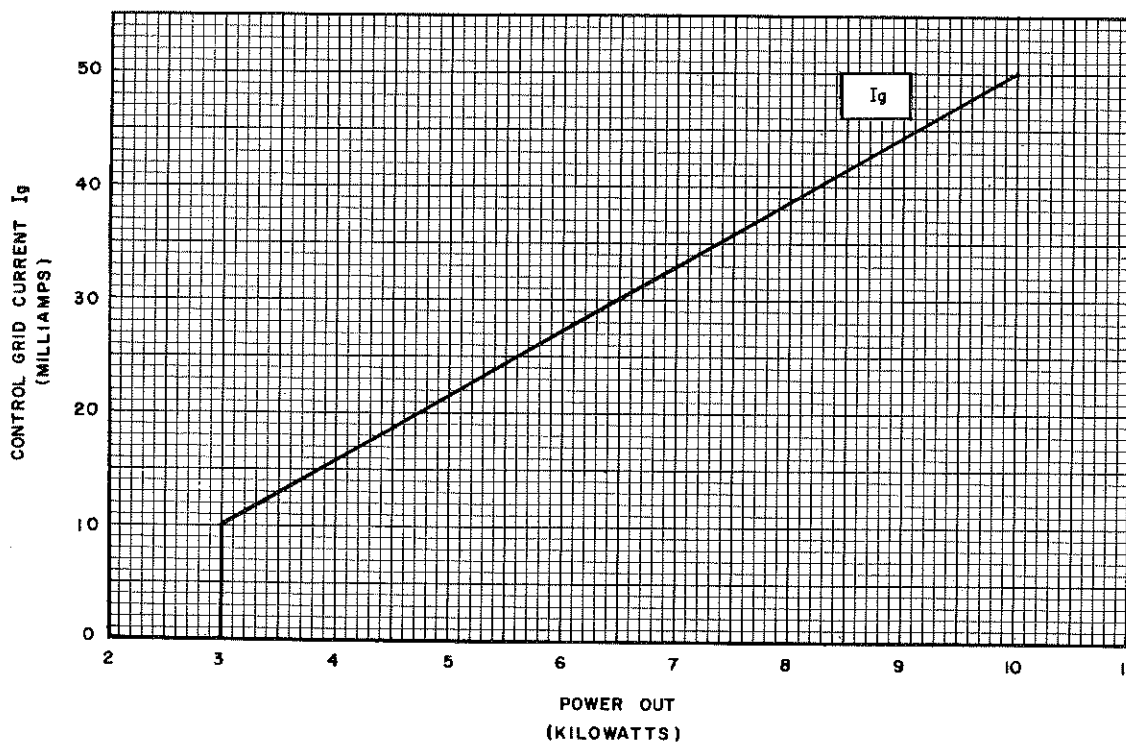
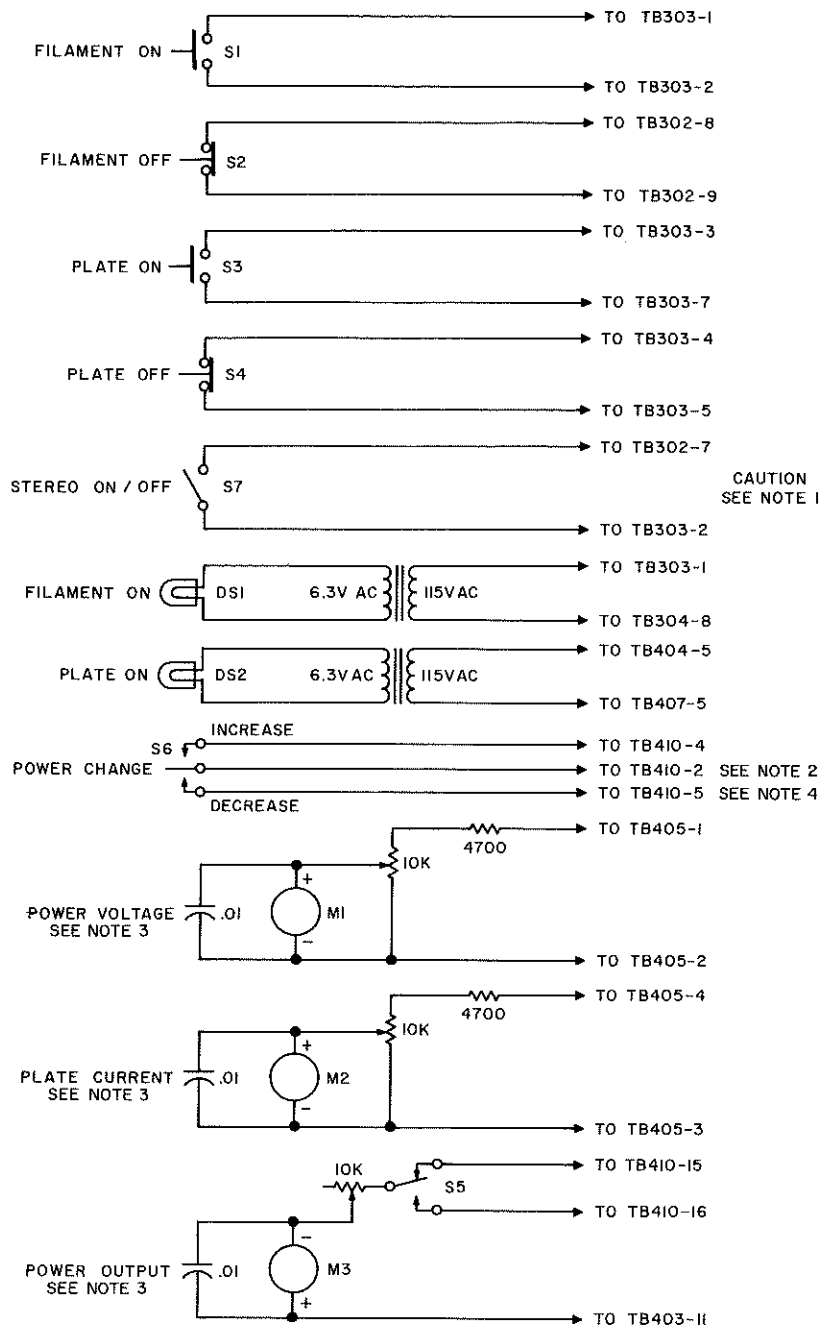


Figure 2-4. Recommended Control Grid Current for Reduced Power Operation



NOTES :

1. CONNECT S7 ONLY IF STEREO GENERATOR 786M-1 IS USED. IF CONNECTED TO A830-2, TURNING S7 ON WILL SHORT THE 27 VOLT SUPPLY
2. IN THE F830-1, JUMPER TB410-1 TO TB410-3
3. M1, USE CPN 099-2325-000
M2, USE CPN 099-2327-000
M3, USE CPN 458-0652-000
4. CONNECT S6 ONLY WHEN OPTIONAL OUTPUT POWER ADJUST MOTOR IS INSTALLED

Figure 2-5. Wired Remote Control Panel

are normally closed, momentary type. For remote operation, set the LOCAL-REMOTE switch in the B830-1 to REMOTE. The REMOTE position allows control from either the remote control panel or the transmitter panel.

For simplified operation, eliminate the FILAMENT ON and PLATE OFF switches in the wired remote control panel. The PLATE ON switch turns on the filaments, and after a time delay, the plate power. The FILAMENT OFF switch shuts down the entire transmitter.

If an optional stereo generator is employed in the 830F-1A, remote control of the stereo mode may be accomplished by a ground on TB302-7. If the ground is present, the transmitter will be in the stereo mode. If the ground is removed, the transmitter will switch to the monaural mode. Local control of the stereo mode is also available at the transmitter.

Equipment is available that will completely control and monitor transmitter operation from a remote location through standard telephone pairs. When such remote control equipment is used, necessary installation and connection information will be supplied with the remote equipment.

2.9 Frequency Change.

If the transmitter operating frequency is changed, five components will have to be changed or adjusted. The components are the exciter heterodyning crystal, Y426; the driver plate slider; the power amplifier grid tank slider; the power amplifier plate tank slider; and the neutralizing bars of the power amplifier.

Table 2-4 lists the channel frequency versus crystal frequency and the Collins part number for each crystal. Figure 2-6 shows the distance the driver plate tank slider should be positioned from the deck plate (tube socket mounting plate) for each operating frequency between 88 and 108 megahertz. Figure 2-7 shows the distance the power amplifier plate tank and grid tank sliders should be positioned from the deck plate for the operating frequencies.

2.9.1 NEUTRALIZATION PROCEDURE

WARNING

Voltages are present in this transmitter that are dangerous to life. Observe safety precautions when performing any inspection or work within the cabinet or plate resonator. Do not depend entirely on the interlocks. Always shut down the transmitter before doing any work inside the transmitter cabinet. Remember that 115 volts is present on one side of the door interlocks.

Power amplifier neutralization must be completed after any change in frequency to provide the proper degree of amplifier stability. Neutralization of the power amplifier is accomplished as follows: Set the neutralization sliding contacts to the position corresponding to the assigned station frequency as shown in figure 2-8. Turn on the exciter and driver, and tune the exciter and driver according to the procedure given in paragraph 2.11. Tune the power amplifier grid and plate tank. Turn the POWER OUTPUT ADJUST control to its maximum counterclockwise position. Turn off the exciter. Turn off the driver plate circuit breaker. Turn on the power amplifier plate voltage and remove the power amplifier control grid bias fuse while observing the WATTMETER for an indication. The WATTMETER switch must be in the FORWARD position. If no indication is noted on the WATTMETER, the power amplifier is properly neutralized.

CAUTION

Do not allow the power amplifier plate current to exceed 2 amperes during the test. Do not run the test for more than 5 seconds without a 1-minute cooling off period between tests.

If a WATTMETER indication is noted with the removal of the control grid bias fuse, readjust the neutralizing sliding contacts and repeat the test.

The neutralization can be checked further by noting the grid reaction as the plate is tuned through resonance. Minimum or no grid current reaction indicates proper neutralization. Neutralization of the 10-kw power amplifier is normally not critical and should be easily adjusted.

2.10 Final Installation Procedure.

- a. Check that all tubes, both in the exciter and power amplifiers, are securely in place.
- b. Check all exciter transistors for proper placement. The transistor locating tab must be pointing to the transistor socket locating mark placed adjacent to the transistor socket.
- c. Check fuses on both the exciter and power amplifiers.
- d. Insert the crystals into the exciter crystal sockets. The 14-MHz crystal should be placed into Y501 and the heterodyning crystal into Y426.
- e. Carefully inspect all rear door and panel interlocks to be certain that they are operating correctly. Do this by pressing the contact block, located on the doors and the lower rear panels, until the spring is completely compressed, then releasing the block. If the block does not spring back to its original position, adjust until it operates properly.

TABLE 2-4. CRYSTAL PART NUMBERS

CHANNEL FREQ (MHz)	CRYSTAL FREQ (MHz)	COLLINS PART NUMBER	CHANNEL FREQ (MHz)	CRYSTAL FREQ (MHz)	COLLINS PART NUMBER
88.1	74.10000	289-2744-00	98.1	84.10000	289-2794-00
88.3	74.30000	289-2745-00	98.3	84.30000	289-2795-00
88.5	74.50000	289-2746-00	98.5	84.50000	289-2796-00
88.7	74.70000	289-2747-00	98.7	84.70000	289-2797-00
88.9	74.90000	289-2748-00	98.9	84.90000	289-2798-00
89.1	75.10000	289-2749-00	99.1	85.10000	289-2799-00
89.3	75.30000	289-2750-00	99.3	85.30000	289-2800-00
89.5	75.50000	289-2751-00	99.5	85.50000	289-2801-00
89.7	75.70000	289-2752-00	99.7	85.70000	289-2802-00
89.9	75.90000	289-2753-00	99.9	85.90000	289-2803-00
90.1	76.10000	289-2754-00	100.1	86.10000	289-2804-00
90.3	76.30000	289-2755-00	100.3	86.30000	289-2805-00
90.5	76.50000	289-2756-00	100.5	86.50000	289-2806-00
90.7	76.70000	289-2757-00	100.7	86.70000	289-2807-00
90.9	76.90000	289-2758-00	100.9	86.90000	289-2808-00
91.1	77.10000	289-2759-00	101.1	87.10000	289-2809-00
91.3	77.30000	289-2760-00	101.3	87.30000	289-2810-00
91.5	77.50000	289-2761-00	101.5	87.50000	289-2811-00
91.7	77.70000	289-2762-00	101.7	87.70000	289-2812-00
91.9	77.90000	289-2763-00	101.9	87.90000	289-2813-00
92.1	78.10000	289-2764-00	102.1	88.10000	289-2814-00
92.3	78.30000	289-2765-00	102.3	88.30000	289-2815-00
92.5	78.50000	289-2766-00	102.5	88.50000	289-2816-00
92.7	78.70000	289-2767-00	102.7	88.70000	289-2817-00
92.9	78.90000	289-2768-00	102.9	88.90000	289-2818-00
93.1	79.10000	289-2769-00	103.1	89.10000	289-2819-00
93.3	79.30000	289-2770-00	103.3	89.30000	289-2820-00
93.5	79.50000	289-2771-00	103.5	89.50000	289-2821-00
93.7	79.70000	289-2772-00	103.7	89.70000	289-2822-00
93.9	79.90000	289-2773-00	103.9	89.90000	289-2823-00
94.1	80.10000	289-2774-00	104.1	90.10000	289-2824-00
94.3	80.30000	289-2775-00	104.3	90.30000	289-2825-00
94.5	80.50000	289-2776-00	104.5	90.50000	289-2826-00
94.7	80.70000	289-2777-00	104.7	90.70000	289-2827-00
94.9	80.90000	289-2778-00	104.9	90.90000	289-2828-00
95.1	81.10000	289-2779-00	105.1	91.10000	289-2829-00
95.3	81.30000	289-2780-00	105.3	91.30000	289-2830-00
95.5	81.50000	289-2781-00	105.5	91.50000	289-2831-00
95.7	81.70000	289-2782-00	105.7	91.70000	289-2832-00
95.9	81.90000	289-2783-00	105.9	91.90000	289-2833-00
96.1	82.10000	289-2784-00	106.1	92.10000	289-2834-00
96.3	82.30000	289-2785-00	106.3	92.30000	289-2835-00
96.5	82.50000	289-2786-00	106.5	92.50000	289-2836-00
96.7	82.70000	289-2787-00	106.7	92.70000	289-2837-00
96.9	82.90000	289-2788-00	106.9	92.90000	289-2838-00
97.1	83.10000	289-2789-00	107.1	93.10000	289-2839-00
97.3	83.30000	289-2790-00	107.3	93.30000	289-2840-00
97.5	83.50000	289-2791-00	107.5	93.50000	289-2841-00
97.7	83.70000	289-2792-00	107.7	93.70000	289-2842-00
97.9	83.90000	289-2793-00	107.9	93.90000	289-2843-00

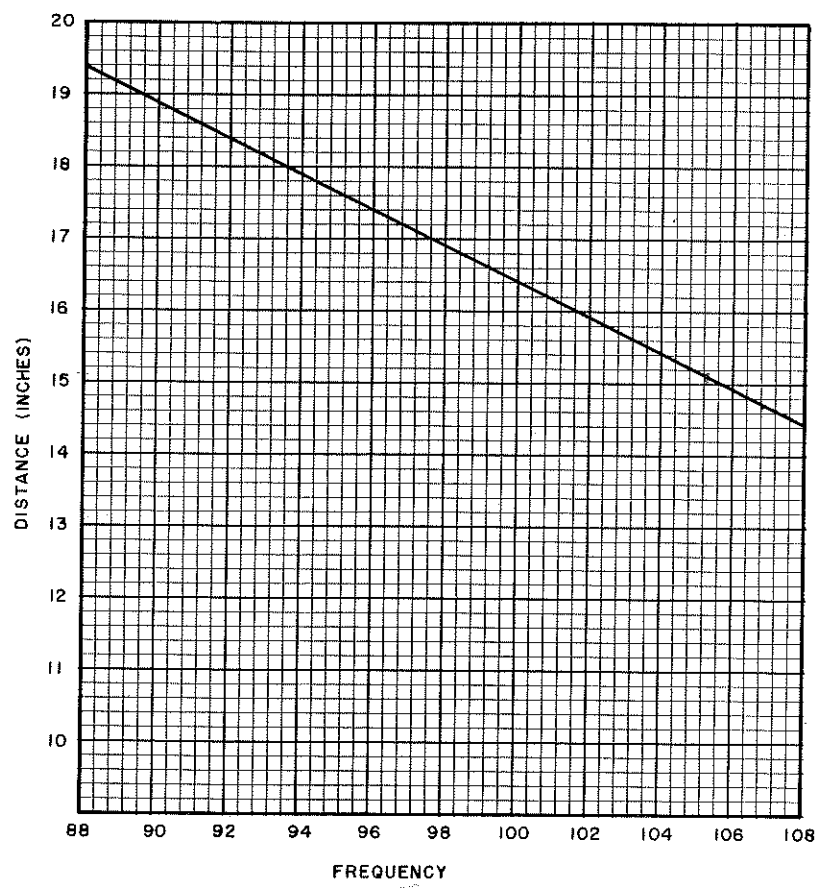
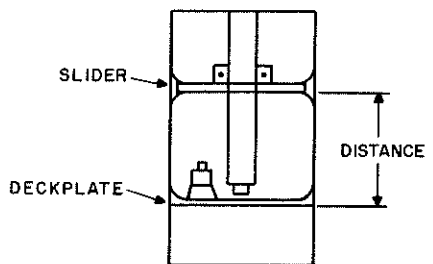


Figure 2-6. Driver Plate Cavity Tuning Chart

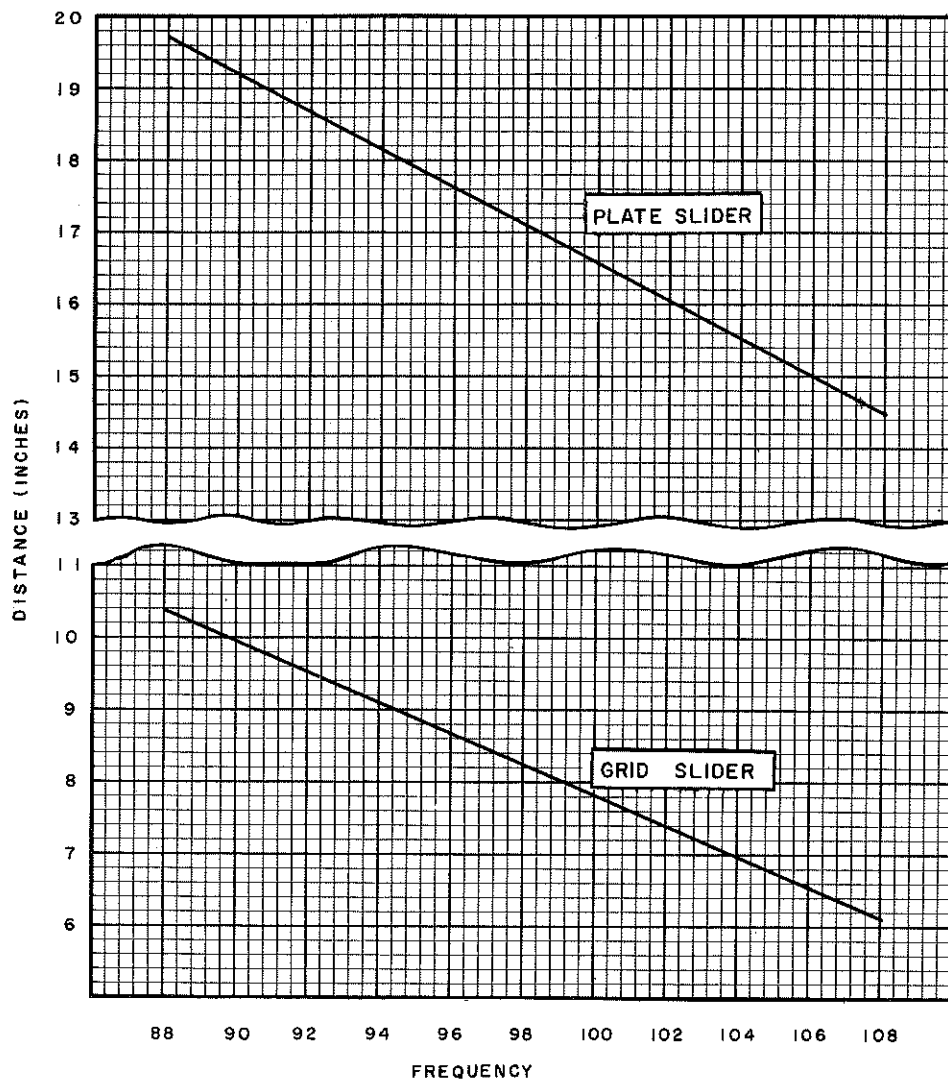
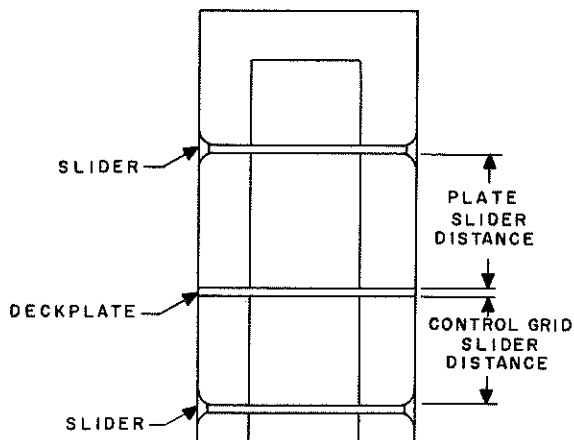


Figure 2-7. Power Amplifier Plate and Grid Tuning Chart

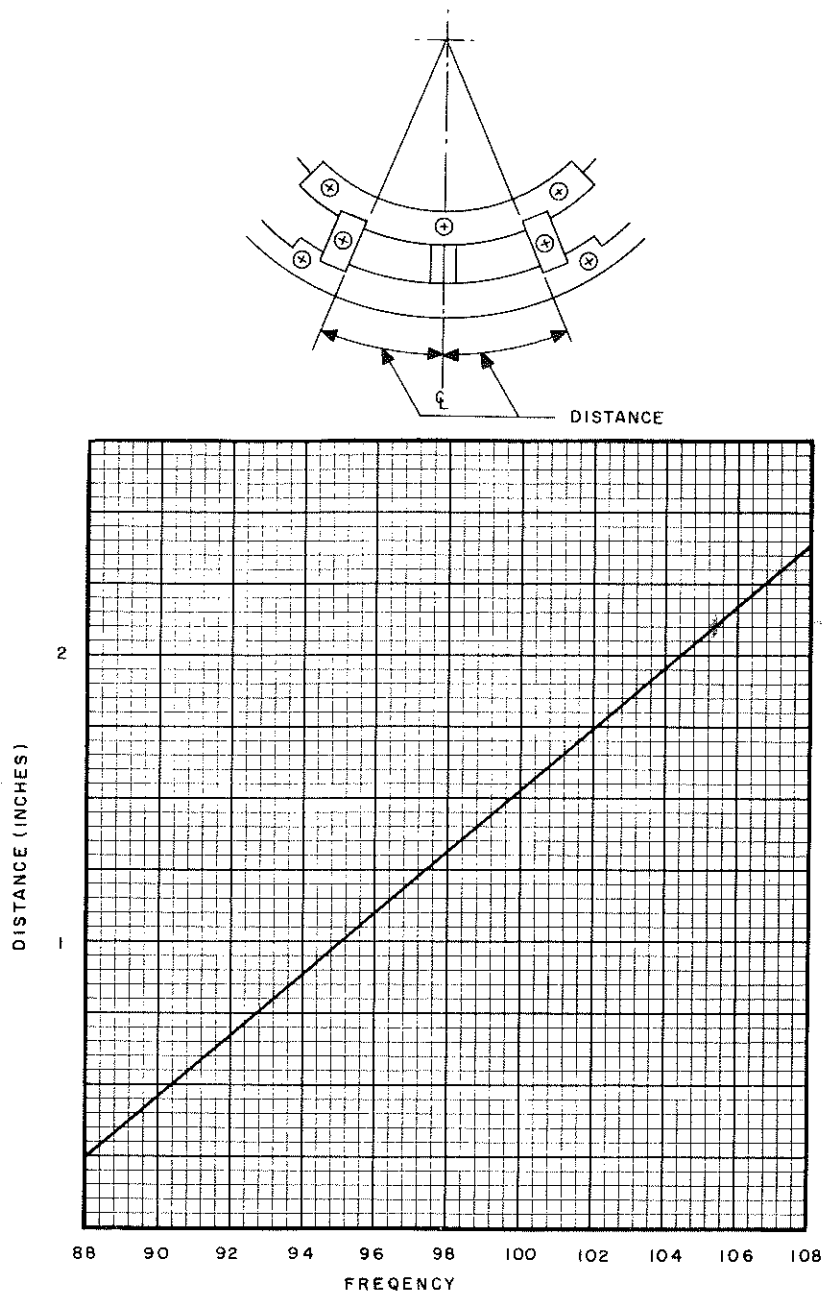


Figure 2-8. Neutralization Tuning Chart

f. Recheck all cables and wiring in the transmitter to be sure that all connections are made securely and properly.

g. Check that the sliders in the tuning resonators of both the driver and the power amplifier are in proper position for the assigned station frequency and that the sliders are tight against the outer resonator walls.

h. Check the final power amplifier tube for proper seating. This tube is pressed into place and may have jarred loose during installation.

i. Replace the lower rear panels on the transmitter cabinets. Insert the ventilating fan plugs into the sockets provided.

2.11 Starting the Transmitter in a New Installation.

Before starting the transmitter for the first time, read section 3 of the subunit instruction books to become familiar with the location and function of the various transmitter controls. Then, perform the following procedures.

WARNING

Voltages are present in this transmitter that are dangerous to life. Observe safety precautions when making any transmitter adjustments. Do not reach inside the rear of the transmitter cabinets whenever high voltages are applied. Do not depend entirely on door interlocks. Always shut off transmitter power at the external cutout box and ground all capacitors in the transmitter cabinets with the shorting stick before doing any work inside the rear of the cabinets. When working in the power amplifier resonators, remember that 115 volts a-c is present on one side of the resonator compartment interlocks. Keep metal tools and all parts of the body away from transistor cases.

a. Complete the entire transmitter installation procedure as directed in earlier paragraphs of this instruction book.

b. Close the doors at the rear of the cabinets. Open the doors at the front of the cabinets and remove the lower front panels so the entire inside panel is exposed. Check to be sure that the covers on the resonator compartments of both the driver and power amplifier are securely closed and latched.

c. Set the PLATE circuit breaker in the driver and the PLATE and FILAMENT breakers in the power amplifier to ON.

d. Press the FILAMENT ON switch on either cabinet. The green indicator lamps at the top left of both cabinets should light. This means that all transmitter tube filaments and cooling air blowers are operating.

NOTE

If mercury-vapor rectifier tubes are used in the 10-kw amplifier (right cabinet), run the tubes with only the filaments lighted for at least 1/2 hour before applying plate voltage to the amplifier. This is done to remove any mercury coating that may be on tube elements. This operation is necessary only for new tubes or used tubes that have been inverted or agitated. While this aging process is being completed, the exciter and 250-watt amplifier may be tuned by performing the following steps.

e. Set the right cabinet MULTIMETER switch to FIL V 8V FS. Adjust the FILAMENT VOLTAGE ADJUST control until the right cabinet MULTIMETER indicates 7.2 volts. If this meter indication cannot be reached, readjust the taps on the filament transformer, T405, to the next lower voltage tap.

NOTE

A three (3) percent decrease in filament voltage will extend tube life fifty (50) percent.

When new, the 4CX5000A tube will operate satisfactorily with less than 7.2 volts on the filament. Initially set the filament voltage for 7.2 volts. When the transmitter is properly tuned, reduce the filament voltage to the point where power output decreases.

As the tube ages, the filament voltage may be increased to more than 7.2 volts.

f. Connect a VOM to TP301 and TP302 on the front of the left hand, B830-1, cabinet. Set PA FIL ADJ, potentiometer R325, for an indication of 6.0 volts on the VOM.

NOTE

When new, the 4CX250B tube will operate satisfactorily with less than 6.0 volts on the filament. Initially set the filament voltage for 6.0 volts at TP301 and TP302. When the B830-1 is properly tuned, reduce filament voltage to the point where power output decreases.

g. Set the POWER switch on the exciter to ON. Allow the exciter oscillator to warm up for 15 minutes.

h. Turn S101 to the 14MC REF B position and check M101 for an indication in the B meter range. Turn S101 to the AFC KEY B position and check M101 for an indication in the B meter range.

NOTE

When S101 is in the AFC KEY B position, the meter pointer will not hold steady but will pulse at approximately 5 Hz, the keying generator rate. This pulse is an indication of normal operation.

Turn S101 to the MOD OUTPUT B position and check M101 for an indication in the B meter range. If all meter indications for the three S101 positions fall within the B meter range, proceed with the following tuning procedures. If any of the meter indications fall outside of the B meter range, the modulator and afc discriminator are out of adjustment and will have to be adjusted according to the maintenance section of this instruction book.

i. Switch S101 to the MIXER GRID A position. Set POWER OUT resistor R454 to its midposition. Using a nonmetallic screwdriver type tuning tool, adjust the BUF TUNE control for a peak indication on meter M101.

NOTE

The MIX BAL control, R428, should be placed in its midrange position. No further adjustment of this control is necessary unless the transmitter frequency falls within the range of 97 to 100 MHz. See step o if the transmitter frequency falls within this range.

j. Switch S101 to the V428B position. Adjust L429 and L430 for a maximum indication on M101.

k. Switch S101 to the V429B position. Adjust L431 and L432 for a maximum indication on M101.

l. Switch S101 to the V430B position. Adjust L433 and L434 for a maximum indication on M101.

m. Switch S101 to the V430C position. Adjust the PA PLATE control for a minimum indication on M101.

n. Set the driver MULTIMETER switch to GRID FS 40 MA. Adjust first the exciter PAMATCH control, then the power amplifier GRID TUNING control for a peak MULTIMETER indication.

o. If the transmitter frequency falls between 97 and 100 MHz, the following additional step will have to be completed. Place a grid dip meter tuned to 98 MHz near the exciter output. Adjust the MIX BAL control for a minimum output as indicated on the grid dip meter.

p. Set the driver POWER OUTPUT ADJUST control fully counterclockwise. Connect a 50-ohm, 250-watt dummy load to the r-f output connector of the driver.

q. Press the driver PLATE ON switch. The red indicator lamp at the top right of the cabinet should light, and the P. A. PLATE VOLTAGE meter should indicate 2100 ± 100 volts.

r. Set the driver MULTIMETER switch to SCREEN FS 400 VDC. The MULTIMETER should indicate 300 ± 35 volts.

s. Adjust the driver PLATE TUNING control for a dip in the P.A. PLATE CURRENT meter indication.

t. Set the driver WATTMETER switch to FORWARD. Adjust the OUTPUT COUPLING control for approximately 5 ma of screen current.

u. Turn the driver POWER OUTPUT ADJUST control approximately two-thirds of its maximum clockwise rotation.

v. Increase the driver coupling a small amount by turning the OUTPUT COUPLING control clockwise until the PA screen current is reduced to approximately 10 ma. Adjust the PLATE TUNING control for a dip in the P.A. PLATE CURRENT meter indication. (The plate tuning capacitor should be near its center position when the dip in the driver plate current occurs. If the capacitor is not in this position, move the plate slider in the appropriate direction and repeat step v.)

w. Rotate the POWER OUTPUT ADJUST control clockwise a small amount.

x. Repeat steps v and w until the P.A. PLATE CURRENT meter indicates a minimum indication and the WATTMETER indicates 250 watts. At this time the driver screen current should be not less than 5 ma nor more than 20 ma.

y. Turn PA FIL ADJ, potentiometer R325, counterclockwise to the point where power output decreases.

z. Turn off the driver plate power and disconnect the dummy load from the driver. Reconnect the coaxial cable from the driver to the power amplifier. Set the driver POWER OUTPUT ADJUST potentiometer fully counterclockwise.

aa. Set the driver WATTMETER switch to REFLECTED. Adjust the power amplifier GRID TUNING control for minimum reflected power.

NOTE

If a low value of reflected power cannot be obtained, change the setting of the power amplifier (right cabinet) grid slider slightly. Adjust the position of the r-f input tap and repeat step aa.

ab. Turn the driver POWER OUTPUT ADJUST control until the proper PA grid current is flowing (proper value approximately 50 ma obtained from figure 2-4).

ac. Set the power amplifier POWER OUTPUT ADJUST control in the maximum counterclockwise direction. Check the power amplifier filament voltage and if necessary readjust the FILAMENT VOLTAGE ADJUST control for 7.2 volts as indicated on the power amplifier MULTIMETER. If the transmitter filaments have been energized for at least 1/2 hour (if mercury-vapor rectifiers are used), press the power amplifier PLATE ON switch. When this switch is pressed, the red indicator lamp at the top right of the power amplifier cabinet should light and the P.A. PLATE VOLTAGE should indicate 6450 ± 200 volts.

ad. Set the WATTMETER switch to FORWARD. Adjust the power amplifier PLATE TUNING control for maximum WATTMETER indication. (The power amplifier plate tuning capacitor should be near its center position when the maximum WATTMETER indication occurs. If the capacitor is not in this position, move the power amplifier plate slider in the appropriate direction and repeat step ad.)

CAUTION

The power amplifier P.A. PLATE CURRENT meter indication should never exceed 2.5 amperes (power supply rating).

When tuning, be sure that the plate dissipation does not exceed 6 kw at any time. Plate dissipation is:

$$\text{Plate dissipation} = E_p I_p - \text{power out}$$

ae. Set the power amplifier WATTMETER switch to REFLECTED. The swr must be less than 2:1 at all times (see figure 2-10). If the indication of reflected power is excessive, check the antenna and its associated r-f cable for a possible mismatch.

af. Set the power amplifier WATTMETER switch to FORWARD. Adjust the OUTPUT COUPLING control for approximately 100 ma of screen current.

ag. Turn the power amplifier POWER OUTPUT ADJUST control to approximately its midpoint position. Recheck the driver power output for proper PA grid current.

NOTE

The values of screen current given in the steps are only approximate. The tube dissipation will allow for greater variations in screen current without adversely affecting tube operation.

ah. Increase the power amplifier coupling a small amount by turning the OUTPUT COUPLING control clockwise until the PA screen current is reduced to approximately 100 ma (or value obtained from figure 2-3). Adjust the PLATE TUNING control for maximum WATTMETER indication.

ai. Rotate the power amplifier POWER OUTPUT ADJUST control clockwise a small amount.

aj. Repeat steps ah and ai until the power amplifier P. A. PLATE CURRENT meter indicates the transmitter output is 10 kw (or authorized power) as measured by the indirect method. At this time, the PA screen current should be approximately 200 ma (or reduced current for reduced power applications obtained from figure 2-3). The indirect method of measuring power output is:

$$\text{Power output} = I_p E_p K$$

If the final does not tune up properly, the fault may lie in improper neutralization. If faulty neutralization is suspected, neutralize the final according to the procedure given in paragraph 2.9.1.

ak. Turn FILAMENT VOLTAGE ADJUST, potentiometer R404, counterclockwise to the point where power output decreases.

al. Check to be sure that the FM monitor that is connected to the transmitter is properly calibrated. Then, if necessary, adjust the exciter VHF OSC FREQ ADJ control until the monitor indicates that the transmitter operating frequency is within specified operating limits.

am. Apply 50-Hz audio tone to the transmitter input. Set the input level for +10 dbm at the transmitter audio input terminals.

an. Adjust the exciter MOD GAIN control until the monitor indicates 100 percent modulation.

ao. Replace the lower front panel on the transmitter cabinet and close the front doors. The transmitter is now ready for standard broadcast use.

NOTE

At this point it is suggested that a record be made of all meter readings for future maintenance and trouble shooting. These meter readings maybe recorded in table 5-3.

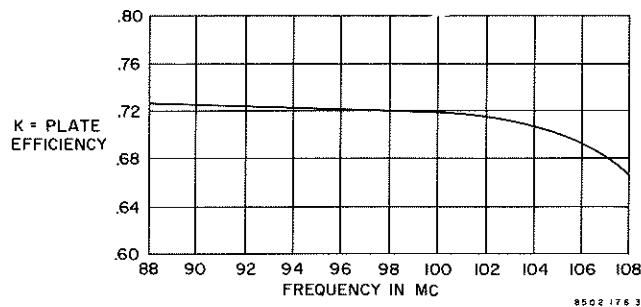


Figure 2-9. Plate Efficiency (K) Versus Frequency Chart

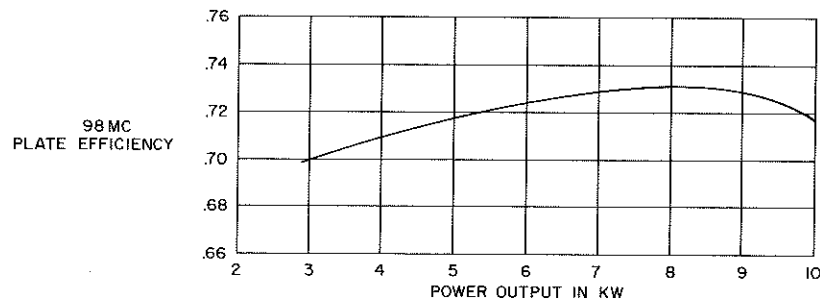


Figure 2-10. Plate Efficiency Versus Power Output

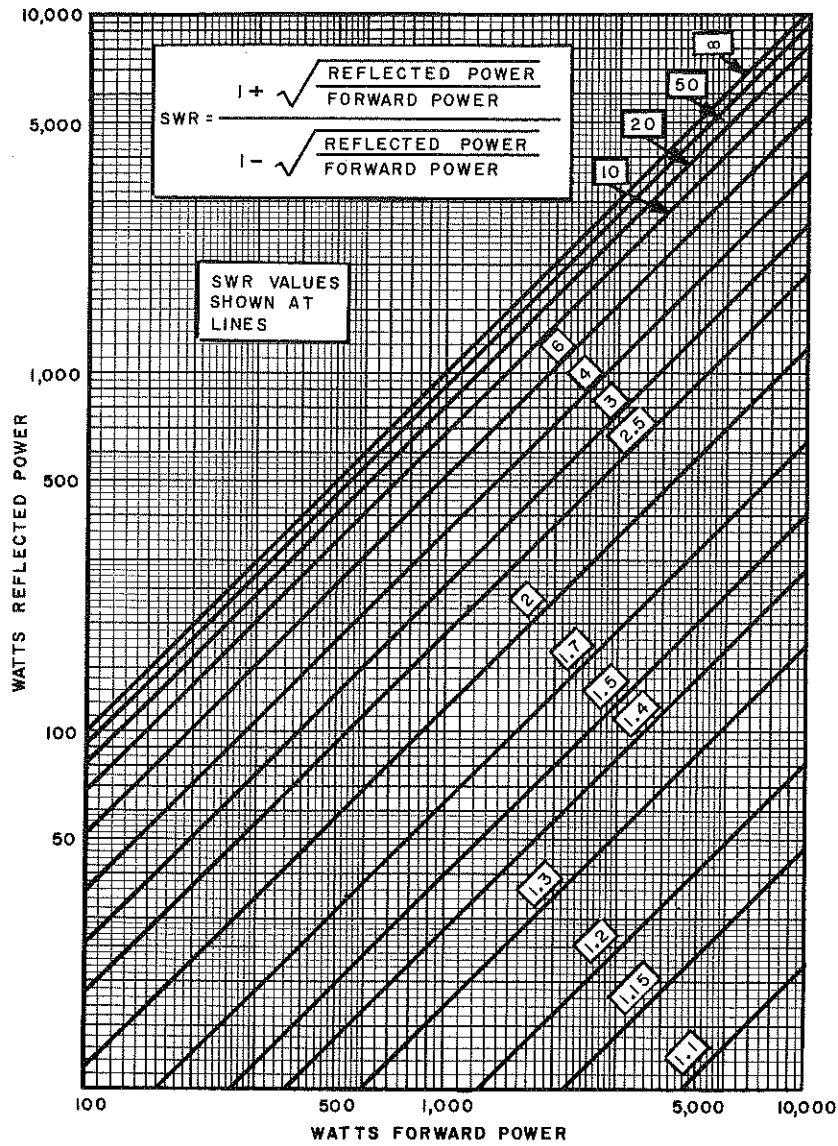


Figure 2-11. Directional Wattmeter SWR Determination Table

3.1 General.

Refer to the unit instruction books to become familiar with the operation and function of controls on the power amplifier, the driver, and the exciter.

After the transmitter has been placed in operation it will be necessary to check meter indications from time to time to be sure the transmitter is operating properly and to occasionally touch-up the power amplifier loading and tuning.

3.2 Starting the Transmitter in Normal Operation.

The transmitter may be put into operation by two different methods, depending upon the circumstances. For normal operation, press either FILAMENT ON switch to start the driver and power amplifier filaments and to warm up the exciter (the exciter POWER switch should be left in the ON position at all times). Check the driver grid current to be sure the exciter is presenting sufficient drive to the driver before applying plate power. Approximately 30 seconds after filament power is applied, press the driver PLATE ON switch.

Check the operation of the driver and, if it is operating properly, press the power amplifier PLATE ON switch, starting the transmitter.

The alternate method of starting the transmitter consists of pressing the power amplifier PLATE ON switch only. The power amplifier filament, the driver filament, and the exciter will immediately start to warm up. As soon as the driver time delay relay has completed its cycle, the driver and power amplifier plate voltages will come on automatically, starting the transmitter.

To shut down the transmitter it is recommended, but not necessary, to press the driver PLATE OFF switch, wait a few seconds, and then shut off the filament and exciter power by pressing either FILAMENT OFF switch. It is also possible to press either FILAMENT OFF switch which immediately removes plate, filament, and exciter power. Pressing the driver PLATE OFF switch first allows the plate power supply voltages to discharge through the driver and power amplifier while the filament is at normal operating temperature and, in addition, cools the power amplifier components.

section **4**

principles of operation

4.1 General.

Refer to figure 4-1, a block diagram of 830F-1A 10-Kw FM Broadcast Transmitter. The transmitter can be broken down into four main subassemblies; an exciter, a driver, a power amplifier, and harmonic filter. Refer to section 2 of the unit instruction books for a complete explanation of the exciter, the driver, and the power amplifier.

4.2 A830-2 10 W Wide-Band FM Broadcast Exciter.

Refer to figure 4-1, a block diagram of the 830F-1A. The baseband audio is coupled to the A830-2 through a pre-emphasis network, and through an 18-db pad to J604 and two baseband amplifiers. The baseband output is coupled to a voltage-sensitive capacitor, C654. C654 is a diode which varies in capacity in proportion to the voltage across it. The FM oscillator is tuned to 14 MHz. The capacity of C654 varies in proportion to the baseband audio and therefore the output is a 14-MHz signal frequency modulated by the baseband audio. The deviation of the 14-MHz signal is ± 75 kHz for 100 percent modulation. The oscillator output is coupled through two limiters to remove any amplitude modulation. The limited 14-MHz signal is then amplified and a portion of the output coupled to the rate correction frequency discriminator and to the output amplifier. The output of the frequency discriminator is simply the baseband audio detected from the modulated 14-MHz signal. This detected audio is coupled back to the baseband input to correct for any nonlinearity in C654.

A portion of the limiter output is also coupled to the afc buffer stage. The afc buffer output, the modulated 14-MHz signal, is coupled to the reference oscillator and afc limiters through a diode switch. The output of the 14-MHz reference oscillator is also coupled to the reference oscillator and afc limiters through a diode switch. The diode switch is operated by a 5-Hz keying generator. The 5-Hz generator is a unijunction transistor operating as a relaxation oscillator keying a multivibrator.

The diode switch alternately connects the modulated 14-MHz signal (afc buffer output) and the 14-MHz reference signal to the afc discriminator. The afc discriminator detects the difference between the 14-MHz reference signal and the modulated 14-MHz signal. The modulated 14-MHz signal will cause a baseband audio output at the discriminator. This is not an error in frequency, so a portion of the baseband audio input is amplified by the baseband canceling amplifier and fed

into the output of the frequency discriminator through a diode switch. This diode switch is keyed by the same 5-Hz signal which switched the reference oscillator and afc limiter input. When the modulated 14-MHz signal is connected to the reference oscillator and afc limiter input, the baseband canceling signal is switched into the output of the frequency discriminator to cancel the baseband output from the discriminator.

The input signal to the four error signal amplifiers is a 5-Hz square wave. The amplitude of this square wave is proportional to the frequency error in the FM oscillator. The error signal amplifier square wave output is converted to a d-c control signal in the synchronous detector. The synchronous detector is also keyed by the 5-Hz keying signal. The d-c error signal is coupled to C654 to correct the frequency modulation oscillator.

A portion of the limiter output is fed to the output amplifier. The modulated 14-MHz signal from the output amplifier is then heterodyned up to the operating frequency in a balanced mixer. The crystal frequency is 14-MHz below the customer's operating frequency. The crystal oscillator output is coupled to a buffer stage and is mixed with the modulated 14-MHz signal in the balanced mixer. The balanced mixer output is limited and amplified to the 10-watt r-f output level. The output impedance of the A830-2 is between 50 and 70 ohms.

The power supply for the A830-2 is of conventional design and supplies operating voltages for the vacuum tubes and transistors in the A830-2.

4.3 Driver and Final.

The driver consists of a single ceramic-type tetrode tube. The tube is operated as a class C amplifier with a tuned coaxial line resonator plate circuit. The output from the driver is fed to a 10-kw final amplifier.

The final power amplifier is also made up of a single ceramic-type tetrode tube. The tube is operated as a grounded screen, class C amplifier, using screen grid neutralization. The plate works into a tuned coaxial line resonator with a similar tuned coaxial line resonator for the control grid tank. The plate output is fed through a harmonic filter which reduces all output harmonics into the antenna.

The harmonic filter consists of two series-resonant M-derived low-pass end sections and two constant-K,

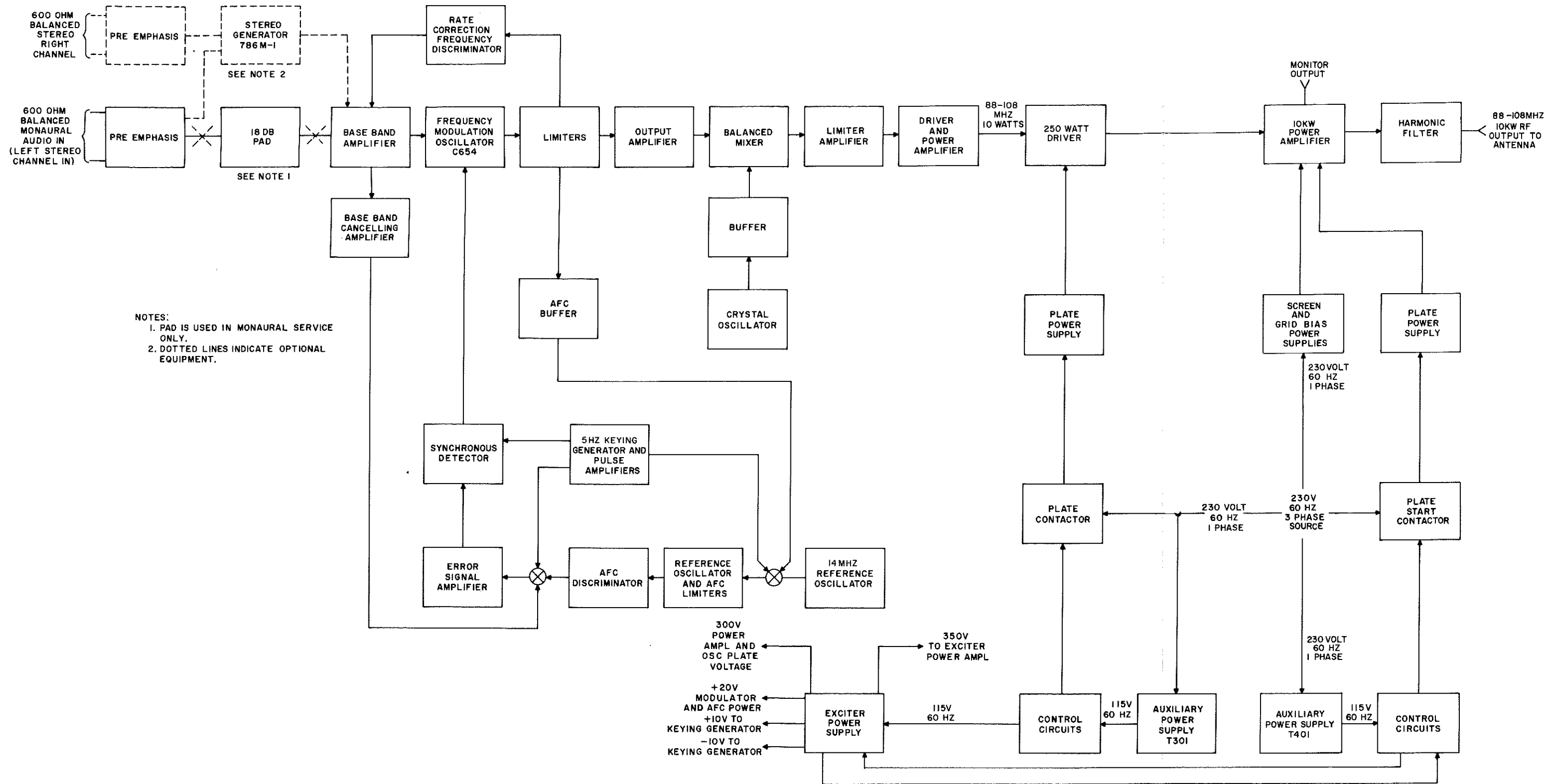


Figure 4-1. 830F-1A 10-Kw FM Broadcast Transmitter, Block Diagram

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T center sections. The harmonic filter starts to attenuate above 110 MHz and reaches maximum attenuation at the carrier second harmonic. The attenuation pattern then tapers off slowly as the frequency rises. The over-all result of the harmonic filter is in keeping the harmonics attenuated at least 80 db below the carrier frequency.

4.3.1 CONTROL CIRCUITS.

One phase of the 230-volt, 3-phase power is stepped down to 115 volts a-c by transformers T301 and T401. This lower voltage is used to activate relays in the transmitter control circuits and is also fed to the exciter as its primary power source. The control circuits allow power to be applied to the transmitter only in the proper sequence to prevent damage to the driver and final amplifier. These circuits also contain protective devices to prevent damage to components from accidental overloads.

4.3.2 PLATE CONTACTORS AND POWER SUPPLIES.

The driver plate contactor consists of a heavy-duty relay which controls the 230-volt a-c primary power to

the plate power supply. The driver plate contactor is actuated by the driver PLATE ON switch through the control circuitry.

The driver plate power supply is a conventional full-wave power supply capable of delivering 2100 volts d-c at 250 ma to the driver.

The power amplifier plate contactors are heavy-duty relays which control the 3-phase power supply and are activated by the power amplifier PLATE ON switch. The two plate contactors are energized in a step-start sequence (switches resistances momentarily into the line) to reduce the generation of transients in the power supply when power is first applied.

The power amplifier plate power supply is a conventional 3-phase full-wave power supply capable of providing 5700 volts at 2.5 amperes. The screen power supply is a full-wave 3-phase silicon diode power supply capable of providing 750 volts at 2.6 amperes. The control grid bias supply places the control grid at about cutoff and is set at the factory.

section **5**

maintenance

5.1 General.

The following paragraphs contain information concerning maintenance of 830F-1A 10-Kw FM Broadcast Transmitter.

WARNING

Voltages are present in this transmitter that are dangerous to life. Observe safety precautions when performing any maintenance. Do not reach inside the transmitter cabinets whenever high voltage is applied. Do not depend on door interlocks. Always shut down the transmitter before doing any work inside the transmitter cabinets. Immediately upon opening the rear cabinet doors, short out the power supply capacitors with the shorting sticks provided with the transmitter.

Refer to the applicable unit instructions for specific maintenance procedures for each subassembly.

5.2 Normal Tuning Procedures.

The following are tuning procedures which should be observed after the transmitter has been installed and tuned according to the installation procedures given in section 2. Table 5-1 presents abbreviated tuning instructions to be used with the following procedures. Table 5-1 can be detached from this instruction book, placed within one of the cabinet doors or adjacent to the transmitter, and used as a reference when the operator becomes familiar with the transmitter.

- a. Open the doors at the front of the cabinets.
- b. Press either FILAMENT ON switch and allow the exciter to warm up for at least 15 minutes.
- c. Set S101 on the exciter to MIXER GRID A. Adjust BUF TUNE control for a peak on M101.
- d. Set S101 to V428 B and adjust L429 and L430 for a peak on M101.
- e. Set S101 on V429 B and adjust L431 and L432 for a peak on M101.
- f. Set S101 to V430 B and adjust L433 and L434 for a peak on M101.

- g. Set S101 to V430C B and adjust the PA PLATE control for a minimum indication on M101.

NOTE

Convenient marked ranges are on the meter which correspond to switch positions. These ranges give an approximate requirement for min-max readings for each switch position.

- h. Tune the exciter coupling by setting the MULTIMETER switch to GRID FS 40 MA and adjusting the exciter PA MATCH control for maximum coupling. Tune the driver GRID TUNING control for a peak MULTIMETER indication.

- i. Connect a VOM to TP301 and TP302 on the driver cabinet. Set PA FIL ADJ on the driver for an indication of 6.0 volts on the VOM.

- j. Set the driver WATTMETER to REFLECTED.

- k. Press the driver PLATE ON switch. Adjust the power amplifier GRID TUNING for a dip in the R.F. WATTMETER indication. Set the driver to FORWARD. In turn, adjust the driver PLATE TUNING control for minimum indication on the driver P.A. PLATE CURRENT meter and increase the OUTPUT COUPLING control and the POWER OUTPUT ADJUST control, by small amounts, until the proper value of PA grid current is flowing (function of power level; see figure 2-4). The driver screen current may be 5 but should not be more than 20 ma when the driver is properly tuned.

- l. Turn the driver PA FIL ADJ control counterclockwise to the point where power output decreases.

- m. Adjust the power amplifier FILAMENT VOLTAGE ADJUST control for 7.2 volts as shown on the MULTIMETER.

- n. Press the power amplifier PLATE ON switch.

- o. Adjust the power amplifier GRID TUNING control for a maximum indication on the MULTIMETER. (This should be near the minimum reflected power on the driver wattmeter.) Place the power amplifier WATTMETER switch in the FORWARD position.

- p. In turn, adjust the power amplifier PLATE TUNING control for a maximum WATTMETER indication and increase the OUTPUT COUPLING control and the POWER OUTPUT ADJUST control, by small amounts, until the transmitter is producing authorized power as measured by the indirect method.

$$\text{Power output} = I_p E_p K$$

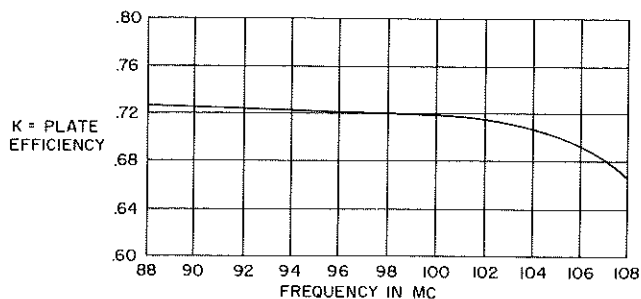


Figure 5-1. Plate Efficiency (K)
Versus Frequency Chart

The power amplifier screen current should be at the value specified in figure 2-3 for the transmitter output power level when the power amplifier is properly tuned. Normal operation is achieved when the R.F. WATTMETER indication is maximum. Efficiency may be improved by detuning plate circuit slightly from maximum power to the high frequency side of resonance (less capacity).

q. Turn the power amplifier FILAMENT VOLTAGE ADJUST control counterclockwise to the point where power output decreases.

r. Adjust the VHF OSC FREQ ADJ control until the FM monitor indicates the transmitter is operating within the specified operating limits.

5.3 Modulator and AFC Discriminator Adjustment Procedures.

The broadband exciter is designed to be exceptionally stable and will require few adjustments over a long period of time. The following adjustment procedures should only be followed if the exciter is not operating within limits upon installation, or if any of the transistors (Q503, Q511, Q601, and Q604) are replaced. Replacement of other components should not normally require a change in the adjustments given in this section. The transmitter will have to be energized when performing steps c and e. Use an a-c vtm such as a Ballantine Model 310A when making adjustments. A d-c vtm such as a Heath type may be used in step f.

NOTE

When adjusting the modulator and afc section of the exciter, use a nonmetallic hex type adjusting tool. Keep all metallic tools, the hands, and other parts of the body away from transistor cases. When disabling the afc with the complete transmitter in operation, check the station monitor to be sure the center frequency stays within the FCC requirements.

a. Remove transistor Q509 and place a vtm from TP501 to ground. Tune L505 and L504 for a peak indication on the vtm. Be sure to tune the inductances in the order given to minimize the limiting effect. Check that each stage is limiting when making

these adjustments. Limiting will show up as a broad flat peak on the vtm when tuning. Set the controls midway between the limiter fall-off points shown on the vtm. Do not replace Q509 at this time.

b. Tune the afc discriminator by placing a vtm from TP501 to ground and tune the DISCR PRI control, C515, for maximum indication. Place the vtm from TP502 to ground and adjust the DISCR SEC control, C518, for 0 on the vtm.

c. Disable the afc by pressing the AFC DISABLE switch and adjust the OSC FREQ control until the station monitor indicates the exciter is on frequency. Replace Q509.

d. Remove Q607. Place a vtm between TP602 and ground. Tune L606 and L603 for a maximum indication on the vtm. Tune the inductors in the order shown to minimize the effects of the limiter.

e. Remove afc by holding down the AFC DISABLE switch. With the vtm from TP602 and ground, tune the DISCR PRI control, C639, for a maximum indication on the vtm. Move the vtm to TP601 and tune the DISCR SEC control, C644, for a 0 indication when the modulation monitor indicates the exciter is approximately on frequency. Repeat the tuning of the DISCR PRI and DISCR SEC controls. Replace Q607.

f. Place a d-c vtm between TP603 and ground. Set the AMP BIAS control for a 7.5-volt indication on the vtm.

g. Place a vtm between TP504 and ground. Remove Q510. Tune L611 and L608 for a maximum indication on the vtm. Replace Q510.

h. With a vtm on TP504, adjust the REF LEVEL control for an equal indication on the vtm with first Q510 removed and then Q509 removed. (This equalizes the modulator oscillator voltage and the 14-MHz reference voltage.) Replace the transistors.

i. Place an oscilloscope between TP504 and ground. Apply a 150-Hz audio signal on J601. Adjust the MOD BAL control for a minimum 150-Hz indication as shown on the oscilloscope.

NOTE

The MOD BAL control must be adjusted slowly to allow the error signal amplifiers to stabilize between adjustments.

For a complete exciter alignment procedure, refer to the maintenance section in TD-536.

5.4 Distortion Testing Procedure.

a. Refer to figure 5-2. Connect an audio frequency signal generator, such as a Barker & Williamson Model 210 to the exciter audio input, terminals 1 and 2 of TB305. (Disconnect the station console audio input leads when making this connection.) Connect a distortion and noise meter, such as a Barker & Williamson Model 410, to the broadcast monitor. Connect a 50-ohm artificial load to the r-f output connector located on top of the transmitter cabinet. Turn on the transmitter.

TABLE 5-1. ABBREVIATED TUNING PROCEDURES

	CONTROL	POSITION	ADJUSTMENT	INDICATING METER	INDICATION	NOTES
EXCITER	S101	MIXER GRID A	BUF TUNE	M101	Maximum	Allow transmitter to warm up at least 15 minutes before tuning.
	S101	V428 B	*L429, L430	M101	Maximum	
	S101	V429 B	*L431, L432	M101	Maximum	
	S101	V430B	*L433, L434	M101	Minimum	
	S101	V430C B	PA (exciter) PLATE	M101	Minimum	
DRIVER	MULTIMETER	GRID FS 40 MA	PA MATCH GRID TUNING	MULTIMETER	Maximum	
	WATTMETER	FORWARD	PLATE TUNING	P.A. PLATE CURRENT	Minimum	Repeat the adjustment of PLATE TUNING, OUTPUT COUPLING, and POWER OUTPUT ADJUST controls until proper power amplifier drive is obtained.
			OUTPUT COUPLING	R.F. WATTMETER	Maximum	
			POWER OUTPUT ADJUST	R.F. WATTMETER	250 watts or less depending on drive requirements	
POWER AMPLIFIER	WATTMETER	FORWARD	PLATE TUNING	R.F. WATTMETER	Maximum	Repeat the adjustment of PLATE TUNING, OUTPUT COUPLING, and POWER OUTPUT ADJUST controls until authorized power is achieved by the indirect power measuring method. $P = I_p E_p K$
			OUTPUT COUPLING	R.F. WATTMETER	Authorized power indication	
			POWER OUTPUT ADJUST	R.F. WATTMETER	Authorized power indication	

*Use slotted nonmetallic screwdriver on these adjustments.

TABLE 5-2. DISTORTION CHECKS

FREQUENCY	DISTORTION IN PERCENT		
	25% MODULATION	50% MODULATION	100% MODULATION
50			
100			
400			
1000			
5000			
7500			
10,000			
15,000			

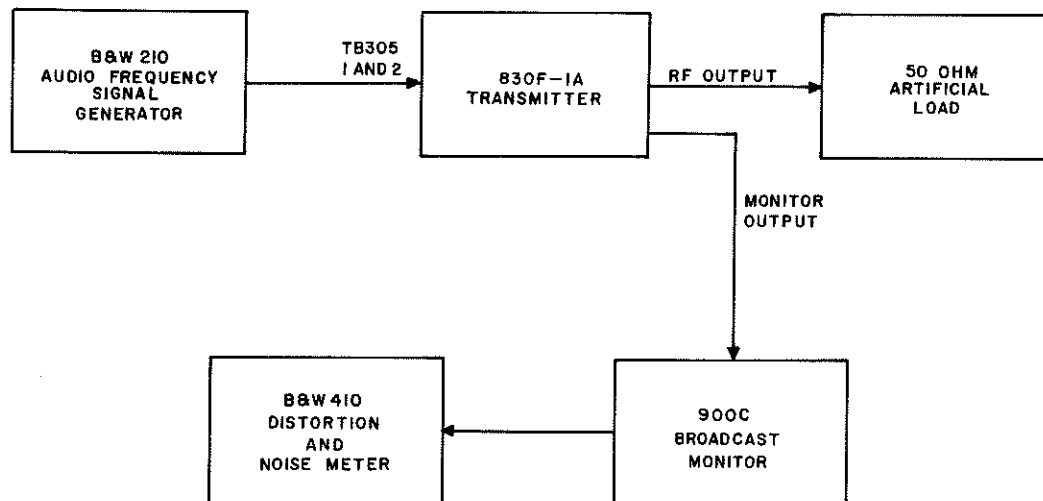


Figure 5-2. Distortion Test Setup

b. Apply a 50-Hz audio tone to the transmitter input. The input level should be such that the voltage at the transmitter audio input terminals is +10 ±2dbm.

c. Adjust the exciter MOD GAIN control until the monitor indicates 100 percent modulation (±75-kHz deviation).

d. Measure the distortion at the frequencies and modulation levels given in table 5-2. The distortion shall be less than 1.0 percent for frequencies between 50 Hz and 15 kHz.

5.5 Audio Frequency Response Measurements.

a. Refer to figure 5-3. Connect an audio frequency signal generator, such as a Barker & Williamson Model 210, to terminals 1 and 2 of terminal

board TB305. (Disconnect the station console audio input leads when making these measurements.) Connect a vacuum-tube voltmeter, such as a Ballantine Model 310A, to the audio output terminals of the audio frequency generator. Connect a 50-ohm artificial load to the r-f output connector located on top of the transmitter cabinet. Turn on the transmitter.

b. Check the audio frequency response of the transmitter by modulating the transmitter at 50, 100, 400, 1000, 5000, 7500, 10,000, and 15,000 Hz for 25 percent, 50 percent, and 100 percent modulation. Audio frequency response is measured by keeping the percentage of modulation constant and measuring the magnitude of audio, at each frequency given, to give the desired percentage of modulation. The audio frequency response must fall within the limits given in figure 5-3.

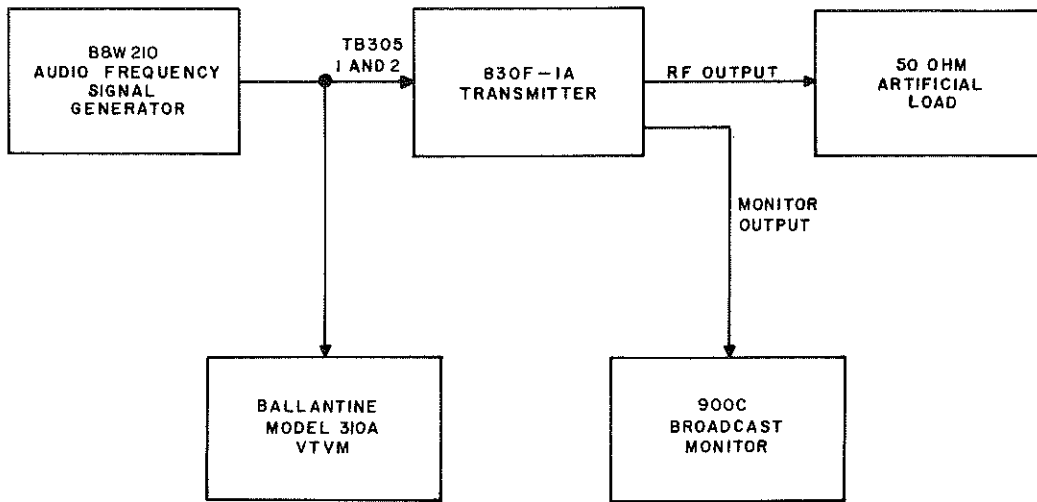


Figure 5-3. Audio Frequency Response, Test Setup

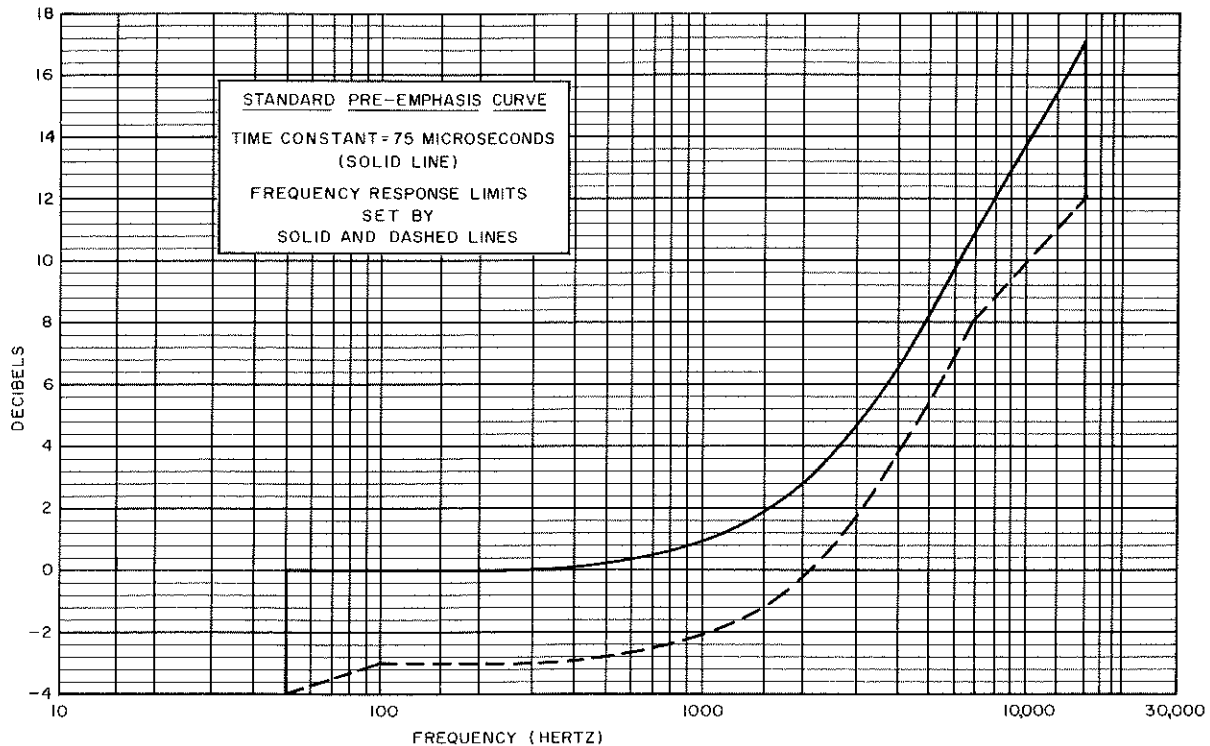


Figure 5-4. Audio Frequency Response Limits

NOTE

When taking audio frequency response measurements, a broadcast monitor, such as Collins 900C, should be used. Do not use an instrument where audio deemphasis might give a false indication of peak modulation.

5.6 FM Noise Measurements.

To measure FM noise (monaural signal-to-noise ratio) with the Collins Modulation Monitor 900C-1, perform the following procedure. Refer to figure 5-5.

- a. On the 900C-1, set the METER switch to the TOTAL MOD position and the DECIBELS switch to the 0 position.

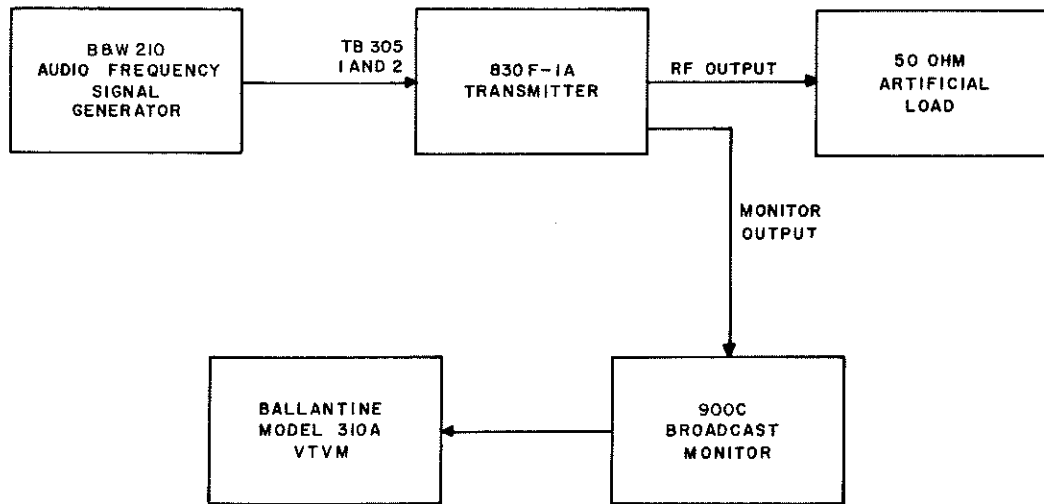


Figure 5-5. FM Noise Test Setup

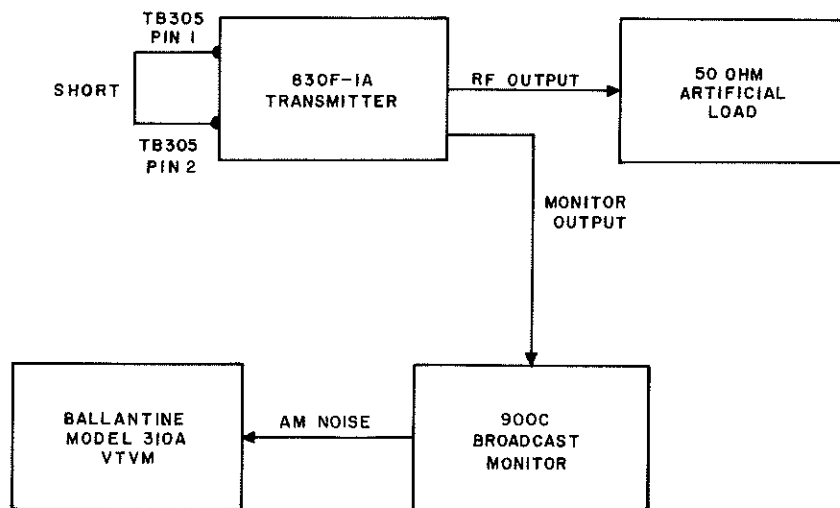


Figure 5-6. AM Noise Test Setup

- b. Connect the Barker and Williamson Model 210 signal generator output to audio input terminals TB305-1 and TB305-2. Set the signal generator to 400 Hz and modulate the transmitter 100 percent.
- c. On the 900C-1, set the DE-EMPHASIS switch to the IN position and the METER switch to the MAIN CHAN AUDIO position. Set the METER ADJUST control for an indication of 0 db on the 900C-1 meter.
- d. Remove the signal generator. Set the DECIBELS switch for an indication on the 900C-1 meter. The monaural, fm, signal-to-noise ratio is the algebraic sum of the DECIMAL switch and the meter indication.
- e. The FM noise level should be 65 db below 100 percent modulation.

5.7 AM Noise Measurements.

To measure AM noise with the Collins 900C-1, perform the following procedure. Refer to figure 5-6.

- a. Connect TB305-1 to TB305-2 on the transmitter.
- b. Connect a vtm to the AM NOISE jack on the 900C-1.
- c. Turn on the transmitter.
- d. On the 900C-1, set the METER switch to the RF LEVEL position. Adjust the RF LEVEL control for an indication of 100 percent on the 900C-1 meter.
- e. Record the AM noise voltage indicated on the vtm. The AM noise voltage should be referenced to a carrier

level of 1 volt rms. The AM noise level should be 55 db below the carrier level.

5.8 Trouble Shooting.

Standard trouble-shooting procedures should be used in finding malfunctions in the transmitter. As suggested in TD-536, TD-538, and TD-580, meter indications for all functions should be recorded when the transmitter is installed and operating properly. Table 5-3 is supplied for recording these readings. If some malfunction should occur after the normal meter readings are recorded, it is a simple matter to compare the meter readings of the malfunctioning equipment with the normal meter readings. When trouble-shooting and comparing the meter readings it is advisable to start with the final stage and proceed backwards until normal readings are encountered. The malfunctioning

stage will then be the one immediately ahead of normal meter indications.

As most cases of trouble will be traced to tubes or transistors, it is advisable to first of all replace the tube (or transistor) in the stage in which the trouble is suspected. If the trouble does not clear with tube or transistor replacement, it will become necessary to take resistance or voltage measurements within the suspected circuit to determine which component has failed.

When tracing trouble within the power amplifier it will be helpful to use the "from-to" information given in unit instructions TD-538 and TD-580. The "from-to" information gives the actual location of individual wires within the transmitter cabinets. When used in conjunction with the schematics, the "from-to" information can be very helpful.

TABLE 5-3. NORMAL TRANSMITTER METER INDICATIONS

	CONTROL	POSITION	METER	INDICATION
EXCITER	S101	BUFFER GRID A	M101	
	S101	MIXER GRID A	M101	
	S101	V428 B	M101	
	S101	V429 B	M101	
	S101	V430 B	M101	
	S101	V430C B	M101	
	S101	MOD OUTPUT B	M101	
	S101	AFC KEY B	M101	
	S101	14MC REF B	M101	
DRIVER	MULTIMETER	SCREEN FS 400 VDC	MULTIMETER	
	MULTIMETER	SCREEN FS 40 MA	MULTIMETER	
	MULTIMETER	GRID FS 40 MA	MULTIMETER	
	WATTMETER	FORWARD	P.A. PLATE VOLTAGE	
	WATTMETER	REFLECTED	P.A. PLATE CURRENT	
	WATTMETER	FORWARD	R.F. WATTMETER	
	WATTMETER	REFLECTED	R.F. WATTMETER	
POWER AMPLIFIER	MULTIMETER	BIAS V400V FS	MULTIMETER	
	MULTIMETER	GRID 80 MA FS	MULTIMETER	
	MULTIMETER	SCREEN 400 MA FS	MULTIMETER	
	MULTIMETER	SCREEN V 800 V FS	MULTIMETER	
	MULTIMETER	EXTERNAL	MULTIMETER	
	WATTMETER	FORWARD 15 KW	P.A. PLATE VOLTAGE	
	WATTMETER	REFLECTED 5 KW	P.A. PLATE CURRENT	
	WATTMETER	FORWARD 15 KW	R.F. WATTMETER	
	WATTMETER	REFLECTED 5 KW	R.F. WATTMETER	

TD-538
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1 February 1962
1st Revision, 1 January 1967



unit instructions

B830-1
250-Watt FM
Power Amplifier

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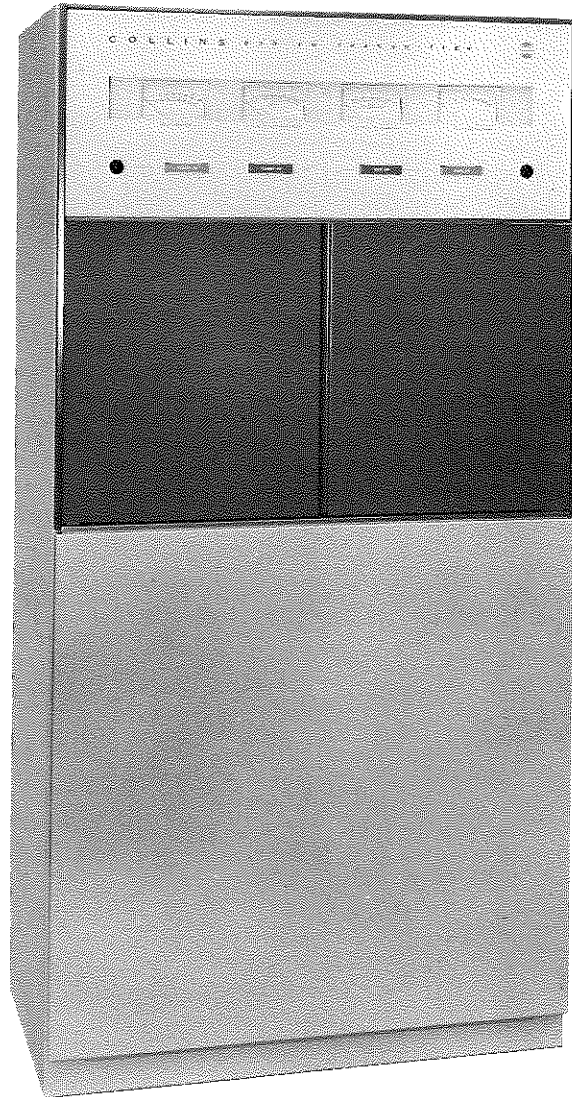


Figure 1-1. Overall View, B830-1 250-Watt FM Power Amplifier

general description

1.1 PURPOSE OF INSTRUCTION BOOK.

Unit Instructions TD-538 provides information about B830-1 250-Watt FM Power Amplifier. Information which is furnished covers a general description of the equipment, principles of operation, maintenance procedures, and a parts list.

1.2 PURPOSE OF EQUIPMENT.

The B830-1 250-Watt FM Power Amplifier can be used for continuous monaural or multiplex and SCA FM broadcast service on a single frequency in the range from 88 to 108 megacycles with an exciter input of 10 watts and an output power of 250 watts.

The B830-1 will drive the 830F 10-KW FM Power Amplifier or the 830E 5-KW FM Power Amplifier to full output.

1.3 DESCRIPTION OF EQUIPMENT.

1.3.1 PHYSICAL DESCRIPTION.

The B830-1 250-Watt FM Power Amplifier, shown in figure 1-1, is contained in a single cabinet that is 38 inches wide, 76 inches high, 27 inches deep, and weighs approximately 596 pounds. All B830-1 operating controls are located behind the doors on the front of the cabinet. The filament and plate on-off controls and four monitoring meters are located at the top front of the cabinet. The meters may be observed easily while operating the tuning controls. The B830-1 uses three tubes, all of which are accessible from the front of the transmitter. The bottom front of the B830-1 cabinet is removable to allow access to components on the bottom of the inside panel.

Large doors at the upper rear of the cabinet allow access to the upper part of the B830-1 for servicing and maintenance. Operating personnel are protected by both electrical and mechanical interlocks on the rear doors and panel. These interlocks remove the B830-1 plate voltage and ground the high-voltage circuits when the doors are opened or the panel is removed. The power amplifier plate-tuning cavity is located in an interlocked compartment at the front of the B830-1.

Inside the B830-1, heavy iron-core components are at the bottom of the cabinet. A standard 19-inch rack is provided for mounting the 10-watt exciter within the confines of the B830-1. Room also is provided on the standard 19-inch rack for the mounting of SCA generators. An optional harmonic filter, which can be connected to the B830-1 output, is suspended from the top of the cabinet.

Cooling air for the B830-1 is drawn through a permanent air filter at the rear of the cabinet by a low-speed, high-volume fan and exhausted through a shielded opening in the top of the cabinet. A single pressure blower supplies cooling air directly to the power amplifier tube.

1.3.2 ELECTRICAL DESCRIPTION.

The B830-1 250-Watt FM Power Amplifier consists of a single, air-cooled, power amplifier tube capable of being driven to full power by a 10-watt exciter. All associated power supply and control circuitry is included for operation of the B830-1. The B830-1 rf input impedance is 50 ohms nominal, unbalanced. The B830-1 output power is at least 250 watts over the frequency range of 88 to 108 megahertz into a 50-ohm load, with an swr not exceeding 2:1.

Line power input required is 50 or 60 hertz, single phase, with primary taps on all power transformers to compensate for line voltage variations from 200 to 250 volts. (For 50-hz operation, a special blower is available on request.) Circuit breakers in the input side of the line are provided for primary circuit protection. The control circuits and the final amplifier filament are fused. A time delay relay provides protection of the power amplifier tube during warmup. Remote control can be exercised over filament-on, filament-off, plate-on, and plate-off functions of the power amplifier. Instruction books covering the exciters and power amplifiers used in conjunction with B830-1 250-Watt FM Power Amplifier are listed in table 1-1.

1.4 EQUIPMENT SUPPLIED.

Table 1-2 lists equipment that is supplied as part of B830-1 250-Watt FM Power Amplifier.

TABLE 1-1. ASSOCIATED EQUIPMENT INSTRUCTION BOOKS

ASSOCIATED EQUIPMENT	INSTRUCTION BOOK NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	TD-536 523-0755303
786M-1 Stereo Generator	TD-537 523-0755304
E830-1 5-Kw FM Power Amplifier	TD-539 523-0755306
F830-1 10-Kw FM Power Amplifier	TD-580 523-0755345

TABLE 1-2. EQUIPMENT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
B830-1 250-Watt FM Power Amplifier	549-2008-000

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Table 1-3 lists equipment that is required for operation of B830-1 250-Watt FM Power Amplifier but not supplied as part of the power amplifier.

1.6 ACCESSORY EQUIPMENT.

Table 1-4 lists accessory equipment that is available for use with B830-1 250-Watt FM Power Amplifier.

1.7 EQUIPMENT SPECIFICATIONS.

1.7.1 MECHANICAL.

- Weight:
596 pounds maximum
- Size:
38 inches wide, 76 inches high, 27 inches deep
- Ventilation:
One ventilating fan, one blower
- Ambient Temperature Range:
+10°C (50°F) to +45°C (113°F)
- Ambient Humidity Range:
Up to 95 percent relative humidity
- Altitude:
Up to 6000 feet. (Blower for higher altitude available on special request.)

1.7.2 ELECTRICAL.

- Power Source:
200 to 250 volts, 50 or 60 Hz, single phase (50-Hz blower available on special request).

Maximum Power Requirements:
730 watts

Rf Input Power:
10 watts nominal

Input Impedance:
50 ohms nominal, unbalanced

Power Output:
250 watts nominal

Output Impedance:
50 ohms, resistive, unbalanced
Maximum swr 2:1

Frequency Range:
88 to 108 megahertz
Exact operating frequency determined by frequency exciter (80 to 100 MHz available on special request).

1.8 TUBE AND SEMICONDUCTOR COMPLEMENT.

Table 1-5 lists the tube and semiconductor complement supplied as part of B830-1 250-Watt FM Power Amplifier.

TABLE 1-3. EQUIPMENT REQUIRED BUT NOT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	522-2714-000
786M-1 Stereo Generator (for use with A830-2 only) (optional)	522-2914-000

TABLE 1-4. ACCESSORY EQUIPMENT

EQUIPMENT	COLLINS PART NUMBER
250-Watt/1-Kw Harmonic Filter (used only if the B830-1 is fed directly to an antenna and not to a higher power amplifier)	549-2010-000

TABLE 1-5. TUBE AND SEMICONDUCTOR COMPLEMENT

QUANTITY	TYPE	FUNCTION
1	4CX250B/7203	Rf power amplifier
2	OD3	Voltage regulation
2	4JA421EH20AB1	Plate and screen voltage rectifiers

principles of operation

2.1 GENERAL.

The B830-1 250-Watt FM Power Amplifier consists of a power amplifier and associated control circuitry for the amplification of 10 watts of exciter drive to 250 watts of rf power. The B830-1 output can drive a higher power amplifier or can be fed through a harmonic filter to an antenna.

Refer to figure 2-1. The 230 volts ac is fed to a control circuit power transformer which reduces the input voltage to 115 volts ac for use by the blower and control circuits. A second transformer located within the control circuitry reduces the 115 volts ac to 6.3 volts for use by the power amplifier filament. The 230 volts ac also is fed to a transformer which supplies the power amplifier plate and screen voltages. The primary power input to the plate power supply is controlled by the plate contactor.

The control circuits provide cabinet interlocks for protection of personnel from all high voltage, local or remote filament-on and filament-off controls, local or remote plate-on and plate-off controls, and time delay to prevent the application of high voltage before the power amplifier filament has heated sufficiently. Provisions also are available within the control circuitry for connection to the control circuitry of a higher power amplifier. The higher power amplifier will then control the B830-1 plate and filament power. Exciter input power is applied directly to the power amplifier where it is raised to 250 watts of rf power. The power amplifier consists of a forced-air-cooled ceramic tetrode, V201. The plate of V201 is connected to a tuned cavity ($\frac{\lambda}{4}$ coaxial line resonator).

The output from the tuned cavity then can be fed to a higher power amplifier, or to a harmonic filter and antenna if higher power amplification is not necessary. A sample of the power amplifier output is taken from the plate tuned cavity for monitoring purposes.

Metering circuits are provided for the power amplifier plate current and voltage, screen current and voltage, grid current, and output power.

2.1.1 CONTROL CIRCUITS.

Refer to figure 2-2. The primary purpose of the control circuitry is to provide filament and plate on and

off control. The power amplifier filament is turned on in the following manner: When momentary FILAMENT ON switch S112 is pressed, a ground is placed on filament control relay K301. As 115 volts ac is present on terminal 2 of relay K301 from 115-volt ac supply transformer T301 the filament control relay will be energized. This closes contacts 3 and 4, holding the relay in the energized position after momentary FILAMENT ON switch S112 is released. The green filament indicator lamp, DS301, will light. When filament control relay K301 is energized, relay contacts 6 and 7 will close, starting the cabinet fan and power amplifier blower B301 and supplying 115 volts ac to the 10-watt exciter. When blower B301 comes up to speed, air interlock switch S314 will close, applying 115 volts ac to filament transformer T302 and time delay relay K303. After approximately 30 seconds (time for power amplifier filament V201 to warm up), time delay relay K303 will be energized, closing contacts 3 and 4, supplying 115 volts ac to plate contactor relay K304.

The plate supply now can be turned on by pressing the momentary PLATE ON switch (providing all interlocks are closed). Pressing the momentary PLATE ON switch places a ground on plate control relay K302. Relay K302 then will energize, closing contacts 3 and 4, holding K302 in the energized position. Contacts 9 and 10 will also close, energizing plate contactor K304 and lighting the red plate indicator lamp. When the plate contactor closes, the primary ac supply will be applied to plate and screen supply transformer T303. The plate power supply then will furnish approximately 2000 volts dc to power amplifier tube V201.

Momentary FILAMENT OFF switch S111 removes power from the control and power amplifier circuits. It accomplishes this by opening the 115-volt ac lead to filament control relay K301, and plate control relay K302. This deenergizes plate contactor K304 and blower interlock S314, removing filament, plate, and screen voltages. The time delay will immediately reset for the next turn-on procedure.

Momentary PLATE OFF switch S114 removes only plate and screen voltage from power amplifier V201. This is accomplished by momentarily opening the ground lead of plate control relay K302, which deenergizes plate contactor K304, removing 230-volt ac power from the plate supply.

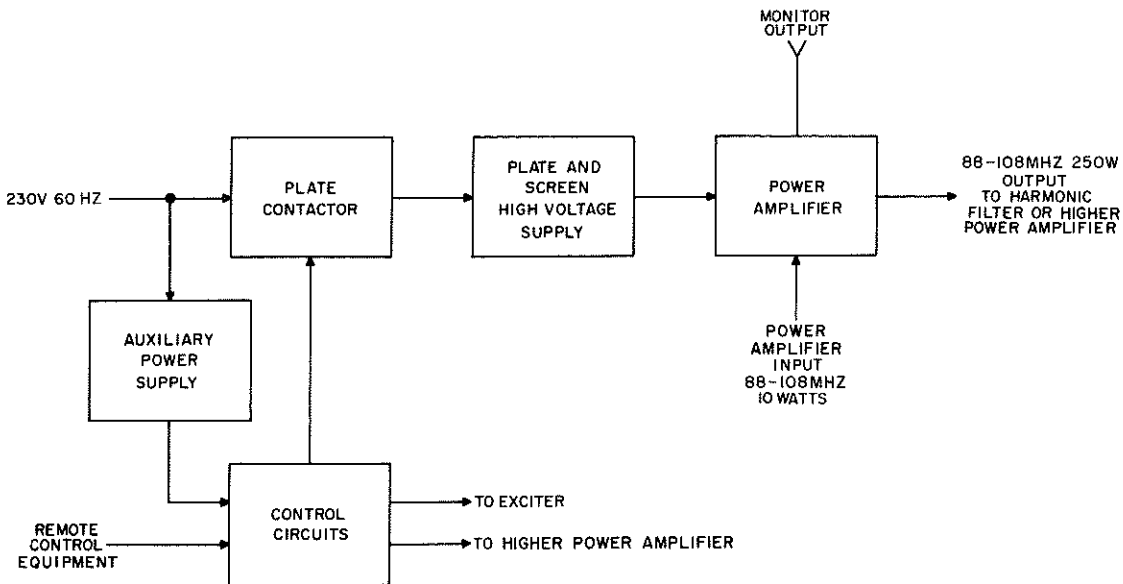


Figure 2-1. Block Diagram, B830-1 250-Watt FM Power Amplifier

Plate overload protection is provided by overload relay K305. As the plate current increases, the voltage across R303 will increase until overload relay K305 energizes, opening the ground lead of plate control relay K302, and removing plate voltage. Potentiometer R304 adjusts the point at which excess plate current will activate overload relay K305.

2.1.2 POWER AMPLIFIER CIRCUITS.

Refer to figure 2-3. The power amplifier consists of a forced-air-cooled tetrode amplifier, working into a tuned cavity over the standard frequency-modulated broadcast band of 88 to 108 megahertz.

The power amplifier plate and screen voltages are obtained from a full-wave, semiconductor, rectifier circuit. Transformer T303 increases the 200- to 250-volt, single-phase, 50- or 60-Hz primary input to approximately 4000 volts rms across terminals 8 and 10 (T303 secondary winding, 2000 volts each side of center tap). The primary winding of transformer T303 has six adjustable taps to compensate for line voltages from 200 to 250 volts. The output voltage from the secondary winding of T303 is fed to a conventional full-wave rectifier consisting of diodes CR301 and CR302, inductors L301 and L302, and capacitors C301 and C302. Resistor R320 and capacitors C303 and C304 form a transient suppressor which eliminates the transient voltages formed when power is first applied to transformer T303, and when power is switched off. The 2000-volt dc output from the power supply is fed through P.A. PLATE CURRENT meter M303 through an rf filter consisting of C210, C217, and L202 to the plate of V201. Plate voltage and plate current are read directly from P.A. PLATE VOLTAGE meter M302 and P.A. PLATE CURRENT meter M303 respectively.

The screen voltage is obtained from the 2000-volt plate supply. The plate supply is fed to a combination bleeder resistor and voltage divider consisting of resistors R305, R308, and R309. Voltage regulator tubes V301 and V302 are placed in parallel with resistors R308 and R309 to form a regulated 300-volt supply which is supplied to the screen grid of V201. Capacitor C212 shunts any rf energy present on the screen grid to ground.

Power amplifier V201 is a cathode and grid leak biased, class C operated tetrode. The control grid circuit of V201 consists of a parallel-tuned resonant tank circuit (L201 and C213) with swamping resistor R201 placed in parallel to provide a low-impedance, broadband load to the control grid. Control grid tuning is accomplished by capacitor C213.

The cathode circuit of V201 contains an output power adjusting potentiometer which raises or lowers the cathode resistance. As V201 is cathode biased, adjusting POWER OUTPUT ADJUST potentiometer R317 changes the cathode bias, as well as the screen potential, which controls the power output of V201. Capacitors C201 through C204 form the cathode bypass.

The plate cavity is formed by a short section of coaxial transmission line resonating with the plate capacity of V201 and plate tuning capacitor C209. The coaxial transmission line is roughly tuned initially by adjusting a shorting plate which lengthens or shortens the coaxial transmission line. Final plate tuning is accomplished by C209. The output coupling network formed by C208 and L203 is connected to the plate transmission line adjacent to the plate of V201 for correct impedance matching. Inductance L203 and capacitor C209 act as an L-section, low-pass

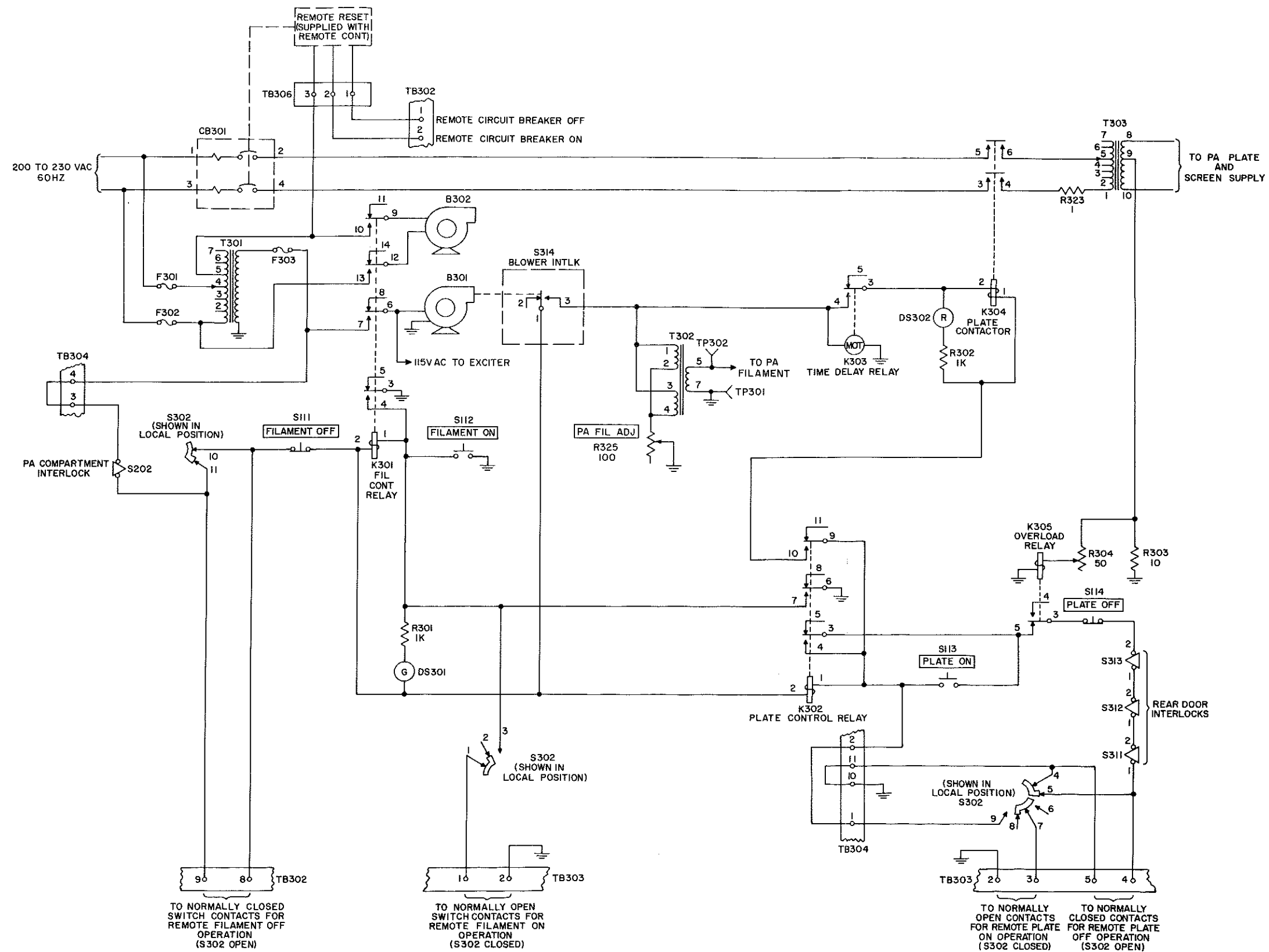


Figure 2-2. Control Circuits Simplified Diagram, B830-1 250-Watt FM Power Amplifier

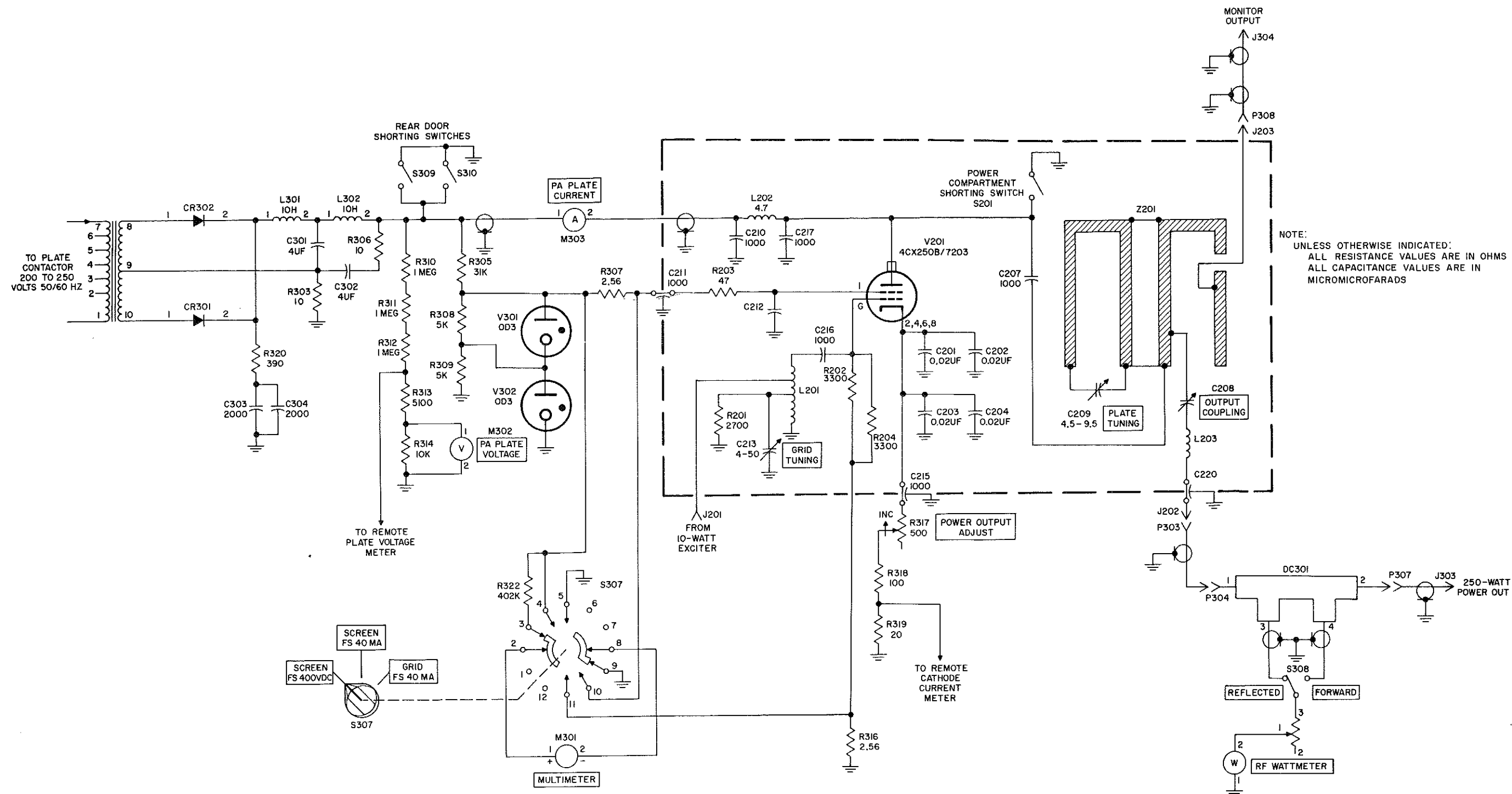


Figure 2-3. Power Amplifier Simplified Diagram, B830-1 250-Watt FM Power Amplifier

filter for frequencies above 130 megahertz to provide additional harmonic suppression. A monitor output is connected directly to the plate cavity for use by the station program monitor.

MULTIMETER M301 is located on the front panel of the power amplifier to enable the station operator to monitor screen voltage, screen current, and grid current. The multimeter functions are selected by the multimeter switch located within the power amplifier cabinet. Screen voltages are determined by connecting MULTIMETER M301 across the regulated screen supply with switch S307. Meter multiplier resistor R322 limits the current through the multimeter for calibration purposes. Screen current is determined by the voltage differential across shunt R307. This voltage is fed to the multimeter when switch S307 is in the proper position. Grid current is determined by the voltage differential across shunt R316. This voltage is also available to the multimeter when S307 is in the proper position.

2.2 CONTROL FUNCTIONS.

The following paragraphs describe all the functions of controls in B830-1 250-Watt FM Power Amplifier. Refer to figure 2-4 for control locations.

The controls located directly on the front panel under the meters include the FILAMENT ON, FILAMENT OFF, PLATE OFF, and PLATE ON switches. The filament indicator and plate indicator lamps are placed in line with the above mentioned controls. The FILAMENT ON switch, S112, energizes the power amplifier filament, the power amplifier, and cabinet blowers, and supplies power to the 10-watt exciter. The FILAMENT OFF switch, S111, deenergizes all transmitter circuits. The PLATE ON switch, S113, energizes the plate power supply, starting the 250-watt power amplifier. The PLATE OFF switch, S114, removes plate and screen voltage. The green filament indicator lamp, DS301, comes on when the FILAMENT ON switch is pressed and indicates that voltage is

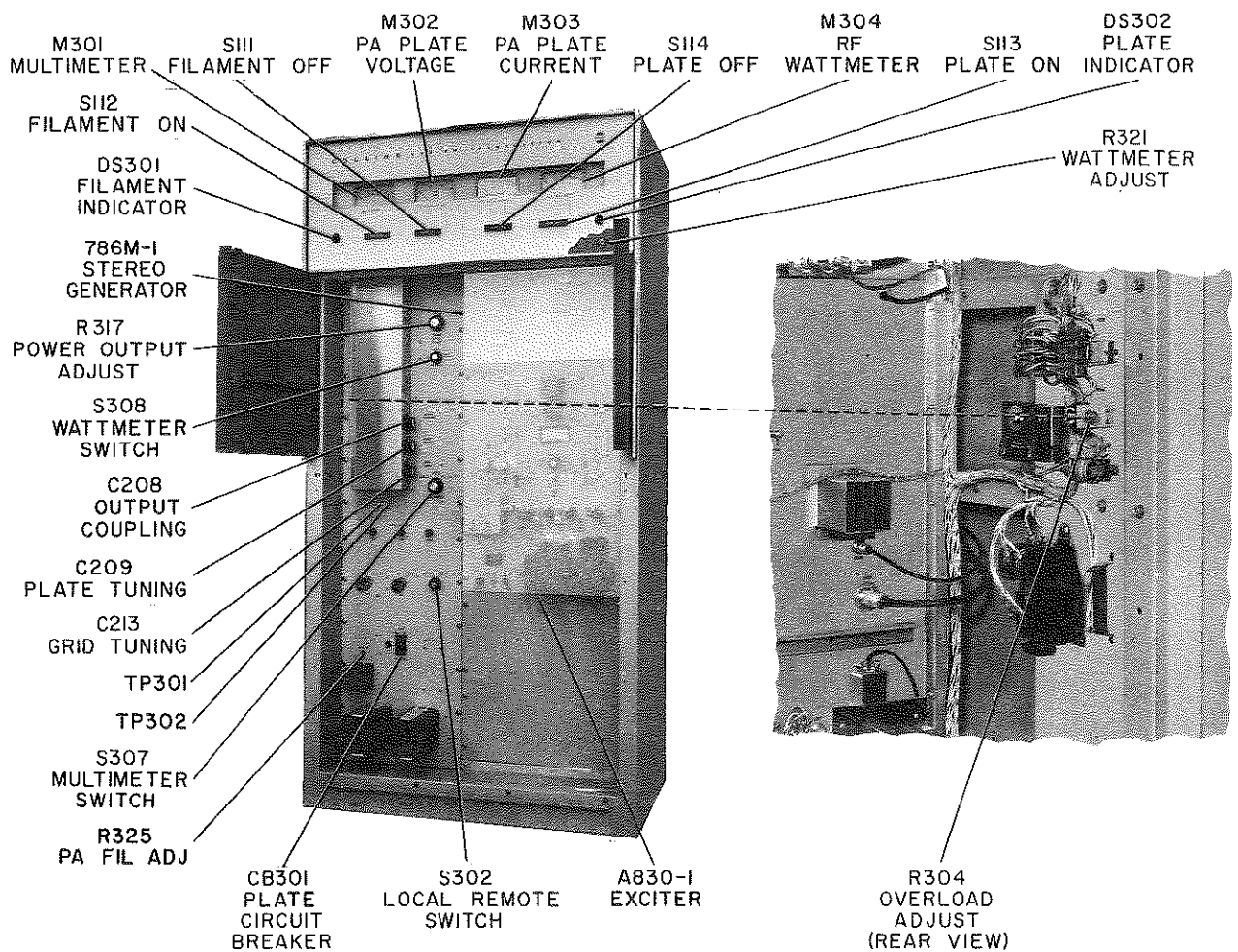


Figure 2-4. Control Locations B830-1 250-Watt FM Power Amplifier

available to the filament control relay and the PA blower. The PA blower will activate the PA blower air interlock which energizes the power amplifier filament. The red plate indicator lamp, DS302, indicates the plate voltage has been applied to the power amplifier.

The following controls are located directly under the left front door on the power amplifier panel. The POWER OUTPUT ADJUST potentiometer, R317, adjusts the power amplifier bias and screen potential, thus changing the output power. The WATTMETER switch, S308, connects the R.F. WATTMETER to either the reflected power or forward power section of the directional coupler. The WATTMETER switch normally is left in the FORWARD 400W position. The MULTIMETER switch, S307, selects either screen voltage, screen current, or grid current for MULTIMETER M301. Table 3-1 lists the MULTIMETER switch positions and typical indications for each of the three meter circuits.

The following controls are located directly behind the left front door on the power amplifier compartment. The OUTPUT COUPLING control, C208, adjusts the coupling of the load to the plate cavity. The PLATE TUNING control, C209, tunes the plate cavity to resonance and is set very near the minimum indication on P.A. PLATE CURRENT meter M303. At this point the power output should be at the peak as indicated on R. F. WATTMETER M304. The GRID TUNING control, C213, tunes the grid tank and is set for maximum indication on MULTIMETER M301 with the MULTIMETER switch, S307, set to GRID FS 40 MA.

The following controls are located on the power panel directly behind the bottom front panel of the power amplifier cabinet. Test points TP301 and TP302 allow measurement of the PA filament voltage from the front panel. PA FIL ADJ, resistor R325, adjusts the PA filament voltage. The LOCAL-REMOTE switch, S302, allows the power amplifier to be operated from a remote position or from the power amplifier. With switch S302 in the REMOTE position, filament-on, filament-off, plate-on, and plate-off functions may be selected from either a remote position or at the power amplifier. With switch S302 in the LOCAL position, filament-on, filament-off, plate-on, and plate-off functions may be selected only at the power amplifier cabinet. The PLATE circuit breaker, CB301, is a protective device which monitors the plate supply transformer primary current. The circuit breaker will activate if the transformer primary current exceeds 5 amperes. The control circuits fuses protect the control circuits from overloads. The two 5-ampere fuses protect the control transformer primary, while the 4-ampere fuse protects the control transformer secondary.

The wattmeter adjusting potentiometer, R321, is located directly below the R.F. WATTMETER when the upper switch and meter panel is raised. The wattmeter adjusting potentiometer is set at the factory and normally does not require adjustment.

The overload adjusting potentiometer, R304, is located inside the right rear door on the relay panel. The overload adjusting potentiometer is set at the factory and normally does not require adjustment.

3.1 GENERAL.

This section contains information concerning the maintenance of B830-1 250-Watt FM Power Amplifier.

WARNING

Voltages present in this equipment are dangerous to life. Observe safety precautions when performing any maintenance. Do not reach inside the B830-1 cabinet whenever high voltage is applied. Do not depend entirely on door interlocks. Always shut down the B830-1 before doing any work inside the B830-1 cabinet. Immediately upon opening the rear doors, short out all high-voltage points using the shorting stick located inside the left rear door.

3.2 PREVENTIVE MAINTENANCE.

Most service interruptions in equipment of this type are caused by dirt and corrosion. Corrosion is accelerated by the presence of moisture and dust. Dust should be removed periodically with a soft brush or a dry, oil-free air jet. Remove dust as often as a perceptible quantity accumulates at any point in the power amplifier.

When the B830-1 is operated near salt water or in other corrosive atmospheres, inspect and clean interlock switches, cable connectors, tube prongs, and other metal parts more frequently to keep the equipment in top operating condition.

3.2.1 AIR FILTER CLEANING.

At least once each month, or more often if needed, clean the air filter according to the following procedure:

a. Remove the air filter from the B830-1 cabinet by loosening the two thumb screws located above the air filter. Slide the air filter to the extreme right, and pull the left side of the air filter out as soon as

the filter clears the panel. Slide the air filter to the left and remove.

b. Mark with an arrow the direction of airflow.

c. Wash by passing a fine spray of hot water through the filter in the direction opposite that of the airflow. Gently shake the water out of the filter.

d. Spray the filter with a water-soluble oil, such as Filter-kote "M" available from Collins Radio Company, Service Parts Department, Dallas, Texas, 75207 (Collins part number 005-0609-000).

e. Lay the filter face down until oil ceases to drip from the filter.

f. Replace the filter into the lower rear panel with the airflow arrow (marked when the filter was removed) pointing in the direction of the airflow. Tighten the two thumb screws.

g. Replacement filters are Collins part number 009-1069-000.

3.2.2 PA TUBE CLEANING.

The power amplifier tube depends upon a stream of air passing through the fins to cool the anode. When these fins become dirty, the airflow is reduced and the tube life is shortened. The radiator fins should be cleaned as follows:

CAUTION

Special care must be used in removing or installing the power amplifier tube.

a. Remove the rf amplifier tube as described in paragraph 3.2.2.1.

b. Direct a low-pressure (50 psi) air stream through the fins in the direction opposite to the normal airflow until all dust is removed.

c. Replace the rf amplifier tube as described in paragraph 3.2.2.1.

3.2.2.1 PA TUBE REMOVAL.

WARNING

Voltages present within the plate cavity are dangerous to life. Shut down the B830-1 before doing any work inside the cavity. Short the plate to ground immediately on opening the plate cavity door. Do not depend entirely on the door interlock.

The power tube may be removed as follows:

- a. Open the power amplifier cavity, and loosen the anode clamp.
- b. Grasp the anode with a tube puller for air-cooled tubes (or with the fingers) and lift. If the anode clamp has not been loosened enough, it will cause binding when the power amplifier tube is removed. Care should be taken not to distort the anode clamp.
- c. Replacement is the reversal of the removal procedure.

3.2.3 INSPECTION.

Once each week check and clean the three interlock switches and the two shorting switches at the rear of the B830-1 cabinet to be sure they are in good working order.

Once each month check all connections in the B830-1. Tighten any nuts, bolts, or screws that may be loose. Check cable connections to see that they are clean and mechanically secure. Check moving parts such as tuning controls for excessive wear. Check the plate cavity slider for oxidation around ground springs.

3.2.4 LUBRICATION.

The PA blower is to be lubricated once every six months with two drops of SAE no. 20 oil in each bearing. The cabinet fan has bearings that are lubricated for the life of the equipment. No other lubrication of the B830-1 is required.

3.2.5 TUBE MAINTENANCE.

The power amplifier, V201, should be inspected (tube in place) once each week to ensure that an accumulation of dust does not build up on the radiator fins. If dust is present, clean as described in paragraph 3.2.2. When tuning the B830-1, care should be taken not to exceed the maximum plate current shown in table 3-1.

A 3 percent decrease in filament voltage will extend the tube life 50 percent. Variable resistor R325, PA FIL ADJ, adjusts V201 filament voltage.

When new, the 4CX250B tube will operate satisfactorily with less than 6.0 volts on the filament. Initially set the filament voltage for 6.0 volts at TP301 and TP302. When the transmitter is properly tuned, reduce the filament voltage to the point where power output decreases.

As the tube ages, the filament voltage may be increased to more than 6.0 volts.

3.3 TROUBLESHOOTING.

The most common cause of trouble will probably be traced to tube failure. If a tube is suspected of failure, replace it with a tube of known quality, and note any change in performance. A small loss in emission of V201 can be compensated for by a change in the setting of the POWER OUTPUT ADJUST potentiometer. Voltage regulator tubes V301 and V302 can be assumed to be operating properly if the screen voltage is held between 280 and 320 volts as read on MULTIMETER M301.

Four meters are located on the B830-1 front panel to assist in locating any trouble which may occur. Table 3-1 contains typical meter indications. These average indications are obtained from several production power amplifiers. The indications of some B830-1 may vary slightly outside the given limits without affecting the power amplifier performance. A list of panel meter indications for each individual power amplifier should be taken when the B830-1 is operating properly in its particular installation. Any abnormal deviation from these values will then be apparent during a check of meter indications.

3.4 CABLE CHART.

Table 3-2 contains from-to information for cables installed in B830-1 250-Watt FM Power Amplifier. The table is useful in locating point-to-point wiring within the B830-1 cabinet. The FROM column is listed in alphanumeric order. To find a particular wire, establish the point on the B830-1 from which wire tracing is to be initiated. Find this point in the FROM column of table 3-2, and the TO column will give the location of the other end of that particular wire. The wire code column gives the type and color of wire used in each case. Refer to the back inside cover of this manual for the wire code explanation. When the wire code CBSJ is encountered, the letters SJ mean shield with jacket.

TABLE 3-1. TYPICAL METER INDICATIONS

METER	METER SWITCH POSITION	INDICATION
MULTIMETER	SCREEN FS 400 VDC	280 to 320 volts
MULTIMETER	SCREEN FS 40 MA	5 to 20 ma
MULTIMETER	GRID FS 40 MA	5 to 20 ma
P. A. PLATE VOLTAGE	---	2000 to 2200 volts
P. A. PLATE CURRENT	---	Not more than 250 ma
R. F. WATTMETER	Forward	250 watts
R. F. WATTMETER	Reflected	Less than 40 watts

TABLE 3-2. FROM-TO INFORMATION

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
CB301-1	TB301-1	VG90	E308	K305-5	RC913
CB301-1	XF301-1	VG90	E308	S113-1	RC913
CB301-2	K304-5	RE90	E308	TB304-7	RC913
CB301-3	TB301-2	VG0	E309	E310	VG9
CB301-3	XF302-1	VG0	E310	TB301-3	VG9
CB301-4	K304-3	RE95	E310	TB303-2	RC9
CR301-1	T303-8	KEC	E310	TB308-7	RC9
CR302-1	T303-10	KE0	E310	E309	VG9
CR302-2	L301-1	KE0	E310	E311	RC9
C301-2	C302-2	RC90	E310	E312	RC9
C301-2	R304-3	RC90	E310	T301-9	RC9
C301-2	I303-9	RC90	E311	E310	RC9
C302-2	C301-2	RC90	E312	K303-1	RC9
C301-1	L301-2	KE0	E312	K305-2	RC9
C206-1	TP302	RA91	E312	E310	RC9
C206-1	T302-5	DA91	E313	DC301-3	SHIELD
C210	M303-2	LE9	E313	DC301-4	SHIELD
C211	E303	RC4	E313	E306	SHIELD
C214	S307-11	RC93	E313	TB333-3	SHIELD
C215	R317-3	RC905	E313	TB333-3	SHIELD
C218	S302-11	RC95	E314	TP301	RA90
C219	TB304-3	RC95	E314	T302-7	CA91
DC301-3	S308B-4	CBSJ905	E317	S112-1	RC9
DC301-3	E313	SHIELD	E317	S307-9	RC9
DC301-4	S308A-11	CBSJ903	E317	TB303-10	RC905
DC301-4	E313	SHIELD	E317	TB307-2	RC9
E301	L302-2	KE0	E317	TB309-2	RC9
E301	M303-1	KE0	E322	K301-3	RC9
E301	S309	KE0	E322	K302-6	RC9
E301	TB308-1	KE0	J305-1	K301-12	RC0
E301	R305-1	KE0	J305-2	K301-9	RC90
E303	C211	RC4	K301-1	K301-9	RC96
E303	S307-10	RC1	K301-1	S112-2	RC96
E304	S307-4	RC96	K301-1	K301-4	RC916
E306	E313	SHIELD	K301-1	S302-3	RC96
E306	M304-1	SHIELD	K301-2	S111-4	RC902
E307	K301-6	RC91	K301-2	K302-2	RC902
E307	TB307-1	RC91	K301-2	S314-1	RC91
E307	TB309-1	RC92	K301-3	E322	RC9
E308	K302-3	RC913	K301-4	K301-1	RC916
			K301-4	K302-7	RC916

TABLE 3-2. FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
K301-6	E307	RC91	S113-1	E308	RC913
K301-7	XF303-2	RC902	S113-2	K302-1	RC916
K301-9	J305-2	RC90	S114-3	S313-2	RC915
K301-10	T301-5	RC93	S114-4	K305-3	RC916
K301-12	J305-1	RC0	S302-1	TB303-1	RC91
K301-13	T301-1	RC92	S302-3	K301-1	RC96
K302-1	K302-4	RC916	S302-3	TB304-6	RC96
K302-1	K302-9	RC91	S302-4	TB303-5	RC912
K302-1	S113-2	RC916	S302-4	TB304-11	RC912
K302-2	K301-2	RC902	S302-5	S311-1	RC90
K302-2	TB304-8	RC902	S302-5	TB303-4	RC90
K302-3	E308	RC913	S302-7	TB303-3	RC92
K302-4	K302-1	RC916	S302-9	TB304-1	RC915
K302-6	E322	RC9	S302-10	TB302-8	RC93
K302-7	K301-4	RC916	S302-11	C218	RC95
K302-9	K302-1	RC91	S302-11	TB302-9	RC95
K302-9	TB304-2	RC923	S307-2	M301-1	RC903
K302-10	K304-1	RC906	S307-4	E304	RC96
K302-10	TB308-11	RC916	S307-4	R308-2	RC96
K303-1	E312	RC9	S307-8	M301-2	RC902
K303-3	K304-2	RC925	S307-9	E317	RC9
K303-4	S314-3	RC92	S307-10	E303	RC1
K304-1	K302-10	RC906	S307-11	C214	RC93
K304-2	K303-3	RC925	S308-2	R321-3	CBSJ902
K304-2	TB304-5	RC925	S308A-6	TB333-5	RAS90
K304-2	XDS302-1	RC923	S308A-11	DC301-4	CBSJ903
K304-3	CB301-4	RE95	S308B-4	DC301-3	CBSJ905
K304-4	R323-1	RE92	S308B-5	TB333-4	RAS90
K304-5	CB301-2	RE90	S309	E301	KE0
K304-6	T303-5	RE91	S309	S310	KE0
K305-1	R304-1	RC915	S310	S309	KE0
K305-2	E312	RC9	S311-1	S302-5	RC90
K305-3	S114-4	RC916	S311-2	S312-1	RC912
K305-5	E308	RC913	S312-1	S311-2	RC912
L301-1	CR302-2	KE0	S312-2	S313-1	RC913
L301-2	C301-1	KE0	S313-1	S312-2	RC913
L301-2	L302-1	KE0	S313-2	S114-3	RC915
L302-1	L301-2	KE0	S314-1	K301-2	RC91
L302-2	E301	KE0	S314-3	K303-4	RC92
M301-1	S307-2	RC903	S314-3	T302-1	RC92
M301-2	S307-8	RC902	TB301-1	CB301-1	VG90
M302-1	TB308-5	RC902	TB301-2	CB301-3	VG0
M302-2	TB303-8	RC902	TB301-3	E310	VG9
M302-2	TB308-6	RC912	TB301-3	TB304-10	RC9
M303-1	E301	KE0	TB302-1	TB306-1	RC90
M303-2	C210	LE9	TB302-2	TB306-2	RC91
M304-1	E306	SHIELD	TB302-3	T301-1	RC92
R304-1	K305-1	RC915	TB302-7	TB307-8	RC96
M304-1	TB308-7	RC9	TB302-8	S111-3	RC90E
M304-2	R321-1	CBSJ906	TB302-8	S302-10	RC93
R304-3	C301-2	RC90	TB302-9	S302-11	RC95
R305-1	E301	KE0	TB303-1	S302-1	RC91
R305-2	XV301-5	RC5	TB303-2	E310	RC9
R308-2	S307-4	RC96	TB303-2	TB333-3	RA9
R308-2	XV301-5	RC96	TB303-3	S302-7	RC92
R317-1	R318-1	RC903	TB303-4	S302-5	RC90
R317-3	C215	RC905	TB303-5	S302-4	RC912
R318-1	R317-1	RC903	TB303-7	TB304-9	RC913
R321-1	M304-2	CBSJ906	TB303-8	M302-2	RC902
R321-3	S308-2	CBSJ902	TB303-9	TB323-A	RC903
R323-1	K304-4	RE92	TB303-9	TB323-4	RC903
R323-2	T303-1	RE93	TB303-10	E317	RC905
S111-3	TB302-8	RC906	TB304-1	S302-9	RC915
S111-4	K301-2	RC902	TB304-2	K302-9	RC923
S111-4	XDS301-1	RC902	TB304-3	C219	RC95
S112-1	E317	RC9	TB304-4	XF303-2	RC93
S112-2	K301-1	RC96	TB304-5	K304-2	RC925
S112-2	TB308-9	RC96	TB304-6	S302-3	RC96

TABLE 3-2. FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
TB304-7	E308	RC913	TB333-2	TB324-F	RA92
TB304-8	K302-2	RC902	TB333-3	E313	SHIELD
TB304-9	TB303-7	RC913	TB333-3	E313	SHIELD
TB304-10	TB301-3	RC9	TB333-3	TB303-2	RA9
TB304-10	TB305-3	RC9	TB333-4	S308B-5	RAS90
TB304-11	S302-4	RC912	TB333-5	S308A-6	RAS90
TB305-1	TB307-3	TAS9	T301-1	TB302-3	RC92
TB305-2	TB307-4	TAS0	T301-1	XF302-2	RE92
TB305-3	TB304-10	RC9	T301-1	K301-13	RC92
TB305-3	TB307-5	SHIELD	T301-5	K301-10	RC93
TB305-3	TB307-5	SHIELD	T301-5	TB306-3	RC93
TB305-3	TB307-5	SHIELD	T301-5	XF301-2	RE91
TB305-4	TB307-6	TAS9	T301-8	XF303-1	RC96
TB305-5	TB307-7	TAS2	T301-9	E310	RC9
TB306-1	TB302-1	RC90	T302-1	S314-3	RC92
TB306-2	TB302-2	RC91	T302-1	T304-1	RC92
TB306-3	T301-5	RC93	T302-5	C206-1	DA91
TB307-1	E307	RC91	T302-7	E314	DA91
TB307-2	E317	RC9	T303-1	R323-2	RE93
TB307-3	TB305-1	TAS9	T303-5	K304-6	RE91
TB307-4	TB305-2	TAS0	T303-8	CR301-1	KE0
TB307-5	TB305-3	SHIELD	T303-9	C301-2	RC90
TB307-5	TB305-3	SHIELD	T303-10	CR302-1	KE0
TB307-5	TB305-3	SHIELD	TP301	E314	RA90
TB307-6	TB305-4	TAS9	TP302	C206-1	RA91
TB307-7	TB305-5	TAS2	T304-1	T302-1	RC92
TB307-8	TB302-7	RC96	T304-7	TB333-1	RA90
TB308-1	E301	KE0	XDS301-1	S111-4	RC902
TB308-5	M302-1	RC902	XDS301-2	TB308-8	RC903
TB308-6	M302-2	RC912	XDS302-1	K304-2	RC923
TB308-7	E310	RC9	XDS302-2	TB308-10	RC925
TB308-7	M304-1	RC9	XF301-1	CB301-1	VG90
TB308-8	XDS301-2	RC903	XF301-2	T301-5	RE91
TB308-9	S112-2	RC96	XF302-1	CB301-3	VG0
TB308-10	XDS302-2	RC925	XF302-2	T301-1	RE92
TB308-11	K302-10	RC916	XF303-1	T301-8	RC96
TB309-1	E307	RC92	XF303-2	K301-7	RC902
TB309-2	E317	RC9	XF303-2	TB304-4	RC93
TB323-A	TB303-9	RC903	XV301-2	XV302-5	RC92
TB323-4	TB303-9	RC903	XV301-5	R305-2	RC5
TB324-F	TB333-2	RA92	XV301-5	R308-2	RC96
TB333-1	T304-7	RA90	XV302-5	XV301-2	RC92

section 4

parts list

This section contains a list of all replaceable electrical, electronic, and critical mechanical parts for the B830-1 250-Watt FM Power Amplifier 549-2008-000. The manufacturers' codes appearing in the MFR CODE column of the parts list are listed in numerical order

at the end of the parts list. The code list provides manufacturers' names and addresses as shown in the Federal Supply Code for Manufacturers, Handbook H4-1. Manufacturers not listed in Handbook H4-1 are assigned a five-letter code and will appear first in the code list.

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Illustrations	4-2
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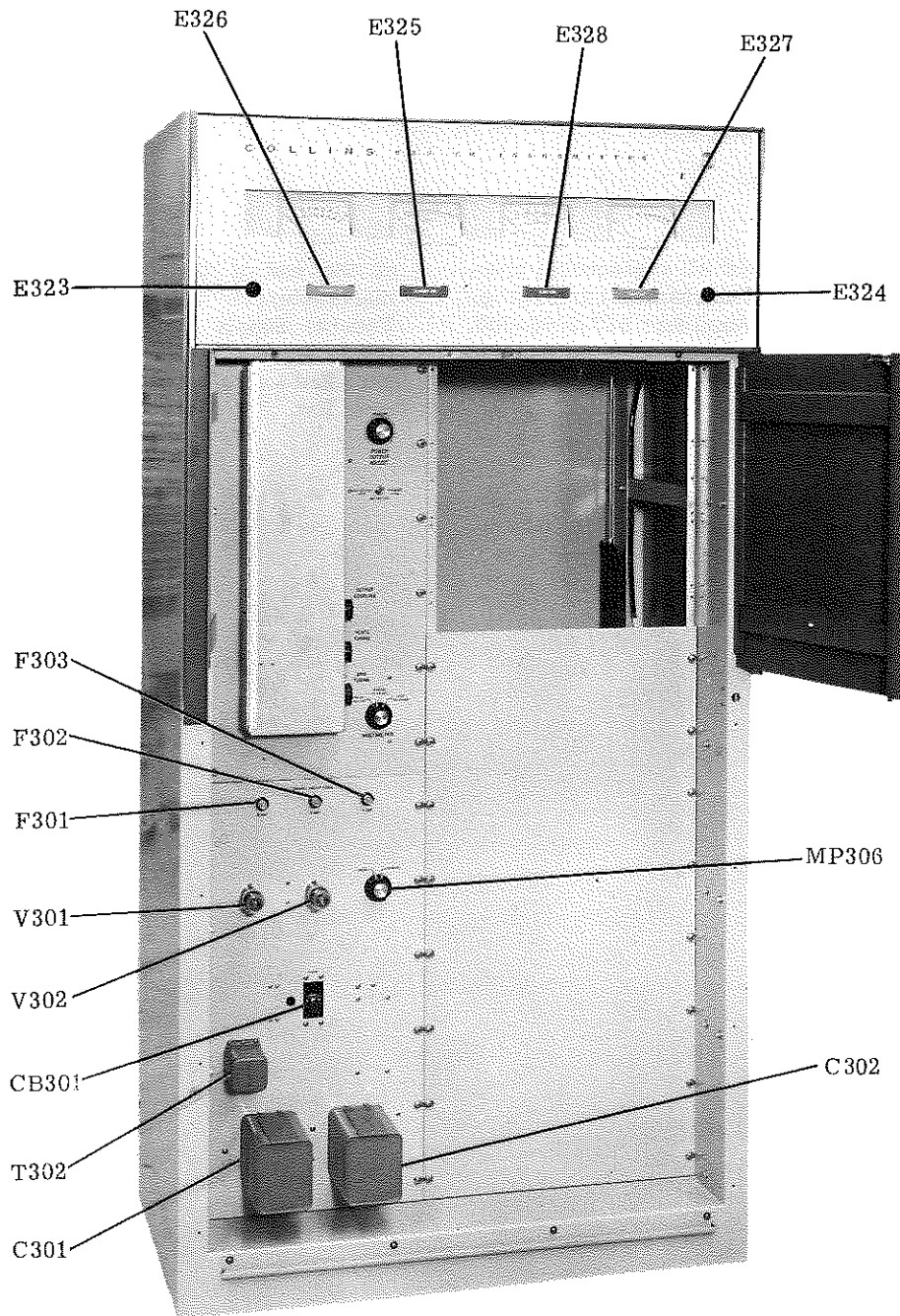


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 1 of 12)

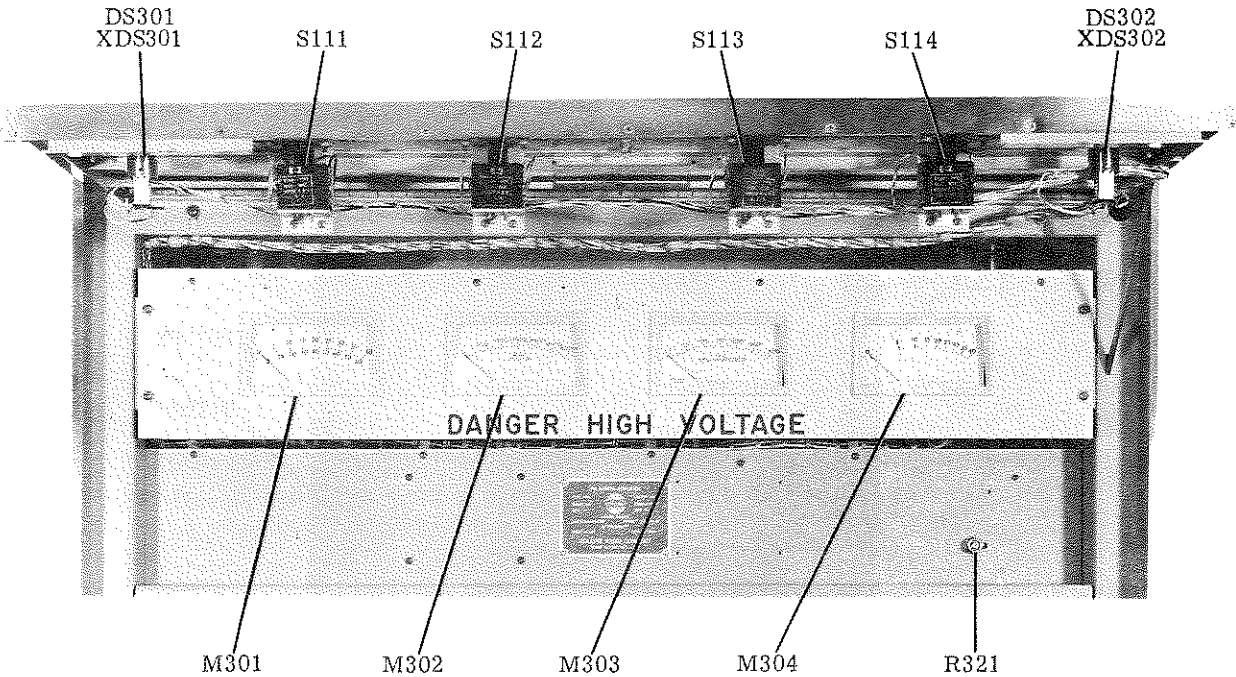


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 2 of 12)

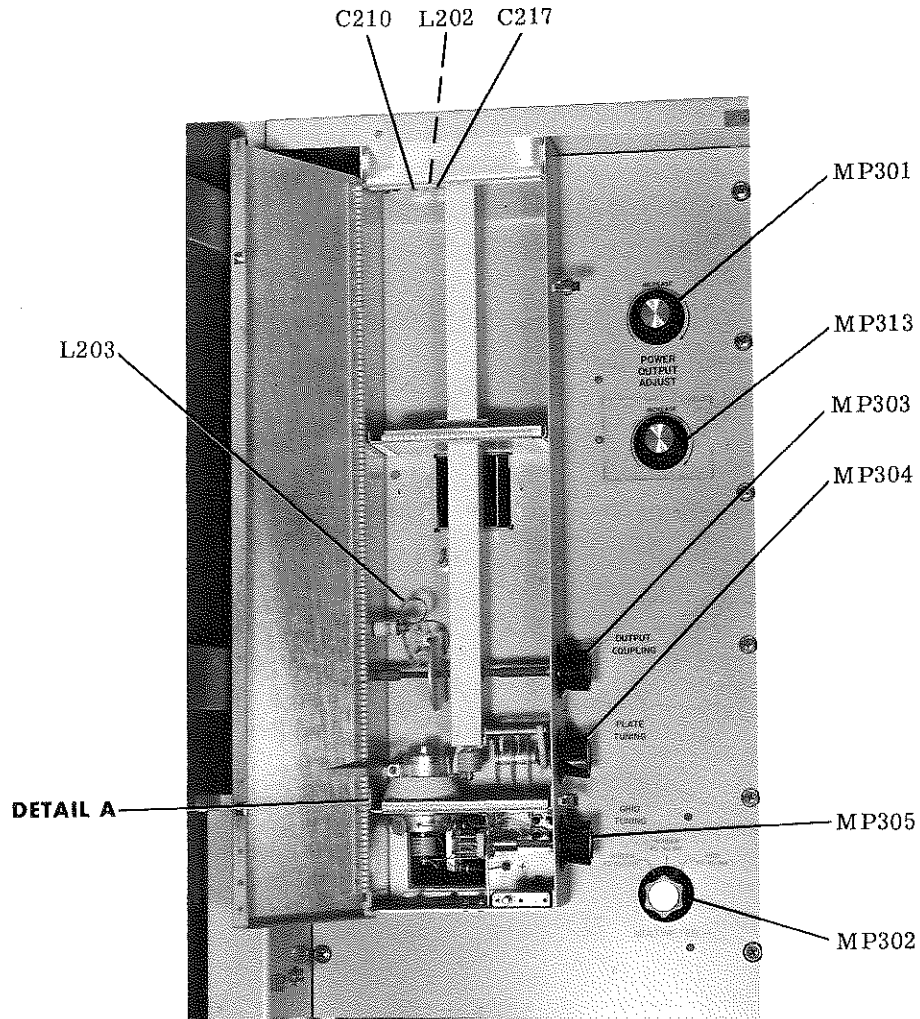


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 3 of 12)

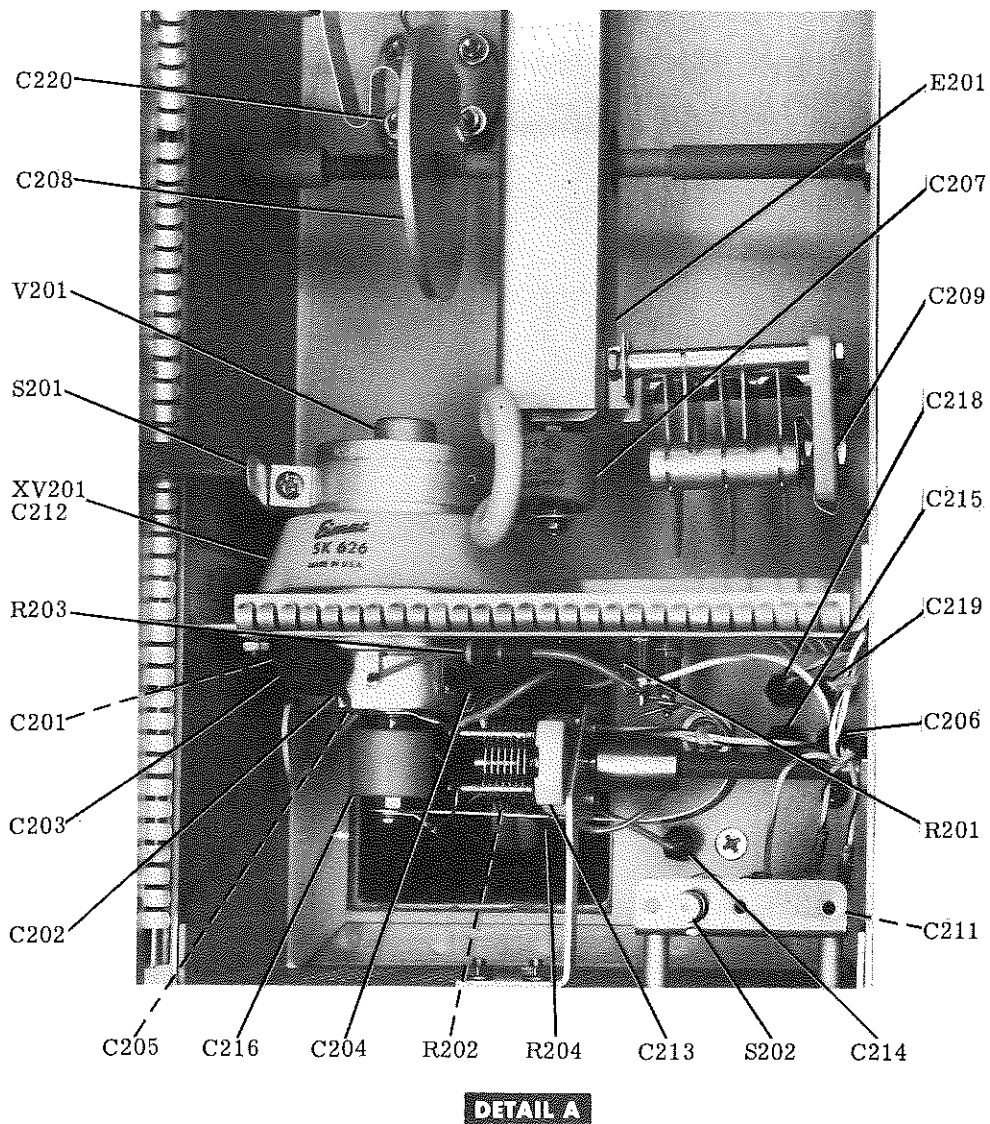


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 4 of 12)

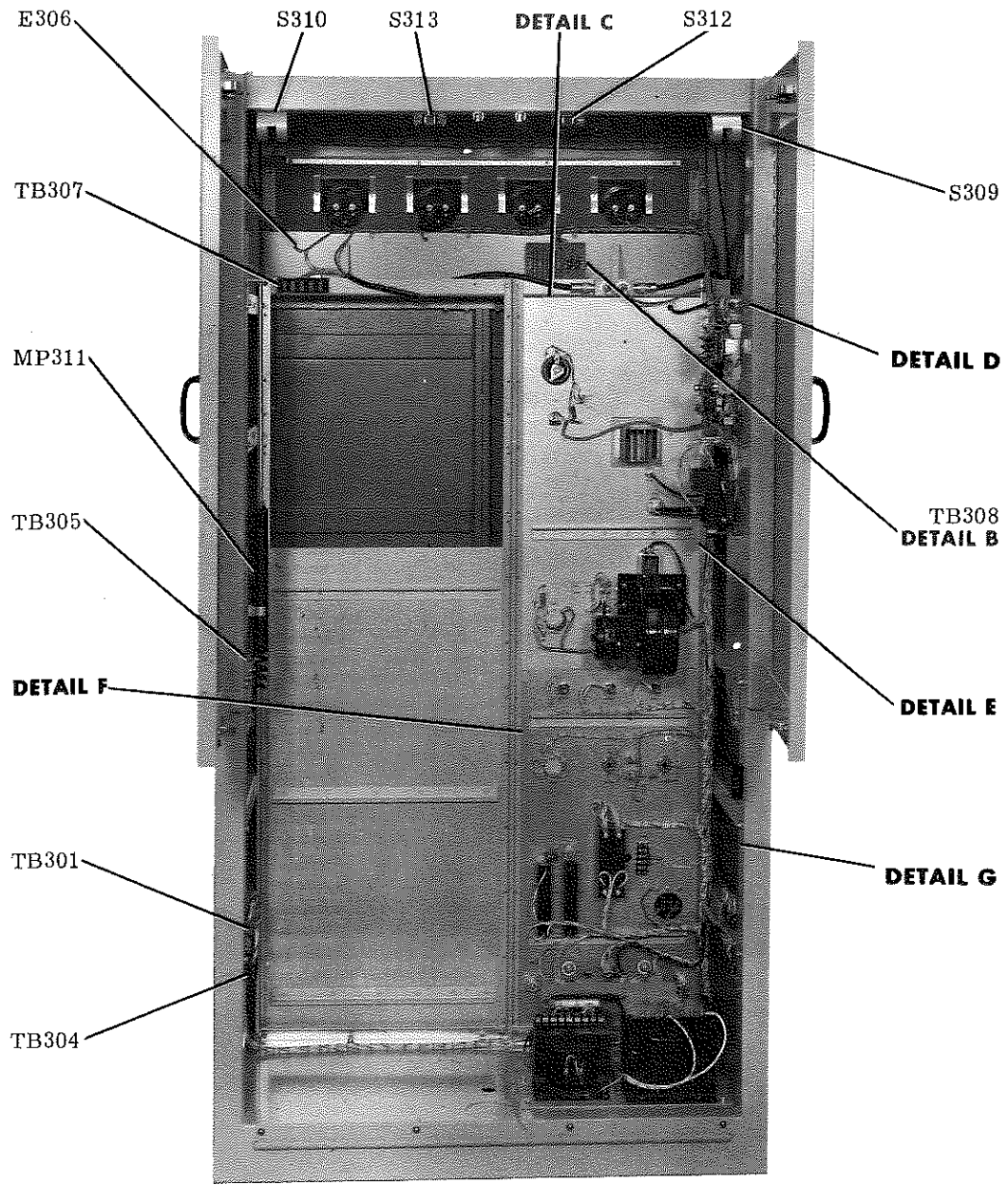


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 5 of 12)

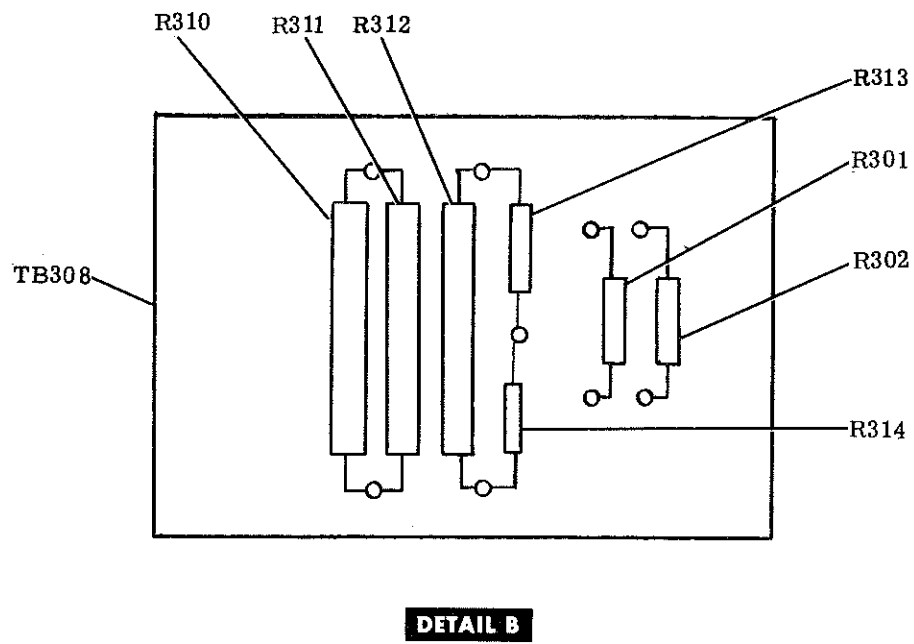


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 6 of 12)

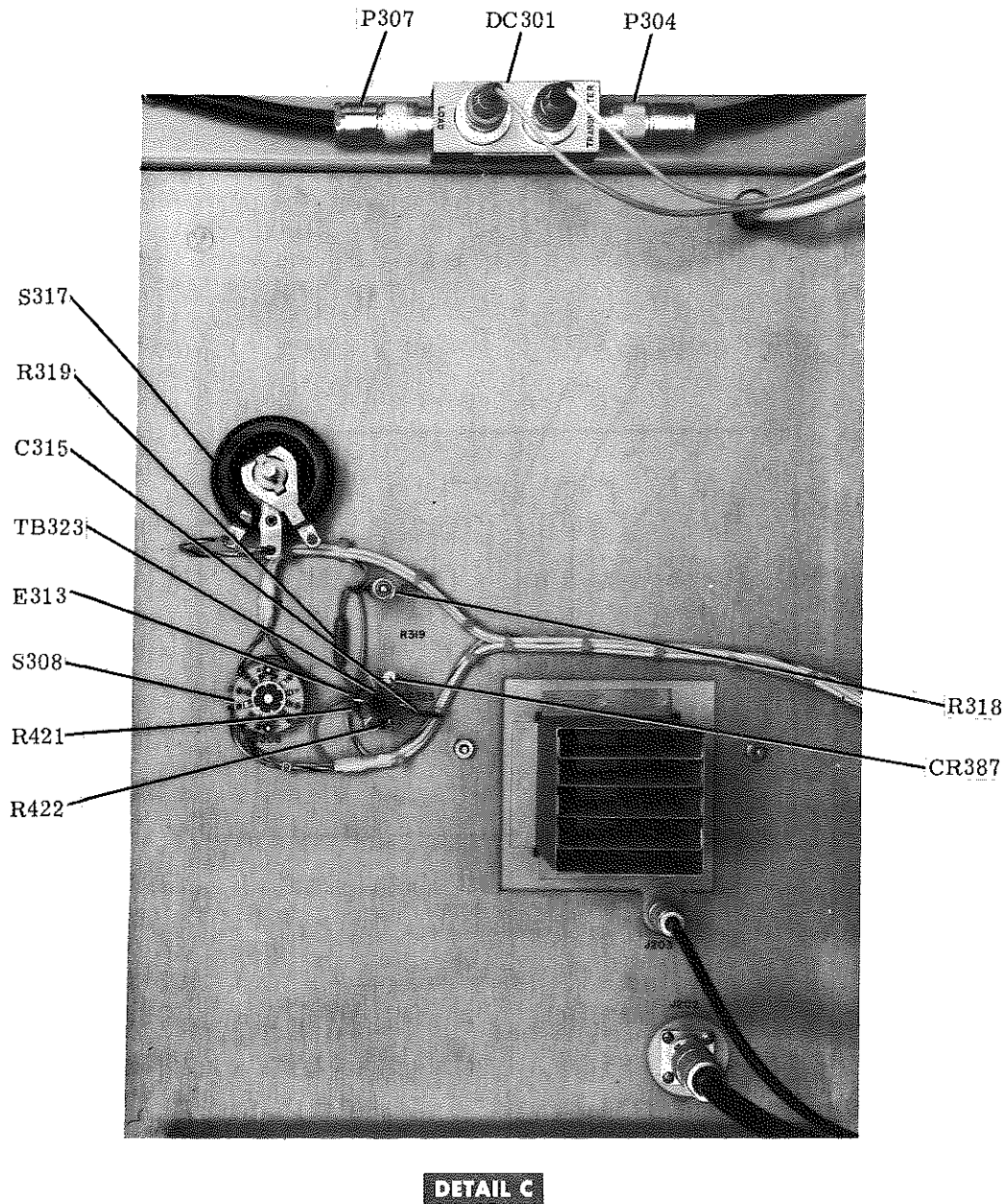


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 7 of 12)

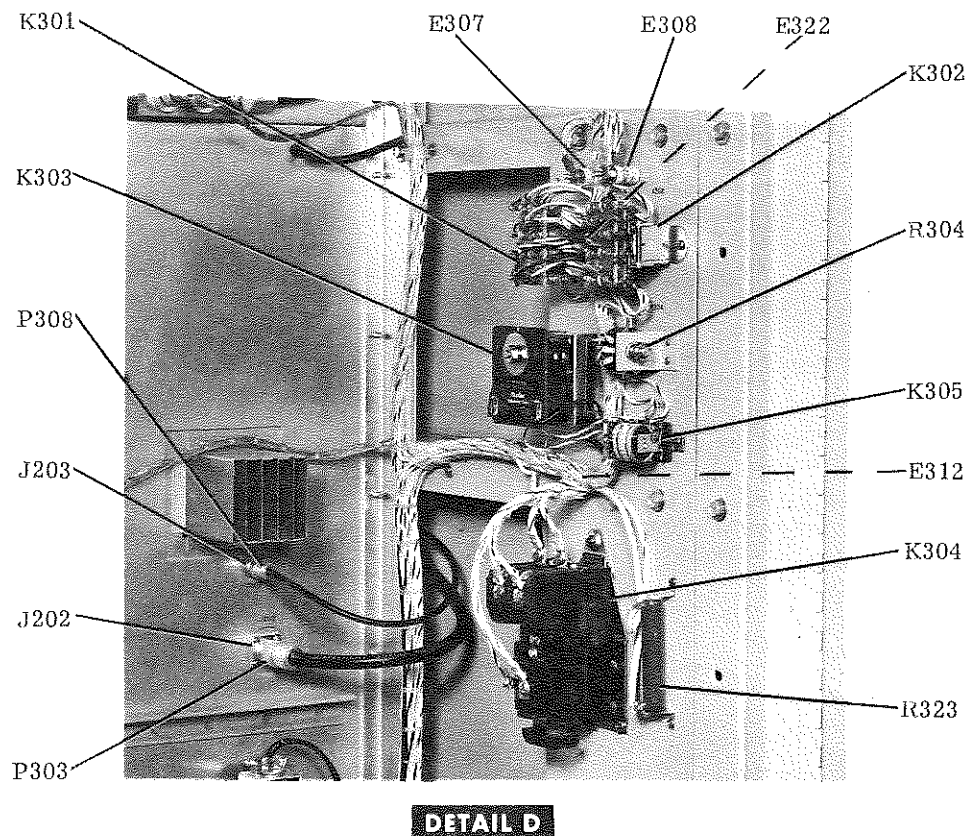
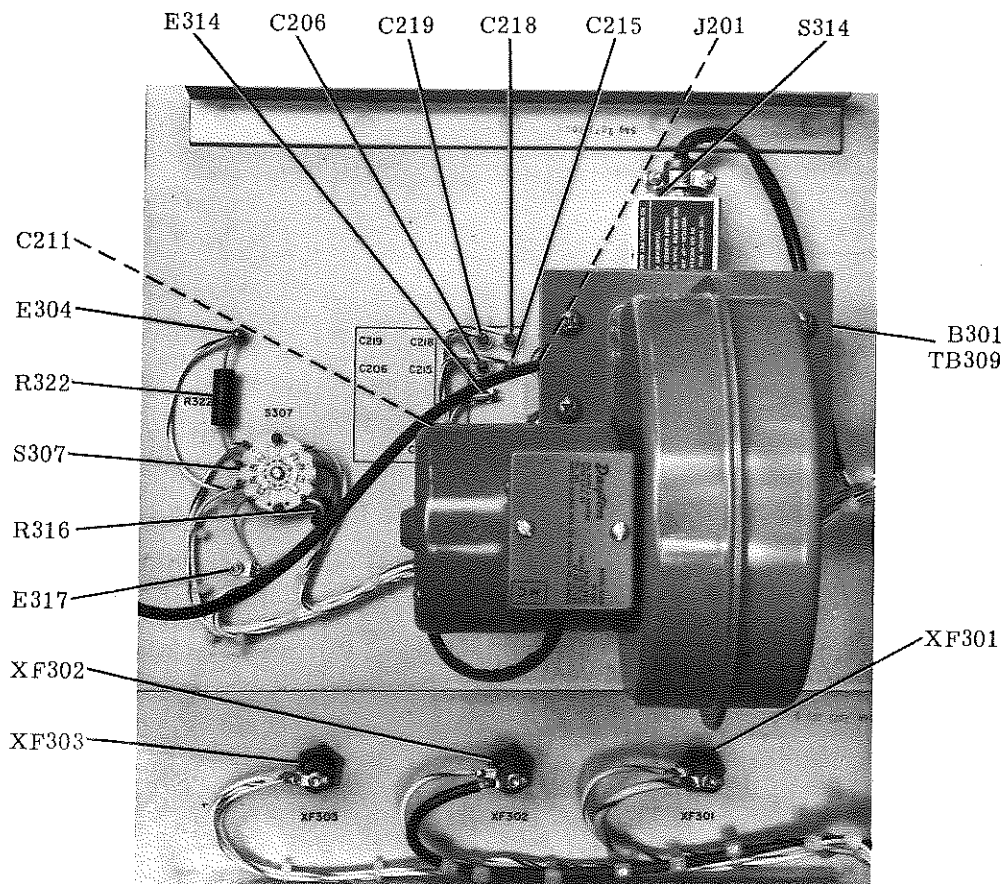
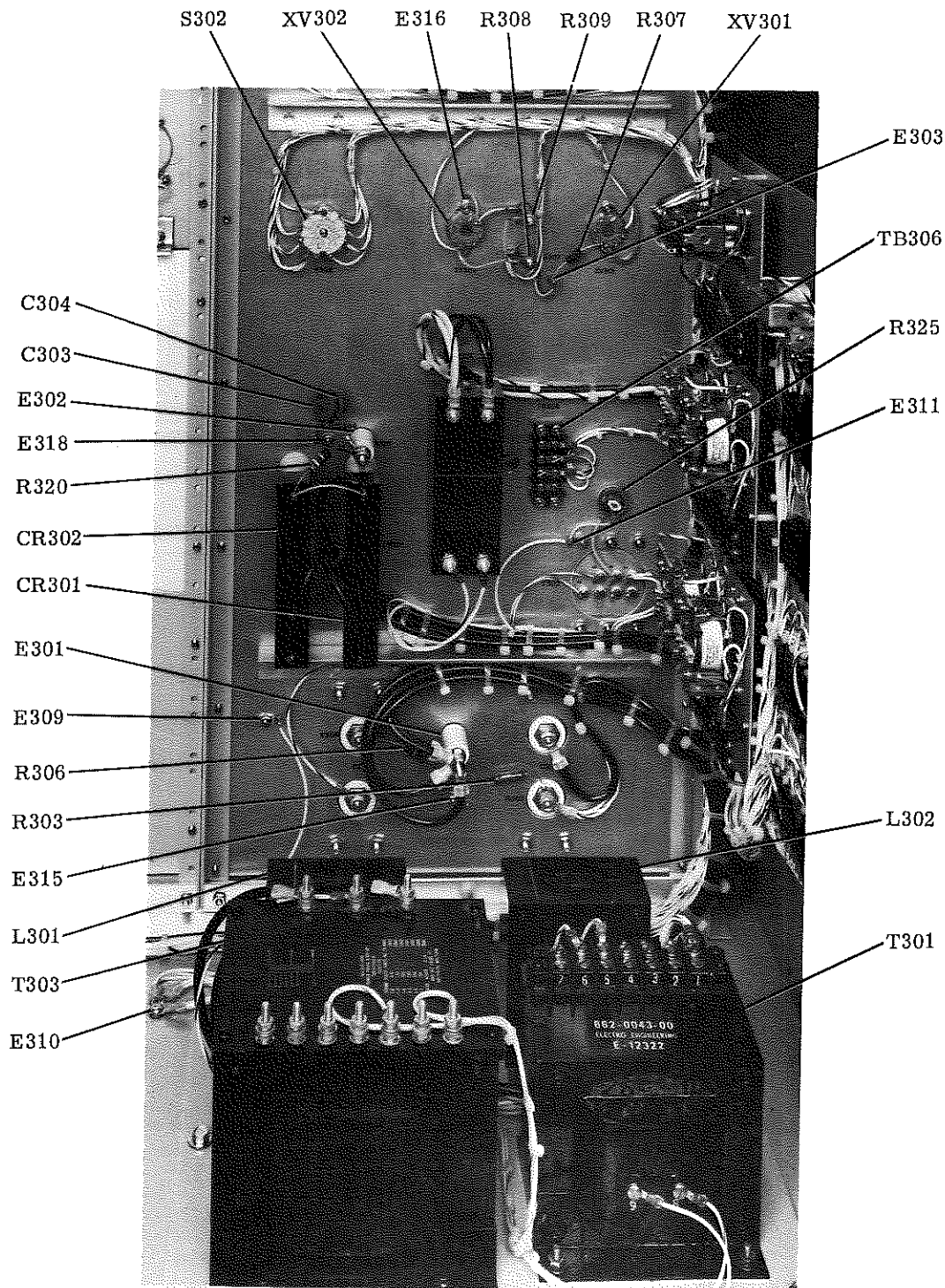


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 8 of 12)



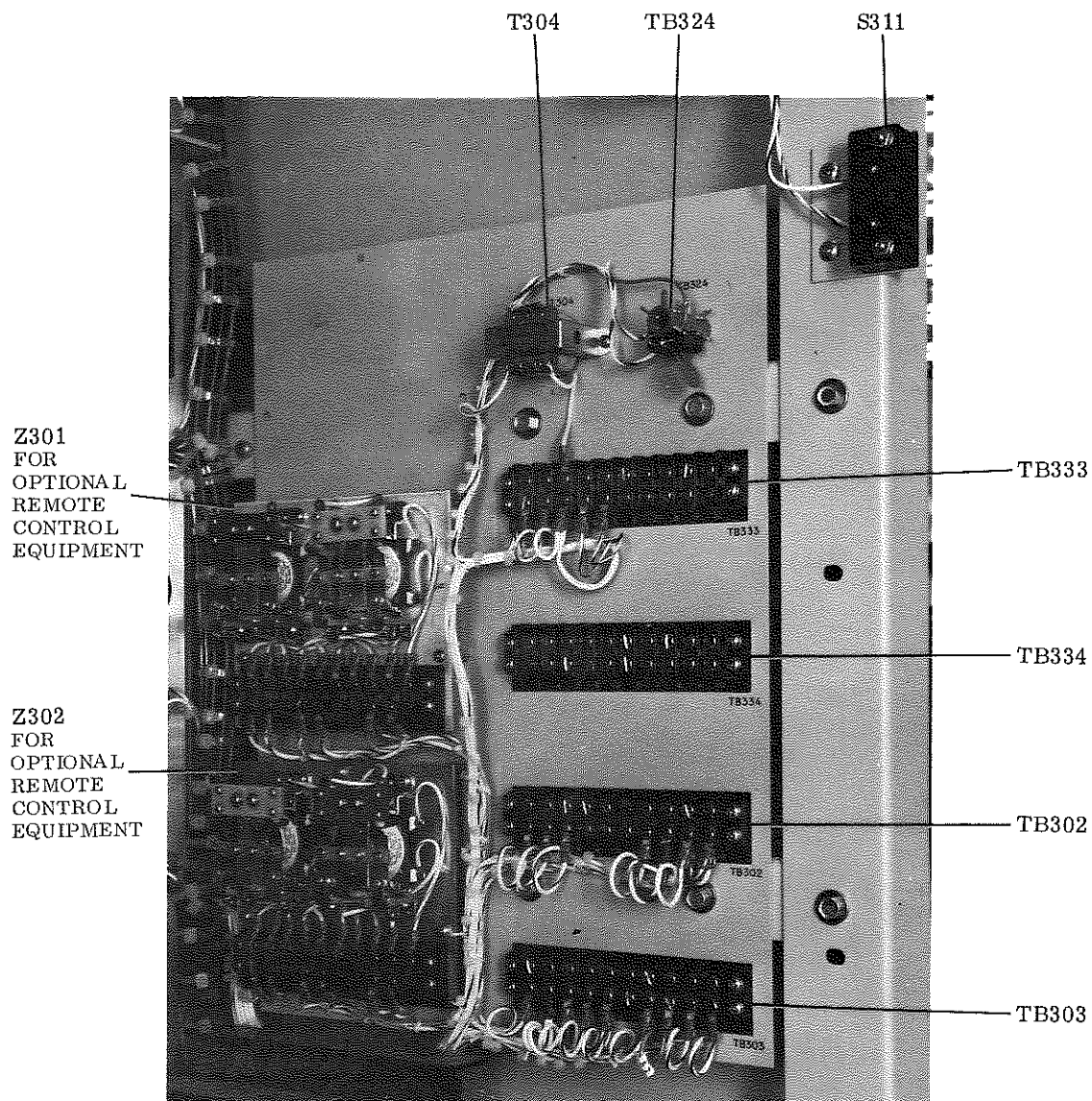
DETAIL E

Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 9 of 12)



DETAIL F

Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 10 of 12)



DETAIL G

Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 11 of 12)

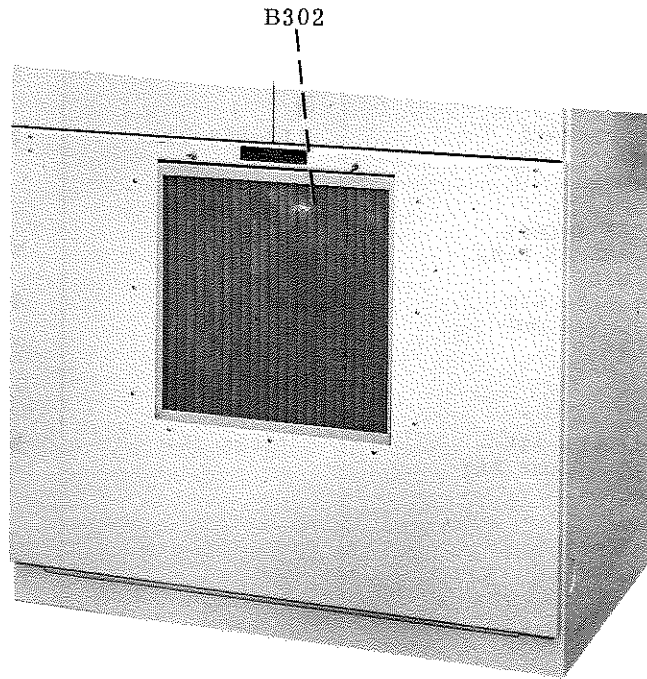


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 12 of 12)

parts list

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
B830-1 250-WATT FM POWER AMPLIFIER				549-2008-000
B301	FAN, CENTRIFUGAL 115 VAC, 60 CPS SINGLE PHASE	2C6010	16327	009-1576-000
B302	MOTOR, ALTERNATING CURRENT 230 VOLTS, 50/60 CPS, 1550 RPM	5KSP51CL17	24446	230-0164-000
C201	CAPACITOR, FXD, CERAMIC 0.02 UF, PLUS 100% MINUS 20%, 500 VDCW	33C2	01939	913-2142-000
C202 THROUGH C205	SAME AS C201			
C206	CAPACITOR, FXD, CERAMIC 1000 UUF, PLUS 80% MINUS 20%, 500 VDCW	327-029X5T0102Z	72982	913-1292-000
C207	CAPACITOR, FXD, CERAMIC 1000 UUF, 20% TOL, 5000 VDCW	DA-858-003	71590	913-0101-000
C208	PLATE, CAPACITOR ALUMINUM, 0.063 INCHES THICK, 2.625 INCHES DIA, 2.625 INCHES WIDE			549-2059-002
C209	CAPACITOR, VARIABLE, AIR 4.5 UUF MIN TO 9.5 UUF MAX, 7000 VOLTS	165-8-2	74970	922-0570-000
C210	SAME AS C207			
C211	SAME AS C206			
C212	PART OF XV201			
C213	CAPACITOR, VARIABLE, AIR 3.9 UUF MIN TO 50 UUF MAX	11726-244	80583	922-0016-000
C214	SAME AS C206			
C215	SAME AS C206			
C216	SAME AS C207			
C217	SAME AS C207			
C218	SAME AS C206			
C219	SAME AS C206			
C220	CAPACITOR, FXD, PLASTIC 35 UUF, 1000 VDCW			549-2126-002
C301	CAPACITOR, FXD, PAPER 4UF, 10% TOL, 4000 VDCW	P47484	56289	930-0705-000
C302	SAME AS C301			
C303	CAPACITOR, FXD, CERAMIC 0.002 UF, 20% TOL, 6000 VDCW	DA172-087CP	71590	913-3540-000
C304	SAME AS C303			
C305	CAPACITOR, FXD, CERAMIC 25 UUF, 10% TOL, 2500 VDCW PART OF HARMONIC FILTER.	850-001	71590	913-4253-000
C306	SAME AS C305			
C307	CAPACITOR, FXD, CERAMIC 33 UUF, 10% TOL, 15,000 VDCW. PART OF HARMONIC FILTER.	857-332	71590	913-1425-000
C308	SAME AS C305-PART OF HARMONIC FILTER.			
C309	SAME AS C305-PART OF HARMONIC FILTER.			
C310 THROUGH C313	SAME AS C305			
C314	CAPACITOR, FXD, CERAMIC 10,000 UUF, 20% TOL, 500 VDCW	CK63AW103M	81349	913-1188-000
C315	SAME AS C314			
C316	SAME AS C314			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
CB301	CIRCUIT BREAKER 50-AMP CURRENT RATING	2263S	74193	260-0239-000
CR301	SEMICONDUCTOR DEVICE, DIODE	4JA421EH2CAB1	24446	353-1794-000
CR302	SAME AS CR301			
CR303	NOT USED			
CR386	NOT USED			
CR387	SEMICONDUCTOR DEVICE, DIODE	IN3016B	07688	353-3121-000
CR388	SEMICONDUCTOR DEVICE, DIODE	IN963A	07688	353-3220-000
DC301	COUPLER UNIT DOUBLE COUPLER, 50 OHMS IMPEDANCE	576KM	16731	277-0156-000
DS301	LAMP, BULB 0.027 AMP, 125 VOLTS	3S6-5	24446	262-3310-000
DS302	SAME AS DS301			
E201	CHIMNEY, AIR SOCKET SYSTEM CERAMIC	SK-626	06980	220-1466-000
E301	TERMINAL LUG			
E302	INSULATOR, STANDOFF			
E303	INSULATOR, STANDOFF			
E304	INSULATOR, STANDOFF			
E305	NOT USED			
E306	INSULATOR, STANDOFF			
E307	INSULATOR, STANDOFF			
E308	INSULATOR, STANDOFF			
E309	TERMINAL LUG			
E310	GROUND LUG			
E311	TERMINAL LUG			
E312	TERMINAL LUG			
E313	TERMINAL LUG			
E314	TERMINAL LUG			
E315	TERMINAL LUG			
E316	TERMINAL LUG			
E317	GROUND LUG			
E318	TERMINAL LUG			
E319	NOT USED			
E320	NOT USED			
E321	NOT USED			
E322	TERMINAL LUG			
E323	LENS, INDICATOR GREEN	75A101GRN	72765	262-0258-000
E324	LENS, INDICATOR RED	75A101RED	72765	262-0259-000
E325	PUSHBUTTON, FILAMENT OFF			548-3584-003
E326	PUSHBUTTON, FILAMENT ON			548-3586-003
E327	PUSHBUTTON, PLATE ON			548-3588-003
E328	PUSHBUTTON, PLATE OFF			548-3590-003
E329	SHIELD, RADIO FREQUENCY			549-2113-004
F301	FUSE, CARTRIDGE 250 VOLTS, 5.0 AMPS	F03A250V5AS	81349	264-0361-000
F302	SAME AS F301			
F303	FUSE, CARTRIDGE 125 VOLTS, 4 AMPS	313004	75915	264-0217-000
J201	CONNECTOR, ELECTRICAL 1 CONTACT	UG1094U	80058	357-9183-000
J202	CONNECTOR, ELECTRICAL 1 CONTACT	UG58AU	80058	357-9003-000
J203	SAME AS J201			
J301	SAME AS J201-PART OF HARMONIC FILTER.			
J302	SAME AS J201-PART OF HARMONIC FILTER.			
J303	CONNECTOR, ELECTRICAL 500 VDCW, 50 OHMS IMPEDANCE	UG-1187/U	80058	357-9476-000
J304	CONNECTOR, ELECTRICAL	100-B3000C-75	94375	357-9248-000
J305	SAME AS J304			
K301	RELAY, ARMATURE	83-3544	04221	970-1933-000

parts list

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
K302	115 VOLTS AC, 330 OHMS RESISTANCE			
K303	SAME AS K301			
K304	RELAY, SWITCH 20 AMPS, 60 CPS, 20 VOLTS	DA2102-002-12060	27780	402-0126-000
K305	RELAY, ARMATURE 2 CONTACTS	702LB0D92	01121	405-0674-000
L201	RELAY, ARMATURE SILVER, 10 OHMS	95062	78277	408-1114-000
L202	RESISTANCE, 10% TOL NOT USED			549-2132-002
L203	COIL, RADIO FREQUENCY 4.7 UH, 10% TOL, 0.60 OHMS	LT7K194	81349	240-0178-000
L301	RESISTANCE COIL, RADIO FREQUENCY			549-2133-002
L302	CHOKE 10 H, 90 OHMS, 0.350 AMPS	E12321	80008	668-0014-000
M301	SAME AS L301			
M302	METER 100 OHMS, PLUS 5% MINUS 10% METER RESISTANCE	56-0443-0000	80145	458-0649-000
M303	METER COIL TYPE, MOVING	56-0383-0000	80145	458-0640-000
M304	METER COIL TYPE, MOVING	56-7733-0000	80145	458-0639-000
MP301	METER COIL TYPE, MOVING	56-4922-0000	80145	458-0638-000
MP302	KNOB BLACK PHENOLIC			546-1293-003
MP305	THROUGH SAME AS MP301			
MP306	KNOB BLACK PHENOLIC			546-1294-003
MP307	CONTACT ASSY INTERLOCK SWITCH	N4050	85107	260-4050-000
MP308	SAME AS MP307			
MP309	LATCH, MAGNETIC ALUMINUM STRIKER PLATE, STEEL FERRITE MAGNET	ADPL100DCST1	84792	015-0899-000
MP310	SAME AS MP309			
MP311	ROD ASSEMBLY, SHORTING BRASS, PLASTIC HANDLE 24.938 INCHES LONG			549-2186-003
MP312	CATCH, HEAVY DUTY STEEL, CADMIUM PLATE	4-2-57	14608	015-0005-000
MP313	SAME AS MP306			
MP314	SHAFT, STRAIGHT			549-2128-002
MP315	LATCH, TOUCH RELEASE STEEL, CADMIUM PLATE	61-380 CAC-1	42689	015-1398-000
MP316	NOT USED			
MP317	CATCH, DOOR	40F3687-1	01930	015-4090-000
MP318	WINDOW, METER OBSERVATION GLASS, 3/16 INCHES THICK			548-3567-002
MP319	PLATE, SWITCH ACTUATOR			549-2054-002
MP320	COUPLING BRASS	2105	74887	015-0257-000
MP321	SAME AS MP301			
MP322	FILTER, AIR STEEL FRAME			009-1069-000
P301	CONNECTOR, ELECTRICAL 1 CONTACT	MS35168-88E	96906	357-9292-000
P302	SAME AS P301			
P303	CONNECTOR, ELECTRICAL 1 CONTACT-PART OF EXCITATION INPUT.	UG1185A/U	81349	357-9326-000
P304	SAME AS P303			
P305	CONNECTOR USED WITH HARMONIC FILTER.			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
P306	SAME AS P305			
P307	SAME AS P301			
P308	NOT USED			
P309	CONNECTOR 2 CONTACTS-USED WITH CABINET FAN			368-0014-000
R201	RESISTOR, FXD, COMPOSITION 2700 OHMS, 10% TOL, 2 WATTS	RC42GF272K	81349	745-5670-000
R202	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10% TOL, 2 WATTS	RC42GF332K	81349	745-5673-000
R203	RESISTOR, FXD, COMPOSITION 47 OHMS, 10% TOL, 1 WATT	RC32GF4070K	81349	745-3296-000
R204	SAME AS R202			
R301	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 2 WATTS	RC42GF102K	81349	745-5652-000
R302	SAME AS R301			
R303	RESISTOR, FXD, WIRE WOUND 10 OHMS RESISTANCE, 5% TOL	78C54F10PGRM5PCT	44655	710-3043-000
R304	RESISTOR ASSEMBLY			549-2016-000
R305	RESISTOR, FXD, WIRE WOUND 31K OHMS, 5% TOL, 210 WATTS	HL-225-31001J	91637	746-6727-000
R306	RESISTOR, FXD, COMPOSITION 10 OHMS, 10% TOL, 2 WATTS	RC42GF100K	81349	745-5568-000
R307	RESISTOR, FXD, WIRE WOUND 2.56 OHMS, 1% TOL, 2.5 WATTS	RS10-10001H	91637	746-9448-000
R308	RESISTOR, FXD, WIRE WOUND 5K OHMS, 5% TOL, 10 WATTS	1 3-4D57F5KPORM- 5PCT	44655	710-2913-000
R309	SAME AS R308			
R310	RESISTOR, FXD, FILM 1000K OHMS, 1% TOL, 2 WATTS	RN80B1004F	81349	705-4254-000
R311	SAME AS R310			
R312	SAME AS R310			
R313	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1 WATT	RC32GF103K	81349	745-3394-000
R314	RESISTOR, FXD, FILM 7500 OHMS, 5% TOL, 1 WATT	RL32S752J	81349	745-3994-000
R315	NOT USED			
R316	SAME AS R310			
R317	RESISTOR, VARIABLE POWER TYPE, 500 OHMS, 10% TOL, 50 WATTS	49474	44655	736-0456-000
R318	RESISTOR, FXD, WIRE WOUND 160 OHMS, 5% TOL, 10 WATTS	1 3-4D57F160POR- M5PCT	44655	710-2921-000
R319	RESISTOR, FXD, WIRE WOUND 20 OHMS, 5% TOL, 5 WATTS	7/8C54F20.0PORM- 5PCT	44655	710-3035-000
R320	RESISTOR, FXD, COMPOSITION 390 OHMS, 10% TOL, 2 WATTS	RC42GF391K	81349	745-5635-000
R321	RESISTOR, VAR, WIRE WOUND 10K OHMS, 20% TOL, 2 WATTS	RV4LAYS103B	81349	380-2757-000
R322	RESISTOR, FXD, FILM 402K OHMS, 1% TOL, 1 WATT	RN75B4023F	81349	705-3287-000
R323	RESISTOR, FXD, WIRE WOUND 1 OHM, 5% TOL, 26 WATTS	RW33V1R0	81349	747-1626-000
R324	NOT USED			
R325	RESISTOR, VARIABLE 100 OHMS, 10% TOL	44968-100	44655	749-4512-000
R326	NOT USED			
THROUGH				
R420				
R421	RESISTOR, FXD, FILM 1800 OHMS, 5% TOL, 1 WATT	RL32S182J	81349	745-3956-000
R422	RESISTOR, FXD, FILM 4700 OHMS, 5% TOL, 1 WATT	RL32S472J	81349	745-3981-000
S111	SWITCH, PUSH	B2BL	04009	260-2020-000

parts list

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
S112	OPST CONTACT ARRANGEMENT SAME AS S111			
S113	SAME AS S111			
S114	SAME AS S111			
S202	SWITCH, INTERLOCK SPDT CONTACT ARRANGEMENT	3AC5	91929	266-8013-000
S301	NOT USED			
S302	SWITCH, ROTARY ROTARY WAFER SWITCH	4MLRC	82104	259-1564-000
S303 THROUGH S306	NOT USED			
S307	SWITCH, ROTARY 8 CONTACTS	4MLRC	82104	259-1565-000
S308	SWITCH, ROTARY ROTARY WAFER SWITCH	228556-F1E	76854	259-1808-000
S309	SPRING, INTERLOCK			549-2315-003
S310	SAME AS S309			
S311	CONTACT ASSEMBLY INTERLOCK SWITCH	N4040	85107	260-4040-000
S311A	PART OF CABINET DOOR			
S311B	CONTACT ASSEMBLY 2 CONTACTS	N4040	85107	260-4040-000
S312	SAME AS S311			
S313	SAME AS S311			
S314	SWITCH, AIRFLOW SPDT CONTACT ARRANGEMENT	4000	82877	266-8307-000
T301	TRANSFORMER, POWER, STEP-DOWN 250 VOLTS, 50 TO 60 CPS	E12322	80008	662-0043-000
T302	TRANSFORMER, POWER, STEP-UP	292-578-361	49956	662-0041-000
T303	SAME AS T302			
TB301	TERMINAL BOARD 4 TERMINALS	4-142	71785	367-5040-000
TB302	TERMINAL BOARD 10 TERMINALS	10-140	71785	367-3100-000
TB303	SAME AS TB302			
TB304	TERMINAL BOARD 12 TERMINALS	600-12M	71785	367-0518-000
TB305	SAME AS TB304			
TB306	TERMINAL BOARD 4 TERMINALS	18A18697	71785	367-4040-000
TB307	TERMINAL BOARD 14 TERMINALS	14-162A-R	75173	367-0300-000
TB308	TERMINAL BOARD 11 TERMINALS			549-2102-003
TB309	TERMINAL BOARD			549-2103-003
TB310 THROUGH TB322	NOT USED			
TB323	TERMINAL BOARD 12 TERMINALS	6H12	00534	306-0909-000
TP301	JACK TIP YELLOW	MS16108-8A	96906	360-0156-000
TP302	JACK TIP BLUE	MS16108-7A	96906	360-0155-000
V201	TUBE, ELECTRON	7203/4CX250B	49671	256-0138-000
V301	TUBE, ELECTRON	0D3-VR150	49671	257-0001-000
V302	SAME AS V301			
XDS301	LAMPHOLDER	75 LESSLENS	72765	262-0255-000
XDS302	SAME AS XDS301			
XF301	FUSEHOLDER 20 AMP CURRENT RATING	HKLJRWZZ	71400	265-1040-000
XF302	SAME AS XF301			
XF303	SAME AS XF301			
XV201	SOCKET, ELECTRON TUBE INSULATED, 1000 VDCW	124-115-2	74970	220-1294-000
XV301	SOCKET, ELECTRON TUBE 8 CONTACTS	88-8TM	02660	220-1005-000
XV302	SAME AS XV301			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
MANUFACTURERS CODES				
CODE	MANUFACTURER			
00213	SAGE ELECTRONICS CORP P.O. BOX 3926 ROCHESTER, N.Y.			
00534	VECTOR MFG. CO. 5616 LAWDALE HOUSTON, TEXAS			
01121	ALLEN-BRADLEY CO. 1201 SOUTH 2ND STREET MILWAUKEE, WIS.			
01930	AMEROCK CORP 4000 AUBURN ST ROCKFORD, ILL.			
01939	SPRAGUE ELECTRIC CO. OF WIS. GRAFTON			
02660	AMPHENOL-BORG ELECTRONICS CORP 25TH AND CERMACK RD MAYWOOD, ILL.			
03508	GENERAL ELECTRIC CO. SEMI-CONDUCTOR PRODUCTS DEPT. SYRACUSE, N.Y.			
03511	GENERAL ELECTRIC CO. SPECIALTY MOTOR DEPT. FORT WAYNE, IND.			
04009	ARROW-HART AND HEGEMAN ELECTRIC CO. HARTFORD, CONN.			
04221	TELEX-AEMCO MANKATO, MINN.			
04713	MOTOROLA INC. SEMICONDUCTOR PRODUCTS DIVISION 5005 EAST MC DOWELL ROAD PHDENIX, ARIZONA			
06980	EITEL-MCCULLOUGH INC. 301 INDUSTRIAL WAY SAN CARLOS, CALIF.			
07688	JOINT ELECTRON DEVICE ENGINEERING COUNCIL WASHINGTON, D.C.			
09922	BURNDY CORPORATION NORWALK, CONN.			
10646	CARBORUNDUM CO. BUFFALO AVE. NIAGARA FALLS, N.Y.			
14608	CORBIN CABINET LOCK DIVISION OF EMHART CORP. 102 WASHINGTON ST. NEW BRITAIN, CONN.			
15605	CUTLER-HAMMER INC. MILWAUKEE, WIS.			
16327	DAYTON ELECTRIC MFG CO. 5959 W HOWARD ST. CHICAGO, ILL.			
16731	MICROWAVE DEVICES INC. INDUSTRIAL PK FARMINGTON, CONN.			
16973	DENVER FIRE CLAY CO. 3033 BLAKE STREET DENVER, COLO.			
24446	GENERAL ELECTRIC CO. SCHENECTADY, N.Y.			
24455	GENERAL ELECTRIC CO. LAMP DIVISION OF CONSUMER			

parts list

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
27780	PRODUCTS GROUP NELA PARK CLEVELAND, OHIO HAYDON DIVISION OF GENERAL TIME CORP 245 E ELM TORRINGTON, CONN.			
42689	NATIONAL LOCK CO. 1902 SEVENTH ST. ROCKFORD, ILL.			
44655	DHMIITE MFG. CO. 3601 HOWARD STREET SKOKIE, ILL.			
49671	RADIO CORPORATION OF AMERICA NEW YORK, N.Y.			
49956	RAYTHEON CO.-MICROWAVE AND POWER TUBE DIVISION ADMINISTRATION BLDG. WALTHAM, MASS.			
56289	SPRAGUE ELECTRIC CO. NORTH ADAMS, MASS.			
70892	BEAD CHAIN MFG CO. 64 MOUNTAIN GROVE ST. BRIDGEPORT, CONN.			
71313	CARDWELL CONDENSER CORP. 80 EAST MONTAUK HIGHWAY LINDENHURST LONG ISLAND, NEW YORK			
71400	BUSSMANN MFG. DIVISION OF MCGRAW-EDISON CO. 2538 WEST UNIVERSITY ST. ST. LOUIS, MO.			
71590	CENTRALAB DIVISION OF GLOBE- UNION INC. 932 EAST KEEFE AVE. MILWAUKEE, WIS.			
71785	CINCH MFG. CO. AND HOWARD B. JONES DIVISION 1026 SOUTH HOMAN AVE. CHICAGO, ILL.			
72619	DIALIGHT CORP. BROOKLYN, N.Y.			
72765	DRAKE MFG. CO. 4626 NORTH OLCOTT AVE. CHICAGO, ILL.			
72982	ERIE TECHNOLOGICAL PRODUCTS INC. 644 WEST 12TH STREET ERIE, PA.			
74193	HEINEMANN ELECTRIC CO. 2612 BRUNSWICK PIKE TRENTON, N.J.			
74545	HUBBELL HARVEY INC. BRIDGEPORT, CONN.			
74887	INSULINE CORP OF AMERICA MANCHESTER, N.H.			
74970	E.F. JOHNSON CO. 297 TENTH AVE. S.W. WASECA, MINN.			
75173	CANCELLED CODE-USE CODE 71785-CINCH MFG CO. DIVISION OF UNITED-CARR FASTENER CORP CHICAGO, ILL.			
75382	KULKA ELECTRIC CORP. MT. VERNON, N.Y.			
75543	LAVELLE RUBBER CO. 424 N. WOOD, CHICAGO, ILL. ZIP CODE 60622			
75915	LITTLEFUZE INC.			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
76005	800 E NORTHWEST HWY DES PLAINES, ILL. ZIP CODE 60016 LORD MFG. CO. 1635 WEST 12TH STREET ERIE, PA			
76487	MILLEN JAMES MFG CO. INC. 150 EXCHANGE ST. MALDEN, MASS. ZIP CODE 02148			
76854	OAK MFG. CO. SOUTH MAIN CRYSTAL LAKE, ILL.			
77554	REDMAN TRAILER CO. ALMA, MICH.			
78277	SIGMA INSTRUMENTS INC. 170 PEARL ST. SOUTH BRAINTREE, MASS.			
80008	ELECTRO ENGINEERING WORKS OAKLAND, CALIF.			
80058	JOINT ELECTRONIC TYPE DESIGNATION SYSTEM			
80145	ASSEMBLY PRODUCTS INC. 7100 WILSON MILLS ROAD CHESTERLAND, OHIO			
80147	BIGGS STEEL FOUNDRY AND FABRICATING CO. AKRON, OHIO			
80583	HAMMARLUND CO. INC NEW YORK, N.Y.			
81349	MILITARY SPECIFICATIONS PROMULGATED BY STANDARDIZATION DIVISION DIRECTORATE OF LOGISTIC SERVICES DSA			
81350	JOINT ARMY-NAVY SPECIFICATIONS PROMULGATED BY STANDARDIZATION DIVISION DIRECTORATE OF LOGISTIC SERVICES DSA			
81483	INTERNATIONAL RECTIFIER CORP. 1523 EAST GRAND AVE. EL SEGUNDO, CALIF.			
81487	SQUARE D CO. INDUSTRIAL CONTROLLER DIVISION 4041 NORTH RICHARDS ST. MILWAUKEE, WIS.			
82104	STANDARD GRIGSBY INC. 2085 N HAWTHORNE AVENUE MELROSE PARK, ILL. ZIP CODE 60160			
82877	ROTRON MFG. CO. INC. 7-9 HASBROUCK LANE WOODSTOCK, N.Y.			
84792	HEPPNER MFG. CO. P.O. BOX Q ROUND LAKE, ILL.			
85107	NEPTUNE ELECTRONICS CO. 30 WEST 15TH STREET NEW YORK, N.Y.			
90211	SQUARE D CO. 9405 RIVER CHICAGO, ILL			
91637	DALE ELECTRONICS INC. COLUMBUS, NEBR			
91929	HONEYWELL INC.-MICRO SWITCH			

parts list

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
92702	DIVISION FREEPORT, ILL. IMC MAGNETICS CORP. EASTERN DIVISION 570 MAIN STREET WESTBURY LONG ISLAND, N.Y.			
94310	TRU-OHM PRODUCTS MEMCOR COMPONETS DIVISION P.O. BOX 890 HUNTINGTON, IND.			
94375	AUTOMATIC METAL PRODUCTS CO. 315 BERRY BROOKLYN, N.Y.			
96214	TEXAS INSTRUMENTS INC. APPARATUS DIVISION DALLAS, TEXAS			
96906	MILITARY STANDARD PROMULGATED BY STANDIZA- TION DIVISION DIRECTORATE			
97488	UNITED STATES RUBBER CO. OF LOGISTIC SERVICES DSA CONSUMER INDUSTRIAL AND PLASTICS PRODUCTS DIVISION CHICAGO, ILL.			
97965	STANCON ELECTRONICS INC CHICAGO, ILL.			

section 5

illustrations



unit instructions

F830-1 10-Kw FM Power Amplifier

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general description

1.1 Purpose of Instruction Book.

This unit instructions provides information about F830-1 10-Kw FM Power Amplifier. Information which is furnished covers a general description of the equipment, principles of operation, maintenance procedures, and a parts list.

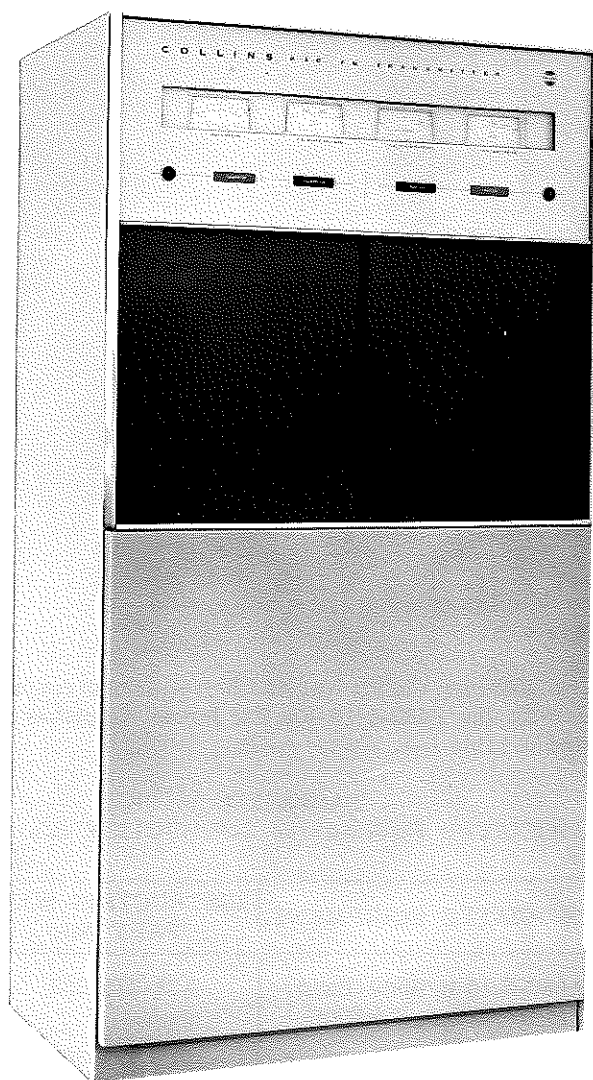


Figure 1-1. F830-1 10-Kw FM Power Amplifier, Over-all View

1.2 Purpose of Equipment.

The F830-1 10-Kw FM Power Amplifier is used for continuous monaural or stereophonic FM broadcast service on a single frequency in the range from 88 to 108 megacycles with an output power of 10,000 watts.

1.3 Description of Equipment.

1.3.1 PHYSICAL DESCRIPTION.

The F830-1 10-Kw FM Power Amplifier, shown in figure 1-1, is contained in a single cabinet that is 38 inches wide, 76 inches high, 27 inches deep, and weighs approximately 1240 pounds. All power amplifier operating controls are located behind the doors on the front of the cabinet. The filament and plate on-off controls and four monitoring meters are located at the top front of the cabinet. The screen circuit breaker is located inside the rear of the cabinet. The monitoring meters may be observed easily while operating the tuning controls. The power amplifier uses one r-f amplifier tube and six rectifier tubes. Silicon diode rectifiers are an optional item used in place of the six rectifier tubes. The r-f amplifier tube is accessible from the front of the power amplifier. The bottom front of the power amplifier cabinet is removable to allow access to components on the bottom of the inside panel.

Large doors at the upper rear of the cabinet (see figure 1-2) allow access to the upper part of the power amplifier for servicing and maintenance. The lower rear half of the power amplifier cabinet is covered by a removable panel containing a ventilating fan and a permanent air filter. Operating personnel are protected by both electrical and mechanical interlocks on the rear doors and panel. These interlocks remove the plate voltage and ground the high-voltage circuits when the doors are opened or disable the high voltage when the panel is removed. The power amplifier plate tuning and grid tuning resonators are located in an interlocked compartment at the front of the transmitter.

Inside the F830-1, heavy iron-core components are at the bottom of the cabinet. A harmonic filter, attached to F830-1, is located in the rear cabinet compartment.

Cooling air for the power amplifier is drawn through a permanent air filter at rear of cabinet by a high-volume fan and exhausted through a shielded opening at top of cabinet. A single high-volume blower supplies cooling air directly to the power amplifier tube.

1.3.2 ELECTRICAL DESCRIPTION.

The F830-1 10-Kw FM Power Amplifier consists of a single, air-cooled power amplifier tube and all

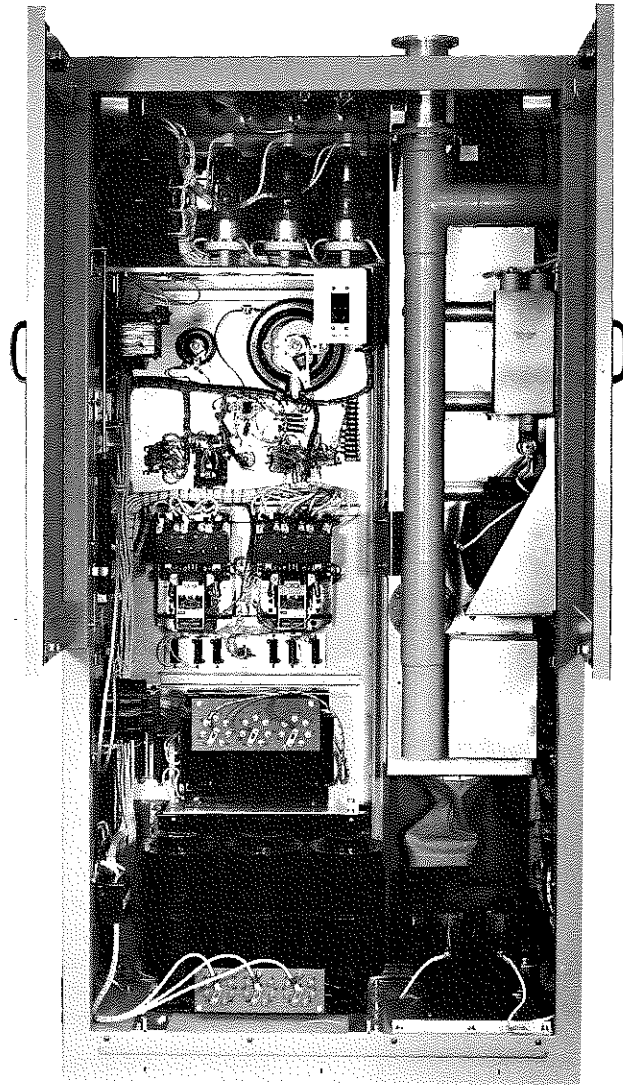


Figure 1-2. F830-1 Rear View with Doors Open and Lower Panel Removed

associated power supply and control circuitry. The F830-1 input impedance is 50 ohms nominal, unbalanced. The F830-1 output power is at least 10,000 watts over the frequency range of 88 to 108 megacycles into a 50-ohm load with an swr not exceeding 2:1.

Line power input required is 60 cycle, 3 phase with primary taps on all power transformers to compensate for local line voltage variations from 200 to 250 volts. Other taps are available for reduced power operation. Circuit breakers in the input side of the plate, screen, and control circuits are provided for primary current overload protection. The control circuit auxiliary power supply and the control grid bias supply are fused. Time delay circuitry for protection of the power amplifier during warmup is provided, with the actual time delay control received from the driver time delay relay. Circuits are provided for remote control tie-in with the driver remote control circuits, with the actual remote control available from one source. Instruction

books covering the exciter and driver used in conjunction with the F830-1 10-Kw FM Power Amplifier are listed in table 1-1.

TABLE 1-1
ASSOCIATED EQUIPMENT INSTRUCTION BOOKS

ASSOCIATED EQUIPMENT	INSTRUCTION BOOK PART NO.
A830-2 10 W Wide-Band FM Broadcast Exciter	523-0755303
786M-1 Stereo Generator	523-0755304
B830-1 250-Watt FM Power Amplifier	523-0755596
D830-1 1000-Watt FM Power Amplifier	523-0755334

1.4 Equipment Supplied.

Table 1-2 lists equipment supplied as part of the F830-1 10-Kw FM Power Amplifier.

**TABLE 1-2
EQUIPMENT SUPPLIED**

EQUIPMENT	COLLINS PART NUMBER
F830-1 10-Kw FM Power Amplifier	522-2981-00
5/10-Kw Harmonic Filter	549-2192-004

1.5 Equipment Required but not Supplied.

Table 1-3 lists equipment required for operation of F830-1 10-Kw FM Power Amplifier but not supplied as part of the power amplifier. The 250-watt power amplifier is used in place of the 1000-watt power amplifier for reduced power applications.

**TABLE 1-3
EQUIPMENT REQUIRED BUT NOT SUPPLIED**

EQUIPMENT	COLLINS PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	522-2714-00
B830-1 250-Watt FM Power Amplifier	549-2008-00
or	
D830-1 1000-Watt FM Power Amplifier	522-2948-00

1.6 Equipment Specifications.

1.6.1 MECHANICAL.

- Weight 1240 pounds maximum.
- Size 38 inches wide, 76 inches high, 27 inches deep.
- Ventilation One ventilating fan, one blower.
- Ambient temperature range +20°C (68°F) to +45°C (113°F) with mercury vapor rectifiers or +0°C (32°F) to +45°C (113°F) with silicon diode rectifiers.
- Ambient humidity range 0 to 95 percent relative humidity.
- Altitude 0 to 6000 feet.

1.6.2 ELECTRICAL.

- Power source 200 to 250 volts, 60 cycle, 3 phase.
- Maximum 60-cps power requirements 20 kilowatts.
- R-f input power 250 watts nominal.
- Power output 10,000 watts nominal or at optional reduced power.
- Output impedance 50 ohms, nominal unbalanced.
- Frequency range 88 to 108 megacycles. Exact operating frequency determined by frequency of exciter.

1.7 Tube and Semiconductor Complement.

Table 1-4 lists the tube and semiconductor complement supplied as part of the F830-1 10-Kw FM Power Amplifier.

TABLE 1-4. TUBE AND SEMICONDUCTOR COMPLEMENT

QUANTITY	TYPE	FUNCTION
6	872A/872	Plate voltage rectifiers or
72	66-6726	Plate voltage silicon rectifiers
1	4CX5000A	Power amplifier
8	1N540	Control grid bias rectifiers
4	1N540	Multimeter rectifiers
12	66-6726	Screen grid voltage rectifiers
4	1N3044A	Zener remote control line protection
2	1N3016B	Zener remote control line protection

section 2

principles of operation

2.1 General.

The F830-1 10-Kw FM Power Amplifier contains a power amplifier and associated circuitry for the amplification of approximately 250 watts of r-f drive up to 10 kilowatts of r-f power. The F830-1 operates in the frequency range of 88 to 108 megacycles. The F830-1 output can be fed through a harmonic filter, for the attenuation of spurious radiations, to an antenna or to a higher power amplifier.

Refer to figure 2-1, a block diagram of the F830-1 10-Kw FM Power Amplifier. The 230-volt, 60-cps, 3-phase line input is fed to the plate and screen step-start contactors where plate and screen voltage on-off functions are controlled by the control circuits. The 230-volt, 3-phase line input is also fed to an auxiliary power supply, T401, where part of the 230-volt input is reduced to 115 volts single phase. The single phase output of T401 is then fed to the control circuits. The control circuits turn the plate, screen, filament, and control grid bias supply on and off. The control circuits also feed 230-volt, 60-cps, single phase power to the driver. Provisions are made within the control

circuitry to connect to the filament on-off and plate on-off functions of a higher power amplifier, if one is used. The higher power amplifier could then control the filament on-off and plate on-off functions.

The power amplifier consists of a single, ceramic type, forced air-cooled, grounded screen tube working into a resonant, quarter wavelength, coaxial line. The control grid circuit consists of a coaxial line resonator with a swamping resistor in parallel to provide a low impedance broadband load to the control grid. Metering circuits are included to measure filament voltage, control grid bias voltage, screen grid voltage, control grid current, and screen current.

The output power of the F830-1 may be reduced by lowering the plate, screen, and control grid voltages.

2.1.1 CONTROL CIRCUITS.

Refer to figure 2-2, a simplified schematic diagram of the control circuits of F830-1 10-Kw FM Power Amplifier. The control circuits apply or remove filament, plate, screen, and grid bias voltages, turn the cabinet fan and power amplifier blower on and off, and provide

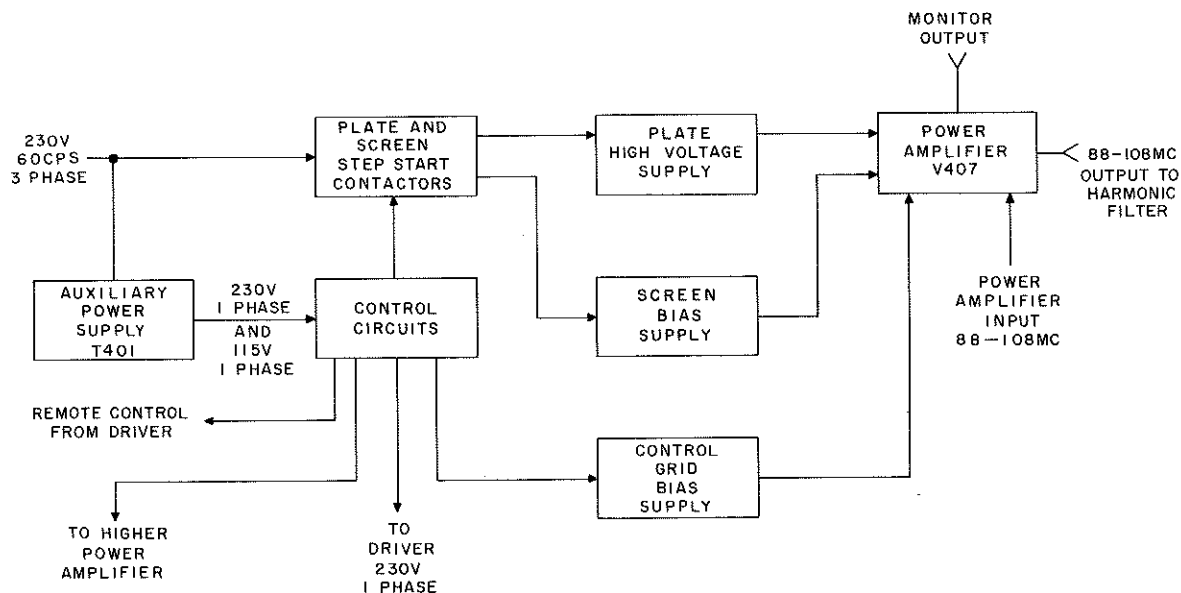


Figure 2-1. F830-1 10-Kw FM Power Amplifier, Block Diagram

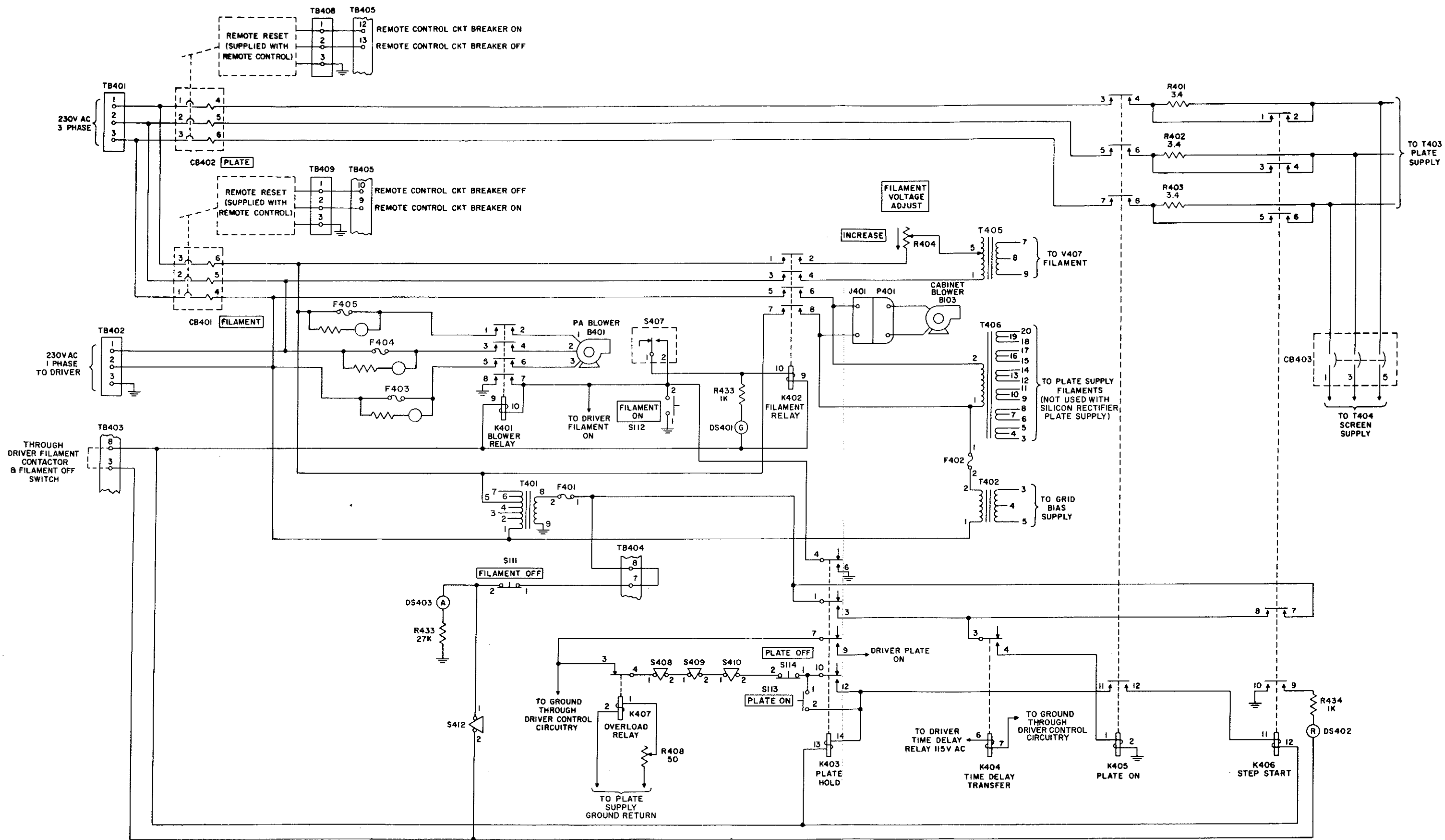
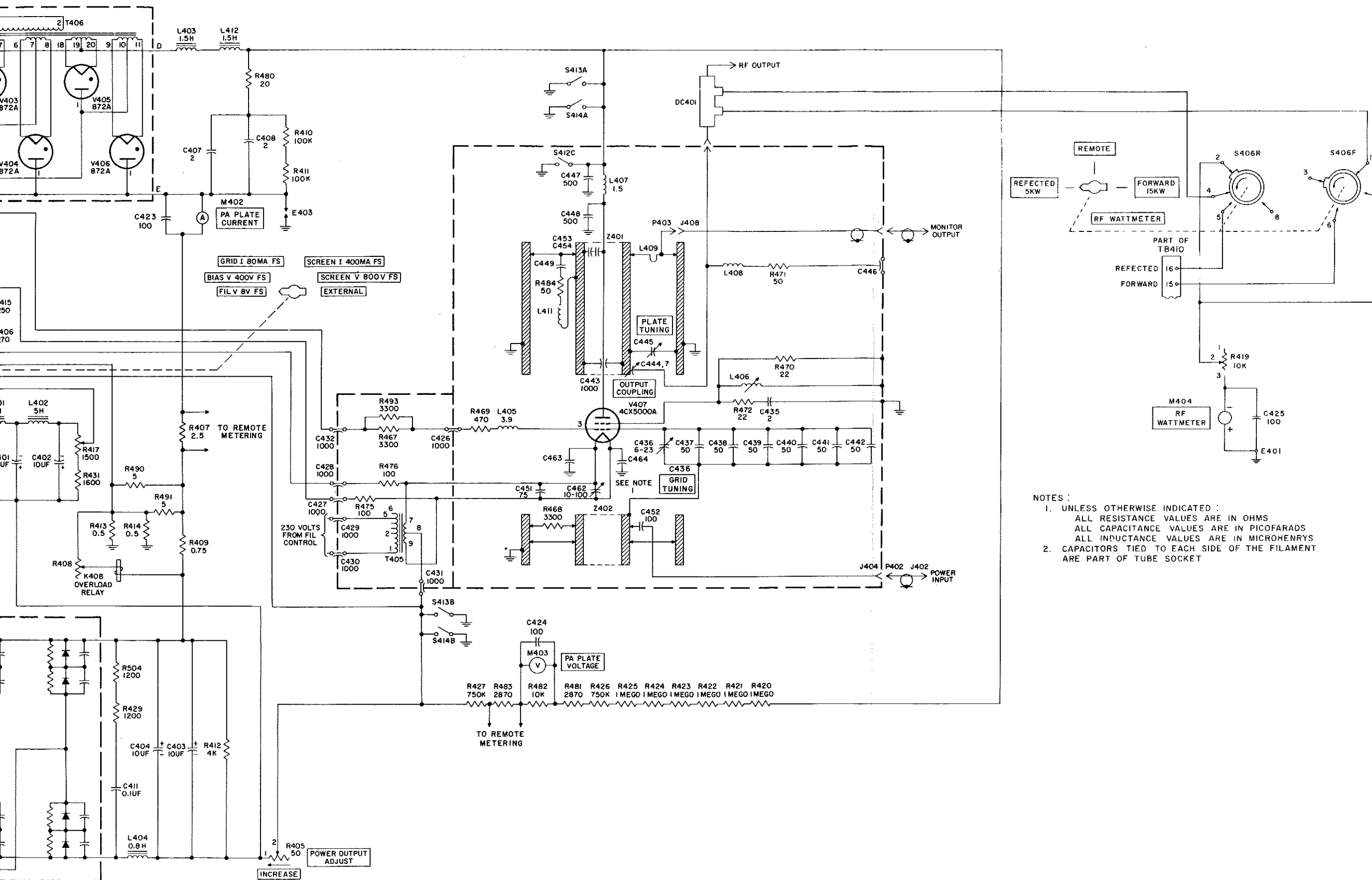


Figure 2-2. F830-1 Control Circuits, Simplified Schematic Diagram



- NOTES:
1. UNLESS OTHERWISE INDICATED:
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN PICOFARADS
ALL INDUCTANCE VALUES ARE IN MICROHENRYS
 2. CAPACITORS TIED TO EACH SIDE OF THE FILAMENT ARE PART OF TUBE SOCKET

Figure 2-3. F830-1 Power Amplifier Circuits. Simplified Schematic Diagram

overload protection for all power amplifier circuits. These functions are discussed in the following paragraphs.

The 230-volt 3-phase power enters the cabinet on TB401 and is fed to two circuit breakers, CB401 and CB402. The PLATE circuit breaker, CB402, protects only the plate and screen supplies, while the filament circuit breaker, CB401, protects the remaining power amplifier circuitry. The 3-phase output from CB402 is fed to two contactors to provide a voltage stepping action when plate and screen power is applied. This stepping action reduces the transients generated in the plate and screen power supplies when the F830-1 is turned on or off. Circuit breaker CB403 is placed in the screen supply 3-phase input to protect the screen power supply and to provide an aid when trouble shooting the transmitter.

The 3-phase output from filament circuit breaker CB401 is split into single phase components and fed to the filament contactor, the blower relay, the auxiliary power supply T401, and the driver.

Power to operate the filament and blower relays is obtained from the 115-volt secondary of T401. A CONTROL indicator, DS403, is lighted when the 115-volt power is present at the secondary of T401. This power is fed through the FILAMENT OFF switch to the 250-watt driver control circuitry at TB403-3. The driver control circuitry can interrupt power at this point if filament-off functions are to be controlled from the driver. Filament and blower control power is routed through the driver and re-enters the F830-1 at TB403-8. The power then is fed directly to the filament and blower control relays.

If FILAMENT ON switch S112 is pressed on either the driver or the F830-1, a ground is placed on blower relay K401 causing the relay to close. This action starts the power amplifier blower, B401, and closes contact K401-7 and K401-8. Closing of these contacts holds a ground on K401 when the momentary FILAMENT ON switch is released. When PA blower B401 comes up to speed, air pressure activated switch S407 closes, causing filament relay K402 to energize. The green filament-on light, DS401, will come on; the cabinet blower will start; and filament power will be fed to the tubes. The control grid bias supply will also be energized from the primary of transformer T401.

Power for operation of the plate circuits is obtained from the same source as the filament power transformer, T401. To start the plate-on sequence, PLATE ON switch S113 is pressed actuating plate hold relay K403. This closes contacts 10 and 12 to hold K403 energized when the PLATE ON switch is released. The ground is obtained from the driver control circuitry to allow the driver to interrupt the ground for the plate-off function. Contacts 7 and 9 will also close, turning on the driver plate power if driver plate power has not been turned on previously. With K403 energized, contacts 1 and 3 will make, transferring the

control voltage to time delay transfer relay K404. K404 will actuate when the driver time delay relay has completed the cycle allowing the filaments to warm up to operating temperature. With K404 energized, 115 volts will be transferred to the plate-on contactor, K405, causing K405 to close and apply power to the plate and screen power supplies. A fraction of a second later (as soon as K405-11 and 12 close), the step-start contactor will actuate and apply 230 volts 3 phase to the plate and screen power supplies. The red plate-on indicator, DS402, will light, indicating that plate and screen power is applied to the power amplifier. This stepping action limits transients that may be introduced into the power supply by the initial application of power.

If the PLATE OFF switch, S114, is pressed, plate and screen voltage will be removed from the power amplifier only and will not normally affect the driver. Pressing the PLATE OFF switch, S114, opens the ground to plate-hold relay K403, releasing K403. Step-start contactor K406 will then release removing direct 3-phase power from the plate and screen power supplies and momentarily throwing dropping resistors R401, R402, and R403 into the plate-screen circuits. Moments after step-start contactor K406 opens, plate-on contactor K405 will open, removing all power from the plate and screen power supplies. This stepping action limits transients that would normally be introduced into the power supply by the sudden removal of power.

If FILAMENT OFF switch S111 is pressed, power will be removed momentarily from all circuits within the driver and power amplifier, causing the holding relays to drop out and shut off the power amplifier and driver.

2.1.2 POWER AMPLIFIER CIRCUITS.

Refer to figure 2-3, a simplified schematic of the power amplifier circuitry of F830-1 10-Kw FM Power Amplifier. The power amplifier consists of a single ceramic type, forced air-cooled tube working into a tuned coaxial line resonator over the standard frequency modulated broadcast band of 88 to 108 megacycles.

Power amplifier V407 is a fixed bias, class C, grounded screen tetrode. The input from the driver is fed through blocking capacitor C452 into a tuned coaxial line resonator (a foreshortened $\frac{\lambda}{4}$ transmission line)

and fed to the control grid. Resistor R468 in the grid circuit swamps out much of the driver power which is fed into the tuned coaxial line resonator and, in addition, presents a low impedance broadband load to the control grid. Initial tuning of the grid coaxial line resonator is accomplished by a slider which physically lengthens or shortens the grid coaxial line resonator. Fine grid tuning is accomplished by adjusting variable capacitor C436. Fixed capacitors C437, C438, C439, C440, C441, and C442 in parallel with C436 couple the input tuned circuit to the grid. As the power amplifier is a grounded screen amplifier, the filament must be below ground potential. The grid bias supply is floating and is connected in series with the screen grid

power supply giving negative control grid bias with respect to the filament. L405 blocks r-f from the grid bias supply.

The plate works into a tuned coaxial line resonator (foreshortened $\frac{\lambda}{4}$ transmission line) similar to the grid resonator. The plate resonator consists of a short piece of coaxial transmission line which resonates with the plate capacity of V407 and PLATE TUNING capacitor C445. Initial tuning is similar to the grid resonator, and is accomplished by a shorting slider on the transmission line which physically lengthens or shortens the transmission line. Parasitic suppressors located within the resonator (C449, R474, L410, R484, and L411) suppress resonances around 200 and 400 megacycles. The parasitic suppressor capacity is formed by the distributed capacity of resistors R747 and R484 and the resonator walls.

R-f output coupling is achieved by a movable plate within the resonator forming a capacitor between the center conductor of the coaxial transmission line and the movable metal plate. This capacitor is C444. R-f output from C444 is then fed to a directional coupler if a higher power amplifier is driven, or to a harmonic filter and through the directional coupler if an antenna is fed directly. Suppressor L408, R471, and C446 effectively damp the higher order resonances of the plate tank circuit.

As stated previously, power amplifier V407 operates as a grounded screen amplifier. Actually, the screen is slightly above r-f ground to provide screen neutralization of the tube. Neutralization is accomplished by balancing the capacitance bridge formed by the plate-to-control grid capacitance, the plate-to-screen grid capacitance, and the screen-to-control grid capacitance. This is accomplished by adding a small variable inductance, L406, to form an r-f voltage from the screen-to-control grid 180 degrees out of phase with the plate-to-control grid r-f. This additional impedance balances the bridge to neutralize the tube for a fixed operating frequency.

Plate voltage is obtained from a conventional 3-phase power supply, which, when connected in series with the screen power supply, forms the plate voltage. The power supply transformer is connected in a delta primary and a wye secondary configuration. Six mercury-vapor rectifier tubes, V401 through V406, are arranged in a 3-phase full-wave bridge rectifier circuit. Silicon diode rectifiers are optional. A P.A. PLATE CURRENT meter, M402, is placed in the ground side of the plate supply to indicate only plate current. As the screen supply is in series with the plate supply, the P.A. PLATE VOLTAGE meter, M403, is placed across both the screen and plate supplies to indicate the cathode-to-plate voltage. The plate supply output is approximately 5700 volts d-c at 2.5 amperes. When the plate supply voltage is added to the screen supply voltage, the total, 6450 volts, equals the total plate voltage.

Screen voltage is obtained from a conventional 3-phase semiconductor power supply. A transient suppressor,

R506, R507, and C411, reduces transients formed when the power supply is turned on or off. The screen supply output is approximately 750 volts at 2.6 amperes.

The control grid bias supply is a single-phase, semi-conductor power supply. A resistor and capacitor placed in parallel with each diode equalize currents and minimize transients in each diode. A transient suppressor, C412 and R430, reduces transients when power is turned on or off. The positive end of the grid bias supply is connected to the fixed side of POWER OUTPUT ADJUST potentiometer R405. This permits R405 to control both the bias voltage and screen voltage when R405 is adjusted. The negative end of the bias supply is tied into the control grid through a meter shunt resistor and a filtering network. The control grid bias supply output is approximately -300 volts at 300 ma. Bias voltage is made adjustable by R417.

The filament of power amplifier V407 is below d-c ground because of the grounded screen configuration. The filament-to-ground potential will then be the screen voltage. Capacitors placed across the filament, and from each side of the filament to ground, provide r-f grounding.

Metering circuits are provided to measure the filament voltage, control grid bias voltage, control grid current, screen current, and screen grid voltage. In addition, an external metering position is available for connection to the multimeter. The customer may employ this extra meter position for any use that he may desire. The external meter movement input is 0-1 ma at 100 ohms.

The filament voltage metering circuit employs a full-wave bridge rectifier to change the a-c filament voltage to d-c. The bridge output is filtered by R418 and C410, and the complete circuit is calibrated by R415. The grid bias metering circuit is a voltage measuring device which measures the control grid bias voltage directly through the use of meter multiplier resistor R416. Grid current is metered by shunt resistors R428 and R492. Screen current is measured by placing the MULTIMETER across shunt resistors R413 and R414. As the screen is grounded, only screen current will flow through these resistors. Screen voltage is measured directly by the use of meter multiplying resistor R495. External meter readings may be made by connecting to the proper terminals on TB405 (not shown on simplified schematic diagram, figure 2-3). (See figure 5-1.) The MULTIMETER is shunted with capacitor C450 to prevent any stray r-f from damaging the meter movement.

2.2 Control Functions.

The following paragraphs describe the functions of all controls in F830-1 10-Kw FM Power Amplifier. Refer to figure 2-4 for control locations.

The controls located on the front panel directly under the meters include the FILAMENT ON, FILAMENT OFF, PLATE OFF, and PLATE ON controls. The green filament on indicator and red plate on indicator are placed in line with the above-mentioned controls.

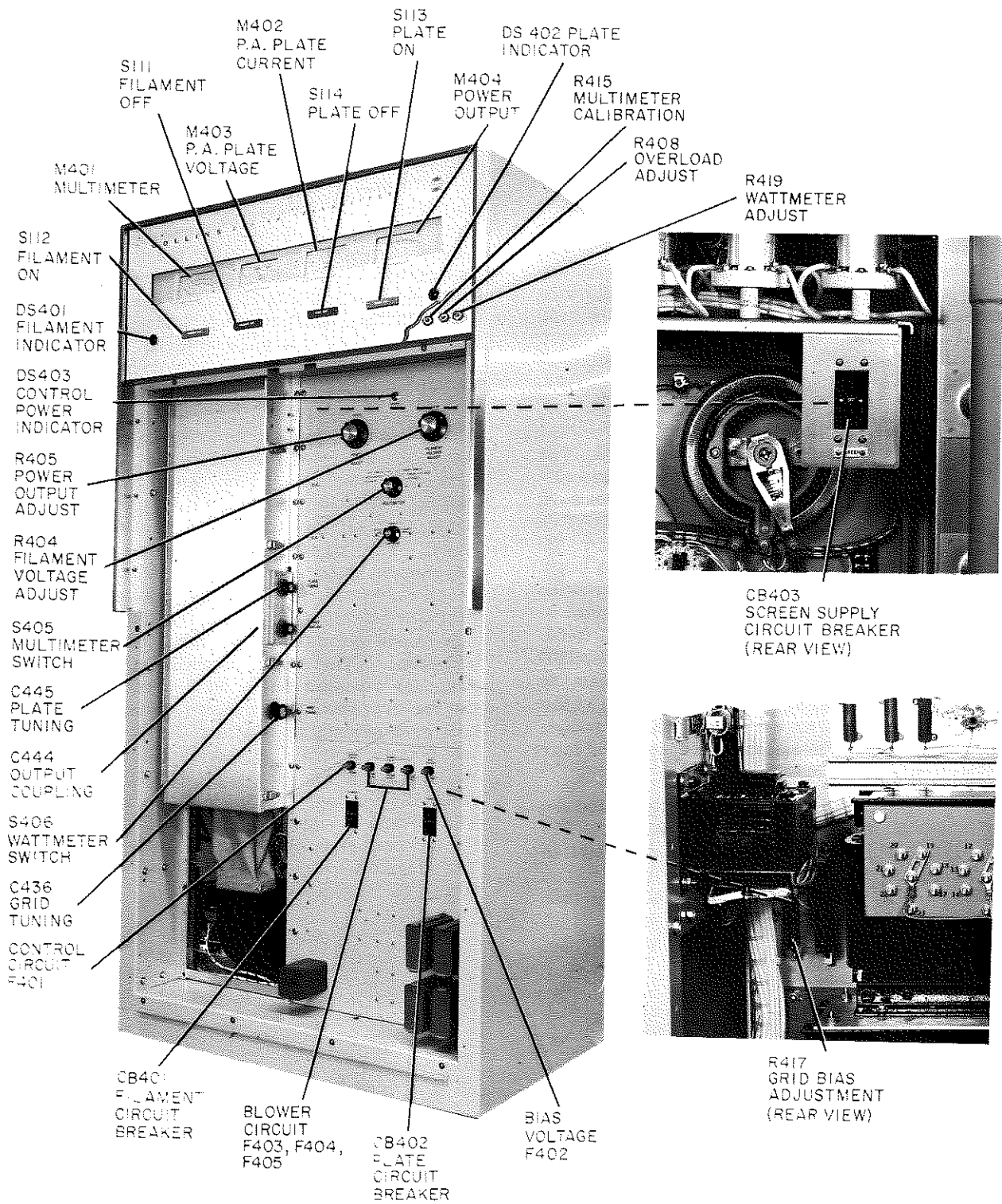


Figure 2-4. F830-1 Control and Adjustment Locations

The FILAMENT ON switch, S112, energizes the filaments, the blowers, and the bias supply and will turn on the driver filament and the exciter if connected correctly. The FILAMENT OFF switch, S111, de-energizes all transmitter circuits. The PLATE ON switch, S113, energizes the plate and screen power supplies and the driver plate supply. The PLATE OFF switch, S114, removes plate and screen voltage. The green filament indicator light, DS401, lights when the FILAMENT ON switch is pressed and the PA blower has activated the PA blower interlock. DS401 indicates that voltage is available to the filament control contactor. The filament control contactor starts the cabinet blower and the bias supply and supplies the necessary voltage to the F830-1 filaments. The red plate-on indicator light, DS402, indicates plate voltage has been applied to the power amplifier. The following controls are located directly under the right front door on the power amplifier panel. The POWER OUTPUT ADJUST potentiometer, R405, adjusts the power amplifier screen potential thus changing the output power. The FILAMENT VOLTAGE ADJUST potentiometer, R404, adjusts the filament transformer input voltage thus changing the filament voltage of V407. The WATTMETER switch, S406, connects the R.F. WATTMETER to either the reflected power or forward power section of the directional coupler. The WATTMETER switch is normally left in the FORWARD position. In addition, the WATTMETER switch has a third position for connecting both forward and reflected output power voltages from the directional coupler to remote lines. The MULTIMETER switch, S405, selects either filament voltage, bias voltage, control grid current, screen current, or screen voltage. In addition, an external position is available for use by the customer. Table 3-1 lists the MULTIMETER switch positions and typical indications for each of the four meter positions.

The following controls are located directly behind the left front door on the power amplifier resonator. The PLATE TUNING control, C445, tunes the plate to resonance and is set near the minimum indication on the P.A. PLATE CURRENT meter, M402. At this

point, the power output should be at the peak as indicated on R.F. WATTMETER M404. The OUTPUT COUPLING control, C444, adjusts the coupling of the load to the plate coaxial line resonator center conductor. The GRID TUNING control, C436, tunes the grid resonator.

The following controls are located on the power panel directly behind the bottom front panel of the power amplifier cabinet. The PLATE circuit breaker, CB402, is a protective device which monitors the plate and screen supply transformer primary currents. The circuit breaker will open when the current exceeds 50 amperes. The CONTROL circuit breaker, CB401, monitors the total control circuit current. This current includes the power fed to the driver and exciter. The circuit breaker will open when the control circuit current exceeds 8 amperes. The 5-ampere CONTROL CIRCUIT fuse, F401, protects the control circuits from overloads. The 1/4-ampere BIAS VOLTAGE fuse, F402, protects the bias supply from overloads. Blower fuses, F403, F404, and F405 protect PA blower B401.

The following adjustments are located directly below the P.A. PLATE CURRENT and R.F. WATTMETER indicators when the upper switch and meter panel is raised. The left potentiometer, located behind the panel, is filament voltmeter calibrating potentiometer R415. The filament metering circuit calibrating adjustment is set at the factory and normally will not require adjustment. The center potentiometer is the overload adjusting potentiometer, R408. The overload adjustment normally is set for a plate current of 2.6 amperes. The right potentiometer is wattmeter adjusting resistor R419. This potentiometer, set at the factory, should not require adjustment. The control grid adjustable resistor, R417, is located in the left bottom rear of the power amplifier cabinet. The resistor is set for approximately 500 ma maximum of plate current with no drive to the power amplifier. The screen circuit breaker CB403, is located behind the left rear door, and is attached to the rectifier panel. The circuit breaker protects the screen power supply from overloads above 10 amperes.

3.1 General.

This section contains information concerning the maintenance of F830-1 10-Kw FM Power Amplifier.

WARNING

Voltages present in this equipment are dangerous to life. Observe safety precautions when performing any maintenance. Do not reach inside the F830-1 cabinet when high voltage is applied. Do not depend entirely on door interlocks. Always shut down the F830-1 before doing any work inside the F830-1 cabinet. Immediately upon opening the rear doors, short out all high-voltage points using the shorting stick located inside the left rear door.

3.2 Preventive Maintenance.

Most service interruptions in equipment of this type are caused by dirt and corrosion. Corrosion is accelerated by the presence of moisture and dust. Dust should be removed periodically with a soft brush or a dry, oil-free air jet. Remove dust as often as a perceptible quantity accumulates at any point in the power amplifier.

When the F830-1 is operated near salt water or in other corrosive atmospheres, inspect and clean interlock switches, cable connectors, tube prongs, and other metal parts more frequently to keep the equipment in top operating condition.

3.2.1 AIR FILTER CLEANING.

At least once each month, or more often if needed, clean the air filter according to the following procedure:

- a. Remove the air filter from the F830-1 cabinet by loosening the two thumb screws located above the air filter. Slide the air filter to the extreme right, and pull the left side of the air filter out as soon as the filter clears the panel. Slide the air filter to the left and remove.
- b. Mark with an arrow the direction of the airflow.
- c. Wash by passing a fine spray of hot water through the filter in the direction opposite that of the airflow. Gently shake the water out of the filter.

- d. Dip the filter in water-soluble oil, such as Filterkote M (Collins part number 005-0609-00), available from Collins Radio Company Service Parts Department, Cedar Rapids, Iowa.

- e. Remove the filter from the oil; lay the filter face down until oil ceases to drip from the filter.

- f. Replace the filter into the lower rear panel with the airflow arrows (marked when the filter was removed) pointing in the direction of the airflow. Tighten the two thumb screws.

- g. Replacement filters are Collins part number 009-1069-00.

3.2.2 PA TUBE CLEANING.

The power amplifier tube depends upon a stream of air passing through the fins to cool the anode. When these fins become dirty, the airflow is reduced, and the tube life is shortened. The radiator fins should be cleaned as follows:

- a. Remove the r-f amplifier tube as described in paragraph 3.2.2.1.

CAUTION

Special care must be used in removing or installing the power amplifier tube.

- b. Direct a low-pressure (50 psi) air stream through the fins in the direction opposite to the normal airflow until all dust is removed.

- c. Replace the r-f amplifier tube as described in paragraph 3.2.2.1.d.

3.2.2.1 PA TUBE REMOVAL.

WARNING

Voltages present within the plate compartment are dangerous to life. Shut down the F830-1 before doing any work inside the compartment.

The power tube may be removed as follows:

- a. Open the power amplifier resonator door.
- b. Loosen the slider clamp, and raise the center conductor straight up until it clears the tube completely. Make sure the slider stays in its original position while raising the center conductor.

c. While holding up the center conductor, grasp the tube handle and remove the tube from its socket. It may be necessary to push the tube partially into the center conductor so the tube will clear the tube socket shield before complete tube removal.

d. Tube replacement is the reverse of removal. After tube replacement, check the plate slider for proper distance from the deck plate for the station frequency. See System Instructions, Frequency Change, for this approximate distance. Be sure the tube is seated firmly in the tube socket before replacing the center transmission line.

3.2.3 INSPECTION.

Once a week, check and clean the three interlock switches at the rear of the F830-1 cabinet to be sure they are in good working order. Once each month, check all connections in the F830-1. Tighten any nuts, bolts, or screws that may be loose. Check cable connections to see that they are clean and mechanically secure. Check moving parts, such as tuning controls, for excessive wear. Check the plate and grid sliders for oxidation around ground springs.

Silicon rectifier diodes should be checked for shorts approximately every six months. To check for diode shorts, place a reverse voltage from an ohmmeter across each diode. If any diode reads shorted, replace the diode. Normally, a high resistance will be noticed across each diode caused by the diode parallel resistor or by diode leakage.

3.2.4 LUBRICATION.

The PA blower has bearings that are lubricated for the life of the equipment. Lubricate each of the cabinet

fan bearings every 6 months with 3 drops of SAE #20 nondetergent oil. The rear cabinet fan bearing oil hole may be reached through the air filter opening, with the air filter removed.

3.2.5 TUBE MAINTENANCE.

Power amplifier V401 should be inspected (tube in place) once each week to ensure that an accumulation of dust does not build up on the radiator fins. If dust is present, clean as described in paragraph 3.2.2. When tuning the F830-1, care should be taken not to exceed the maximum plate current shown in table 3-1.

If mercury-vapor tubes are used in the plate power supply, spare, preaged mercury-vapor rectifier tubes should be available for immediate replacement. To ready these tubes for emergency use, place them in the power amplifier during off-the-air hours, and run them for twenty minutes with only the filaments lighted. This will remove the mercury coating from the tube elements. Then carefully remove the tubes from the F830-1, and store them in an upright position where they will not be inverted or agitated. When these preaged tubes are placed in the F830-1, handle them carefully to avoid the twenty-minute warmup period that will be required if mercury comes in contact with the tube elements. Never apply plate voltage to mercury-vapor rectifier tubes that have not been aged long enough to remove all mercury from the tube elements.

3.3 Trouble Shooting.

The most common cause of trouble will probably be traced to tube failure. If a tube is suspected of failure,

TABLE 3-1. TYPICAL METER INDICATIONS

METER	METER SWITCH POSITION	INDICATION
MULTIMETER	FIL V 8V FS	7.5 volts
MULTIMETER	BIAS V 400V FS	180-220 volts
MULTIMETER	GRID 80MA FS	45-60 ma
MULTIMETER	SCREEN 400MA FS	150-225 ma
MULTIMETER	SCREEN 800V FS	750 volts
PA PLATE VOLTAGE		6400-6500 volts
PA PLATE CURRENT		Approx. 2.25 A
R.F. WATTMETER	FORWARD 15KW	10 kw
R.F. WATTMETER	REFLECTED 5KW	Less than 500 watts

replace it with a tube of known quality, and note any change in performance. A small loss in emission of V407 can be compensated by a change in the setting of the POWER OUTPUT ADJUST potentiometer.

Four meters are located on the F830-1 front panel to assist in locating any trouble which may occur. Table 3-1 contains typical meter indications. These average indications are obtained from several production power amplifiers. The indications of certain F830-1 may vary slightly outside the given limits without affecting power amplifier performance. A list of panel meter indications for each individual power amplifier should be taken when the F830-1 is operating properly in its particular installation. Any abnormal deviation from

these values will be apparent during a check of meter indications.

3.4 Cable Chart.

Table 3-2 contains from-to information for cables installed in F830-1 10-Kw FM Power Amplifier. The table is useful in locating point-to-point wiring within the F830-1 cabinet. The from column is listed in alphabetical and numerical order. To find a particular wire, establish the point on the F830-1 from which wire tracing is to be initiated. Find this point in the from column of table 3-2, and the to column will give the location of the other end of that particular wire. The wire information given in table 3-2 pertains only to those wires located in the main cable of the F830-1.

TABLE 3-2. CABINET FROM-TO INFORMATION

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
B401-1	K401-2	RD90	CB401-4	T402-2	RC5
B401-2	K401-4	RD92	CB401-4	TB402-2	RE5
B401-3	K401-6	RD95	CB401-4	XF403-1 (top)	RD95
C401-1	L401-2	VC905	CB401-5	K402-3	RD92
C401-2	T402-4	RB91	CB401-5	TB402-1	RE2
C401-2	TB406-12	VC902	CB401-5	XF404-1 (top)	RD92
C402-1	L402-2	VC906	CB401-6	K402-1	RD93
C402-1	R417-1	VC92	CB401-6	T401-5	RD93
C402-2	R431-2	VC91	CB401-6	XF405-1 (top)	RD93
C403-1	R405-1	VE92	CB402-1	CB401-3	H9
C403-1	R412-1	VE92	CB402-1	TB401-1	H9
C403-1	S412-B	VE92	CB402-2	CB401-2	H9
C403-2	R412-2	RE92	CB402-2	TB401-2	H9
C404-1	L404-2	VE92	CB402-3	CB401-1	H9
C404-1	R431-2	VC95	CB402-3	TB401-3	H9
C408-2	E407	VE93	CB402-4	K405-3	H9
C408-2	R411-2	VE92	CB402-5	K405-5	H9
C427	R415-3	RC93	CB402-6	K405-7	H9
C428	TB407-2	VB93	CB403-1	K406-6	RE5
C429	R404-2	RC90	CB403-2	K406-4	RE2
C430	K402-4	RC92	CB403-3	K406-2	RE90
C431	R405-2	JE2	CB403-4	T404-15	RE5
C432	S405-13	VB91	CB403-5	T404-8	RE2
CB401-1	CB402-3	H9	CB403-6	T404-1	RE90
CB401-2	CB402-2	H9	DC401 (red)	S406-11	DAS2
CB401-3	CB402-1	H9	DC401 (yellow)	S406-4	DAS9
CB401-4	T401-1	RD95	E401 (grd)	K401-8	RC9

TABLE 3-2. CABINET FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
E401 (grd)	E402 (grd)	RE9	K402-5	T401-1	RC923
E401 (grd)	K403-6	RC9	K402-6	J401-1	RC95
E401 (grd)	K405-2	RC9	K402-6	T406-2	RC95
E401 (grd)	K406-10	RC9	K402-7	T401-5	RD90
E401 (grd)	M404-1 (+)	RC9	K402-8	J401-2	RC90
E401 (grd)	S112-1	RC9	K402-8	T406-1	RC90
E401 (grd)	S405-15	VB9	K402-8	XF402-1	RC90
E401 (grd)	R413-2	VE9	K402-9	K401-9	RC935
E401 (grd)	T401-9	RC9	K402-9	K403-13	RC91
E402 (grd)	E401 (grd)	RE9	K402-9	TB404-5	RC935
E402 (grd)	TB402-4	RE9	K402-9	XDS401-1	RC936
E402 (grd)	TB403-10	RE9	K402-10	S407-1	RC936
E407	C408-2	VE93	K402-10	TB407-12	RC902
E407	M402-2(-)	VE92	K403-1	K406-7	RC6
E410	TB407-3	VC92	K403-1	XF401-1	RD96
E411	S405-12	VB93	K403-3	K406-8	RC6
E411	TB407-1	VB93	K403-4	K401-7	RC93
E418	R405-2	VB92	K403-4	S407-2	RC93
E422 (grd)	TB407-20	RC9	K403-6	E401 (grd)	RC9
J401-1	K402-6	RC95	K403-7	K404-7	RC923
J401-2	K402-8	RC90	K403-7	K407-3	RC923
K401-1	XF405-2 (side)	RD93	K403-9	TB403-2	RC923
K401-2	B401-1	RD90	K403-10	TB404-3	RC925
K401-3	XF404-2 (side)	RD92	K403-12	K403-14	RC926
K401-4	B401-2	RD92	K403-12	K405-11	RC926
K401-5	XF403-2 (side)	RD95	K403-13	K402-9	RC91
K401-6	B401-3	RD95	K403-13	K406-12	RC91
K401-7	K401-10	RC93	K403-14	K403-12	RC926
K401-7	K403-4	RC93	K403-14	S113-2	RC905
K401-8	E401 (grd)	RC9	K403-14	TB404-4	RC926
K401-9	K402-9	RC935	K404-1	K404-6	RC4
K401-9	TB403-8	RC935	K404-2	TB404-10	RC7
K401-10	K401-7	RC93	K404-3	K406-8	RC6
K401-10	S112-2	RC93	K404-4	K405-1	RC6
K401-10	TB403-6	RC93	K404-6	K404-1	RC4
K402-1	CB401-6	RD93	K404-6	TB403-5	RC4
K402-2	R404-1	RC902	K404-7	K403-7	RC923
K402-3	CB401-5	RD92	K405-1	K404-4	RC6
K402-4	C430	RC92	K405-2	E401 (grd)	RC9

TABLE 3-2. CABINET FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
K405-3	CB402-4	H9	L402-1	L401-2	VC6
K405-4	K406-1	H9	L402-2	C402-1	VC906
K405-5	CB402-5	H9	L404-1	Z404-5	VE93
K405-6	K406-3	H9	L404-2	C404-1	VE92
K405-7	CB402-6	H9	M401-1 (+)	S405-11	VB92
K405-8	K406-5	H9	M401-2 (-)	S405-2	VB90
K405-11	K403-12	RC926	M402-1 (+)	R407-1	RE92
K405-12	K406-11	RC91	M402-2 (-)	E407	VE92
K406-1	K405-4	H9	M403-1 (+)	TB407-7	VC906
K406-1	R401-1	H9	M403-2 (-)	TB407-15	VC905
K406-2	CB403-3	RE90	M404-1 (+)	E401 (grd)	RC9
K406-2	R401-2	H9	M404-2 (-)	R419-3	RC91
K406-2	T403-1	H9	R401-1	K406-1	H9
K406-3	K405-6	H9	R401-2	K406-2	H9
K406-3	R402-1	H9	R402-1	K406-3	H9
K406-4	CB403-2	RE2	R402-2	K406-4	H9
K406-4	R402-2	H9	R403-1	K406-5	H9
K406-4	T403-8	H9	R403-2	K406-6	H9
K406-5	K405-8	H9	R404-1	K402-2	RC902
K406-5	R403-1	H9	R404-2	C429	RC90
K406-6	CB403-1	RE5	R405-1	C403-1	VE92
K406-6	R403-2	H9	R405-2	C431	VE2
K406-6	T403-15	H9	R405-2	E418	VB92
K406-7	K403-1	RC6	R405-2	TB407-14	VC92
K406-8	K403-3	RC6	R407-1	M402-1 (+)	RE92
K406-8	K404-3	RC6	R407-1	TB415-G	VC92
K406-9	TB407-5	RC902	R407-2	TB415-L	VC91
K4-6-10	E401 (grd)	RC9	R408-1	R413-1	VB93
K406-11	K405-12	RC91	R408-2	K407-1	VB95
K406-12	K403-13	RC91	R409-1	K407-2	VB92
K406-12	XDS402-1	RC91	R409-1	Z404-4	RE92
K407-1	R408-2	VB95	R411-2	C408-2	VE92
K407-2	R409-1	VC92	R412-1	C403-1	VE92
K407-3	K403-7	RC923	R412-2	C403-2	RE92
K407-3	TB403-7	RC92	R413-1	R408-1	VB93
K407-4	S408-1	RC923	R413-1	S405-6	VB91
L401-1	TB406-5	VC903	R413-2	E401 (grd)	VE9
L401-2	C401-1	VC905	R414-2	TB415-K	VC9
L401-2	L402-1	VC6	R415-3	C427	RC93

TABLE 3-2. CABINET FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
R417-1	C402-1	VC92	S410-2	S114-4	RC923
R417-3	S405-5	VB90	S412-B	C403-1	VE92
R419-2	S406-2	DAS3	S412-1	S111-2	RC1
R419-3	M404-2 (-)	RC91	S412-2	TB403-3	RC91
R431-2	C402-2	VC91	S413-B	S414-B	VE903
R431-2	C404-1	VC95	S414-B	S413-B	VE903
S111-3	TB404-7	RC1	T401-1	CB401-4	RD95
S111-4	S412-1	RC1	T401-1	K402-5	RC923
S111-4	XDS403-1	RC1	T401-5	CB401-6	RD93
S112-1	E401 (grd)	RC9	T401-5	K402-7	RD90
S112-2	K401-10	RC93	T401-8	XF401-2	RC6
S113-1	S114-1	RC925	T401-9	E401 (grd)	RC9
S113-1	TB404-3	RC925	T402-1	XF402-2	RC90
S113-2	K403-14	RC905	T402-2	CB401-4	RC5
S114-3	S113-1	RC925	T402-3	TB406-1	RB90
S114-4	S410-2	RC923	T402-4	C401-2	RB91
S405-2	M401-2 (-)	VB90	T402-5	TB406-7	RB92
S405-5	R417-3	VB90	T403-1	K406-2	H9
S405-6	R413-1	VB91	T403-8	K406-4	H9
S405-7	S405-15	RC9	T403-15	K406-6	H9
S405-8	TB405-7	VB902	T404-1	CB403-6	RE90
S405-11	M401-1 (+)	VB92	T404-8	CB403-5	RE2
S405-12	E411	VB93	T404-15	CB403-4	RE5
S405-13	C432	VB91	T404-22	Z404-3	VD91
S405-15	E401 (grd)	VB9	T404-23	Z404-1	VD95
S405-15	S405-7	RC9	T404-24	Z404-2	VD96
S405-17	TB405-8	VB96	T406-1	K402-8	RC90
S406-2	R419-2	DAS3	T406-2	K402-6	RC95
S406-4	DC401 (yellow)	DAS9	TB401-1	CB402-1	H9
S406-5	TB410-16	RA95	TB401-2	CB402-2	H9
S406-6	TB410-15	RA90	TB401-3	CB402-3	H9
S406-11	DC401 (red)	DAS2	TB401-4	E402 (grd)	RE9
S407-1	K402-10	RC936	TB401-4	TB402-3	RE9
S407-2	K403-4	RC93	TB402-1	CB401-5	RE2
S408-1	K407-4	RC923	TB402-2	CB401-4	RE5
S408-2	S409-1	RC92	TB402-3	TB401-4	RE9
S409-1	S408-2	RC92	TB403-1	TB404-9	RB90
S409-2	S410-1	RC92	TB403-2	K403-9	RC923
S410-1	S409-2	RC92	TB403-3	S412-2	RC91

TABLE 3-2. CABINET FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
TB403-5	K404-6	RC4	TB407-4	XDS402-2	RC902
TB403-6	K401-10	RC93	TB407-5	K406-9	RC902
TB403-6	TB404-6	RC93	TB407-6	TB405-2	VC91
TB403-7	K407-3	RC92	TB407-7	M403-1 (+)	VC906
TB403-8	K401-9	RC935	TB407-12	K402-10	RC902
TB403-9	TB404-2	RC1	TB407-13	XDS401-2	RC902
TB403-10	E402 (grd)	RE9	TB407-14	R405-2	VC92
TB403-11	TB410-1	RA91	TB407-15	M403-2 (-)	VC905
TB404-2	TB403-9	RC1	TB407-15	TB405-1	VC92
TB404-3	K403-10	RC925	TB407-20	E422 (grd)	RC9
TB404-3	S113-1	RC925	TB408-1*	TB405-12	VB96
TB404-4	K403-14	RCR26	TB408-2*	TB405-13	VB93
TB404-5	K402-9	RC935	TB409-1*	TB405-10	VB92
TB404-6	TB403-6	RC93	TB409-2*	TB405-9	VB91
TB404-7	S111-3	RC1	TB410-1	TB403-11	RA91
TB404-8	TB405-11	VB95	TB410-1	TB411-1	RA91
TB404-8	XF401-1	RD96	TB410-2	TB411-2	RA91
TB404-9	TB403-1	RB90	TB410-3	TB411-3	RA93
TB404-10	K404-2	RC7	TB410-4	TB411-4	RA95
TB405-1	TB407-15	VC92	TB410-5	TB411-5	RA96
TB405-2	TB407-6	VC91	TB410-15	S406-6	RA90
TB405-3	TB415-B	VC93	TB410-16	S406-5	RA95
TB405-4	TB415-H	VC95	TB411-1	TB410-1	RA91
TB405-7	S405-8	VB902	TB411-2	TB410-2	RA91
TB405-8	S405-17	VB96	TB411-3	TB410-3	RA93
TB405-9	TB409-2*	VB91	TB411-4	TB410-4	RA95
TB405-10	TB409-1*	VB92	TB411-5	TB410-5	RA96
TB405-11	TB404-8	VB95	TB415-B	TB405-3	VC93
TB405-12	TB408-1*	VB96	TB415-G	R407-1	VC92
TB405-13	TB408-2*	VB93	TB415-H	TB405-4	VC95
TB406-1	T402-3	RB90	TB415-K	R414-2	VC9
TB406-5	L401-1	VC903	TB415-L	R407-2	VC91
TB406-7	T402-5	RB92	XDS401-1	K402-9	RC936
TB406-12	C401-2	VC902	XDS401-2	TB407-13	RC902
TB407-1	E411	VB93	XDS402-1	K406-12	RC91
TB407-2	C428	VB93	XDS402-2	TB407-4	RC902
TB407-3	E410	VC92	XDS403-1	S111-4	RC1

*For remote control only. Otherwise, tie in cable.

TABLE 3-2. CABINET FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
XF401-1	K403-1	RD96	XF404-2 (side)	K401-3	RD92
XF401-1	TB404-8	RD96	XF405-1 (top)	CB401-6	RD93
XF401-2	T401-8	RC6	XF405-2 (side)	K401-1	RD93
XF402-1	K402-8	RC90	Z404-1	T404-23	VD95
XF402-2	T402-1	RC90	Z404-2	T404-24	VD96
XF403-1 (top)	CB401-4	RD95	Z404-3	T404-22	VD91
XF403-2 (side)	K401-5	RD95	Z404-4	R409-1	RE92
XF404-1 (top)	CB401-5	RD92	Z404-5	L404-1	VE93

section **4**

parts list

This section contains a list of all replaceable electrical, electronic, and critical mechanical parts for F830-1 10-Kw Power Amplifier 522-2981-000. The manufacturers' codes appearing in the MFR CODE column of the parts list are listed in numerical order at the end

of the parts list. The code list provides manufacturers' names and addresses as shown in the Federal Supply Code for Manufacturers, Handbook H4-1. Manufacturers not listed in Handbook H4-1 are assigned a five-letter code and will appear first in the code list.

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F830-1 Parts List	35
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Rectifier Parts List	47/48

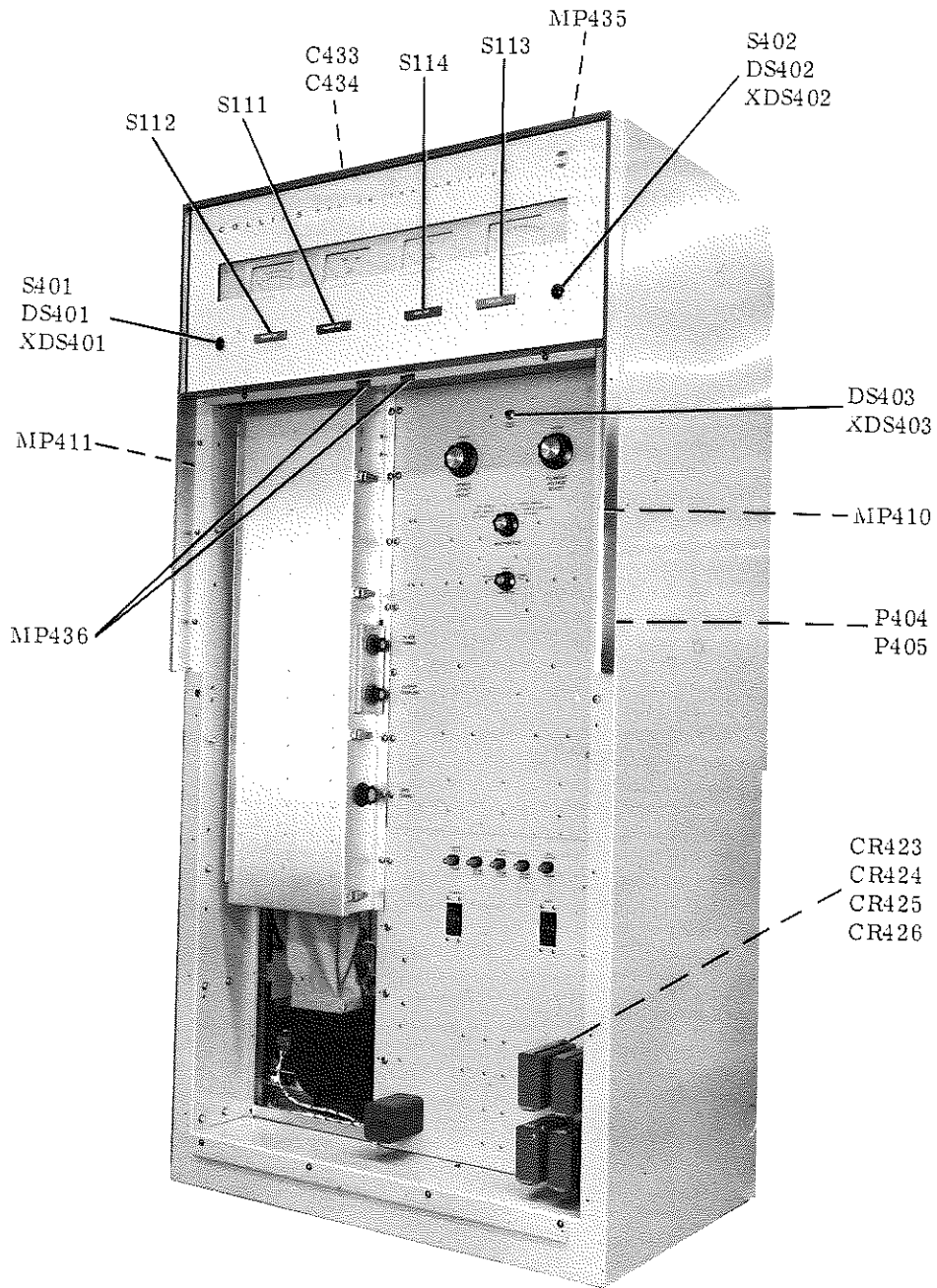


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 1 of 15)

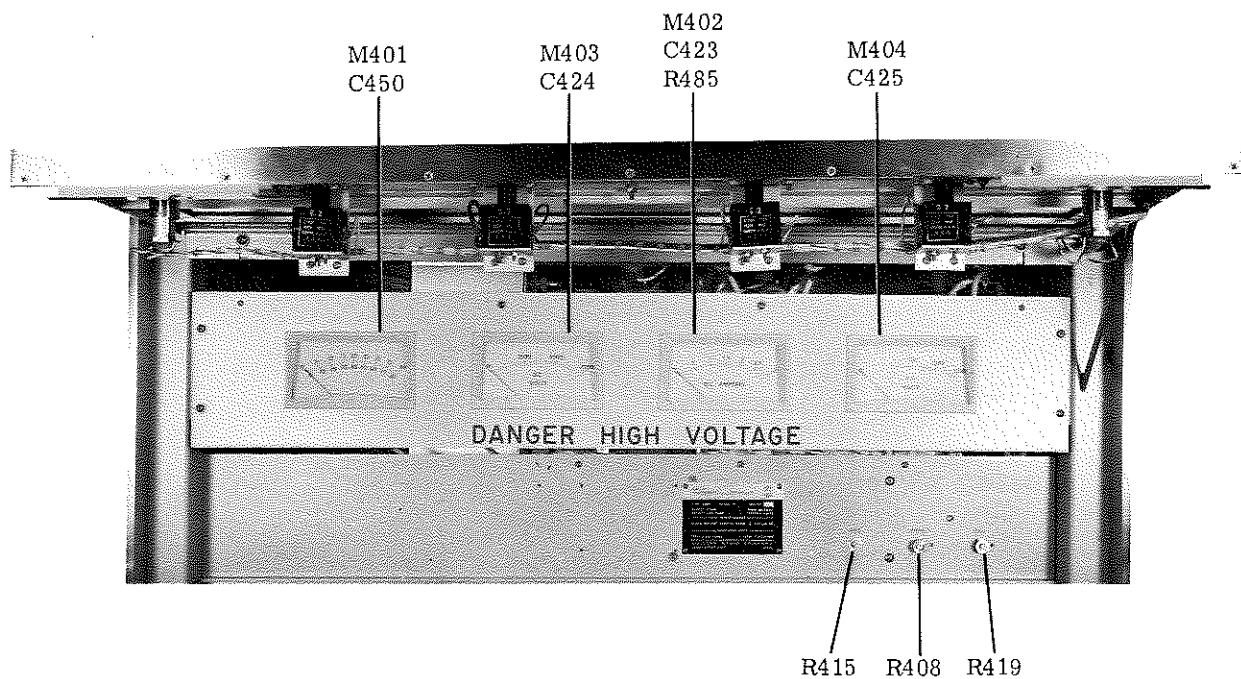


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 2 of 15)

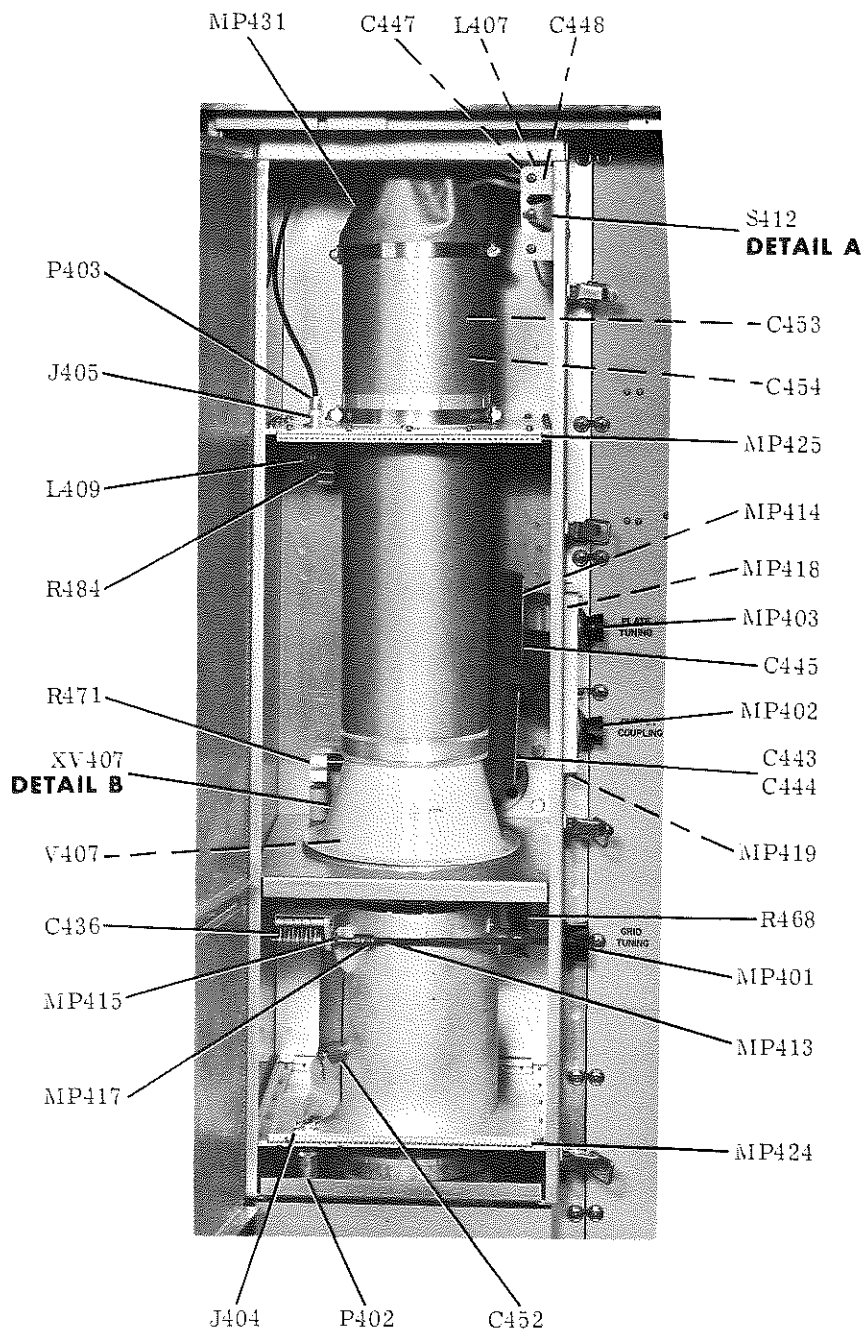
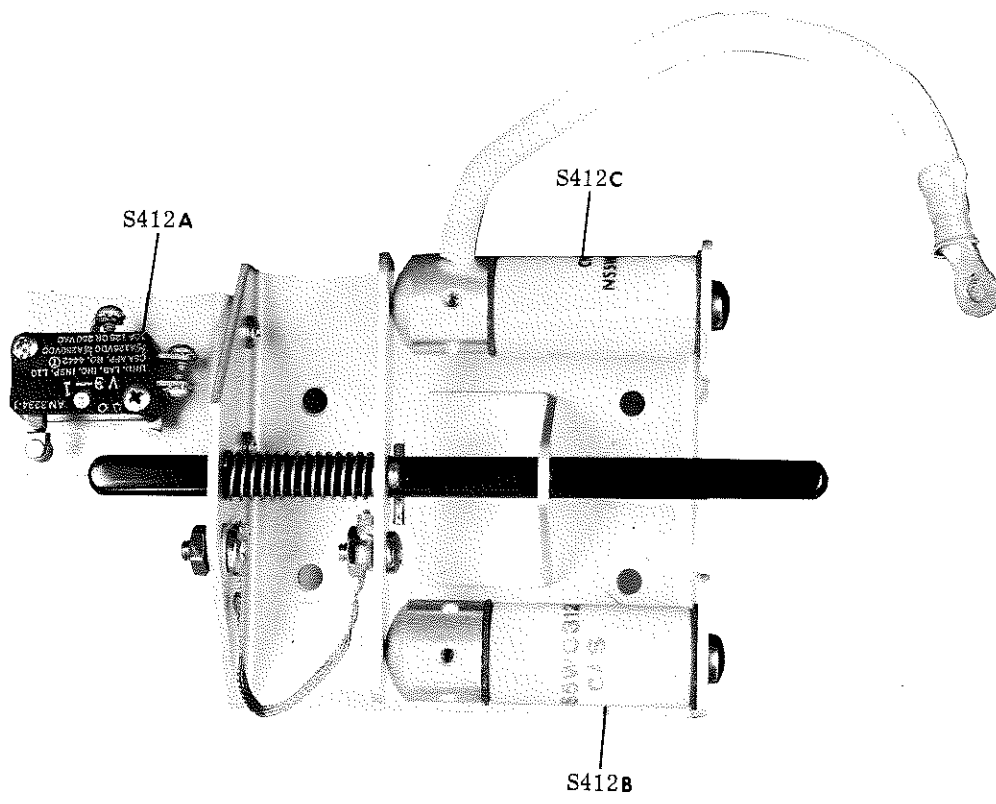


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 3 of 15)



DETAIL A

Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 4 of 15)

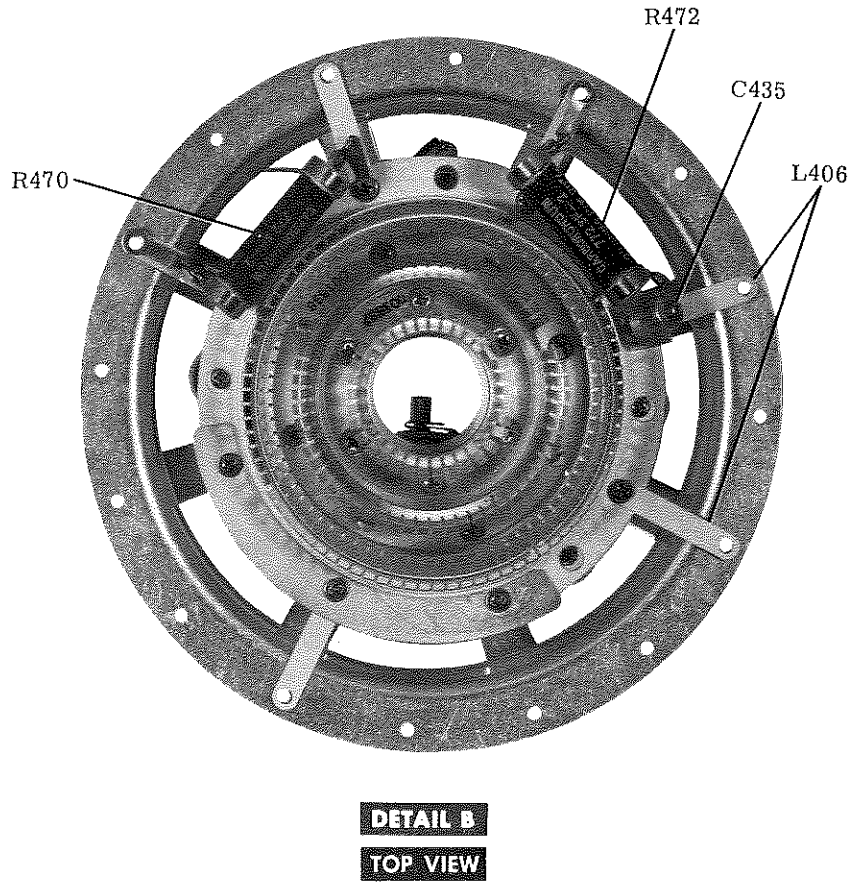


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 5 of 15)

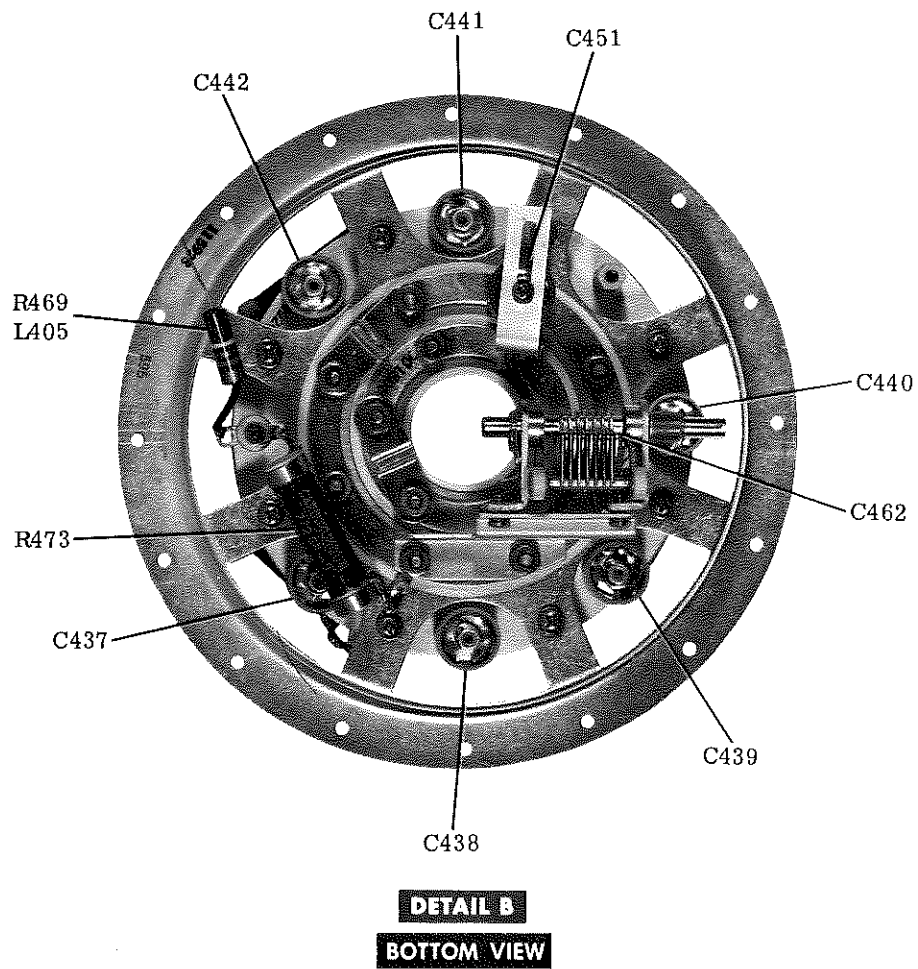


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 6 of 15)

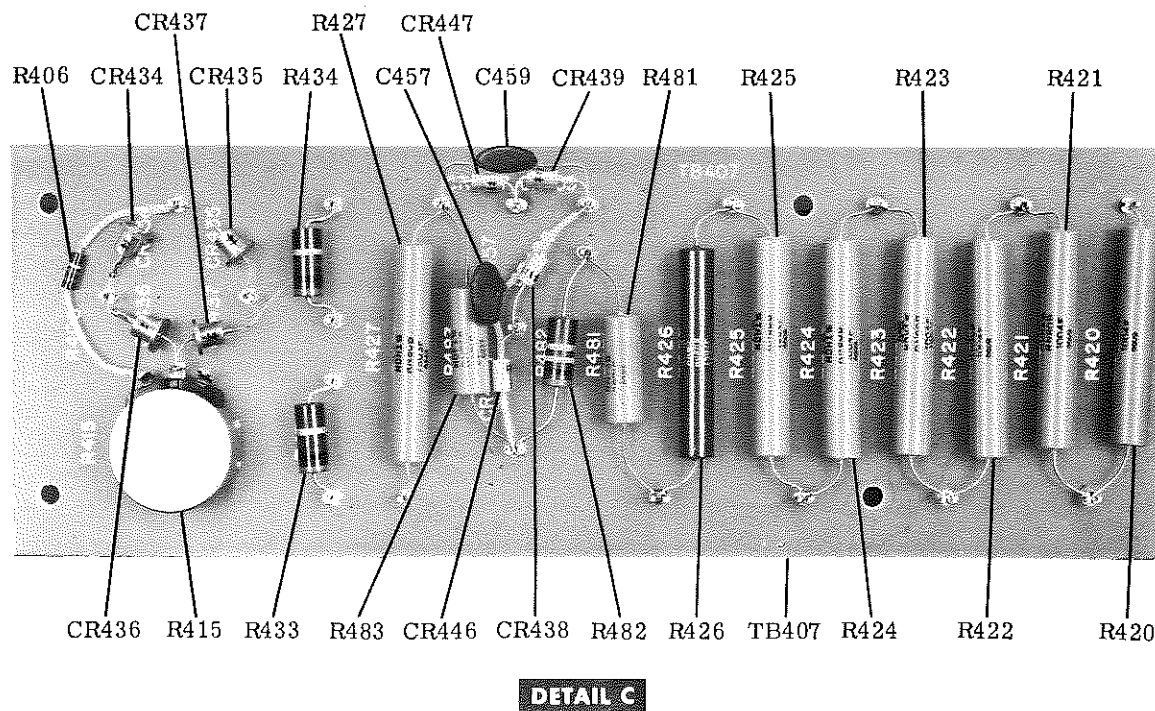
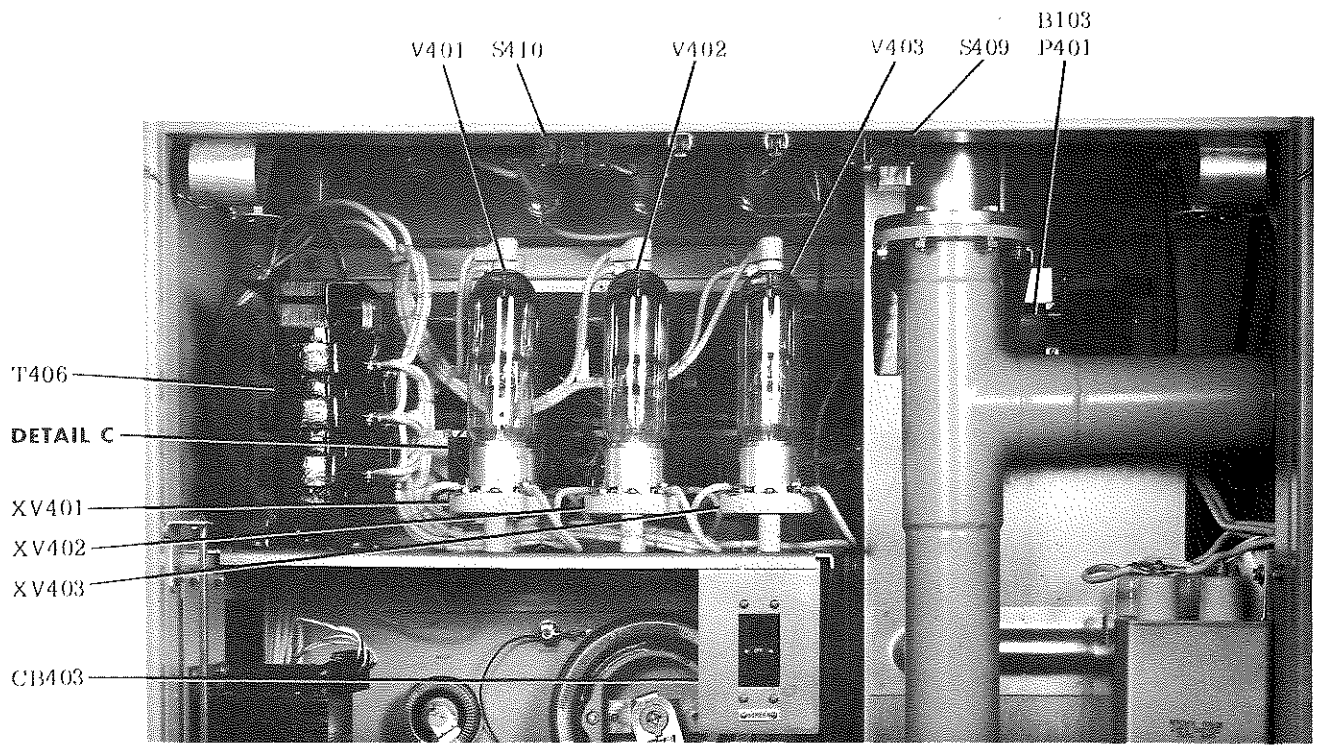


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 7 of 15)

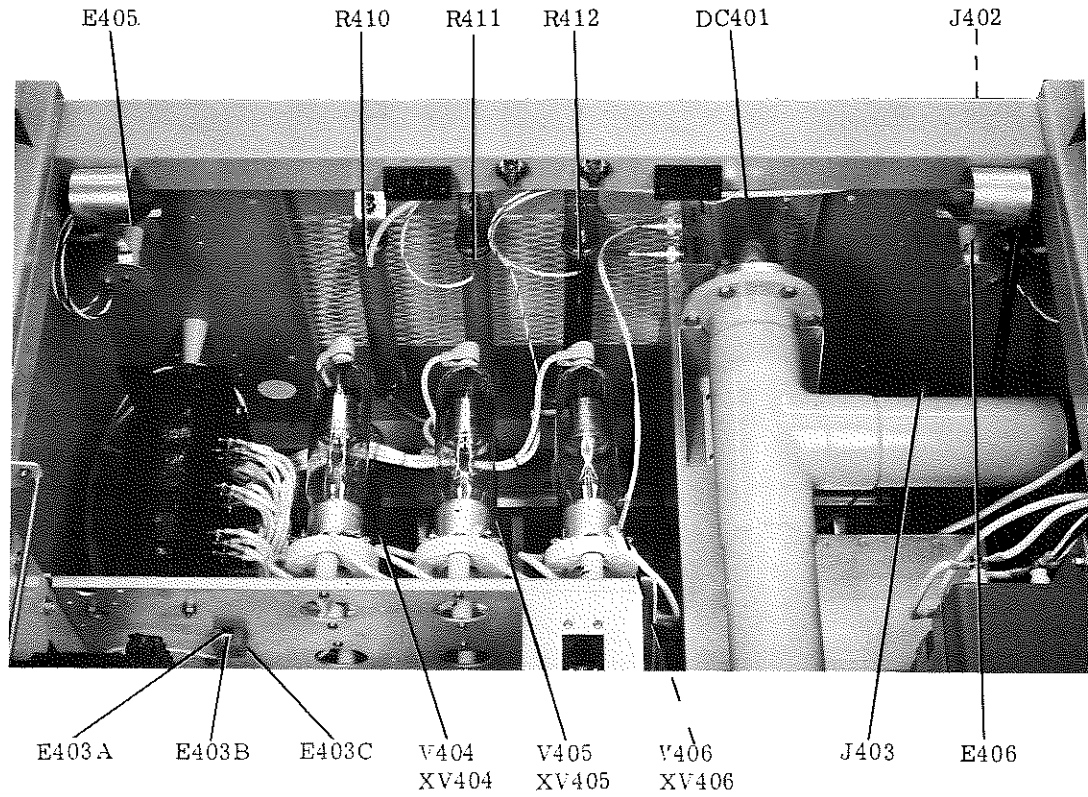


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 8 of 15)

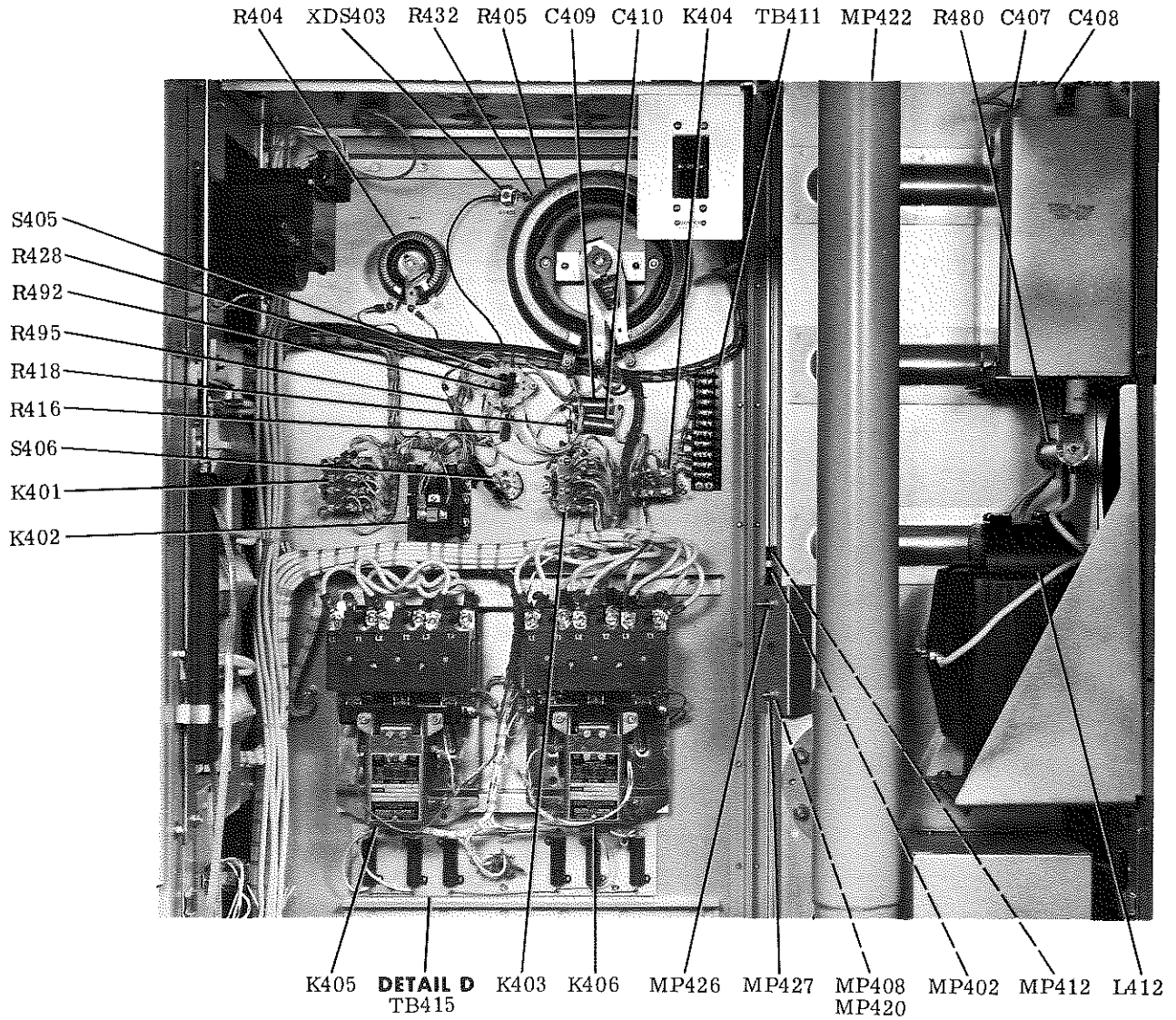


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 9 of 15)

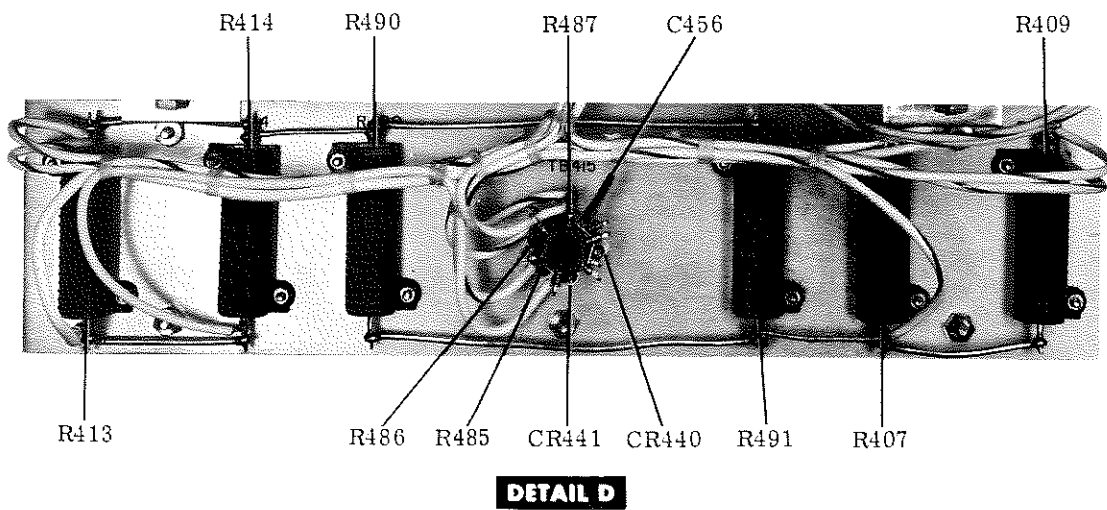


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 10 of 15)

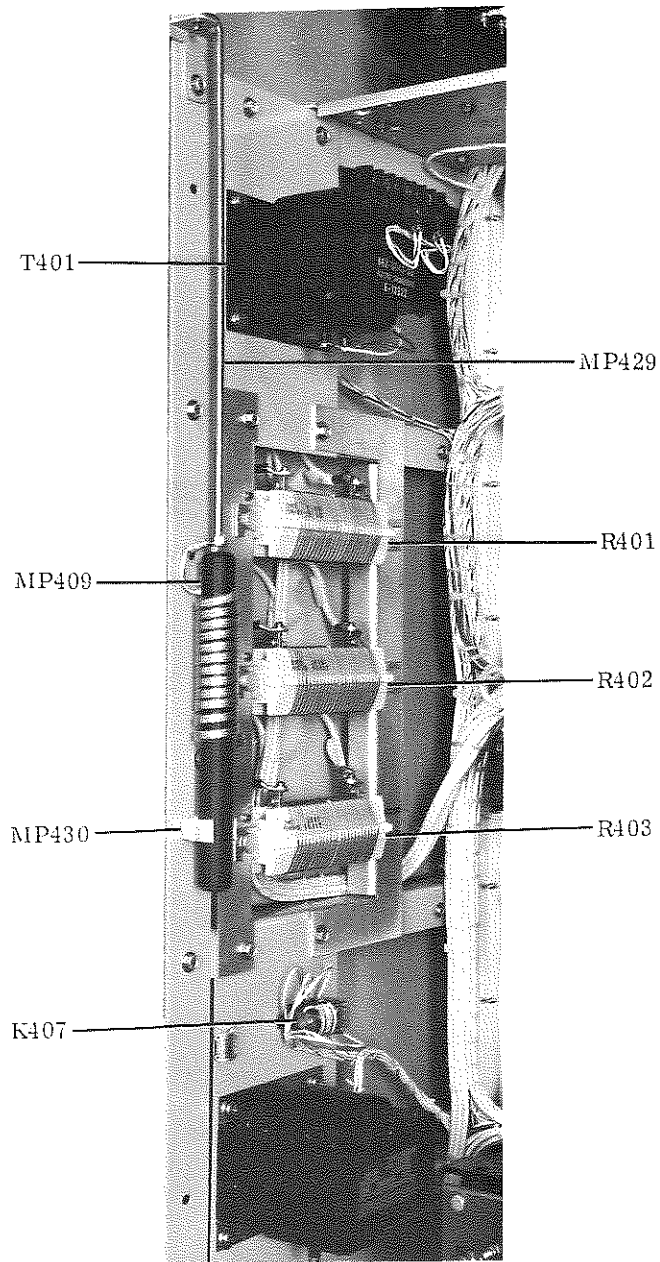


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 11 of 15)

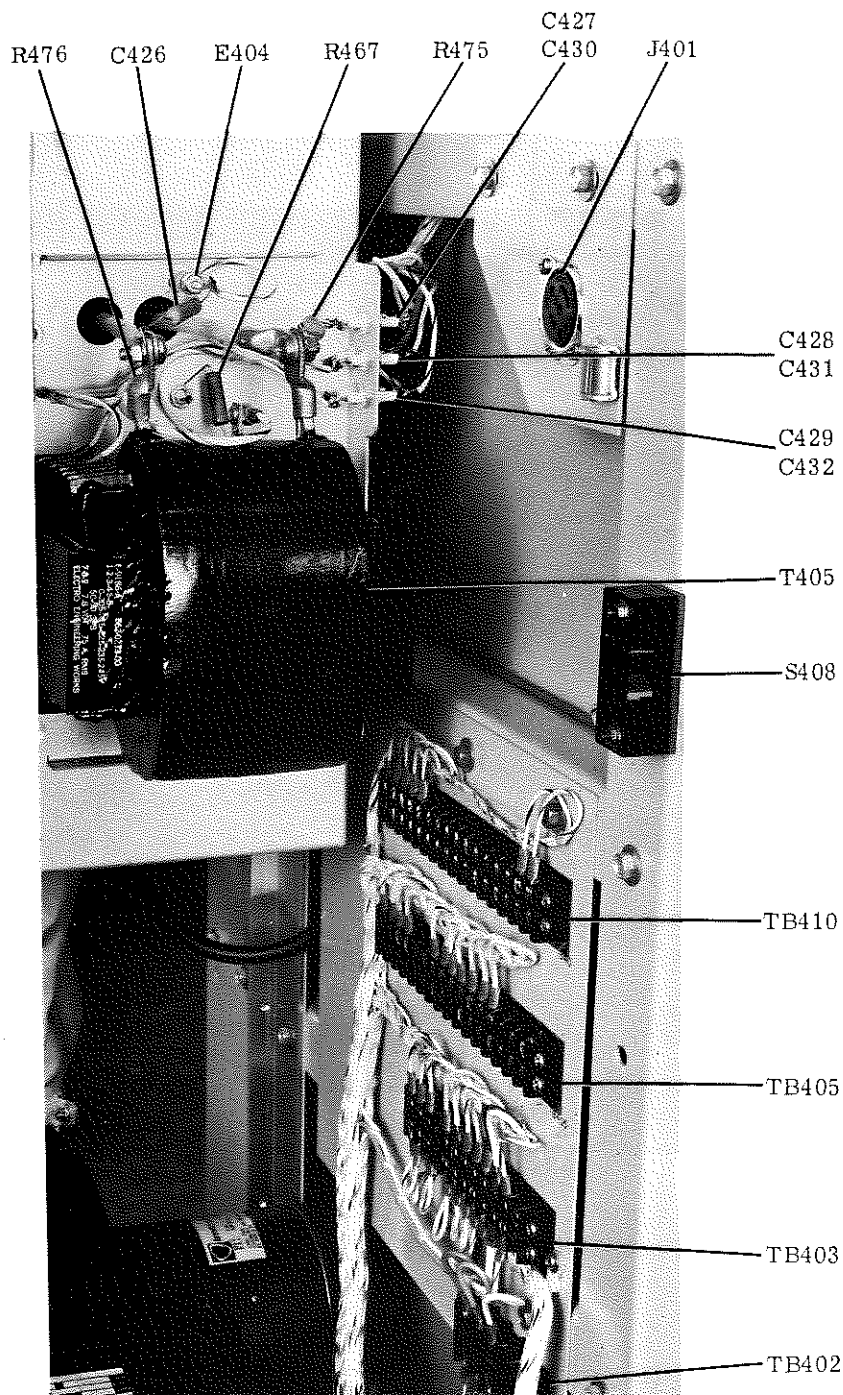


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 12 of 15)

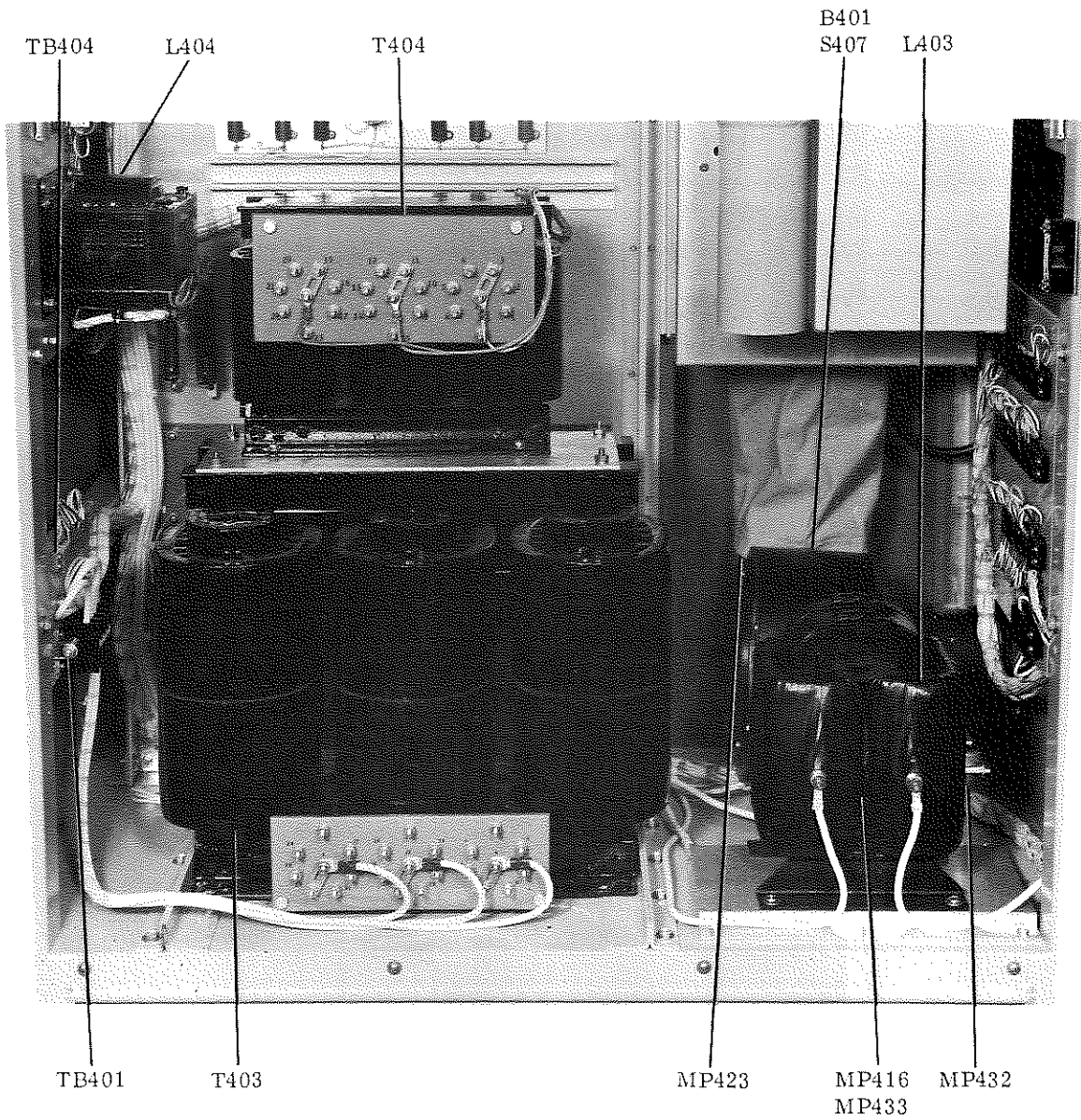


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 13 of 15)

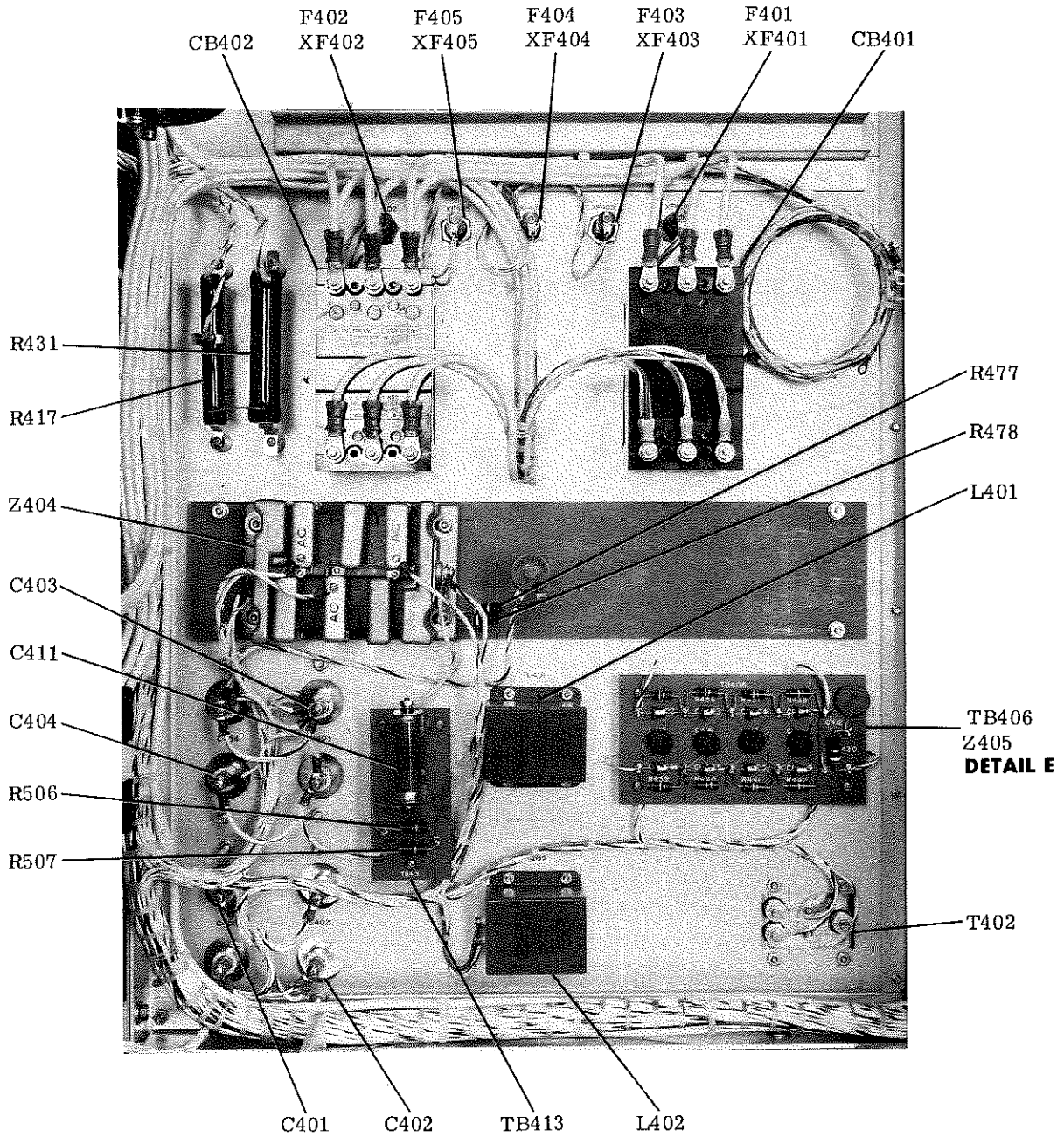


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 14 of 15)

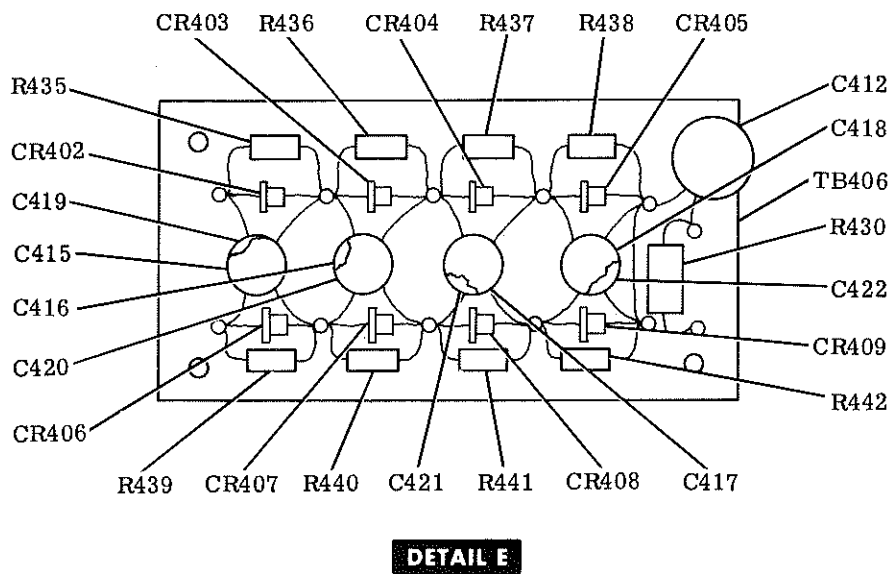


Figure 4-1. F830-1 10-Kw FM Power Amplifier (Sheet 15 of 15)

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
F830-1 10-KW FM POWER AMPLIFIER				522-2981-000
B103	MOTOR, DIRECT CURRENT PERMANENT MAGNET, REVERSIBLE MOTOR WITH PINION GEAR	5KSP298K1033A	03511	230-0448-000
B401	FAN, CENTRIFUGAL 230 VAC, 50/60 CPS	BT3830B-19	92702	009-1621-000
C401	CAPACITOR, FXD, PAPER 10 UF, 10% TOL, 1000 VDC	CP70F1FG106K1	81349	962-4360-000
C402	SAME AS C401			
C403	SAME AS C401			
C404	SAME AS C401			
C405	NOT USED			
C406	NOT USED			
C407	CAPACITOR, FXD, PAPER 2 UF, 10% TOL, 7500 VDC	Y9477	56289	930-0330-000
C408	SAME AS C407			
C409	CAPACITOR, FXD, PAPER 1 UF, 20% TOL, 100 VDC	SDB1K01105M	56289	931-4500-000
C410	SAME AS C409			
C411	CAPACITOR, FXD, CERAMIC 0.005 UF, 20% TOL, 3000 VDC	DA172-062CB	71590	913-3512-000
C412	SAME AS C411			
C413	NOT USED			
C414	NOT USED			
C415	CAPACITOR, FXD, CERAMIC 0.02 UF, 20% TOL, 500 VDC	33C2	01939	913-2142-000
C416	SAME AS C415			
C417	SAME AS C415			
C418	NOT USED			
THROUGH				
C422				
C423	CAPACITOR, FXD, CERAMIC 100 UF, 5% TOL, 500 VDC	308611U2J010ZJ	72982	916-4059-000
C424	SAME AS C423			
C425	SAME AS C423			
C426	CAPACITOR, FXD, CERAMIC 1000 UUF, 1600 VDC	2432000X5U0102P	72982	913-0154-000
C427	SAME AS C426			
THROUGH				
C430				
C431	CAPACITOR, FXD, CERAMIC 75 UUF, 5% TOL, 3500 VDC	850575ZPORM5PCT	71590	913-0830-000
C432	SAME AS C426			
C433	CAPACITOR, FXD, CERAMIC 100 UUF, 10% TOL, 5000 VDC	850S100NPORM10-PCT	71590	913-0821-000
C434	SAME AS C433			
C435	CAPACITOR, FXD, CERAMIC 2 UF, 5000 VDC	DA854-025	71590	913-0757-000
C436	CAPACITOR, VAR, AIR 20.7 UUF, 4500 VDC	PL1752	71313	922-0571-000
C437	CAPACITOR, FXD, CERAMIC 20 UUF, 5% TOL, 4000 VDC	850S20Z	71590	913-0838-000
C438	SAME AS C437			
THROUGH				
C442				
C443	CAPACITOR, FXD, PLASTIC BRASS CAPACITOR RING, 3-7/8 INCHES BY 5-1/8 INCHES			549-2069-003
C444	CAPACITOR, PLATE ALUMINUM, 0.090 INCHES THICK BY 3.750 INCHES LONG			549-2510-003
C445	CAPACITOR, PLATE ALUMINUM, 0.090 INCHES THICK BY 3.500 INCHES LONG			549-2181-003
C446	NOT USED			

F830-1 10-Kw FM Power Amplifier

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
C447	CAPACITOR, FXD, CERAMIC 500 UUF, 50% TOL, 20,000 VDC			913-1101-000
C448	SAME AS C447			
C449	NOT USED			
C450	SAME AS C423			
C451	CAPACITOR, FXD, CERAMIC 75 UUF, 5% TOL, 3500 VDC	8505752PORM5PCT	71590	913-0830-000
X C452	CAPACITOR, FXD, CERAMIC 100 UUF, 10% TOL, 5000 VDC	850S100N	71590	913-0822-000
C453	SAME AS C452			
C454	SAME AS C452			
C455	NOT USED			
C456	CAPACITOR, FXD, CERAMIC 10,000 UUF, 20% TOL, 500 VDC	CK63AW103M	81349	913-1188-000
C457	SAME AS C456			
C458	NOT USED			
C459	SAME AS C456			
C460	NOT USED			
C461	NOT USED			
C462	CAPACITOR, VAR, AIR SINGLE SECTION, 7 UUF TO 100 UUF			922-0025-000
CB401	CIRCUIT BREAKER 10 AMP CURRENT RATING	33635	74193	260-0407-000
CB402	CIRCUIT BREAKER 50.0 AMP CURRENT RATING			260-1569-000
CB403	SAME AS CB401			
CR401	NOT USED			
CR402	SEMICONDUCTOR DEVICE, DIODE			353-1546-000
CR403				
THROUGH	SAME AS CR402			
CR409				
CR410	SEMICONDUCTOR DEVICE, RECTIFIER	66-6794	81483	353-6259-000
CR411				
THROUGH	NOT USED			
CR421				
CR422	SEMICONDUCTOR DEVICE, DIODE	MR326R	04713	353-1453-000
CR423				
THROUGH	SAME AS CR422			
CR426				
CR427				
THROUGH	NOT USED			
CR433				
CR434	SEMICONDUCTOR DEVICE, DIODE			353-1546-000
CR435	SAME AS CR434			
CR436	SAME AS CR434			
CR437	SAME AS CR434			
CR438	SEMICONDUCTOR DEVICE, DIODE	1N3044A	07688	353-1339-000
CR439	SAME AS CR438			
CR440	SEMICONDUCTOR DEVICE, DIODE	1N3016B	07688	353-3121-000
CR441	SAME AS CR440			
CR442				
THROUGH	NOT USED			
CR444				
CR445	SEMICONDUCTOR DEVICE, DIODE	6RS21SA3H3	03508	353-0289-000
CR446	SAME AS CR438			
CR447	SAME AS CR438			
DC401	COUPLER, DIRECTIONAL DOUBLE COUPLER WITH CENTER CONDUCTOR, 12,000 WATTS	442E3	16973	277-0183-000
DS401	LAMP, INCANDESCENT PILOT LIGHT BULB	3S6-5	24446	262-3310-000
DS402	SAME AS DS401			
DS403	LAMP, GLOW 1/25 WATT, 65 VAC	NE51	24455	262-0021-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
E401	LENS, INDICATOR LIGHT GLASS, GREEN TRANSLUCENT	75A101GRN	72765	262-0258-000
E402	LENS, INDICATOR LIGHT GLASS, RED TRANSLUCENT	75A101RED	72765	262-0259-000
E403A	DISCHARGER, ELECTROSTATIC CONSISTING OF ONE PLAIN CARBON BLOCK	P1385	77554	975-0008-000
E403B	SAME AS E403A			
E403C	ARRESTOR			549-2453-002
E404	TERMINAL LUG PREINSULATED SOLDERLES RING TONGUE	MS25036	00779	304-0253-000
E405	SPRING, DUAL INTERLOCK			549-2315-003
E406	SAME AS 405			
F401	FUSE, CARTRIDGE 5.0 AMPS, 0.03 OHMS, 250 VDC	F02A250U5AS	81349	264-4090-000
F402	FUSE CARTRIDGE 0.250 AMPS, 250 VDC	F02B250V1-4AS	81349	264-4240-000
F403	FUSE CARTRIDGE 2 AMPS	F02B125V2AS	81349	264-0008-000
F404	SAME AS F403			
F405	SAME AS F403			
J401	CONNECTOR, ELECTRICAL 3 CONTACTS	7484	74545	368-0014-000
J402	CONNECTOR, ELECTRICAL 50 OHMS, 500 VOLTS	UG1187U	80058	357-9476-000
J403	CONNECTOR, ELECTRICAL COPPER CONTACTS	000C75	94375	357-9248-000
J404	CONNECTOR, ELECTRICAL 1 CONTACT	UG58AU	80058	357-9003-000
J405	CONNECTOR, ELECTRICAL 1 CONTACT	UG1094U	80058	357-9183-000
K401	X RELAY, ARMATURE 4C CONTACT ARRANGEMENT	83-4544	04221	970-1933-000
K402	RELAY, POWER 10 AMPS, 600 VAC, 50 CPS	700B400A110V60	01121	405-0428-000
K403	SAME AS K401			
K404	RELAY, ARMATURE 2C CONTACT ARRANGEMENT	83-3598-	04221	970-1934-000
K405	RELAY, POWER 50 AMPS, 110 VAC, 60 CPS	8502	81487	405-0298-000
K406	SAME AS K405			
K407	RELAY, ARMATURE 1C CONTACT ARRANGEMENT	95062	78277	408-1114-000
L401	REACTOR 100 MA DC, 280 OHMS, 1000 VOLTS	18892	97965	678-0584-000
L402	SAME AS L401			
L403	REACTOR 3.0 AMPS, 7 OHMS	E11868	80008	668-0089-000
L404	REACTOR 2.6 AMPS, 10 OHMS	E12631	80008	668-0032-000
L405	COIL, RADIO FREQUENCY 0.50 OHMS, 3.9 UH, 1145 MA CURRENT	LT7K193	81349	240-0177-000
L406	NOT USED			
L407	CHOKE	LT7K189	81349	240-0173-000
L408	NOT USED			
L409	COIL, RADIO FREQUENCY SOLDERED, 1/2 INCH BY 1- 1/8 INCHES LONG BY 5/8 INCHES			549-2297-003
L410	NOT USED			
L411	NOT USED			
L412	SAME AS L403			
M401	METER, ELECTRICAL 1 MA DC METER RANGE, 100 OHMS			548-0649-000
M402	AMMETER	56-0824-0000	80145	458-0658-000

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SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
M403	3 AMP METER RANGE METER, ELECTRICAL	56-0423-0000	80145	458-0644-000
M404	1 MA DC, 1% ACCURACY WATTMETER	56-4752-000	80147	458-0652-000
MP401	0-200 METER RANGE, 900 OHMS KNOB			548-1293-003
MP402	BLACK PHENOLIC			
MP403	SAME AS MP401			
MP404	SAME AS MP401			
MP405	NOT USED			
MP406	NOT USED			
MP407	NOT USED			
MP408	CHAIN ASSEMBLY SINGLE LEG, TERMINATED WITH HOOK			548-3592-002
MP409	ROD ASSEMBLY, SHORTING BRASS, WITH PLASTIC HANDLE 24.938 INCHES LONG			549-2186-003
MP410	BAR, ADJUSTING ALUMINUM, 0.375 INCHES BY 1 INCH BY 5.250 INCHES OVERALL			549-2294-003
MP411	BAR, ADJUSTING FIBER GLASS, 0.375 INCHES BY 1 INCH BY 5.250 INCHES OVERALL			549-2295-003
MP412	SPROCKET WHEEL BRASS, 0.646 INCHES DIAMETER BY 0.187 INCHES LONG			549-2168-003
MP413	SHAFT, SHOULDER MELAMINE ROD, 0.250 INCHES OUTSIDE DIAMETER BY 8-1/8 INCHES LONG			549-2223-002
MP414	SHAFT, SPROCKET ALUMINUM, 0.249 INCH DIAMETER BY 1-5/16 INCHES LONG			549-2225-002
MP415	SHAFT, FLAT PASSIVATE FINISH, 0.310 INCH DIAMETER BY 0.244 INCHES BY 5-7/32 INCHES LONG			549-2242-003
MP416	REDUCER, SHAFT BRASS, 5/8 INCH DIAMETER UNDERCUT TO 0.250 INCH DIAMETER BY 7/8 INCHES LONG			549-2275-002
MP417	EXTENSION, SHAFT PASSIVATE FINISH, 0.250 INCHES IN DIAMETER BY 1 INCH LONG			549-2284-002
MP418	SPROCKET WHEEL BRASS, 60 SPROCKETS			549-2352-002
MP419	SAME AS MP418			
MP420	SAME AS MP412			
MP421	NOT USED			
MP422	FILTER, LOW PASS 50 OHMS, 4 FEET LONG			549-2192-004
MP423	TRANSITION, AIR PLASTIC, 5.132 INCHES BY 10.125 INCHES BY 12 INCHES			549-2254-004
MP424 THROUGH MP430 MP431	NOT USED			
	TRANSITION, AIR-OUTLET GLOSSTEX, 5-9/16 INCH INSIDE DIAMETER BY 9-11/16			549-2518-004

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
MP432	INCHES LONG MOUNT, RESILIENT CADMIUM ISOLATOR, 0.169 INCHES WIDE BY 0.169	100PH377-2	76005	200-1957-000
MP433	LONG MOUNT, RESILIENT CADMIUM ISOLATOR, 0.169 INCHES WIDE BY 0.169 INCHES LONG	100PH377-8	76005	200-1961-000
MP434	NOT USED			
MP435	SAME AS MP408			
MP436	LATCH, MAGNETIC ALUMINUM, SUPPLIED WITH OR WITHOUT STRIKER PLATE	ADPL100DCST1	84792	015-0899-000
P401	CONNECTOR, ELECTRICAL 3 WIRE MIDGET, TWIST LOCK, 10 AMPS, 250 VOLTS			368-0013-000
P402	CONNECTOR, ELECTRICAL BRASS, 3/4 INCH DIAMETER BY 1-1/2 INCHES LONG	UG1185AU	81349	357-9326-000
P403	CONNECTOR, ELECTRICAL 1 CONTACT	MS35168-88E	96906	357-9292-000
P404	SAME AS P402			
P405	SAME AS P402			
R401	RESISTOR, FXD, WIRE WOUND 3.4 OHMS, 10% TOL, 8.3 AMPS	41162-2	44655	714-1612-000
R402	SAME AS R401			
R403	SAME AS R401			
R404	RESISTOR, FXD, WIRE WOUND 7.5 OHMS, 10% TOL, 100 WATTS	R100W7-5-10PCT7- 8	94310	738-0025-000
R405	RHEOSTAT 50 OHMS, 10% TOL, 500 WATTS	50446	44655	735-5300-000
R406	RESISTOR, FXD, COMPOSITION 270 OHMS, 10% TOL, 1/2 WATT	RC20GF271K	81349	745-1328-000
R407	RESISTOR, FXD, WIRE WOUND 2.5 OHMS, 3% TOL, 50 WATTS	RH50-2R500G	91637	747-8697-000
R408	RESISTOR, VAR, WIRE WOUND 50 OHMS, 10% TOL, 2 WATTS			377-0619-000
R409	RESISTOR, FXD, WIRE WOUND 0.75 OHMS, 5% TOL, 50 WATTS	M50W-75-5	00213	747-9566-000
R410	RESISTOR, FXD, WIRE WOUND 100K OHMS, 5% TOL, 210 WATTS	RW47V104	81349	746-6737-000
R411	SAME AS R410			
R412	RESISTOR, FXD, WIRE WOUND 4K OHMS, 5% TOL, 210 WATTS	HL225-40000J	91637	746-6709-000
R413	RESISTOR, FXD, WIRE WOUND 0.5 OHMS, 5% TOL, 50 WATTS	M50W0-5-5	00213	747-9564-000
R414	SAME AS R413			
R415	RESISTOR, FXD, FILM 1/4 WATT, 1% TOL			705-0519-000
R416	RESISTOR, FXD, FILM 402K OHMS, 1% TOL, 1 WATT	RN75B4023F	81349	705-3287-000
R417	RESISTOR, ADJUSTABLE, WIRE WOUND 1500 OHMS, 10% TOL, 50 WATTS			716-0026-000
R418	RESISTOR, FXD, COMPOSITION 3900 OHMS, 10% TOL, 1 WATT	RC32GF392K	81349	745-3377-000
R419	RESISTOR, VAR, COMPOSITION 10K OHMS, 20% TOL, 2 WATTS	RV4LAYS103B	81349	380-2757-000
R420	RESISTOR, FXD, FILM 1K OHMS, 1% TOL, 2 WATTS	RN80B1004F	81349	705-4254-000
R421 THROUGH	SAME AS R420			

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SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R425 R426	RESISTOR, FXD, FILM 750K OHMS, 1% TOL, 2 WATTS	RN80B7503K	81349	705-4251-000
R427	SAME AS R426			
R428	RESISTOR, FXD, WIRE WOUND 2.5 OHMS, 3% TOL, 5 WATTS	155062-5-3PCT	00213	747-9748-000
R429	NOT USED			
R430	RESISTOR, FXD, COMPOSITION 390 OHMS, 10% TOL, 2 WATTS	RC42GF391K	81349	745-5635-000
R431	RESISTOR, FXD, WIRE WOUND 1600 OHMS, 5% TOL, 55 WATTS	RW35V162	81349	747-2751-000
R432	RESISTOR, FXD, COMPOSITION 27K OHMS, 10% TOL, 1 WATT	RC32GF273K	81349	745-3412-000
R433	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 2 WATTS	RC42GF102K	81349	745-5652-000
R434	SAME AS R433			
R435	RESISTOR, FXD, COMPOSITION 100K OHMS, 10% TOL, 1 WATT	RC32GF104K	81349	745-3436-000
R436	SAME AS R435			
R437	SAME AS R435			
R438	SAME AS R435			
R439 THROUGH	SAME AS R435			
R442 R443 THROUGH	NOT USED			
R466 R467	RESISTOR, FXD, WIRE WOUND 220 OHMS, 5% TOL, 6.5 WATTS	RC42BF184K	81349	747-5447-000
R468	RESISTOR, FXD, COMPOSITION 3300 OHMS, 1% TOL, 6.5 WATTS	886AS3300	10646	712-4224-000
R469	RESISTOR, FXD, COMPOSITION 470 OHMS, 10% TOL, 2 WATTS	RC42GF471K	81349	745-5638-000
R470	RESISTOR, FXD, SILICON 22 OHMS, 20% TOL, 15 WATTS	772SP2	10646	712-0002-000
R471	RESISTOR, FXD, CERMET 50 OHMS, 20% TOL, 60 WATTS	218SP9	10646	712-0070-000
R472	SAME AS R470			
R473	SAME AS R467			
R474	NOT USED			
R475	RESISTOR, FXD, WIRE WOUND 100 OHMS, 5% TOL, 5 WATTS	RW67V101	81349	747-5440-000
R476	SAME AS R475			
R477	RESISTOR, FXD, COMPOSITION 39 OHMS, 10% TOL, 2 WATTS	RC42GF390K	81349	745-5593-000
R478	SAME AS R477			
R479	NOT USED			
R480	RESISTOR, FXD, WIRE WOUND 20 OHMS, 5% TOL, 55 WATTS	RW35V200	81349	747-2713-000
R481	RESISTOR, FXD, FILM 2870 OHMS, 1% TOL, 1 WATT	RN75B2871F	81349	705-3272-000
R482	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 2 WATTS	RC42GF103K	81349	745-5694-000
R483	SAME AS R481			
R484	SAME AS R471			
R485	RESISTOR, FXD, FILM 1200 OHMS, 5% TOL, 1 WATT	RL325122J	81349	745-3946-000
R486	SAME AS R485			
R487	RESISTOR, FXD, FILM 3600 OHMS, 5% TOL, 1 WATT	RL325362J	81349	745-3974-000
R488	NOT USED			
R489	NOT USED			
R490	SAME AS R407			
R491	SAME AS R407			
R492	RESISTOR, FXD, WIRE WOUND 2.5 OHMS, 3% TOL, 5 WATTS	1550552-5-3PCT	00213	747-9748-000
R493	SAME AS R467			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R494 R495	NOT USED RESISTOR, FXD, FILM 825K OHMS, 1% TOL, 2 WATTS	RN80B8253F	81349	705-4269-000
R496 THROUGH R505 R506	NOT USED RESISTOR, FXD, COMPOSITION 1200 OHMS, 10% TOL, 2 WATTS	RC42GF122K	81349	745-5656-000
R507 S111	SAME AS R506 SWITCH, PUSH DPST CONTACT ARRANGEMENT	B2BL	04009	260-2020-000
S112 S113 S114 S401	SAME AS S111 SAME AS S111 SAME AS S111 SWITCH, PUSHBUTTON NORMALLY OPEN CONTACTS, 3 AMPS AT 110 VAC RATING	B2BL	04009	260-2020-000
S402 THROUGH S404 S405	SAME AS S401 SWITCH, ROTARY 2 CONTACTS	230-307	71590	259-0113-000
S406	SWITCH, ROTARY 1 SECTION, 2 CIRCUITS, 3 POSITIONS, 2 POLES	228556F1E	76854	259-1808-000
S407	SWITCH, AIRFLOW INTERLOCK SPOT CONTACT ARRANGEMENT	1000	82877	266-8309-000
S408A	CONTACT ASSEMBLY, ELECTRICAL 5/8 INCHES BY 11/16 INCHES BY 1-7/8 INCHES			260-4040-000
S409A S410A S411	SAME AS S408A SAME AS S408A SWITCH, TOGGLE 10 AMPS, 250 VAC, 3 LUG TYPE TERMINALS	7611K2	15605	260-2274-000
S412	ELEMENT SECTION, ANTENNA NO. 1			
S412A	SWITCH, SENSITIVE 6 AMPS, 28.5 VDC			260-0025-000
S412B S412C	PART OF S412 PART OF S412			
T401	TRANSFORMER, STEP-DOWN 250 VOLTS, 50 TO 60 CPS	E12322	8C008	662-0043-000
T402	TRANSFORMER, STEP-UP 230 VOLTS, 60 CPS	31260	97965	662-0049-000
T403	TRANSFORMER, STEP-UP 230 VOLTS, 50 TO 60 CPS	E12628	80008	664-0017-000
T404	TRANSFORMER, STEP-UP 250 VOLTS, 50 TO 60 CPS	E12632	80008	664-0018-000
T405	TRANSFORMER, STEP-UP 245 VOLTS, 50 TO 60 CPS	E9186A	80008	662-0213-000
T406	TRANSFORMER, STEP-DOWN 230 VOLTS, 50 TO 60 CPS	E10240C	80008	662-0273-000
TB401	TERMINAL BOARD, ELECTRICAL HEAVY DUTY, 3 CONDUCTOR TERMINAL BLOCK	9080U3	90211	367-1188-000
TB402	TERMINAL STRIP 4 TERMINALS	4-142	71785	367-5040-000
TB403	TERMINAL STRIP 12 TERMINALS	12-141	71785	367-4120-000
TB404 TB405	SAME AS TB403 TERMINAL BOARD 16 TERMINALS			267-4160-000
TB406 TB407	TERMINAL BOARD TERMINAL BOARD LAMINATED GLASS CLOTH, 1/8 INCH THICK, 4-1/4 INCHES WIDE BY 12 INCHES LONG			549-2234-003 549-2264-003

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
TB408	TERMINAL BOARD 4 TERMINALS, FOR USE WITH OPTIONAL REMOTE CONTROL EQUIPMENT	600-4	75382	367-0002-000
TB409	SAME AS TB408			
TB410	SAME AS TB405			
TB411	TERMINAL STRIP 10 TERMINALS	10-141	71785	367-4100-000
TB412	TERMINAL BOARD PLASTIC, 1/16 INCHES THICK BY 2-1/8 INCHES BY 4-9/16 INCHES LONG			533-5766-003
TB413	SAME AS TB412			
TB414	NOT USED			
TB415	TERMINAL BOARD TWO RINGS OF 6 TERMINALS EACH	6H12	00534	306-0909-000
V401	ELECTRON TUBE GLASS ENVELOPE, RECTIFIER	872A872	72092	256-0037-000
V402	SAME AS V401			
THROUGH V406				
V407	ELECTRON TUBE TETRODE	1X2AB	49671	256-0122-000
XDS401A	LAMPHOLDER PANEL MOUNTING, USE WITH CANDELABRA SCREW BASE LAMP	75LESSLENS	72765	262-0255-000
XDS402A	SAME AS XDS401A			
XDS403A	LAMPHOLDER MOUNTING BRACKET	50	72765	262-1260-000
XF401	FUSEHOLDER	HKLJRWZZ	71400	265-1040-000
XF402	SAME AS XF401			
XF403	SAME AS XF401			
XF404	SAME AS XF401			
XF405	SAME AS XF401			
XV401	SOCKET, ELECTRON TUBE 4 PIN BAYONET BASE TUBE SOCKET, 20 AMP	123-211-30	74970	220-1460-000
XV402	SAME AS XV401			
THROUGH XV406				
XV407	SOCKET, ELECTRON TUBE AIR SYSTEM SOCKET	Y291	06980	220-1491-000
Z401	NOT USED			
Z402	NOT USED			
Z403	NOT USED			
Z404	SEMICONDUCTOR DEVICE, RECTIFIER THREE PHASE BRIDGE, 400 CPS	67-7304	81483	353-6273-000
Z405	RECTIFIER ASSEMBLY BIAS 0.062 INCHES BY 3.500 INCHES BY 6.625 INCHES			549-2259-004
Z406	SEMICONDUCTOR DEVICE, RECTIFIER SILICON, THREE PHASE FULL WAVE BRIDGE VOLTAGE DOUBLER, OPTIONAL ASSEMBLY. SEE BREAKDOWN ON PAGE 47/48	67-7303	81483	756-8563-000
MANUFACTURERS CODES				
CODE	MANUFACTURER			
EIMAC 00213	EIMAC SAGE ELECTRONICS CORP P.O. BOX 3926 ROCHESTER, N.Y.			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
00534	VECTOR MFG. CO. 5616 LAWDALE HOUSTON, TEXAS			
01121	ALLEN-BRADLEY CO. 1201 SOUTH 2ND STREET MILWAUKEE, WIS.			
01939	SPRAGUE ELECTRIC CO. OF WIS. GRAFTON			
03511	GENERAL ELECTRIC CO. SPECIALTY MOTOR DEPT. FORT WAYNE, IND.			
04009	ARROW-HART AND HEGEMAN ELECTRIC CO. HARTFORD, CONN.			
04221	TELEX-AEMCO MANKATO, MINN.			
04713	MOTOROLA INC. SEMICONDUCTOR PRODUCTS DIVISION 5005 EAST MC DOWELL ROAD PHOENIX, ARIZONA			
06980	EITEL-MCCULLOUGH INC. 301 INDUSTRIAL WAY SAN CARLOS, CALIF.			
07688	JOINT ELECTRON DEVICE ENGINEERING COUNCIL WASHINGTON, D.C.			
10646	CARBORUNDUM CO. RUFFALO AVF. NIAGARA FALLS, N.Y.			
15605	CUTLER-HAMMER INC. MILWAUKEE, WIS.			
16973	DENVER FIRE CLAY CO. 3033 BLAKE STREET DENVER, COLO.			
24446	GENERAL ELECTRIC CO. SCHENECTADY, N.Y.			
24455	GENERAL ELECTRIC CO. LAMP DIVISION OF CONSUMER PRODUCTS GROUP NELA PARK CLEVELAND, OHIO			
44655	OHMITE MFG. CO. 3601 HOWARD STREET SKOKIE, ILL.			
49671	RADIO CORP OF AMERICA NEW YORK CITY, N.Y.			
56289	SPRAGUE ELECTRIC CO. NORTH ADAMS, MASS.			
71313	CARDWELL CONDENSER CORP. 80 EAST MONTAUK HIGHWAY LINDENHURST LONG ISLAND, NEW YORK			
71400	BUSSMANN MFG. DIVISION OF MCGRAW-EDISON CO. 2538 WEST UNIVERSITY ST. ST. LOUIS, MO.			
71590	CENTRALAB DIVISION OF GLOBE- UNION INC. 932' EAST KEEFE AVE. MILWAUKEE, WIS.			
71785	CINCH MFG. CO. AND HOWARD B. JONES DIVISION 1026 SOUTH HOMAN AVE. CHICAGO, ILL.			
72619	DIALIGHT CORP. BROOKLYN, N.Y.			
72765	DRAKE MFG. CO. 4626 NORTH OLCOTT AVE. CHICAGO, ILL.			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
72982	ERIE TECHNOLOGICAL PRODUCTS INC. 644 WEST 12TH STREET ERIE, PA.			
74193	HEINEMANN ELECTRIC CO. 2612 BRUNSWICK PIKE TRENTON, N.J.			
74545	HUBBELL HARVEY INC. BRIDGEPORT, CONN.			
74970	E.F. JOHNSON CO. 297 TENTH AVE. S.W. WASECA, MINN.			
75382	KULKA ELECTRIC CORP. MT. VERNON, N.Y.			
76005	LORD MFG. CO. 1635 WEST 12TH STREET ERIE, PA.			
76854	OAK MFG. CO. SOUTH MAIN CRYSTAL LAKE, ILL.			
78277	SIGMA INSTRUMENTS INC. 170 PEARL ST. SOUTH BRAINTREE, MASS.			
80008	ELECTRO ENGINEERING WORKS OAKLAND, CALIF.			
80058	JOINT ELECTRONIC TYPE DESIGNATION SYSTEM			
80145	ASSEMBLY PRODUCTS INC. 7100 WILSON MILLS ROAD CHESTERLAND, OHIO			
80147	BIGGS STEEL FOUNDRY AND FABRICATING CO. AKRON, OHIO			
81349	MILITARY SPECIFICATIONS PROMULGATED BY STANDARDIZATION DIVISION DIRECTORATE OF LOGISTIC SERVICES DSA			
81483	INTERNATIONAL RECTIFIER CORP. 1523 EAST GRAND AVE. EL SEGUNDO, CALIF.			
81487	SQUARE D CO. INDUSTRIAL CONTROLLER DIVISION 4041 NORTH RICHARDS ST. MILWAUKEE, WIS.			
82877	ROTRON MFG. CO. INC. 7-9 HASBROUCK LANE WOODSTOCK, N.Y.			
84792	HEPPNER MFG. CO. P.O. BOX Q ROUND LAKE, ILL.			
85107	NEPTUNE ELECTRONICS CO. 30 WEST 15TH STREET NEW YORK, N.Y.			
90211	SQUARE D CO. 9405 RIVER CHICAGO, ILL.			
91637	DALE ELECTRONICS INC. COLUMBUS, NEBR.			
92702	IMC MAGNETICS CORP. EASTERN DIVISION 570 MAIN STREET WESTBURY LONG ISLAND, N.Y.			
94310	TRU-OHM PRODUCTS MEMCOR COMPONETS DIVISION P.O. BOX 890 HUNTINGTON, IND.			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
<p>94375</p> <p>96906</p>	<p>AUTOMATIC METAL PRODUCTS CO. 315 BERRY BROOKLYN, N.Y. MILITARY STANDARD PROMULGATED BY STANDIZA- TION DIVISION DIRECTORATE OF LOGISTIC SERVICES DSA</p>			

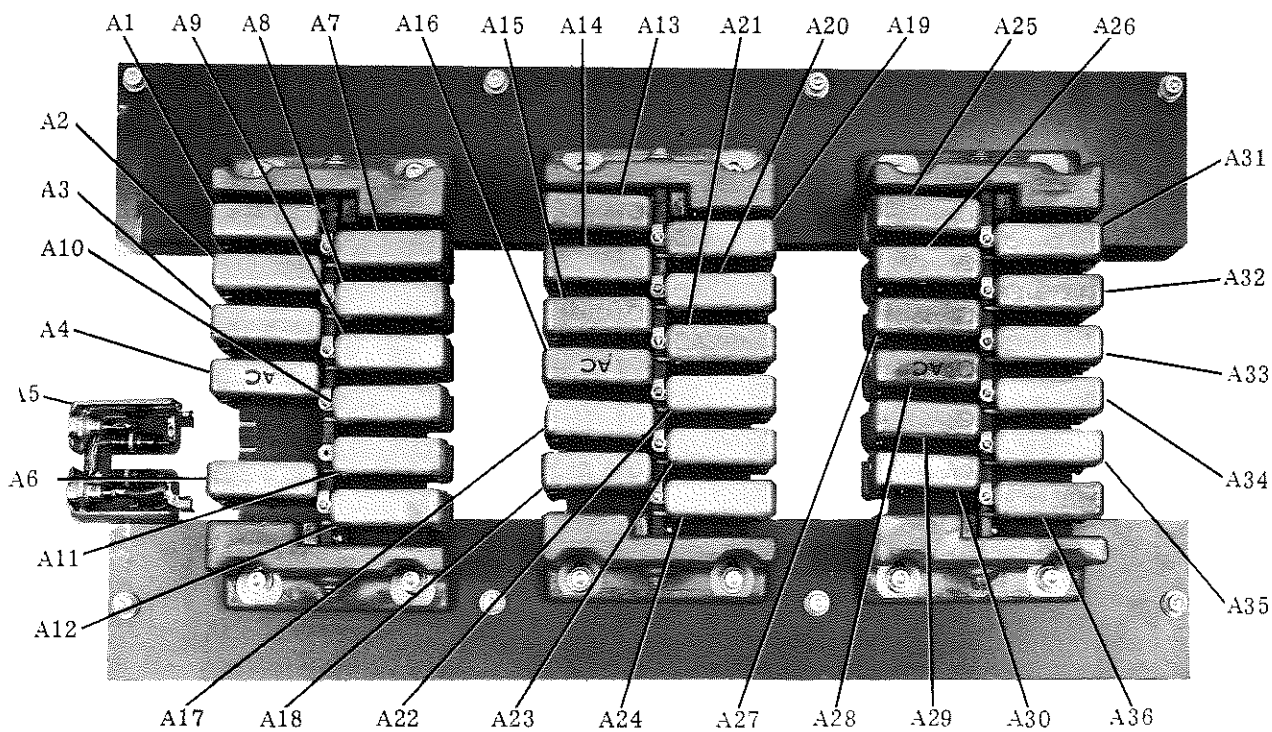
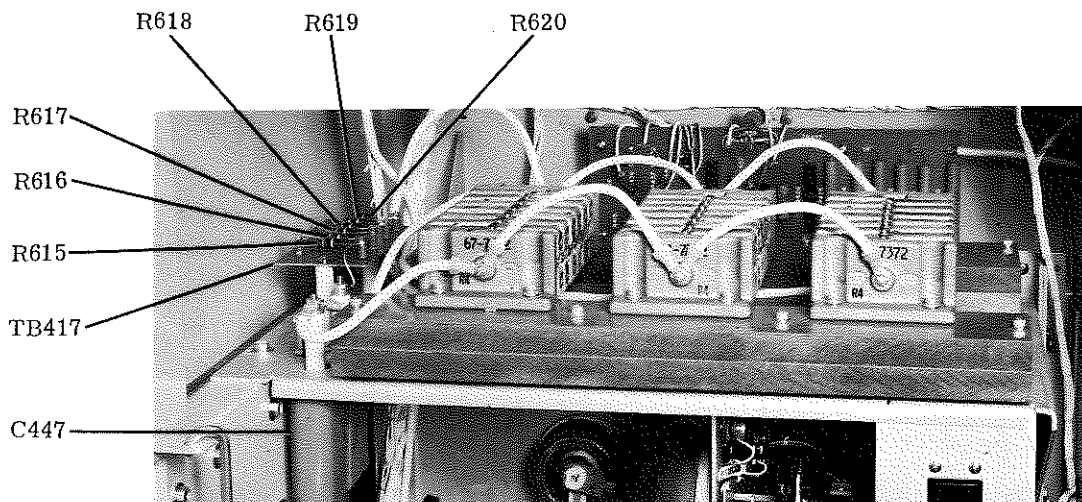


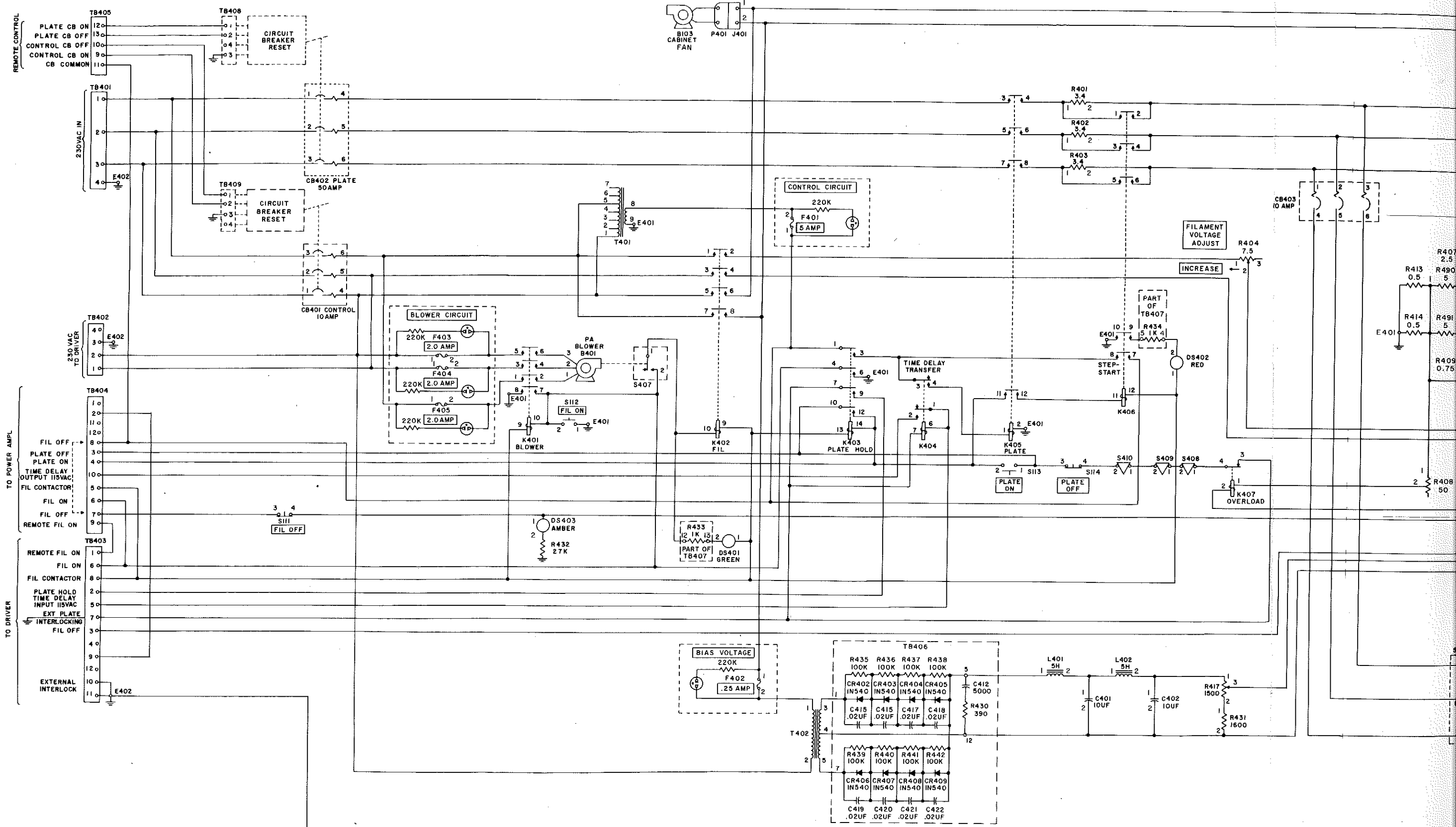
Figure 4-2. Semiconductor Device, Rectifier

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
SEMICONDUCTOR DEVICE, RECTIFIER				756-8563-000
A1 A2 A3 A4 A5 THROUGH A15 A16 A17 THROUGH A27 A28 A29 THROUGH A36 C447 R615 R616 THROUGH R620 TB417	MODULE ASSEMBLY REPLACE ENTIRE ASSEMBLY SAME AS A1 SAME AS A1 MODULE ASSEMBLY REPLACE ENTIRE ASSEMBLY SAME AS A1 SAME AS A4 SAME AS A1 SAME AS A4 SAME AS A1 CAPACITOR, FXD, CERAMIC 500 UUF, PLUS 50% MINUS 20%, 20,000 VDCW RESISTOR, FXD, COMPOSITION 56 OHMS, 10% TOL, 2 WATTS SAME AS R615 TERMINAL BOARD	66-6794 66-6795 RC42GF560K	81483 81483 81349	353-6259-000 353-6260-000 913-1101-000 745-5600-000 756-3671-002
MANUFACTURERS CODES				
81349 81483	MANUFACTURER MILITARY SPECIFICATIONS INTERNATIONAL RECTIFIER CORP. 1523 EAST GRAND AVE. EL SEGUNDO, CALIF.			

FOR single phase DRIVER only
OPERATION

MODIFICATION TO RUN TO Allow driver
without POWER PB

CONNECT TB304-4 TO TB404-8
Remove F401 & disconnect T401
change F303 TO 5A



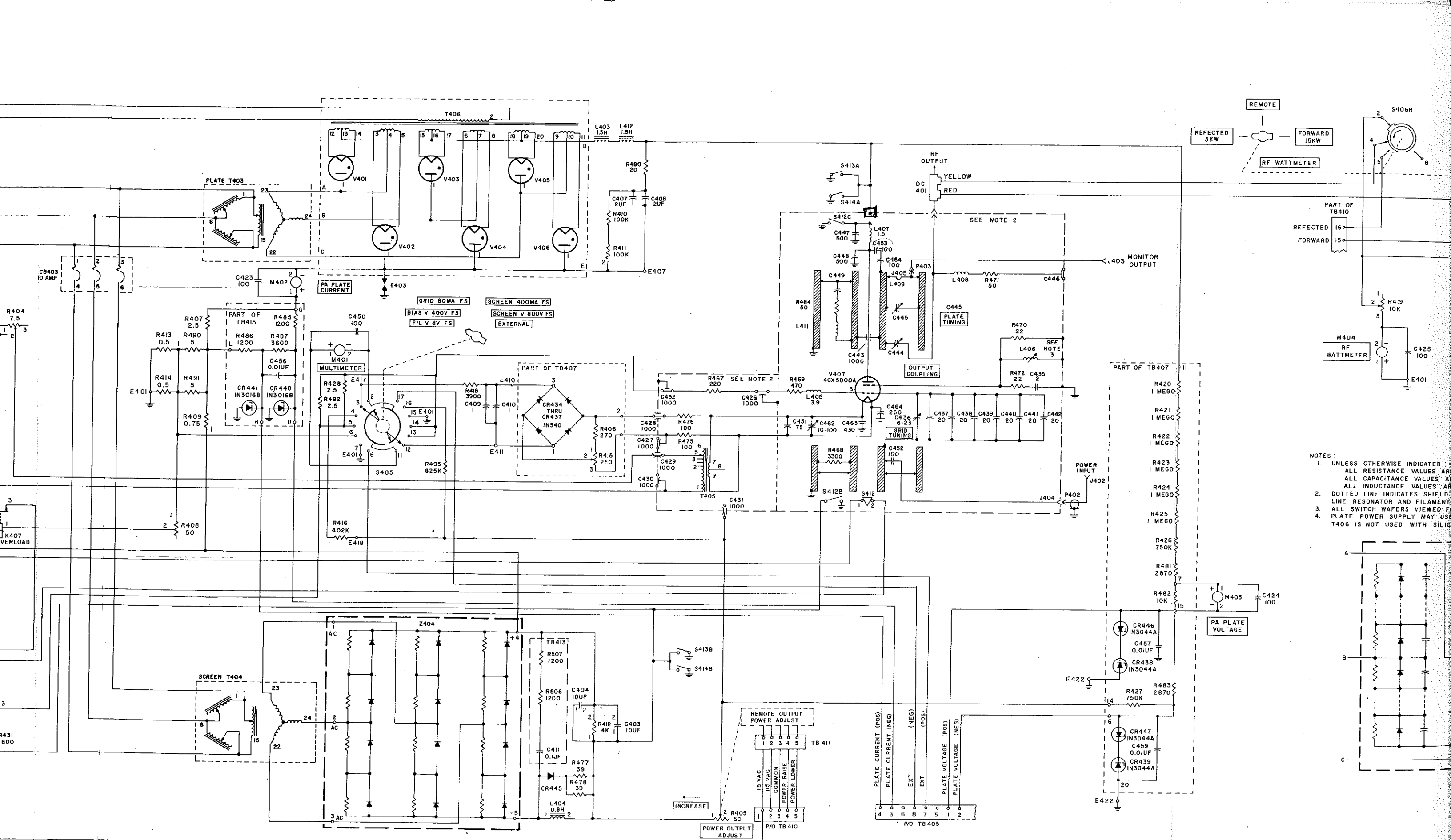
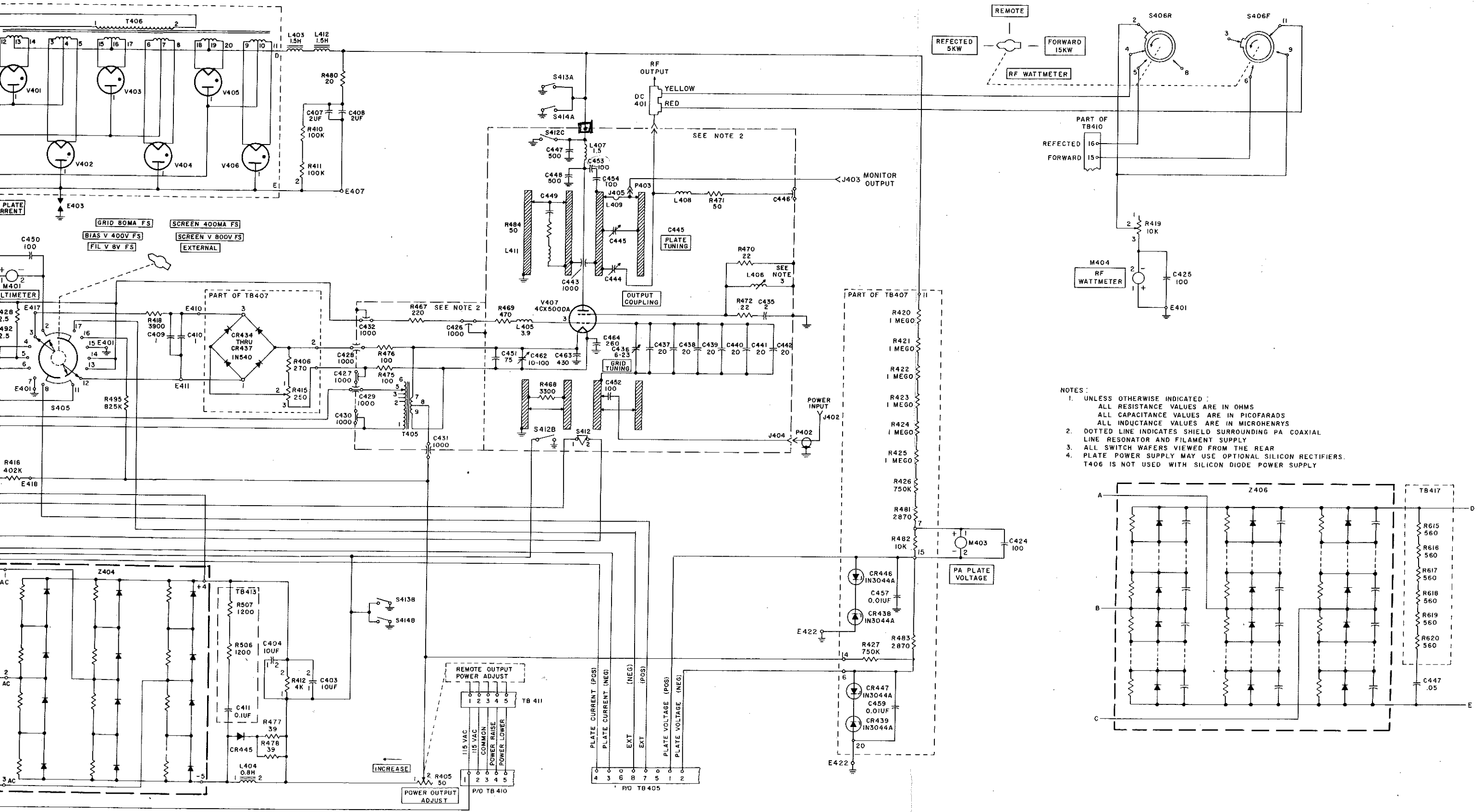


Figure 5-1. F830-1 10-Kw FM Power



- NOTES:
- UNLESS OTHERWISE INDICATED: ALL RESISTANCE VALUES ARE IN OHMS ALL CAPACITANCE VALUES ARE IN PICOFARADS ALL INDUCTANCE VALUES ARE IN MICROHENRYS
 - DOTTED LINE INDICATES SHIELD SURROUNDING PA COAXIAL LINE RESONATOR AND FILAMENT SUPPLY
 - ALL SWITCH WAFERS VIEWED FROM THE REAR
 - PLATE POWER SUPPLY MAY USE OPTIONAL SILICON RECTIFIERS. T406 IS NOT USED WITH SILICON DIODE POWER SUPPLY

Figure 5-1. F830-1 10-Kw FM Power Amplifier, Schematic Diagram

HOOK-UP WIRE CODE

The characteristics of the hook-up wire used in this equipment are indicated by groups of symbols on the diagrams. Each symbol group consists of a maximum of three letters followed by a maximum of three numerals. When three letters are used the first indicates the type of wire, the second represents the size of wire, and the third is the letter "S", used only when the wire is shielded. When two letters are used, the first and second letters indicate either the type and size of wire or the size of wire and shielding, respectively. When one letter is used it indicates the wire size only. The first numeral indicates the color of the wire body and the second and third numerals, if any, represent the colors of tracers, all numerals being in accordance with the standard EIA and MIL-W-16878 color code.

The symbols are assigned according to the following table.

CODE	TYPE OF WIRE CODE DESCRIPTION	CODE	TYPE OF WIRE CODE DESCRIPTION
A	Cotton Braid Over Plastic	L5	Silicone, Non-Mil, 15,000 Volts
A2	Irradiated Modified Polyolefin, (300 Volts)	L6	Silicone, Non-Mil, 20,000 Volts
A3	Irradiated Modified Polyolefin, (600 Volts)	L7	Silicone, Non-Mil, 25,000 Volts
A4	Irradiated Modified Polyolefin, (1000 Volts)	L8	Silicone, Non-Mil, 30,000 Volts
A5	Irradiated Modified Polyolefin, (3000 Volts)	M	
B	Bus Wire, Round Tinned	N	Single Conductor Stranded (Non-Rubber)
C	Polyvinyl Chloride, MIL-W-16878, Type B (600 Volts) (No. 20-18-16)	P	Single Conductor Stranded (Rubber Covered)
D	Polyvinyl Chloride, MIL-W-16878, Type B (600 Volts) (No. 22-26-28)	Q	
E	Vinyl, MIL-W-5086, Type I (600 Volts)	R	Polyvinyl Chloride, MIL-W-16878, Type C (1000 Volts)
E2	Vinyl, MIL-W-5086, Type II (600 Volts) (No. 22-12) Note 1	S	
E3	Vinyl, MIL-W-5086, Type II (600 Volts) (No. 0000-10) Note 2	T	Teflon (TFE), MIL-W-16878, Type E (600 Volts) Stranded
E4	Vinyl, MIL-W-5086, Type III (600 Volts) (No. 12-22) Note 3	V	Polyvinyl Chloride, MIL-W-16878, Type D (3000 Volts)
E5	Vinyl, MIL-W-5086, Type III (600 Volts) (No. 0000-10) Note 4	W	Teflon (TFE), MIL-W-16878, Type EE (1000 Volts)
F	Extra Flexible Varnished Cambric	X	Teflon (TFE), MIL-W-16878, Type ET (250 Volts)
G		X2	Teflon (FEP), MIL-W-16878, Type K (600 Volts)
H	KEL-F (Monochlorotrifluoroethylene)	X3	Teflon (FEP), MIL-W-16878, Type KT (250 Volts)
J		X4	Teflon (TFE), Non-Mil, (3000 Volts)
K	Neon Sign Cable (15,000 Volts)	Y	Telephone Type, Polyvinyl
L	Silicone, MIL-W-16878, Type FF (600 Volts)	Y1	Teflon (TFE) Non-Mil; Solid Conductor
L2	Silicone, MIL-W-16878, Type FFW (1000 Volts)	Z	Telephone Type, Braided Yarn
L3	Silicone, Non-Mil, 5000 Volts		
L4	Silicone, Non-Mil, 10,000 Volts		

Note 1 - Extruded nylon over fiber glass braid over primary vinyl.

Note 2 - Braided, lacquered nylon over fiber glass braid over primary vinyl.

Note 3 - Extruded nylon over secondary vinyl over fiber glass over primary vinyl.

Note 4 - Lacquered extruded nylon over secondary vinyl over fiber glass over primary vinyl.

SIZE OF WIRE		COVERING OF WIRE	COLOR CODE	
CODE	SIZE		CODE	TYPE
A	No. 22 AWG		0	Black
B	No. 20		1	Brown
C	No. 18		2	Red
D	No. 16		3	Orange
E	No. 14		4	Yellow
F	No. 12		5	Green
G	No. 10		6	Blue
H	No. 8		7	Violet
J	No. 6		8	Gray (Slate)
K	No. 4		9	White
L	No. 2		a	Clear
M	No. 1		b	Tan
N	No. 0		c	Pink
P	No. 00		d	Maroon
Q	No. 000		e	Light Green
R	No. 0000	S Shielded	f	Light Blue
T	No. 28			
V	No. 26	SJ Shielded and Jacketed		
W	No. 24			
X	No. 19			
Y	No. 30			
Z				

EXAMPLES

DA 92	Unshielded Wire, Polyvinyl, No. 22 AWG, White with a Red Tracer <div style="text-align: center; margin: 5px 0;"> D A 9 2 </div> Type of Wire Size of Wire Clr of Body Clr of Trs
DAS 9123	Shielded Wire (Single) Polyvinyl, No. 22 AWG, White Body with Brown, Red and Orange Tracers <div style="text-align: center; margin: 5px 0;"> D A S 9 123 </div> Type of Wire Size of Wire Shld Clr of Body Clr of Trs
DASJ (9) (92)	Shielded and Jacketed Wire (Multiple), Polyvinyl, No. 22 AWG, White and White with Red Tracer <div style="text-align: center; margin: 5px 0;"> D A SJ (9) (92) </div> Type of Wire Size of Wire Shld First Cond Sec Cond & Jkd
A2A 91	Unshielded Wire, Irradiated Polyolefin, No. 22 AWG, White with Black Tracer <div style="text-align: center; margin: 5px 0;"> A2 A 9 1 </div> Type of Wire Size of Wire Clr of Body Clr of Trs





unit instructions

A830-2
10W Wide-Band FM
Broadcast Exciter

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SECTION I GENERAL DESCRIPTION

1.1 GENERAL.

This instruction book contains information for operation and maintenance of A830-2 10 W Wide-Band FM Broadcast Exciter. See figure 1-1. The A830-2 is manufactured by Collins Radio Company, Cedar Rapids, Iowa.

1.2 PURPOSE OF EQUIPMENT.

The A830-2 10 W Wide-Band FM Broadcast Exciter is a direct FM exciter designed specifically to meet the stringent requirements of stereophonic FM broadcasting. The A830-2 may be used in monaural broadcasting, Storecasting (SCA), or with Collins 786M-1

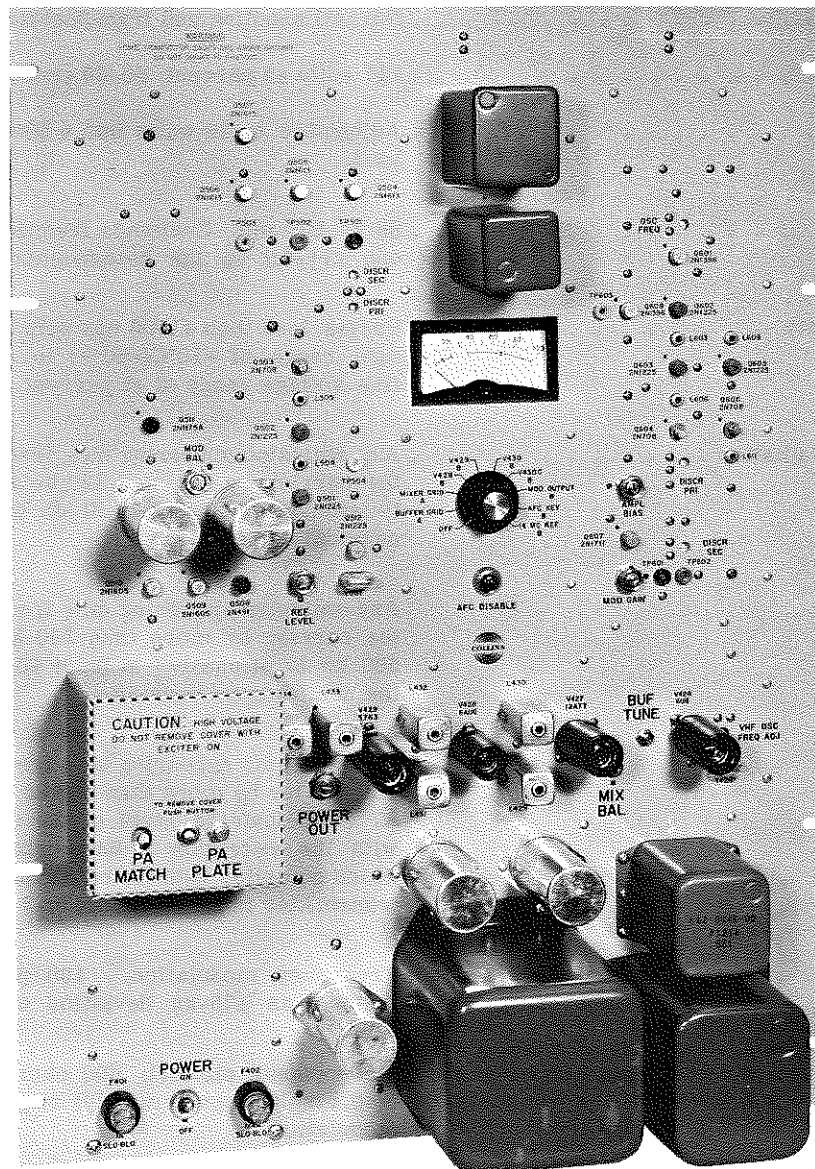


Figure 1-1. A830-2 10 W Wide-Band FM Broadcast Exciter, Over-all View

Stereo Generator (optional) for stereophonic broadcasting. The A830-2 is used to drive higher power amplifiers in the FM broadcast service.

The A830-2 mounts in the same cabinet as the first stage of amplification (250 or 1000 watts) in the transmitter. A rear view of the A830-2 is shown in figure 1-2.

1.3 EQUIPMENT SUPPLIED.

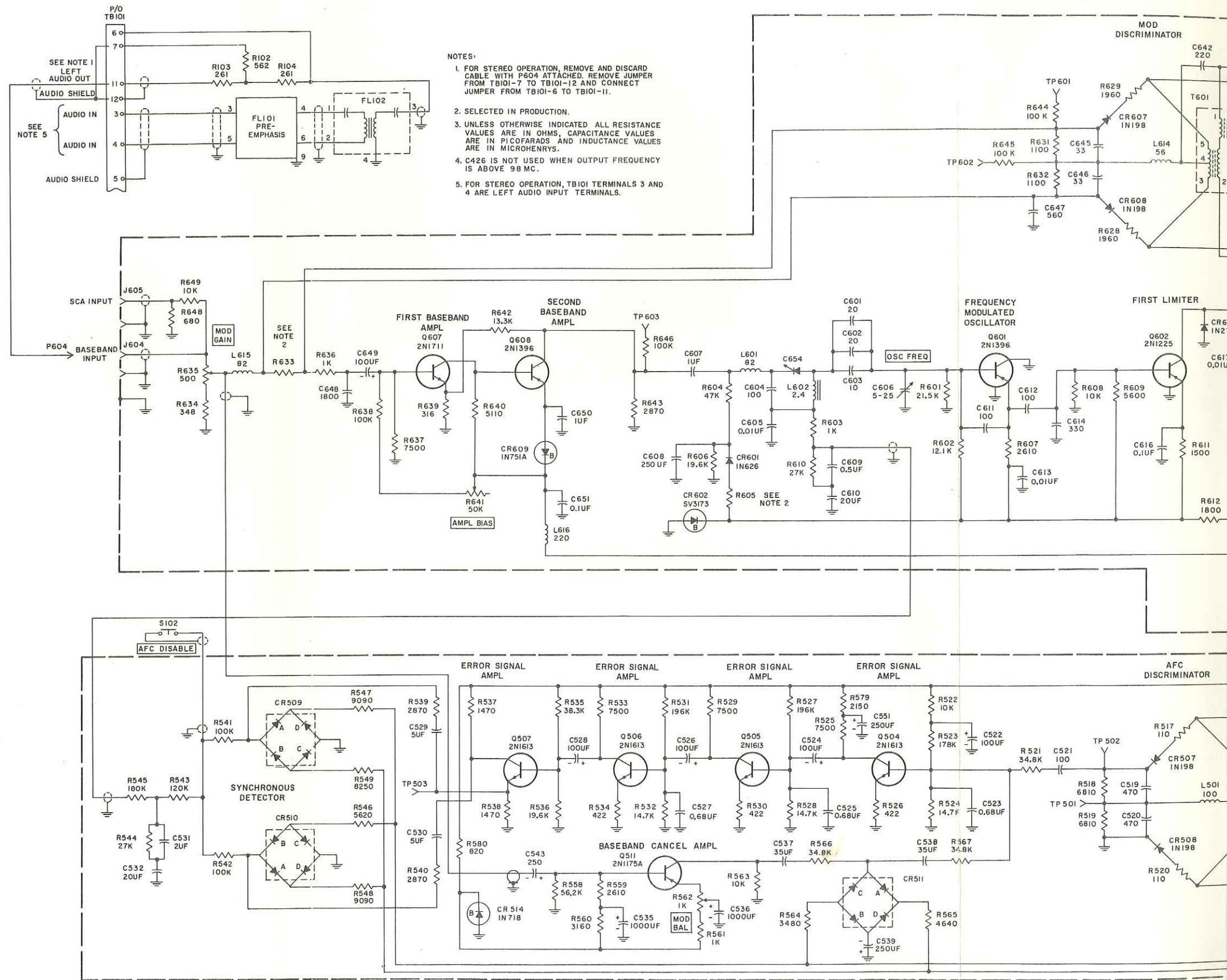
The A830-2 is normally supplied as a part of a Collins FM transmitter (830B-1A, 830D-1A, 830E-1A, etc.).

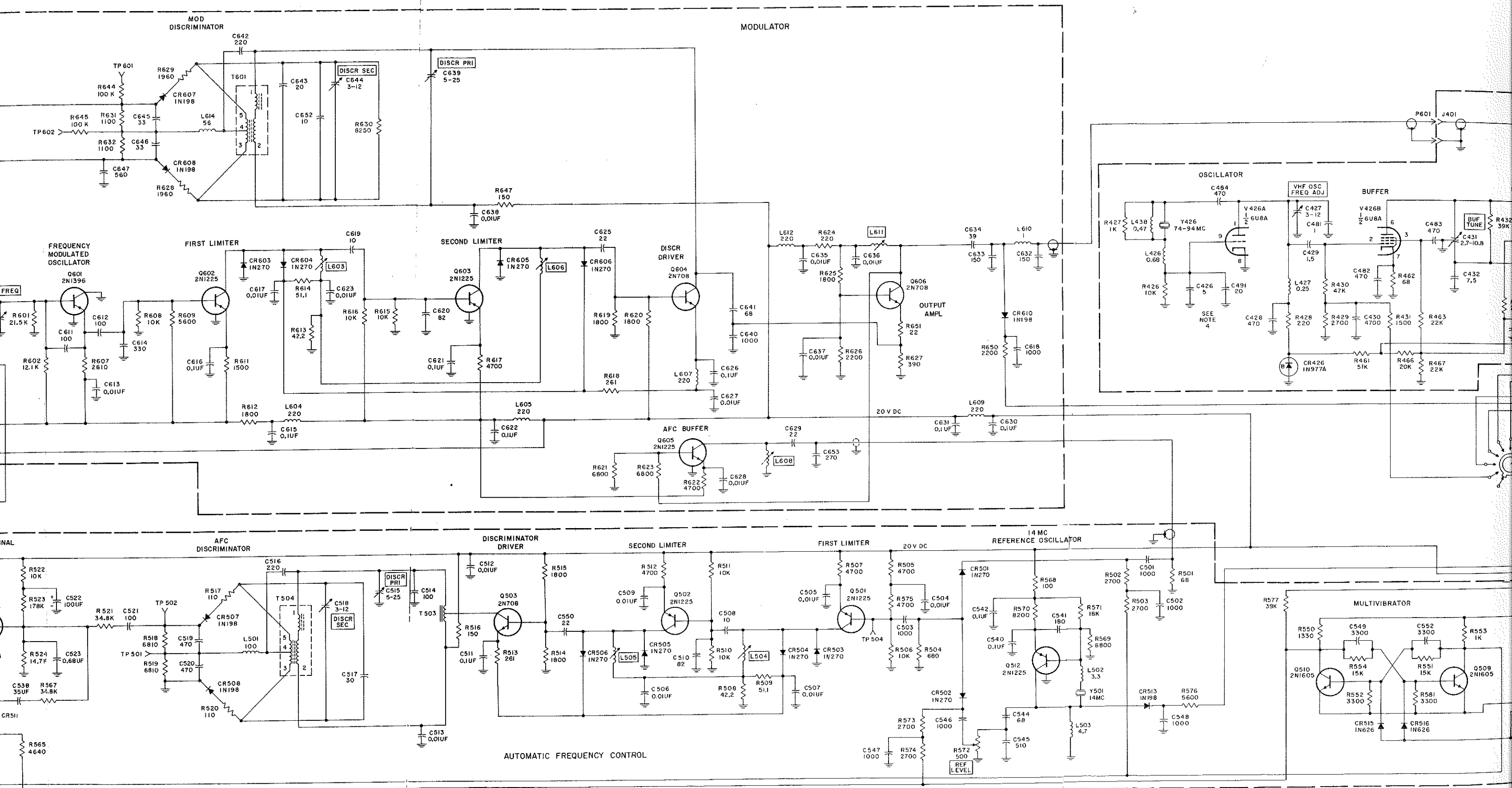
1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

The A830-2 is supplied with all required equipment.

1.5 TECHNICAL SUMMARY.

Ambient temperature range	+10°C(+50°F) to +55°C(+131°F).
Ambient humidity range	0 to 95 percent relative.
Altitude	7500 feet, maximum.
Shock and vibration	Normal handling and transportation.
Power source	117 volts ±5 percent, 50/60 cps, single phase.
R-f power output	Adjustable to 10 watts into a 50- to 70-ohm resistive load.
Frequency range	88 to 108 mc. Customer frequency is determined by one crystal in the heterodyning oscillator circuit.
Carrier frequency stability	Varies less than ±1000 cps with an ambient temperature range of +10°C(+50°F) to +55°C(+131°F), and a line-voltage range of ±5 percent.
Harmonic and spurious radiation	Any emission appearing on a frequency removed from the carrier by between 120 kc and 240 kc, inclusive, is attenuated at least 30 db below the level of the unmodulated carrier. Any emission appearing on a frequency removed from the carrier by more than 240 kc up to and including 600 kc is attenuated at least 40 db below the level of the unmodulated carrier. Any emission appearing on a frequency removed from the carrier by more than 600 kc is attenuated at least 80 db below the level of the unmodulated carrier, with the exception of harmonics of the r-f carrier which complies with the requirements of the particular transmitter in which the A830-2 is installed.
Type of modulation	Frequency modulation. 100 percent modulation is defined as ±75-kc deviation of the main carrier.
Exciter inputs	Stereophonic channel: 600 ohms, unbalanced. Input of 0.1 volt (approximately) required for 100 percent modulation. Monophonic channel: 600 ohms, balanced. Input of 10 dbm ±2 db (approximately 2.45 volts) required for 100 percent modulation.





SECTION V ILLUSTRATIONS

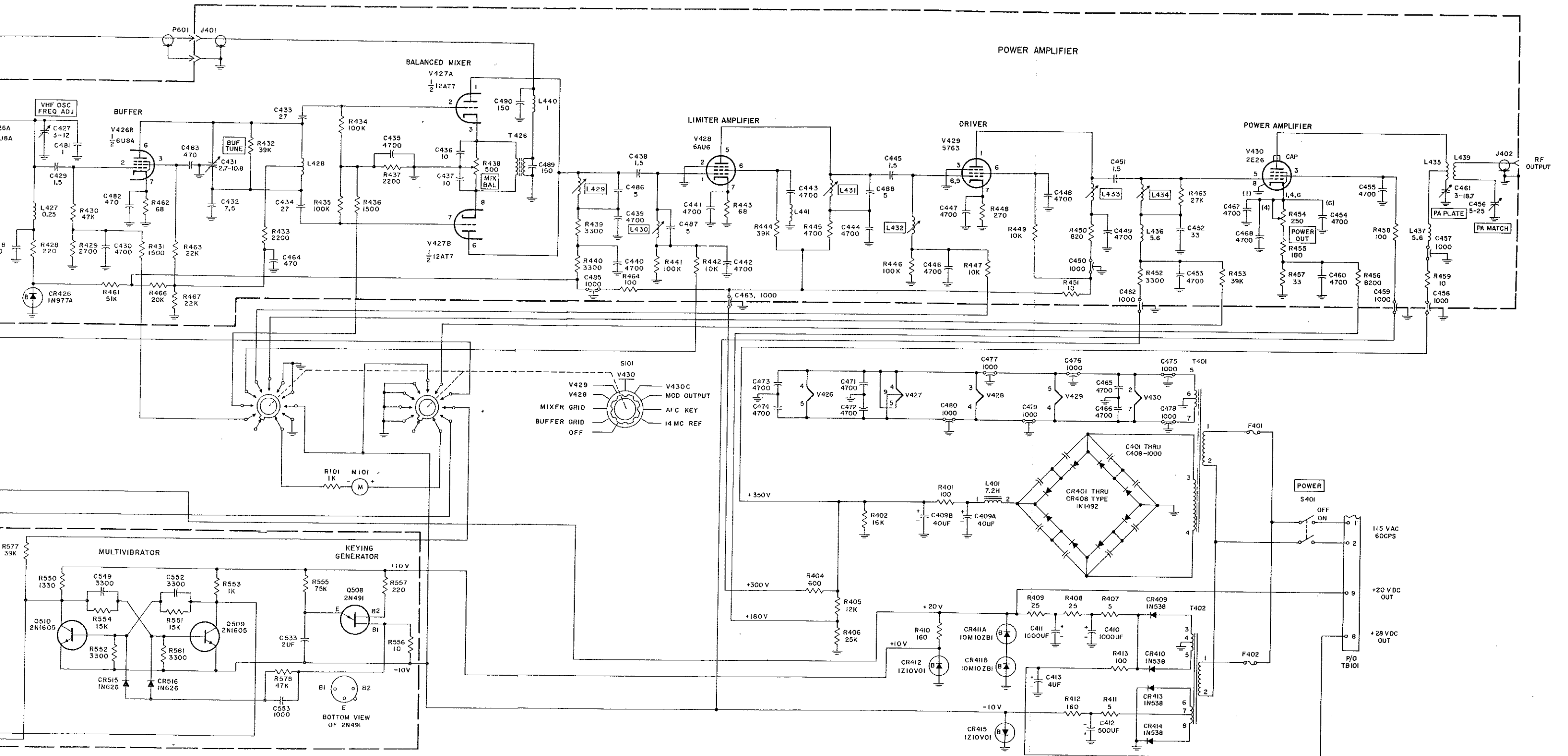


Figure 5-1. A830-2 10 W Wide-Band FM Broadcast Exciter, Schematic Diagram

SCA channel: 600 ohms, balanced. Input of 0.35 volt (approximately) required for 10 percent modulation.

- Frequency and phase response The frequency and phase response of the A830-2 is such that when used with a suitable stereophonic generator such as the 786M-1, stereophonic separation between left and right stereophonic channels shall be better than 35 db at audio modulating frequencies between 30 and 15,000 cps.
- Distortion Does not exceed 0.5 percent in the 30- to 15,000-cps frequency range and 1.0 percent in the 15,000- to 75,000-cps frequency range.
- Pre-emphasis Standard 75-microsecond pre-emphasis.
- FM noise level 65 db below 100 percent modulation.
- AM noise level 55 db below 100 percent AM level.

1.6 VACUUM-TUBE, FUSE, AND SEMICONDUCTOR COMPLEMENT.

Table 1-1 lists all of the vacuum tubes, fuses, and semiconductors used in the A830-2.

TABLE 1-1. VACUUM-TUBE, FUSE, AND SEMICONDUCTOR COMPLEMENT

SYMBOL	TYPE	FUNCTION
V426	6U8A	Oscillator and buffer
V427	12AT7	Balanced mixer
V428	6AU6	Limiter-amplifier
V429	5763	Driver
V430	2E26	Power amplifier
Q501	2N1225	First afc limiter
Q502	2N1225	Second afc limiter
Q503	2N708	Afc discriminator driver
Q504	2N1613	First error signal amplifier
Q505	2N1613	Second error signal amplifier
Q506	2N1613	Third error signal amplifier
Q507	2N1613	Fourth error signal amplifier
Q508	2N491	Keying generator
Q509	2N1605	Multivibrator
Q510	2N1605	Multivibrator
Q511	2N1175A	Baseband cancellation amplifier
Q601	2N1396	Frequency modulated oscillator
Q602	2N1225	First limiter
Q603	2N1225	Second limiter
Q604	2N708	Discriminator driver
Q605	2N1225	Afc buffer
Q606	2N708	Modulator output amplifier
Q607	2N1711	First baseband amplifier
Q608	2N1396	Second baseband amplifier
CR401	1N1492	B+ rectifier
CR402	1N1492	B+ rectifier
CR403	1N1492	B+ rectifier
CR404	1N1492	B+ rectifier
CR405	1N1492	B+ rectifier

TABLE 1-1. VACUUM-TUBE, FUSE, AND SEMICONDUCTOR COMPLEMENT (Cont)

SYMBOL	TYPE	FUNCTION
CR406	1N1492	B+ rectifier
CR407	1N1492	B+ rectifier
CR408	1N1492	B+ rectifier
CR409	1N538	+20-volt rectifier
CR410	1N538	+20-volt rectifier
CR411	10M10ZB1	+20-volt regulator
CR412	1Z10V01	+10-volt regulator
CR413	1N538	-10-volt rectifier
CR414	1N538	-10-volt rectifier
CR415	1Z10V01	-10-volt regulator
CR426	1N977A	Oscillator plate voltage regulator
CR501	1N270	Gate
CR502	1N270	Gate
CR503	1N270	Afc limiter
CR504	1N270	Afc limiter
CR505	1N270	Afc limiter
CR506	1N270	Afc limiter
CR507	1N198	Afc discriminator
CR508	1N198	Afc discriminator
CR509	FA-4000	Synchronous detector
CR510	FA-4000	Synchronous detector
CR511	FA-4000	Gate
CR512	1N198	Meter rectifier
CR513	1N198	Meter rectifier
CR514	1N718	Voltage regulator
CR601	1N626	Temperature compensation
CR602	SV3173	Voltage regulator
CR603	1N270	Limiter
CR604	1N270	Limiter
CR605	1N270	Limiter
CR606	1N270	Limiter
CR607	1N198	Modulation discriminator
CR608	1N198	Modulation discriminator
CR609	1N751A	Voltage regulator
CR610	1N198	Meter rectifier
F401	1 amp	Protect T401
F402	1/4 amp	Protect T402

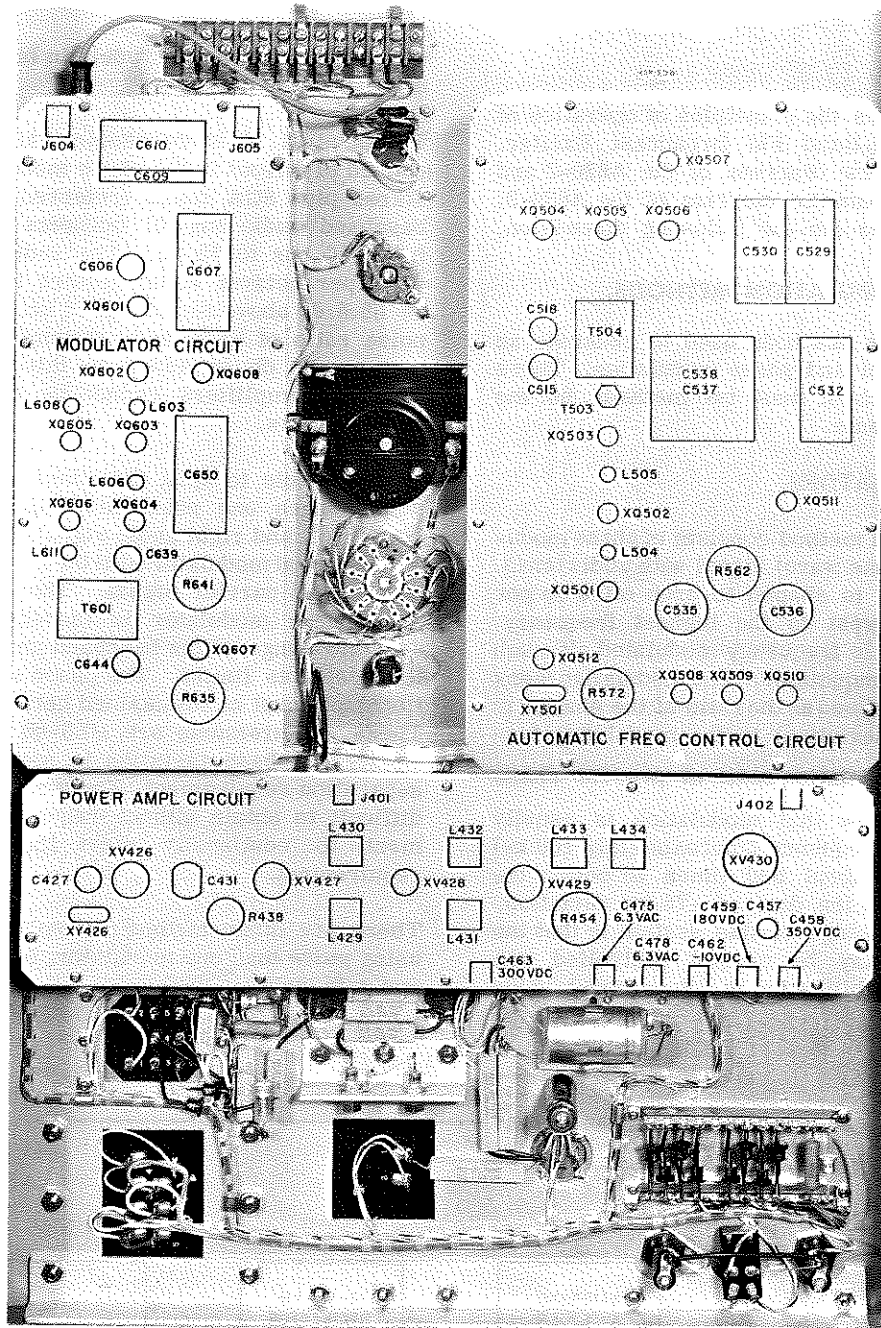


Figure 1-2. A830-2 10 W Wide-Band FM Broadcast Exciter, Rear View

SECTION II PRINCIPLES OF OPERATION

2.1 GENERAL.

This section describes the principles of operation of A830-2 10 W Wide-Band FM Broadcast Exciter. Figure 2-2 is a block diagram of the A830-2 and figure 5-1 is the schematic diagram of the A830-2. Refer to these figures for the following discussion.

2.2 FREQUENCY MODULATION METHODS.

There are two basic methods used to generate an FM signal, direct FM and phase modulation. There are variations of each of these two methods, but the end results are the same.

2.2.1 PHASE MODULATORS.

The phase modulation method consists of phase modulating a CW (continuous wave) signal with audio tones. The audio response is shaped to drop off 6 db per octave from the lowest to the highest frequency. The resultant signal is frequency modulated although produced by a phase modulator. The modulation index of an FM signal is defined as the ratio of the change in carrier frequency (deviation) to the modulating frequency, $\frac{\Delta f}{f_m}$. The modulation index of present phase modulators is so low that modulation is usually performed at a low frequency (approximately 100 kc) and then multiplied about 800 times to obtain the output frequency with the desired ± 75 -kc deviation. The outstanding advantage of this system is that the 100-kc oscillator may be crystal controlled and further frequency stabilization is not required. This

system has been used widely in broadcast FM transmitters in the past.

The arrival of stereophonic FM broadcasting has caused problems in the phase modulator. A composite stereo plus SCA signal (referred to hereafter as the baseband audio signal) occupies a frequency band from 50 cps to 75 kc. The audio response shaping (6 db per octave) would require that 50-cps signals be 65.5 db above signals at 75 kc. When a signal-to-noise ratio of 65 db and a dynamic range of approximately 60 db is added to this, it is obvious that baseband amplifiers cannot be built to meet these requirements.

It is possible to split the phase modulation into two steps where one phase modulator accepts only the L + R (left and right audio signals) audio spectrum and a subsequent modulator adds the L - R double-sideband suppressed carrier signal. The audio bandwidth for each phase modulator is thereby reduced and the dynamic range of the baseband amplifiers is reduced to acceptable limits. The phase and amplitude relationships must be maintained between the two signals. These requirements are ± 0.3 -db gain variation and ± 3 -degree phase variation to meet the 30-db stereo separation requirement. These requirements would be difficult to obtain without frequent on-the-air adjustment to continually meet the stereo separation requirement.

There are other methods of splitting the signal and using more than one modulator, but all have the phase and gain stability problem.

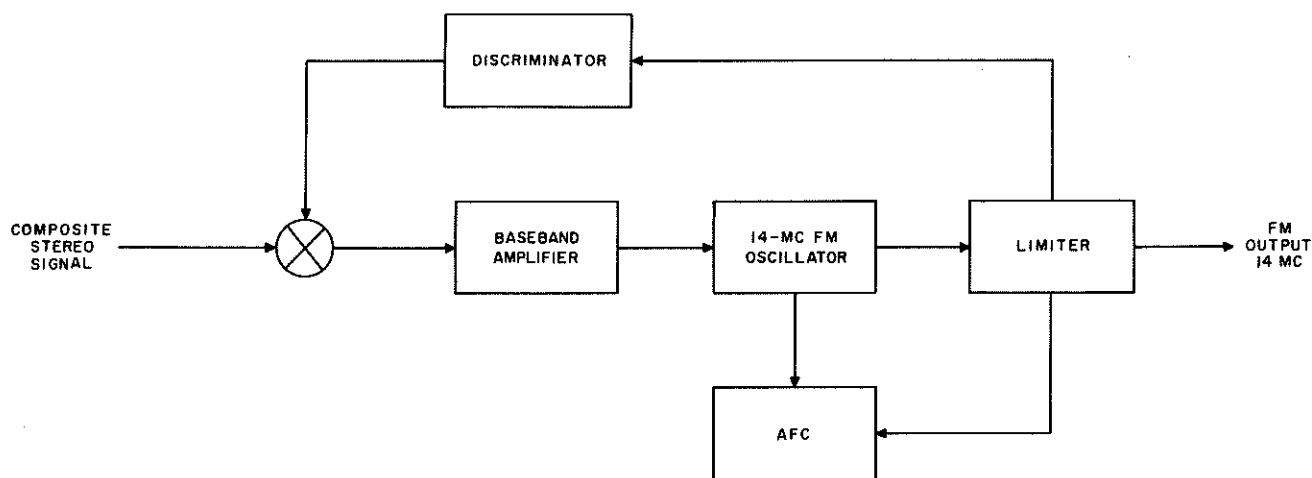


Figure 2-1. Direct FM Modulation, Simplified Block Diagram

2.2.2 DIRECT FREQUENCY MODULATION.

The direct method of generating a frequency modulated signal is shown in figure 2-1. The complete stereo signal (and SCA signal if used) is fed through a baseband amplifier to a frequency-modulated oscillator. The discriminator completes an audio feedback loop which suppresses FM oscillator distortion, incidental FM noise, transient carrier offset, and gain/phase variation in the baseband amplifier and modulator. The center frequency of the oscillator is not sufficiently stable so an automatic frequency control (afc) circuit is required to maintain frequency stability. The output of the modulator is a 14-mc FM signal with ± 75 -kc peak deviation. The output frequency is obtained by translating this signal with a stable vhf oscillator. The use of the direct FM system removes the requirement for double modulators, phase delay lines, and baseband amplifiers with a response which changes with frequency.

2.3 BLOCK DIAGRAM.

Refer to figure 2-2, a block diagram of the A830-2.

2.3.1 MODULATOR.

The A830-2 uses the direct FM method of generating an FM signal. The baseband input (and SCA input, if used) is connected to baseband amplifiers Q607 and Q608. The response of these amplifiers is flat.

The gain of the baseband amplifiers is adjustable with AMPL BIAS control R641. Refer to figure 5-1. The emitter voltage on Q608 is regulated to +15 volts by a silicon breakdown diode, CR609. The output of Q608 is coupled to frequency-modulated oscillator Q601. Q601 is an LC oscillator which has a center frequency of 14 mc. The tuned circuit in the base of Q601 contains a voltage-sensitive capacitor, C654. Refer to figure 5-1. The capacitance of C654 varies proportionately with the voltage across it. The change in capacity of C654 makes a corresponding change in the frequency of oscillations in Q601. Thus, the frequency deviation of the output of Q601 is directly proportional to the amplitude of the modulating signal and the peak deviation is ± 75 kc.

The output of Q601 is coupled to two limiters, Q602 and Q603. The limiters remove any amplitude modulation from the FM signal. This amplitude modulation is caused by variation of the tuned circuit capacity by the baseband signal. The transistors do not do any limiting. The limiting takes place in the diodes connected to the collectors. This method provides symmetrical limiting (positive and negative) which avoids the phase modulation that occurs when unsymmetrical clipping followed by filtering is used. The limiters are set up so that as the input level is raised, the second limiter operates first; just before it becomes nonlinear, the first limiter starts limiting. The limiting range is approximately 31 db.

The output of the second limiter is coupled to discriminator driver Q604. One output of the discriminator driver is connected to modulator discriminator T601 and the other output goes to output amplifier Q606.

Modulator discriminator T601 converts the frequency-modulated 14-mc signal to an AM signal which is detected by diodes CR607 and CR608. The detected audio is mixed with the input baseband audio at the input to the baseband amplifiers. This feedback loop suppresses distortion from the FM oscillator, incidental FM noise, transient carrier offset, and gain/phase variation in the baseband amplifier and modulator.

Output amplifier Q606 provides a signal output of 1.0 volt rms for the balanced mixer in the power amplifier compartment. This output is matched to 50 ohms by an L-section impedance, L611 and C634. A low-pass filter, C632, C633, and L610, attenuates harmonics of the 14-mc signal. A portion of this output is rectified and connected to meter switch S101 for monitoring purposes.

The second output from Q606 is coupled to afc buffer amplifier Q605. This amplifier, as well as the limiters and amplifiers preceding it, reduces oscillator frequency change caused by variation of loading on the output. The output of Q605 is 0.1 volt rms across 50 ohms.

2.3.2 AUTOMATIC FREQUENCY CONTROL.

The A830-2 requires automatic frequency control to maintain the center frequency of the modulated oscillator at 14 mc. The error in frequency of this oscillator may be caused by temperature drift, carrier shift due to distortion in the modulator, etc. The afc circuits correct these errors to bring the stability of the output frequency to ± 1000 cycles per second over a temperature range of $+10^{\circ}\text{C}(+50^{\circ}\text{F})$ to $+55^{\circ}\text{C}(+131^{\circ}\text{F})$ and a line voltage range of ± 5 percent.

The afc correction voltage is obtained by comparing the modulator output signal with the output of a crystal-controlled reference oscillator, and deriving a d-c voltage which is proportional in magnitude and polarity to the magnitude and direction of the difference in frequency of these two signals.

The reference oscillator is a conventional crystal-controlled oscillator using a fundamental 14-mc series-resonant crystal. The temperature drift of this crystal contributes only ± 70 cycles per second to the output frequency drift over temperature.

The signal from afc buffer Q605 and the output from the reference oscillator are connected to a diode switch, CR501 and CR502. The diode switch is simply two diodes which are alternately switched on and off by the 5-cps square wave. The diode switch is controlled by a signal from keying generator Q508. This

signal, a square wave with a frequency of approximately 5 cps, alternately couples the reference signal, then the modulated carrier, to the input of first limiter Q501.

The two limiters, Q501 and Q502, and discriminator driver Q503 are identical to the limiters and driver (Q602, Q603, and Q604) used in the modulator. The limiters remove any amplitude difference which might exist between the two signals. The level of the reference signal is adjustable with REF LEVEL control R572. Q503 amplifies the limited signal to a level sufficient to drive the afc discriminator. Assume that there is no modulation applied. In this case, the output from the discriminator will be a 5-cps square wave with an amplitude proportional to the frequency error in the FM oscillator.

The 5-cps error signal is amplified and applied to the synchronous detector which develops the d-c correction voltage. This d-c voltage is coupled through a low-pass filter to the voltage-sensitive capacitor in the frequency-modulated oscillator to tune the FM oscillator back on frequency.

The operation of the afc circuitry is only slightly different when modulation is applied at ± 75 -kc deviation. Assume now that modulation is applied and an error of 100 cps exists in the FM oscillator. The output of the afc discriminator due to the 100-cps signal would be $100 K_d$ where K_d is the gain of the discriminator in volts per cps. The output of the discriminator due to the modulation on the carrier would be $150,000 K_d$. This means that the undesired signal is 1500 times greater than the desired signal. The undesired signal is removed by the modulation canceling circuit consisting of baseband cancel amplifier Q511 and diode switch CR511. Whenever the modulated carrier is connected to the first limiter diode switch, CR501 and CR502, the baseband audio input is connected to the discriminator output by diode switch CR511. This baseband audio is 180 degrees out of phase with the discriminator output, and when MOD BAL control R652 is properly adjusted, the output of the afc discriminator due to modulation is completely canceled. The 5-cps error signal due to the frequency error in the FM oscillator is then amplified and detected as if modulation were not applied.

Note that the afc discriminator is used as a comparator rather than as a reference. The exact center frequency of the discriminator is not important since the output voltage need only be proportional to the difference in the two frequencies rather than to the absolute value of these frequencies. Therefore, the center frequency stability of the discriminator does not effect the operation of the afc system.

The last stage of the error signal amplifiers, Q507, is a phase splitter to provide a push-pull output to the synchronous detector. The synchronous detector

is keyed by the 5-cps square-wave keying signal from the keying generator.

The synchronous detector recovers the information contained in the amplitude and phase of the 5-cps error signal. The circuit used in the A830-2 is actually two synchronous detectors operating from opposite half cycles of the 5-cps square-wave keying signal so that the 5-cps square-wave keying signal is balanced out in the output. This is analogous to a double-sideband balanced modulator in which neither input signal is present in the output.

Figures 2-3 through 2-5 illustrate the operation of the two diode switches and the synchronous detector. The electronic circuit and a mechanical analog for each of the circuits is shown. The resistances marked R_f represent the forward resistance of the diodes.

The output of the synchronous detector may be disabled for test and adjustment by depressing AFC DISABLE switch S102 on the front panel.

2.3.3 POWER AMPLIFIER.

The 14-mc FM signal from the modulator is coupled to a balanced mixer, V427. The other input to V427 is the amplified output of a vhf crystal oscillator, V426A. The crystal oscillator operates with a fifth-overtone series-resonant crystal in the 74- to 94-mc frequency range. The specific frequency of the crystal is 14 mc below the station's assigned output frequency. The exact frequency is adjustable over a small range by VHF OSC FREQ ADJ control C427. This adjustment is required to compensate for the finishing tolerance and aging in crystals Y426 and Y501. The output of V426A is amplified in V426B and coupled to V427. The two input signals are balanced out of the output of V427 and the sum of the two signals is the operating frequency. The MIX BAL control compensates for unbalance between the sections of V427.

The output of V427 is coupled to limiter amplifier V428. The limiter amplifier removes any amplitude modulation resulting from mixing and couples this signal to driver stage V429. The signal is amplified by V429 to a level sufficient to drive power amplifier stage V430. The power output is adjustable with POWER OUT control R454. The tuning and loading of the output stage is accomplished with C461 and C456.

2.3.4 POWER SUPPLY.

The power supply in the A830-2 provides all operating voltages for the A830-2 and 786M-1 Stereo Generator, if used. The primary power may be 115 or 230 volts, 60 cps. The power supply is of conventional design using a bridge rectifier and a voltage divider for the high voltages. The low voltages are obtained from full-wave rectifiers. Voltage breakdown diodes are used for regulating the +20-volt, +10-volt, and -10-volt outputs to ± 5 percent.

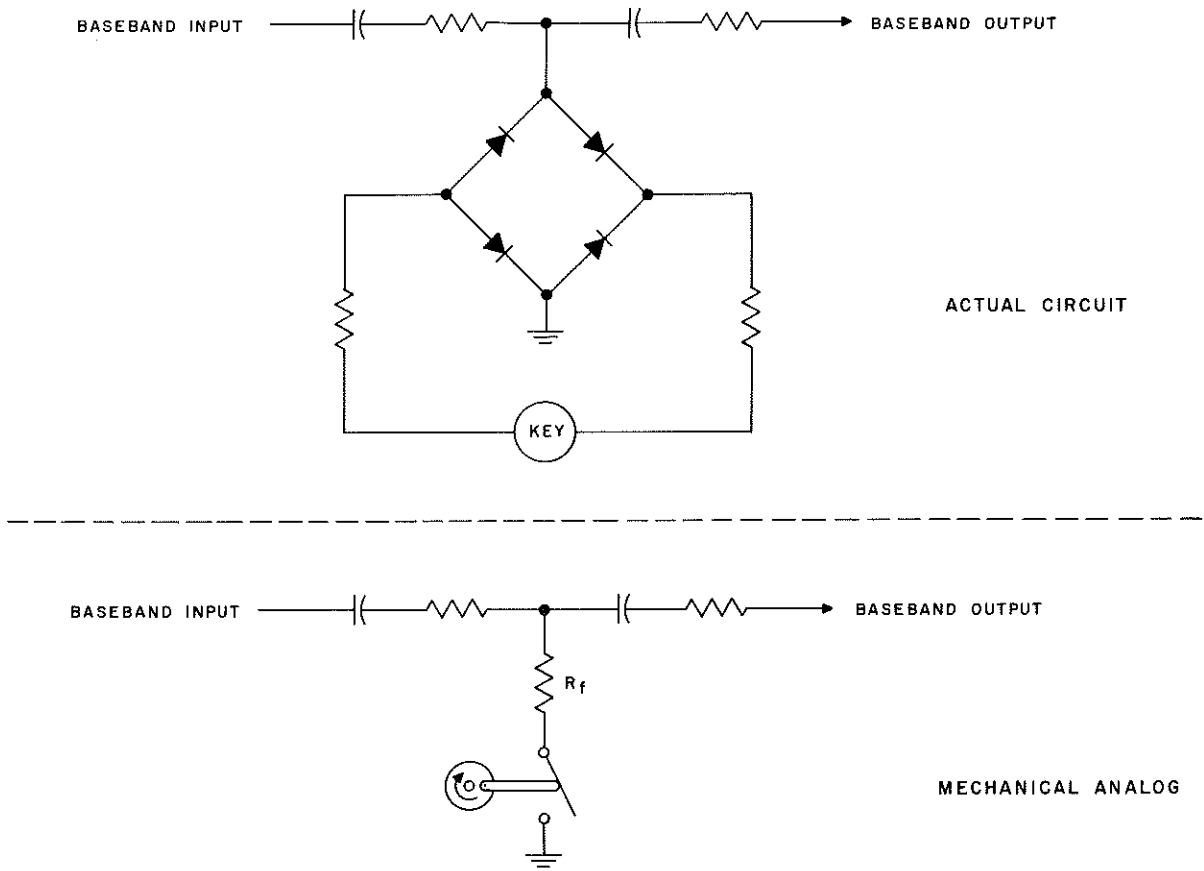


Figure 2-4. Baseband Cancel Switch, Simplified Schematic and Mechanical Analog Diagram

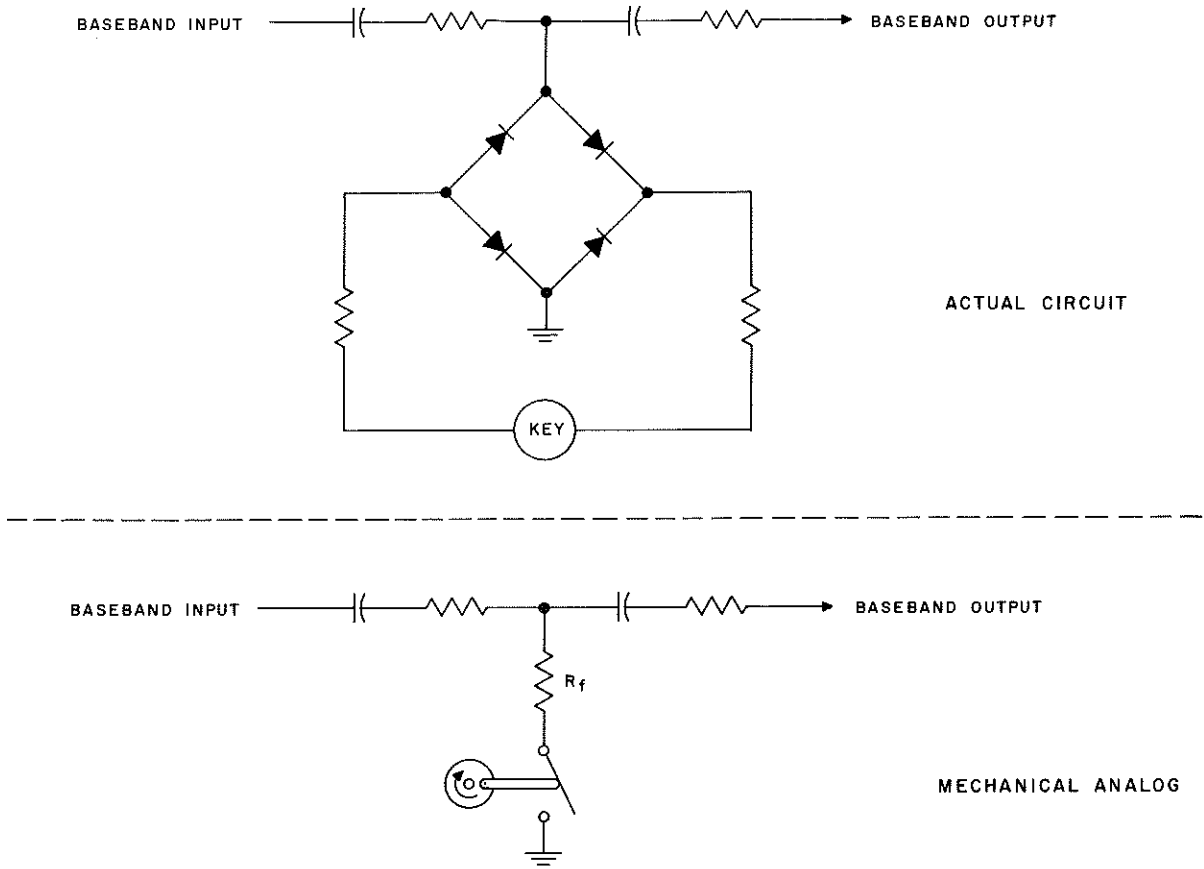


Figure 2-4. Baseband Cancel Switch, Simplified Schematic and Mechanical Analog Diagram

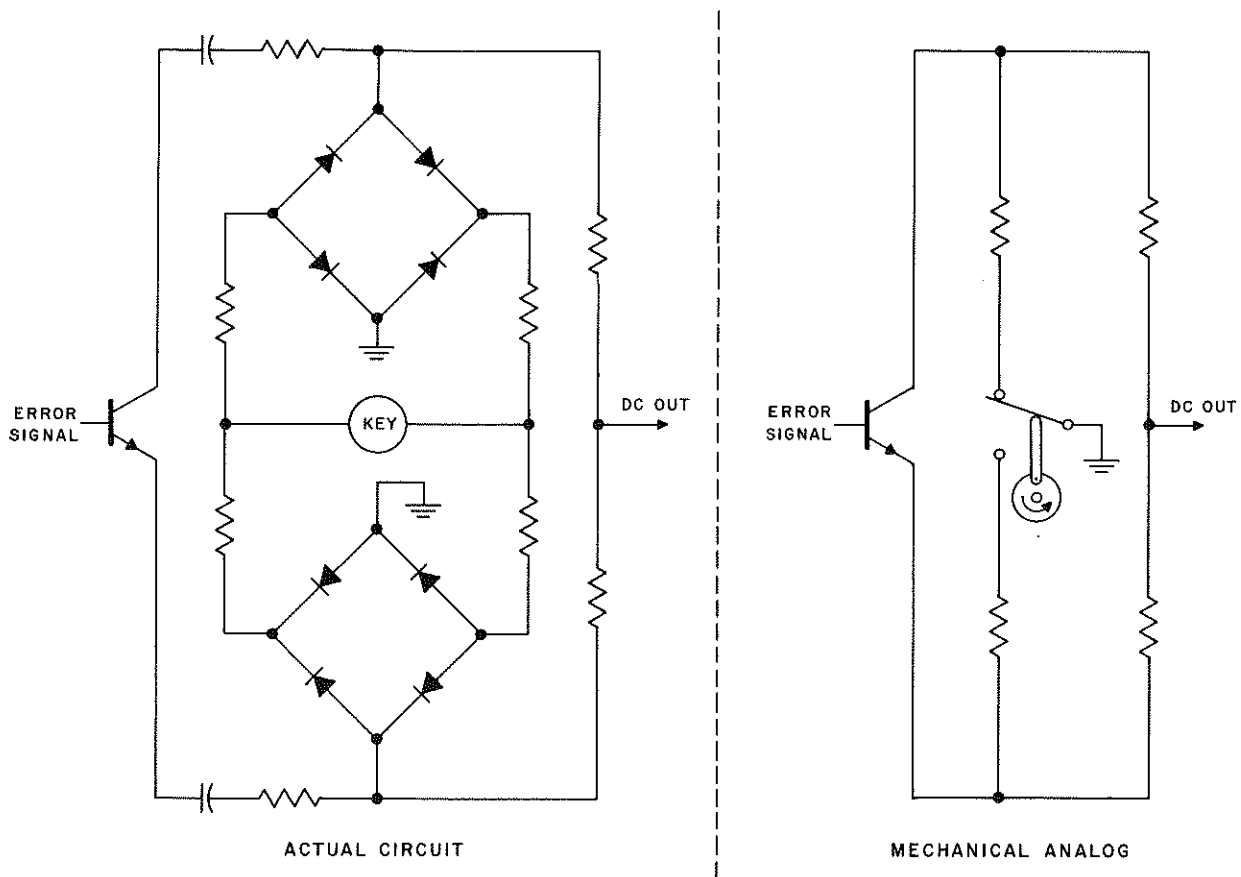


Figure 2-5. Synchronous Detector, Simplified Schematic and Mechanical Analog Diagram

SECTION III MAINTENANCE

3.1 GENERAL.

This section contains alignment instructions, adjustment procedures, and minimum performance standards for the A830-2.

3.2 TEST EQUIPMENT REQUIRED.

The test equipment in table 3-1, or its equivalent, is required to perform the procedures given in this section.

TABLE 3-1
TEST EQUIPMENT REQUIRED

ITEM	MANUFACTURER'S DESIGNATION
Audio oscillator	Hewlett-Packard 200AB
Distortion and noise meter	Hewlett-Packard 330D
A-c vtvm	Hewlett-Packard 410B
R-f vtvm*	Bird 91C
Communications receiver	Capable of receiving 14 mc
10-db pad	Microlab AD-10N
Oscilloscope	
FM monitor	Hewlett-Packard 335B
50-ohm load	
*The 91C is not required if a Tektronix 541 oscilloscope is available. See paragraph 3.3.10.	

3.3 ALIGNMENT AND ADJUSTMENT.



Do not make any adjustment in the modulator or automatic frequency control sections of the A830-2 unless trouble has definitely been traced to misadjustment.

3.3.1 PRELIMINARY ADJUSTMENTS.

Perform the following procedure prior to performing any of the alignment procedures.

- a. Set the meter switch on the A830-2 to the OFF position.
- b. Short AFC DISABLE switch S102 on the A830-2 with a clip lead.

c. Connect the 50-ohm load to RF OUTPUT jack J402.

d. Operate POWER switch S401 to the ON position. Allow 10 minutes for equipment warm up.

3.3.2 MODULATOR LIMITER-DISCRIMINATOR ALIGNMENT.

- a. Remove Q601 from its socket.
- b. Rotate REF LEVEL control R572 fully counterclockwise.
- c. Connect a 0.01-uf capacitor and clip lead between the movable arm of REF LEVEL control R572 and the emitter pin on the socket for Q601. This supplies an accurate 14-mc signal for alignment of the A830-2.
- d. Connect the HP-410B to TP602 and set it to the lowest d-c scale.
- e. Rotate R572 clockwise until an indication is observed on the HP-410B.

NOTE

During this adjustment, maintain the 14-mc signal at a level below limiting. Limiting causes the tuning peaks to be very broad.

f. Adjust C639, L606, and L603 for maximum indication on the HP-410B.

g. Remove the 0.01-uf capacitor and clip lead from XQ601 and R572. Replace Q601 into XQ601.

h. Connect the 91C to TP504.

NOTE

Refer to note in paragraph 3.3.10.

- i. Remove Q509 from its socket.
- j. Adjust R572 for an indication of 30 millivolts.
- k. Replace Q509.

3.3.3 MODULATOR OUTPUT AMPLIFIER TUNING.

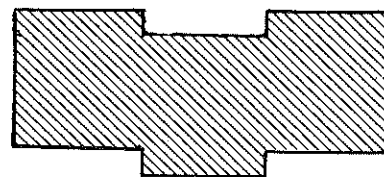
- a. Set the meter selector switch on the front panel of the A830-2 to the MOD OUTPUT B position.
- b. Tune L611 for maximum indication on the front panel meter.

3.3.4 AFC BUFFER TUNING.

- a. Connect the 91C (or Tektronix oscilloscope) to TP504.
- b. Remove Q510 from its socket.
- c. Tune L608 for maximum indication on the 91C (or oscilloscope).
- d. Replace Q510 into its socket.

3.3.5 FM OSCILLATOR ADJUSTMENT.

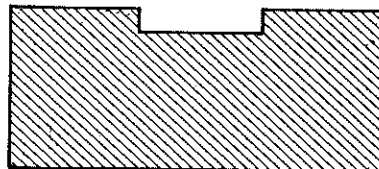
- a. Loosely couple the communications receiver to FM oscillator Q601 and to the 14-mc reference oscillator. If the receiver has a bfo, turn it off.
- b. Adjust OSC FREQ control C606 for a zero beat on the communication receiver.
- c. Remove the communications receiver.



IMPROPER ADJUSTMENT

3.3.6 MODULATION DISCRIMINATOR.

- a. Connect the HP-410B to TP601.
- b. Adjust DISCR SEC control C644 for a zero indication on the HP-410B.
- c. Check adjustment of DISCR PRI control C639. It should be set for a maximum indication, and C644 set for a minimum indication.



PROPER ADJUSTMENT

3.3.7 AMPLIFIER BIAS ADJUSTMENT.

- a. Connect the HP-410B to TP603.
- b. Adjust R641 for an indication of +7.5 volts d-c.

Figure 3-1. Reference Level Adjustment, Oscilloscope Patterns

3.3.8 MODULATOR GAIN ADJUSTMENT.

- a. Remove the 50-ohms load and connect the HP-335B to the output of the A830-2 through the 10-db pad.
- b. Connect the HP-200AB to baseband input jack J604.
- c. Set the output level of the HP-200AB to 0.1 volt rms at 1000 cps.
- d. Adjust MOD GAIN control R635 for an indication of 100 percent modulation (± 75 -kc deviation) on the HP-335B.

3.3.9 AFC LIMITER-DISCRIMINATOR ALIGNMENT.

- a. Connect the HP-410B to TP501 and set to 10-volt scale.
- b. Remove Q509 from its socket.
- c. Adjust REF LEVEL control R572 fully counterclockwise.
- d. Adjust L504, L505, and C515 (DISCR PRI control) for maximum indication on the HP-410B.
- e. Connect the 91C to TP504.
- f. Adjust R572 for an indication of 30 millivolts on the 91C.
- g. Connect the HP-410B to TP502 and adjust DISCR SEC control C518 for a minimum indication on the HP-410B when set to its lowest range.
- h. Replace Q509 in its socket.
- i. Reset R572 as specified in paragraph 3.3.10.

- a. Connect the 91C to TP504.
- b. Remove Q510 from its socket.
- c. Tune L608 for maximum indication on the 91C. Record the reading on the 91C.
- d. Replace Q510 and remove Q509 from its socket.
- e. Adjust R572 for the same indication recorded in step c.
- f. Replace Q509 in its socket.
- g. Connect the Tektronix oscilloscope to TP504.
- h. Adjust R572 for alignment of base lines of alternate signals. See figure 3-1.
- i. Set meter switch S101 on the A830-2 front panel to the 14 MC REF B position. The meter should indicate in the B range.

3.3.11 BASEBAND CANCELING ADJUSTMENT.

- a. Remove Q510 from its socket.
- b. Make certain that AFC DISABLE switch S102 is still jumpered.
- c. Rotate R562 to its maximum counterclockwise position.
- d. Connect the oscilloscope to TP503.
- e. Connect the HP-200AB to baseband input jack J604.
- f. Set the HP-200AB to 50 cps.
- g. Set the level of the HP-200AB to produce a 2-volt peak-to-peak waveform on the oscilloscope.
- h. Adjust the oscilloscope to display the 50-cps waveform.
- i. Slowly adjust R562 to cancel the signal on the oscilloscope. Gradually increase the input signal from the HP-200AB to 0.1 volt while maintaining the null by adjustment of R562. The waveform on the oscilloscope should be less than 1 volt peak-to-peak when the input signal is 0.1 volt.
- j. Replace Q510.

3.3.10 REFERENCE LEVEL ADJUSTMENT.

NOTE

The following procedure may be accomplished with the 91C or with a Tektronix 541 oscilloscope. Steps a through f describe the procedure for using the 91C and steps g and h describe the procedure for using the 541 oscilloscope.

3.3.12 AFC LOOP CHECK.

- a. Remove the jumper from across AFC DISABLE SWITCH S102.
- b. Observe the deviation meter on the HP-335B and depress the AFC DISABLE switch. The frequency should slowly drift off and come back quickly when the AFC DISABLE switch is released.

3.3.13 POWER AMPLIFIER ADJUSTMENT AND TUNING.

- a. Set meter switch S101 on the A830-2 to the MIXER GRID A position.
- b. Adjust C431 for maximum indication on front panel meter M101.
- c. Adjust VHF OSC FREQ ADJ control C427 so that the HP-335B indicates on frequency.
- d. Switch S101 to BUFFER GRID A and observe meter. It should indicate approximately 1 unit.
- e. Switch S101 to V428 B.
- f. Adjust L429, L430, and MIX BAL control R438 for maximum indication on the front panel meter.
- g. Switch S101 to V429 B.
- h. Adjust L431 and L432 for maximum indication on the front panel meter.
- i. Remove all connections to J402 and connect the 50-ohm load to J402.
- j. Connect the HP-410B across the 50-ohm load.
- k. Switch S101 to V430C B.
- l. Adjust PA PLATE control C461 for minimum indication on the front panel.
- m. Adjust PA MATCH control C456 for a maximum indication on the HP-410B.
- n. Adjust POWER OUT control R454 for an indication of 22.5 volts.

3.4 MINIMUM PERFORMANCE STANDARDS.

The A830-2 should be tested in accordance with the following procedures after alignment and adjustment. The following tests may be used to determine if the A830-2 is operating properly.

3.4.1 PRELIMINARY ADJUSTMENTS.

- a. Connect the HP-200AB to J604 on the A830-2.
- b. Connect the HP-335B through the 10-db pad to J402.
- c. Connect the HP-330D to the modulation output of the HP-335B.

3.4.2 FREQUENCY RESPONSE.

- a. Perform the preliminary procedures of paragraph 3.4.1.
- b. Set the HP-200AB for an output of 0.100 volt on a frequency of 400 cps.
- c. Adjust the HP-330D for an indication of 0 db.
- d. Set the HP-200AB to 50 cps and reset output level to 0.100 volt. The HP-330D indication should be 0 ± 0.3 db.
- e. Repeat step d for a frequency setting of 15,000 cps.

3.4.3 HARMONIC DISTORTION.

- a. Perform the preliminary procedures of paragraph 3.4.1.
- b. Set the HP-200B frequency to 50 cps and the output level to 0.01 volt. Measure the harmonic distortion on the HP-330D. It should be 1.0 percent or less.
- c. Repeat step b for frequencies of 400 and 15,000 cps.

3.4.4 RESIDUAL FM NOISE.

- a. Perform the preliminary procedures of paragraph 3.4.1.
- b. Set the HP-200AB to 400 cps at an output level of 0.100 volt.
- c. Measure the level across terminals 1 and 2 of the HP-335B with the HP-330D. Record the reading.
- d. Turn off the HP-200AB and record the indication on the HP-330D. Record this reading.
- e. Compute the s+n/n ratio using the readings recorded in steps c and d. The ratio should not be less than 60 db.

3.4.5 CARRIER FREQUENCY SHIFT.

- a. Perform the preliminary procedures of paragraph 3.4.1.
- b. Remove the audio input from J604.
- c. Connect the output of the HP-200AB to terminals 3 and 4 of TB101.
- d. Adjust the output of the HP-200AB to a frequency of 1000 cps and to a level sufficient to modulate the carrier 100 percent.
- e. Remove the audio connections from terminals 3 and 4.
- f. Adjust the HP-335B to indicate 0 frequency deviation.
- g. Touch the audio connections from the HP-200AB to terminals 3 and 4 of TB101 and note the carrier deviation on the HP-335B. It should be less than 500 cps.

3.4.6 AM NOISE MEASUREMENT.

- a. Perform the preliminary procedures of paragraph 3.4.1.
- b. Set the HP-335B function switch to CARRIER LEVEL and read the carrier output voltage on the modulation meter. An indication of 100 percent modulation equals 10 volts, 90 percent modulation equals 9 volts, etc.
- c. Connect the 91C to J3 on the HP-335B and measure the noise output. Compute the carrier-to-AM noise ratio using the following formula:

$$\frac{\text{Carrier}}{\text{AM Noise}} = 20 \log_{10} \frac{\text{Carrier Voltage}}{\text{AM Noise Voltage}}$$

The ratio should not be less than 50 db.

SECTION IV PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
A830-2 10 W WIDE-BAND FM BROADCAST EXCITER 549-1588-00		
PANEL		
FL101	ATTENUATOR, FIXED: pre-emphasis network for use in FM commercial broadcast equipment; 600 ohms balanced, w/ center tap; ± 1 to ± 1.5 db frequency response	379-0426-00
FL102	FILTER, HIGH PASS: metal encased, hermetically sealed, input 600 ohms, output 600 ohms, 4 solder type terminals; continuous duty cycle; A, D, C, part no. D10390	673-0869-00
M101	METER, ARBITRARY SCALE: permanent magnet moving coil d-c microammeter, 500 ua, 100 ohms resistance; 2 scales, A scale, 10-90 ua, B scale, 175-500 ua; Assembly Products, Inc. part no. 361	458-0650-00
R101	RESISTOR, FIXED, COMPOSITION: 1000 ohms $\pm 10\%$, 1/2 w	745-1352-00
R102	RESISTOR, FIXED, FILM: 562 ohms $\pm 1\%$, 1/4 w	705-7084-00
R103	RESISTOR, FIXED, FILM: 261 ohms $\pm 1\%$, 1/4 w	705-7068-00
R104	RESISTOR, FIXED, FILM: same as R103	705-7068-00
S101	SWITCH, ROTARY: 2 circuit, 2 pole, 10 position, 2 section, 2 moving, 22 fixed contacts	259-1567-00
S102	SWITCH, PUSH: spst; momentary; 125 v a-c, 0.75 amp, 250 v a-c, 0.25 amp; Cutler-Hammer part no. 8411-K6	266-6169-00
TB101	TERMINAL BOARD: barrier type w/ double row front connection of 12 screw terminals; 13/32 in. by 7/8 in. by 5-11/64 in.; Howard B. Jones, Div. Cinch Mfg. Co. part no. 12-140-D	367-0518-00
TB102	TERMINAL BOARD: Bakelite, 4 terminals, 1 grounded, 3 insulated; 21/32 in. w by 1-1/2 in. lg; Cinch Mfg. Corp. part no. 1534-A	306-2240-00
XFL101	SOCKET, ELECTRON TUBE: 8 prong octal tube socket w/ steel mtg plate; Amphenol-Borg Electronics part no. 88-8TM	220-1005-00
POWER AMPLIFIER AND POWER SUPPLY		
C401	CAPACITOR, FIXED, CERAMIC: 1000 uuf $\pm 20\%$, 500 vdcw	913-1186-00
C402	CAPACITOR, FIXED, CERAMIC: same as C401	913-1186-00
C408		
C409	CAPACITOR, FIXED, ELECTROLYTIC: dual section, 40 uf ea section; -10% $+50\%$, 450 vdcw; Sprague Electric part no. Y27674	183-1259-00
A & B		
C410	CAPACITOR, FIXED, ELECTROLYTIC: 1000 uf -10% $+100\%$, 50 vdcw	183-1403-00
C411	CAPACITOR, FIXED, ELECTROLYTIC: same as C410	183-1403-00
C412	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf -10% $+100\%$, 50 vdcw	183-1575-00
C413	CAPACITOR, FIXED, ELECTROLYTIC: 4 uf -10% $+100\%$, 50 vdcw	183-1389-00
C414	NOT USED	
C425		
C426	CAPACITOR, FIXED, MICA: 5 uuf $\pm 5\%$, 500 vdcw; Electro Motive part no. DM15C050J01	912-2750-00
C427	CAPACITOR, VARIABLE, CERAMIC: 3.0 uuf min to 12.0 uuf max, 350 vdcw	917-1072-00
C428	CAPACITOR, FIXED, MICA: 470 uuf $\pm 5\%$, 300 vdcw; Electro Motive part no. DM15F471J01	912-2864-00
C429	CAPACITOR, FIXED, CERAMIC: 1.5 uuf $\pm 5\%$, 500 vdcw; Stackpole Carbon Co. part no. GA-1.5uufPORM5	913-2981-00
C430	CAPACITOR, FIXED, CERAMIC: 4700 uuf $\pm 20\%$, 500 vdcw	913-1187-00
C431	CAPACITOR, VARIABLE, AIR: 3.0-9.8 uuf, 1250 vdcw; E. F. Johnson part no. 160-211	922-0046-00
C432	CAPACITOR, FIXED, CERAMIC: 7.5 uuf $\pm 5\%$, 500 vdcw; Stackpole Carbon Co. part no. GA-7.5uufPORM5	913-2997-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C433	CAPACITOR, FIXED, MICA: same as C426	912-2774-00
C434	CAPACITOR, FIXED, MICA: same as C426	912-2774-00
C435	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C436	CAPACITOR, FIXED, MICA: 10 uuf $\pm 5\%$, 500 vdcw; Electro Motive part no. DM15C100J01	912-2753-00
C437	CAPACITOR, FIXED, MICA: same as C436	912-2753-00
C438	CAPACITOR, FIXED, CERAMIC: same as C429	913-2981-00
C439	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
thru		
C444		
C445	CAPACITOR, FIXED, CERAMIC: same as C429	913-2981-00
C446	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
thru		
C449		
C450	CAPACITOR, FIXED, CERAMIC: 1000 uuf -20% $+80\%$, 500 vdcw; Erie Resistor part no. 327-029X5T0102Z	913-1292-00
C451	CAPACITOR, FIXED, CERAMIC: same as C429	913-2981-00
C452	CAPACITOR, FIXED, MICA: 33 uuf $\pm 5\%$, 500 vdcw; Electro Motive part no. DM15E330J01	912-2780-00
C453	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C454	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C455	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C456	CAPACITOR, VARIABLE, CERAMIC: 4.5 uuf min to 25 uuf max, 500 vdcw	917-1026-00
C457	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C458	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C459	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C460	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C461	CAPACITOR, VARIABLE, AIR: 3.0 uuf min to 18.7 uuf max; 1250 v a-c; E. F. Johnson Co. part no. 160-110-3	922-0033-00
C462	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C463	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C464	CAPACITOR, FIXED, MICA: same as C428	912-2864-00
C465	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
thru		
C468		
C469	NOT USED	
C470	NOT USED	
C471	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
thru		
C474		
C475	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
thru		
C480		
C481	CAPACITOR, FIXED, CERAMIC: 1.0 uuf $\pm 5\%$, 500 vdcw; Stackpole Carbon Co. part no. GA-1.0uufPORM5	913-2977-00
C482	CAPACITOR, FIXED, MICA: same as C428	912-2864-00
C483	CAPACITOR, FIXED, MICA: same as C428	912-2864-00
C484	CAPACITOR, FIXED, MICA: same as C428	912-2864-00
C485	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C486	CAPACITOR, FIXED, MICA: same as C426	912-2750-00
C487	CAPACITOR, FIXED, MICA: same as C426	912-2750-00
C488	CAPACITOR, FIXED, MICA: same as C426	912-2750-00
C489	CAPACITOR, FIXED, MICA: 150 uuf $\pm 5\%$, 500 vdcw; Electro Motive part no. DM15F151J01	912-2828-00
C490	CAPACITOR, FIXED, MICA: same as C489	912-2828-00
C491	CAPACITOR, FIXED, MICA: 20 uuf $\pm 5\%$, 500 vdcw; Electro Motive part no. DM15C200J01	912-2765-00
CR401	SEMICONDUCTOR DEVICE, DIODE: silicon; Motorola part no. 1N1492	353-1661-00
CR402	SEMICONDUCTOR DEVICE, DIODE: same as CR401	353-1661-00
thru		
CR408		
CR409	SEMICONDUCTOR DEVICE, DIODE: silicon, single phase, half-wave; General Electric part no. 1N538	353-1526-00
CR410	SEMICONDUCTOR DEVICE, DIODE: same as CR409	353-1526-00
CR411	SEMICONDUCTOR DEVICE, SET: two hermetically sealed silicon voltage reference diodes; Motorola part no. 10M10ZB1	353-1238-00
A & B		
CR412	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed; International Rect. Corp part no. 1Z10V01	353-1208-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
CR413	SEMICONDUCTOR DEVICE, DIODE: same as CR409	353-1526-00
CR414	SEMICONDUCTOR DEVICE, DIODE: same as CR409	353-1526-00
CR415	SEMICONDUCTOR DEVICE, DIODE: same as CR412	353-1208-00
CR416 thru CR425	NOT USED	
CR426	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed, diffused-junction type; Motorola part no. 1N977A	353-3237-00
F401	FUSE, CARTRIDGE: 1.00 amp current rating, 250 v, glass body, ferrule terminals; Bussmann part no. MDL 1	264-4280-00
F402	FUSE, CARTRIDGE: 0.250 amp current rating, 250 v d-c, glass body, ferrule terminals	264-4240-00
J401	JACK, TELEPHONE: steel, miniature, panel mtg; Switchcraft, Inc. part no. 3501FP	360-0148-00
J402	CONNECTOR, RECEPTACLE, ELECTRICAL: single round female contact, right angle shape; Amphenol part no. 31-213	357-9258-00
L401	REACTOR: 7.2 henrys min. 0.300 amp d-c; 60 ohms; 4-37/64 in. by 5-5/16 in. overall; Stancor Elec. Inc. part no. RS-8300	668-0015-00
L402 thru L425	NOT USED	
L426	COIL, RADIO FREQUENCY: 0.68 uh \pm 3%, 250 mc, 0.12 ohm, 1750 ma; 3/16 in. dia by 7/16 in. lg; Delevon part no. 1840	240-1844-00
L427	COIL, RADIO FREQUENCY: 0.25 uh \pm 3%, 400 mc, 0.04 ohm, 2850 ma; 3/16 in. dia by 7/16 in. lg	240-1843-00
L428	COIL, RADIO FREQUENCY, NO. 1: single layer wound #14 wire, 1/2 in. ID of coil, 7/8 in. lg overall	549-1605-003
L429	COIL, RADIO FREQUENCY: variable; 88 to 108 mc, +15°C to +55°C temp range; 850 v d-c dielectric strength	278-0730-00
L430 thru L434	COIL, RADIO FREQUENCY: same as L429	278-0730-00
L435	COIL, RADIO FREQUENCY, NO. 2: single layer wound #16 wire; 3/4 in. ID of coil, 2-7/8 in. lg overall	549-1606-003
L436	COIL, RADIO FREQUENCY: single layer wound; 5.6 uh, 860 ma current, 0.95 ohm; Jeffers Electronics Div. of Speer Carbon Co. part no. 10402-34	240-0179-00
L437	COIL, RADIO FREQUENCY: same as L436	240-0179-00
L438	COIL, RADIO FREQUENCY: single layer wound, 0.47 uh nom inductance, 0.09 ohm max dc resistance, 1600 ma max current rating; Jeffers Electronics, Div. of Speer Carbon Co. part no. 10100-126	240-0060-00
L439	COIL, RADIO FREQUENCY, NO. 3: single layer wound #14 wire, 3/4 in. ID of coil, 1-3/8 in. h; approx 1-11/16 in. lg overall	549-1607-003
L440	COIL, RADIO FREQUENCY: 1.00 uh \pm 10%, 0.30 ohm d-c resistance; 850 ma d-c; Jeffers Electronics part no. 10100-128	240-0062-00
L441	COIL, RADIO FREQUENCY, NO. 4: single layer wound #18 wire, 3/16 in. ID of coil, 5/16 in. lg	553-5671-002
R401	RESISTOR, FIXED, WIREWOUND: 100 ohms \pm 10%, 10 w	710-9053-00
R402	RESISTOR, FIXED, WIREWOUND: 16,000 ohms \pm 5%, 25 w	710-0369-00
R403	NOT USED	
R404	RESISTOR, FIXED, WIREWOUND: 600 ohms \pm 10%, 10 w	710-9081-00
R405	RESISTOR, FIXED, WIREWOUND: 12,000 ohms \pm 10%, 10 w	710-9070-00
R406	RESISTOR, FIXED, WIREWOUND: 25,000 ohms \pm 10%, 10 w	710-9068-00
R407	RESISTOR, FIXED, WIREWOUND: 5.0 ohms \pm 10%, 5 w	710-9105-00
R408	RESISTOR, FIXED, WIREWOUND: 25 ohms \pm 10%, 7 w	710-9019-00
R409	RESISTOR, FIXED, WIREWOUND: same as R408	710-9019-00
R410	RESISTOR, FIXED, COMPOSITION: 160.0 ohms \pm 5%, 5 w	747-5444-00
R411	RESISTOR, FIXED, COMPOSITION: same as R407	710-9105-00
R412	RESISTOR, FIXED, COMPOSITION: same as R410	747-5444-00
R413	RESISTOR, FIXED, WIREWOUND: 100 ohms \pm 10%, 7 w	710-9005-00
R414 thru R425	NOT USED	

ITEM	DESCRIPTION	COLLINS PART NUMBER
R426	RESISTOR, FIXED, COMPOSITION: 10,000 ohms \pm 10%, 1/2 w	745-1394-00
R427	RESISTOR, FIXED, COMPOSITION: 1000 ohms \pm 10%, 1/2 w	745-1352-00
R428	RESISTOR, FIXED, COMPOSITION: 220 ohms \pm 10%, 1/2 w	745-1324-00
R429	RESISTOR, FIXED, COMPOSITION: 2700 ohms \pm 10%, 1/2 w	745-1370-00
R430	RESISTOR, FIXED, COMPOSITION: 47,000 ohms \pm 10%, 1/2 w	745-1422-00
R431	RESISTOR, FIXED, COMPOSITION: 1500 ohms \pm 10%, 1/2 w	745-1350-00
R432	RESISTOR, FIXED, COMPOSITION: 39,000 ohms \pm 10%, 1/2 w	745-1419-00
R433	RESISTOR, FIXED, COMPOSITION: 2200 ohms \pm 10%, 1/2 w	745-1366-00
R434	RESISTOR, FIXED, COMPOSITION: 0.10 megohm \pm 10%, 1/2 w	745-1436-00
R435	RESISTOR, FIXED, COMPOSITION: same as R434	745-1436-00
R436	RESISTOR, FIXED, COMPOSITION: same as R431	745-1359-00
R437	RESISTOR, FIXED, COMPOSITION: same as R433	745-1366-00
R438	RESISTOR, VARIABLE: COMPOSITION; 500 ohms \pm 20%, 0.2 w	376-0202-00
R439	RESISTOR, FIXED, COMPOSITION: 3300 ohms \pm 10%, 2 w	745-5673-00
R440	RESISTOR, FIXED, COMPOSITION: same as R439	745-5673-00
R441	RESISTOR, FIXED, COMPOSITION: same as R434	745-1436-00
R442	RESISTOR, FIXED, COMPOSITION: same as R426	745-1394-00
R443	RESISTOR, FIXED, COMPOSITION: 68 ohms \pm 10%, 1/2 w	745-1303-00
R444	RESISTOR, FIXED, COMPOSITION: 39,000 ohms \pm 10%, 1 w	745-3419-00
R445	RESISTOR, FIXED, COMPOSITION: 4700 ohms \pm 10%, 1 w	745-3380-00
R446	RESISTOR, FIXED, COMPOSITION: same as R434	745-1436-00
R447	RESISTOR, FIXED, COMPOSITION: same as R426	745-1394-00
R448	RESISTOR, FIXED, COMPOSITION: 270 ohms \pm 10%, 1 w	745-3328-00
R449	RESISTOR, FIXED, COMPOSITION: 10,000 ohms \pm 10%, 1 w	745-3394-00
R450	RESISTOR, FIXED, COMPOSITION: 820 ohms \pm 10%, 2 w	745-5649-00
R451	RESISTOR, FIXED, COMPOSITION: 10 ohms \pm 10%, 1/2 w	745-1268-00
R452	RESISTOR, FIXED, COMPOSITION: 3300 ohms \pm 10%, 1/2 w	745-1373-00
R453	RESISTOR, FIXED, COMPOSITION: same as R432	745-1419-00
R454	RESISTOR, VARIABLE, WIREWOUND: 250 ohms \pm 10%, 2 w	377-0821-00
R455	RESISTOR, FIXED, COMPOSITION: 180 ohms \pm 10%, 2 w	745-5621-00
R456	RESISTOR, FIXED, COMPOSITION: 8200 ohms \pm 10%, 1/2 w	745-1391-00
R457	RESISTOR, FIXED, COMPOSITION: 33 ohms \pm 10%, 1/2 w	745-1289-00
R458	RESISTOR, FIXED, COMPOSITION: 100 ohms \pm 10%, 1/2 w	745-1310-00
R459	RESISTOR, FIXED, COMPOSITION: same as R451	745-1268-00
R460	NOT USED	
R461	RESISTOR, FIXED, FILM: 51,000 ohms \pm 10%, 5 w	714-2973-00
R462	RESISTOR, FIXED, COMPOSITION: same as R443	745-1303-00
R463	RESISTOR, FIXED, COMPOSITION: 22,000 ohms \pm 10%, 1/2 w	745-1408-00
R464	RESISTOR, FIXED, COMPOSITION: same as R458	745-1310-00
R465	RESISTOR, FIXED, COMPOSITION: 27,000 ohms \pm 10%, 1/2 w	745-1412-00
R466	RESISTOR, FIXED, WIREWOUND: 20,000 ohms \pm 10%, 10 w	710-9067-00
R467	RESISTOR, FIXED, COMPOSITION: 22,000 ohms \pm 10%, 2 w	745-5708-00
S401	SWITCH, TOGGLE: dpst; 125 v a-c, 15 amp, 250 v a-c, 10 amp; Cutler-Hammer, Inc. part no. 7561K4	286-0099-00
T401	TRANSFORMER, POWER, STEP-UP, STEP-DOWN: pri 120 v; sec. #1, 438 v, sec. #2, 6.3 v, ct; 50/60 cps; continuous duty cycle; Stancor Electric part no. 31215	662-0046-00
T402	TRANSFORMER, POWER, STEP-DOWN: pri 120 v rms; sec. #1, 77 v, ct; sec. #2, 41.5 v, ct; 50/60 cps; continuous duty cycle; Stancor Electric part no. 31214	662-0048-00
T403 thru T425	NOT USED	

ITEM	DESCRIPTION	COLLINS PART NUMBER
T426	TRANSFORMER, RADIO FREQUENCY: pri 14 turns #26 wire, close wound; sec. 13 turns #26 wire, close wound	549-1590-00
TB401	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 1/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1520-A	306-9033-00
TB402	TERMINAL BOARD: Bakelite, 2 terminals; 21/32 in. by 3/4 in. lg; Cinch Mfg. Co. part no. 1513-A	306-2220-00
TB403	TERMINAL BOARD: laminated phenolic w/ 4 solder-lug terminals; 27/32 in. w by 1-1/2 in. lg overall; Cinch Mfg. Co. part no. 1909	306-0838-00
TB404	TERMINAL BOARD: same as TB401	306-9033-00
TB405	TERMINAL BOARD: phenolic; steel mounting base, brass lugs, 12 terminals; H. B. Jones part no. 2012	367-0905-00
TB406	TERMINAL BOARD: same as TB405	367-0905-00
TB407	NOT USED	
thru		
TB425		
TB426	TERMINAL BOARD: phenolic, 4 brass solder-lug terminals; 1/16 in. by 3/8 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1532-A	306-9032-00
TB427	TERMINAL BOARD: same as TB403	306-0838-00
TB428	TERMINAL BOARD: phenolic, 5 brass solder-lug terminals; 1/16 in. by 3/8 in. by 1-7/8 in.; Cinch Mfg. Corp. part no. 1542-A-FV	306-0951-00
TB429	TERMINAL BOARD: same as TB428	306-0951-00
TB430	TERMINAL BOARD: same as TB402	306-2220-00
TB431	TERMINAL BOARD: same as TB428	306-0951-00
V401	NOT USED	
thru		
V425		
V426	ELECTRON TUBE: triode-pentode; Radio Corp. of America part no. 6U8A	255-0328-00
V427	ELECTRON TUBE: glass envelope; twin triode; Radio Corp. of America part no. 12AT7	255-0205-00
V428	ELECTRON TUBE: pentode; Radio Corp. of America part no. 6AU6	255-0202-00
V429	ELECTRON TUBE: glass envelope; vhf beam power; Radio Corp. of America part no. 5763	257-0059-00
V430	ELECTRON TUBE: glass envelope; Radio Corp. of America part no. 2E26	256-0084-00
XF401	FUSE HOLDER: extractor post type, for use w/ 3 AG fuses; 0-20 amp, 100-125 v; clear knob; neon lamp type	265-1072-00
XF402	FUSE HOLDER: same as XF401	265-1072-00
XV401	NOT USED	
thru		
XV425		
XV426	SOCKET, ELECTRON TUBE: 9 contact miniature; copper nonmagnetic alloy contacts; phenolic insulation; Sylvania Electric Products, Inc. part no. 7490-0100	220-1244-00
XV427	SOCKET, ELECTRON TUBE: same as XV426	220-1244-00
XV428	SOCKET, ELECTRON TUBE: 7 contact miniature for uhf application; phenolic insulation; Sylvania Electric Products, Inc. part no. 7470-0125	220-1203-00
XV429	SOCKET, ELECTRON TUBE: same as XV426	220-1244-00
XV430	SOCKET, ELECTRON TUBE: 8 prong octal tube socket w/ steel mtg plate; Amphenol-Borg Electronics part no. 88-8TM	220-1005-00
AUTOMATIC FREQUENCY CONTROL		
C501	CAPACITOR, FIXED, CERAMIC: 1000 uuf ±20%, 500 vdcw	913-1186-00
C502	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C503	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C504	CAPACITOR, FIXED, CERAMIC: 0.01 uf -0% +100% temp range; 100 vdcw; Erie Resistor Corp. part no. 855-502-X550-103P	913-3680-00
C505	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C506	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C507	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C508	CAPACITOR, FIXED, MICA: 10 uuf ±5%, 500 vdcw; Electro Motive part no. DM15C100J01	912-2753-00
C509	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C510	CAPACITOR, FIXED, MICA: 82 uuf ±5%, 500 vdcw; Electro Motive part no. DM15E820J01	912-2810-00
C511	CAPACITOR, FIXED, CERAMIC: 0.1 uf -20% +80%, 50 vdcw; Sprague Electric part no. 33C41	913-3886-00
C512	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C513	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C514	CAPACITOR, FIXED, MICA: 100 uuf ±5% 500 wvdc	912-2816-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C515	CAPACITOR, VARIABLE, CERAMIC: 5.0 uuf min to 37.5 uuf max, 350 vdcw; Erie Resistor part no. 557018C0P039R	917-1073-00
C516	CAPACITOR, FIXED, MICA: 220 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F221J01	912-2840-00
C517	CAPACITOR, FIXED, MICA: 30 uuf ±2%, 500 vdcw; Electro Motive part no. DM15E300G01	912-2776-00
C518	CAPACITOR, VARIABLE, CERAMIC: 3.0 uuf min to 12.0 uuf max, 350 vdcw	917-1072-00
C519	CAPACITOR, FIXED, MICA: 470 uuf ±5%, 300 vdcw; Electro Motive part no. DM15F471J01	912-2864-00
C520	CAPACITOR, FIXED, MICA: same as C519	912-2864-00
C521	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf -10% +100%, 10 vdcw; Sprague Electric part no. S13691	183-2151-00
C522	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf -10%, +100%, 25 vdcw; Sprague Electric part no. 30D188A1	183-1192-00
C523	CAPACITOR, FIXED, CERAMIC: 0.68 uf -20% +80%, 25 vdcw; Sprague Electric part no. 5C12A	913-3809-00
C524	CAPACITOR, FIXED, ELECTROLYTIC: same as C522	183-1192-00
C525	CAPACITOR, FIXED, CERAMIC: same as C523	913-3809-00
C526	CAPACITOR, FIXED, ELECTROLYTIC: same as C522	183-1192-00
C527	CAPACITOR, FIXED, CERAMIC: same as C523	913-3809-00
C528	CAPACITOR, FIXED, ELECTROLYTIC: same as C522	183-1192-00
C529	CAPACITOR, FIXED, PAPER: 5.0 uf ±20%, 150 vdcw; Sprague Electric part no. 121P50501R5S2	931-2585-00
C530	CAPACITOR, FIXED, PAPER: same as C529	931-2585-00
C531	CAPACITOR, FIXED, PAPER: 2.0 uf ±20%, 200 vdcw; Aerovox Corp. part no. P8292ZN14	951-0670-00
C532	CAPACITOR, FIXED, PAPER: 20 uf ±20%, 150 vdcw; Sprague Electric part no. 143P101M	951-2004-00
C533	CAPACITOR, FIXED, PAPER: same as C531	951-0670-00
C534	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf -10% +100%, 30 vdcw	183-1565-00
C535	CAPACITOR, FIXED, ELECTROLYTIC: 1000 uf -10% +100%, 50 vdcw	183-1403-00
C536	CAPACITOR, FIXED, ELECTROLYTIC: same as C535	183-1403-00
C537	CAPACITOR, FIXED, PAPER: 35 uf ±20%, 150 vdcw; Sprague Electric part no. 143P4M	951-2003-00
C538	CAPACITOR, FIXED, PAPER: same as C537	951-2003-00
C539	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf -10% +100%, 12 vdcw; Sprague Electric Co. part no. 30D157A1	183-1190-00
C540	CAPACITOR, FIXED, CERAMIC: same as C511	913-3886-00
C541	CAPACITOR, FIXED, MICA: 180 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F181J01	912-2834-00
C542	CAPACITOR, FIXED, CERAMIC: same as C511	913-3886-00
C543	NOT USED	
C544	CAPACITOR, FIXED, MICA: 68 uuf ±5%, 500 vdcw; Electro Motive part no. DM15E680J01	912-2804-00
C545	CAPACITOR, FIXED, MICA: 510 uuf ±5%, 300 vdcw; Electro Motive part no. DM15F511J01	912-2867-00
C546	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C547	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C548	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C549	CAPACITOR, FIXED, CERAMIC: 3300 uuf ±20%, 500 vdcw	913-1193-00
C550	CAPACITOR, FIXED, MICA: 22 uuf ±5%, 500 vdcw; Electro Motive part no. DM15C220J01	912-2768-00
C551	CAPACITOR, FIXED, ELECTROLYTIC: same as C534	183-1565-00
C552	CAPACITOR, FIXED, CERAMIC: same as C549	913-1193-00
C553	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
CR501	SEMICONDUCTOR DEVICE, DIODE: germanium; Transistron part no. 1N270	353-2018-00
CR502	SEMICONDUCTOR DEVICE, DIODE: same as CR501	353-2018-00
thru		
CR506		
CR507	SEMICONDUCTOR DEVICE, DIODE: germanium; Erie Resistor part no. 1N198	353-0160-00
CR508	SEMICONDUCTOR DEVICE, DIODE: same as CR507	353-0160-00
CR509	SEMICONDUCTOR DEVICE, SET: four matched silicon diodes; encapsulated; Fairchild Semiconductor Corp. part no. FA-4000	353-3271-00
CR510	SEMICONDUCTOR DEVICE, SET: same as CR509	353-3271-00
CR511	SEMICONDUCTOR DEVICE, SET: same as CR509	353-3271-00
CR512	NOT USED	
CR513	SEMICONDUCTOR DEVICE, DIODE: same as CR507	353-0160-00

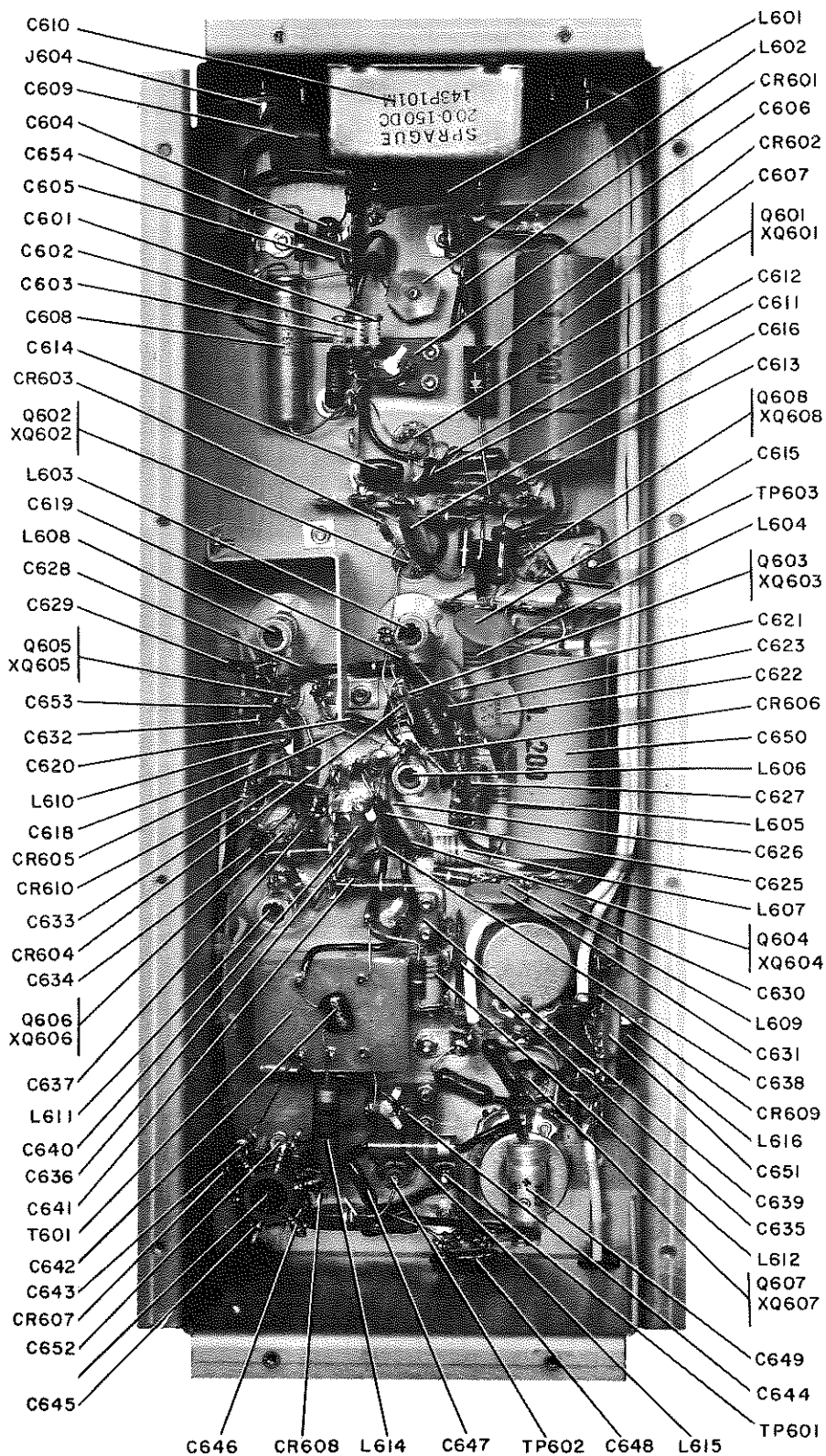


Figure 4-1. Modulator Compartment, Component
 (Except Resistors) Identification

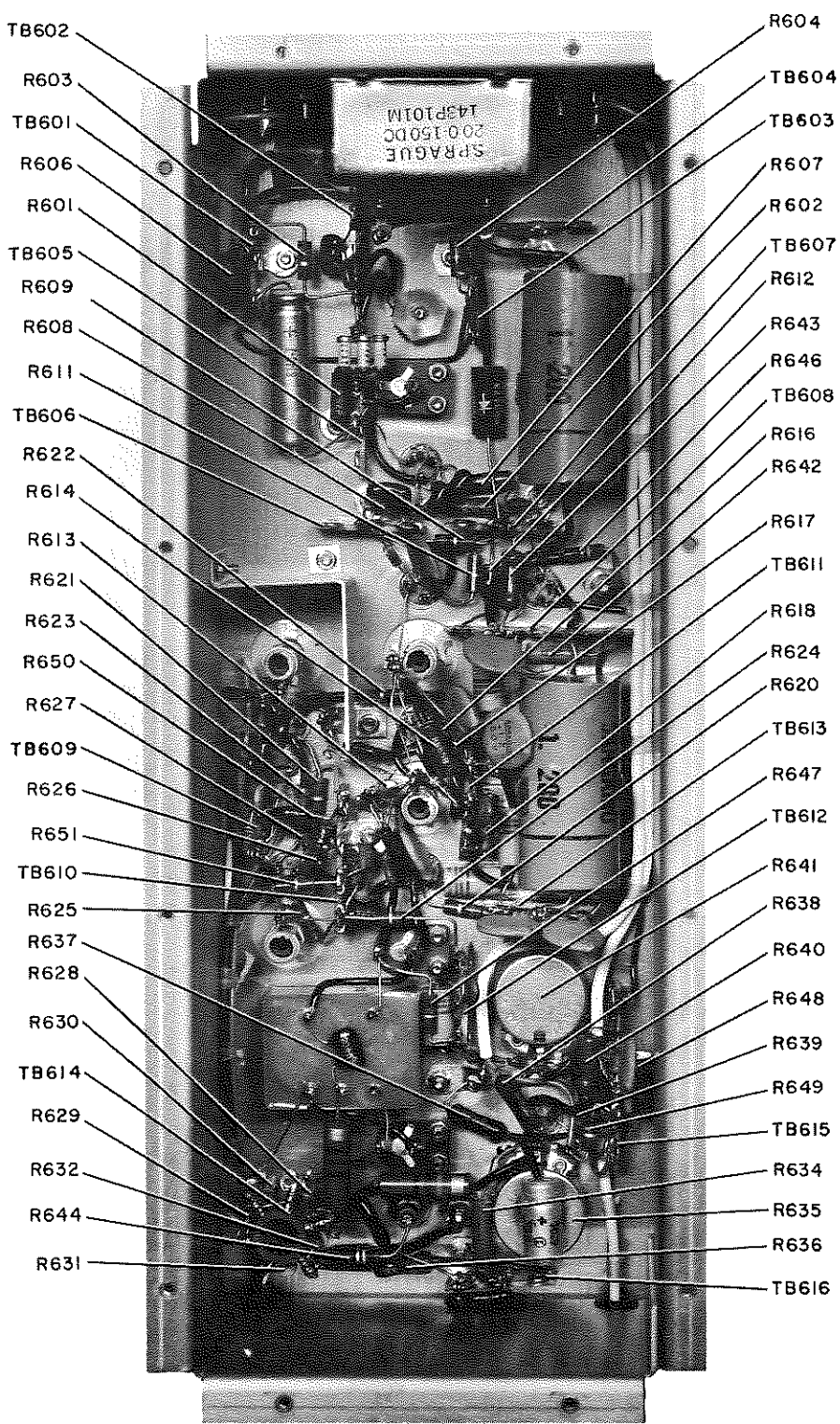


Figure 4-2. Modulator Compartment, Resistor Identification

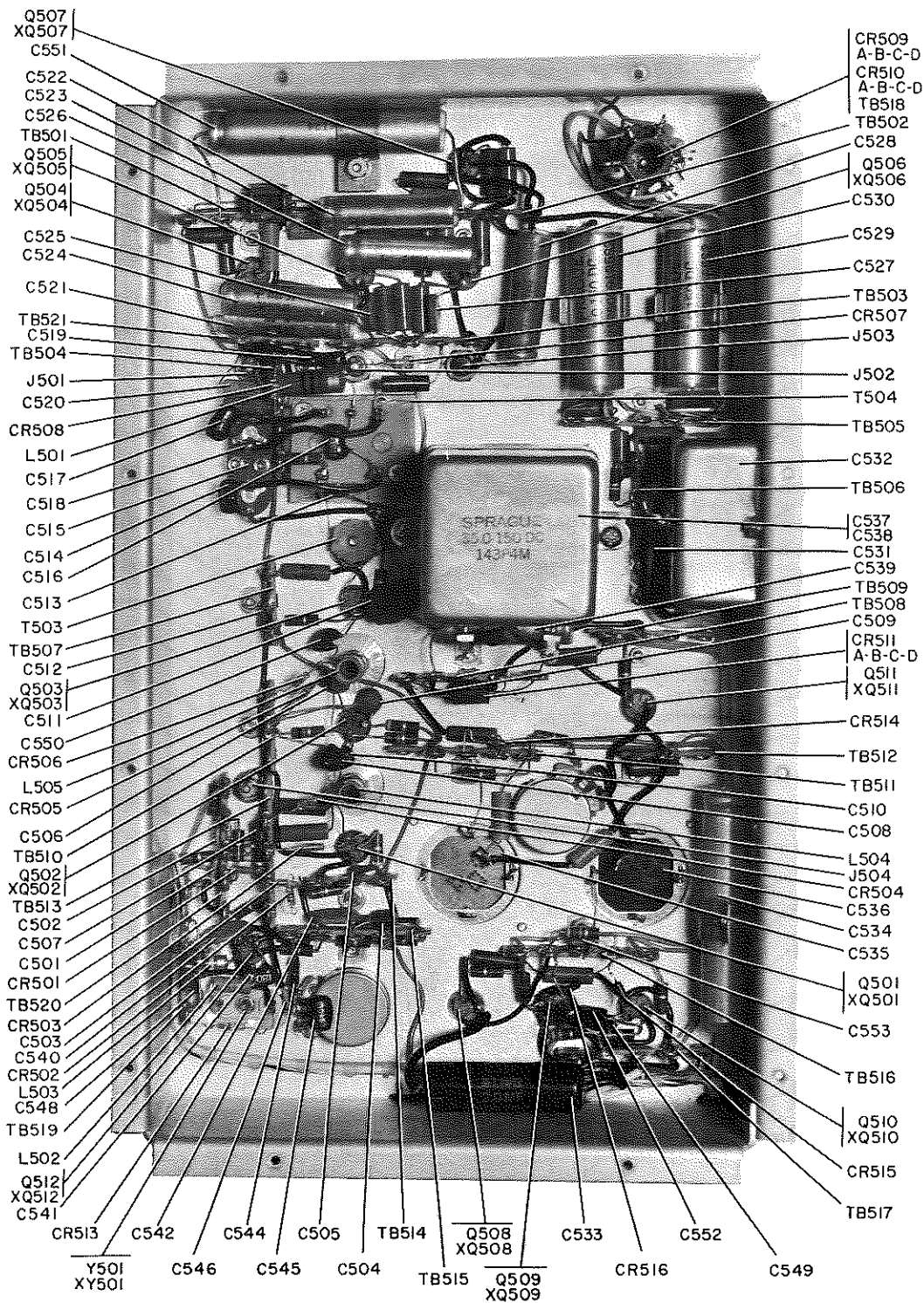


Figure 4-3. AFC Compartment, Component (Except Resistors) Identification

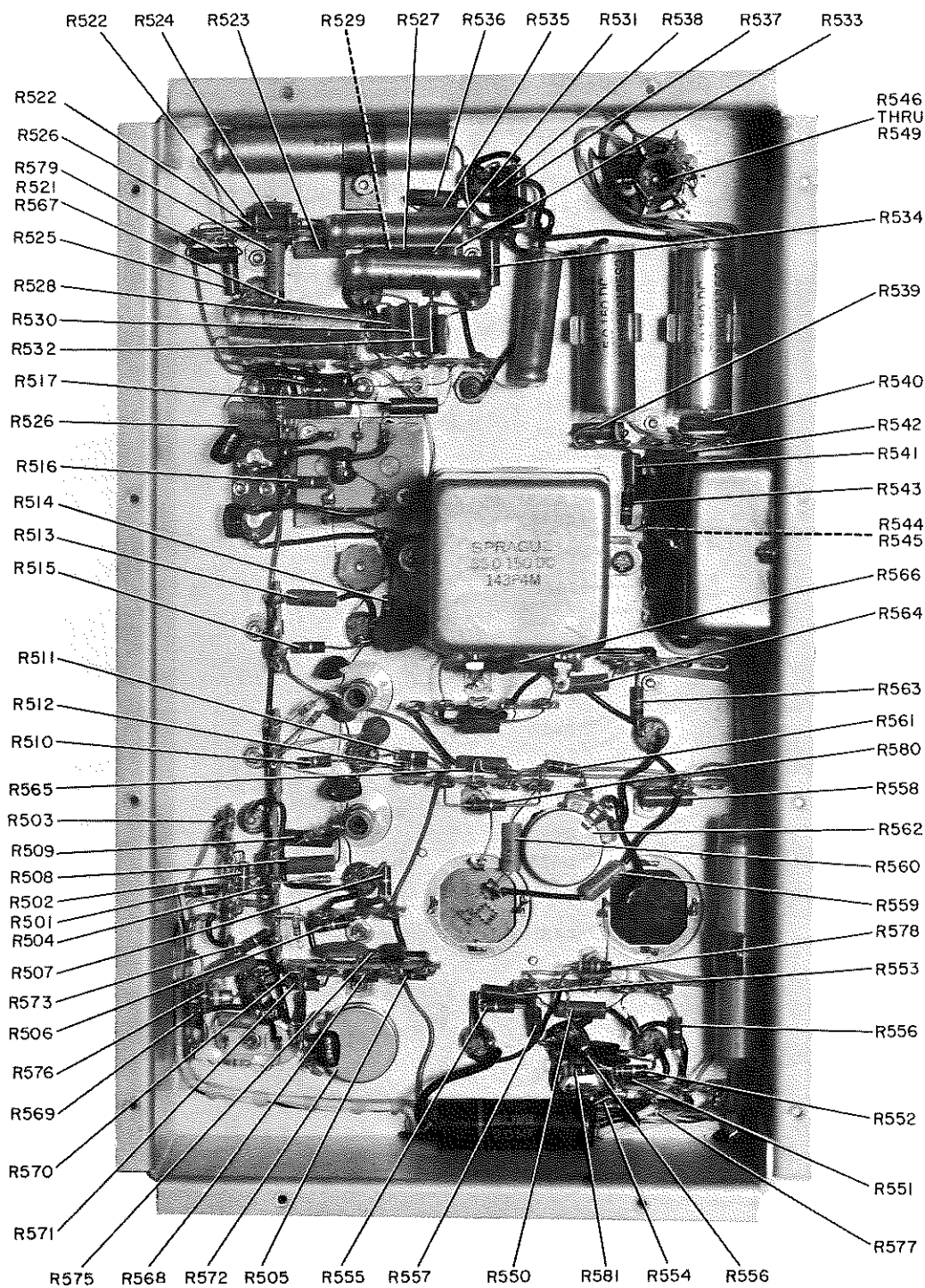


Figure 4-4. AFC Compartment, Resistor Identification

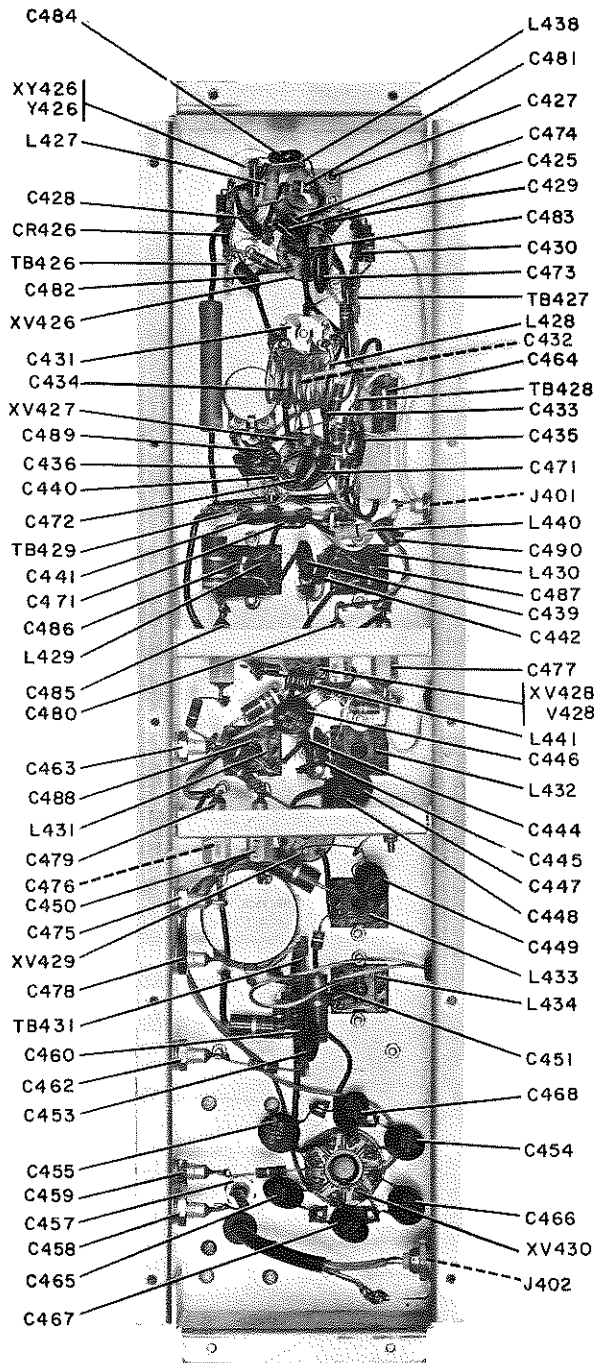


Figure 4-5. Power Amplifier Compartment, Component (Except Resistors) Identification

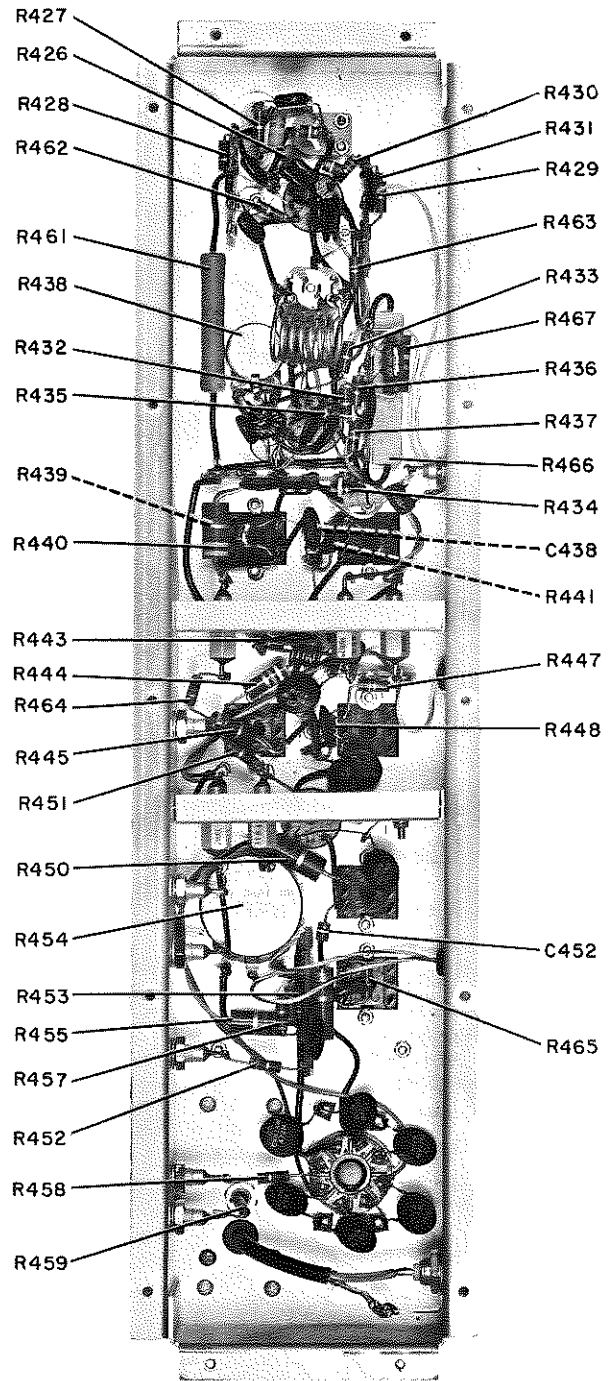


Figure 4-6. Power Amplifier Compartment, Resistor Identification

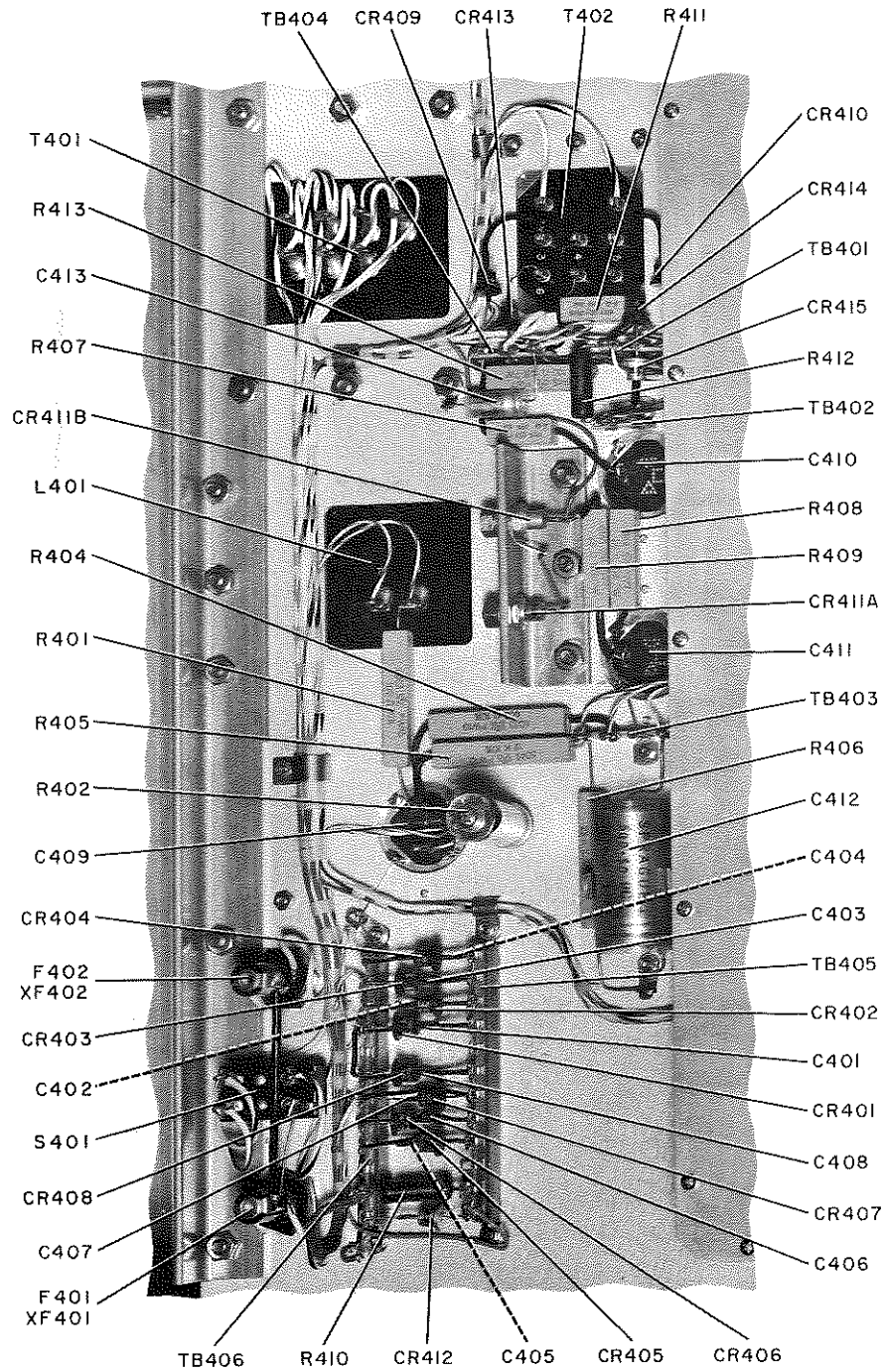


Figure 4-7. Power Supply, Component Identification

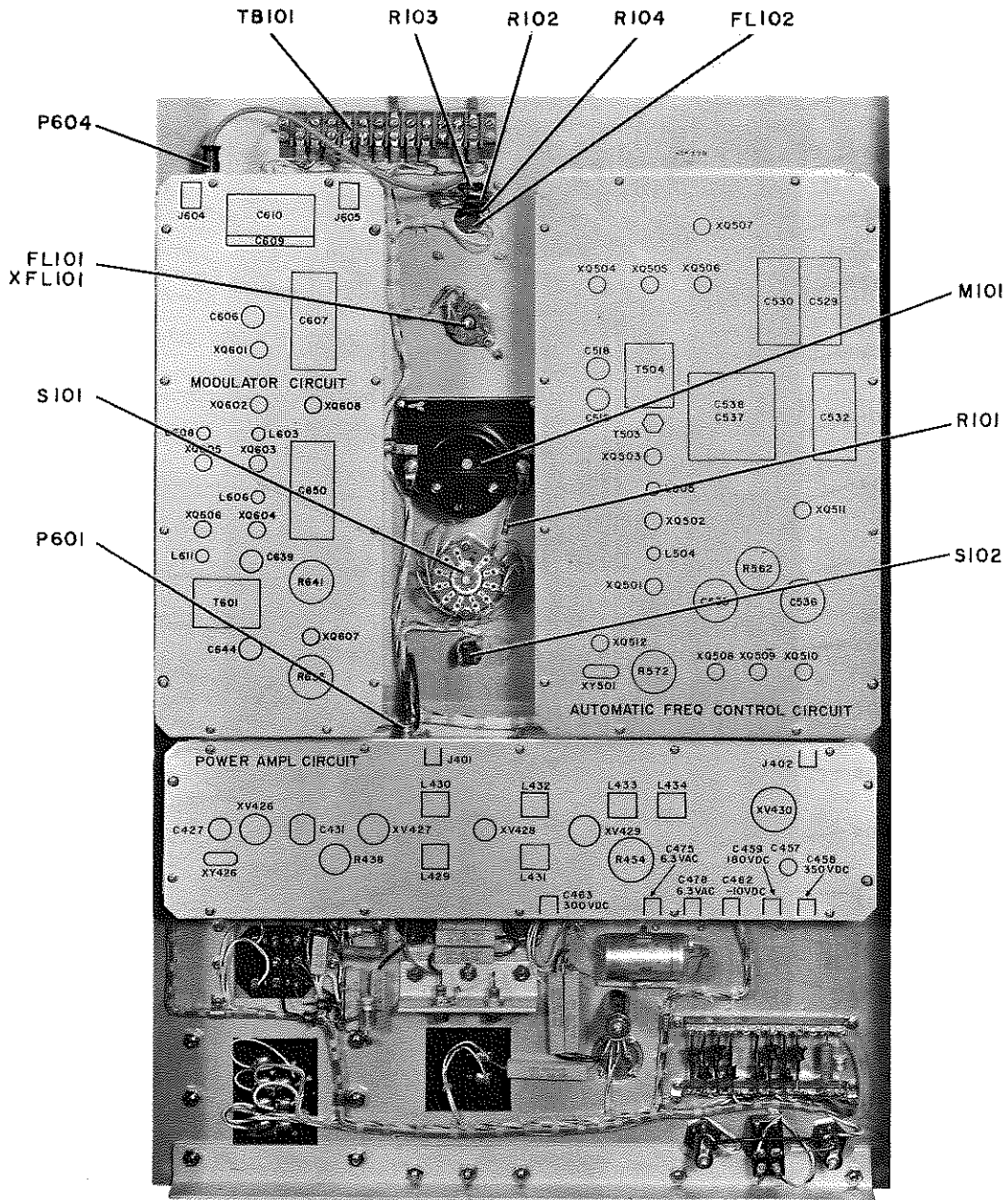
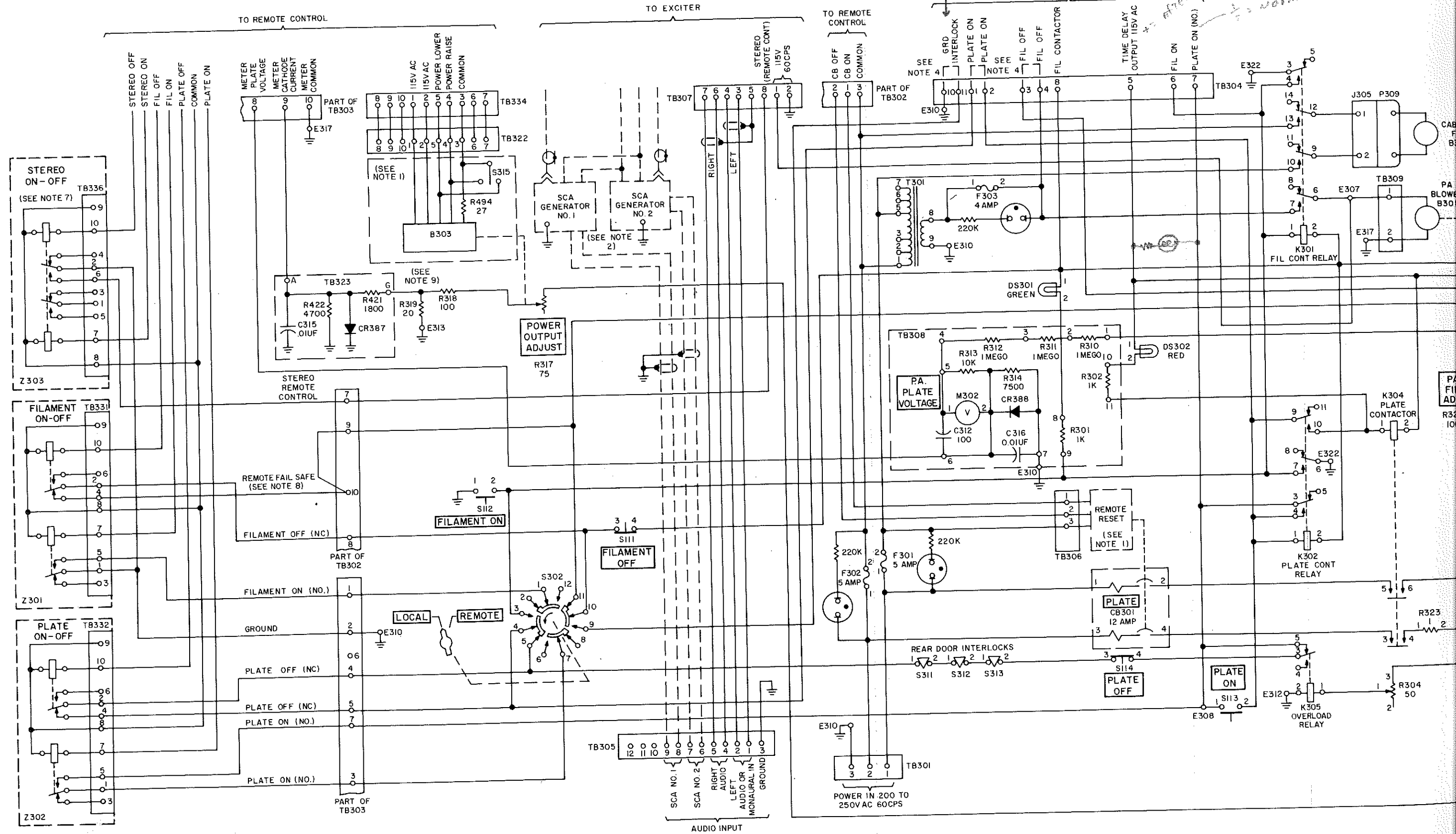


Figure 4-8. Chassis, Component Identification



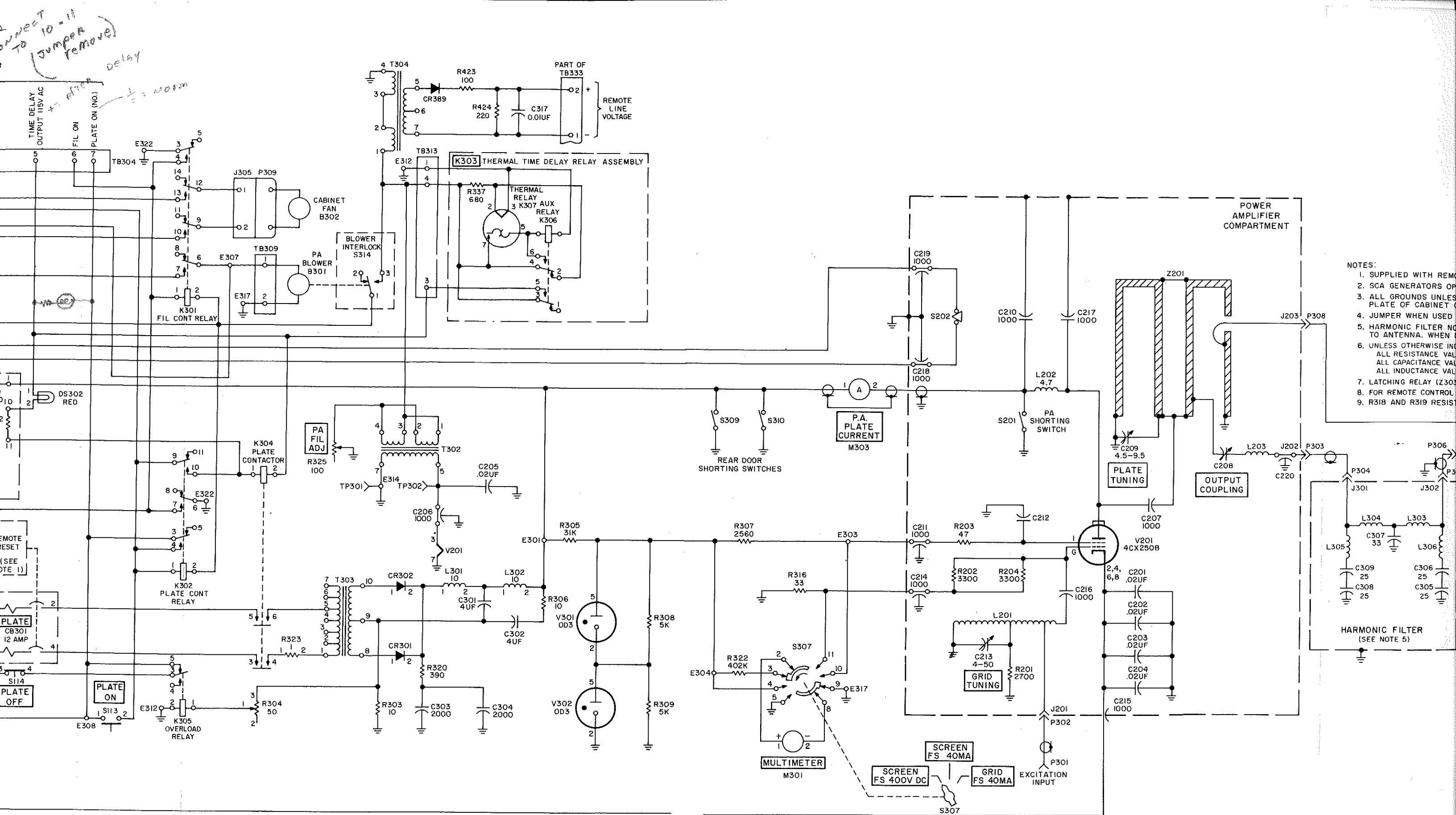


Figure 5-1.

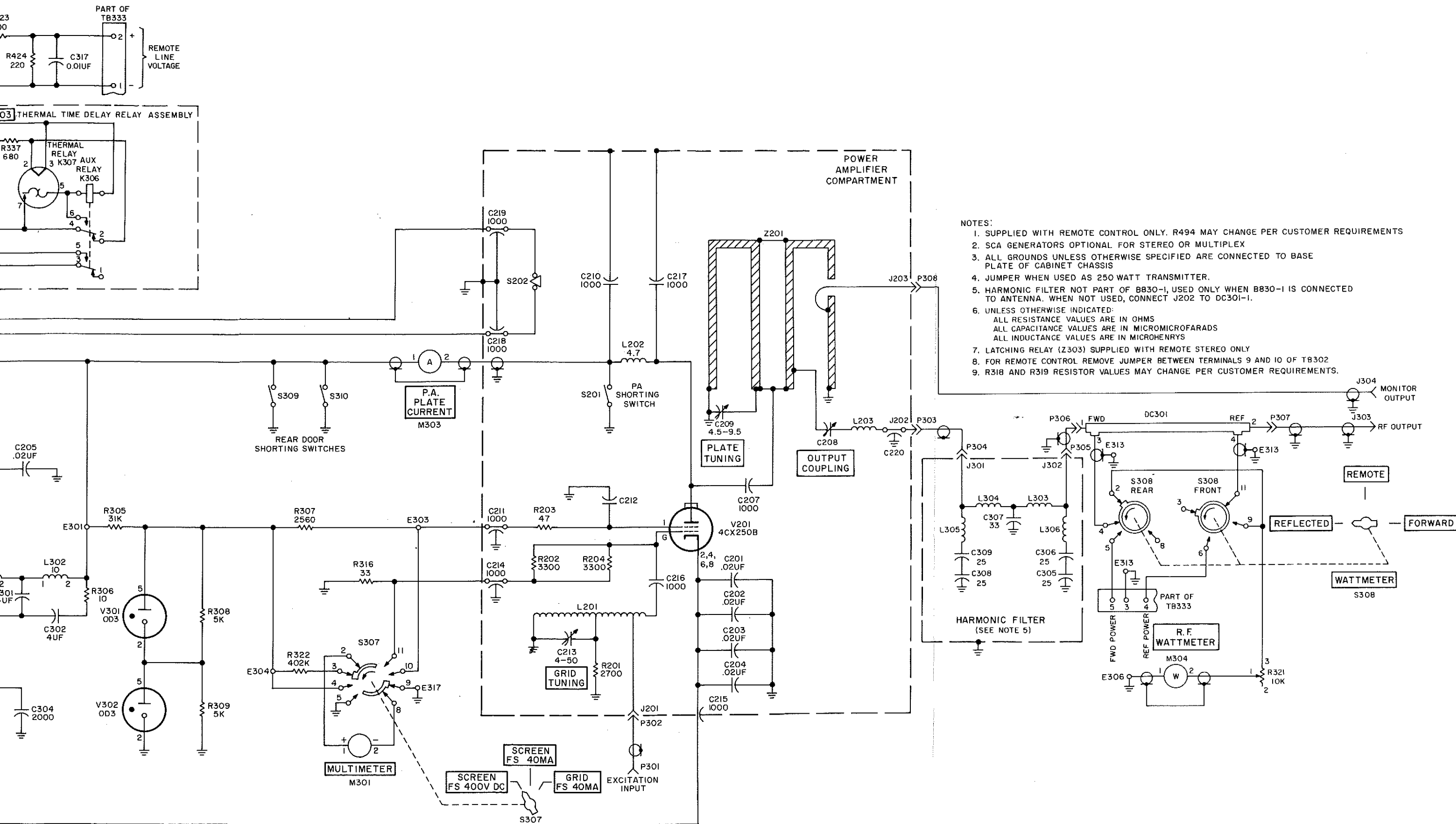


Figure 5-1. Overall Schematic, B830-1 250-Watt FM Power Amplifier

786M-1

Stereo Generator



unit instructions

Collins Radio Company | Dallas, Texas

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SECTION I GENERAL DESCRIPTION

1.1 PURPOSE OF INSTRUCTION BOOK.

Unit Instructions TD-537 provides information about 786M-1 Stereo Generator, Collins part number 522-2914-00. Information which is furnished includes a general description of the equipment, principles of operation, maintenance procedures, and a parts list.

1.2 PURPOSE OF THE EQUIPMENT.

The 786M-1 Stereo Generator is used to convert stereophonic audio input signals into main and stereophonic subchannel signals and to generate a pilot subcarrier. The resultant signal is suitable for modulation of wide-band FM broadcast exciters.

1.3 DESCRIPTION OF EQUIPMENT.

1.3.1 PHYSICAL DESCRIPTION.

The 786M-1 Stereo Generator, shown in figure 1-1, is constructed on a standard 19-inch rack-mounted panel. This panel is 19 inches wide, 10-1/2 inches high, 7

inches deep, and weighs approximately 14 pounds. All operating controls are located on the front panel with seldom-used adjustments located inside the back panel. A meter is placed conveniently on the lower left portion of the front panel for monitoring of input and output signals. All transistors and the 38-kc crystal are placed on the front panel for convenient access. Bulky components are grouped in the upper right-hand corner of the front panel leaving the remaining portion of the panel free of obstacles for ease of maintenance and adjustment. All components located in the rear of the unit are protected in a dust-resistant enclosure.

1.3.2 ELECTRICAL DESCRIPTION.

The 786M-1 Stereo Generator is an all transistorized unit consisting of the following circuits; a crystal controlled 38-kilocycle oscillator, a 19-kilocycle locked oscillator, a meter amplifier, two audio amplifiers, and a balanced modulator. All components for operation of the time division stereo generator are

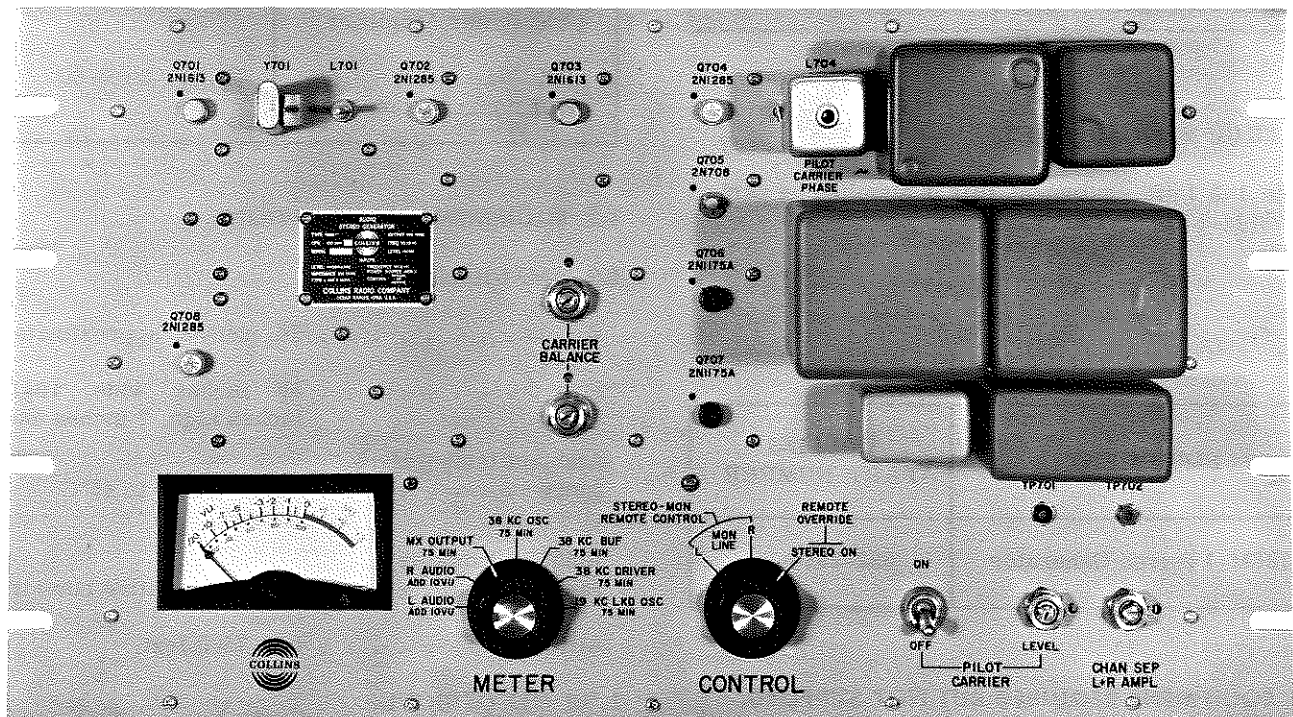


Figure 1-1. 786M-1 Stereo Generator, Over-all View

contained within the 19-inch rack-mounted panel with the exception of a left audio channel pre-emphasis network. This function must be supplied externally and is available in the Collins A830-2 10 W Wide-Band FM Broadcast Exciter.

Power input required is 20 ±0.1 volts d-c which is supplied by the A830-2. Remote control can be exercised over the stereophonic and monophonic modes. Power required for operation of remote control is 28 ±2.8 volts d-c. Instruction books covering the exciter and power amplifiers, used in conjunction with the 786M-1, are listed in table 1-1.

TABLE 1-1
ASSOCIATED EQUIPMENT INSTRUCTION BOOKS

ASSOCIATED EQUIPMENT	INSTRUCTION BOOK PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	TD-536
B830-1 250-Watt FM Power Amplifier	TD-538
D830-1 1000-Watt FM Power Amplifier	TD-567
E830-1 5-Kw FM Power Amplifier	TD-539

1.4 EQUIPMENT SUPPLIED.

Table 1-2 lists equipment that is supplied as part of the 786M-1 Stereo Generator.

TABLE 1-2
EQUIPMENT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
786M-1 Stereo Generator	522-2914-00

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Table 1-3 lists equipment that is required for operation of the 786M-1 Stereo Generator but not supplied as part of the 786M-1.

TABLE 1-3
EQUIPMENT REQUIRED BUT NOT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	522-2714-00

1.6 ACCESSORY EQUIPMENT.

Table 1-4 lists accessory equipment that is available for use with 786M-1 Stereo Generator.

TABLE 1-4
ACCESSORY EQUIPMENT

EQUIPMENT	COLLINS PART NUMBER
B830-1 250-Watt FM Power Amplifier	549-2008-00
D830-1 1000-Watt FM Power Amplifier	522-2948-00
E830-1 5-Kw FM Power Amplifier	549-2009-00
250-Watt/1-Kw Harmonic Filter	549-2010-00

1.7 EQUIPMENT SPECIFICATIONS.

1.7.1 MECHANICAL.

Weight 14 pounds approximately.

Size 19 inches wide, 10-1/2 inches high, 7 inches deep.

Ambient temperature range +15°C (59°F) to 45°C (113°F).

Ambient humidity range 0 to 95% relative humidity.

Altitude 0 to 7500 feet.

1.7.2 ELECTRICAL.

Power source 20 ±0.1 volts d-c.
28 ±2.8 volts d-c (for remote operation).

<p>Input Balanced 600 ohms, left and right channels.</p> <p>Input level 10 ±2 dbm for 100% composite modulation.</p> <p>Frequency range 30 to 15,000 cps for each channel.</p> <p>Output level 280 ±50 mv peak to peak.</p> <p>Pilot carrier frequency 19 kc ±2 cps.</p> <p>Pilot carrier level Equivalent to 9%±1% modulation of the main carrier.</p> <p>Channel separation Greater than 30 db, 50 cps to 15,000 cps.</p> <p>Crosstalk More than 40 db below single channel level.</p>	<p>Distortion Less than 0.5% over the frequency range of 30 to 15,000 cps.</p> <p>38-kc subcarrier suppression 40 db below output with 10-dbm input level.</p> <p>Main channel and stereo- phonic subcarrier phase relationship. ±3 degrees for audio frequencies from 50 to 15,000 cps.</p> <p>Audio-frequency response Complies with FCC standard 75-microsecond pre-emphasis curve (right channel only, left channel pre-emphasis is obtained from exciter).</p>
--	---

1.8 SEMICONDUCTOR COMPLEMENT.

Table 1-5 lists the semiconductor complement supplied as part of 786M-1 Stereo Generator.

TABLE 1-5. SEMICONDUCTOR COMPLEMENT

SYMBOL	QUANTITY	TYPE	FUNCTION
Q701	1	2N1613	38-kc oscillator
Q702	1	2N1285	38-kc buffer
Q703	1	2N1613	38-kc driver
Q704	1	2N1285	38-kc isolation amplifier
Q705	1	2N708	19-kc locked oscillator
Q706	1	2N1175A	Left audio amplifier
Q707	1	2N1175A	Right audio amplifier
Q708	1	2N1285	Meter amplifier
CR702	4	1N270	Balanced modulator diode switches

SECTION II PRINCIPLES OF OPERATION

2.1 GENERAL.

The 786M-1 Stereo Generator provides facilities for the conversion of stereophonic input signals to an output which conforms to the standards approved by the FCC for the transmission of stereophonic signals. The following paragraphs discuss stereophonic principles and the operation of the 786M-1 Stereo Generator.

2.2 PRINCIPLES OF FM STEREO.

2.2.1 STEREOPHONIC SOUND SYSTEMS.

An elementary stereophonic sound system consists of two directional microphones placed to the right and left of a sound source. See figure 2-1. Each microphone in turn is connected to an amplifier and speaker system. When the listener is situated between the speakers, the left channel will be received by the left ear and the right channel will be received by the right

ear. The effect upon the listener of such a system is to simulate placing the listener at a point midway between the two microphones and receiving a true representation of the originating sound source.

To provide a realistic stereo effect, the difference in time delay and signal amplitude from the sound source to each of the microphones must be maintained through the entire stereo system. If the time delay or amplitude difference is changed in one of the amplifier or speaker systems, the effect to the listener will be a change in direction of the sound source, when in reality no change has occurred. A change in time delay of the left or right channel is referred to as a phase relationship change. This phase relationship change between the channels must be held, in stereo transmitting equipment, to within ± 3 degrees.

If the amplitude difference and time delay in each system is identical (as when the sound source is centered between the microphones), the sound source will

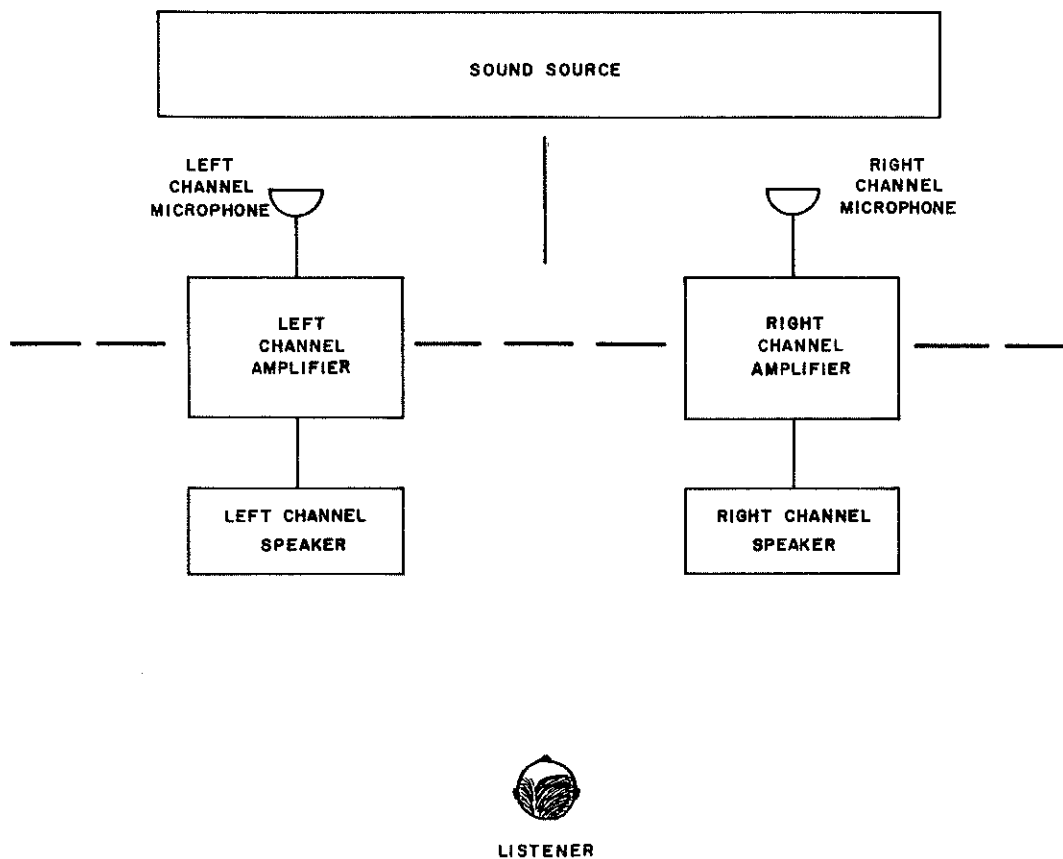


Figure 2-1. Elementary Stereophonic System

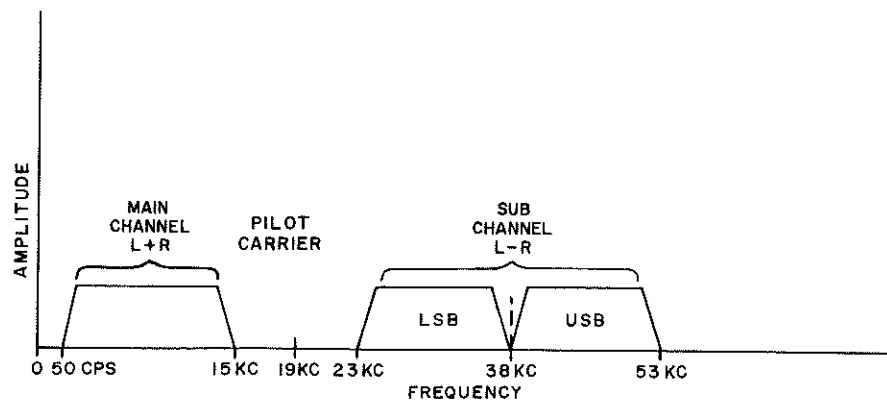


Figure 2-2. Spectrum of Signals in Baseband Audio

appear to the listener to be centered between the speakers. This is actually the true relationship of the microphones and the sound source.

To enhance the stereo effect to the listener, it is desirable for each microphone to be directional, as stated previously, so that sounds originating directly in front of the right microphone will be received by the right microphone, and as little as possible by the left microphone, and vice versa. If too much of the right sound source is picked up by the left microphone or vice versa, the effect to the listener will be to move the sound source to the center. This isolation between the two sound systems is known as channel separation and must be held greater than 29.7 db in stereo transmitting equipment.

If proper isolation of the amplifiers is not obtained, and there is an interchange of signals, the sound source will again appear to move toward the center. If the channel separation is reduced to zero, the effect would be to replace the two microphones with a single microphone feeding the same information to both amplifier and speaker systems. It is then understood that monophonic operation can be obtained by paralleling (adding) the left and right microphone outputs. This monophonic component is referred to as L+R.

An interchange of information between channels (main and subchannel) is referred to as crosstalk. Crosstalk will deteriorate the stereo signals by adding noise to the signal. In stereo transmitting systems, crosstalk must remain at least 40 db below a single channel level.

2.2.2 METHODS OF GENERATING FCC STEREO.

Signals which are prescribed by the FCC for the transmission of stereophonic intelligence is shown in figure 2-2. This band of frequencies must be generated and transmitted in order that both monaural and stereophonic receivers will be able to detect the FM signal. For monaural receivers, only the L+R (left plus right) channel is received, with the pilot carrier and L-R (left minus right) signals rejected by the pass band of the monaural receiver. Stereophonic FM receivers

detect the complete band of frequencies in a discriminator and will process the signals into left and right stereophonic channels. The 19-kc pilot carrier is used in this process. The method of generating the signals shown in figure 2-2 depends upon the method chosen for modulating an FM signal.

The methods of modulating an FM signal may be broken down into two groups, a direct and an indirect method. These two general categories may be broken down further into various methods of obtaining the end result. Phase modulation is the most generally used method of generating an FM signal by the indirect method. If this system is used to modulate the composite stereo signal, various problems are encountered. The most serious problem is that of frequency response of the phase modulator. As the phase modulator audio response exhibits nonlinear modulation characteristics (rises 6 db per octave from the lowest to the highest frequency), predistortion is employed to compensate for this trait. In a stereo FM phase modulator this predistortion would amount to 65.5 db over the entire modulating frequency range of 50 cps to 75 kc (SCA added to stereo signal). When a 65-db signal to noise ratio and a 60-db dynamic range is added to this, it is apparent that baseband amplifiers cannot be built to give this characteristic.

It is possible to split the phase modulation into two steps and modulate one phase modulator with the L+R signal and the second phase modulator with the L-R and pilot carrier signals. This type of stereophonic phase modulation is not desirable because of the required phase linearity of ± 3 degrees and the gain requirements of stereophonic transmission systems. These requirements are difficult, if not impossible, to maintain.

Another method of FM stereophonic modulation which could be employed is a combination of direct and indirect modulation. With this method the L+R signal directly FM modulates an oscillator, while the L-R signal phase modulates the signal produced in the oscillator, in a later stage. As in phase modulation of the stereophonic signal, it is difficult to maintain phase linearity and gain characteristics.

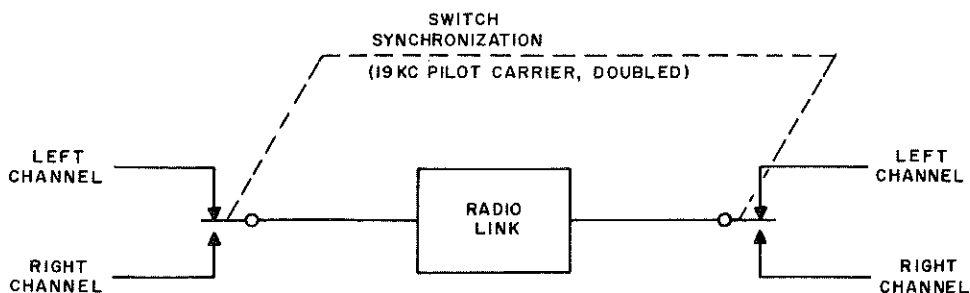


Figure 2-3. An Elementary Time Division Multiplex System

A third method of generating a stereophonic FM signal is by the use of direct modulation over the entire stereophonic generator frequency range. Phase relationship and gain characteristics are then easy to maintain because of the point input source. Until recently, it has been difficult to directly modulate an FM signal with a wide bandwidth of signals. With the advent of solid state components and specifically the production of the variable capacity diode, this wide-band type of modulation is possible. This is the type of modulation used in the Collins A830-2 10 W Wide-Band FM Broadcast Exciter. The development of the wide-band type of modulator made possible the development of 786M-1 Stereo Generator which is discussed in paragraph 2.3.

2.3 PRINCIPLES OF OPERATION OF 786M-1.

The 786M-1 Stereo Generator generates the spectrum of signals shown in figure 2-2 by the time division multiplex method. By this method, shown simplified in figure 2-3, the left and the right channels are switched alternately at a 38-kc rate. If the receiver switching rate is synchronized with the transmitter switching rate, the original left and right audio signals will be detected. In the receiver, the 19-kc pilot carrier is doubled to synchronize the receiver to the transmitter. It is important that the switching frequency in both the stereo generator and the receiver be of the same phase to retain the identity of the left and right audio signals.

The mathematical analysis of two audio signals being switched alternately by a square wave shows that the resultant signal is made up of two components of interest. One component is directly proportional to the sum of the two audio signals (L+R) and the other is a double-sideband (DSB) signal centered on a frequency equal to the switching frequency (38 kc). The modulation appearing on this DSB signal is directly proportional to the difference of the two audio channels (L-R). If L is defined as the audio signal in the left channel, R is defined as the audio signal in the right channel, and f_c is defined as the switching frequency, the composite signal is equal to:

$$\frac{L+R}{2} + \frac{2}{\pi} (L-R) \cos 2\pi f_c t - \frac{2}{3\pi} (L-R) \cos 6\pi f_c t + \frac{2}{5\pi} (L-R) \cos 10\pi f_c t \text{ etc.}$$

The first term of this expansion is the main channel component, the second term is the stereophonic sub-channel component, and the remaining terms are higher frequency terms which are undesired.

The following is a block diagram explanation of the 786M-1 Stereo Generator which generates the signals just mentioned. Refer to figure 2-4. It is noted on the block diagram that the left audio channel is fed through the pre-emphasis network and high-pass filter of the A830-2 wide-band exciter and then to the 786M-1.

The right audio channel utilizes the pre-emphasis network and the high-pass filter located in the 786M-1. The outputs of the high-pass filters are fed through 15-kc low-pass filters where audio components above 15 kc are attenuated sharply. The 15-kc filter outputs are then fed to emitter follower amplifiers where isolation of the two channels from the balanced modulator is obtained. The two-channel audio output is then fed to a balanced modulator whose action resembles that of a switch. The balanced modulator utilizes the signal generated in the 38-kc oscillator to alternately switch on and off each audio channel. The balanced modulator consists of the composite spectrum which includes both desired and undesired components. The fundamental 38-kc modulating signal and all even order harmonics are balanced out.

The balanced modulator output is mixed with a small amount of direct L+R signal which equalizes the peak amplitude of the main and subchannel signals. The modulator output is then fed through a 50-cps to 53-kc low-pass linear phase filter where all odd harmonics above 53 kc are attenuated. The filter output is mixed with a 19-kc signal from the pilot carrier phase locked oscillator and is fed to the 786M-1 output. All FCC phasing, channel separation, crosstalk, and amplitude specifications are satisfied within the 786M-1 Stereo Generator.

2.3.1 DETAILED DESCRIPTION OF 786M-1 STEREO GENERATOR.

Refer to figure 5-1, a schematic diagram of the 786M-1. The right audio channel is identical to the left audio channel except that the pre-emphasis network and the 15-kc filter for the left channel are located within the A830-2 exciter. Only the right channel is discussed in the following paragraphs.

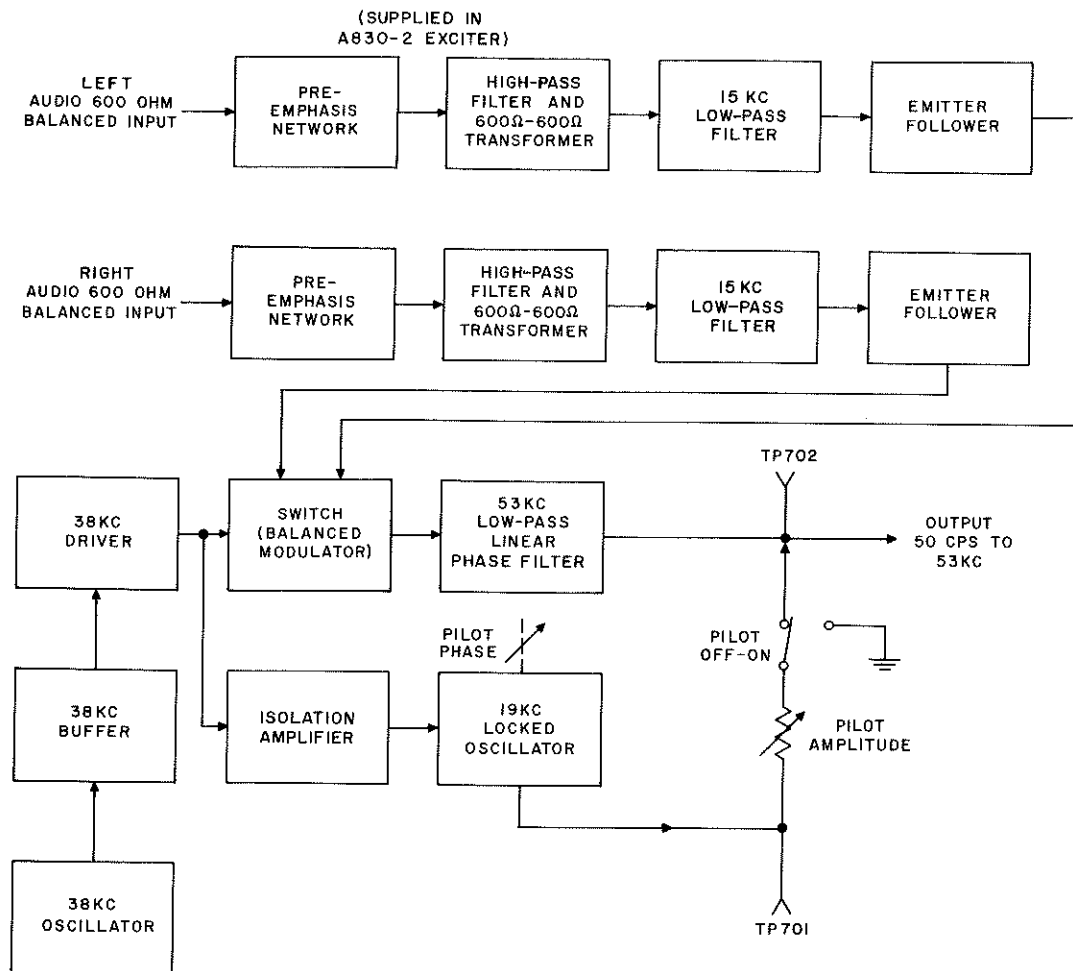


Figure 2-4. 786M-1 Stereo Generator, Block Diagram

The 600-ohm balanced right audio channel is fed into a pre-emphasis network, FL701. Due to the inherently low level of high-frequency audio components in program material, pre-emphasis is employed to overcome the effects of noise which is often found in home receivers. The 786M-1 follows the standard 75-microsecond pre-emphasis curve established by the FCC. The output of pre-emphasis filter FL701 is fed into a 30-cps high-pass filter, FL702, which sharply attenuates audio components below 30 cps. This is necessary to prevent 5-cps audio components from interfering with the 5-cps sampling circuits within the A830-2 exciter. Filter FL702 also transforms the 600-ohm balanced input into a 600-ohm single-ended output.

The output of FL702 is connected to relay K701 which remotely selects either the stereo mode for transmission, or the left or right audio channels for monaural operation. Relay K701 operates by applying 28 volts d-c across the solenoid. This 28-volt d-c source is supplied by the A830-2 exciter. Selection of either the left or right monaural channel is determined by the position of S701. At this point, if either the left or right channel is selected for monaural operation, the single 50-cps to 15-kc audio signal is fed through an

8-db loss pad to the output of the 786M-1 Stereo Generator. The 8-db loss pad is made up of R750, R751, and R752. The resulting audio input to the A830-2 is the same as that obtained without the stereo generator. Switch S701 will also override the remote relay if desired.

If the stereo mode is selected by S701, the audio component is fed to a 15-kc low-pass filter, FL704. FL704 attenuates all frequencies over 15 kc to prevent their interfering with adjacent channels. The output of FL704 is fed to the base of emitter follower Q707, which isolates the audio circuits from the balanced modulator.

The function of the balanced modulator is to generate the L+R and the L-R components shown in figure 2-2. The balanced modulator resembles a switch which samples the left audio channel and the right audio channel in turn. The 38-kc switching frequency and all even order harmonics are balanced out in the modulator output. The 38-kc switching frequency is obtained from the 38-kc driver and is impressed across transformer T701. If the primary switching voltage is negative, the secondary voltage will switch on diodes CR702D and CR702A. Thus, right audio will appear at the secondary center tap. If the primary switching

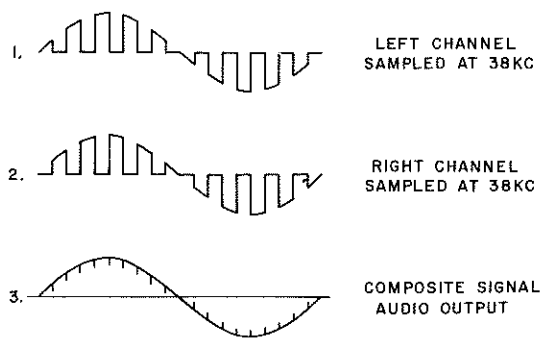


Figure 2-5. Balanced Modulator Output
When $L+R=2$, $L-R=0$

voltage is positive, the secondary voltage will switch on diodes CR702B and CR702C. The left audio channel will then appear on the secondary of T701. A representation of a sine wave input in each channel ($L=R$, $L+R=2$, $L-R=0$) switched in this manner is shown in figure 2-5. It is seen in this illustration that the composite signal at the output of the balanced modulator is a sine wave of an amplitude equal to the original signal level in each channel. The spikes shown on the composite sine wave result from imperfect switching and are filtered out in FL705.

Figure 2-6 shows the balanced modulator output when $R=0$, $L+R=1$, and $L-R=1$. The output of the balanced modulator is an audio component plus DSB components centered on the switching frequency and odd harmonics which form the square wave shape. When the odd harmonics are filtered out by the 53-kc harmonic

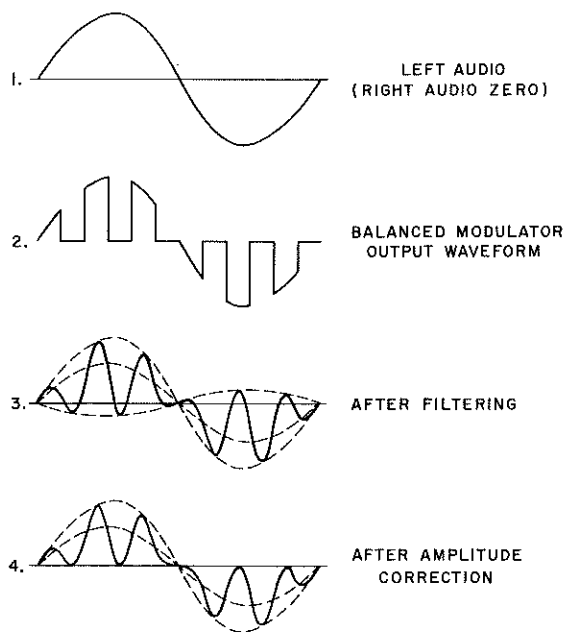


Figure 2-6. Balanced Modulator Output
When $L+R=1$ and $L-R=1$

filter, FL705, the third waveform results. Because the fundamental component of a square wave is $\frac{4}{\pi}$ times the square wave amplitude, the DSB component is larger than the audio. The audio component is then increased by $\frac{4}{\pi}$ and the fourth illustration results. The audio component is added by resistors R724 and R730 which leak a small portion of $L+R$ directly around the balanced modulator. Potentiometer R755 adjusts the audio component so the $\frac{4}{\pi}$ loss in filtering is exactly compensated. Capacitors C736 through C739 are selected capacitor values which balance out the stray balanced modulator capacitance. This balanced condition reduces the suppressed 38-kc switching frequency level to well below the 40 db required by the FCC. On some units these capacitors are unnecessary.

Figure 2-7 shows the time division signal when $L=-R$, or $L+R=0$, $L-R=2$. The composite waveform from the balanced modulator is shown in the third illustration. This waveform is composed of audio components and odd harmonics centered on the switching frequency. When the odd harmonics are removed by filtering in FL705, the waveshape in the fourth illustration results. This waveshape is a DSB signal which equals $L-R$ as required by the matrix process.

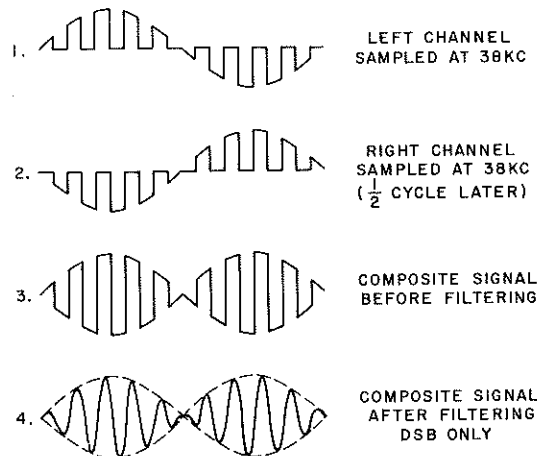


Figure 2-7. Balanced Modulator Output
When $L+R=0$ and $L-R=2$

The output of the balanced modulator and $L+R$ mixing is fed to a low-pass 53-kc filter, FL705. Filter FL705 removes all harmonics and noise above 53 kc to form the DSB waveshape as shown in figures 2-6 and 2-7. The output from FL705 is mixed with a 19-kc pilot carrier and fed to the stereo override switch, S701, and the remote relay, K701. Operation at this point is similar to audio switching which was discussed earlier. If relay K701 is energized and S701 is in the STEREO ON position, the composite stereo is fed to J701 for connection to the A830-2 10 W Wide-Band FM Exciter.

The balanced modulator switching frequency is obtained from crystal-controlled oscillator Q701. Oscillations are sustained by taking the output of L701

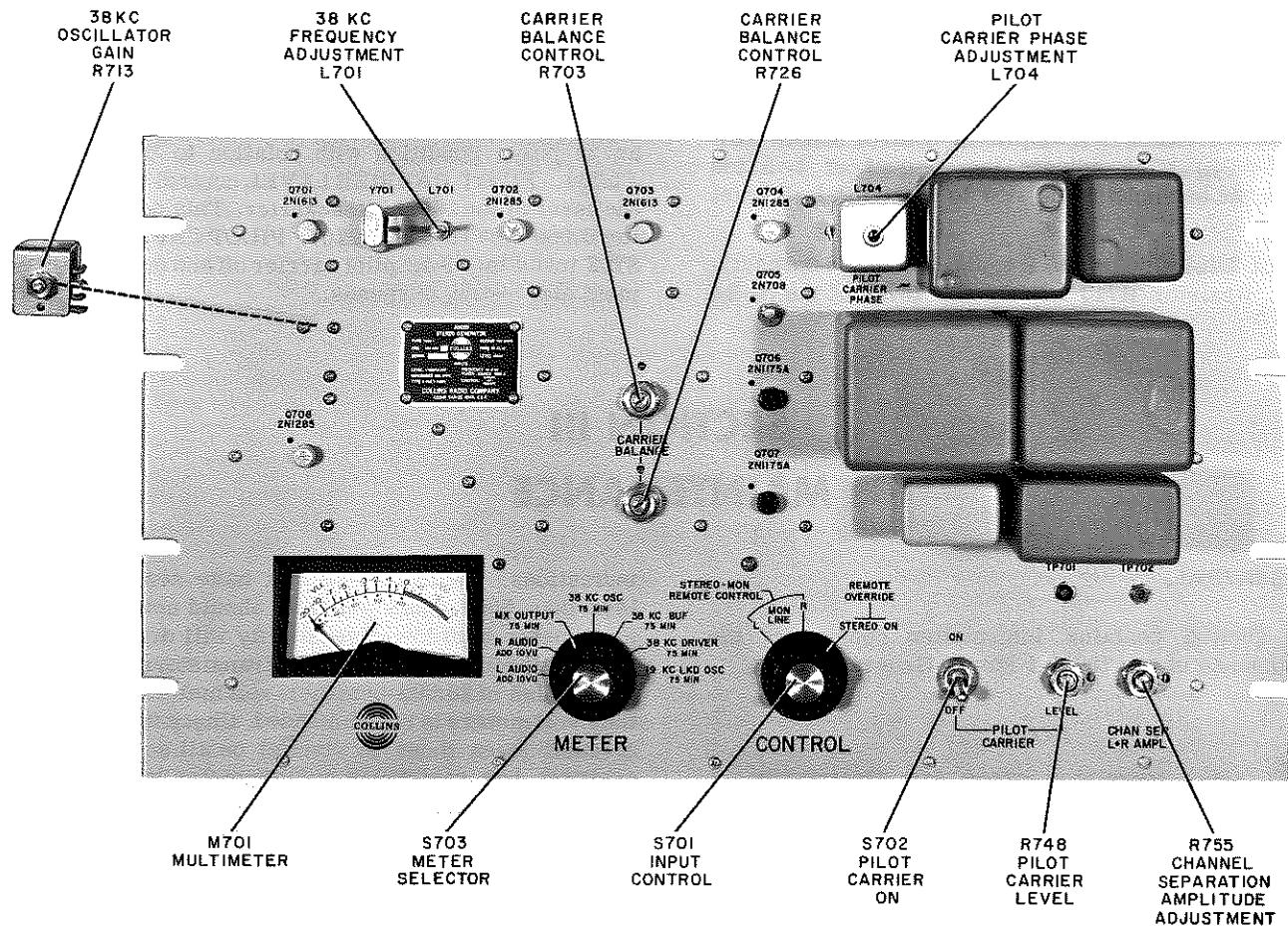


Figure 2-8. 786M-1 Control and Adjustment Locations

and feeding it into the base of Q701. The 38-kc output of L701 is also capacitively coupled into the 38-kc buffer amplifier, Q702. The output of Q702 is tuned to 38 kc by C714 and L702. The output of buffer amplifier Q702 is further amplified to approximately 4 volts peak to peak by driver amplifier Q703. The gains of Q701, Q702, and Q703 are stabilized by emitter degeneration to reduce gain variations between transistors. The output of Q703 is capacitively coupled to the primary of T701 (balanced modulator switching transformer) and to the 19-kc pilot carrier locked oscillator through an isolation stage, Q704.

The pilot carrier oscillator, Q705, is basically a grounded base oscillator which is synchronized by injecting a 38-kc signal into the base. The oscillator output is a 19-kc resonant tank placed across the base to emitter junction by means of a capacity voltage divider. The 19-kc output is taken from the emitter circuit and is injected into the output of FL705. The pilot carrier phase, which must be maintained in phase with the output of FL705, is adjusted by varying the inductance of L704. Pilot carrier level is adjusted with R748.

Metering circuits are provided within the 786M-1 to assist in trouble shooting. Meter amplifier Q705

provides isolation of the matrixing and oscillator circuits from the metering circuits. The right audio and left audio channels are fed directly from the 600-ohm balanced input through meter multiplying resistors R711 and R710 to meter M701.

2.3.2 CONTROL FUNCTIONS.

The following paragraphs describe the functions of all controls in the 786M-1 Stereo Generator. Refer to figure 2-8 for control locations.

Meter selector S703 connects meter M701 into various circuits for monitoring purposes. The metering positions are as follows; L AUDIO (left audio), R AUDIO (right audio), MX OUTPUT (multiplex output), R AUDIO OSC (38-kc oscillator), 38 KC BUF (38-kc buffer amplifier), 38 KC DRIVER, and 19 KC LKD OSC (19-kc locked oscillator output).

Audio input switch S701 selects one of three possible audio inputs; left audio, right audio, and stereo. If switch S701 is placed in the left audio or right audio positions, remote relay K701 is able to provide remote control over the monaural or stereo modes. When S701 is in the stereo mode, relay K701 is disabled and has no effect on stereo generator inputs.

CARRIER BALANCE controls R703 and R726 balance out the 38-kc carrier and 76-kc second harmonic in the secondary of T701. These controls are adjusted for zero indication at TP701 with no audio in either channel.

Channel separation L+R amplitude control (CHAN SEP L+R AMPL) R755 adjusts the amount of L+R fed around the balanced modulator to raise the L+R level by $\frac{4}{\pi}$.

Inductor L701 adjusts the frequency of the 38-kc oscillator. Resistor R713 adjusts the level of the 38-kc

driver output into the balanced modulator. This level is set for 6 volts peak to peak at TP701 at the factory and should never need readjustment.

PILOT CARRIER PHASE control L704 adjusts the phase of the 19-kc pilot carrier. The control is set for an in-phase condition with relation to the output of FL705. PILOT CARRIER LEVEL control R748 adjusts the level of the 19-kc pilot carrier. This control is set for 0.009 volt rms at TP701. PILOT CARRIER switch S702 turns the 19-kc pilot carrier off and on for adjustment and testing purposes.

SECTION III MAINTENANCE

3.1 GENERAL.

This section contains information concerning the maintenance of the 786M-1 Stereo Generator.

NOTE

As some transistor cases are electrically above ground, do not short transistor cases to ground or damage to the transistor may result. Always replace transistors with the transistor locating mark placed adjacent to the transistor socket.

3.2 SERVICING TRANSISTOR CIRCUITS.

Servicing procedures and test equipments that have been used in the past with other types of electronic equipment, for the most part, may be used with transistor circuits. Some special precautions which must be used are listed below.

3.2.1 TEST EQUIPMENT.

Damage to transistors by test equipment is usually the result of accidentally applying too much voltage to the transistor elements. Common causes of damage from test equipment are as follows:

a. Test equipment with a transformerless power supply is one source of such voltage. This type of test equipment can be used by employing an isolation transformer in the power line.

b. It is still possible to damage transistors from line voltage even though the test equipment has a power transformer in the power supply, if the test equipment is equipped with a line filter. This filter may act like a voltage divider and apply 55 volts a-c to the transistor. To eliminate trouble from this situation, connect a ground wire from the chassis of the test equipment to the chassis of the equipment under test before making any other connections.

c. Another cause of transistor damage is a multimeter that requires excessive current for adequate

indications. Multimeters that have sensitivities of less than 5000 ohms per volt should not be used. A multimeter with lower sensitivity will draw too much current through many types of transistors and damage them. Use of 20,000-ohm-per-volt meters or vacuum-tube volt meters is recommended. Check the ohmmeter circuits (even those in vtvm's) on all scales with an external, low-resistance milliammeter in series with the ohmmeter leads. If the ohmmeter draws more than one milliamperere on any range, this range cannot be used safely on small transistors.

3.2.2 ELECTRIC SOLDERING IRONS.

The following are possible causes of transistor damage from soldering irons:

a. Electric soldering irons may damage transistors through leakage current. To check a soldering iron for leakage current, connect an a-c volt meter between the tip of the iron and a ground connection, allow the iron to heat, then check for a-c voltage with the meter. Reverse the plug in the a-c receptacle and again check for voltage. If there is any indication on the meter, isolate the iron from the a-c line with a transformer. The iron may be used without the isolation transformer if the iron is plugged in and brought to temperature then unplugged for the soldering operation. It is also possible to use a ground wire between the tip of the iron and the chassis of the equipment being repaired to prevent damage from leakage current.

b. Light-duty soldering irons of 20 to 25 watts capacity are adequate for transistor work and should be used. If it is necessary to use a heavier duty iron, wrap a piece of number 10 copper wire around the tip of the iron and make it extend beyond the tip of the iron. Tin the end of the piece of copper wire and use it as the soldering tip.

3.2.3 SERVICING PRACTICES.

a. If a transistor is to be evaluated in an external test circuit, be sure that no more voltage is applied

to the transistor than normally is used in the circuit from which it came.

b. Test prods should be clean and sharp. Because many of the resistors used in transistorized equipments have low values, any additional resistance produced by a dirty test prod will make a good resistor appear to be out of tolerance.

3.2.4 TROUBLE SHOOTING.

The usual trouble-shooting practices apply to transistors. Be sure the test equipment and tools meet the requirements outlined in the above paragraphs. It is recommended that transistor testers be used to evaluate the transistor.

If a transistor tester is not available, a good ohmmeter may be used for testing. Be sure the ohmmeter meets the requirements as set forth in the paragraph on test equipment, above. To check a PNP transistor, connect the positive lead of the ohmmeter to base and the negative lead to the emitter. (The red lead is not necessarily the positive lead on all ohmmeters.) Generally, a resistance reading of 50,000 ohms or more should be obtained. Connect the negative lead to the collector; again a reading of 50,000 ohms or more should be obtained. Reconnect the circuit with the negative lead of the ohmmeter to the base. With the positive lead connected to the emitter, a value of resistance in the order of 500 ohms or less should be obtained. Likewise, with the positive lead connected to the collector, a value of 500 ohms or less should be obtained.

Similar tests made on an NPN transistor produce results as follows: With the negative ohmmeter lead connected to the base, the value of resistance between the base and the emitter and between the base and the collector should be high. With the positive lead of the ohmmeter connected to the base, the value of resistance between the base and the emitter and between the base and collector should be low. If the readings do not check out as indicated, the transistor probably is defective and should be replaced.



If a defective transistor is found, make sure that the circuit is in good operating order before inserting the replacement transistor.

Make sure that the value of the bias resistors in series with the various transistor elements are as shown on the schematic diagram. The transistor is very sensitive to improper bias voltages; therefore, a short or open circuit in the bias resistors may damage the transistor. For this reason, do not trouble-shoot by shorting various points in the circuit to ground and listening for clicks.

3.3 TROUBLE SHOOTING.

Trouble shooting can best be accomplished by using standard trouble-shooting techniques. Suspected troubles should be isolated to individual stages before

components are replaced. The pilot carrier can be turned off with switch S702 as an aid in trouble shooting and testing.

3.4 ADJUSTMENTS AND TESTS.

The 786M-1 is fitted with adjustments which adjust 38-kc oscillator tuning, carrier balance, pilot carrier level, and pilot carrier phase.

NOTE

Do not attempt the following adjustments without using the proper test equipment as serious deterioration of the 786M-1 output quality may result from the use of inferior test equipment.

The test equipments or their equivalents required to perform the specified tests are listed in table 3-1.

**TABLE 3-1
TEST EQUIPMENT REQUIRED**

EQUIPMENT	MANUFACTURER AND TYPE
Oscilloscope	Tektronix Model 545A with Type 53/54C plug-in unit and a Type D plug-in unit
Oscillator	Hewlett-Packard Model 200AB
Distortion and noise meter	Hewlett-Packard Model 330D
Vtvm	Hewlett-Packard Model 400H (or equivalent)

Figure 3-1 is a standard transistor base, viewed from the bottom, which provides a transistor element reference.

3.4.1 38-KC OSCILLATOR TUNING.

Turn on the A830-2 10 W Wide-Band FM Exciter. Connect an a-c vtvm to the collector of Q702. (See figure 3-1.) Turn R713 fully clockwise. Adjust L701 for a maximum indication on the vtvm. The oscillator output at the collector of Q702 should be approximately 1.5 volts.

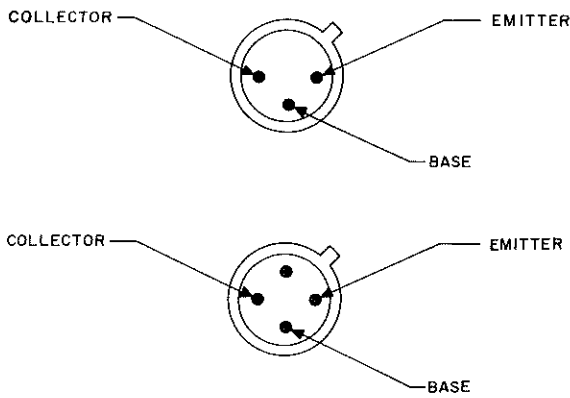


Figure 3-1. Transistor Base Configuration

3.4.2 38-KC AMPLITUDE CHECK.

Connect a calibrated Tektronix oscilloscope, provided with a Type D plug-in unit, across terminals 1 and 2 of T701. The voltage at this point should be 6 volts peak to peak as read on the oscilloscope. Adjust R713 if necessary to obtain 6 volts.

3.4.3 CARRIER BALANCE.

Turn the PILOT CARRIER switch to OFF. Remove any audio from the left and right audio channels. Connect the Tektronix oscilloscope with the Type D

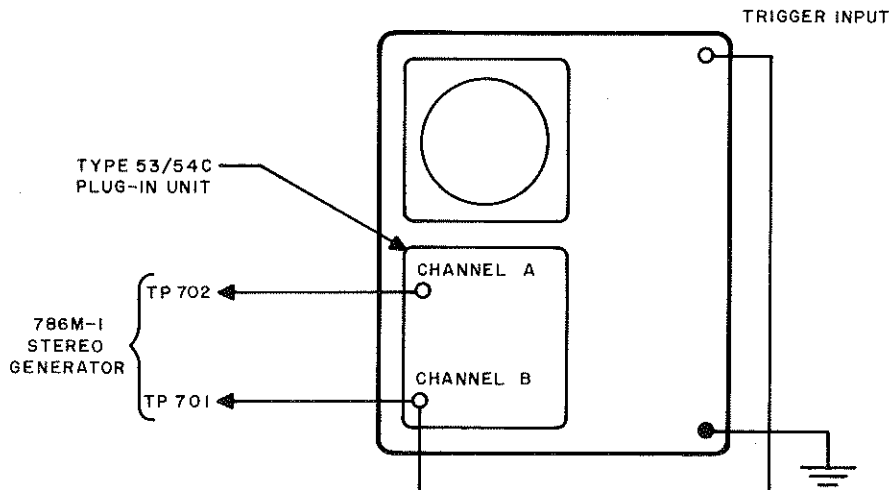
plug-in unit to TP702 and ground. Adjust in turn R703 and R726 in small steps for a minimum indication on the oscilloscope. The final indication on the oscilloscope must be more than 40 db below 100 millivolts (10 millivolts).

3.4.4 PILOT CARRIER PHASE.

Connect the Tektronix oscilloscope to the 786M-1 Stereo Generator as shown in figure 3-2. Connect the audio oscillator into the 786M-1 through 10-db pads to give an L=-R signal (right audio channel 180 degrees out of phase with the left audio channel) into the audio input terminals at a frequency of 1000 cps and a level of 7.8 volts rms. Set the PILOT CARRIER switch to OFF. Switch the CONTROL switch to STEREO ON. Adjust the PILOT CARRIER PHASE control until both traces on the oscilloscope are stationary and an exact coincidence of the zero crossings of the 19-kc pilot carrier and the L-R signal is obtained as shown in figure 3-3. Expand the sweep to 5X, and adjust the horizontal position knob to check the two points of coincident zero crossing.

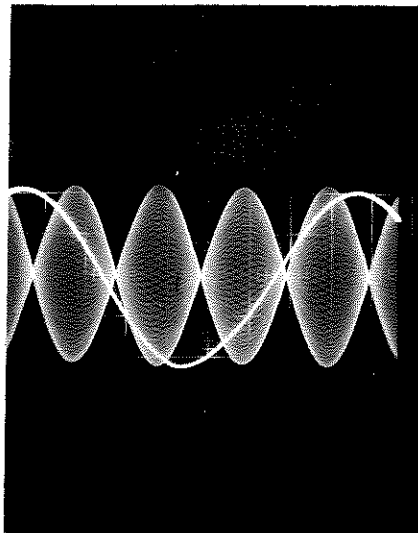
3.4.5 PILOT CARRIER LEVEL.

Remove any audio from the 786M-1 audio input channels and connect a vtvm to TP702. Set the PILOT CARRIER switch to ON, and adjust the PILOT CARRIER LEVEL control for a reading of 0.009 volt rms as read on the vtvm.

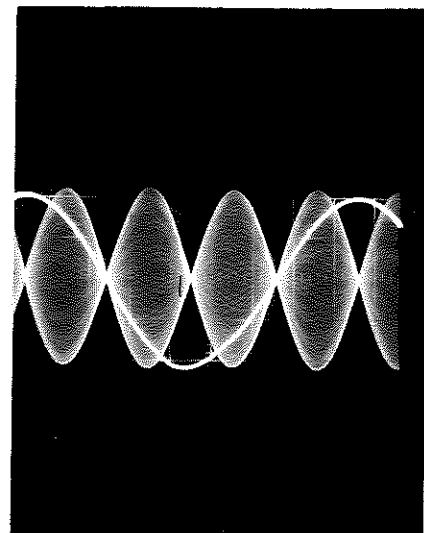


CONTROL SETTINGS	
1. CHANNEL A	0.05 V/CM, TP702
2. CHANNEL B	0.05 V/CM, TP701
3. MODE -ALTERNATE	
4. TRIGGERING MODE -AUTOMATIC TRIGGER SLOPE - + EXTERNAL	
5. SWEEP TIME/CM 5 USEC	
6. MAGNIFIER	X1, X5

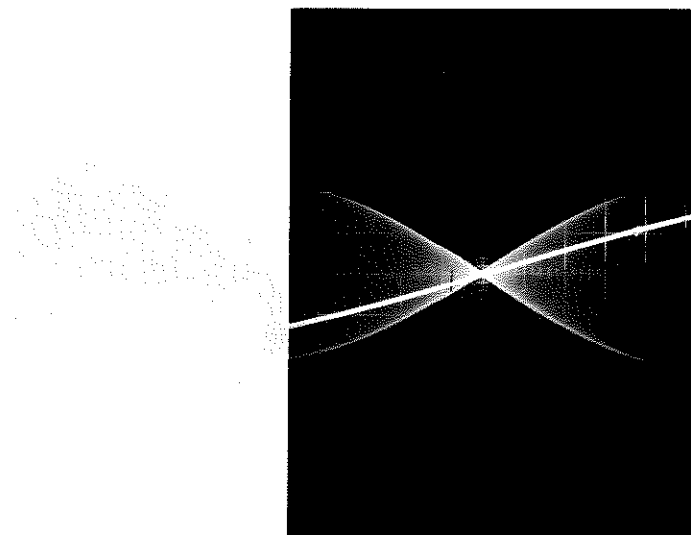
Figure 3-2. Pilot Carrier Phase Test Setup



MALADJUSTMENT OF PILOT
CARRIER PHASE CONTROL.



PROPER ADJUSTMENT OF PILOT
CARRIER PHASE CONTROL.



PROPER ADJUSTMENT OF PILOT
CARRIER PHASE CONTROL, EX
PANDED HORIZONTAL DEFLEC-
TION.

Figure 3-3. Pilot Carrier Phase Adjustment, Oscilloscope Pattern

3.4.6 CHANNEL SEPARATION ADJUSTMENT.

Set the audio oscillator to 5000 cps, and connect it to the left audio input of the 786M-1. Connect the Tektronix oscilloscope with the type D plug-in unit to TP702 and ground, and adjust the audio oscillator for a 300-millivolt peak-to-peak indication on the oscilloscope. Adjust the CHAN SEP L+R AMPL control to produce a straight zero axis (within 4 millivolts) as shown in figure 3-4. Repeat with the audio input into the right audio channel. The final adjustment must bring the zero axis to within 4 millivolts of a straight zero axis.

3.5 MINIMUM PERFORMANCE STANDARDS.

3.5.1 OVER-ALL GAIN.

- Connect the Tektronix oscilloscope to TP702 and ground.
- Switch the PILOT CARRIER switch to OFF.
- Connect the audio oscillator through 10-db pads to the 786M-1 in such a way to obtain an L=R signal (left channel equal in amplitude and phase with right channel).
- Adjust the audio oscillator frequency to 1000 cps, and adjust the audio oscillator output to obtain 0 VU on the 786M-1 VU meter when the METER switch is set to L AUDIO or R AUDIO. The peak-to-peak indication on the oscilloscope shall be from 200 to 300 millivolts.
- Connect the audio input so L= -R (right channel equal in amplitude but 180 degrees out of phase with

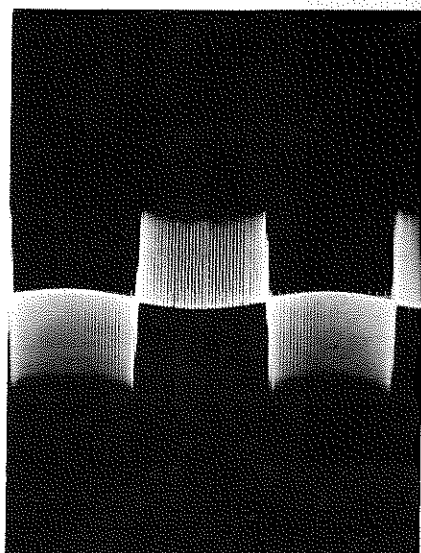
the left channel). The peak-to-peak indication shall be from 200 to 300 millivolts.

3.5.2 FREQUENCY RESPONSE.

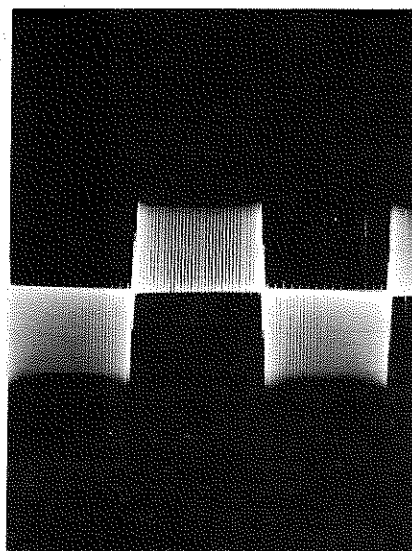
- Connect the distortion analyzer between TP702 and ground.
- Switch the PILOT CARRIER switch to OFF.
- Connect the audio oscillator through 10-db pads to each channel in such a way to obtain an L=R signal (left channel equal in amplitude and in phase with right channel).
- Adjust the audio oscillator frequency to 1000 cps, and adjust the audio oscillator output to obtain 0 VU on the 786M-1 VU meter when the METER switch is set to L AUDIO. Set the distortion analyzer to 0 db.
- Set the audio oscillator to 50 cps, and adjust the audio level from the audio oscillator for 0 VU on the 786M-1 VU meter. The indication on the distortion analyzer shall be within ± 0.5 db of the level at 1000 cps.
- Repeat step e at 15,000 cps. The indication on the distortion analyzer shall be within ± 1.5 db of the level at 1000 cps.
- Repeat steps d, e, and f with the METER switch set at R AUDIO.

3.5.3 HARMONIC DISTORTION.

- Connect the test setup as described in paragraph 3.5.2, steps a, b, and c.
- The distortion at 50, 1000, and 15,000 cps should be not more than one percent.



MALADJUSTMENT OF CHANNEL SEPARATION L AND R AMPL CONTROL.



PROPER ADJUSTMENT OF CHANNEL SEPARATION L AND R AMPL CONTROL.

Figure 3-4. Channel Separation Adjustment, Oscilloscope Pattern

SECTION IV PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
786M-1 STEREO GENERATOR		522-2914-00
C701	CAPACITOR, FIXED, ELECTROLYTIC: 30 uf -10% +100%, 10 v d-c	183-1377-00
C702	CAPACITOR, FIXED, ELECTROLYTIC: 50 uf -10% +100%, 25 v d-c	183-1379-00
C703	CAPACITOR, FIXED, ELECTROLYTIC: same as C701	183-1377-00
C704	CAPACITOR, FIXED, ELECTROLYTIC: same as C702	183-1379-00
C705	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf -10% +100%, 12 v d-c; Sprague Electric part no. 30D157A1	183-1190-00
C706	CAPACITOR, FIXED, ELECTROLYTIC: same as C705	183-1190-00
C707	CAPACITOR, FIXED, ELECTROLYTIC: 15 uf -10% +100%, 25 v d-c; Sprague Electric part no. 40D180A1	183-1362-00
C708	CAPACITOR, FIXED, MICA: 6800 uuf ±10%, 300 v d-c	935-2110-00
C709	CAPACITOR, FIXED, PAPER: 0.047 uf ±10%, 400 v d-c; Sprague Electric part no. 160P47394	931-0295-00
C710	CAPACITOR, FIXED, PAPER: 0.1 uf ±10%, 400 v d-c; Sprague Electric part no. 160P10494	931-0299-00
C711	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf -10% +100%, 25 v d-c; Sprague Electric part no. 40D181A2	183-1365-00
C712	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C713	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C714	CAPACITOR, FIXED, MICA: 1800 uuf ±5%, 500 v d-c; Electro Motive part no. DM20F182J500WV	912-3333-00
C715	CAPACITOR, FIXED, PAPER: same as C710	931-0299-00
C716 thru C719	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C720	CAPACITOR, FIXED, MICA: 510 uuf ±5%, 500 v d-c; Electro Motive part no. DM19E511J	912-2980-00
C721	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C722	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C723	CAPACITOR, FIXED, PAPER: same as C710	931-0299-00
C724	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C725	CAPACITOR, FIXED, MICA: 10,000 uuf ±2%, 500 v d-c; Electro Motive part no. DM30F103G	912-2734-00
C726	CAPACITOR, FIXED, FILM: 0.1 uf, ±1%, 50V d-c; Sprague Electric Co. part no. 114P1041 R5S4	933-0279-00
C727	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C728	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C729	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C730	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf -10% + 100%, 50 v d-c	183-1369-00
C731	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C732	CAPACITOR, FIXED, CERAMIC: 4700 uuf ±20%, 500 v d-c; MIL type CK62AW472M	913-1187-00
C733 thru C735	CAPACITOR, FIXED, CERAMIC: same as C732	913-1187-00
*C736	CAPACITOR, FIXED, CERAMIC: 5 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH050D	916-0118-00
*C736	CAPACITOR, FIXED, CERAMIC: 10 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH100D	916-0138-00
*C736	CAPACITOR, FIXED, CERAMIC: 15 uuf ±5%, 500 v d-c; MIL type CC20CH150J	916-0671-00
*C736	CAPACITOR, FIXED, CERAMIC: 20.0 uuf ±5%, 500 v d-c; MIL type CC20CH200J	916-0677-00

*Selected and added by test in the vicinity of TB714, TB718, and T701

ITEM	DESCRIPTION	COLLINS PART NUMBER
*C737	CAPACITOR, FIXED, CERAMIC: 5 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH050D	916-0118-00
*C737	CAPACITOR, FIXED, CERAMIC: 10 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH100D	916-0138-00
*C738	CAPACITOR, FIXED, CERAMIC: 1.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CK010D	916-0071-00
*C738	CAPACITOR, FIXED, CERAMIC: 2.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CK020D	916-0076-00
*C738	CAPACITOR, FIXED, CERAMIC: 3.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CJ030D	916-0145-00
*C738	CAPACITOR, FIXED, CERAMIC: 4.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH040D	916-0114-00
*C739	CAPACITOR, FIXED, CERAMIC: 1.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CK010D	916-0071-00
*C739	CAPACITOR, FIXED, CERAMIC: 2.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CK020D	916-0076-00
*C739	CAPACITOR, FIXED, CERAMIC: 3.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CJ030D	916-0145-00
*C739	CAPACITOR, FIXED, CERAMIC: 4.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH040D	916-0114-00
CR701	NOT USED	
CR702	SEMICONDUCTOR DEVICE, SET: four hermetically sealed matched germanium diodes; Hughes Products part no. MQ4032	353-2041-00
A,B,C, &D		
FL701	ATTENUATOR, FIXED: pre-emphasis network for u/in FM commercial broadcast equipment; 75 microseconds, 600 ohms input and output	379-0426-00
FL702	FILTER, HIGH PASS: metal encased, hermetically sealed, input 600 ohms, output 600 ohms, 4 solder-type terminals, continuous duty cycle; A.D.C. part no. D10390	673-0869-00
FL703	FILTER, LOW PASS: continuous duty cycle, input 600 ohms ±20%, output 600 ohms ±20%, metal encased, hermetically sealed; C.A.C. part no. 90-1015-00	673-0871-00
FL704	FILTER, LOW PASS: same as FL703	673-0871-00
FL705	FILTER, LOW PASS: linear, continuous duty cycle, input 600 ohms ±20%, output 600 ohms ±20%, metal encased, hermetically sealed, solder-type terminals; C.A.C. part no. 90-1012-00	673-0870-00
J701	JACK, TIP: insulated for u/w 0.080 in. test probes; brown; E.F. Johnson part no. 105-208-200	360-0152-00
J702	JACK, TIP: insulated for u/w 0.080 in. test probes; red; E.F. Johnson part no. 105-202-200	360-0150-00
K701	RELAY, ARMATURE: 4 C contact arrangement; 0.25 amp, 300 v d-c, 1 inductive winding, 250 ohms resistance, 27.5 v d-c; 0.11 amp approx operating current; Aemco, Inc. part no. 94-3473	974-0127-00
L701	COIL, RADIO FREQUENCY: multilayer solenoid type winding; 2.3 ohms; -15°C to +55°C; 0.5 to 3.5 mh; Chicago Standard Transformer Corp. part no. WC-7	278-0734-00
L702	COIL, RADIO FREQUENCY: single layer wound, 10,000 uh, 66.5 ohms d-c, 75 ma current rating; Delevan part no. 2590-76	240-2564-00
L703	COIL, RADIO FREQUENCY: same as L702	240-2564-00
L704	COIL, RADIO FREQUENCY: 8 mh inductance; w/core; 1-5/32 in. by 1-5/32 in. by 2-1/2 in. excl terminals; Communications Coil part no. X-544-2	278-0780-00
M701	METER, AUDIO LEVEL: VU Meter for use in equipments exposed to environments; background color, white	456-0056-00
O701	KNOB: setscrew type; black phenolic body; 1.125 in. dia by 0.843 in. thk w/ skirt	546-1294-003
O702	KNOB: same as O701	546-1294-003
P701	PLUG, TELEPHONE: brass; phenolic insulation, w/solder-lug terminal; Switchcraft part no. 3501MC	361-0062-00
Q701	TRANSISTOR: hermetically sealed NPN diffused silicon planar transistor; Fairchild Semiconductor Corp. part no. 2N1613	352-0349-00
Q702	TRANSISTOR: germanium; RCA part no. 2N1285	352-0243-00
Q703	TRANSISTOR: same as Q701	352-0349-00
Q704	TRANSISTOR: same as Q702	352-0243-00
Q705	TRANSISTOR: hermetically sealed; NPN silicon; Fairchild Semiconductor Corp. part no. 2N708	352-0322-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
Q706	TRANSISTOR: hermetically sealed, PNP germanium; General Electric part no. 2N1175A	352-0315-00
Q707	TRANSISTOR: same as Q706	352-0315-00
Q708	TRANSISTOR: same as Q702	352-0243-00
R701	RESISTOR, FIXED, FILM: 750 ohms $\pm 1\%$, 1/4 w	705-7090-00
R702	RESISTOR, FIXED, FILM: same as R701	705-7090-00
R703	RESISTOR, VARIABLE, WIREWOUND: 10 ohms $\pm 10\%$, 1/2 w	377-0113-00
R704	RESISTOR, FIXED, COMPOSITION: 3900 ohms $\pm 10\%$, 1/2 w	745-1377-00
R705	RESISTOR, FIXED, COMPOSITION: 15,000 ohms $\pm 10\%$, 1/2 w	745-1401-00
R706	RESISTOR, FIXED, COMPOSITION: 3300 ohms $\pm 10\%$, 1/2 w	745-1373-00
R707	RESISTOR, FIXED, COMPOSITION: same as R704	745-1377-00
R708	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R709	RESISTOR, FIXED, COMPOSITION: same as R706	745-1373-00
R710	RESISTOR, FIXED, FILM: 1330 ohms $\pm 1\%$, 1/4 w	705-7102-00
R711	RESISTOR, FIXED, FILM: same as R710	705-7102-00
R712	RESISTOR, FIXED, COMPOSITION: 33,000 ohms $\pm 10\%$, 1/2 w	745-1415-00
R713	RESISTOR, VARIABLE, COMPOSITION: 5000 ohms $\pm 20\%$, 0.2 w	376-0205-00
R714	RESISTOR, FIXED, COMPOSITION: 10,000 ohms $\pm 10\%$, 1/2 w	745-1394-00
R715	RESISTOR, FIXED, COMPOSITION: 120 ohms $\pm 10\%$, 1/2 w	745-1314-00
R716	RESISTOR, FIXED, COMPOSITION: 4700 ohms $\pm 10\%$, 1/2 w	745-1380-00
R717	RESISTOR, FIXED, COMPOSITION: 1000 ohms $\pm 10\%$, 1/2 w	745-1352-00
R718	RESISTOR, FIXED, COMPOSITION: same as R712	745-1415-00
R719	RESISTOR, FIXED, COMPOSITION: 12,000 ohms $\pm 10\%$, 1/2 w	745-1398-00
R720	RESISTOR, FIXED, COMPOSITION: 6800 ohms $\pm 10\%$, 1/2 w	745-1387-00
R721	RESISTOR, FIXED, COMPOSITION: 180 ohms $\pm 10\%$, 1/2 w	745-1321-00
R722	RESISTOR, FIXED, COMPOSITION: 2700 ohms $\pm 10\%$, 1/2 w	745-1370-00
R723	RESISTOR, FIXED, COMPOSITION: 39 ohms $\pm 10\%$, 1/2 w	745-1293-00
R724	RESISTOR, FIXED, FILM: 1980 ohms $\pm 1\%$, 1/4 w	705-7110-00
R725	RESISTOR, FIXED, FILM: 464 ohms $\pm 1\%$, 1/4 w	705-7080-00
R726	RESISTOR, VARIABLE, WIREWOUND: same as R703	377-0113-00
R727	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R728	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R729	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R730	RESISTOR, FIXED, FILM: same as R724	705-7110-00
R731	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R732	RESISTOR, FIXED, COMPOSITION: same as R706	745-1373-00
R733	RESISTOR, FIXED, COMPOSITION: 150 ohms $\pm 10\%$, 1/2 w	745-1317-00
R734	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R735	RESISTOR, FIXED, FILM: 13,300 ohms $\pm 1\%$, 1/4 w	705-7150-00
R736	RESISTOR, FIXED, COMPOSITION: 560 ohms $\pm 10\%$, 1/2 w	745-1342-00
R737	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R738	RESISTOR, FIXED, COMPOSITION: same as R733	745-1317-00
R739	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R740	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R741	RESISTOR, FIXED, FILM: 287 ohms $\pm 1\%$, 1/4 w	705-7070-00
R742	RESISTOR, FIXED, COMPOSITION: same as R720	745-1391-00
R743	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R744	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R745	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R746	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R747	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R748	RESISTOR, VARIABLE: composition; 10,000 ohms $\pm 30\%$, 1/4 w	376-4725-00
R749	RESISTOR, FIXED, COMPOSITION: same as R712	745-1415-00
R750	RESISTOR, FIXED, FILM: 562 ohms $\pm 1\%$, 1/4 w	705-7084-00
R751	RESISTOR, FIXED, FILM: 261 ohms $\pm 1\%$, 1/4 w	705-7068-00
R752	RESISTOR, FIXED, FILM: same as R751	705-7068-00
R753	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R754	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R755	RESISTOR, VARIABLE: composition; 250 ohms $\pm 20\%$, 1/4 w	376-4725-00
R756	RESISTOR, FIXED, FILM: 619 ohms $\pm 1\%$, 1/4 w	705-7086-00
R757	RESISTOR, FIXED, COMPOSITION: same as R736	745-1342-00
R758	RESISTOR, FIXED, COMPOSITION: same as R736	745-1342-00
R759	RESISTOR, FIXED, COMPOSITION: same as R723	745-1293-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R760	RESISTOR, FIXED, COMPOSITION: same as R719	745-1398-00
R761	RESISTOR, FIXED, FILM: same as R724	705-7110-00
R762	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R763	RESISTOR, FIXED, COMPOSITION: 390 ohms $\pm 10\%$, 1/2 w	745-1335-00
R764	RESISTOR, FIXED, COMPOSITION: 0.12 megohm $\pm 10\%$, 1/2 w	745-1440-00
R765	RESISTOR, FIXED, FILM: 5110 ohms $\pm 1\%$, 1/4 w	705-7130-00
R766	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R767	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R768	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R769	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R770	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R771	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R772	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
S701	SWITCH SECTION, ROTARY: 6 circuit, 3 position; 3 section; 4 moving, 16 fixed contacts; Oak Mfg. Co. part no. 222274-AH3	259-1597-00
S702	SWITCH, TOGGLE: spdt; 40 amp continuous; 28 v d-c, 20 amp resistive, 15 amp inductance; 115 v, 400 cps, 10 amp resistance, 10 amp inductance; Hetherington, Inc. part no. T1003-AN	266-3099-00
S703	SWITCH SECTION, ROTARY: 4 circuit, 7 position, 4 section; 3 moving, 24 fixed contacts; Grigsby Allison Co., Inc. part no. A25242-4MLR-4	259-1596-00
T701	TRANSFORMER, RADIO FREQUENCY, BALANCED: c/o plastic fabric base phenolic board 1/16 in. by 1-3/16 in. by 1-3/16 in.; plus 3 coils, 75 turns ea; coil #1, wound ccw, coils #2 and #3, cw; plus plastic rod 0.159 in. w by 0.413 in. dia	549-1639-00
TB701	TERMINAL BOARD: phenolic, barrier type w/ lug for back connection; 12 terminals	367-0020-00
TB702	TERMINAL BOARD: bakelite, 4 terminals, 3/8 in. by 1/2 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1534-A	306-2240-00
TB703	TERMINAL BOARD: same as TB702	306-2240-00
TB704	TERMINAL BOARD: 4 solder-lug terminals, brass; 3/8 in. by 1-1/2 in. overall	306-0698-00
TB705	TERMINAL BOARD: phenolic, 4 brass solder lug terminals; 1/16 in. by 3/8 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1532A	306-9032-00
TB706	TERMINAL BOARD: phenolic, 3 solder-lug terminals; 11/16 in. by 1-1/8 in. lg	306-0587-00
TB707	TERMINAL BOARD: same as TB706	306-0587-00
TB708	TERMINAL BOARD: same as TB702	306-2240-00
TB709	TERMINAL BOARD: phenolic, 5 brass solder lug terminals; 1/16 in. by 3/8 in. by 1-7/8 in.; Cinch Mfg. Corp. part no. 1542-A-FV	306-0951-00
TB710	TERMINAL BOARD: same as TB702	306-2240-00
TB711	TERMINAL BOARD: laminated phenolic w/ 4 solder lug terminals; 27/32 in. w by 1-1/2 in. lg; Cinch Mfg. Corp. part no. 1909	306-0838-00
TB712	TERMINAL BOARD: same as TB702	306-2240-00
TB713	TERMINAL BOARD: same as TB706	306-0587-00
TB714	TERMINAL BOARD: same as TB711	306-0838-00
TB715	TERMINAL BOARD: same as TB711	306-0838-00
TB716	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1520-A	306-9033-00
TB717	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1525A	306-0001-00
TB718	TERMINAL BOARD: same as TB704	306-0698-00
TB719	TERMINAL BOARD: same as TB702	306-2240-00
TB720	TERMINAL BOARD: same as TB717	306-0001-00
TB721	TERMINAL BOARD: same as TB704	306-0698-00
XFL701	SOCKET, ELECTRON TUBE: 8 prong octal tube socket w/ steel mtg plate; Amphenol-Borg Electronics part no. 88-8TM	220-1005-00
XQ701	SOCKET, TRANSISTOR: 3 contacts spaced on 0.200 in. dia circle; Elco Corp. part no. 3307X	352-9903-00
XQ702	SOCKET, TRANSISTOR: 4 contacts spaced on 0.200 in. dia circle; Elco Corp. part no. 3307	352-9902-00
XQ703	SOCKET, TRANSISTOR: same as XQ701	352-9903-00
XQ704	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ705	SOCKET, TRANSISTOR: same as XQ701	352-9903-00
XQ706	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ707	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ708	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XY701	SOCKET, CRYSTAL: 2 regularly spaced contact positions, 0.486 in. c to c ea contact, 0.243 in. from center; cadmium plated phosphor bronze or beryllium copper; Hugh H. Eby part no. 8879	292-0082-00
Y701	CRYSTAL UNIT, QUARTZ: 38,000 kc	289-5392-00

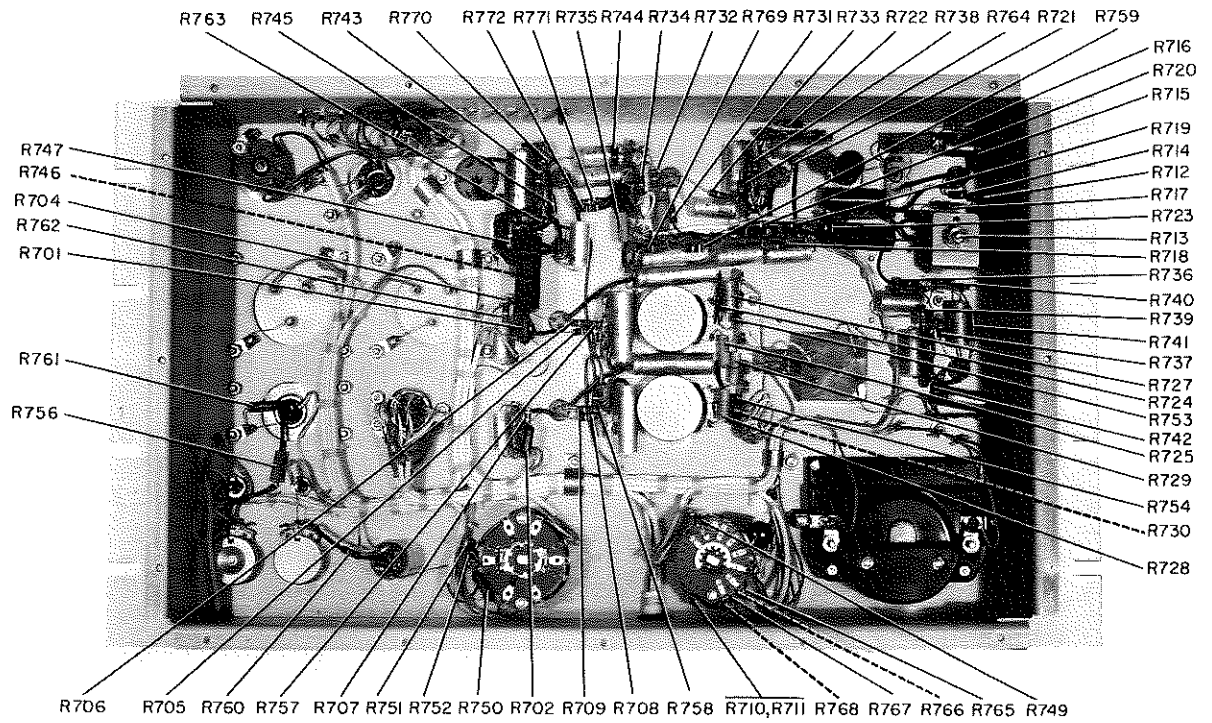


Figure 4-1. 786M-1 Stereo Generator, Rear View, Resistor Location

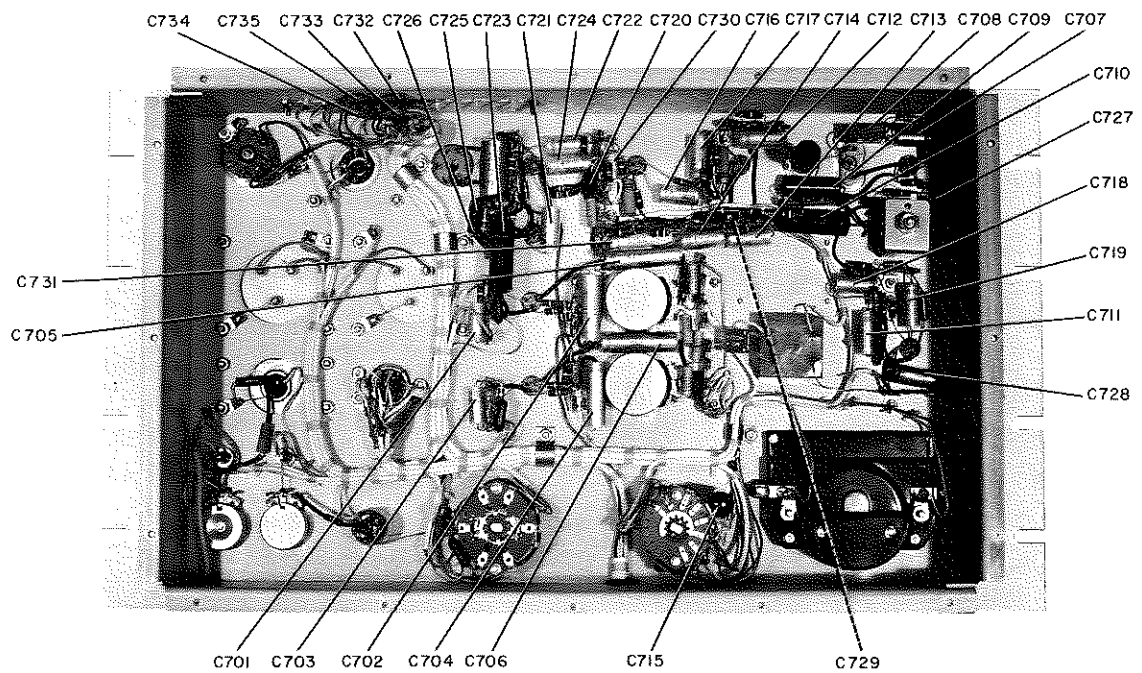


Figure 4-2. 786M-1 Stereo Generator, Rear View, Capacitor Location

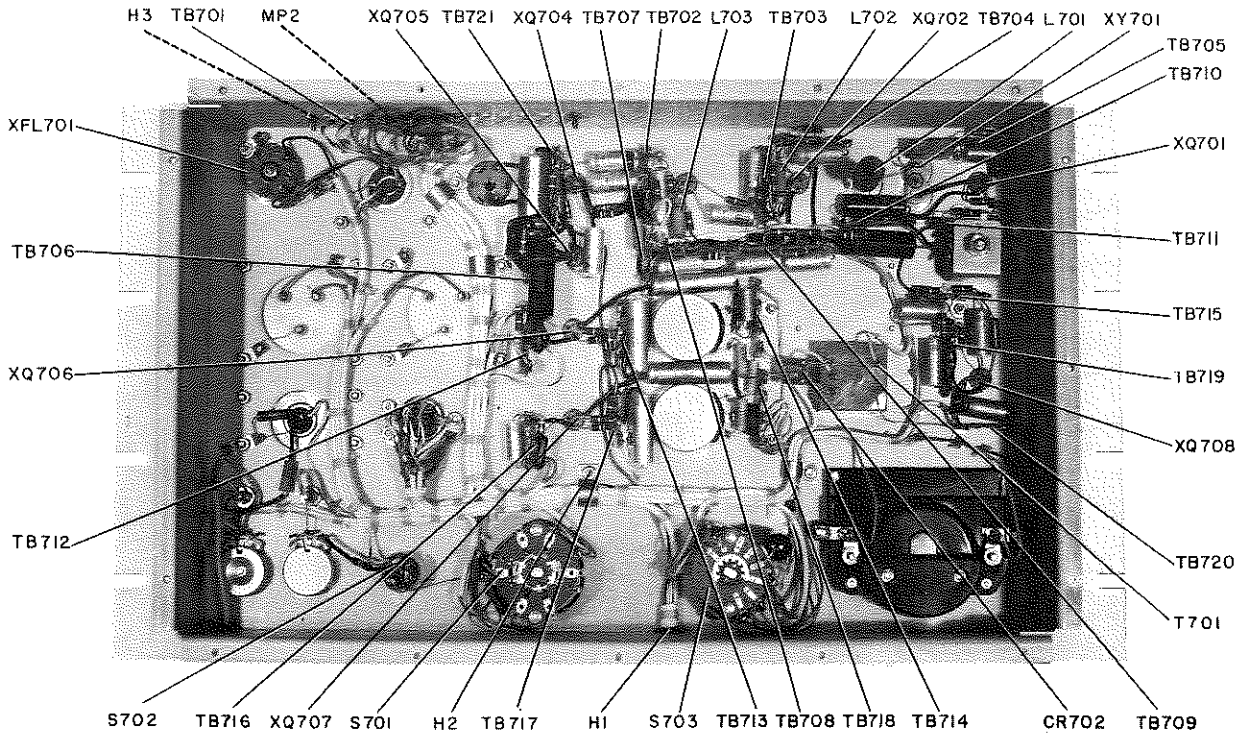


Figure 4-3. 786M-1 Stereo Generator, Rear View, Miscellaneous Parts Location

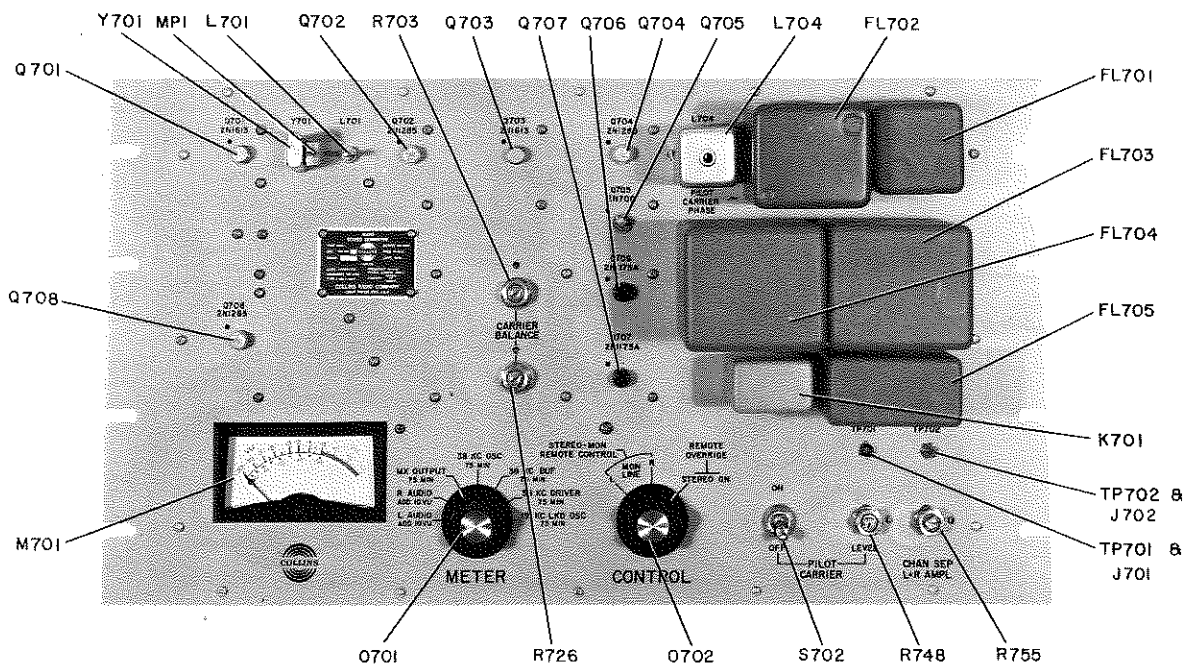
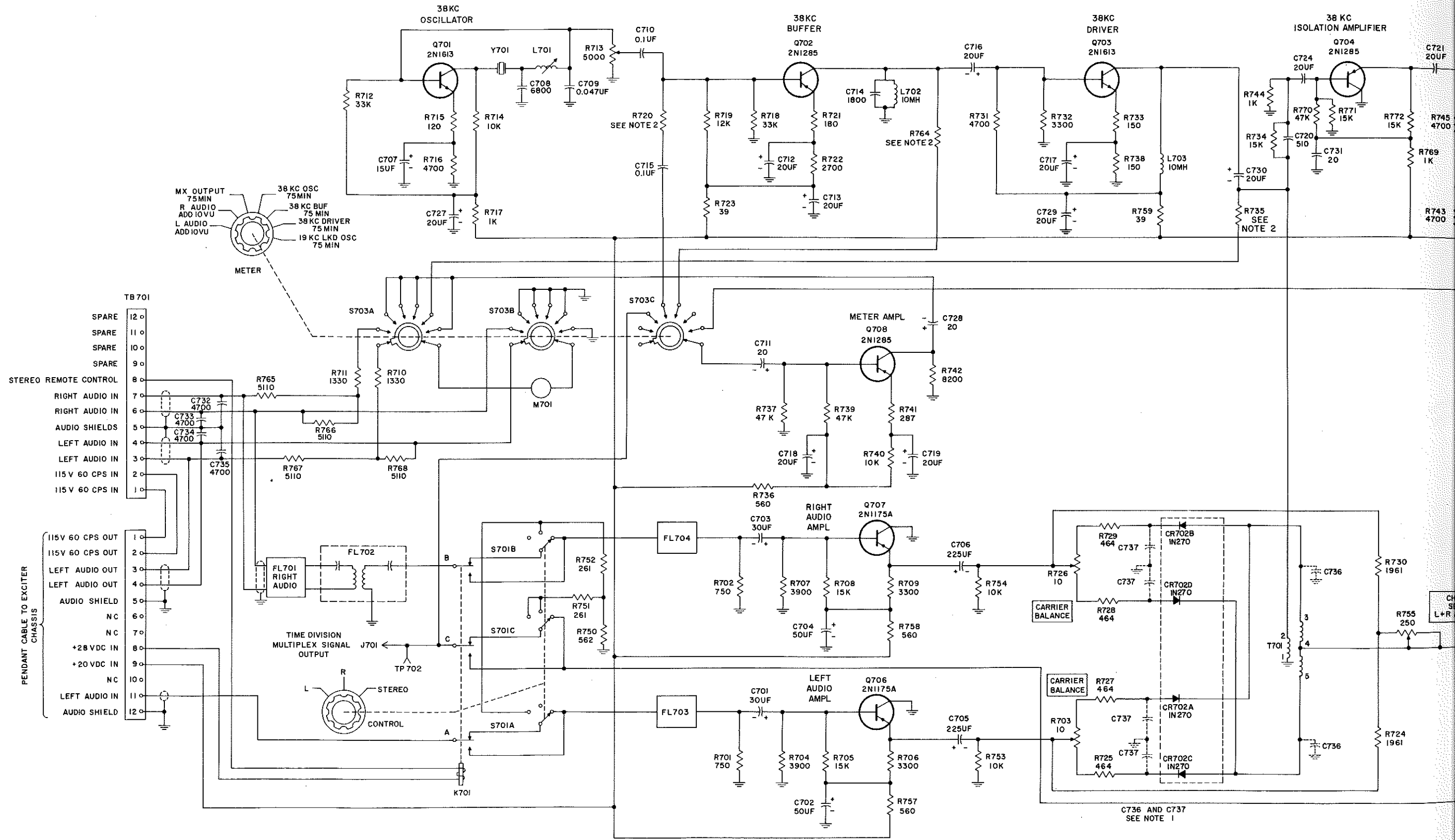


Figure 4-4. 786M-1 Stereo Generator, Front View, Parts Location



SECTION V ILLUSTRATIONS

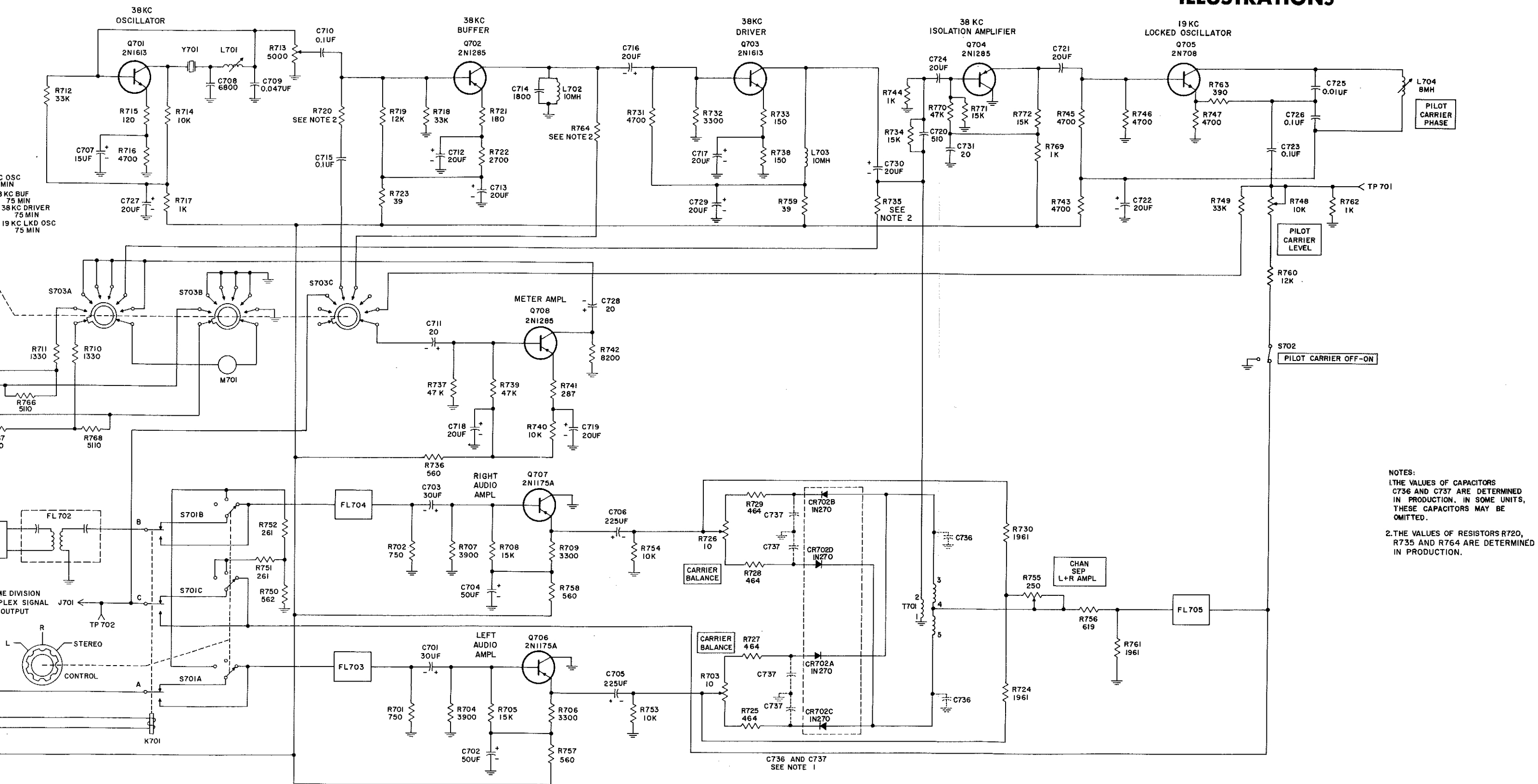


Figure 5-1. 786M-1 Stereo Generator, Schematic Diagram