Rockwell International

instruction book



Commercial Telecommunications Group

# 831C-2 1.25-kW FM Transmitter and 831D-2 2.5-kW FM Transmitter 310Z-2 FM Exciter

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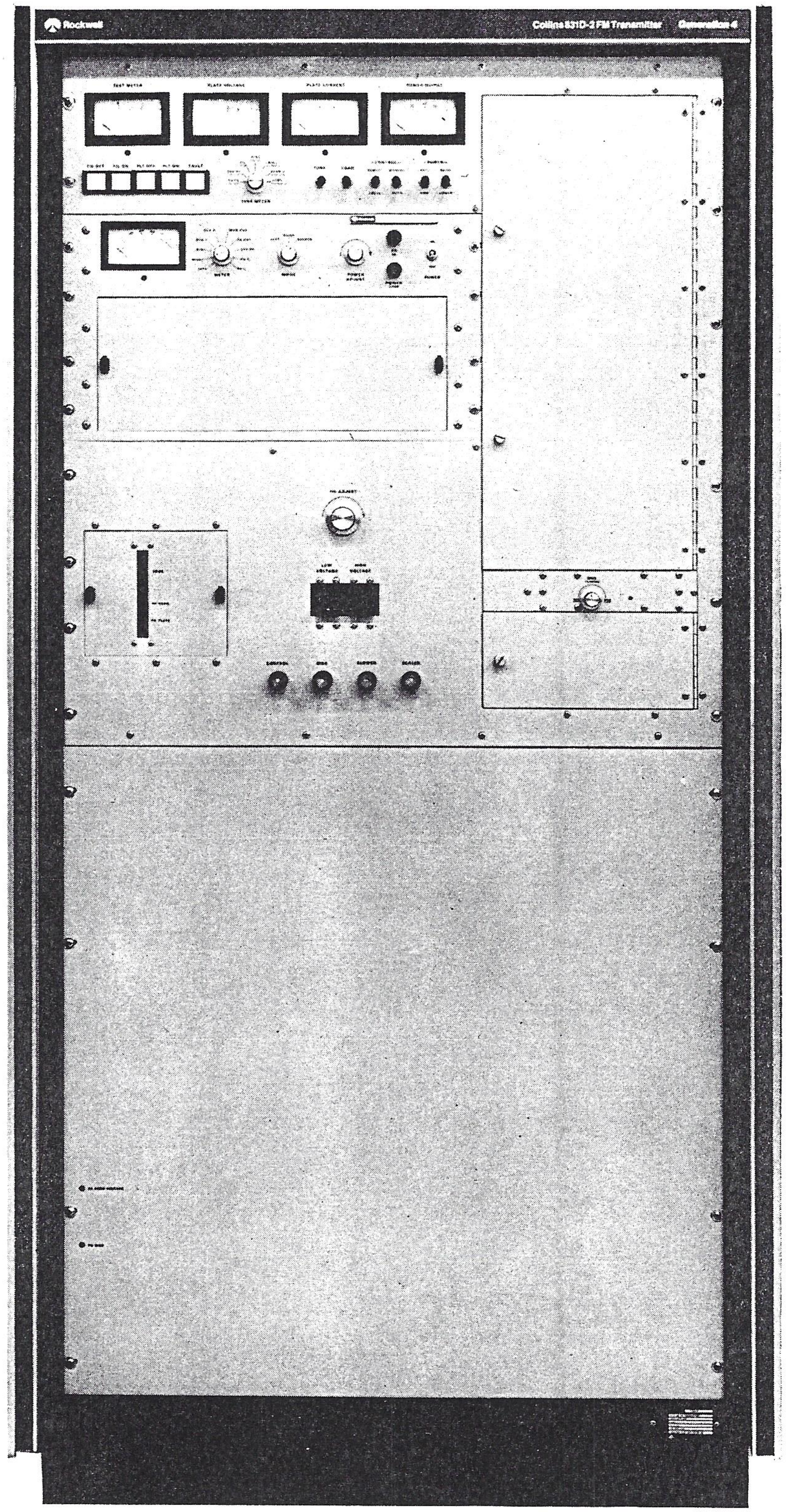


Figure 1-1. 831D-2 2.5-kW FM Transmitter, Typical for 831C-2 1.25-kW FM Transmitter (Sheet 1 of 3).

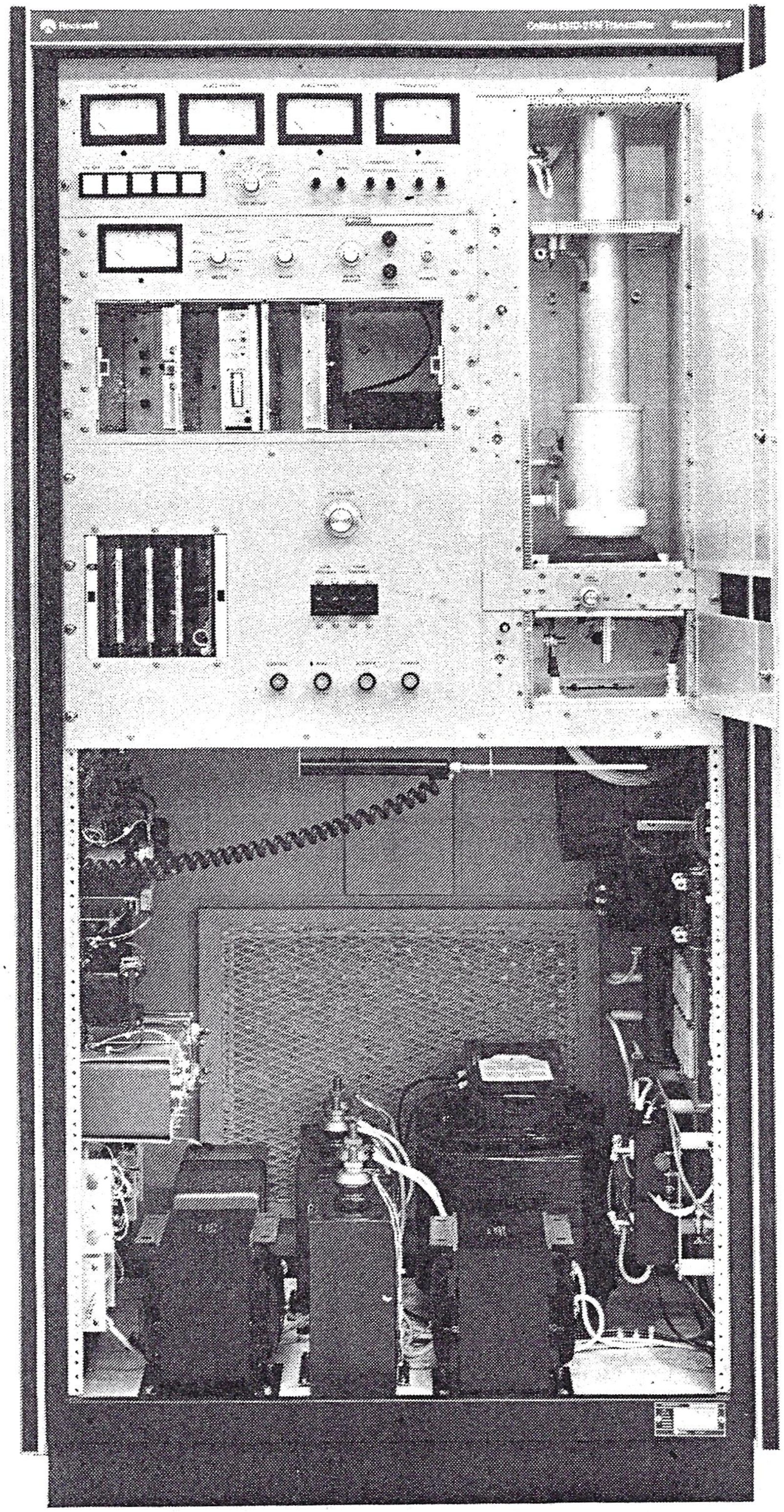


Figure 1-1. 831D-2 2.5-kW FM Transmitter, Typical for 831C-2 1.25-kW FM Transmitter (Sheet 2 of 3).

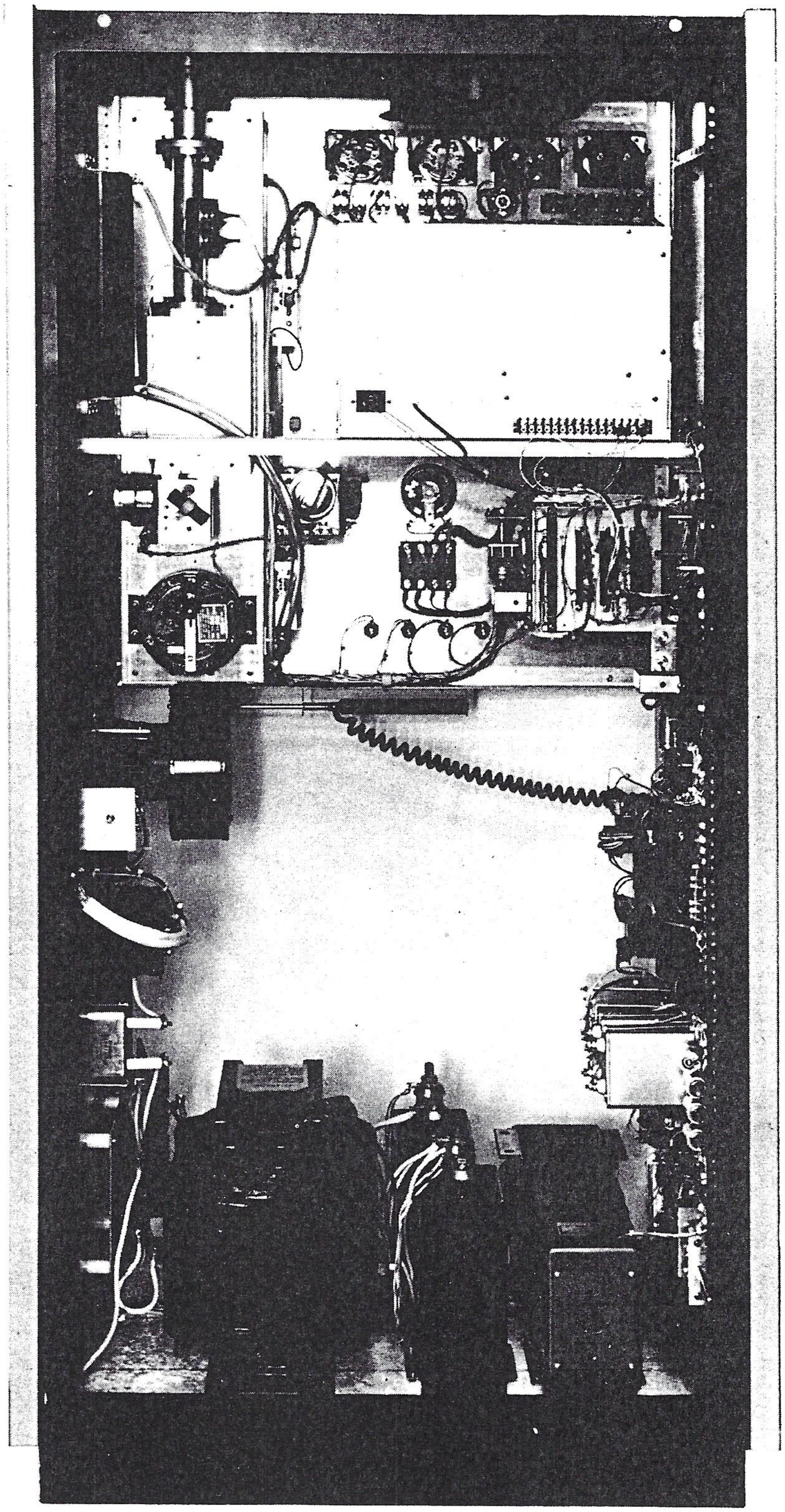


Figure 1-1. 831D-2 2.5-kW FM Transmitter, Typical for 831C-2 1.25-kW FM Transmitter (Sheet 3 of 3).

## 1.1 INTRODUCTION

The Collins 831C-2 1.25-kW FM Transmitter and 831D-2 2.5-kW FM Transmitter (figure 1-1) operate in the FM broadcast range (88 to 108 MHz), and when equipped with optional stereo generator and SCA generator, provide continuous monaural, stereophonic, and SCA (subsidiary communication authorization) frequency-modulated service. Reduced power output is available by tap changes at the plate and screen transformers and by "phasing back" the power controller.

## 1.2 PHYSICAL DESCRIPTION

The transmitter is housed in a single cabinet which utilizes a steel frame with removable front and rear panels. Access is from the front for exciter modules, control circuit cards, and the power amplifier tube, and from the front and rear for other components. Mechanical and electrical interlocks are provided on front and rear access panels, power amplifier plate cavity door, and grid compartment door. Location of major assemblies that make up the transmitter is shown in figure 3-1.

The transmitter output connection is a 50-ohm, 4.1-cm (1-5/8-inch) EIA flange. A transmission line which terminates in an FM antenna or 50-ohm dummy load must be connected to the transmitter output before energizing the equipment.

## 1.3 FUNCTIONAL DESCRIPTION

The 831C-2 and 831D-2 transmitters consist of a 310Z-2 FM Exciter, a single tube rf power amplifier cavity assembly, solid-state sensing circuits, and an optional overload tally/recycle card. The FM exciter generates a 20-watt frequency-modulated signal that drives a single 5CX1500A power amplifier tube to 1250 watts (831C-2) or to 2500 watts (831D-2) output power into a 50-ohm load. Solid-state sensing circuits remove power if a power amplifier plate, power amplifier screen, or vswr overload occurs. The optional overload tally/recycle card provides status memory of which circuit overloaded and provides either 2-shot or 4-shot transmitter recycle.

The transmitter may be controlled locally at the transmitter, through an extended control panel, or remotely with a customer-supplied external remote control unit. Remote connections are accomplished through terminal boards inside the transmitter.

## 1.4 TECHNICAL CHARACTERISTICS

### 1.4.1 Mechanical

| | |
|---|---|
| Weight: | 317.5 kg (700 pounds), 831C-2<br>340.2 kg (750 pounds), 831D-2 |
| Size: | 1736.4 mm (68.38 inches) high<br>882.6 mm (34.75 inches) wide<br>616.0 mm (24.25 inches) deep |
| Ventilation: | Squirrel-cage type blower mounted inside transmitter under power tube compartment; cabinet flushing fan mounted on top panel |
| Ambient Humidity: | Up to 95% relative humidity |
| Ambient Temperature Range: | $+15^{\circ}$ to $+45^{\circ}C$ ($+59^{\circ}$ to $+113^{\circ}F$) |
| Altitude: | Up to 2286 m (7500 feet) at $+30^{\circ}C$ ($+86^{\circ}F$) |
| Shock and Vibration: | Normal handling and transportation |
| Finish: | Cabinet exterior - gray baked enamel |

### 1.4.2 Electrical

| | |
|---|---|
| Frequency Range: | 88 to 108 MHz; exact operating frequency determined by crystal in oscillator of exciter |
| Power Output: | |
| 831C-2 | 1250 watts maximum, into a 50-ohm unbalanced load, standing wave ratio not to exceed 2:1 |
| 831D-2 | 2500 watts maximum, into a 50-ohm unbalanced load, standing wave ratio not to exceed 2:1 |
| Power Range: | |
| 831C-2 | 250 to 1250 watts |
| 831D-2 | 500 to 2500 watts |
| Power Source: | 200 to 250 volts ac, 60 Hz, single phase (50 Hz available) |
| Input Power Requirements: | |
| 831C-2 | 3000 watts; power factor 0.90 |
| 831D-2 | 4900 watts; power factor 0.90 |

| | |
|---|---|
| Excitation Source: | 310Z-2 20-Watt FM Exciter |
| Output Impedance: | 50 ohms, unbalanced |
| Output Connection: | 4.1-cm (1-5/8-inch) EIA flange |
| Carrier Frequency Stability: | Within ±500 Hz of specified carrier frequency for an ambient temperature range of $+15^{\circ}$ to $+45^{\circ}C$ ($+59^{\circ}$ to $+113^{\circ}F$) and line voltage variation of ±5% |
| Harmonic and Spurious Radiation: | Any emission appearing on a frequency removed from the carrier by 120 to 240 kHz inclusive is at least 25 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 35 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 77 dB below the level of the unmodulated carrier for the 831D-2, and at least 74 dB for the 831C-2. |
| Modulation Characteristics: | Wide-band direct FM |
| Audio Input Impedance (to the exciter): | 600 ohms, balanced |
| Audio Input Level (to the exciter): | +10 dBm ±2 dB |
| Audio Frequency Response: | Complies with standard FCC 75-μs preemphasis curve |
| Audio Frequency Distortion: | |
| Monaural | Not more than 0.25% |
| Stereo | Not more than 0.5% |
| Intermodulation Distortion: | |
| Monaural | 0.25% maximum |
| Stereo | 0.5% maximum |
| Stereo Separation: | 50 Hz to 15,000 Hz, 35 dB minimum; reaching 50-dB midrange |
| FM Noise Level: | 65 dB below 100% modulation (±75 kHz) |

| | |
|---|---|
| AM Noise Level (rms): | Not less than 55 dB below equivalent 100% AM level |
| SCA: | |
| Monaural | 41 kHz and 67 kHz available |
| Stereo | 67 kHz only; without filters for band-limited audio or with 5-kHz low-pass audio filter and bandpass output filter, 150-μs preemphasis |

## 2.1 UNPACKING AND INSPECTING

### 2.1.1 Domestic Shipments

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

**CAUTION**

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

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

b. Lift the transmitter from the shipping skid.

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

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

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

### 2.1.2 Foreign Shipments

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

**CAUTION**

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

a. Position the crated transmitter near its installation site.

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

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

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

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

## 2.2 PREINSTALLATION

### 2.2.1 Power and Control Cables

Refer to figure 2-1. Power and audio cables may be brought into the transmitter through access holes at the top or at the bottom of the transmitter. Determine the length needed and the placement of the following cables:

a. Wiring for the 200- to 250-volt ac, 60-Hz, single-phase power source, from customer-supplied disconnect switch (25 amperes for 831C-2, 40 amperes for 831D-2) to A2TB4.

b. The 4.1-cm (1-5/8-inch) rf output coax from the 4.1-cm (1-5/8-inch) EIA flange to the antenna.

c. Audio cables from audio source to 310Z-2 exciter through the customer wiring duct.

d. Rf coaxial cables from cavity sample loops to station monitors (if equipped).

e. Remote control and remote metering cables to customer-supplied remote control equipment.

### 2.2.2 Power Source

The 831C-2/831D-2 transmitters require a 200- to 250-volt ac, 60-Hz, single-phase power source capable of delivering 3000/4900 watts at a power factor of 0.9. Provision should be made for a fused main power disconnect switch or circuit breakers. The fuse or breaker should be rated at 25 amperes for the 831C-2 and 40 amperes for the 831D-2. Connect the primary power to terminal board A2TB4 with no. 8 AWG gauge wire (or in accordance with local wiring codes) as follows:

a. Connect the hot wires to A2TB4-1 and A2TB4-2.

b. Connect the neutral wire to A2TB4-3.

c. Connect the station ground to A2TB4-4.

**NOTE**

> Installation of power line transient voltage suppressors from each power line to ground is recommended. The suppressors should be installed at the fused disconnect box with as short leads as the installation will permit. The voltage from each line to ground should be measured and the appropriate size selected from one of several available reputable suppliers. For further information, contact Collins Customer Service.

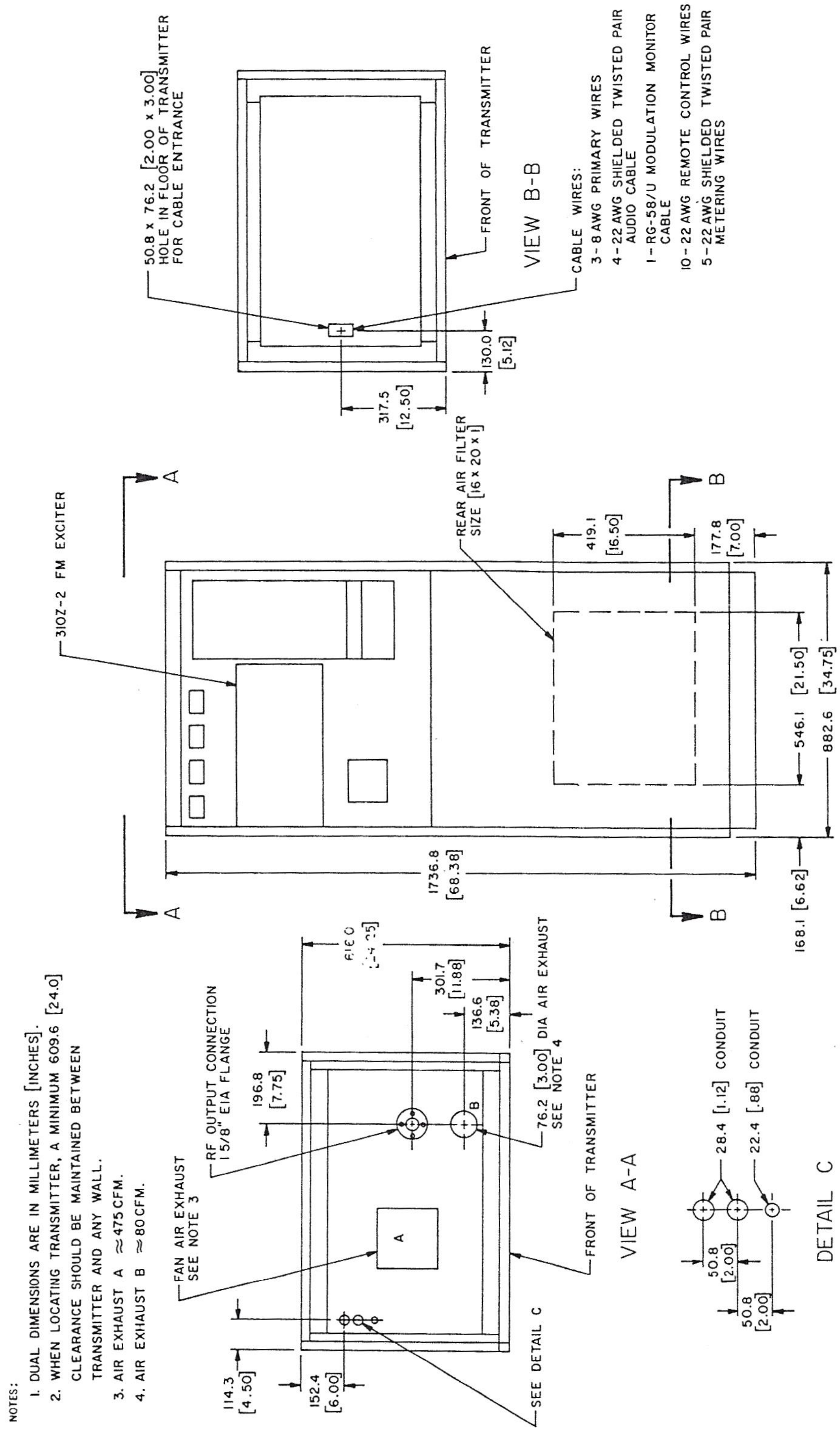



Figure 2-1. 831C-2/831D-2 Outline and Installation Drawing.

### 2.2.3 Transmitter Control

The transmitter may be controlled locally at the transmitter, through an extended control panel (not supplied as part of transmitter), or remotely through customer-supplied remote equipment. Both the extended and remote control configurations use an optional remote control interface card.

## 2.3 COOLING

### 2.3.1 General

The transmitter should be located in a room supplied with an abundance of clean, cool air. If hood and ducting are chosen to dispose of heat to the outside, the hood and exhaust duct must be capable of 1000 cubic feet per minute ($ft^3/min$) and not create any backpressure to the transmitter. It then follows that if the air is exhausted out of the room, an equal amount must be provided into the room to prevent transmitter air supply starvation. Be sure the ambient air conditions comply with equipment specifications.

### 2.3.2 Heat Load

The heat load to the room per hour is as follows:

| | |
|---|---|
| 831C-2 | 1750 watts or 5973 Btu |
| 831D-2 | 2400 watts or 8191 Btu |

### 2.3.3 Air Requirements

The total air flow through the cabinet of the 831C-2 or the 831D-2 is the same, and is as follows:

| | |
|---|---|
| Cabinet Flushing | 475 $ft^3/min$ |
| Tube Cooling | 80 $ft^3/min$ |

All air into the cabinet enters through the air filter on the lower half of the back access panel, and is exhausted out the top of the cabinet. (See figure 2-1 for inlet and exhaust locations.)

## 2.4 LOCATION AND ASSEMBLY

### 2.4.1 Location

a. Place the cabinet in the desired location, making sure that all cables mentioned in paragraph 2.2 are accessible when the cabinet is in position.

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

c. Ascertain that environmental conditions are within the temperature, humidity, and altitude limits listed in paragraph 1.4.1.

WARNING

HIGH VOLTAGE is used in this equipment. DEATH ON CONTACT may result if you fail to observe safety precautions.

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

WARNING

Primary power must not be applied until the procedures in paragraphs 2.4 and 2.5 are completed.

2.4.2 Assembly

a. Remove rear access panel by removing two screws at the bottom of the panel. Lift panel up and off.

b. Remove front access panel.

NOTE

All 831C-2 and 831D-2 transmitters are factory adjusted at a specific line voltage. This voltage is noted on an orange tag affixed to plate transformer T2. If your line voltage is different, set taps on T2, A2T2, and A2T1 before applying power to the transmitter.

c. The range of allowable voltage input is made possible by the availability of tap connections on plate transformer T2, screen transformer A2T1, and 28-volt transformer A2T2. The available power source range is 200 to 250 volts rms ac, 50 or 60 Hz. See figure 2-2 for transmitter transformer connections. Note that 831D-2 plate transformer T2 has additional primary taps 2 and 3 for reduced power operation (lower plate voltage). Additional primary taps are not required on the 831C-2.

NOTE

Transmitters are tuned and tested at the customer's frequency, and are normally shipped with the tube and transformers in position. Under normal initial switch-on conditions, the customer will not be required to perform steps d. through f.

d. Unscrew two panel fasteners on the rf power amplifier cavity door and open the door. Raise the blocking capacitor covering the tube socket and insert the 5CX1500A power amplifier tube. Ensure that the tube fits properly in the socket before turning it clockwise to lock in place. Connect the plate cap lead to the tube and lower the blocking capacitor over the tube.

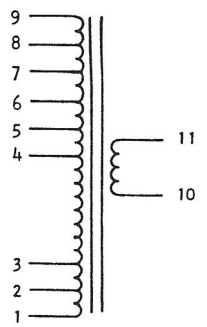
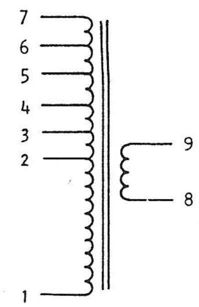


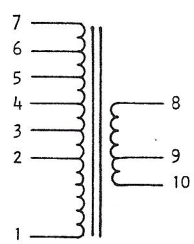

PLATE TRANSFORMER, T2

| LINE VOLTAGE | PRIMARY TERMINAL CONNECTION USED | |
|---|---|---|
| | 831C-2 | 831D-2 |
| 200 | 1-4 | 3-4 |
| 210 | 1-5 | 3-5 |
| 220 | 1-6 | 3-6 |
| 230 | 1-7 | 3-7 |
| 240 | 1-8 | 3-8 |
| 250 | 1-9 | 3-9 |




28 VOLT TRANSFORMER, A2T2

| LINE VOLTAGE | PRIMARY TERMINAL CONNECTION USED |
|---|---|
| 200 | 1-2 |
| 210 | 1-3 |
| 220 | 1-4 |
| 230 | 1-5 |
| 240 | 1-6 |
| 250 | 1-7 |




NOTES

1. FOR OPERATION OF THE 831D-2 TRANSMITTER AT LESS THAN 1400 WATTS OUTPUT, USE TERMINALS 8-9. OTHERWISE USE TERMINALS 8-10.
2. TERMINALS 2 AND 3 ARE NOT PRESENT ON PLATE TRANSFORMER T2 FOR THE 831C-2.

SCREEN TRANSFORMER, A2T1

| LINE VOLTAGE | PRIMARY TERMINAL CONNECTION USED |
|---|---|
| 200 | 1-2 |
| 210 | 1-3 |
| 220 | 1-4 |
| 230 | 1-5 |
| 240 | 1-6 |
| 250 | 1-7 |

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Figure 2-2. Transmitter Transformer Connections.

e. Measure the distance from the floor of the plate cavity to the bottom of the plate slider and make sure this distance corresponds to the proper operating frequency (customer operating frequency), as indicated in figure 2-3. (The plate slider has been preset in the factory for the customer's operating frequency; but if it has been jarred loose in shipping or has been moved for some other reason, it must be reset.) Close the cavity door and lock the fasteners in place.

f. Open the grid tuning door, and measure the distance from the top of the grid tuning bars to the top of the control grid slider (figure 2-3), and ensure the measured distance corresponds to operating frequency. (This distance has also been preset in the factory and should not be adjusted unless the slider has been moved before initial turn-on.) Close the grid tuning door and lock the fastener.

g. Connect the audio cables to the exciter as instructed in the 310Z-2 exciter section of this manual.

h. Connect the customer-supplied 50-ohm output rf transmission line to the 4.1-cm (1-5/8-inch) EIA output flange on the top of the transmitter.

CAUTION

Ensure that the transmission line and antenna or dummy load present an impedance of 50 ohms at a vswr of not more than 2:1 at the operating frequency. Damage will result from an improper match between the transmitter and the transmission line.

i. Connect the customer-supplied modulation and frequency monitor to the jacks on the rear of the power amplifier cavity.

j. Replace all access panels and close all access doors.

## 2.5 INITIAL TURN-ON PROCEDURE

NOTE

Thoroughly familiarize yourself with the location and function of all controls and indicators before proceeding. See figure 2-4 and table 2-1.

### 2.5.1 Preliminary Operating Control Settings

a. Ensure that all circuit breakers are off.

b. Remove paper insulator inserted in the battery pack, BT1 through BT4, located on the A2 assembly. If batteries are low, leave control fuse F1 and LOW VOLTAGE circuit breaker A1CB1 on overnight.

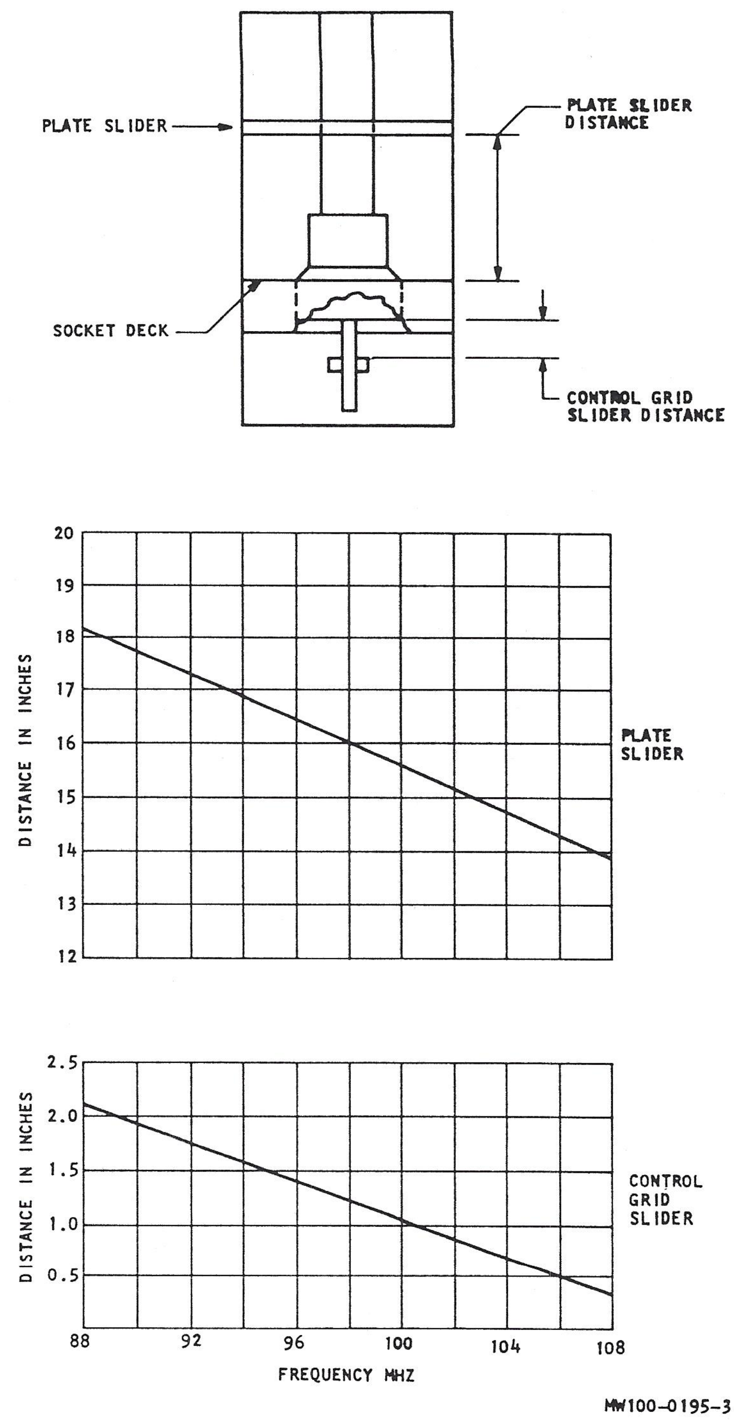



Figure 2-3. Plate and Grid Slider Adjustments.

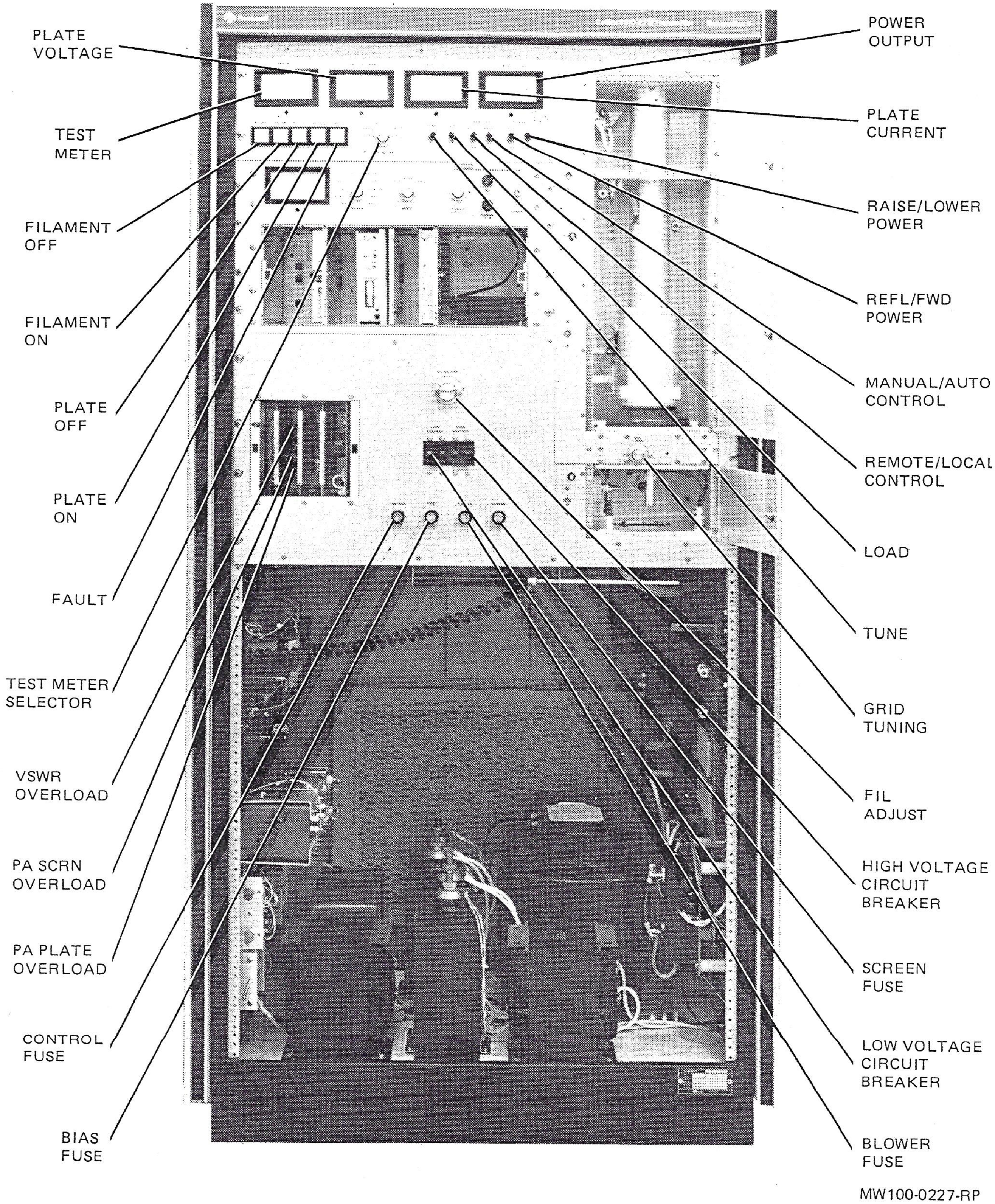



Figure 2-4. 831C-2/831D-2 Controls and Indicators.

Table 2-1. 831C-2 and 831D-2 Controls and Indicators.

| REFERENCE DESIGNATION | CONTROLS AND INDICATORS | FUNCTION |
|---|---|---|
| A1S1 | FIL OFF | Pushbutton momentary switch with indicator lamp. Removes filament voltage from the transmitter. |
| A1S2 | FIL ON | Pushbutton momentary switch with indicator lamp. Applies filament voltage to the transmitter after the blower starts. |
| A1S3 | PLT OFF | Pushbutton momentary switch with indicator lamp. Removes plate and screen voltage from the 5CX1500A. |
| A1S4 | PLT ON | Pushbutton momentary switch with indicator lamp. Applies all operating voltage to the transmitter following a 30- to 45-second plate-on time delay. |
| A1S5 (DS16) | FAULT | Indicates plate, screen, or vswr overload. Pushbutton resets overload indicator. |
| A1S6 | TEST METER Selector | Rotary switch that selects one of seven readings to display on the test meter. |
| A1M1 | TEST METER | Displays seven internal operational voltage or current readings. |
| A1M2 | PLATE VOLTAGE | Displays power amplifier plate voltage. |
| A1M3 | PLATE CURRENT | Displays power amplifier plate current. |
| A1M4 | POWER OUTPUT | Displays transmitter forward or reflected power. |
| A1S7 | TUNE | Spring-loaded momentary switch that positions plate tuning capacitor C9. |
| A1S8 | LOAD | Spring-loaded momentary switch that positions plate loading capacitor C10. |
| A1S9A | REMOTE/LOCAL CONTROL | 2-position switch that selects remote or local control of transmitter. |
| A1S10 | MANUAL/AUTO CONTROL | 2-position switch that selects manual or automatic control of transmitter power. |

Table 2-1. 831C-2 and 831D-2 Controls and Indicators (Cont).

| REFERENCE DESIGNATION | CONTROLS AND INDICATORS | FUNCTION |
|---|---|---|
| A1S11 | REFL/FWD POWER | 2-position switch that selects forward or reflected power for display on the POWER OUTPUT meter. |
| A1S12 | RAISE/LOWER POWER | Spring-loaded momentary switch that lowers or raises power when power control switch S10 is in MANUAL. |
| A1R1 | FIL ADJUST | Potentiometer, adjusts filament voltage. |
| A1CB1 | LOW VOLTAGE | 5-ampere magnetic circuit breaker. |
| A1CB2 | HIGH VOLTAGE | 20-ampere magnetic circuit breaker 831C-2). 30-ampere magnetic circuit breaker 831D-2). |
| A1F1 | CONTROL | 0.5-ampere fuse. |
| A1F2 | BIAS | 0.5-ampere fuse. |
| A1F3 | BLOWER | 2-ampere fuse. |
| A1F4 | SCREEN | 1-ampere fuse. |
| A1A6C4 | GRID TUNING | Adjusts C4 in PA GRID CIRCUIT. |
| A1A2CR2 | VSWR | Tally light on optional talley/recycle card. Indicates vswr overload. Reset by pressing A1S5. |
| A1A2CR4 | PA SCRN | Tally light on optional tally/recycle card. Indicates PA screen overload. Reset by pressing A1S5. |
| A1A2CR5 | PA PLATE | Tally light on optional tally/recycle card. Indicates PA plate overload. Reset by pressing A1S5. |

NOTE

Batteries should be removed during the time the LOW VOLTAGE circuit breaker is open, otherwise, the batteries will run down and will not be able to provide A1A1 logic memory required to restore transmitter to on-air status after a power failure.

Also, the RECYCLE ON/OFF switch in A1A1 control circuit card must remain in the OFF position unless the transmitter is equipped with the optional A1A2 tally/recycle card; in which case, the switch must be in the ON position for the A1A2 card to function.

c. Set the REMOTE/LOCAL CONTROL switch to LOCAL.

d. Set the AUTO/MANUAL CONTROL switch to MANUAL.

e. Set the FWD/REFL POWER switch to FWD.

f. Set the 310Z-2 exciter POWER switch to OFF.

2.5.2 Initial Turn-On

a. Check the fuses in the circuit breaker and fuse panel and make sure that they have the same rating as marked on the panel.

b. Close the primary disconnect switch.

c. Set the LOW VOLTAGE circuit breaker A1CB1 to ON. Press FIL OFF pushbutton. The FIL OFF and PLT OFF pushbuttons should light. Blower may start and run for 30 seconds or less, depending on the status of A1A1.

d. Set TEST METER switch A1S6 to 28V PS position. TEST METER should read 28 volts.

e. Set TEST METER switch A1S6 to 5V PS position. TEST METER should read 5 volts.

f. Set TEST METER switch to FIL position.

g. Press FIL ON pushbutton. Blower should start and when up to speed, the FIL ON pushbutton should light. The TEST METER, with A1S6 in the FIL position, should read 5 volts. If the meter reading is not 5 volts (15 volts full scale), adjust the front panel FIL ADJUST control A1R1 for a 5-volt indication on the TEST METER.

h. Make certain that HIGH VOLTAGE circuit breaker A1CB2 is in the OFF position.

i. Push the PLT ON pushbutton.

NOTE

The PLT ON indicator in the PLT ON pushbutton should light when the high voltage contactor A2K2 operates. A2K2 operates within 30 to 45 seconds after the PLT ON pushbutton is pressed.

j. Set A1S6 to BIAS position. The TEST METER should read approximately 95 volts.

k. After the PLT ON lamp has come on, perform the following steps:

NOTE

High-voltage interlocks and shorting switches are actuated by all the access panels and doors (except the cabinet side panels). When a door or access panel is opened, the high voltage is automatically cut off and the screen and plate power supplies are shorted to ground.

1. Open the plate cavity door. The PLT ON lamp should go out and the PLT OFF lamp should come on. Close the plate cavity door and the PLT OFF lamp should go out and the PLT ON lamp should come on.

2. Open the grid tuning compartment door. The PLT ON and FIL ON lamps should go out and the PLT OFF and FIL OFF lamps should come on. Opening the grid tuning compartment door more than 1 inch deenergizes the PA tube filament. Close the grid tuning compartment door and the PLT OFF and FIL OFF lamps should go out and the PLT ON and FIL ON lamps should come on.

3. Remove and replace lower front access panel, rear panel, and control section cover plate sequentially, noting that each time an access panel or cover plate is opened, the PLT ON lamp goes out and PLT OFF lamp comes on.

CAUTION

Make sure that a 50-ohm transmission line and antenna or suitable dummy load has been connected before proceeding.

l. Set the 310Z-2 POWER switch to ON.

m. Set the MANUAL/AUTO switch to MANUAL.

n. Close HIGH VOLTAGE circuit breaker A1CB2.

o. Press the PLT ON pushbutton. After a maximum delay of 30 to 45 seconds, the PLT ON indicator should light.

p. Set TEST METER switch A1S6 to each of the seven switch positions and compare the indications observed on TEST METER A1M1 with readings given in tables 2-2 or 2-3.

q. If meter indications are substantially lower, perform the following tune-up procedure:

1. Set REFL/FWD POWER switch to FWD. Set TEST METER switch A1S6 to GRID I position.

2. Adjust GRID TUNING capacitor A1A6C4 for peak in grid current, as read on TEST METER.

3. Operate TUNE switch on the control panel to dip plate current.

Table 2-2. Typical Control Panel Meter Readings at Various Output Power Levels (831C-2).

| METER | 250 W | 500 W | 750 W | 1000 W | 1250 W |
|---|---|---|---|---|---|
| TEST METER positions | | | | | |
| 5V PS | 5.1V | 5.1V | 5.1V | 5.1V | 5.1V |
| 28V PS | 30V | 30V | 30V | 30V | 30V |
| FIL | 4.95V | 5.0V | 5.0V | 5.0V | 5.0V |
| BIAS | 135V | 131V | 128V | 125V | 121V |
| GRID I | 7.0mA | 6.5mA | 5.8mA | 5.2mA | 4.5mA |
| SCRN V | 210V | 270V | 310V | 350V | 390V |
| SCRN I | 25mA | 37mA | 47mA | 57mA | 66mA |
| PLATE VOLTAGE | 1450V | 1900V | 2280V | 2550V | 2880V |
| PLATE CURRENT | 290mA | 390mA | 470mA | 550mA | 630mA |
| POWER OUTPUT | 100% | 100% | 100% | 100% | 100% |

Table 2-3. Typical Control Panel Meter Readings at Various Output Power Levels (831D-2).

| METER | 500 W | 1000 W | 2000 W | 2500 W |
|---|---|---|---|---|
| TEST METER positions | | | | |
| 5V PS | 5V | 5V | 5V | 5V |
| 28V PS | 28V | 28V | 28V | 28V |
| FIL | 4.8V | 4.8V | 4.8V | 4.8V |
| BIAS | 105V | 100V | 100V | 98V |
| GRID I | 11mA | 10mA | 9.5mA | 9.3mA |
| SCRN V | 270V | 350V | 465V | 525V |
| SCRN I | 54mA | 65mA | 78mA | 90mA |
| PLATE VOLTAGE | 2250V | 3200V | 4500V | 4750V |
| PLATE CURRENT | 340mA | 480mA | 680mA | 790mA |
| POWER OUTPUT | 100% | 100% | 100% | 100% |

4. Operate LOAD switch to maximize power output.

NOTE

The TUNE and LOAD controls operate motors driving plate-tuning capacitor C9 and plate-loading capacitor C10. Considerable interaction exists between the controls and adjustment may have to be repeated several times to optimize power output and efficiency.

5. Operate the RAISE/LOWER POWER switch to obtain the desired power.

NOTE

The RAISE/LOWER POWER switch raises and lowers the plate and screen voltage of the 5CX1500A tube.

6. The POWER OUTPUT meter readings should approximate those in table 2-2 for the 831C-2 or table 2-3 for the 831D-2.

r. Set the MANUAL/AUTO CONTROL switch to AUTO.

s. Adjust APC control R13 (screwdriver-adjust trimpot) on power monitor card A1A3 to the required rf power output level.

NOTE

The power control circuits constantly monitor the transmitter. Any overload occurring in the transmitter is sensed and the transmitter is automatically shut down. With the power control in AUTO, the rf output power level is also monitored, and the plate and screen voltages are automatically raised and lowered to maintain output power at a level determined by APC control A1A3R13.

t. Perform FCC Proof of Performance tests and record normal operating voltage current and power levels.

u. The transmitter is now ready for normal operation.

## 2.6. NORMAL TURN-ON AND ADJUSTMENTS

a. Close both the LOW VOLTAGE (A1CB1) and HIGH VOLTAGE (A1CB2) circuit breakers.

b. Press FIL OFF pushbutton.

c. Press FIL ON pushbutton.

d. Wait 30 to 45 seconds and check ALARM indicator on the modulator exciter circuit card in the 310Z-2 exciter. The indicator should be extinguished.

e. Set MANUAL/AUTO CONTROL switch to MANUAL.

f. Press PLT ON pushbutton.

g. Observe forward and reflected power. Forward power should be near 100%. If it is not, refer to the factory test data sheet supplied with the transmitter and check all meter readings.

h. Set TEST METER switch A1S6 to GRID I position and adjust GRID TUNING control A1A6C4 for a peak indication on TEST METER A1M1.

i. Operate the TUNE switch to obtain a dip in plate current.

j. Operate the LOAD switch to obtain maximum power output.

NOTE

The LOAD and TUNE controls will interact to a certain degree, and they should be adjusted alternately for highest output with lowest input (best efficiency).

k. Adjust the RAISE/LOWER POWER control for 100% output, as read on the POWER OUTPUT meter.

l. Set the MANUAL/AUTO CONTROL switch to AUTO and adjust R13 on power monitor card A1A3 for an indication of 100% on the POWER OUTPUT meter.

NOTE

A 100% indication on the POWER OUTPUT meter corresponds to the station authorized power level and should correspond to: $E_p \times I_p \times$ EFFICIENCY FACTOR = STATION AUTHORIZED POWER. Efficiency factors for the transmitters are given in figures 2-5 and 2-6.

## 2.7 TURN-OFF PROCEDURES

### 2.7.1 Normal Turn-Off

a. Push PLT OFF pushbutton A1S3.

b. Push FIL OFF pushbutton A1S1.

c. Blower will continue to run for approximately 45 seconds to allow tube cool-down.

d. When the blower stops, set HIGH VOLTAGE (A1CB2) and LOW VOLTAGE (A1CB1) circuit breakers to OFF.

e. Open the primary disconnect switch.

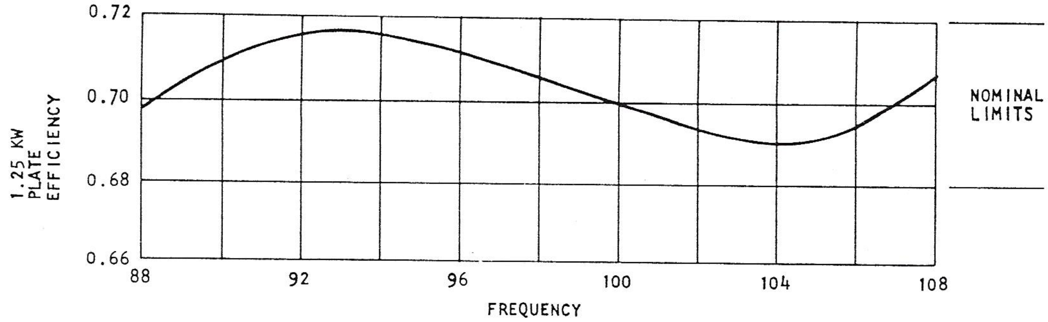
### 2.7.2 Emergency Turn-Off

a. Push FIL OFF pushbutton A1S1.

b. Open HIGH VOLTAGE (A1CB2) and LOW VOLTAGE (A1CB1) circuit breakers

or

c. Open primary disconnect switch.




POWER OUTPUT = $I_P E_P K$

WHERE: $I_P$ = PA PLATE CURRENT IN AMPERES

$E_P$ = PA PLATE VOLTAGE IN VOLTS

K = EFFICIENCY FACTOR FROM CHART

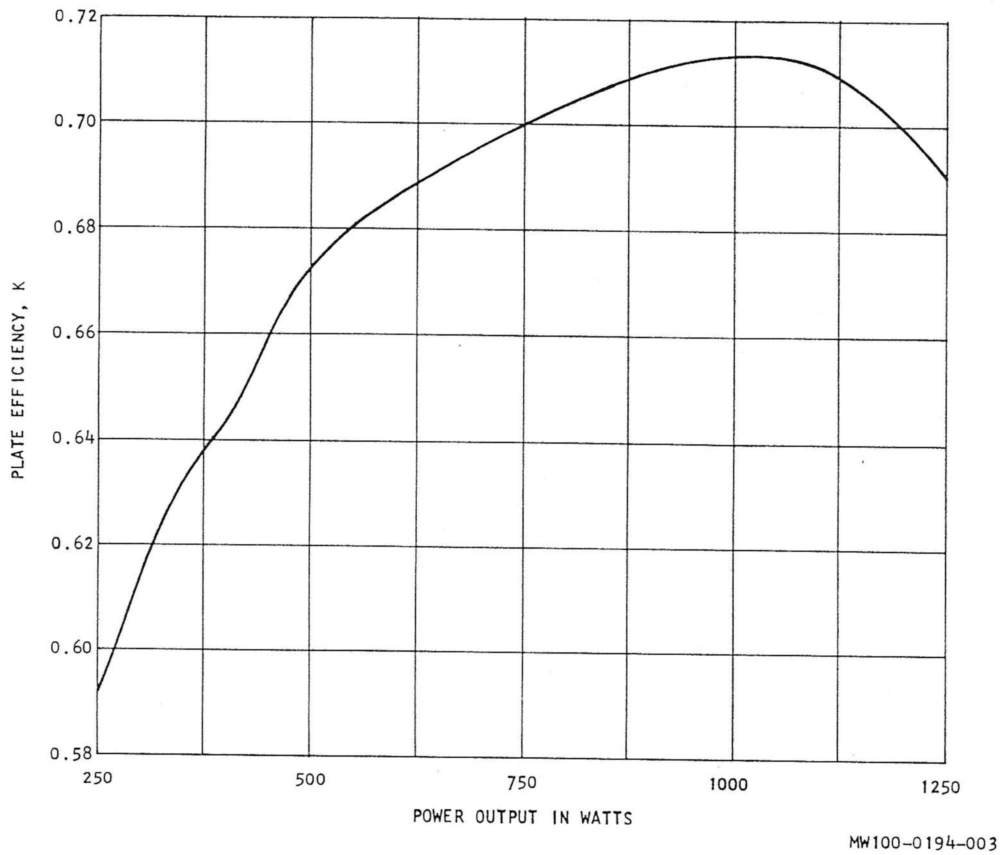
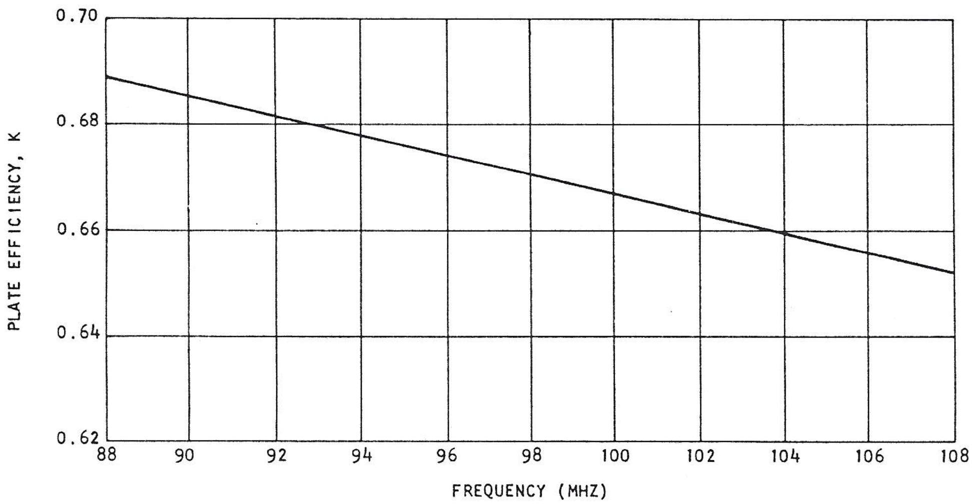



Figure 2-5. 831C-2 Transmitter Efficiency Curves, Typical.

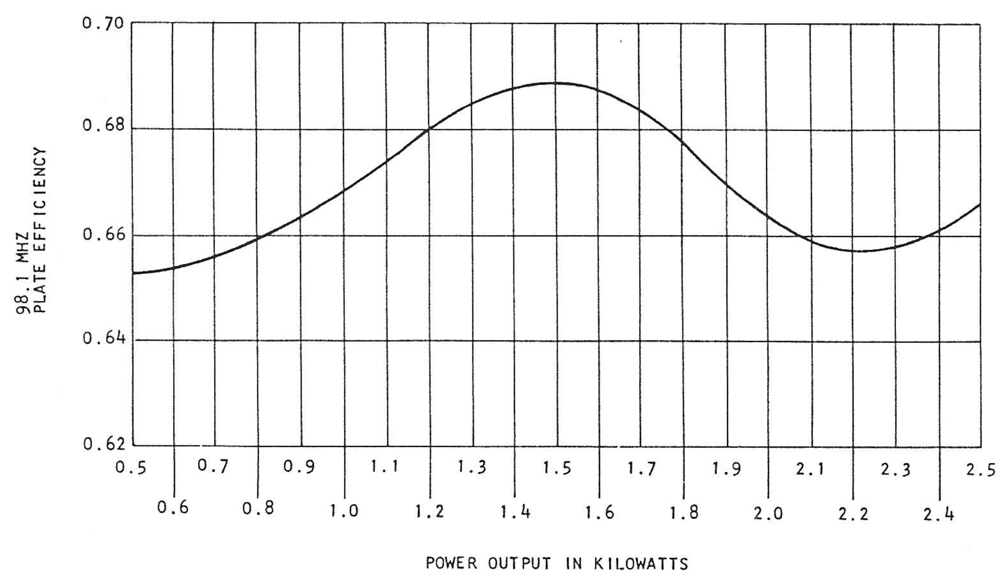



POWER OUTPUT = $I_P E_P K$

WHERE: $I_P$ = PA PLATE CURRENT IN AMPERES

$E_P$ = PA PLATE VOLTAGE IN VOLTS

K = EFFICIENCY FACTOR FROM CHART




MW100-0184-3

Figure 2-6. 831D-2 Transmitter Efficiency Curves, Typical.

## 2.8 REMOTE CONTROL

### 2.8.1 General

The transmitter can be remotely controlled when it is used with the optional remote control assembly A2A4 (Collins part number 632-0073-001) and connected to a customer furnished remote control panel. (See figure 2-7.) Control wiring from the remote control assembly is terminated on A2TB5 in the transmitter. Control information from the remote control panel is fed via an STL (studio transmitter link) to TB1 of the remote control assembly. The remote control panel may also be hard wired to TB1 of the remote control assembly for control purposes and to A2TB6 for metering purposes. See paragraph 2.9 and figure 2-9 for metering terminations and figure 2-8 for typical remote panel.

Fail-safe relay K5 on the remote control assembly A2A4 must be energized at all times the transmitter is under remote control. Relay K5 is energized as long as the transmitter REMOTE/LOCAL CONTROL switch A1S9 has been switched to the REMOTE position, and the sensing relay of the telemetry output of the STL receiver are closed. When the STL relay contacts open, K5 is deenergized. K5 contacts are connected in series with the transmitter's interlock circuits, thus the interlocks are opened when the fail-safe relay is not energized. The mono/stereo select relay is a latching relay. It and all other relays operate on momentary application of 28 volts. The fail-safe relay is energized at all times when the transmitter is operating properly under remote control conditions.

Control pushbuttons on the remote control panel should be of the momentary contact type and should be provided for the following functions:

| | | | |
|---|---|---|---|
| FILAMENT ON | PLATE ON | RAISE POWER | MONO SELECT |
| FILAMENT OFF | PLATE OFF | LOWER POWER | STEREO SELECT |

### 2.8.2 Remote Control Installation

Prior to initial connection of the remote control system, the following transmitter switches must be set:

a. LOW VOLTAGE and HIGH VOLTAGE circuit breakers A1CB1 and A1CB2 to OFF.

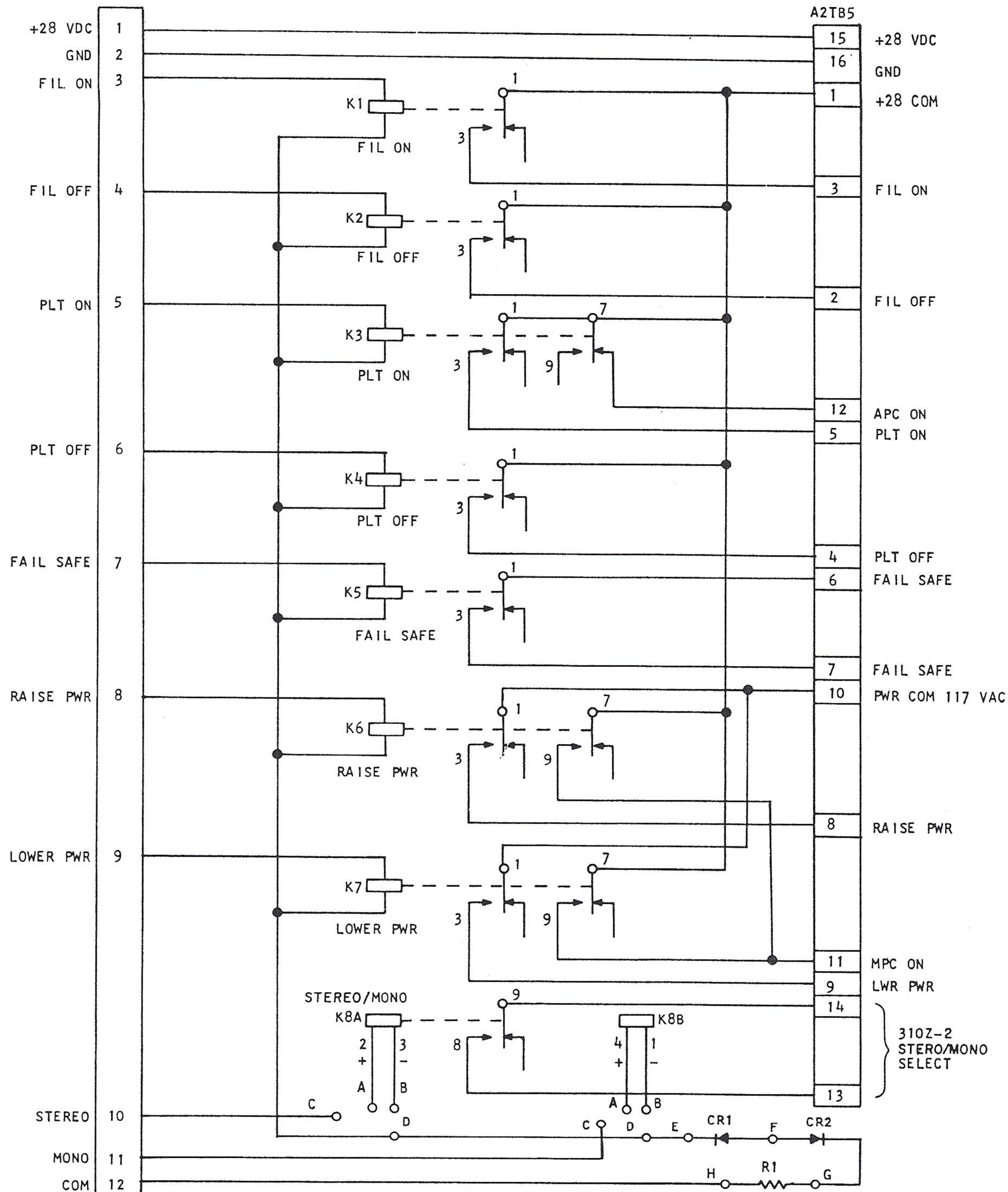
b. Primary disconnect switch to OFF.

### 2.8.3 Remote Interface Board Strapping

The 831C-2/831D-2 will interface with three types of remote control systems; a 28- or 48-volt negative common control power supply system, a 28- or 48-volt positive common control power supply system, or a 115-volt ac control power supply system.

Pins A through H (figure 2-7) provide strapping for the type of power control system used. The internal 28-volt power supply may be used as the remote control source.

The remote control unit is connected to terminals 1 through 6 and 8 through 12 of TB1. The telemetry output of the receiver is connected to a sensing relay with one contact of the relay connected to 28 volts, and one contact connected to pin 7 of TB1.

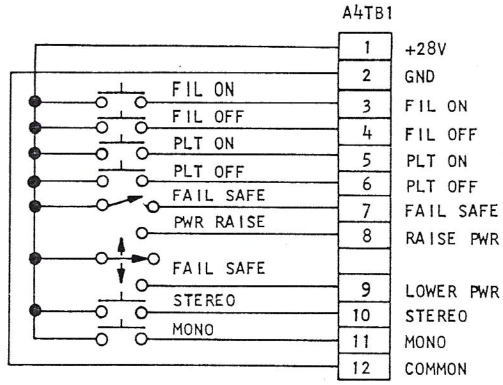



| WIRING CONNECTIONS | | |
|---|---|---|
| VOLTAGE | NEG COM | POS COM |
| 24/48 VDC | E-F, G-H, A-C, B-D | F-H, A-D, B-C |
| 115 VAC | N/A | F-G, A-D, B-C |

NOTE:
WITH EXCEPTION OF FAIL SAFE RELAY K5, OPERATION OF RELAYS REQUIRES ONLY A MOMENTARY PULSE.

MW100-0218-3

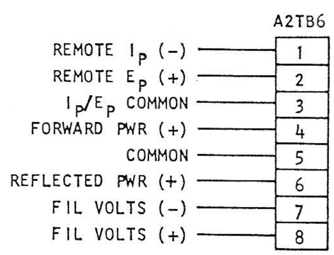
Figure 2-7. Optional Remote Control Interface Card Connections.




NOTES:
1. ALL SWITCHES MOMENTARY EXCEPT FAIL SAFE.
2. REMOTE INTERFACE CARD SHOULD BE STRAPPED 24V NEG COMMON.

MW100-0185-2

Figure 2-8. Remote Switching Connections, Interface Card.




MW100-0186-2

Figure 2-9. Remote Metering Connections.

2.8.4 Remote Control Status

a. Position REMOTE/LOCAL CONTROL switch A1S9A to REMOTE.

b. Set primary power disconnect switch to ON.

c. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers ON.

d. Set 310Z-2 exciter POWER switch to ON.

2.8.5 Remote Power Control

Automatic or manual control of transmitter power can be selected at the remote control panel through PLT ON, RAISE POWER, and LOWER POWER pushbuttons.

Pressing the PLT ON pushbutton on the remote control panel applies +28 volts through A2TB5-5 to pin 8 at U1C in the A1A1 control circuit card and through A2TB5-11 to pins 4 and 5 of U4B in the A1A3 power monitor card. Thus, remote plate-on operations to start or to recycle the transmitter after an overload condition, allow the transmitter to be switched on in the automatic power control mode.

The manual power control mode is selected at the remote control panel by operation of the remote RAISE POWER or LOWER POWER pushbuttons. Operation of either pushbutton energizes K6 or K7 in the remote control interface card and applies +28 volts through A2TB5-12 to pins 1 and 2 of U4A on the A1A3 power monitor card.

Pressing the remote RAISE POWER pushbutton also applies 117 volts ac through A2TB5-8 to the E4 contact of power adjust motor A1A5B1, and operation of the remote LOWER POWER pubhsutton applies 117 volts ac through A2TB5-9 to the E3 contact of the power adjust motor. The power adjust motor drives manual power adjust potentiometer A1A5R2 to control transmitter output power level.

2.8.6 Remote Stereo/Monaural Switching

Remote stereo/monaural switching momentary contact closure of the remote STEREO pushbutton latches relay K8 in one direction and closes the relay contacts. Momentary contact closure of the MONO pushbutton latches K8 in the opposite direction and opens the relay contacts. The relay contact status is applied through A2TB5-13 and A2TB5-14 of the transmitter to TB1-13 and TB1-14 of the 310Z-2 exciter, controlling relay K1 in the A6 audio processing card.

NOTE

> The MODE switch on the 310Z-2 exciter must be in either the LEFT or RIGHT position for remote operation. The STEREO position overrides the remote stereo OFF function.

2.8.7 Remote Overload Reset

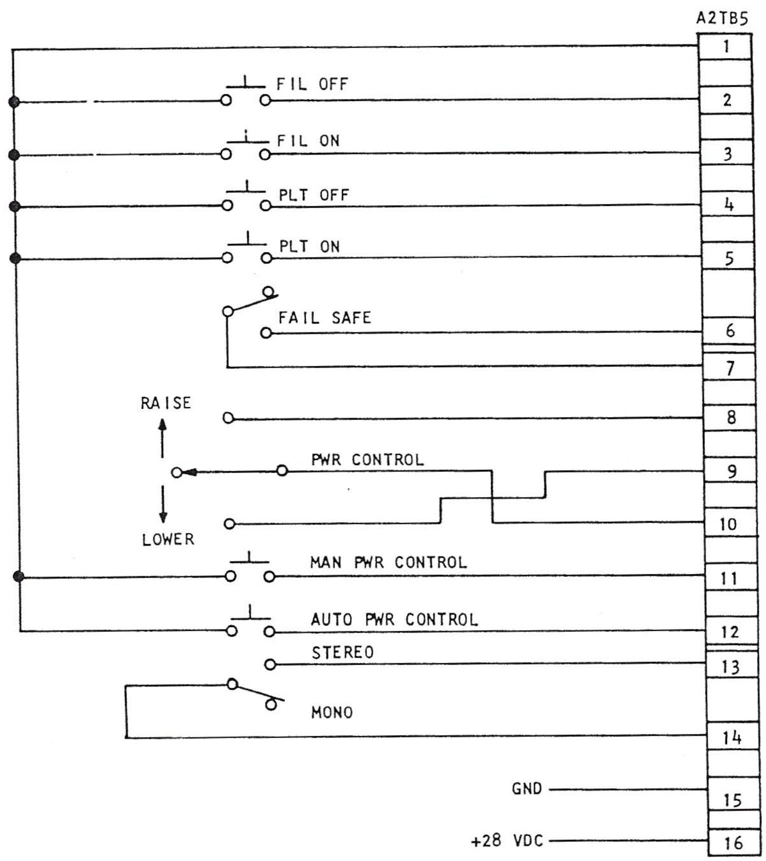
The transmitter may be reset from the remote control panel by pushing the PLT ON pushbutton. The FAULT lamp on the transmitter FAULT pushbutton will remain lit. Manual operation of the FAULT pushbutton on the transmitter is necessary to clear the FAULT lamp.

## 2.9 REMOTE METERING

Refer to figure 2-9. Connections for remote metering of five transmitter parameters; plate current, plate voltage, forward power, reflected power, and filament voltage, are provided at A2TB6.

NOTE

Remote meters must have dc movements and, except for power meters, linear scales.




NOTE:
1. ALL SWITCHES MOMENTARY EXCEPT FAIL SAFE AND MONO/STEREO SELECT.
2. CONNECTIONS SHOWN DIRECT TO A2TB5 AND NOT THROUGH REMOTE INTERFACE CARD.

MW100-0217-3

Figure 2-10. Local Hard-Wired Remote Panel, Optional Connections.

## 3.1 GENERAL

The 831C-2 and 831D-2 FM transmitters (figure 3-1) operate in the 88- to 108-MHz frequency range. The 831C-2 FM Transmitter operates at 1250-watt maximum power output and the 831D-2 FM Transmitter operates at 2500-watt maximum power output.

A Collins 310Z-2 solid-state FM wide-band exciter drives the power amplifier section of the transmitter. The 310Z-2 has provisions for monaural or stereo, and SCA operation.

The 831C-2 and 831D-2 transmitters contain automatic power control circuits and power amplifier overload sensing circuits. An optional overload recycle/tally card may be provided that functions to restore the transmitter to on-the-air status should a temporary overload occur.

Control of the transmitter may be locally at the transmitter or remotely with customer-supplied remote control equipment.

Refer to figure 3-2.

Direct audio (monaural, stereo, SCA) or studio transmitter link (STL) baseband is applied to the 310Z-2 FM Exciter to frequency modulate the on-frequency (88- to 108-MHz) carrier generated in the exciter. The FM exciter provides a stable signal amplified to 20 watts to drive the transmitter power amplifier. The power amplifier cavity contains a 5CX1500A vacuum tube operated class C to amplify the 20-watt signal to output level. The amplified signal is passed through a low-pass filter to attenuate any harmonics or spurious radiation. The filtered signal is applied through a directional coupler to the antenna.

Power control and overload sensing circuits monitor the plate and screen power supply current and rf output levels. The power control circuits monitor dc analog voltage samples of forward and reflected power and raise or lower the plate and screen supply primary transformer voltage to maintain the rf output at a preset level. The overload sensing circuits detect any overload occurring in the plate and screen power supplies and remove power from these supplies by deenergizing the high-voltage contactor. Power for the power control and overload sensing circuits is provided by +28- and +5-volt dc power supplies.

## 3.2 CIRCUIT DESCRIPTION

For purposes of description, the transmitter can be divided into the following sections:

a. 310Z-2 FM Exciter

b. Amplifier

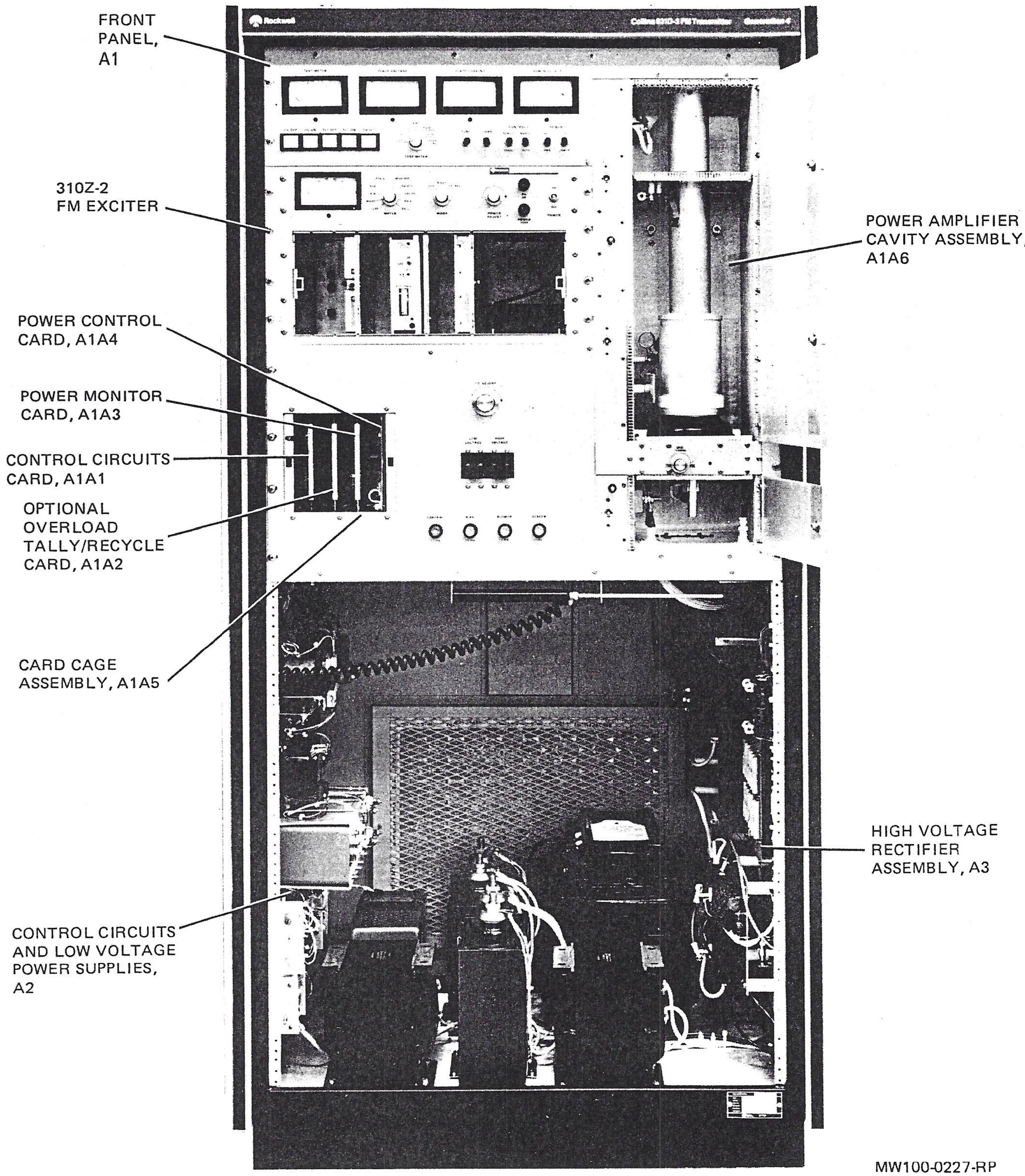



Figure 3-1. 831C-2 and 831D-2 Transmitters, Major Assemblies Location.

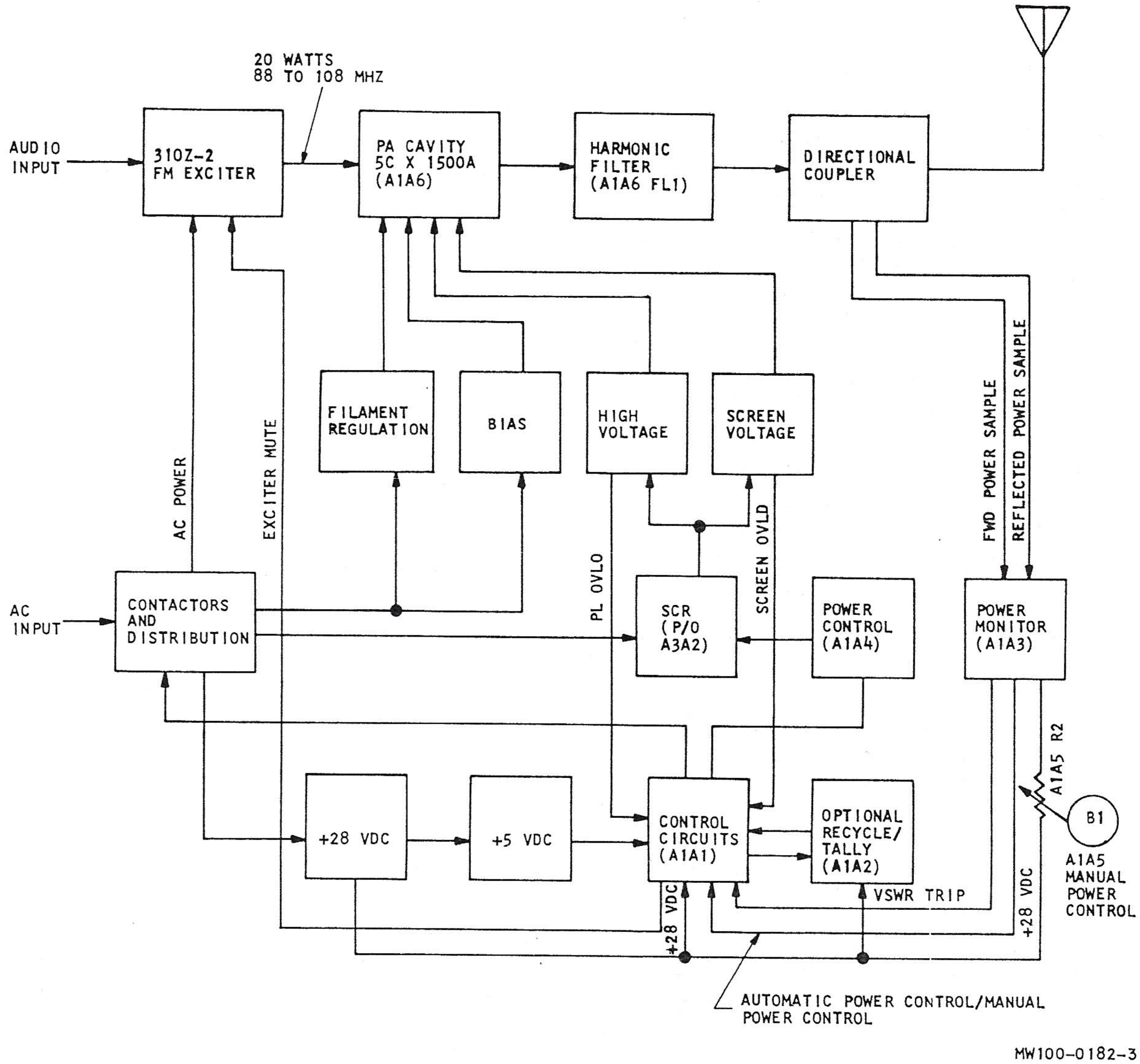



Figure 3-2. 831C-2/831D-2 Transmitters, Simplified Block Diagram.

c. Control Circuits

d. Power Supplies

e. AC Distribution

### 3.2.1 310Z-2 FM Exciter

Refer to the 310Z-2 FM Exciter instruction book furnished as an element to this instruction book.

### 3.2.2 Amplifier Section

The amplifier section consists of a power amplifier cavity, a harmonic filter, and a directional coupler.

Refer to figure 3-3.

3.2.2.1 Power Amplifier Cavity

The output of the FM exciter is coupled through capacitor A1A6C5 to a 5CX1500A pentode operated in class C mode. A1A6C5 acts as a drive level control by matching the output impedance of the exciter (50 ohms) to the input impedance of the 5CX1500A. The input tank circuit of the 5CX1500A is determined by a parallel resonant grid tank circuit composed of capacitors A1A6C4 and A1A6L9, which is formed with two parallel bars shorted by a movable slider.

The internal capacity of the tube socket, choke A1A6L6, choke A1A6L7 and feedthrough capacitor A1A6C1, bypass and decouple the screen. The rf output from the plate of the 5CX1500A is coupled through dc blocking capacitor A1A6C11 to the output tank circuit composed of A1A6C9 and a foreshortened quarter-wave section of transmission line A1A6L10 shorted by a movable plate. Capacitor A1A6C11 is formed by two concentric metal sleeves with Teflon dielectric between them.

The plate TUNE switch A1S7 on the control panel controls tuning motor A1A6B1 to drive tuning capacitor A1A6C9 in the cavity. The plate LOAD switch A1S8 on the control panel controls loading motor A1A6B2 to drive capacitor A1A6C10 in the cavity. Limit switches on motors A1A6B1 and A1A6B2 prevent excessive travel of the capacitors.

Excellent shielding is provided between the plate and control grid of the 5CX1500A, therefore no neutralization is used or is needed.

3.2.2.2 Harmonic Filter

The rf output from the plate tank circuit is applied to harmonic filter FL1. FL1 consists of two series-resonant, M-derived, low-pass end half-sections and a constant-K T center section. The plate tank circuit, L-section L8, and capacitor C27 combined with the harmonic filter provide at least 77-dB attenuation to all main-carrier harmonics through the 10th harmonic. Maximum attenuation occurs at the second harmonic frequency.

3.2.2.3 Directional Coupler

The output of harmonic FL1 is applied to directional coupler DC1. The directional coupler provides an rf output to the antenna and dc analog voltage samples of the forward and reflected power to the power control circuits.

3.2.3 Control Circuits

3.2.3.1 General

The control circuits of the 831C-2/831D-2 transmitter provide automatic switching sequence to take the transmitter to full power, to shut down the transmitter, adjustment for power output, automatic recycle and overload talley (optional), and variable plate and screen voltage control. Overload sensing circuits monitor the plate and screen current and the reflected power from the antenna.

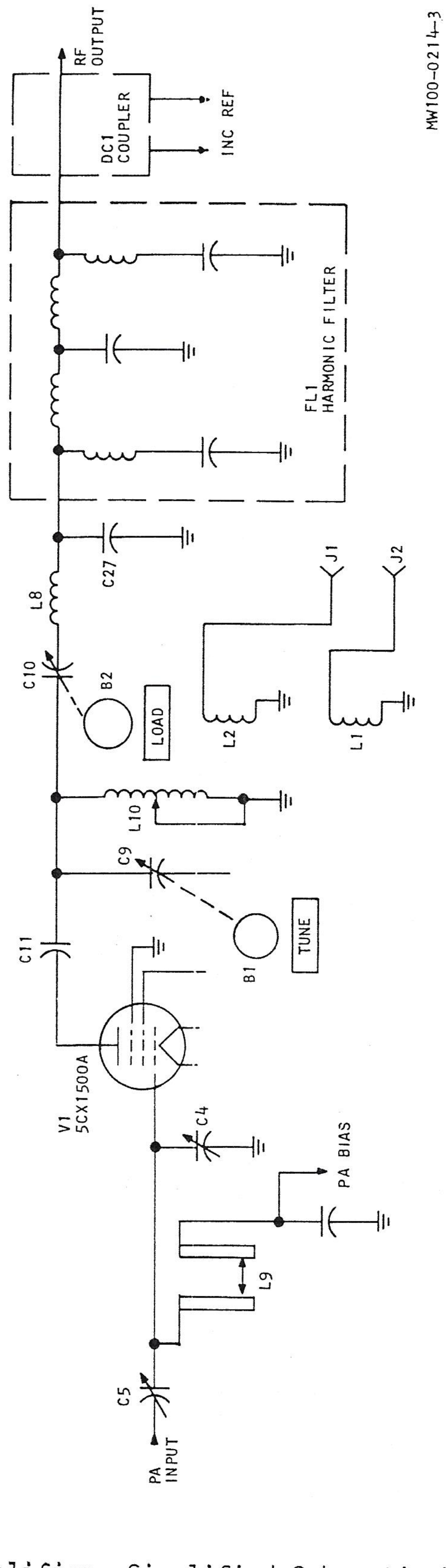



Figure 3-3. Power Amplifier, Simplified Schematic Diagram.

The control circuits include the following circuit cards:

A1A1 Control Circuit Card
A1A2 Overload Tally/Recycle Card (optional)
A1A3 Power Monitor Card
A1A4 Power Control Card

Additional control circuitry is provided in the A2A1 control circuits/low-voltage power supply board assembly and various relays, air switches, and interlock switches.

Most functions in the control circuits utilize common 4700 series TTL integrated circuit logic.

### 3.2.3.2. Control Circuit Card

The basic on/off and overload circuits are contained on control circuit card A1A1, which is a single plug-in card located in the front-panel card cage of the transmitter.

Refer to figure 3-4.

Integrated circuit U1 is a 4-section NOR gate used as an inverter for filament and plate on/off commands. When a filament on command is applied at pin 15, the output of U1A goes to a low state which sets flip-flop U2A and causes the Q output to rise to a high level. The Q output is routed to NAND gate U3A and NOR gate U5A. The output of U5A is directly coupled to both inputs of U5B which inverts the U5A output and causes the output to go to a high state which appears on pin L of the card. The output from pin L is connected through A2TB2 to the control circuits/low-voltage power supply card A2A1. Transistor Q6 on the A2A1 assembly turns on and energizes relay A2K1 which turns on the blower and the primary of a regulator transformer for the power amplifier filament supply. When the blower comes up to speed, air pressure switch A1A6S7 closes and completes a circuit to pin 12 of the A1A1 card. This is a high input which combines with the high output from U2A to produce a low output at U3A. This low output is then fed to NAND gate U3B and timer U6. NAND gate U3B is used as an inverter and presents a high signal to transistor A4 on the A2A1 assembly. Q4 serves as a current amplifier to fire triac Q5 to turn on the PA tube amplifier.

When the filaments are turned off, timer U4 in conjunction with gate U5A provides a timed interval for blower turn-off to allow cooling.

Refer to figure 3-5.

Timer U6 functions as a plate-on time delay, with its output coupled to a flip-flop formed by U3C and U3D. When the time delay has elapsed, an input to NAND gate U7A is readied in the high state. The interlock input through pin D and the plate-on input from flip-flop U2B must also be in the high state for the plate supply to be energized. U2B is set by application of a plate-on command through pin B. With the three inputs to U7A high, its output is low. The U7A output is inverted by U7B and applied to transistor Q4 and through pin 3 to transistor Q7 in the control circuit/low-voltage power supply board assembly (A2A1). The output from Q4 removes the mute voltage from the 310Z-2 exciter, initiates a ramp start voltage for power control A1A4, and lights the PLT ON indicator in the A1S4 pushbutton. Q7 acts as a current amplifier for triac Q8. When Q8 fires, K2 is energized, and primary voltage is applied through SCR's A3Q1 and A3Q2 to the plate and screen supply transformer primaries.

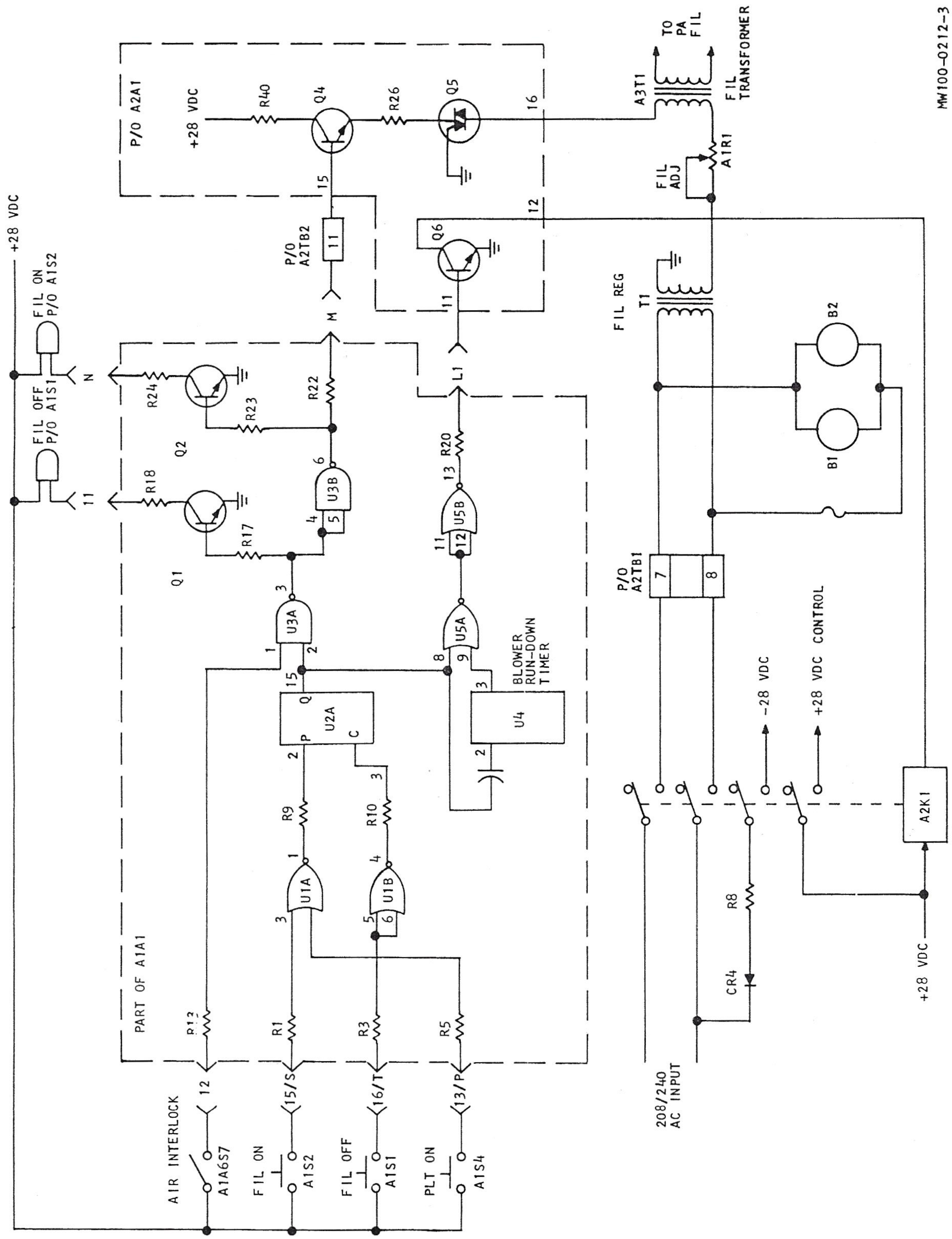



Figure 3-4. Filament and Blower Control, Simplified Schematic Diagram.

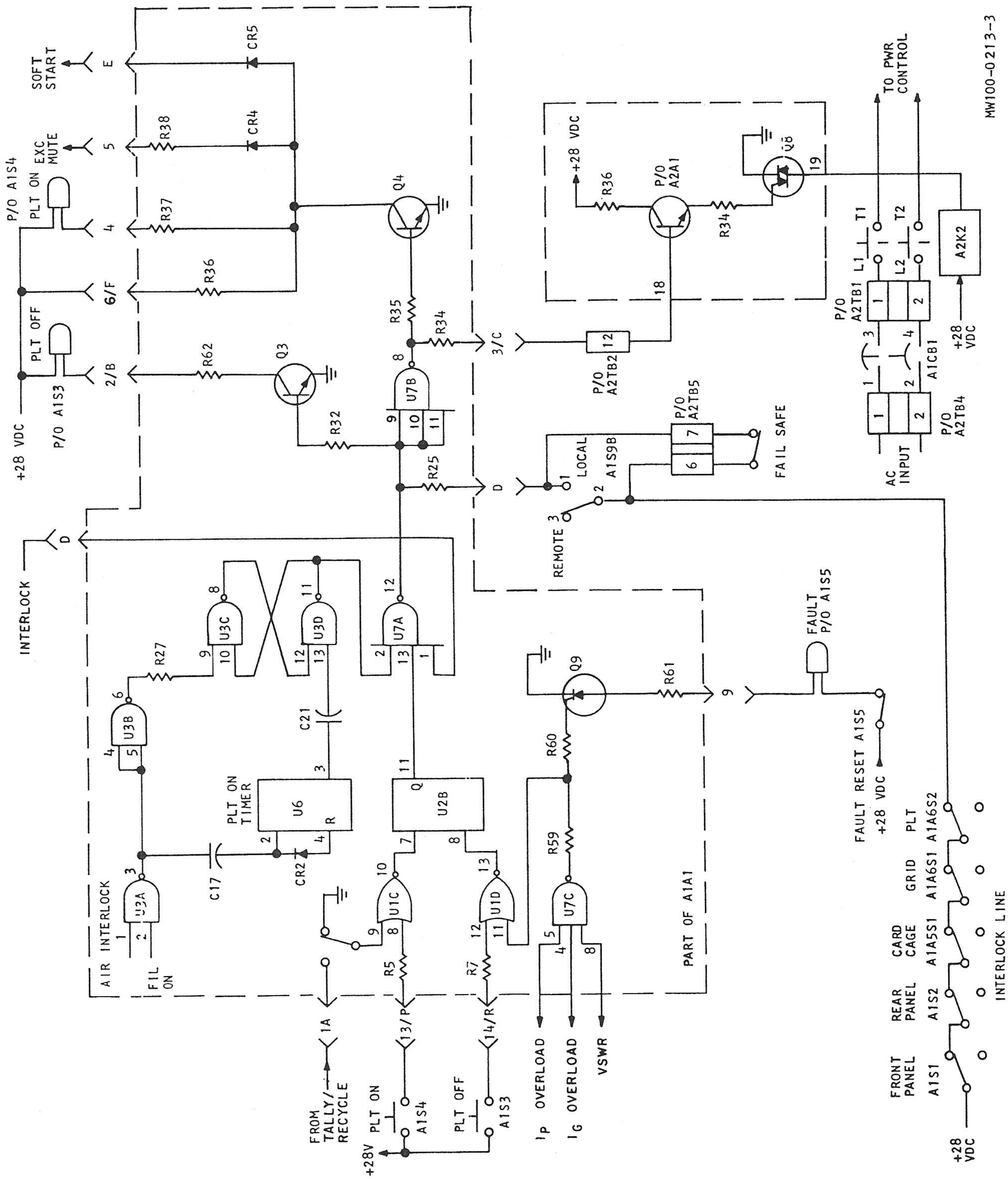



Figure 3-5. Plate Control, Simplified Schematic Diagram.

Refer to figure 3-6.

Overload circuitry is supplied for three functions in the transmitter; plate current, screen current, and vswr.

Overload circuitry for the plate current, in the event of plate overload, shuts down the transmitter, illuminates a fault indicator, and develops a pulse for automatic recycling. A small sample of voltage derived from a shunt resistor in the return leg of the plate power supply is applied through pin 22 to R42. When sufficient voltage is developed across R42 to constitute an overload condition, transistor Q5 turns on, providing an input to amplifier U8A.

Amplifiers U8A and U8B serve as high-gain amplifiers to square-up the transitions between on and off states of Q5 and provide a sharp edge on the transitions. The output of U8B goes to a low state for the duration of an overload and is applied to pin U for use in fault location and through diode CR6 to gate U7C. The U8B output is inverted by U7C and applied to NOR gate U1D and to gate U5D. U1D supplies a plate-off command to turn off the high-voltage supply and U5D develops a trigger pulse to be used for automatic recycling, if equipped. A high state at the output of U7C also fires SCR Q9 to illuminate front-panel fault indicator DS16.

The screen current and vswr overload circuits operate in a similar manner.

3.2.3.3. Optional Overload Tally/Recycle Card

Refer to the 831C-2/831D-2 schematic diagram in the rear of this instruction book.

Overload tally/recycle card A1A2 is an optional plug-in circuit card that when used, serves two functions in the transmitter. It will automatically restart the transmitter up to four times within a 30-second interval, and will provide a memory and fault indicator function of which overload caused an outage. The fault indicator lamps will remain on after the transmitter automatically returns to the air, until manually cleared by the operator.

During an overload condition, a trigger pulse generated by the overload circuits is applied through pin 12 to timers U1 and U3 and gates U6A through U6D. Timer U1 generates a 1/2-second delay which is used to trigger timer U2, and is also applied to gate U5A. U2 generates a short pulse which is applied to gate U5D and a plate-on command is generated via transistor Q2. The plate-on command is applied to the A1A1 card to restart the plate circuit.

Timer U3 generates a pulse approximately 30 seconds in length which enables counter U4. When a restart pulse is generated by timer U1, it is fed through gate U5A to the trigger input of counter U4. Output B (2-shot recycle) of U4 will be high when a count of two is received, and output C (4-shot recycle) will be high when a count of four is received. A high output from U4 causes the outputs of inverters U5B and U5C to go low. Gate U5B will inhibit any further attempts to increase the count in counter U4, and U5C will inhibit any further recycle attempts. When approximately 30 seconds has elapsed since the first recycle attempt, timer U3 times out and its output goes low and resets the count in counter U4 to zero which clears gates U5B and U5C. The recycle circuit is then clear and will repeat as needed.

The trigger pulse that activates the recycle circuits is also applied to NOR gates U6A, U6B, U6C, and U6D. When both inputs to a given NOR gate are low,

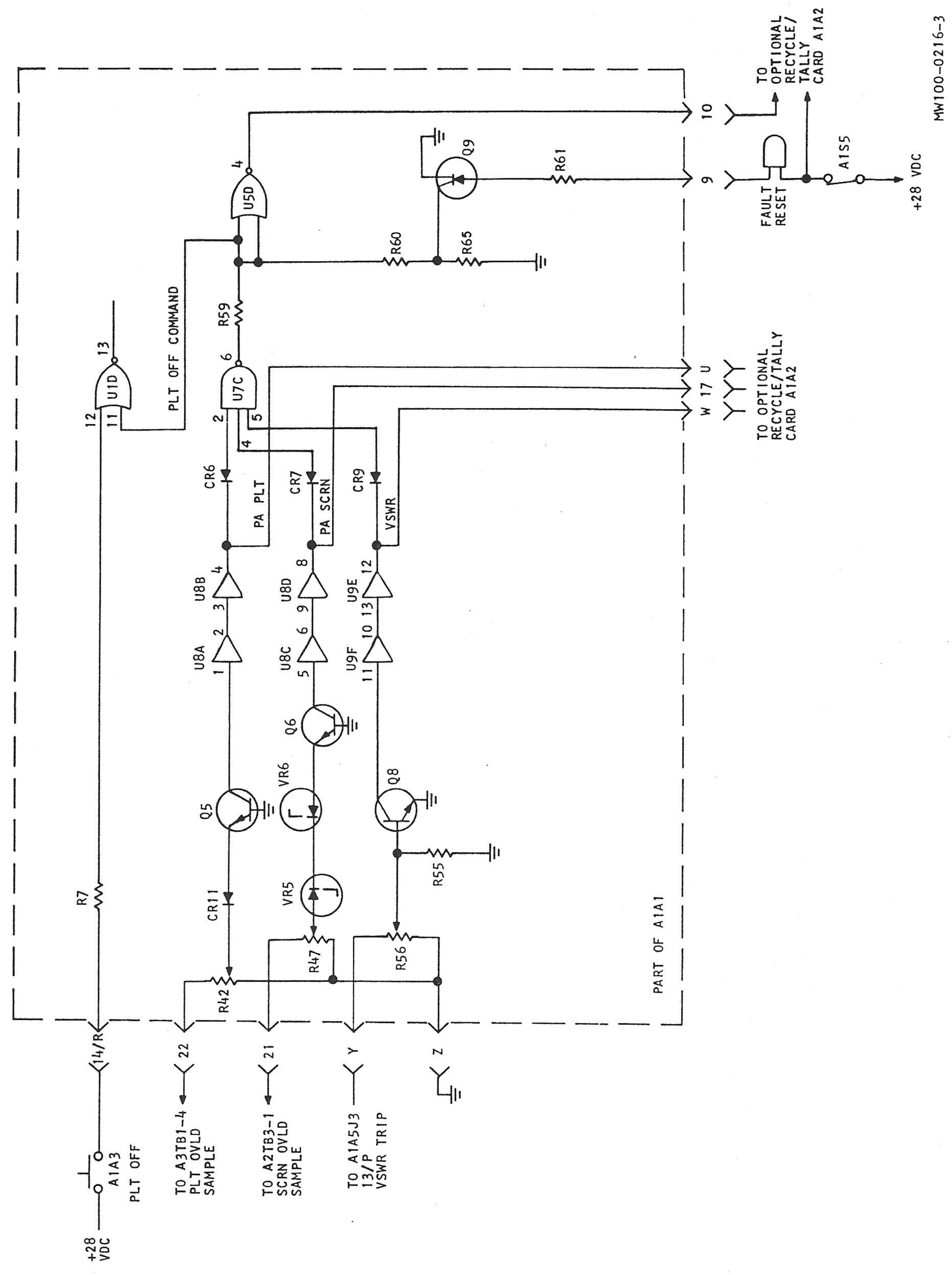



Figure 3-6. Overload Sensing, Simplified Schematic Diagram.

its output is high which causes the associated SCR (Q3, Q4, Q5, or Q6) to fire, lighting the appropriate LED (CR2, CR3, CR4, or CR5) to indicate the source of the overload. The indicators are manually reset by pressing the FAULT pushbutton.

#### 3.2.3.4. Power Monitor Card

Power Monitor Card A1A3 provides for calibration of the POWER OUTPUT meter (paragraph 4.9.5) and adjustment of the automatic power control system (paragraph 4.9.8). In addition, the power monitor card amplifies the low level forward and reflected power outputs from the directional coupler, to drive remote forward and reflected power indicators in any common remote control system.

Refer to figure 3-7.

The operating mode (automatic or manual) is selected by MANUAL/AUTO CONTROL switch A1S10 located on the front panel. Switch A1S10 controls a switching circuit consisting of integrated circuit U4 and transistors Q1 and Q2. In the automatic mode Q1 is off and Q2 is on, and in manual mode Q1 is on and Q2 is off.

In the automatic mode, the forward power sample from the directional coupler is applied to operational amplifier U1. U1 operates at a fixed gain and produces an output on the order of 1 to 5 volts dc. The output of U1 is applied to pin 10/C for remote use, and is also summed with a negative dc reference voltage through APC control R13, producing a positive voltage at the output of U3. The output of U3 is coupled through resistor R21 and diode CR3 to transistor Q4. The Q4 output is fed to power control card A1A4 which develops the firing pulses for SCR's A3Q1 and A3Q2 to regulate the power amplifier plate and screen voltages.

In the manual mode, an external power control voltage derived from motor-driven potentiometer A1A5R2 fed from the internal 28-volt power supply, is coupled through resistor R29 and diode CR4 to transistor Q4.

A soft-start circuit consisting of transistor Q3 and its associated components is driven from the A1A1 card, and is turned off when plate voltage is turned on. A ramp voltage is generated through the time constant of R21 (automatic mode) or R29 (manual mode) and R25, R27, and C14, which slowly brings plate voltage up from zero to normal.

The reflected power sample from the directional coupler is applied to operational amplifier U2. U2 is a fixed-gain amplifier and its output is available for remote use and is also fed through switch S1 to the vswr overload input of the A1A1 card for vswr protection.

#### 3.2.3.5 Power Control Card

Power Control Card A1A4 supplies a pair of pulses to power control SCR's Q1 and Q2 in the A3A2 Component Assembly. The firing angle of Q1 and Q2 is related to the zero crossing of the ac power lines, and is directly controlled by the dc input voltage. In this manner, the output voltages of the plate and screen power supplies may be adjusted from approximately 50 percent to a full rated power.

### 3.2.4. Power Supplies

The 831C/D-2 transmitters contain the following power supplies:

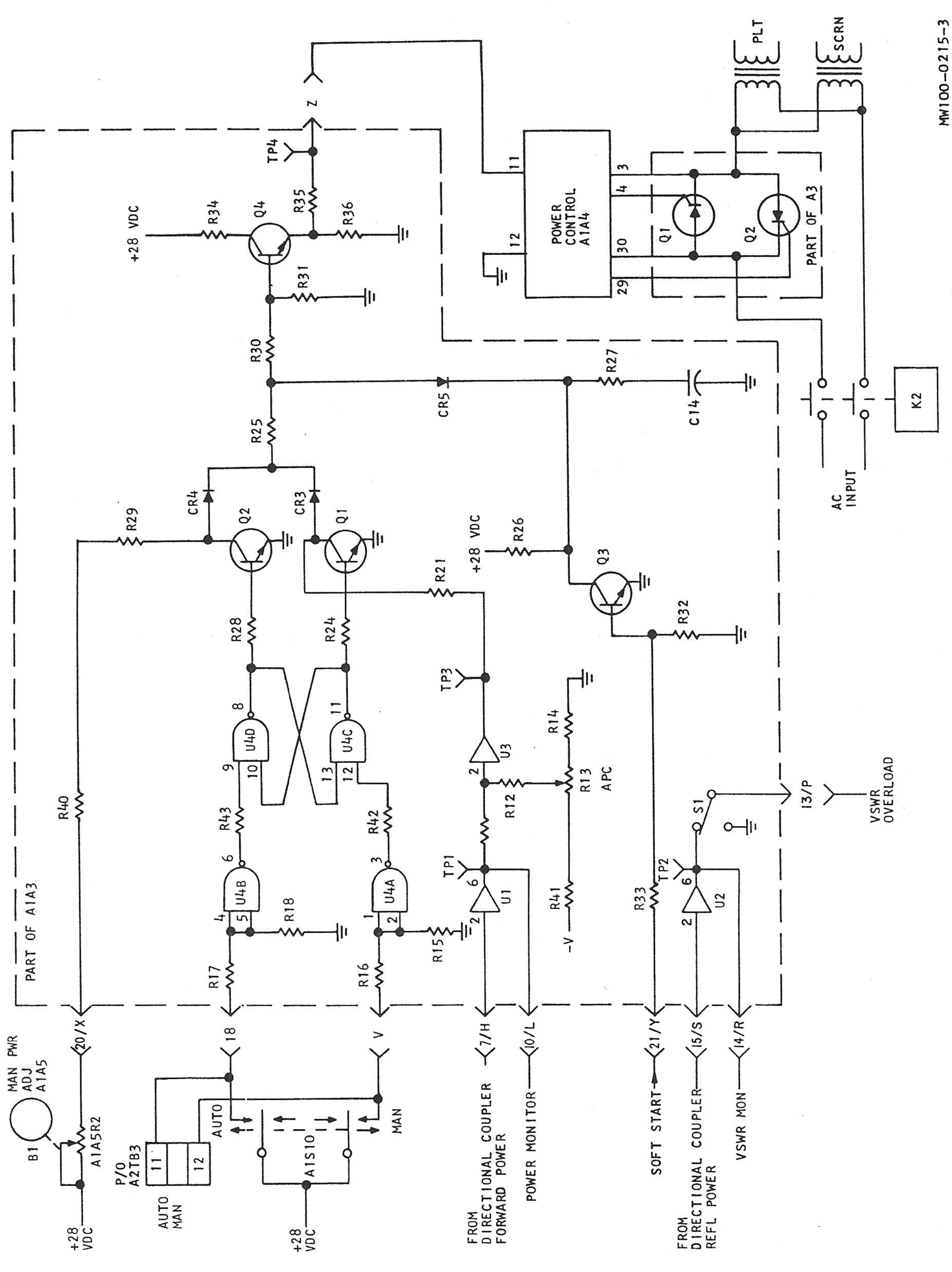



Figure 3-7. Power Control, Simplified Schematic Diagram.

28-volt dc control
5-volt dc logic
-120-volt dc bias
-28-volt dc control
Power amplifier screen
Power amplifier plate
Power amplifier filament
Ac distribution

3.2.4.1 28- and 5-Volt DC Power Supplies

The 28-volt and 5-volt power supplies are derived from a common transformer, rectifier, and filter system. It is a full-wave bridge circuit with a capacitor input filter. The 28-volt supply is regulated by zener diode A2A1VR2 in conjunction with amplifier transistor A2Q2 and pass transistor A2Q1. Short-circuit protection is provided by diodes CR8, CR9, CR10 and resistors R16 and R17 on the A2A1 assembly. The 28-volt supply furnishes power for relay A2K1 and all cards requiring +28 volts.

The 5-volt supply is obtained from the 28-volt supply through 3-terminal regulator A2U1. Batteries BT1 through BT4 are provided as a backup 5-volt supply to maintain the control logic circuitry during a power outage. The batteries are of the alkaline rechargeable type, and are floated on a constant current trickle charger composed of A2A1Q3 and its associated components. In the event of a power failure, the transmitter will restart automatically upon resumption of power, and will be in the same operating mode which existed at the time of power failure.

3.2.4.2. -120-Volt DC Bias Supply

Refer to figure 3-8.

The -120-volt bias supply is a conventional half-wave rectifier with capacitor input filter and with an LC filter following, that provides protective bias in the absence of excitation. Applying excitation causes grid current to flow through A1A6R1, A2A1R14, A2R10 bias adjust and A2R11. This creates a grid leak bias that exceeds the fixed bias from the power supply. In normal operation A2CR3 is reverse biased because the grid leak bias is greater than the bias supply voltage. The bias supply protects the tube from excessive plate dissipation in case grid leak bias is lost. BIAS ADJUST control A2R10 determines the amount of current that will flow in the grid circuit and hence determines the actual operating point of the 5CX1500A. Primary line voltage for the -120-volt bias supply is derived from the secondary of the filament regulator transformer.

3.2.4.3. -28-Volt DC Control Supply

Refer to figure 3-4.

The -28-volt dc control supply is a half-wave supply and provides the negative voltage required for operational amplifiers in the power monitor and power control cards. The control supply is fed from one side of the primary ac power line, rectified by diode CR4, controlled by resistor R8, and switched by relay A2K1.

3.2.4.4 Power Amplifier Screen Supply

Refer to figure 3-9.

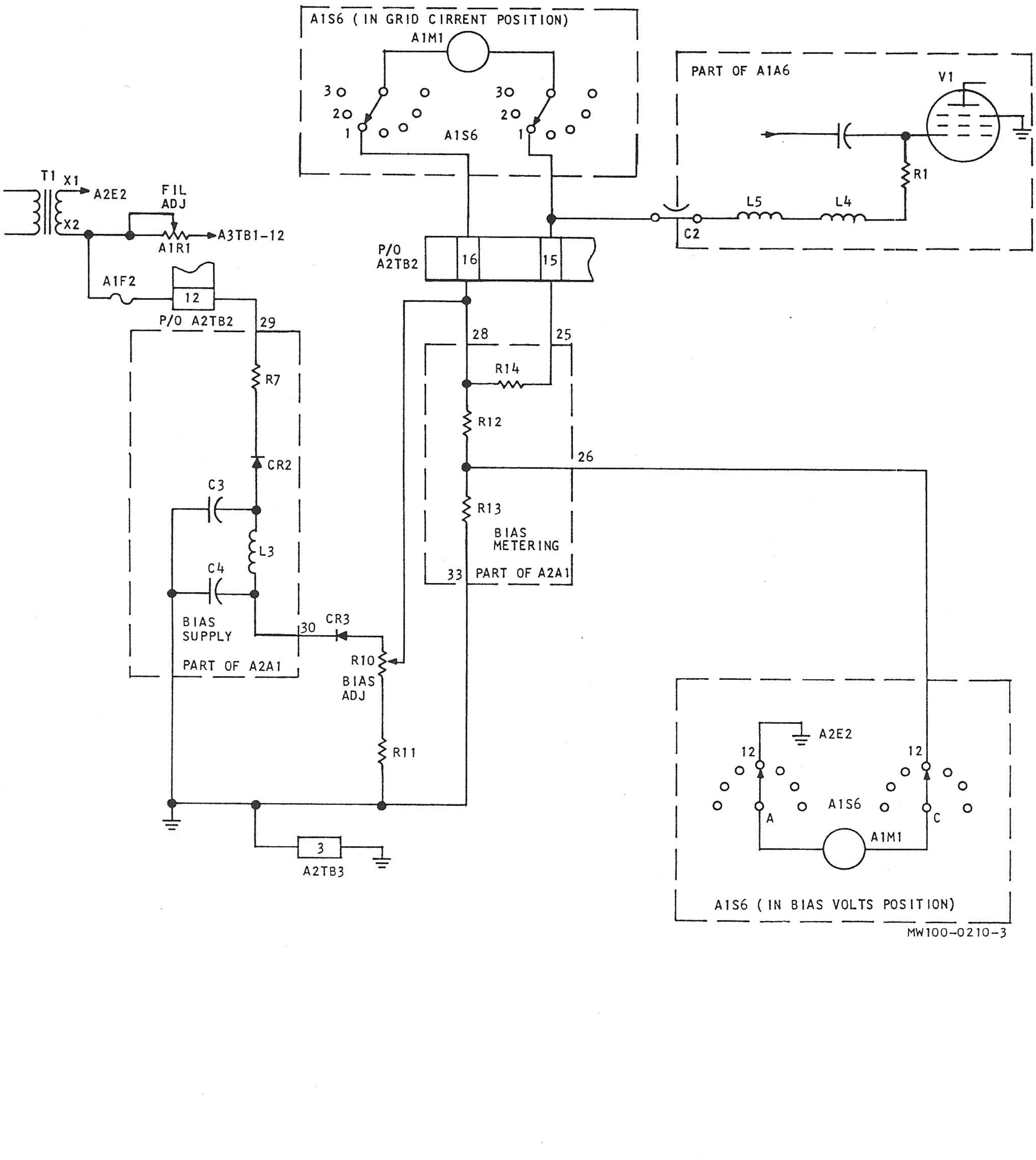



Figure 3-8. Bias Circuit, Simplified Schematic Diagram.

The power amplifier screen supply provides approximately 460 volts dc (for 831C-2) or 500 volts dc (for 831D-2) to the power amplifier screen grid and consists of transformer A2T2 with an associated full-wave bridge rectifier and a double section choke input filter. The screen supply voltage is adjusted by SCRN ADJ rheostat A2R1. Primary power for the supply is derived from the power line through contactor A2K2 and SCR's A3Q1 and A3Q2.

3.2.4.5 Power Amplifier Plate Supply

Refer to figure 3-10.

The power amplifier plate supply is a conventional full-wave bridge supply with a 2-section LC filter, and supplies approximately 3000 volts dc (for 831C-2) or 4500 volts dc (for 831D-2) to the power amplifier plate circuit. The supply is fed from the same circuit as the power amplifier screen supply.

3.2.4.6 Power Amplifier Filament Supply

Refer to figure 3-4.

Connections for local and remote metering of filament voltage are shown in figure 3-11.

3.2.5 AC Distribution

Figure 3-12 is a simplified schematic of primary ac distribution in the 831C-2/831D-2 transmitters. All circuit breakers are open and all contactors are de-energized.

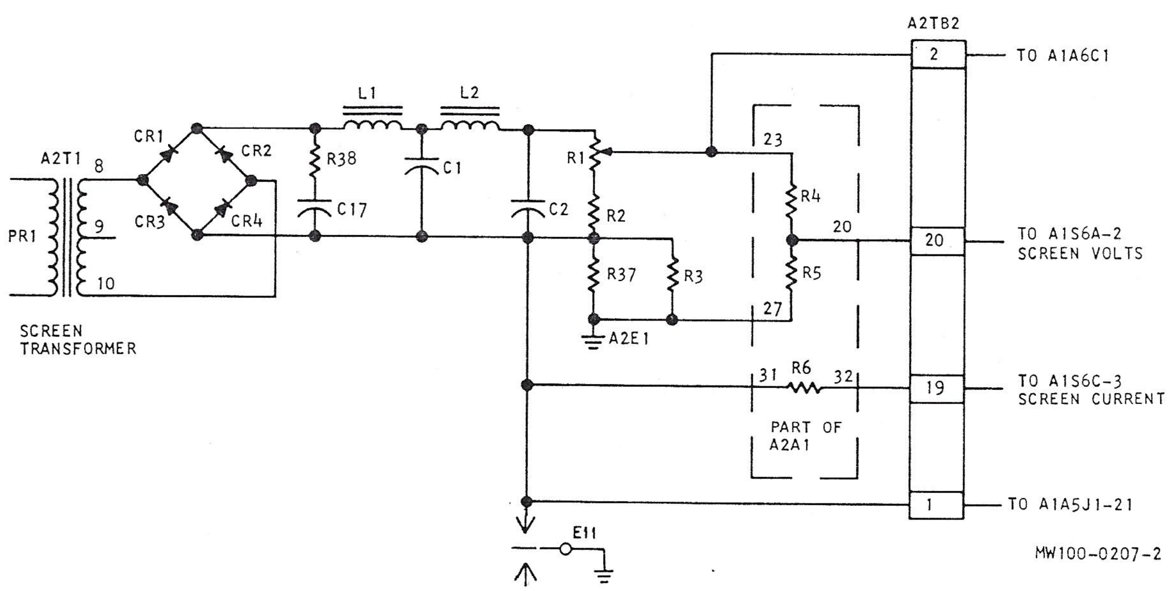



Figure 3-9. Power Amplifier Screen Power Supply and Metering, Simplified Schematic Diagram.

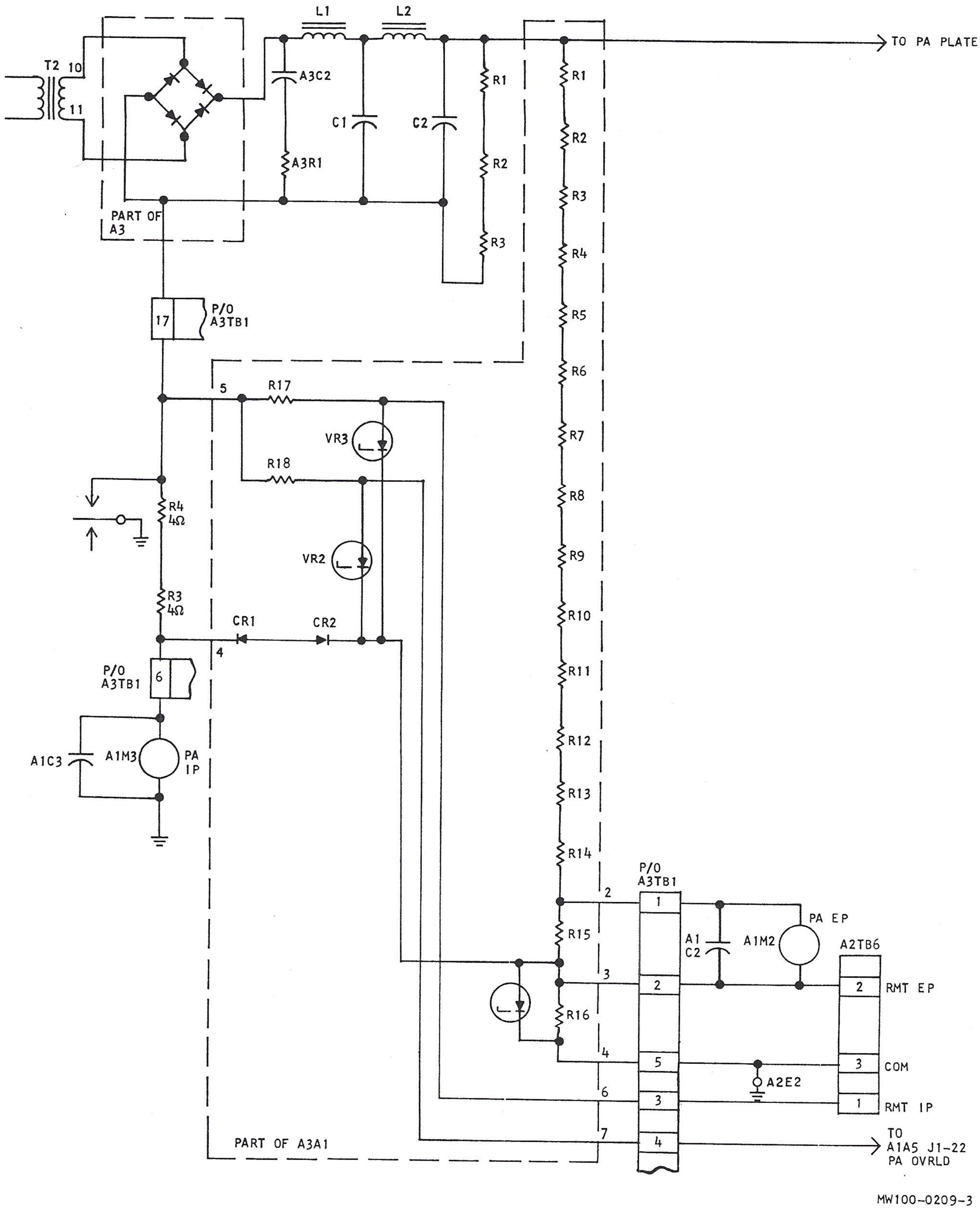



Figure 3-10. High-Voltage Power Supply and Power Amplifier Metering, Simplified Schematic Diagram.

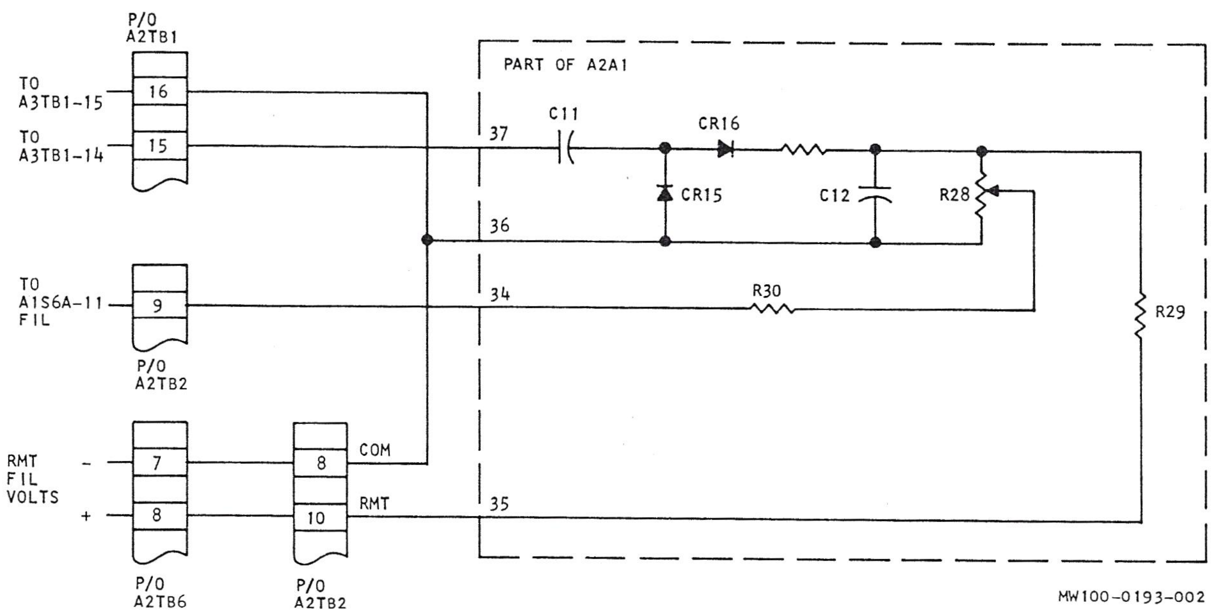



Figure 3-11. Power Amplifier Filament Metering, Simplified Schematic Diagram.

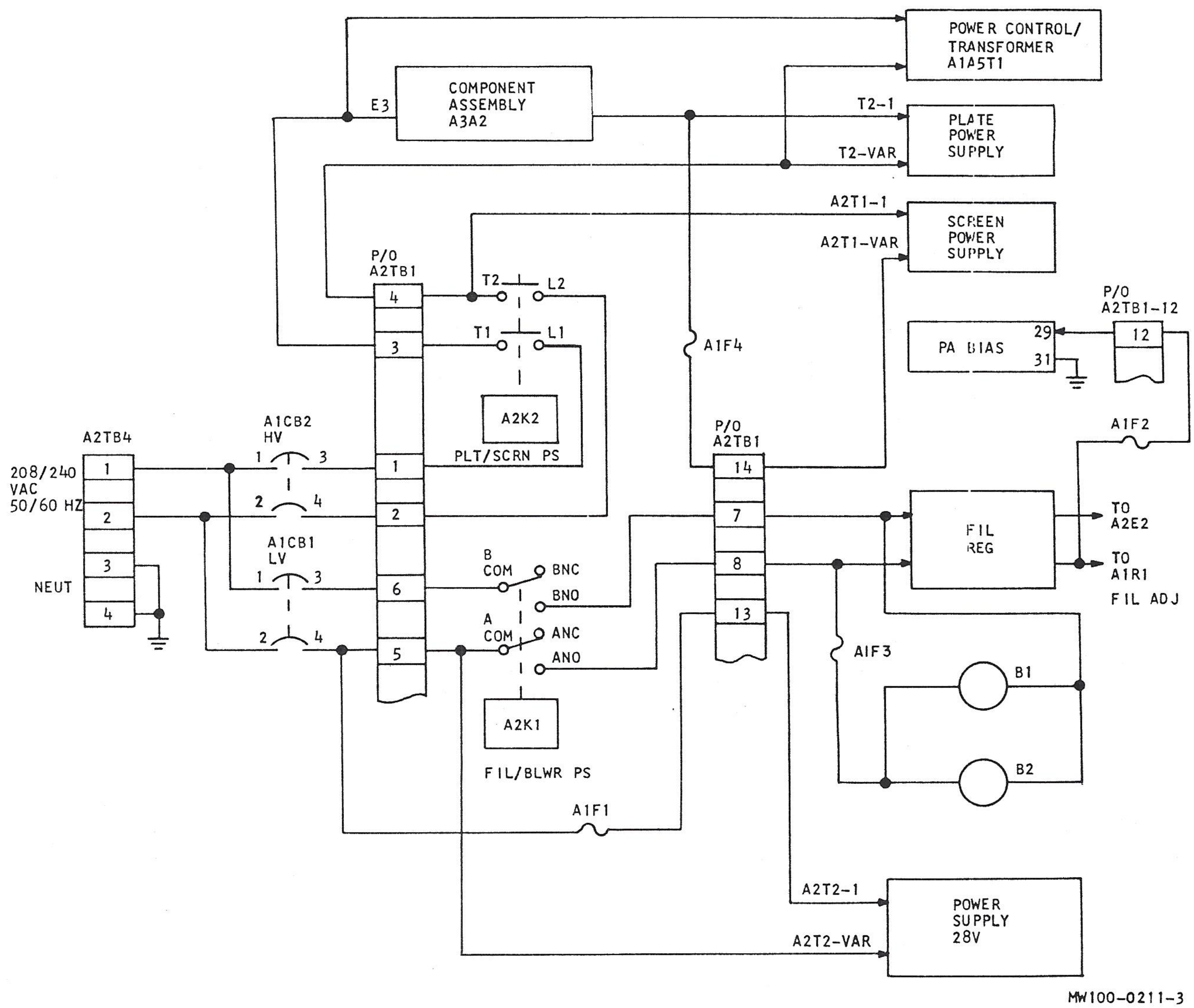



Figure 3-12. Primary AC Power Distribution,
Simplified Schematic Diagram.

## 4.1 GENERAL

The 831C-2/831D-2 has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, to ensure peak performance, adhere to a regular schedule of inspection and cleaning procedures. Refer to the parts list, section 5, for the locations of components in the 831C-2/831D-2.

**WARNING**

HIGH VOLTAGE is used in this equipment.

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

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

**CAUTION**

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

## 4.2 INSPECTION

Perform periodic visual inspection of the 831C-2/831D-2 at least once each week. Inspect all metal parts for rust, corrosion, and general deterioration. Check wiring and components for signs of overheating. Check the blower and cabinet fan for normal operation. Check all operating controls for smoothness of operation. Check all connections and tighten any loose nuts, bolts, or screws. Periodically check the plastic air hose that runs from the grid tuning compartment to the harmonic filter for signs of cracks or other deterioration. Periodically check the cloth air duct connecting the blower outlet to the PA grid compartment for leaks, deterioration, or blockage.

## 4.3 CLEANING

Clean the 831C-2/831D-2 whenever a perceptible quantity of dust accumulates at any point inside the equipment. A solvent consisting of the following mixture may be used as a cleaning material: methylene chloride (25 percent), perchloroethylene (5 percent), and drycleaning solvent (70 percent by volume).

### 4.3.1 General Cleaning Procedure

a. Remove dust from chassis, panels, and components with a soft-bristle brush.
b. Remove any foreign matter from flat surfaces and accessible areas with a lintless cloth moistened with solvent. Dry with a clean, dry, lintless cloth.
c. Wash switch contacts and less accessible areas with solvent lightly applied with a small soft-bristle brush.
d. Clean accumulated dust from power amplifier tube radiating fins (after removing the tube from its socket as outlined in paragraph 4.10.1) with a dry, oil-free jet of air.

### 4.3.2 Air Filter

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

a. Remove the two screws retaining the expanded metal filter panel to the rear cabinet panel.
b. Extract the filter from its holder and discard.
c. Install a new 16- by 20- by 1-inch disposable commercial filter.
d. Replace the expanded metal panel and two screws.

## 4.4 LUBRICATION

The 831C-2/831D-2 transmitter requires no lubrication. All motor bearings are permanently lubricated and sealed.

## 4.5 TROUBLESHOOTING

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

## 4.6 TEST EQUIPMENT

Table 4-1 lists test equipment necessary for transmitter maintenance checks and adjustments.

**CAUTION**

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

## 4.7 MAINTENANCE CHECKS

**WARNING**

HIGH VOLTAGE is used in this equipment.

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

Table 4-1. Test Equipment.

| ITEM | RECOMMENDED MANUFACTURER/MODEL |
| --- | --- |
| Dummy Load, 50 ohms 2.5 kW | Bird Model 8892 |
| Thruline Wattmeter, 2.5 kW/ 250 W | Bird Model 7712 (with 250B1 and 2500B1 Elements) |
| Thruline Wattmeter | Bird Model 43 (with 25 W Element) |
| Volt-Ohm-Milliammeter | Triplett No. 630 |
| ACVM, 0 to 25 V and 0 to 250 V (1% Accuracy) | |
| 0 to 28 V DC Power Supply (at least 1 ampere) | |

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

### 4.7.1 Preliminary Setting

Remove circuit cards A1, A2, A3, and A4 from card cage in A1 front panel. Remove control, bias, blower, and screen fuses.

Operate LOW VOLTAGE circuit breaker A1CB1 to off. Operate HIGH VOLTAGE circuit breaker A1CB2 to off.

### 4.7.2 Batteries

Install a charged set of batteries (BT1, BT2, BT3, and BT4).

NOTE

Low batteries may be recharged by installing the batteries, replacing control fuse (F1), and returning LOW VOLTAGE circuit breaker A1CB1 to ON position for approximately 10 to 12 hours.

### 4.7.3 Fuses

Visually inspect the fuses for correct ratings and type. All are slow-blow type.

| FUSE | FUNCTION | RATING |
| --- | --- | --- |
| F1 | Control | 0.5 A SB |
| F2 | Bias | 0.5 A SB |
| F3 | Blower | 2.0 A SB |
| F4 | Screen | 1.0 A SB |

Replace control fuse F1.

4.7.4 28-Volt Power Supply Checks

a. Operate LOW VOLTAGE circuit breaker A1CB1 to ON.
b. Switch TEST METER switch A1S6 to 28V position. TEST METER A1M1 should read 27 to 30 volts.
c. Verify TEST METER indication with volt-ohm-milliammeter connected between A2A1-E1 (+) and GND (-).

4.7.5 5-Volt Power Supply Checks

a. Switch TEST METER switch A1S6 to 5V position. TEST METER A1M1 should indicate 5 volts.
b. Verify TEST METER indication with volt-ohm-milliammeter connected between A2TB2-3 (+) and GND (-).
c. Operate LOW VOLTAGE circuit breaker A1CB1 to OFF.

4.7.6 Transmitter Recycle Checks

The following procedure checks the automatic sequencing to on and to off of the transmitter.

NOTE

All access panels must be closed before performing the following procedure.

a. Install control circuit card A1A1 in card cage.
b. Switch RECYCLE switch on A1A1 card to OFF.
c. Insert blower fuse F3.
d. On the 310Z-2 exciter, switch POWER switch to OFF.
e. Switch LOW VOLTAGE circuit breaker A1CB1 to ON. FIL OFF and PLT OFF lamps should light. The blower may start, run 30 seconds or less, and shut off, depending on status of control circuit card A1A1.
f. Press FIL ON pushbutton. The blower should start, and when up to speed, FIL ON lamp should light. If the FIL ON lamp does not light, perform adjustments in paragraphs 4.8.1 and 4.8.2.
g. Press the PLT ON pushbutton. After a 30- to 45-second delay, the PLT ON lamp should light and plate contactor A2K2 should close. If necessary, adjust time delay adjust resistor A1A1R29 for the desired length of plate-on delay.
h. Press PLT OFF pushbutton. Plate contactor A2K2 should open, the PLT ON lamp should extinguish, and the PLT OFF lamp should light.
i. Press FIL OFF pushbutton. The FIL ON lamp should extinguish. The blower will run for approximately 30 seconds (not adjustable) before turning off.

4.7.7 Interlocks

The following procedure checks the operation of the four interlock switches for the access panels and compartment doors.

a. Press PLT ON pushbutton. After the PLT ON lamp has lighted, proceed to step b.
b. Open and close, one at a time, the lower front power supply and rear power supply access panels, and upper power amplifier cavity compartment door. As each access panel or compartment door is opened, the PLT ON lamp should extinguish and the PLT OFF lamp should light. As each panel or door is closed, the PLT ON

lamp should be reestablished.

c. Open and close the lower power amplifier cavity compartment door. As the door is opened, the FIL ON and PLT ON lamps should extinguish, and the FIL OFF and PLT OFF lamps should light. As the door is closed, the FIL ON lamp should reestablish, and after the plate-on time delay, the PLT ON lamp should reestablish.

## 4.8 LOW LEVEL ADJUSTMENTS

**WARNING**

HIGH VOLTAGE is used in this equipment.

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

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

### 4.8.1 Air Switch Adjustment

a. Remove power to the transmitter, and open circuit breaker A1CB1.
b. Open the lower power amplifier compartment door, and connect an ac voltmeter (0- to -25-volt scale, 1-percent accuracy) across the power amplifier filament leads at the tube socket.
c. Close the compartment door as far as possible. Ensure the interlock is closed.
d. Apply power and close circuit breaker A1CB1.
e. Open the door approximately 1 inch while manually holding the interlock closed. Adjust air switch A1A6S7 (adjustment screw on bottom rear of switch) so that filament power is removed from the tube.
f. Perform adjustment in paragraph 4.8.2 before removing ac voltmeter.

### 4.8.2 Filament Voltage Checks and Adjustment

a. With power applied and filaments on, rotate FIL ADJUST control A1R1 from minimum to maximum. Minimum voltage should be less than 4.5 volts and maximum voltage should be more than 5.15 volts, as read on ac voltmeter.
b. Set filament voltage at 5 volts.
c. Switch TEST METER switch A1S6 to FIL position.
d. Adjust FIL MASTER CAL control R28 on the A2A1 control circuit low voltage power supply board assembly until the TEST METER indication is the same as read on the ac voltmeter.
e. Remove power to the transmitter open circuit breaker A1CB1, and disconnect the ac voltmeter connected in paragraph 4.8.1, step b.

### 4.8.3 Preliminary Power Amplifier Bias Adjustment

a. Install bias fuse F2.
b. Apply primary power to the transmitter and close circuit breaker A1CB1.
c. Press FIL ON pushbutton.
d. Switch TEST METER switch A1S6 to BIAS position.
e. Observe the indication on TEST METER while varying BIAS ADJ control A2R10 from minimum to maximum. The indication should vary from less than 95 volts to more than 100 volts. Set voltage at 95 volts.

f. Connect a volt-ohm-milliammeter from A1A6-C2(-) to GND (+) and verify TEST METER indication.

4.8.4 Power Amplifier Tuning and Loading Control Checks

a. Operate plate TUNE control A1S7 and observe that limit switches A1A6S3 and A1A6S4 shut off tuning motor A1A6B1 to limit travel of tuning capacitor A1A6C9. In the up (increase) position, the capacitor plate moves toward the cavity center conductor.
b. Similarly operate plate LOAD control A1S8 and observe that limit switches A1A6S5 and A1A6S6 shut off tuning motor A1A6B2 to limit travel of capacitor A1A6C10.
c. Remove primary power and open circuit breaker A1CB1

4.8.5 Preliminary Overload Adjustment

NOTE

HIGH VOLTAGE circuit breaker A1CB2 must remain off during the following preliminary adjustments.

4.8.5.1 Power Amplifier Plate

a. With primary power removed and circuit breaker A1CB1 open, connect a variable 9-volt source between A3TB1-17(-) and GND (+).
b. Adjust the 9-volt source for a 700-mA indication for the 831C-2 transmitter or 850-mA for the 831D-2 transmitter, as read on PLATE CURRENT meter A1M3.
c. Apply primary power and close LOW VOLTAGE circuit breaker A1CB1.
d. Adjust PA PLT overload control R42 on the A1A1 control circuit card until the plate relay opens, as indicated by PA PLATE lamp on tally/recycle card coming on.
e. Remove the 9-volt source and reset the overload indicator by pressing the FAULT pushbutton.
f. Remove primary power and open circuit breaker A1CB1.

4.8.5.2 Power Amplifier Screen

a. With primary power removed and circuit breaker A1CB1 open, connect the variable 9-volt source between A2TB3-1(-) and GND(+).
b. Adjust the 9-volt source for an indication of 125 mA, as read on TEST METER A1M1 with TEST METER switch A1S6 in SCRN1 position.
c. Apply primary power and close circuit breaker A1CB1.
d. Adjust PA SCRN overload control A1A1R47 until the plate relay opens, as indicated by the PA SCRN lamp on the tally/recycle card coming on.
e. Remove the 9-volt source and reset the overload indicator by pressing the FAULT pushbutton.
f. Remove primary power and open circuit breaker A1CB1.

4.8.5.3 VSWR

a. Ensure primary power is removed and circuit breaker A1CB1 is open.
b. Extend the A1A1 control circuit card on card extender. Ensure that switch S1 on power monitor card is in ON position.
c. Apply primary power and close circuit breaker A1CB1.

d. Press PLT ON pushbutton.
e. After PLT ON lamp lights, with the variable 9-volt source apply 2 volts across A1A1 pin Y (+) and GND (-).
f. Adjust vswr overload control A1A1R56 until vswr lamp on the tally/recycle card lights.
g. Remove the 9-volt source and reset the overload indicator by pressing FAULT pushbutton.
h. Remove primary power, open circuit breaker A1CB1, and remove extender card.

4.8.6 Tally/Recycle Card Checks

Tally/recycle card A1A2 is an optional card and, when used, provides automatic 2-shot or 4-shot recycle starting (dependent on card strapping) and individual fault tally readouts for plate current, screen current, and vswr overloads. If the tally/recycle card is not used with the transmitter, recycle switch S1 on the A1A1 control circuit card must be switched to OFF.

The following procedure checks the tally/recycle card for proper recycling operation.

a. Remove primary power to the transmitter and open LOW VOLTAGE circuit breaker A1CB1 and HIGH VOLTAGE circuit breaker A1CB2.
b. Install tally/recycle card A1A2 in card cage.
c. Apply primary power to transmitter and close only LOW VOLTAGE circuit breaker A1CB1.
d. Press PLT ON pushbutton.
e. Set recycle switch A1A1S1 to ON.
f. After the plate-on time delay has timed out and plate contactor A2K2 has closed, proceed with step g.
g. Momentarily simulate any one of the three overloads simulated in paragraphs 4.8.5.1, 4.8.5.2, or 4.8.5.3. After a momentary overload the transmitter will apply a restart pulse within approximately 1 second closing contactor A2K2.
h. Momentarily apply a second simulated overload. The transmitter will restart as in step g.
i. Momentarily apply a third simulated overload. The transmitter will not restart and will remain off if the third overload occurred within a 30-second time frame.

NOTE

The transmitter may be started manually by pressing the PLT ON push-button. If nonsimulated overload condition persists, the transmitter will merely overload and shut down. After 30 seconds following initial overload, the recycle circuit resets automatically and is again ready to supply two or four restarts (depending on the tally/recycle card strapping).

j. Press the FAULT pushbutton to extinguish tally lamp lights during simulated overload.

4.8.7 Power Monitor Card, Preliminary Checks and Adjustments

a. Remove primary power and open circuit breakers A1CB1 and A1CB2.
b. Install power monitor card A1A3 in card cage.

c. Apply primary power and close only LOW VOLTAGE circuit breaker A1CB1.
d. Press FIL ON pushbutton.
e. Insert volt-ohm-milliammeter (set on 1.2-mA scale) between TP1 (red) and TP5 (black). Adjust resistor R37 and progress to 60-μa scale as U1 balance is achieved.
f. Move volt-ohm-milliammeter to TP2 (orange) and TP5 (black) and adjust resistor R38 to balance U2.

## 4.9 INITIAL POWER ADJUSTMENTS

**WARNING**

HIGH VOLTAGE is used in this equipment.

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

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

### 4.9.1 Static Plate Current

Replace screen fuse F1, close HIGH VOLTAGE circuit breaker A1CB2, and press the PLT ON pushbutton. Note that plate current as read on the PLATE CURRENT meter is approximately 200 mA, or less. The 310Z-2 POWER switch is switched to OFF, and no drive is present.

### 4.9.2 310Z-2 FM Exciter

With HIGH VOLTAGE circuit breaker A1CB2 in the OFF position, apply primary power. Tune the exciter as per 310Z-2 section of this book.

### 4.9.3 Grid Tuning

a. Insert Thruline wattmeter with 25-watt element between the 310Z-2 output and the input to the power amplifier grid.
b. Apply a 5- to 10-watt (or enough to allow adjustment) rf signal to the power amplifier grid.
c. Adjust power amplifier GRID TUNING control A1A6C4 and the coupling for peak grid current at minimum swr.

**NOTE**

Set Thruline wattmeter for reflected component. Several adjustments will be necessary as there is considerable interaction. Final adjustment will be necessary after the power amplifier plate voltage is applied.

d. Reduce power amplifier drive (310Z-2 output) to minimum.

### 4.9.4 Power Amplifier Tuning

a. Close HIGH VOLTAGE circuit breaker A1CB2.
b. Raise the drive level to approximately 10 watts.
c. Adjust TUNE control A1S7 for minimum plate current.
d. Increase and decrease LOAD control, retuning each time for minimum plate current.

NOTE

The TUNE and LOAD controls interact, thus adjusting one will require adjustment of the other. Refer to tables 2-2 and 2-3 for typical operating readings.

e. Increase the drive level to at least 20 watts, and readjust both TUNE and LOAD controls until rated transmitter power output is attained.

NOTE

In following paragraphs 4.9.5 and 4.9.6, 100-percent reading on POWER OUTPUT meter A1M4 must be set to correspond to station authorized power.

4.9.5 POWER OUTPUT Meter Adjustments

a. Set REFL/FWD POWER switch A1S11 to FWD.
b. Using a calibrated Thruline wattmeter together with a 50-ohm dummy load as a standard, adjust FWD CAL control A1A3R1 until the transmitter POWER OUTPUT meter indication is the same as the calibrated meter.
c. Reduce power output to 10 percent (as read on POWER OUTPUT meter) and note exciter drive, transmitter grid current, plate current, and plate voltage.
d. Remove primary power to the transmitter.
e. Remove and invert (in transmission line) directional coupler A1DC1.
f. Restore transmitter power, and re-establish same conditions as in step c., above.
g. Set REFL/FWD POWER switch A1S11 to REFL position and adjust REFL CAL control A1A3R4 for a 10-percent (0- to 12-percent range) indication on POWER OUTPUT meter.

NOTE

In absence of calibrated Thruline wattmeter, use efficiency factors in figure 2-5 or 2-6 to determine transmitter output power, using equation: $E_p \times I_p \times$ EFF FACTOR (F) = POWER OUTPUT.

Before returning the directional coupler to normal direction in transmission line, perform procedure in paragraph 4.9.6.

4.9.6 Reflected Power Overload Checks

a. Operate vswr switch A1A3S1 to ON.
b. With the transmitter operating at 10 percent (125 watts for 831C-2, 250 watts for 831D-2), adjust vswr overload control A1A1R56 until the transmitter vswr overload trips.
c. Remove primary power and restore directional coupler A1DC1 to normal direction.
d. Restore power (1250/2500 watts; 100 percent), and note whether reflected position is less than 1 percent (occurs only with a purely resistive 50-ohm dummy load).

4.9.7 Manual Power Control

With REMOTE/LOCAL CONTROL switch in LOCAL position, operate RAISE/LOWER POWER switch A1S12 and check that power output can be varied from approximately 50-percent power to 105-percent power (1312/2625 watts, maximum).

4.9.8 Automatic Power Control

Place MANUAL/AUTO CONTROL switch A1S10 in AUTO, and adjust APC control A1A3R13 until transmitter is delivering station authorized power with nominal line voltage.

4.9.9 Monitor Output

Connect a section of RG58U line terminated with a 50-ohm load to MONITOR SAMPLE jack A1A6J2. With normal power out, adjust the pickup coil inside the cavity to obtain a 6- to 10-volt output at A1A6J2. Move the line to MONITOR SAMPLE jack A1A6J3 and adjust coil to obtain a 6- to 10-volt output at A1A6J3.

4.10 REPLACEMENT OF PARTS

4.10.1 5CX1500A Tube

a. Open the plate cavity access panel.
b. Lift the blocking capacitor covering the anode of the tube.
c. Remove the plate lead.
d. Turn the tube counterclockwise in its socket to the unlocked position, and lift the tube straight up and out.
e. To insert a replacement tube, reverse the procedure.

4.10.2 FIL OFF, FIL ON, PLT OFF, PLT ON, and FAULT Indicator Lamps

a. Pull out on the switch to remove the indicator button.
b. Compress bulb holder springs at the sides and remove holder with bulbs.
c. Replace bulbs, reinsert bulb holder.
d. Place indicator button over the switch and press in firmly to seat.

4.10.3 Fuses

Push in on fuse assembly; rotate counterclockwise and remove the assembly. Replace the fuse, reinsert fuse assembly, push in on the assembly, and rotate clockwise.

4.11 CHANGE OF FREQUENCY

All 831C-2/831D-2 transmitters are factory adjusted for the specific customer's frequency requirements. To change frequency first follow the procedure for tuning the 310Z-2 exciter as outlined in the exciter section of this manual. The power amplifier is tuned per paragraph 2.4.2, steps d. through j., using figure 2-4 and paragraph 2.5.2, step q. Use typical meter readings tables 2-2 and 2-3 to establish normal operation.

## 5.1 GENERAL

This section contains parts lists and parts locations for electrical components of the 831C-2 and 831D-2 transmitters. Figures 5-1 through 5-4 provide general views of the transmitters with various access panels removed. The remaining figures, with corresponding parts lists, identify electrical components. Figures and parts lists are sequenced according to assembly reference designation.

## 5.2 ORDERING REPLACEMENT PARTS

Refer to information provided inside the front cover for instructions for ordering replacement parts.

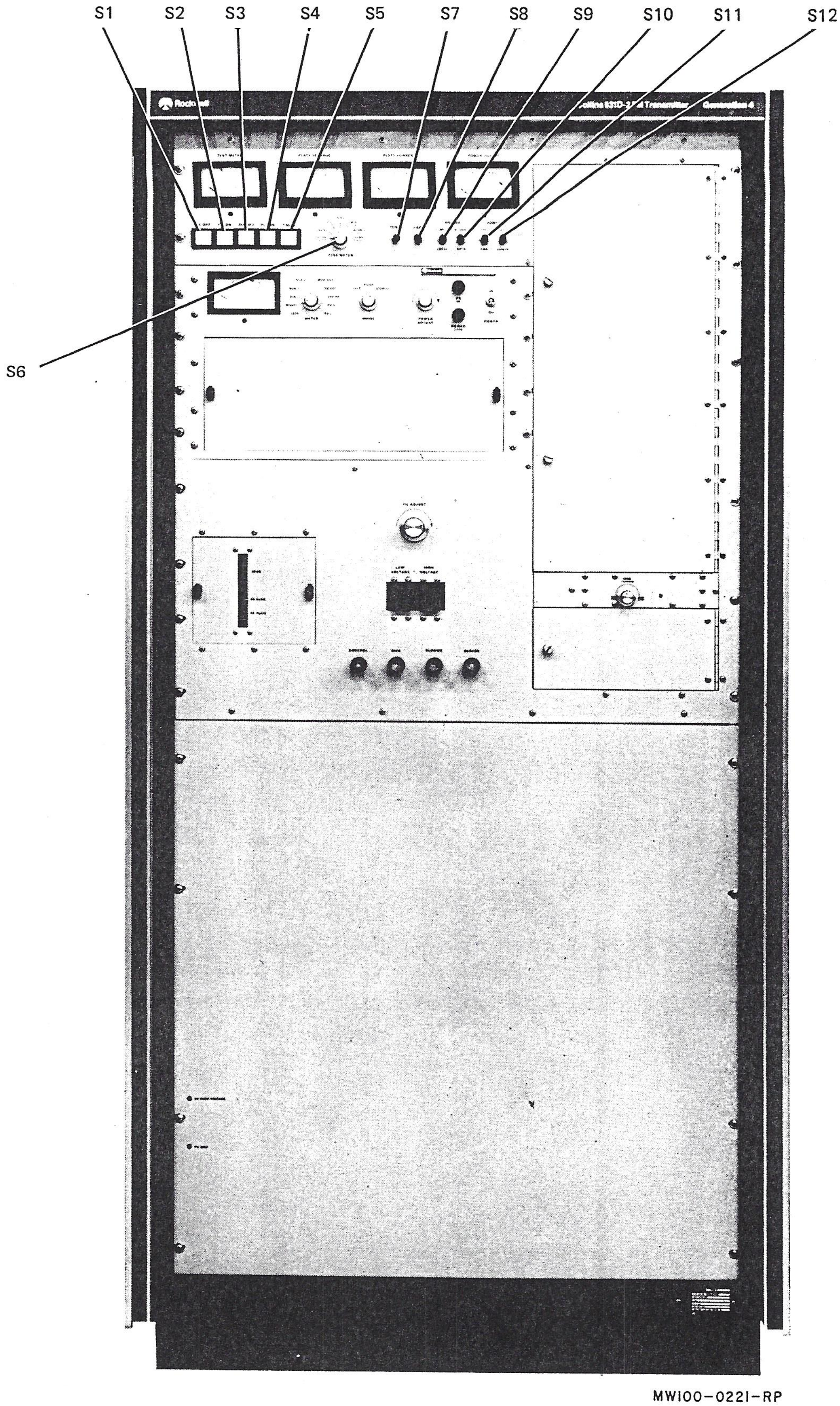



Figure 5-1. 831D-2 2.5-KW FM Transmitter, Front View (Typical for 831C-2 1.25-KW FM Transmitter).

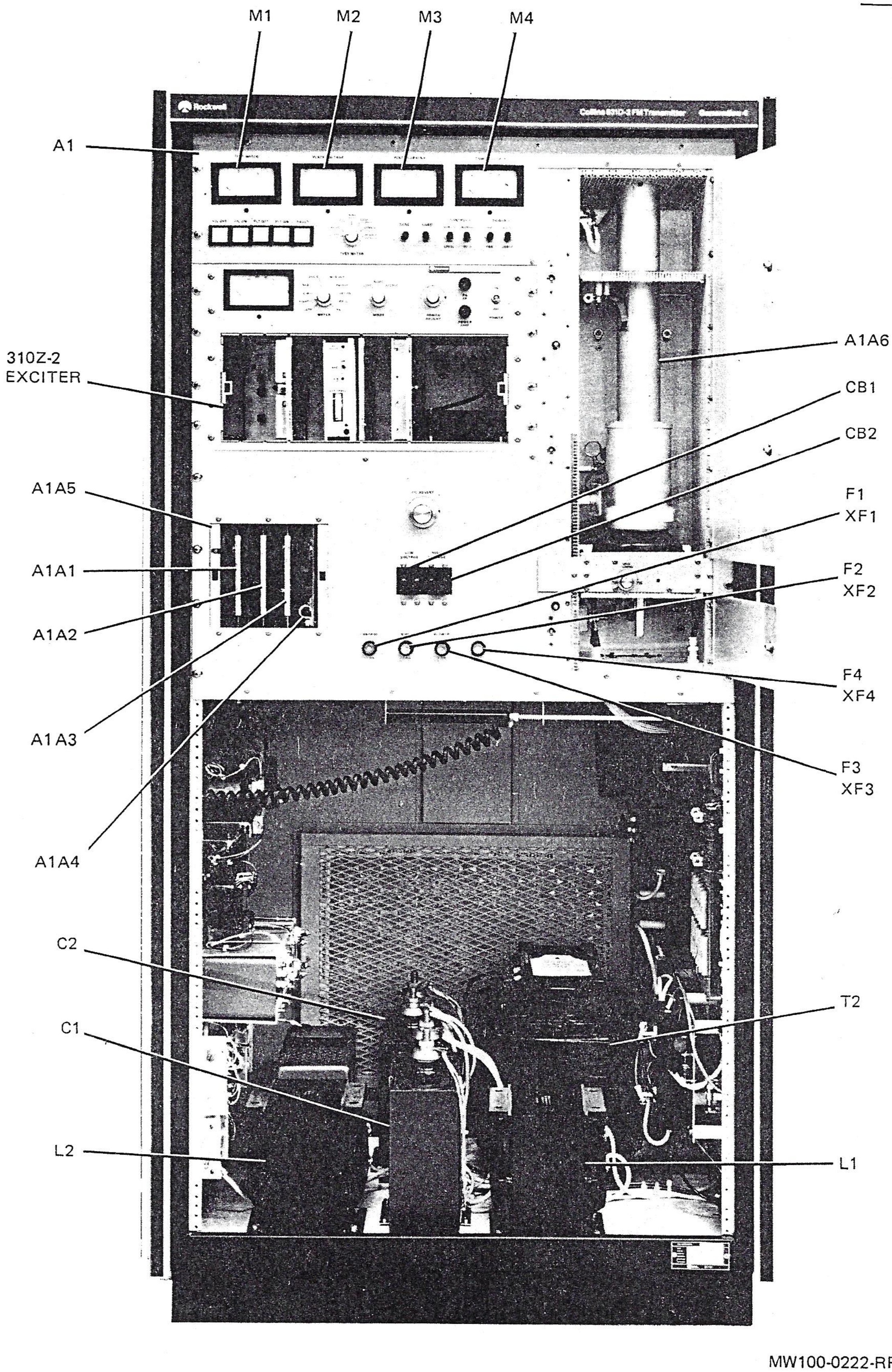



Figure 5-2. 831D-2 2.5-KW FM Transmitter, Front View With Access Panels Removed (Typical for 831C-2 1.25-KW FM Transmitter).

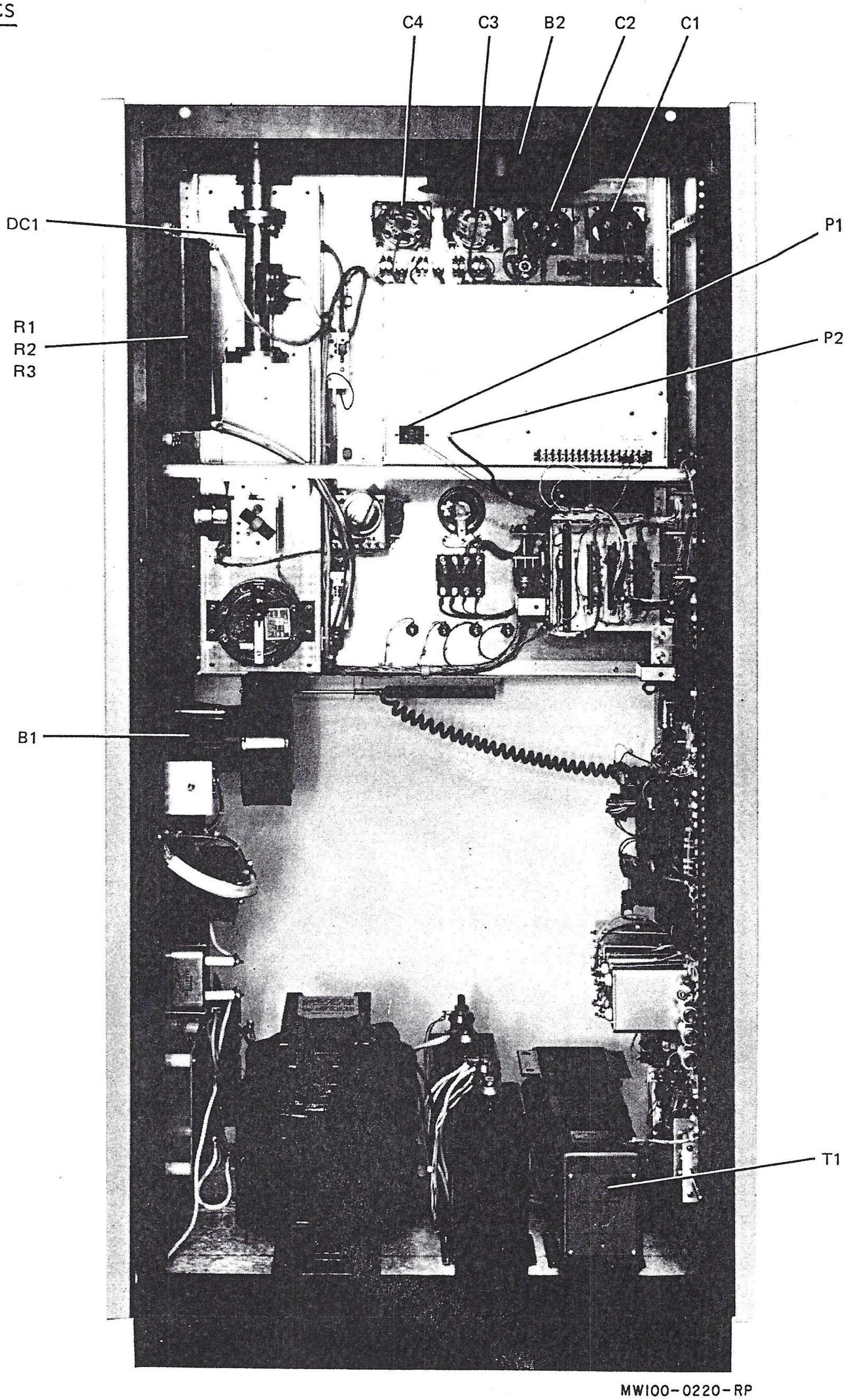
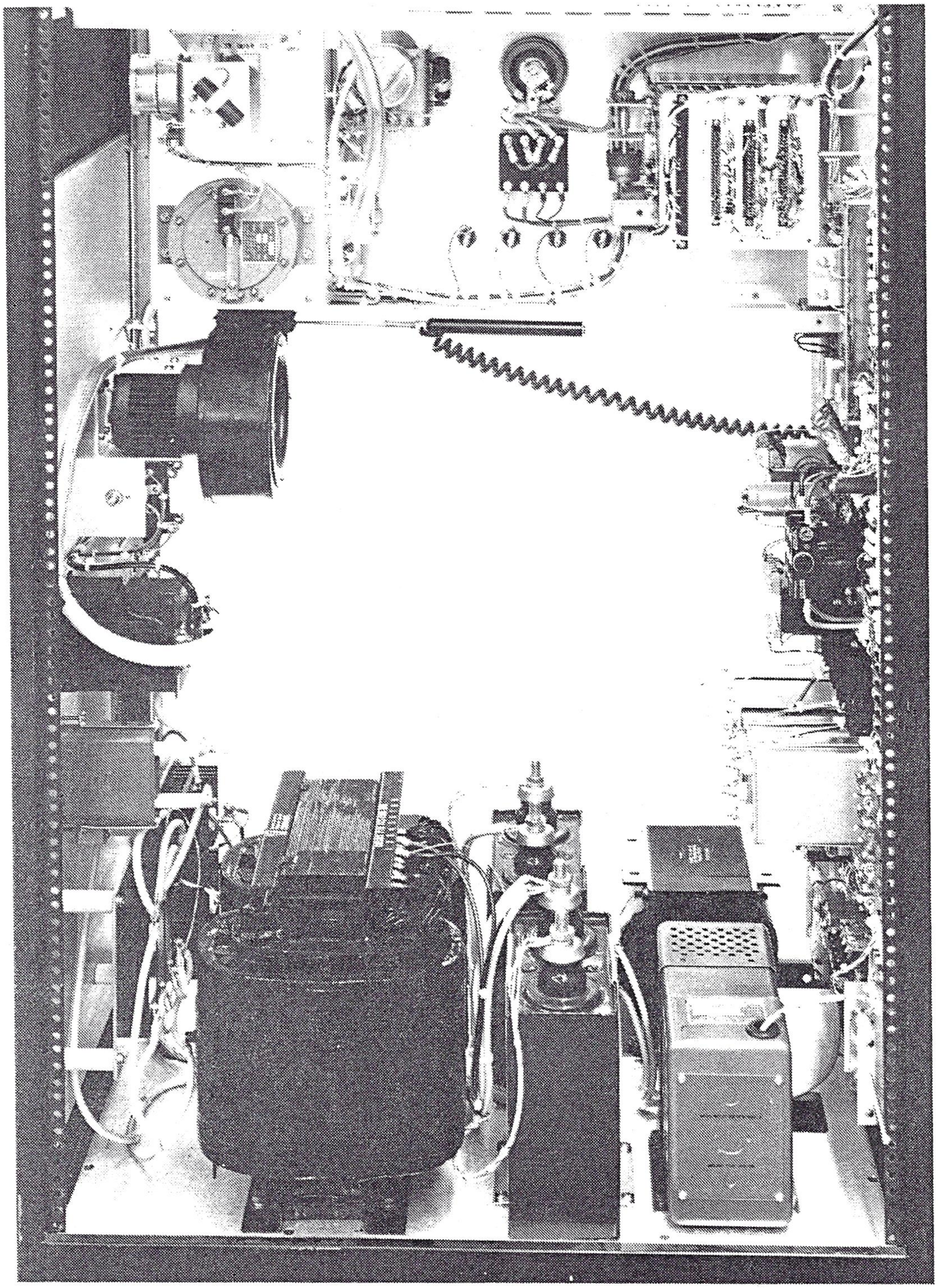



Figure 5-3. 831D-2 2.5-KW FM Transmitter, Rear View With Access Panel Removed (Typical for 831C-2 1.25-KW FM Transmitter.



MW100-0223-RP

Figure 5-4. 831D-2 2.5-KW FM Transmitter, Rear View Floor Mounted Components (Typical for 831C-2 1.25-KW FM Transmitter).

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | 831C-2 1.25-KW FM TRANSMITTER<br>831D-2 2.5-KW FM TRANSMITTER | |
| A1 | FRONT PANEL<br>SEE BREAKDOWN ON PAGE 5-7 | 632-0030-001 |
| A2 | CONTROL CIRCUITS AND LOW VOLTAGE POWER SUPPLIES<br>SEE BREAKDOWN ON PAGE 5-30 | 632-0021-001 |
| A3 | HIGH VOLTAGE RECTIFIER ASSEMBLY<br>SEE BREAKDOWN ON PAGE 5-38 | 632-0033-001 |
| A4 | REMOTE CONTROL ASSEMBLY (OPTIONAL)<br>SEE BREAKDOWN ON PAGE 5-45 | 632-0071-001 |
| A5 | EXTENDER CARD | 632-0062-001 |
| B1 | BLOWER, TUBE COOLING | 009-1858-010 |
| B2 | FAN, CABINET FLUSHING | 009-1801-010 |
| DC1 | DIRECTIONAL COUPLER | 277-0445-010 |
| J4 | CONNECTOR (SEE FIGURE 5-9 FOR LOCATION) | 357-9248-010 |
| P1 | CONNECTOR, POWER, 310Z-2 EXCITER | 366-8060-000 |
| P2 | CONNECTOR, BNC, RF EXCITER | 357-9292-000 |
| R1 | RESISTOR, 30 KILOHMS, 210 W | 746-6827-000 |
| R2 | SAME AS R1 | |
| R3 | SAME AS R1 | |
| T1 | TRANSFORMER, FILAMENT REGULATOR | 662-0292-050 |
| | NOTE<br>THE FOLLOWING COMPONENTS ARE USED ONLY IN THE 831C-2 TRANSMITTER: | |
| CB2 | CIRCUIT BREAKER, 20 AMP | 260-1004-420 |
| C1 | CAPACITOR, 4.0 $\mu$F, 4 kV | 930-0705-000 |
| C2 | SAME AS C1 | |
| L1 | CHOKE, 10 H | 668-0022-000 |
| L2 | SAME AS L1 | |
| T2 | TRANSFORMER, HIGH VOLTAGE | 662-0368-020 |
| | NOTE<br>THE FOLLOWING COMPONENTS ARE USED ONLY IN THE 831D-2 TRANSMITTER: | |
| CB2 | CIRCUIT BREAKER, 30 AMP | 260-4052-010 |
| C1 | CAPACITOR, 8 $\mu$F | 930-0781-020 |
| C2 | SAME AS C1 | |
| L1 | CHOKE, 10 H | 668-0161-010 |
| L2 | SAME AS L1 | |
| T2 | TRANSFORMER, HIGH VOLTAGE | 662-0368-010 |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | FRONT PANEL, A1 | 632-0030-001 |
| A1A1 | CONTROL CIRCUITS CARD<br>SEE BREAKDOWN ON PAGE 5-11 | 632-0013-001 |
| A1A2 | OVERLOAD TALLY/RECYCLE CARD (OPTIONAL)<br>SEE BREAKDOWN ON PAGE 5-17 | 632-0013-001 |
| A1A3 | POWER MONITOR CARD<br>SEE BREAKDOWN ON PAGE 5-21 | 632-0010-001 |
| A1A4 | POWER CONTROL CARD | 270-0313-010 |
| A1A5 | CARD CAGE ASSEMBLY<br>SEE BREAKDOWN ON PAGE 5-24 | 632-0031-001 |
| A1A6 | POWER AMPLIFIER CAVITY ASSEMBLY<br>SEE BREAKDOWN ON PAGE 5-28 | 632-0039-001 |
| C1 | CAPACITOR, 100 PF | 912-2816-001 |
| C2 | SAME AS C1 | |
| C3 | SAME AS C1 | |
| C4 | SAME AS C1 | |
| CB1 | CIRCUIT BREAKER, 5 AMP | 260-1964-000 |
| F1 | FUSE, .5 AMP | 264-0293-000 |
| F2 | SAME AS F1 | |
| F3 | FUSE, 2 AMP | 264-0294-000 |
| F4 | FUSE, 1 AMP | 264-0295-000 |
| M1 | MULTIMETER 1 MA FS 1500 OHMS ±1% | 458-0859-010 |
| M2 | VOLTMETER, PLATE 6 KV FS ±1% | 458-0859-020 |
| M3 | AMMETER, PLATE 0-1A ±2% | 458-0859-090 |
| M4 | WATTMETER, RF | 458-0859-100 |
| R1 | RESISTOR, 15 OHMS, 100 W | 735-5201-020 |
| R2 | RESISTOR, 1740 OHMS | 705-6758-000 |
| S1 | SWITCH | 266-7509-020 |
| S2 | SAME AS S1 | |
| S3 | SAME AS S1 | |
| S4 | SAME AS S1 | |
| S5 | SAME AS S1 | |
| S6 | SWITCH | 259-2692-010 |
| S7 | SWITCH | 375-1019-190 |
| S8 | SAME AS S7 | |
| S9 | SWITCH | 375-1019-180 |
| S10 | SAME AS S7 | |
| S11 | SAME AS S9 | |
| S12 | SAME AS S7 | |
| XF1 | FUSEHOLDER | 265-1241-090 |
| XF2 | SAME AS XF1 | |
| XF3 | SAME AS XF1 | |
| XF4 | SAME AS XF1 | |

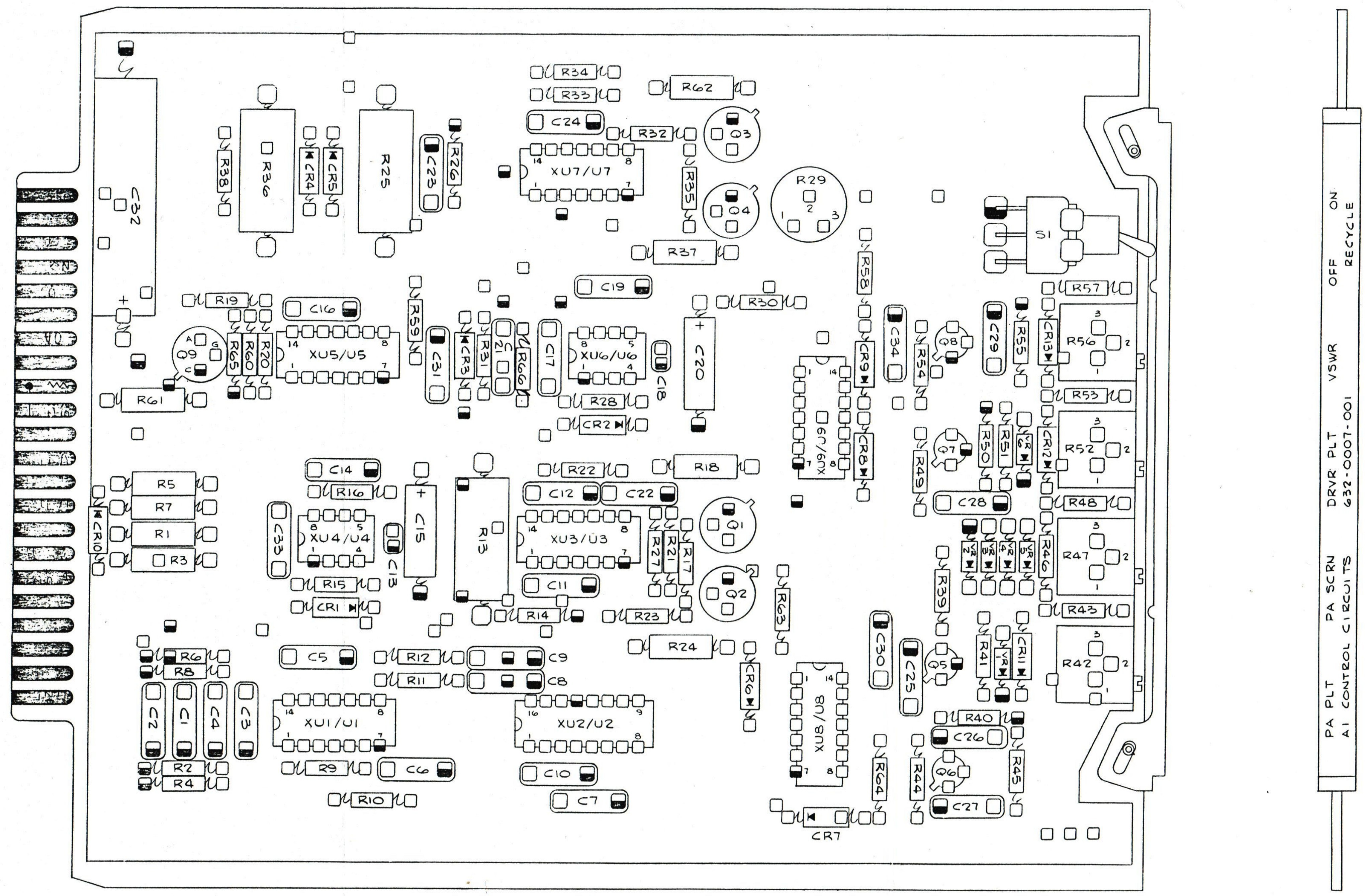



Figure 5-5. Control Circuits Card.

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | CONTROL CIRCUITS CARD, A1A1 | 632-0007-001 |
| C1 | CAPACITOR, 1.0 UF, 25 V | 913-3810-000 |
| C2 THRU C12 | SAME AS C1 | |
| C13 | CAPACITOR, 0.01 UF | 913-3279-110 |
| C14 | SAME AS C1 | |
| C15 | CAPACITOR, 10.0 UF, 20 V | 184-9086-470 |
| C16 | SAME AS C1 | |
| C17 | SAME AS C1 | |
| C18 | SAME AS C13 | |
| C19 | SAME AS C1 | |
| C20 | CAPACITOR, 22 UF, 15 V | 184-9086-320 |
| C21 THRU C31 | SAME AS C1 | |
| C32 | CAPACITOR, 250 UF, 12 V | 183-1190-000 |
| C33 | SAME AS C1 | |
| C34 | SAME AS C1 | |
| CR1 | DIODE, 1N914 | 353-2906-000 |
| CR2 THRU CR13 | SAME AS CR1 | |
| Q1 | TRANSISTOR, 2N3053 | 352-0613-010 |
| Q2 | SAME AS Q1 | |
| Q3 | SAME AS Q1 | |
| Q4 | SAME AS Q1 | |
| Q5 | TRANSISTOR, 2N2222A | 352-0661-023 |
| Q6 | SAME AS Q5 | |
| Q7 | SAME AS Q5 | |
| Q8 | SAME AS Q5 | |
| Q9 | SCR, C6F | 353-6468-010 |
| R1 | RESISTOR, 1500 OHMS, 1/2 W | 745-1359-000 |
| R2 | RESISTOR, 330 OHMS, 1/4 W | 745-0731-000 |
| R3 | SAME AS R1 | |
| R4 | SAME AS R2 | |
| R5 | SAME AS R1 | |
| R6 | SAME AS R2 | |
| R7 | SAME AS R1 | |
| R8 | SAME AS R2 | |
| R9 | RESISTOR, 100 OHMS, 1/4 W | 745-0713-000 |
| R10 | SAME AS R9 | |
| R11 | SAME AS R9 | |
| R12 | SAME AS R9 | |
| R13 | RESISTOR, 1500 OHMS, 2 W | 745-5659-000 |
| R14 | SAME AS R2 | |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| R15 | RESISTOR, 4700 OHMS, 1/4 W | 745-0773-000 |
| R16 | RESISTOR, 2.2 MEGOHMS, 1/4 W | 745-0869-000 |
| R17 | RESISTOR, 2200 OHMS, 1/4 W | 745-0761-000 |
| R18 | RESISTOR, 27 OHMS, 1/2 W | 745-1286-000 |
| R19 | SAME AS R17 | |
| R20 | RESISTOR, 470 OHMS, 1/4 W | 745-0737-000 |
| R21 | SAME AS R17 | |
| R22 | SAME AS R20 | |
| R23 | SAME AS R17 | |
| R24 | SAME AS R18 | |
| R25 | SAME AS R13 | |
| R26 | SAME AS R2 | |
| R27 | SAME AS R9 | |
| R28 | RESISTOR, 3300 OHMS, 1/4 W | 745-0767-000 |
| R29 | RESISTOR, VAR, 1 MEGOHM | 380-3761-130 |
| R30 | RESISTOR, 1 MEGOHM, 1/4 W | 745-0857-000 |
| R31 | SAME AS R15 | |
| R32 | SAME AS R17 | |
| R33 | SAME AS R17 | |
| R34 | SAME AS R20 | |
| R35 | SAME AS R17 | |
| R36 | RESISTOR, 1000 OHMS, 2 W | 745-5652-000 |
| R37 | SAME AS R18 | |
| R38 | SAME AS R17 | |
| R39 | SAME AS R17 | |
| R40 | RESISTOR, 1000 OHMS, 1/4 W | 745-0749-000 |
| R41 | RESISTOR, 220 OHMS, 1/4 W | 745-0725-000 |
| R42 | RESISTOR, VAR, 500 OHMS | 381-1721-030 |
| R43 | SAME AS R20 | |
| R44 | SAME AS R17 | |
| R45 | RESISTOR, 1000 OHMS, 1/4 W | 745-0749-000 |
| R46 | RESISTOR, 220 OHMS, 1/4 W | 745-0725-000 |
| R47 | SAME AS R42 | |
| R48 | SAME AS R20 | |
| R49 | SAME AS R17 | |
| R50 | SAME AS R40 | |
| R51 | SAME AS R41 | |
| R52 | SAME AS R42 | |
| R53 | SAME AS R20 | |
| R54 | SAME AS R17 | |
| R55 | SAME AS R17 | |
| R56 | RESISTOR, VAR, 5000 OHMS | 381-1721-060 |
| R57 | SAME AS R9 | |
| R58 | SAME AS R15 | |
| R59 | SAME AS R9 | |
| R60 | SAME AS R20 | |
| R61 | SAME AS R18 | |
| R62 | SAME AS R18 | |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| R63 | SAME AS R15 | |
| R64 | SAME AS R15 | |
| R65 | SAME AS R20 | |
| R66 | SAME AS R15 | |
| S1 | SWITCH | 266-5321-980 |
| U1 | INTEGRATED CIRCUIT, SN7402N | 351-7628-010 |
| U2 | INTEGRATED CIRCUIT, SN7476N | 351-7702-010 |
| U3 | INTEGRATED CIRCUIT, SN7400N | 351-7629-010 |
| U4 | INTEGRATED CIRCUIT, NE555V | 351-1137-020 |
| U5 | SAME AS U1 | |
| U6 | SAME AS U4 | |
| U7 | INTEGRATED CIRCUIT, SN7410N | 351-7635-010 |
| U8 | INTEGRATED CIRCUIT, SN7404N | 351-7630-010 |
| U9 | SAME AS U8 | |
| VR1 | ZENER DIODE, 1N4728A | 353-6481-010 |
| VR2 THRU VR6 | SAME AS VR1 | |
| XU1 | SOCKET, INTEGRATED CIRCUIT | 220-0049-010 |
| XU2 | SOCKET, INTEGRATED CIRCUIT | 220-0049-020 |
| XU3 | SAME AS XU1 | |
| XU4 | SOCKET, INTEGRATED CIRCUIT | 220-0001-060 |
| XU5 | SAME AS XU1 | |
| XU6 | SAME AS XU4 | |
| XU7 | SAME AS XU1 | |
| XU8 | SAME AS XU1 | |
| XU9 | SAME AS XU1 | |

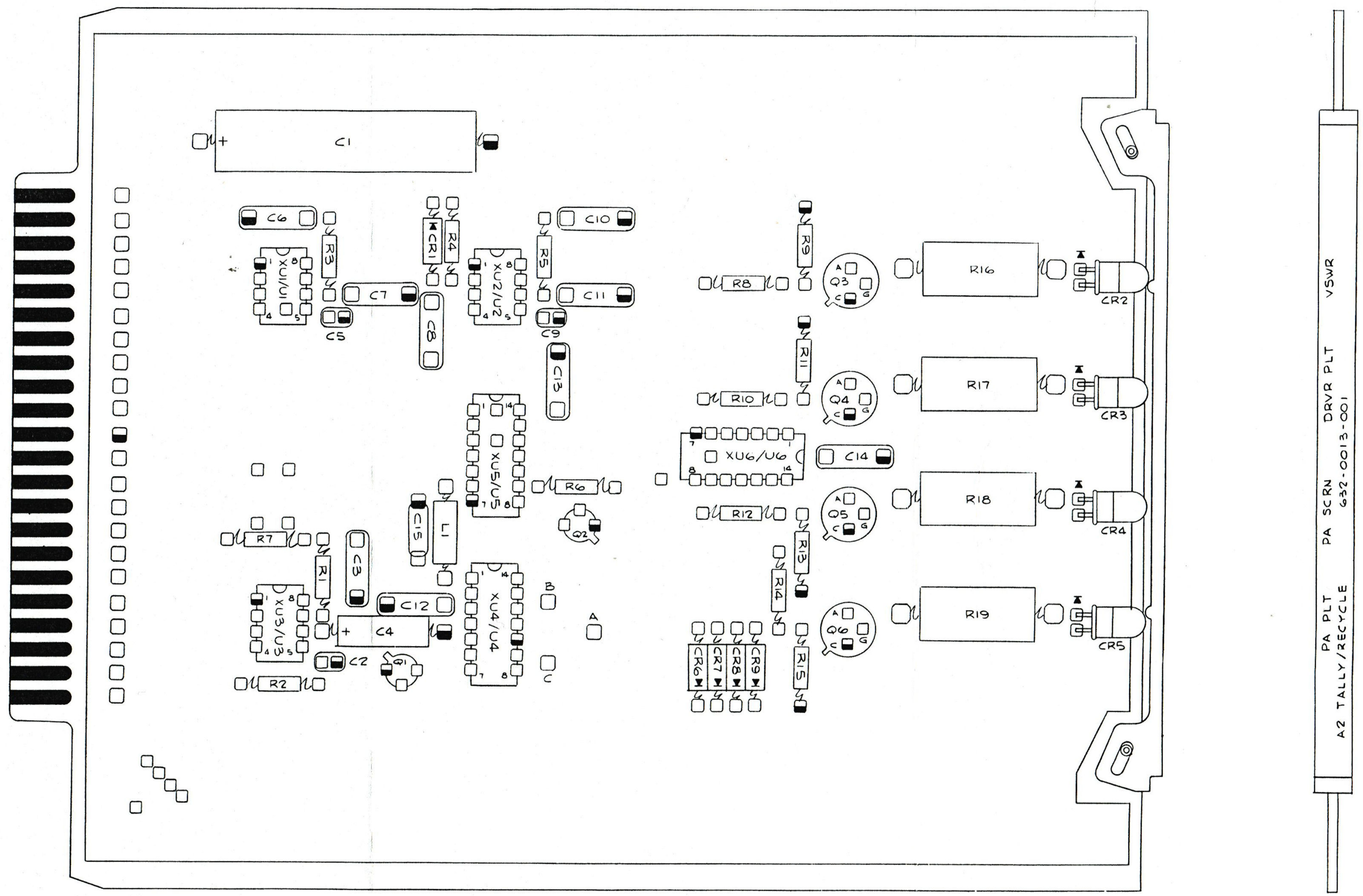



Figure 5-6. Overload Tally/Recycle Card (Optional).

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | OVERLOAD TALLY/RECYCLE CARD (OPTIONAL), A1A2 | 632-0013-001 |
| C1 | CAPACITOR, 250 μF, 12 V | 183-1190-000 |
| C2 | CAPACITOR, 0.01 μF, 50 V | 913-3279-110 |
| C3 | CAPACITOR, 1.0 μF, 25 V | 913-3810-000 |
| C4 | CAPACITOR, 10 μF, 20 V | 184-9086-470 |
| C5 | SAME AS C2 | |
| C6 | SAME AS C3 | |
| C7 | SAME AS C3 | |
| C8 | SAME AS C3 | |
| C9 | SAME AS C2 | |
| C10 THRU C14 | SAME AS C3 | |
| C15 | CAPACITOR, .01 μF | 913-3680-000 |
| CR1 | DIODE, 1N914 | 353-2906-000 |
| CR2 | DIODE, LIGHT EMITTING | 353-3725-030 |
| CR3 | SAME AS CR2 | |
| CR4 | SAME AS CR2 | |
| CR5 | SAME AS CR2 | |
| CR6 | SAME AS CR1 | |
| CR7 | SAME AS CR1 | |
| CR8 | SAME AS CR1 | |
| CR9 | SAME AS CR1 | |
| L1 | CHOKE, 100 μH | 240-2715-370 |
| Q1 | TRANSISTOR, 2N2222A | 352-0661-023 |
| Q2 | SAME AS Q1 | |
| Q3 | SCR, C6F | 353-6468-010 |
| Q4 | SAME AS Q3 | |
| Q5 | SAME AS Q3 | |
| Q6 | SAME AS Q3 | |
| R1 | RESISTOR, 2.2 MEGOHMS, 1/4 W | 745-0869-000 |
| R2 | RESISTOR, 1000 OHMS, 1/4 W | 745-0749-000 |
| R3 | RESISTOR, 1 MEGOHM, 1/4 W | 745-0857-000 |
| R4 | RESISTOR, 4700 OHMS, 1/4 W | 745-0773-000 |
| R5 | RESISTOR, 470 KILOHMS, 1/4 W | 745-0845-000 |
| R6 | RESISTOR, 2200 OHMS, 1/4 W | 745-0761-000 |
| R7 | SAME AS R6 | |
| R8 | RESISTOR, 470 OHMS, 1/4 W | 745-0737-000 |
| R9 THRU R15 | SAME AS R8 | |
| R16 | RESISTOR, 1200 OHMS, 2 W | 745-5656-000 |
| R17 | SAME AS R16 | |
| R18 | SAME AS R16 | |
| R19 | SAME AS R16 | |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| U1 | INTEGRATED CIRCUIT, NE555V | 351-1137-020 |
| U2 | SAME AS U1 | |
| U3 | SAME AS U1 | |
| U4 | INTEGRATED CIRCUIT, SN7492N | 351-7771-010 |
| U5 | INTEGRATED CIRCUIT, SN7400N | 351-7629-010 |
| U6 | INTEGRATED CIRCUIT, SN7402N | 351-7628-010 |
| XU1 | SOCKET, INTEGRATED CIRCUIT | 220-0001-060 |
| XU2 | SAME AS XU1 | |
| XU3 | SAME AS XU1 | |
| XU4 | SOCKET, INTEGRATED CIRCUIT | 220-0049-010 |
| XU5 | SAME AS XU4 | |
| XU6 | SAME AS XU4 | |

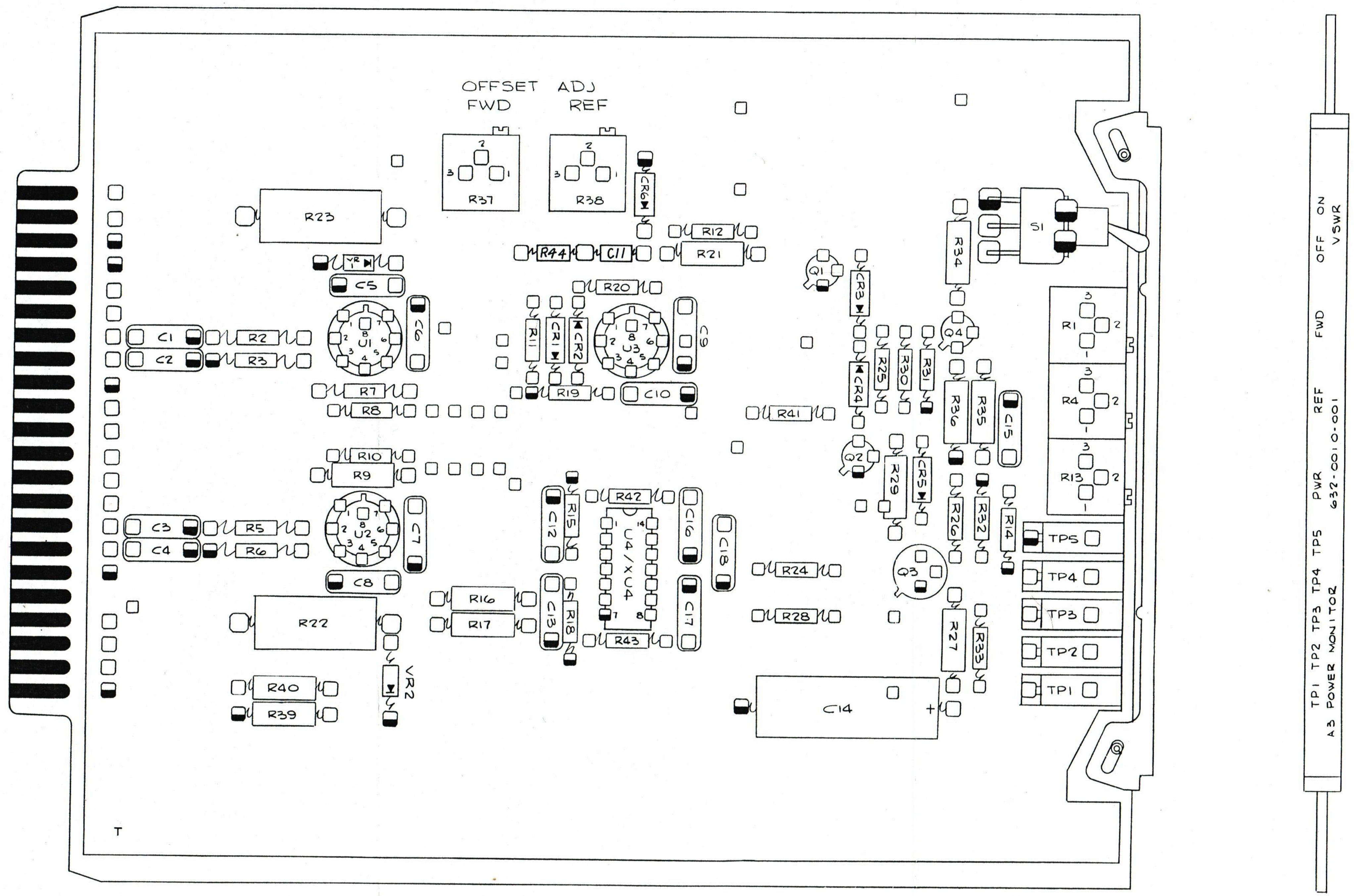



Figure 5-7. Power Monitor Card.

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | POWER MONITOR CARD, A1A3 | 632-0010-001 |
| C1 | CAPACITOR, 1.0 $\mu$F, 25 V | 913-3810-000 |
| C2 THRU C10 | SAME AS C1 | |
| C11 | CAPACITOR, 1 $\mu$F, 35 V | 184-9102-350 |
| C12 | SAME AS C1 | |
| C13 | SAME AS C1 | |
| C14 | CAPACITOR, 150 $\mu$F, 30 V | 184-8673-000 |
| C15 THRU C18 | SAME AS C1 | |
| CR1 | DIODE, 1N914 | 353-2906-000 |
| CR2 THRU CR5 | SAME AS CR1 | |
| CR6 | DIODE, 1N4003 | 353-6442-030 |
| R1 | RESISTOR, VAR, 20 KILOHMS | 381-1721-150 |
| R2 | RESISTOR, 10 KILOHMS, 1/8 W | 705-1454-630 |
| R3 | RESISTOR, 10.5 KILOHMS, 1/8 W | 705-1470-870 |
| R4 | RESISTOR, VAR, 20 KILOHMS | 381-1721-150 |
| R5 | SAME AS R2 | |
| R6 | SAME AS R3 | |
| R7 | RESISTOR, 68.1 KILOHMS, 1/8 W | 705-1454-830 |
| R8 | RESISTOR, 1000 OHMS, 1/4 W | 705-0749-000 |
| R9 | RESISTOR, 78.7 KILOHMS | 705-1087-000 |
| R10 | SAME AS R8 | |
| R11 | SAME AS R2 | |
| R12 | SAME AS R2 | |
| R13 | RESISTOR, VAR, 10 KILOHMS | 381-1721-130 |
| R14 | RESISTOR, 4640 OHMS, 1/8 W | 705-1454-550 |
| R15 | RESISTOR, 220 OHMS, 1/4 W | 745-0725-000 |
| R16 | RESISTOR, 1500 OHMS, 1/2 W | 745-1359-000 |
| R17 | SAME AS R16 | |
| R18 | RESISTOR, 220 OHMS, 1/4 W | 745-0725-000 |
| R19 | RESISTOR, 5110 OHMS | 705-6630-000 |
| R20 | RESISTOR, 825 KILOHMS, 1/8 W | 705-9736-000 |
| R21 | RESISTOR, 1000 OHMS, 1/2 W | 745-1352-000 |
| R22 | RESISTOR, 220 OHMS, 2 W | 745-5624-000 |
| R23 | SAME AS R22 | |
| R24 | RESISTOR, 2200 OHMS, 1/4 W | 745-0761-000 |
| R25 | SAME AS R8 | |
| R26 | RESISTOR, 68 KILOHMS, 1/4 W | 745-0815-000 |
| R27 | RESISTOR, 100 OHMS, 1/2 W | 745-1310-000 |
| R28 | SAME AS R24 | |
| R29 | SAME AS R21 | |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| R30 | SAME AS R8 | |
| R31 | RESISTOR, 4700 OHMS, 1/4 W | 745-0773-000 |
| R32 | SAME AS R24 | |
| R33 | RESISTOR, 10 KILOHMS, 1/4 W | 745-0785-000 |
| R34 | SAME AS R21 | |
| R35 | RESISTOR, 470 OHMS, 1/2 W | 745-1338-000 |
| R36 | SAME AS R21 | |
| R37 | RESISTOR, VAR, 10 KILOHMS | 381-1721-120 |
| R38 | SAME AS R37 | |
| R39 | RESISTOR, 4700 OHMS, 1/2 W | 745-1380-000 |
| R40 | RESISTOR, 5600 OHMS, 1/2 W | 745-1384-000 |
| R41 | RESISTOR, 3320 OHMS, 1/2 W | 705-1470-750 |
| R42 | RESISTOR, 100 OHMS, 1/4 W | 745-0713-000 |
| R43 | SAME AS R42 | |
| R44 | RESISTOR, 56 KILOHMS, 1/4 W | 745-0812-000 |
| S1 | SWITCH, SPDT | 266-5321-980 |
| TP1 | TEST POINT | 360-0434-030 |
| TP2 | TEST POINT | 360-0434-040 |
| TP3 | TEST POINT | 360-0434-070 |
| TP4 | TEST POINT | 360-0434-050 |
| TP5 | TEST POINT | 360-0434-010 |
| Q1 | TRANSISTOR, 2N2222A | 352-0661-023 |
| Q2 | SAME AS Q1 | |
| Q3 | TRANSISTOR, 2N3053 | 352-0613-010 |
| Q4 | TRANSISTOR, 2N2222A | 352-0661-023 |
| U1 | INTEGRATED CIRCUIT, UA 741 | 351-1029-020 |
| U2 | SAME AS U1 | |
| U3 | SAME AS U1 | |
| U4 | INTEGRATED CIRCUIT, SN7400N | 351-7629-010 |
| VR1 | ZENER DIODE, 1N4744A | 353-6481-330 |
| VR2 | SAME AS VR1 | |
| XU4 | SOCKET, INTEGRATED CIRCUIT | 220-0049-010 |

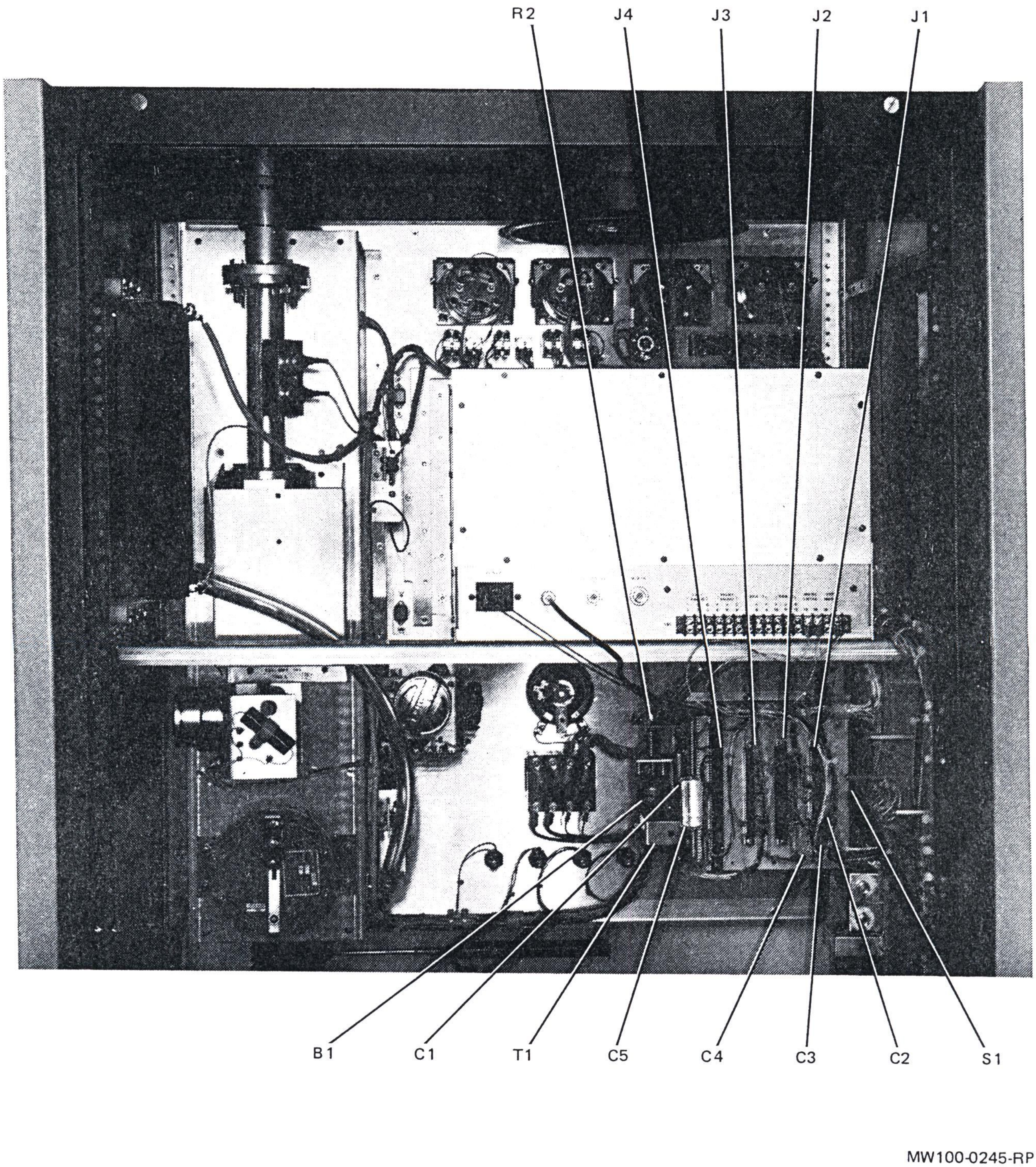



Figure 5-8. Card Cage Assembly.

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | CARD CAGE ASSEMBLY, A1A5 | 632-0031-001 |
| B1 | MOTOR | 230-0641-010 |
| C1 | CAPACITOR, 0.33 UF, 600 V | 951-1066-000 |
| C2 | CAPACITOR, 0.1 UF, 25 V | 913-3806-000 |
| C3 | SAME AS C2 | |
| C4 | SAME AS C2 | |
| C5 | CAPACITOR, 1000 UF, 50 V | 183-1282-140 |
| J1 | CONNECTOR | 372-7514-030 |
| J2 | SAME AS J1 | |
| J3 | SAME AS J1 | |
| J4 | CONNECTOR | 372-5906-010 |
| R1 | NOT USED | |
| R2 | RESISTOR, VAR, 5 KILOHMS | 372-2487-000 |
| S1 | SWITCH | 266-8000-000 |
| T1 | TRANSFORMER | 270-0313-020 |

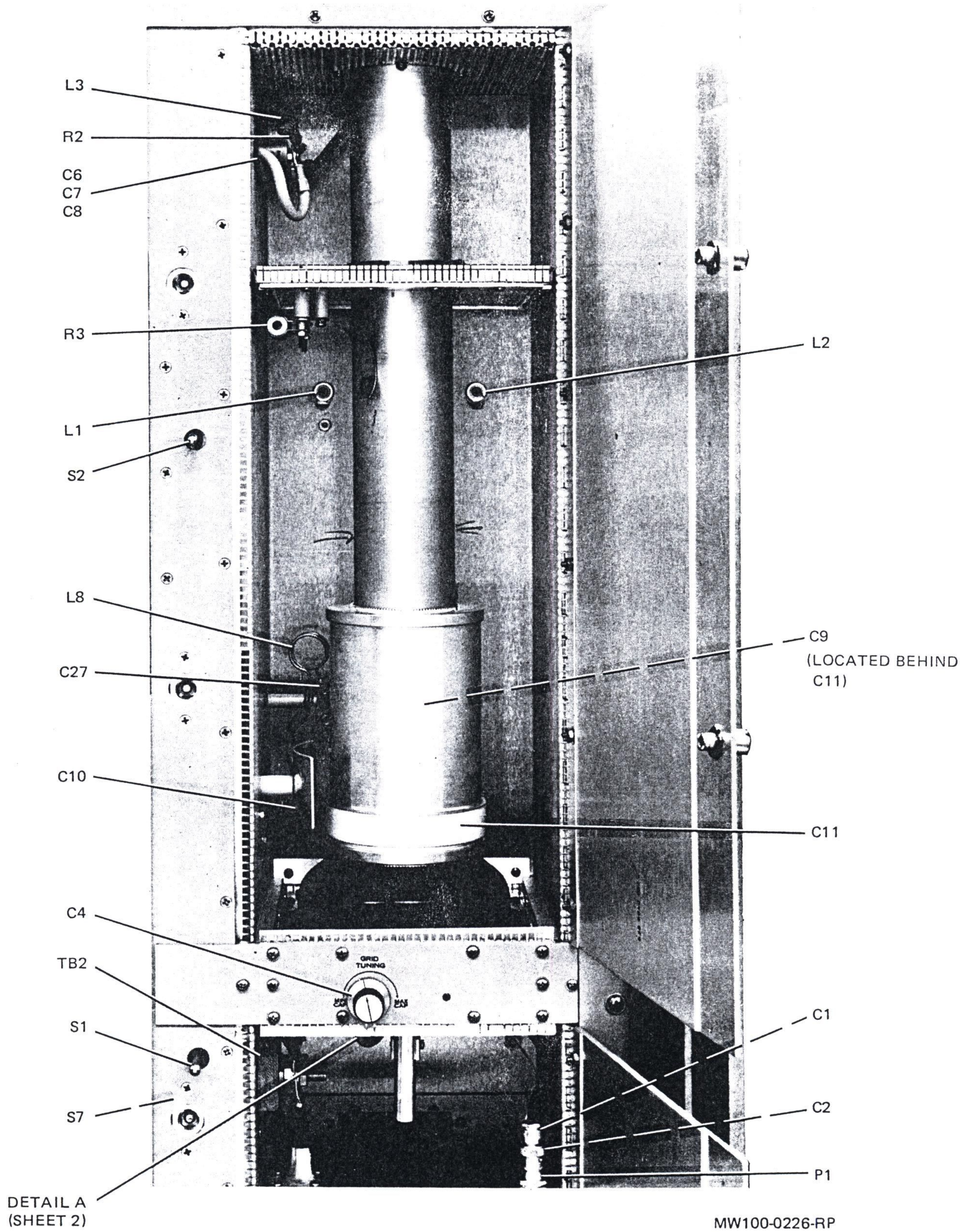



Figure 5-9. Power Amplifier Cavity Assembly (Sheet 1 of 3).

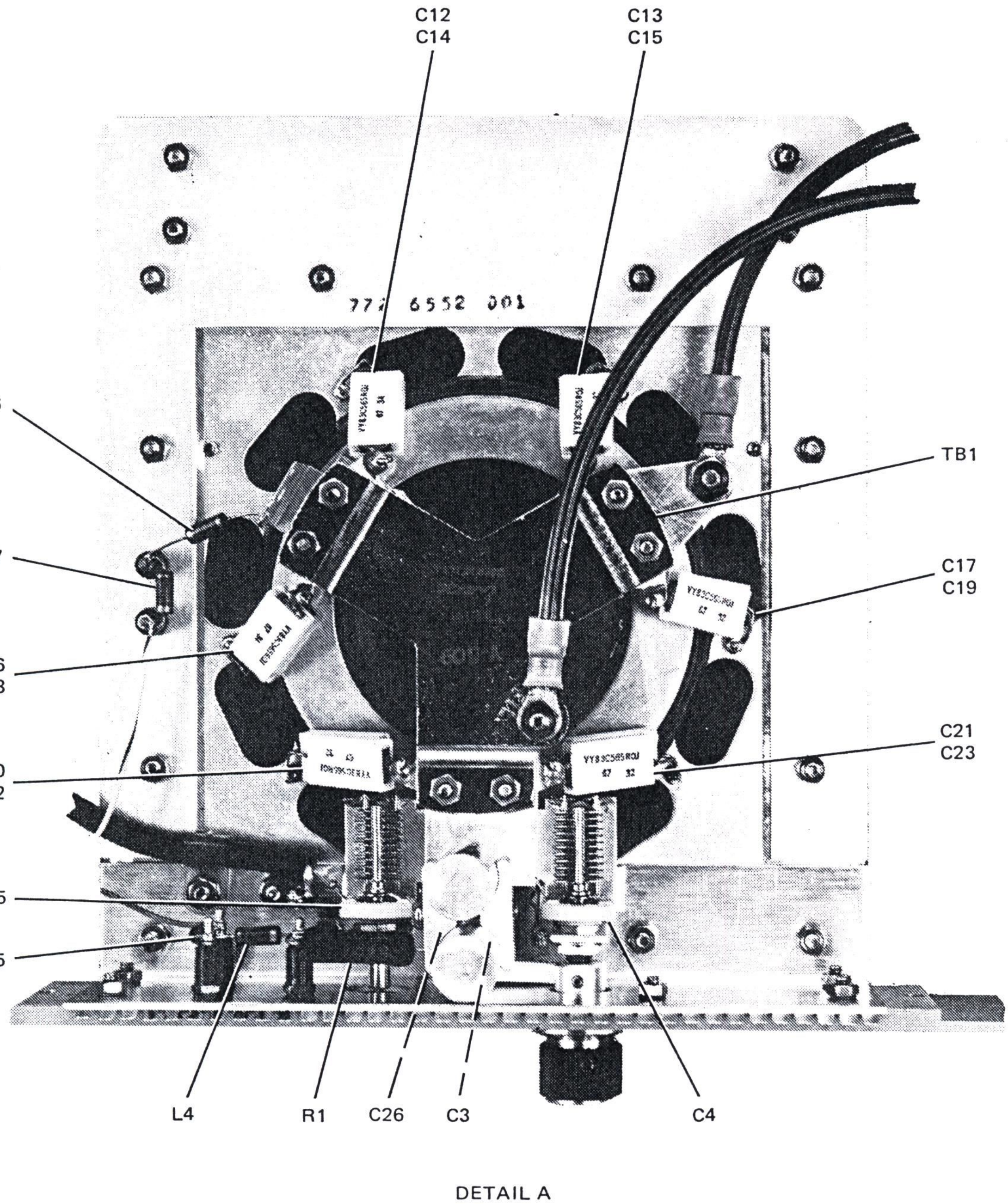



Figure 5-9. Power Amplifier Cavity Assembly (Sheet 2 of 3).

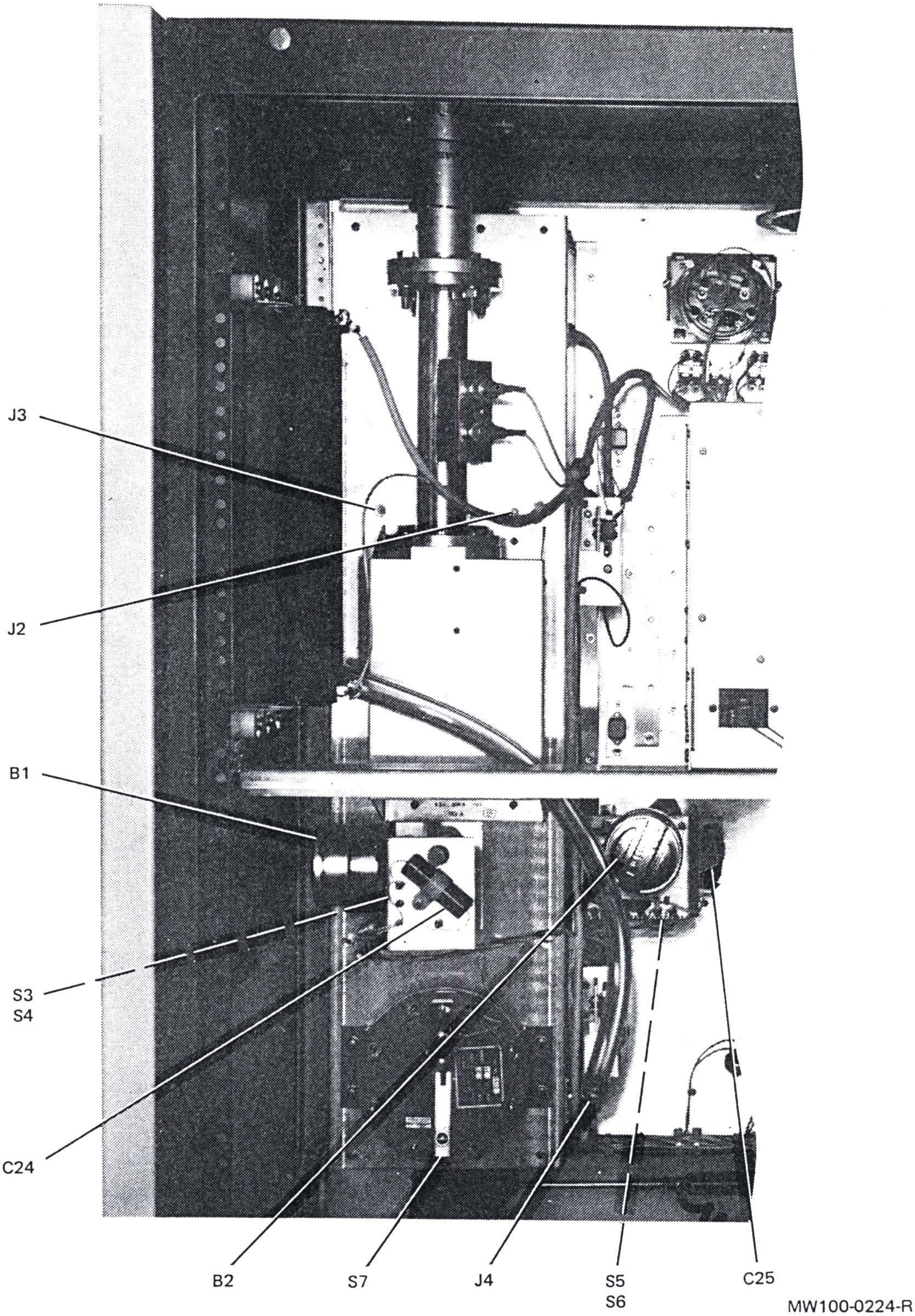



Figure 5-9. Power Amplifier Cavity Assembly (Sheet 3 of 3).

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | POWER AMPLIFIER CAVITY ASSEMBLY, A1A6 | 632-0039-001 |
| B1 | MOTOR | 230-0581-010 |
| B2 | SAME AS B1 | |
| C1 | CAPACITOR, 1000 pf | 913-4238-010 |
| C2 | CAPACITOR, 1000 pf | 913-1292-000 |
| C3 | CAPACITOR, 565 pf | 914-2721-000 |
| C4 | CAPACITOR, VAR, 3.0 - 18.7 pf | 922-0033-000 |
| C5 | SAME AS C4 | |
| C6 | CAPACITOR, 1000 pf | 913-0101-000 |
| C7 | SAME AS C6 | |
| C8 | SAME AS C6 | |
| C9 | CAPACITOR, MECHANICAL PART | |
| C10 | SAME AS C9 | |
| C11 | CAPACITOR, BLOCKER | 788-8249-001 |
| C12 THRU C23 | SAME AS C3 | |
| C24 | CAPACITOR, .47 uF | 931-6849-000 |
| C25 | SAME AS C24 | |
| C26 | SAME AS C3 | |
| C27 | CAPACITOR, 20 pf | 913-0838-000 |
| FL1 | FILTER, HARMONIC | 632-0068-001 |
| J1 | NOT USED | |
| J2 | CONNECTOR | 357-9670-000 |
| J3 | SAME AS J2 | |
| L1 | COIL, RF | |
| L2 | SAME AS L1 | |
| L3 | INDUCTOR, 4.7 UH | 240-0178-000 |
| L4 | INDUCTOR, 3.3 UH | 240-1574-000 |
| L5 | SAME AS L4 | |
| L6 | SAME AS L4 | |
| L7 | SAME AS L4 | |
| L8 | INDUCTOR | 788-8218-001 |
| L9 | INDUCTOR, MECHANICAL PART | |
| L10 | INDUCTOR, MECHANICAL PART | |
| P1 | CONNECTOR | 357-9292-000 |
| R1 | RESISTOR, 120 Ohms | 747-5442-000 |
| R2 | RESISTOR, 12 Ohms | 747-0726-000 |
| R3 | RESISTOR, 50 Ohms | 712-0072-000 |
| S1 | SWITCH, SHORTING | 627-9743-005 |
| S2 | SWITCH, SHORTING | 627-9743-001 |
| S3 | SWITCH, SENSITIVE, SPDT | 260-2293-000 |
| S4 | SAME AS S3 | |
| S5 | SAME AS S3 | |
| S6 | SAME AS S3 | |
| S7 | SWITCH, PRESSURE | 266-8384-090 |
| TB1 | BOARD, TERMINAL | 772-6593-001 |
| TB2 | BOARD, TERMINAL | 772-6535-001 |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| V1 | TUBE, 5CX1500A | 256-0200-000 |
| XV1 | SOCKET, TUBE | 220-0967-010 |

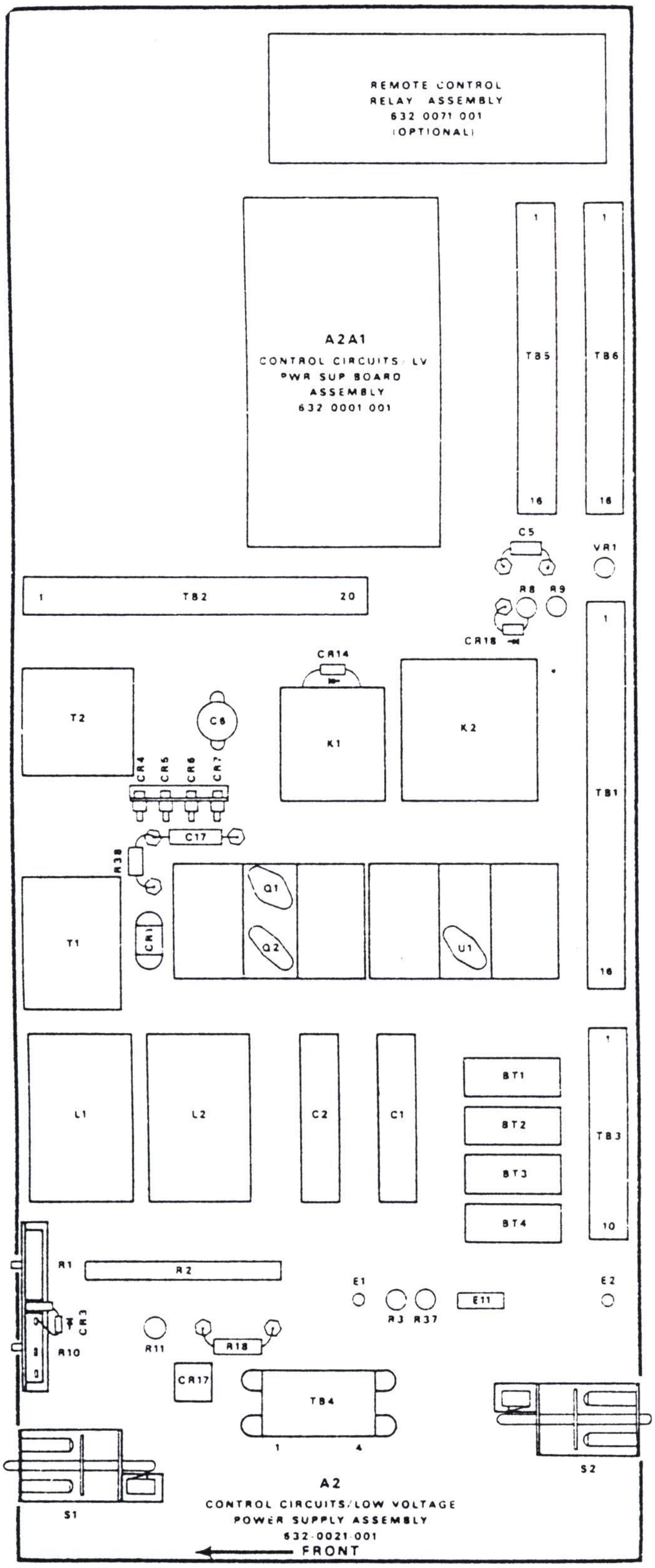



Figure 5-10. Control Circuits and Low Voltage Power Supplies.

| SYMBOL | DESCRIPTION | COLLINS NUMBER |
|---|---|---|
| | CONTROL CIRCUITS AND LOW VOLTAGE POWER SUPPLIES, A2 | 632-0021-001 |
| A1 | CONTROL CIRCUITS AND LOW VOLTAGE POWER SUPPLIES BOARD ASSEMBLY<br>SEE BREAKDOWN ON PAGE 5-35 | 632-0001-001 |
| BT1 | BATTERY | 221-0080-010 |
| BT2 | SAME AS BT1 | |
| BT3 | SAME AS BT1 | |
| BT4 | SAME AS BT1 | |
| C1<br>C2 | CAPACITOR, 10 UF, 1 kV | 930-0038-000 |
| C3 | NOT USED | |
| C4 | NOT USED | |
| C5 | CAPACITOR, 100 UF, 50 V | 183-1281-080 |
| C6 | CAPACITOR, 3900 UF, 50 V | 183-1278-370 |
| C7<br>THRU<br>C16 | NOT USED | |
| C17 | CAPACITOR, .02 UF, 1 kV | 962-0915-000 |
| CR1 | RECTIFIER | 353-6333-000 |
| CR2 | NOT USED | |
| CR3 | DIODE, 1N4006 | 353-6442-060 |
| CR4 | DIODE, 1N1202 | 353-1889-000 |
| CR5 | DIODE, 1N1202 | 353-1889-000 |
| CR6 | DIODE, 1N1202 | 353-1889-000 |
| CR7 | DIODE, 1N1202 | 353-1889-000 |
| CR8 | DIODE, 1N1202 | 353-1889-000 |
| CR9<br>THRU<br>CR13 | NOT USED | |
| CR14 | DIODE, 1N4003 | 353-6442-030 |
| CR15 | NOT USED | |
| CR16 | NOT USED | |
| CR17 | DIODE | |
| E11 | ARRESTOR | 013-1332-020 |
| K1 | RELAY, FILAMENT CONTRACTOR | 970-2426-070 |
| K2 | RELAY, PLATE CONTRACTOR | 401-0015-020 |
| L1 | INDUCTOR, 10 H | 678-0156-010 |
| L2 | SAME AS L1 | |
| Q1 | TRANSISTOR, 2N3055 | 353-0583-010 |
| Q2 | TRANSISTOR, 2N3054 | 353-0581-010 |
| R1 | RESISTOR, VARIABLE, 1000 OHMS, 25 W | 735-1013-200 |
| R2 | RESISTOR, 7500 OHMS, 55 W | 747-2857-000 |
| R3 | RESISTOR, 150 OHMS, 11 W | 746-6145-000 |
| R4<br>THRU<br>R7 | NOT USED | |
| R8 | RESISTOR, 1200 OHMS, 14 W | 747-0766-000 |
| R9 | RESISTOR, 1500 OHMS, 11 W | 746-6161-000 |
| R10 | RHEOSTAT, 15 KILOHMS, 25 W | 735-1013-510 |
| R11 | RESISTOR, 5000 OHMS, 11 W | 746-6169-000 |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| R11 | RESISTOR, 5000 OHMS, 11 W | 746-6169-000 |
| R12 THRU R17 | NOT USED | |
| R18 | RESISTOR, 33 OHMS, 6.5 W | 747-5491-000 |
| R19 THRU R36 | NOT USED | |
| R37 | RESISTOR, 150 OHMS, 11 W | 746-6145-000 |
| R38 | RESISTOR, 15 KILOHMS, 2 W | 745-5701-000 |
| S1 | SWITCH, FRONT INTERLOCK | 627-9743-007 |
| S2 | SWITCH, REAR INTERLOCK | 627-9743-006 |
| T1 | TRANSFORMER | 662-0357-010 |
| T2 | TRANSFORMER | 662-0358-010 |
| TB1 | TERMINAL BOARD | 367-5160-000 |
| TB2 | TERMINAL BOARD | 367-4200-000 |
| TB3 | TERMINAL BOARD | 367-4100-000 |
| TB4 | TERMINAL BOARD | 306-0778-000 |
| TB5 | TERMINAL BOARD | 367-4160-000 |
| TB6 | SAME AS TB5 | |
| U1 | REGULATOR | 351-1120-080 |
| VR1 | DIODE, ZENER, 1N2988 | 353-1367-000 |
| VR2 | NOT USED | |
| VR3 | NOT USED | |
| VR4 | DIODE, ZENER, 1N3997A | |
| XBT1 | HOLDER, BATTERY | 139-2699-030 |
| XBT2 | SAME AS XBT1 | |
| XBT3 | SAME AS XBT1 | |
| XBT4 | SAME AS XBT1 | |
| XE11 | HOLDER, ARRESTOR | 013-1332-010 |
| XQ1 | SOCKET, TRANSISTOR | 220-0968-010 |
| XQ2 | SOCKET, TRANSISTOR | 220-0968-020 |
| XU1 | SAME AS XQ1 | |

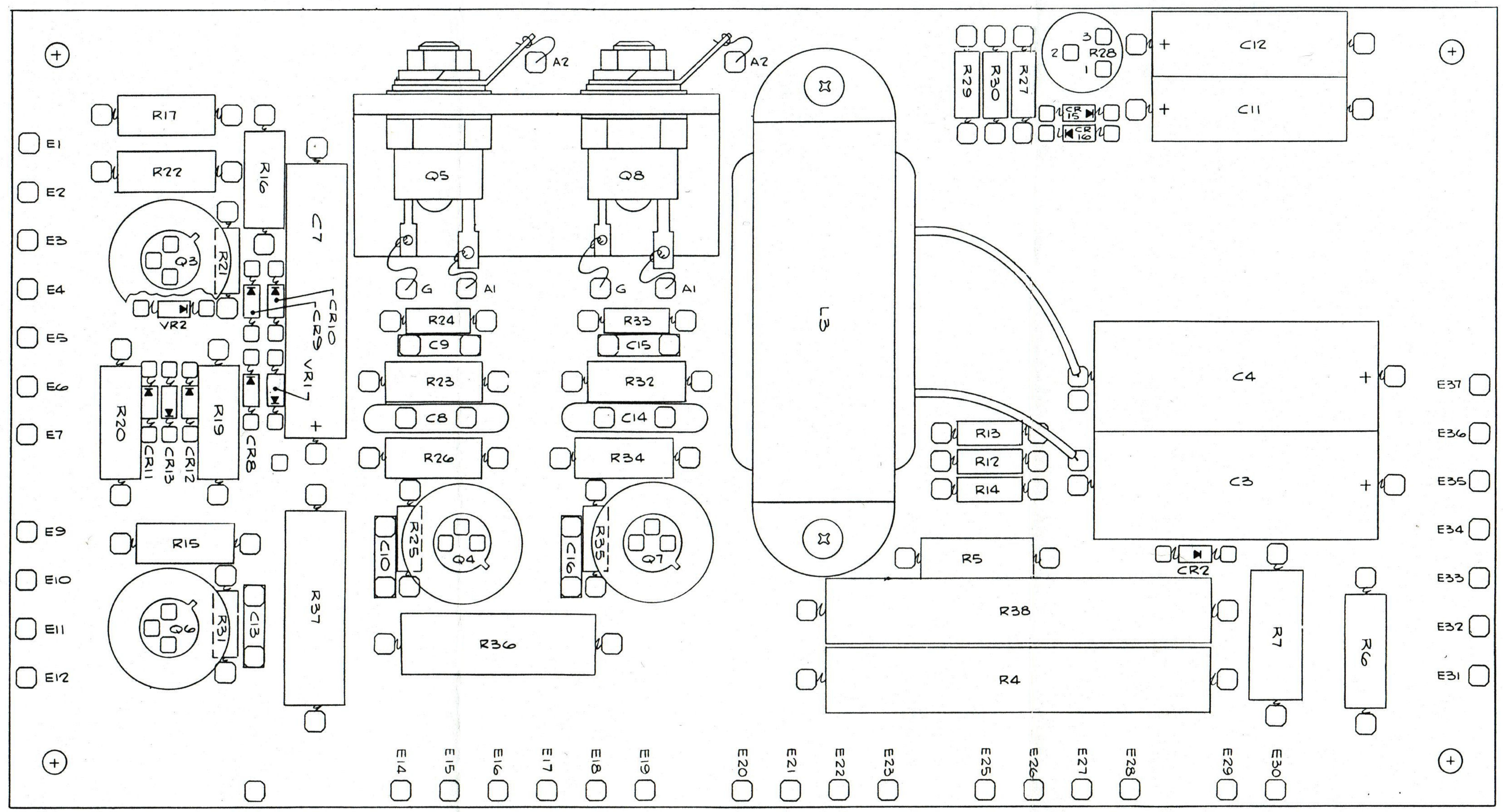



Figure 5-11. Control Circuits and Low Voltage Power Supplies Board Assembly.

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | CONTROL CIRCUITS AND LOW VOLTAGE POWER SUPPLIES, BOARD ASSEMBLY, A2A1 | 632-0001-001 |
| C1 | NOT USED | |
| C2 | NOT USED | |
| C3 | CAPACITOR, 30 UF, 200 V | 183-1282-330 |
| C4 | SAME AS C3 | |
| C5 | NOT USED | |
| C6 | NOT USED | |
| C7 | CAPACITOR, 100 UF, 50 V | 183-1281-080 |
| C8 | CAPACITOR, 0.1 UF, 500 V | 913-3234-000 |
| C9 | CAPACITOR, 0.1 UF, 25 V | 913-3806-000 |
| C10 | SAME AS C9 | |
| C11 | CAPACITOR, 180 UF, 25 V | 184-8664-000 |
| C12 | SAME AS C11 | |
| C13 | SAME AS C9 | |
| C14 | SAME AS C8 | |
| C15 | SAME AS C9 | |
| C16 | SAME AS C9 | |
| CR1 | NOT USED | |
| CR2 | DIODE, 1N4006 | 353-6442-060 |
| CR3 THRU CR8 | NOT USED | |
| CR9 | DIODE, 1N4003 | 353-6442-030 |
| CR10 THRU CR13 | SAME AS CR9 | |
| CR14 | NOT USED | |
| CR15 | SAME AS CR9 | |
| CR16 | SAME AS CR9 | |
| CR17 | NOT USED | |
| CR18 | SAME AS CR9 | |
| CR19 | DIODE, 1N4006 | 353-6442-060 |
| L1 | NOT USED | |
| L2 | NOT USED | |
| L3 | REACTOR, 16 H | 668-0163-010 |
| Q1 | NOT USED | |
| Q2 | NOT USED | |
| Q3 | TRANSISTOR, 2N4037 | 352-0714-020 |
| Q4 | TRANSISTOR, 2N3053 | 352-0613-010 |
| Q5 | TRIAC, SC-45D | 353-6490-030 |
| Q6 | SAME AS Q4 | |
| Q7 | SAME AS Q4 | |
| Q8 | SAME AS Q5 | |
| R1 | NOT USED | |
| R2 | NOT USED | |
| R3 | NOT USED | |
| R4 | RESISTOR, 750 KILOHMS, 2 W | 705-1493-020 |
| R5 | RESISTOR, 10 KILOHMS, 1/2 W | 745-1394-000 |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| R6 | RESISTOR, 8870 OHMS, 1/2 W | 705-7320-000 |
| R7 | RESISTOR, 47 OHMS, 2 W | 745-5596-000 |
| R8 THRU R11 | NOT USED | |
| R12 | RESISTOR, 287 KILOHMS, 1/2 W | 705-7214-000 |
| R13 | RESISTOR, 33 KILOHMS, 1/2 W | 745-1415-000 |
| R14 | RESISTOR, 5110 OHMS, 1/2 W | 705-7014-000 |
| R15 | RESISTOR, 470 OHMS, 1 W | 745-3338-000 |
| R16 | RESISTOR, 0.1 OHM, 3 W | 747-5115-000 |
| R17 | SAME AS R16 | |
| R18 | NOT USED | |
| R19 | RESISTOR, 2870 OHMS, 1/2 W | 705-7166-000 |
| R20 | RESISTOR, 1330 OHMS, 1/2 W | 705-7150-000 |
| R21 | RESISTOR, 180 OHMS, 1/2 W | 745-1321-000 |
| R22 | RESISTOR, 1500 OHMS, 1 W | 745-3359-000 |
| R23 | RESISTOR, 100 OHMS, 1 W | 745-3310-000 |
| R24 | RESISTOR, 220 OHMS, 1/2 W | 745-1324-000 |
| R25 | RESISTOR, 2200 OHMS, 1/2 W | 745-1366-000 |
| R26 | RESISTOR, 10 OHMS, 1 W | 745-3268-000 |
| R27 | RESISTOR, 470 OHMS 1/2 W | 745-1338-000 |
| R28 | RESISTOR, AR, 10 KILOHMS | 380-3761-070 |
| R29 | RESISTOR, 1000 OHMS, 1/2 W | 745-1352-000 |
| R30 | SAME AS R29 | |
| R31 | SAME AS R25 | |
| R32 | SAME AS R23 | |
| R33 | SAME AS R24 | |
| R34 | SAME AS R26 | |
| R35 | SAME AS R25 | |
| R36 | RESISTOR, 390 OHMS, 6.5 W | 747-5452-000 |
| R37 | NOT USED | |
| R38 | NOT USED | |
| R39 | SAME AS R4 | |
| R40 | SAME AS R36 | |
| VR1 | NOT USED | |
| VR2 | DIODE, ZENER, 1N4751A | 353-6481-470 |
| VR3 | DIODE, ZENER, 1N4734A | 353-6481-130 |

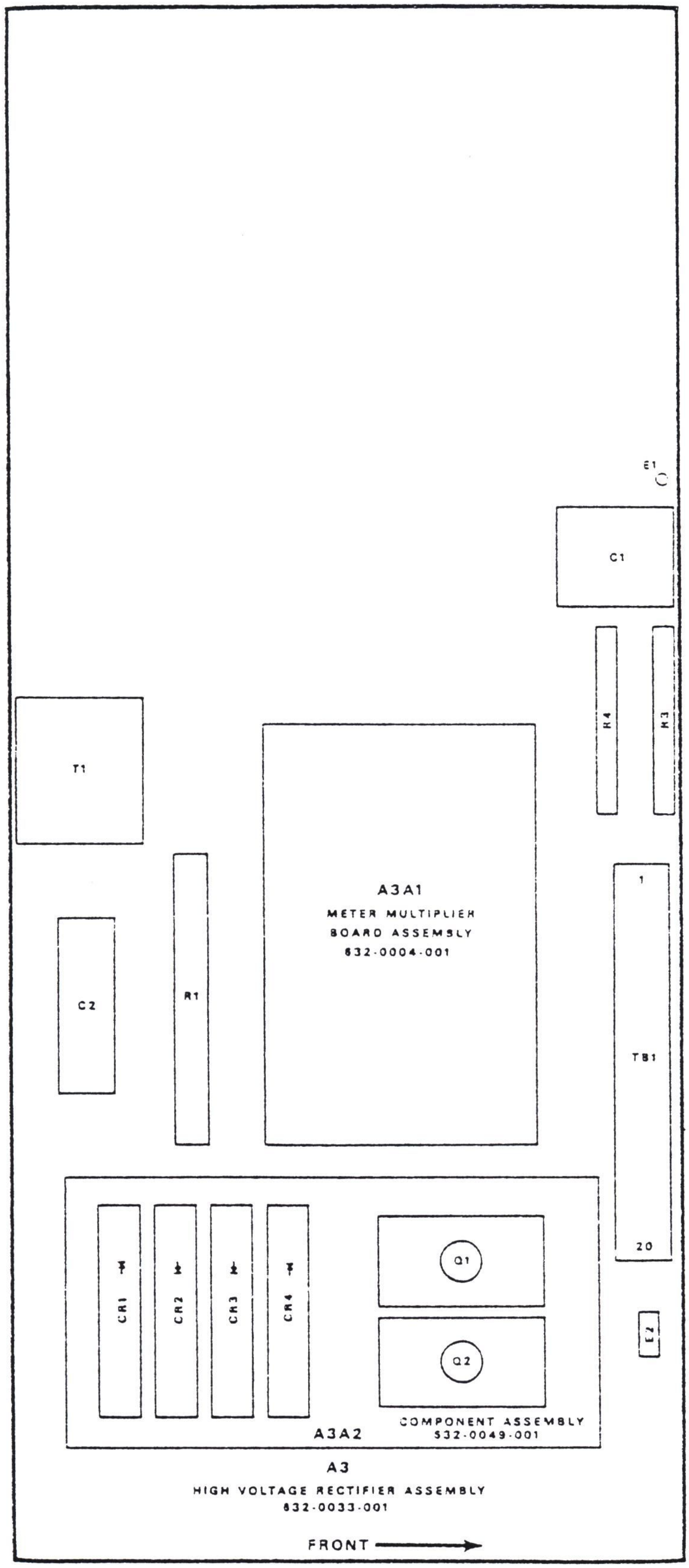



Figure 5-12. High Voltage Rectifier Assembly.

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | HIGH VOLTAGE RECTIFIER ASSEMBLY, A3 | 632-0033-001 |
| A3A1 | METER MULTIPLIER BOARD ASSEMBLY SEE BREAKDOWN ON PAGE 5-41 | 632-0004-001 |
| A3A2 | COMPONENT ASSEMBLY SEE BREAKDOWN ON PAGE 5-42 | 632-0049-001 |
| C1 | CAPACITOR, 4.0 UF, 220 VAC | 930-0773-040 |
| C2 | CAPACITOR, .02 UF, 15 kV | 930-0776-050 |
| E2 | ARRESTOR | 013-1332-020 |
| R1 | RESISTOR, 27 KILOHMS, 55 W | 747-3823-000 |
| R3 | RESISTOR, 4 OHMS | 710-5076-060 |
| R4 | SAME AS R3 | |
| R5 | RESISTOR, VAR, 10 OHMS, 50 W | 735-1013-500 |
| T1 | TRANSFORMER | 662-0342-010 |
| TB1 | TERMINAL BOARD | 367-4200-000 |
| XE2 | HOLDER, ARRESTOR | 013-1332-010 |

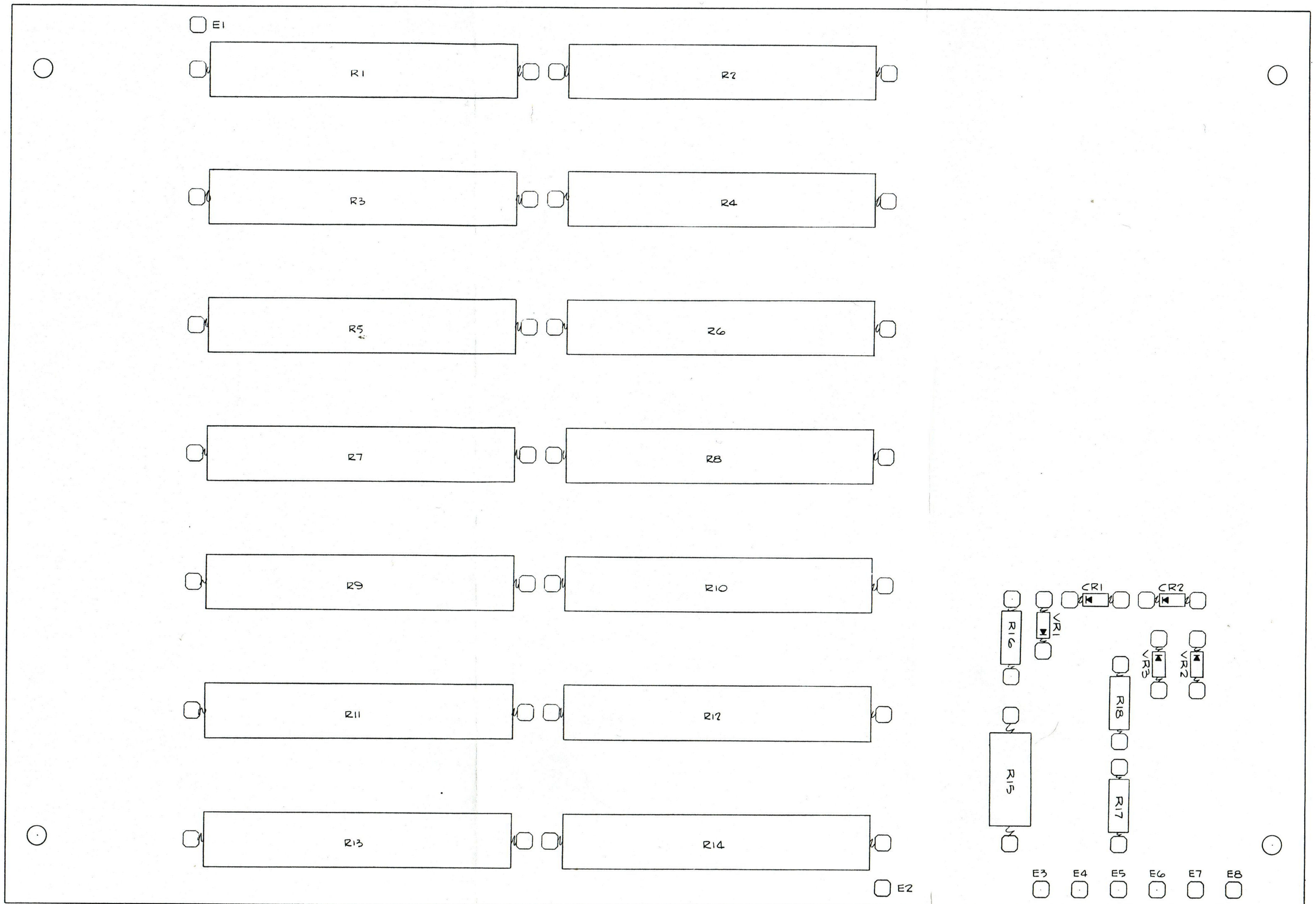



Figure 5-13. Meter Multiplier Board Assembly.

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | METER MULTIPLIER BOARD ASSEMBLY, A3A1 | 632-0004-001 |
| CR1 | DIODE, 1N4003 | 353-6442-030 |
| CR2 | SAME AS CR1 | |
| R1 | RESISTOR, 200 KILOHMS, 2 W | 705-1493-050 |
| R2 THRU R14 | SAME AS R1 | |
| R15 | RESISTOR, 1470 OHMS, 1/2 W | 705-7151-000 |
| R16 | RESISTOR, 4700 OHMS, 1/2 W | 745-1380-000 |
| R17 | RESISTOR, 10 KILOHMS, 1/2 W | 745-1394-000 |
| R18 | RESISTOR, 470 OHMS, 1/2 W | 745-1338-000 |
| VR1 | ZENER DIODE, 1N4744A | 353-6481-330 |
| VR2 | SAME AS VR1 | |
| VR3 | SAME AS VR1 | |

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | COMPONENT ASSEMBLY, A3A2 | 632-0049-001 |
| C1 | CAPACITOR, .1 UF, 500 V | 913-3234-000 |
| CR1 | DIODE | 353-0413-020 |
| CR2 | SAME AS CR1 | |
| CR3 | SAME AS CR1 | |
| CR4 | SAME AS CR1 | |
| Q1 | SCR, 2N1799 | 353-1025-010 |
| Q2 | SAME AS Q1 | |
| R1 | RESISTOR, 100 OHMS, 2 W | 745-5610-000 |

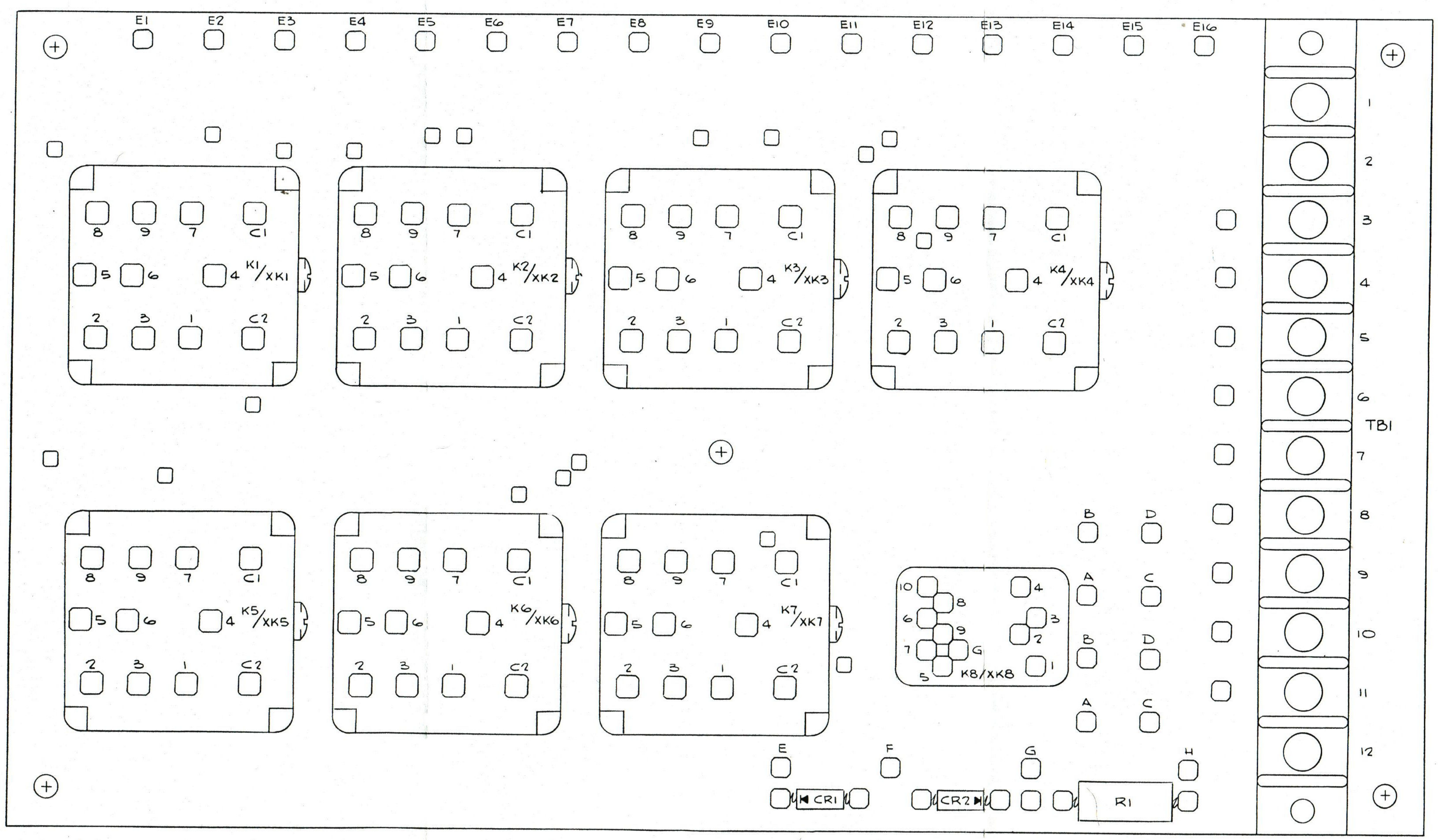



Figure 5-14. Remote Control Assembly (Optional).

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | REMOTE CONTROL ASSEMBLY (OPTIONAL), A4 | 632-0071-001 |
| CR1 | DIODE, 1N4006 | 353-6442-060 |
| CR2 | DIODE, 1N4006 | 353-6442-060 |
| K1 | RELAY | 970-2454-270 |
| K2 THRU K7 | SAME AS K1 | |
| K8 | RELAY | 970-0004-030 |
| R1 | RESISTOR,470 OHMS, 3 W | 747-5391-000 |
| TB1 | TERMINAL BOARD | 367-0812-120 |




| CONTRACT NO | COLLINS RADIO COMPANY<br>DALLAS, TEX NEWPORT BEACH, CALIF CEDAR RAPIDS, IA |
|---|---|
| PREP Charles Riley 5/2/75 | SCHEMATIC, DIAGRAM-<br>831C/D-2<br>12.5/25 KW FM TRANSMITTER |
| CHK | SIZE — CODE IDENT 13499 — DWG NO. 632-0074-001 |
| APVD | SCALE — SHEET |

523-0563912-011431
1 March 1978

Rockwell International

instruction book

# 310Z-2 FM Exciter

Commercial Telecommunications Group
Rockwell International
Broadcast and Transmission Test Products
P.O. Box 10462
Dallas, Texas 75207

*Printed in United States of America*

list of illustrations

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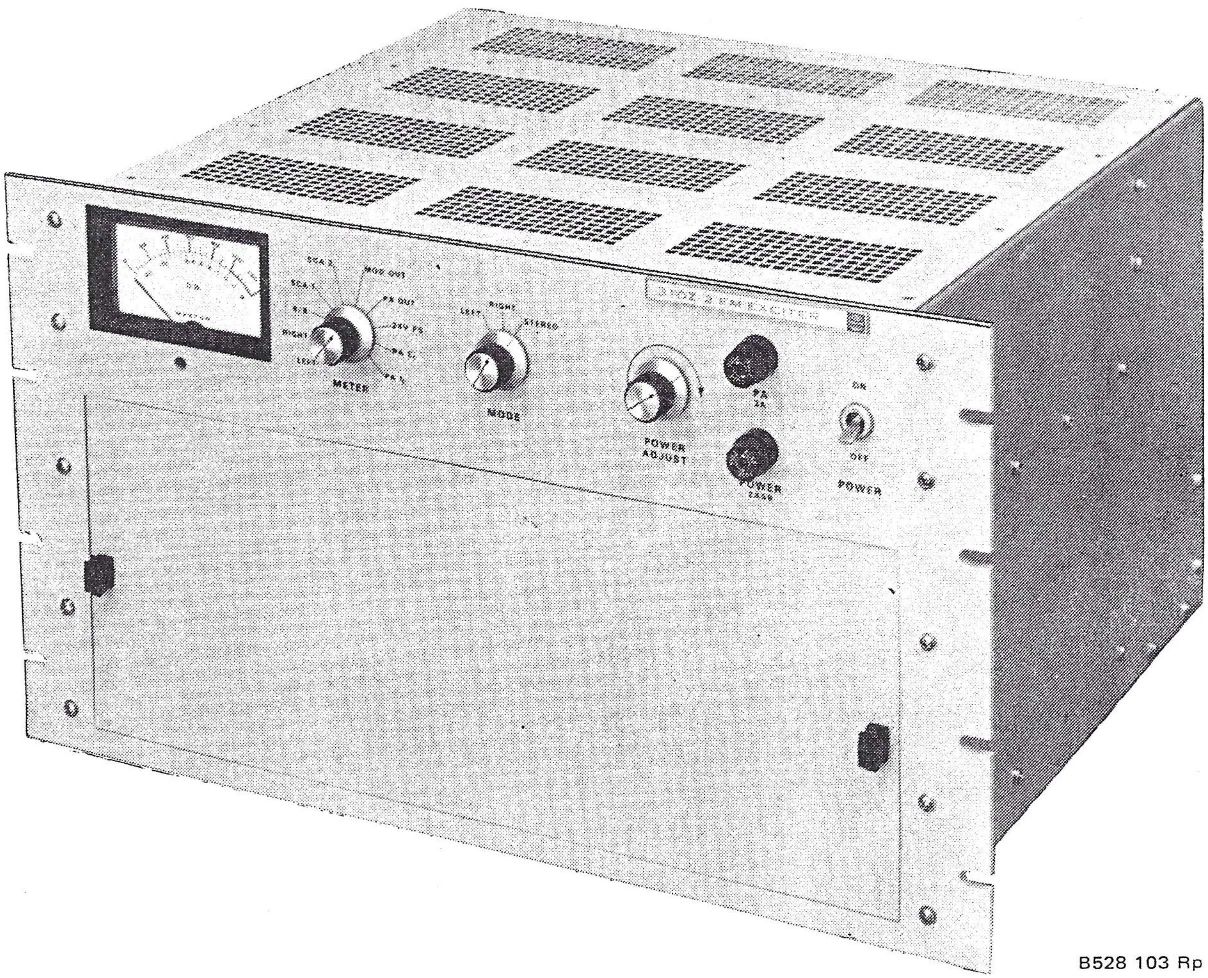



Figure 1-1. 310Z-2 FM Broadcast Exciter.

## 1.1 INTRODUCTION

The solid-state 310Z-2 FM broadcast exciter (figure 1-1) provides a frequency-modulated signal in the 88- to 108-MHz range (exact frequency as specified by the customer) for further amplification and transmission. The exciter can be adjusted manually to provide maximum output of 20 watts and is prewired to accept three optional plug-in modules. The optional 786W-1 SCA Generators enable background music to be transmitted at either 41 kHz or 67 kHz multiplexed on an FM broadcast. The optional 786V-1 Stereo Generator allows broadcasting compatible time-division multiplex stereo. In addition, the optional 785E-1 STL (studio transmitter link) Interface Card can be substituted for the 786V-1 Stereo Generator to interface the 310Z-2 with common composite STL systems or other systems requiring an external baseband input to the modulator.

## 1.2 PHYSICAL DESCRIPTION

The 310Z-2 exciter is 483 mm (19 in.) wide, 267 mm (10.5 in.) high, and 381 mm (15 in.) deep, weighs approximately 18 kg (40 lb) and is designed for mounting a standard 483-mm (19-in.) equipment rack. Controls and power supply components are mounted on the chassis. A card cage secured to the chassis provides receptacles for the five plug-in circuit cards that contain most of the circuits. A removable front panel provides access to the cards. Connectors for the rf signal output and for the ac power input as well as the terminal strip for audio inputs are located on the back of the exciter. Built-in shielding prevents radiation and interference.

## 1.3 FUNCTIONAL DESCRIPTION

The functional units of the 310Z-2 FM Exciter are an FM modulator and an rf amplifier. In addition, a stereo generator and one or two sca (subsidiary communication authorization) generators are optional units that may be included as part of the 310Z-2. Each of these major functional units is constructed as a plug-in module, and the 310Z-2 is prewired so that the stereo generator and the sca generator plug-in modules can be added at any time.

When the 310Z-2 is used only for monaural broadcasts (without the optional sca generators or stereo generator), the audio input is applied to the baseband input of the FM modulator through the required audio processing circuits. A carrier frequency oscillator is modulated to full deviation by the input. This FM signal is also applied to the AFC system, which maintains the oscillator output frequency at carrier frequency.

When the stereo generator is used, the exciter functions the same as described above with the exception that left and right audio inputs are applied to the stereo generator through separate preemphasis networks. These audio signals are multiplexed to provide the baseband signal, which is filtered and applied to the FM modulator. When an sca generator is used, the sca audio input is amplified and used to frequency-modulate a 41- or 67-kHz subcarrier oscillator. The FM sca output is filtered and applied to the FM modulator.

## 1.4 OPTIONAL EQUIPMENT

The 786V-1 Stereo Generator, 785E-1 STL Interface Card, and 786W-1 SCA Generators are customer options. Table 1-1 lists several 310Z-2 FM exciter features and indicates optional modules or cards required for each feature.

## 1.5 TECHNICAL CHARACTERISTICS

The technical characteristics for the 310Z-2 are listed below, and have been divided into five groups: (1) generator characteristics that apply to all 310Z-2 exciters, (2) those characteristics that apply to the 310Z-2 when it is used for monaural FM, (3) those characteristics that apply to the 310Z-2 when it is used for stereo FM with the 786V-1 Stereo Generator, (4) those characteristics that apply to the 310Z-2 when it is used for sca transmission with the 786W-1 SCA Generator, and (5) those characteristics that apply to the 310Z-2 when it is used for composite stereo STL transmission with the 785E-1 STL Interface Card.

### 1.5.1 General

| | |
|---|---|
| Ambient Temperature Range: | 0° to 55°C (32° to 131°F) |
| Ambient Humidity Range: | Up to 95% |
| Maximum Altitude: | 2300 m (7500 ft) |
| Input Power Requirement: | 117/234 volts ac, ±10%, single-phase, 50/60 Hz |
| RF Power Output: | 0 to 20 watts |
| Output Impedance: | 50 to 70 ohms, unbalanced |
| Output Frequency Range: | 88 to 108 MHz, crystal-controlled (crystal installed and exciter adjusted at factory to meet customer requirement) |
| Carrier Frequency Stability: | Within ±500 Hz with ac line voltage of ±10% and temperature range of 0° to +55°C (32° to 131°F) |
| Harmonic and Spurious Radiation: | Any emission appearing on a frequency removed from the carrier by between 120 and 240 kHz is attenuated at least 30 dB below the level of the unmodulated carrier.<br><br>Any emission appearing on a frequency removed from the carrier by more than 240 kHz up to and including 600 kHz is attenuated at least 35 dB below the level of the unmodulated carrier.<br><br>Any emission appearing on a frequency removed from the carrier by more than 600 kHz is attenuated at least 80 dB below the level of the unmodulated carrier, with the exception of harmonics of the rf carrier. |

Table 1-1. 310Z-2 FM Exciter Special Features and Customer Options.

| FEATURE | OPTIONAL MODULES OR CARDS REQUIRED | | |
|---|---|---|---|
| | 786V-1 STEREO GENERATOR | 785E-1 STL INTERFACE CARD | 786W-1 SCA GENERATOR(S) |
| Monaural broadcasting (no options required) | | | |
| Monaural broadcasting with sca | | | X |
| Stereo broadcasting | X | | |
| Stereo broadcasting with sca | X | | X |
| Composite STL | | X | |
| Composite STL with sca | | X | X |

| | |
|---|---|
| Type of Modulation: | Direct frequency modulation |
| Modulating Frequencies: | 20 Hz to 100 kHz |
| FM Noise Level: | 65 dB below 100% modulation |
| AM Noise Level: | 55 dB below carrier level |

1.5.2 Monaural FM

| | |
|---|---|
| Audio Input Impedance: | 600 ohms balanced |
| Audio Input Levels: | |
| Monaural | +10 ±2 dB mW for 100% modulation |
| SCA | -10 to +15 dB mW adjustable from 0% to 10% modulation |
| Frequency Response: | Standard 75-microsecond preemphasis; others optional |
| Distortion: | Not more than 0.25% thd (total harmonic distortion) |
| | Not more than 0.25% imd (intermodulation distortion) |

1.5.3 Stereo FM With 786V-1

| | |
|---|---|
| Audio Input Impedance: | 600 ohms balanced |
| Audio Input Levels: | +10 ±2 dB mW for 100% modulation |
| Frequency Response: | Standard 75-microsecond preemphasis for both right and left channels; others optional |
| Distortion: | Not more than 0.5% thd for 50-Hz to 15-kHz audio modulation, |
| | Not more than 0.5% imd |
| Stereophonic Subcarrier and Pilot Carrier Phasing: | Phase difference between the stereophonic subcarrier and pilot carrier is within the limits required for channel separation of more than 35 dB with audio-modulating frequencies of 50 Hz to 15 kHz. |
| Stereo Channel Separation: | At least 35 dB, 50 Hz to 15 kHz |
| Crosstalk: | At least 45 dB below either single-channel level |
| 38-kHz Stereo Subcarrier Suppression: | 45 dB below 90% modulation of the main carrier |
| Pilot Carrier Frequency: | 19 kHz ±2 Hz |
| Pilot Carrier Level: | Adjustable from 0% to 12% modulation of main carrier |

1.5.4 SCA FM With 786W-1

| | |
|---|---|
| Audio Input Impedance: | 600 ohms, balanced |
| Audio Input Level: | -10 to +15 dB mW, adjustable from 0% to 10% modulation |
| SCA Subcarrier Center Frequency: | 67 kHz or 41 kHz |
| SCA Frequency Modulation of Main Carrier: | Adjustable from 0% to 30% |
| SCA Generator Center Frequency Stability: | Within ±0.5% |
| Frequency Response: | Standard 75-microsecond preemphasis |

| | |
|---|---|
| FM Noise Level: | Less than -55 dB |
| Distortion: | 1.0% for 50 Hz to 5 kHz with 3.5-kHz deviation |
| | 2.0% for 50 Hz to 5 kHz with 7.5-kHz deviation |
| Crosstalk: | Crosstalk from main channel and stereo subchannel into the sca channel shall be 50 dB below 10% modulation of the main channel. Reference: 4.0-kHz sca deviation. |

1.5.5 Composite Stereo STL With 785E-1

| | |
|---|---|
| External Baseband Input: | 3.5 V p-p into 4700 ohms when used with 785E-1 STL Interface Card |
| External Telemetry Input: | 1 V rms 20 to 30 Hz, when used with 786W-1 SCA Generator |

## 2.1 GENERAL

Remove all packing material carefully. Check equipment against shipping invoices and records. Inspect the unit for damaged or missing components. Check for free movement of front panel controls. Any claims for damage should be filed promptly with the transportation agency. If such claims are to be filed, all packing material must be retained. Store the factory shipping container for future use.

## 2.2 PREINSTALLATION

Make sure that all plug-in filters and cards are securely plugged in. Refer to Section 6, Parts List for locations.

NOTE

If the 786V-1 Stero Generator is not to be installed, filter FL1 is not required.

## 2.3 WIRING

### 2.3.1 Audio Input Connections

Use only balanced 600-ohm audio inputs to the 310Z-2. Use only twisted, shielded parts for input cables. (See figure 2-1.)

a. Monaural Inputs - Connect the monaural audio input line to TB1-1 and TB1-3. Connect the cable shield to TB1-2. (See figure 2-1.)

b. Stereophonic Inputs - Connect the left channel audio input line to TB1-1 and TB1-3. (See figure 2-1.) Connect the cable shield to TB1-2. Connect the right channel audio input line to TB1-4 and TB1-6. Connect the cable shield to TB1-5. Be sure that the 786V-1 Stero Generator is plugged into the 310Z-2.

c. SCA Inputs - Connect the SCA-1 (41-kHz) audio input to TB1-7 and TB1-9. Connect the cable shield to TB1-8. Connect the SCA-2 (67-kHz) audio input to TB1-10 and TB1-12. Connect the cable shield to TB1-11. Be sure that the 786W-1 SCA Generator is plugged into the 310Z-2. Set the 786W-1 METER switch to 3.5 kHz or 7.5 kHz, depending on the deviation to be used. Set the 786W-1 MUTE ENABLE switch to ON.

d. Composite STL Input - Connect the output of the STL receiver to B/B IN jack J2 on the rear of the exciter. This connection should be made with RG-58A/U or RG-223 coaxial cable. Check to see that the 785E-1 STL card is installed in the A3 card position and that filter FL1 is removed from its socket.

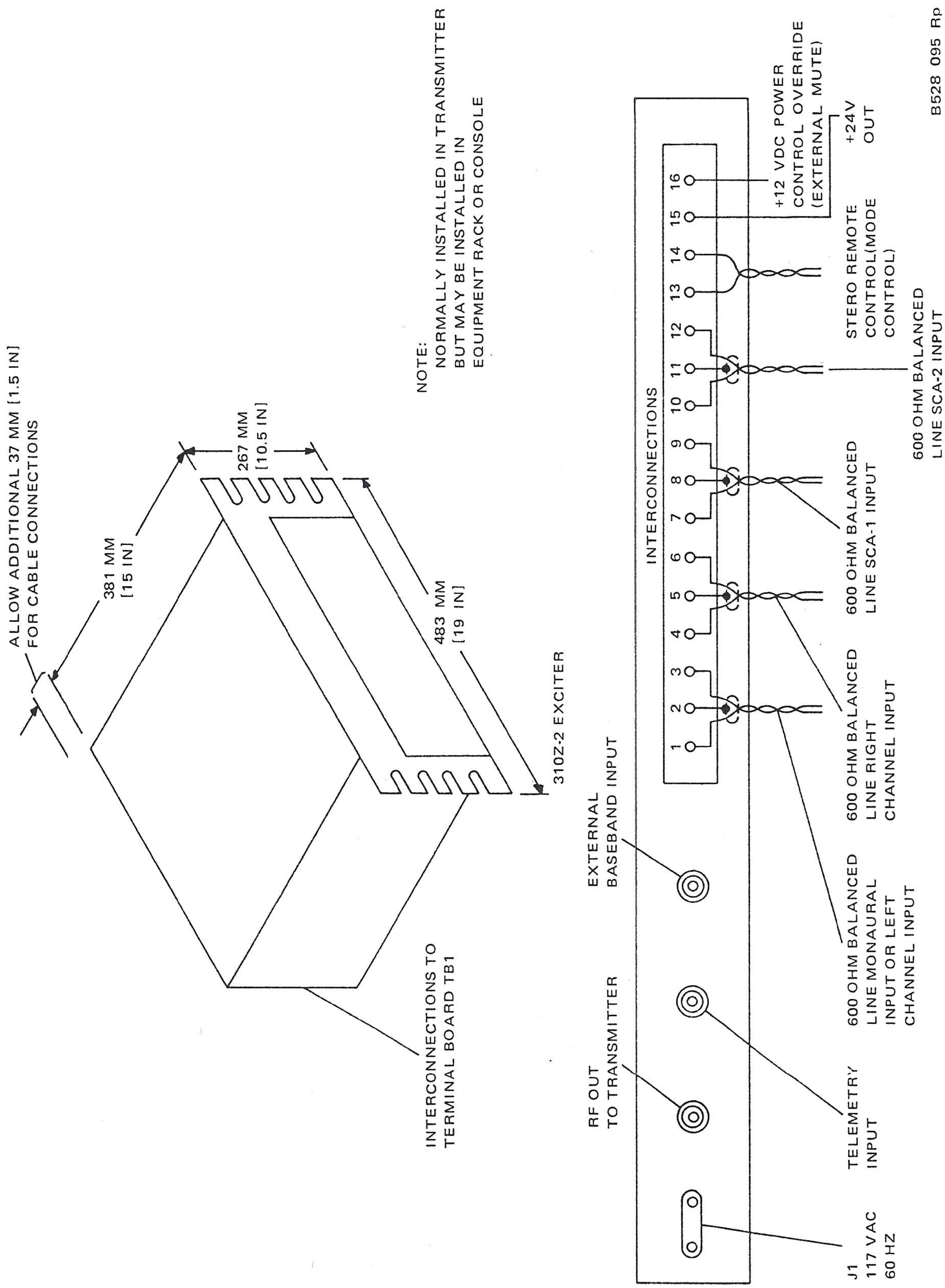



Figure 2-1. 310Z-2 FM Exciter, Outline Dimensions and Installation Details.

e. \Radio Remote Control Telemetry Input - Connect the telemetry output of the remote control unit to TELE IN jack J3 on the rear of the exciter. This connection should be made with RG-58A/U or RG-223 coaxial cable. Check to see that a 67-kHz 786V-1 SCA Generator is installed in the A2 card position.

2.3.2 Stereo Remote Control

If stereo remote control is desired, connect the leads from the station remote control system to TB1-13 and TB1-14 (ground). A normally closed contact must be provided for stereo operation.

2.3.3 RF Output

Connect a coaxial cable from the transmitter rf input to the exciter RF OUT jack, J1.

2.3.4 Input Power

Connect the ac line cord between P1 on the exciter and 117 volts ac.

CAUTION

Do not operate the 310Z-2 exciter without a load connected to the rf output, and do not operate the exciter over any extended period of time into a vswr greater than 2:1. To guard against such operation, steps should be taken during installation, as outlined in paragraph 2.3.5.

2.3.5 Power Control Override

A dc voltage source (+12 volts) should be connected to TB1-16 to protect the exciter output transistors when no plate voltage is present in the transmitter. This dc voltage is applied to the power regulator card to reduce the exciter output power to a safe level.

If the override voltage is not available directly from the transmitter with which the exciter is being used, the voltage provided at TB1-15 of the exciter may be connected through a relay so that it is applied whenever plate voltage is removed from the power amplifier stage in the transmitter.

## 2.4 INITIAL CHECKS

The 310Z-2 exciter is carefully adjusted and inspected at the factory and no special tests or adjustments are required upon installation. However, once the exciter has been installed, the transmitter should be checked to ensure that it is operating properly.

## 2.5 OUTPUT FREQUENCY CHANGE

The output frequency of the 310Z-2 is crystal controlled and can be changed to any desired frequency between 88 and 108 MHz. To change the exciter frequency, refer to paragraph 5.8.

## 3.1 GENERAL

Only the three front panel switches and the meter on the front panel of the exciter are used during normal operation. Refer to figure 3-1 for control and indicator locations and to table 3-1 for control and indicator descriptions. After the exciter has been placed in operation, it is necessary only to check meter indications (table 3-2) from time to time to ensure that the exciter is operating properly.

## 3.2 NORMAL TURN-ON PROCEDURE

a. Place POWER switch to ON.

b. Set MODE switch to LEFT, RIGHT, or STEREO, depending on the type of modulation desired.

## 3.3 ALTERNATE TURN-ON PROCEDURE

When the 310Z-2 is used in a Collins transmitter that has automatic-sequencing circuits, the POWER switch is normally left in the ON position and the exciter is turned on and off by the power-sequencing circuits of the transmitter.

## 3.4 STEREO/MONAURAL REMOTE SWITCHING

When it is desired to switch the exciter from monaural to stereo from a remote location, a stereo on/off switch is connected between pins 13 and 14 of terminal board TB1. This switch will then control relay K1 so that remote switching can be used as long as the MODE switch is in either the LEFT or RIGHT position. The STEREO position overrides the remote stereo OFF position. The selected LEFT or RIGHT line will then serve as a feed for monaural operation.

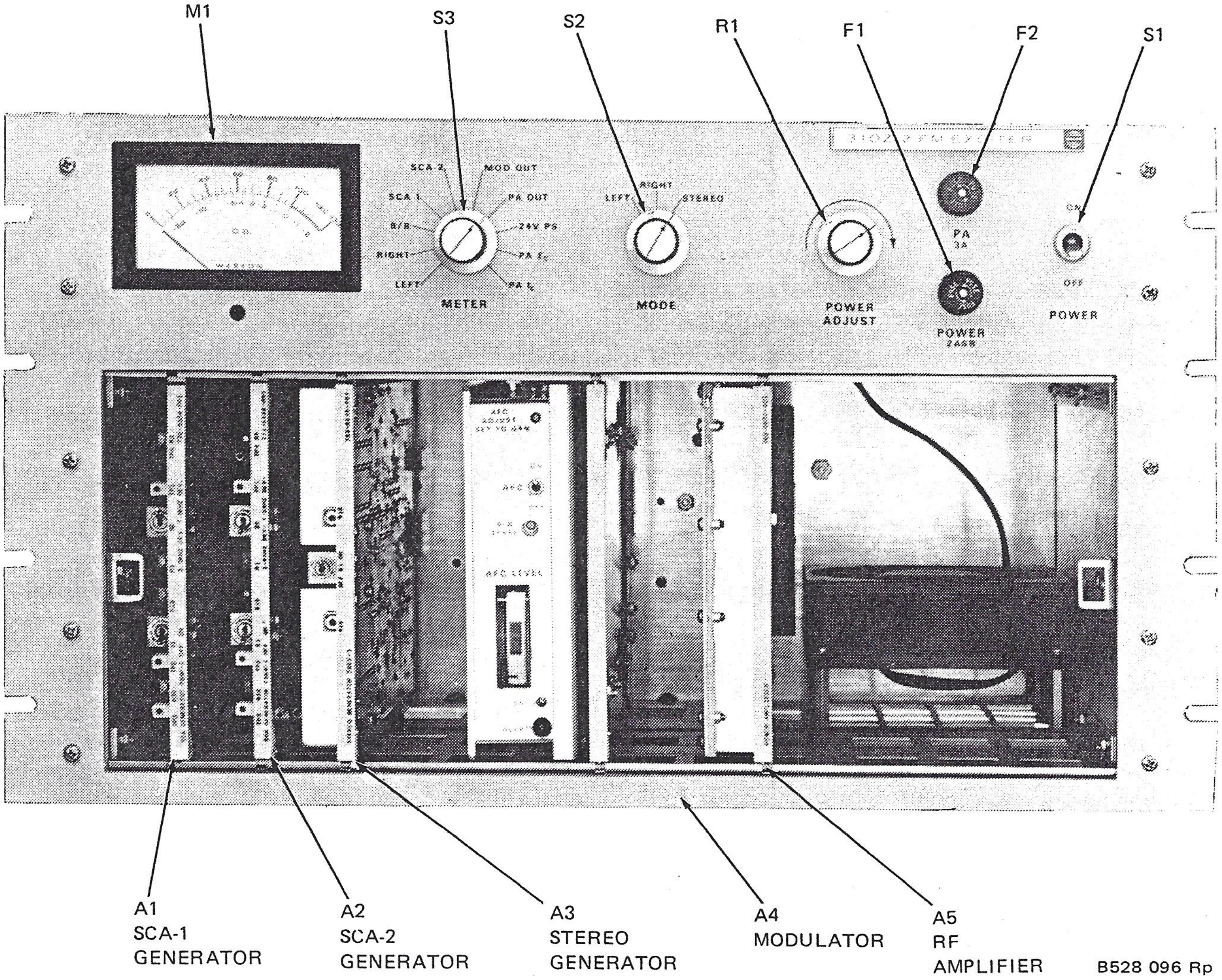



Figure 3-1. 310Z-2 FM Exciter, Front Panel Controls and Indicators.

Table 3-1. 310Z-2 FM Broadcast Exciter, Front Panel Controls and Indicators.

| REF DES | CONTROL OR INDICATOR | FUNCTION |
|---|---|---|
| S1 | POWER | Controls the application of primary power to the exciter. |
| S2 | MODE | Selects either the left audio input to be broadcast monaurally (LEFT), or the right audio input to be broadcast monaurally (RIGHT), or the left and right audio inputs to be broadcast stereophonically (STEREO). |
| S3, M1 | METER | Meter M1, in conjunction with function switch S3, permits monitoring of the various audio inputs and dc parameters from the 310Z-2 exciter. Refer to table 3-2. |
| R1 | POWER ADJUST | Adjusts power output of exciter. |

Table 3-2. Test Meter Indications

| POSITION OF METER SWITCH S3 | FUNCTION | METER INDICATION |
|---|---|---|
| LEFT | Left channel modulation | Semi-peak reading meter responds to peak audio level in manner similar to modulation monitor. |
| RIGHT | Right channel modulation | Same |
| B/B | Baseband output of stereo generator | Same |
| SCA-1 | 41-kHz sca modulation | Calibration at 100% determined by setting of S2 on 786W-1 in A1 card position. |
| SCA-2 | 67-kHz sca modulation | Same as SCA-1 except card A2 |
| MOD OUT | Modulator rf output | Relative rf output of modulator. Reads 50% to 100% as noted on individual data sheet. |

Table 3-2. Test Meter Indications (Cont).

| POSITION OF METER SWITCH S3 | FUNCTION | METER INDICATION |
|---|---|---|
| PA OUT | Power amplifier rf output | Relative rf output of power amplifier. Calibration controlled by R2 on 310Z-2 main frame. Set for 100% under normal power output and load conditions. |
| 24V PS | Output of fixed power supplies of main frame | Reads combined output of fixed 24-volt power supplies. Normally reads 85% to 115%. Reads 40% to 60% when either supply inoperative. |
| PA Ec | Power amplifier collector voltage | Reads relative collector voltage to driver and power amplifier transistors. Consult data sheet for normal readings. |
| PA Ic | Power amplifier collector current | Reads relative collector current to driver and power amplifier transistors. Consult data sheet for normal readings. |

## 4.1 GENERAL

The 310Z-2 exciter produces a frequency-modulated output for driving a power amplifier in an FM broadcast transmitter. The 310Z-2 employs the direct method of frequency modulation. The optional 786V-1 Stereo Generator produces signals that meet all FCC requirements for stereophonic broadcasting. The optional 786W-1 SCA Generator produces an FM subcarrier for broadcasting background music under an FCC Subsidiary Communications Authorization.

## 4.2 BLOCK DIAGRAM DISCUSSION

Refer to figure 4-1 (simplified block diagram), figure 7-1 (detail block diagram), and figure 7-2 (main frame schematic) during the following discussion. The major circuits of the 310Z-2 are contained on plug-in modules; and as shown on figure 4-1, these modules are the major blocks of the 310Z-2 exciter. When an exciter is used for monaural broadcasting without the optional modules, the monaural input is normally applied to the audio-processing circuits and then directly to the modulator module as the baseband signal. Since the remaining circuits operate the same for either monaural or stereophonic and sca broadcasting, the block diagram discussion covers a complete exciter with the optional modules.

The left and right audio input signals are applied through the audio frequency circuits as the modulation input to the balanced modulator of the stereo generator. These signals modulate two 38-kHz subcarrier signals that are 180° out of phase. As a result, the 38-kHz carrier is canceled so that the modulator output consists of only the two modulation frequencies and the desired modulation sidebands of the carrier frequency. One component is directly proportional to the sum of the two audio signals (L + R), and the other component is a double-sideband signal (L - R). The output from the balanced modulator is combined with the 19-kHz pilot carrier. Signal generation within the stereo generator is described in paragraph 4.3.

The output from the stereo generator is passed through a 53-kHz low-pass filter and then combined with the output from the sca generator (if used) to produce the baseband signal. The 19-kHz pilot carrier is derived in the stereo generator by routing one of the 38-kHz subcarrier signals to a divide-by-2 circuit to produce the 19-kHz pilot carrier, which is phase-locked to the 38-kHz signals. The baseband signal is then applied to the modulator.

The sca audio inputs are applied to an audio transformer in the sca generators, routed through a preemphasis network, amplified, and used to frequency-modulate the carrier frequency of the subcarrier. The audio input is also monitored by a carrier mute circuit, which removes the sca output whenever the audio input drops below the selected mute level.

## 4.3 STEREO GENERATOR A2

The 786V-1 Stereo Generator performs the conversion of stereophonic input signals to an output that conforms to the standards approved by the FCC for transmission of stereophonic signals. To provide a realistic stereo effect, the 786V-1 maintains the difference in time delay and signal amplitude from the sound source to both the right and left channel microphones through the entire stereo system. Channel separation, which is the isolation between the two channels, is held to greater than 35 dB by the 786V-1 to enhance the stereo effect to the listener. The following paragraphs discuss stereophonic signal generation and the principles of operation of the 786V-1 Stereo Generator. Refer to figure 7-4 for a schematic diagram of the 786V-1 Stereo Generator.

### 4.3.1 Signals Required

The FCC requires that stereophonic FM broadcast signals be compatible, which means that the signals may be detected by either a monophonic or stereophonic receiver. To satisfy this and other requirements of the FCC, the signals and frequencies generated must be as shown in figure 4-2. In monophonic receivers only, the L + R (left plus right) audio frequency component of the signal, called the main channel, is used. The L - R (left minus right) component of the baseband signal, called the subchannel, is a difference signal only and is composed of sidebands of a 38-kHz suppressed subcarrier. This difference component and the 19-kHz pilot carrier signal are reduced by the deemphasis network of the monophonic receiver.

In FM stereophonic receivers, all signals shown in figure 4-2 are detected and used. The L - R subchannel and L + R main channel signals are mixed, added, and subtracted to separate them into left and right audio signals. The 19-kHz pilot carrier signal is doubled in the receiver to regenerate the 38-kHz suppressed subcarrier, which is used to demodulate the stereo signal. By this means, proper phase relationship is maintained between main channel and subchannel frequencies and between the left and right audio channels.

After the L + R and L - R signals have been generated, any interaction or exchange of information between the main channel (L + R) and the subchannel (L - R) represents crosstalk, which deteriorates the signals and has the effect of adding noise. In stereo transmitting systems, crosstalk must be kept at least 40 dB below either signal-channel level.

To maintain 30-dB channel separation, as required by the FCC, for the condition of an input into one channel only, the main channel and stereo subchannel signals must have equal peak amplitude, within approximately 0.3 dB, and the envelope of the subchannel signal must cross the zero level simultaneously with the main channel signal, within approximately ±3°.

### 4.3.2 Method of Signal Generation in 786V-1 Stereo Generator

The 786V-1 generates the spectrum of signals shown in figure 4-2 by the time-division multiplex method. The basic system operating principle is shown in figure 4-3. The left and right audio channels are switched into the link (used alternately) at a 38-kHz rate. If the receiver switching rate is synchronized with the transmitter switching rate, the original left and right audio signals are detected. In the receiver the frequency of the 19-kHz 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. In the 786V-1 generator

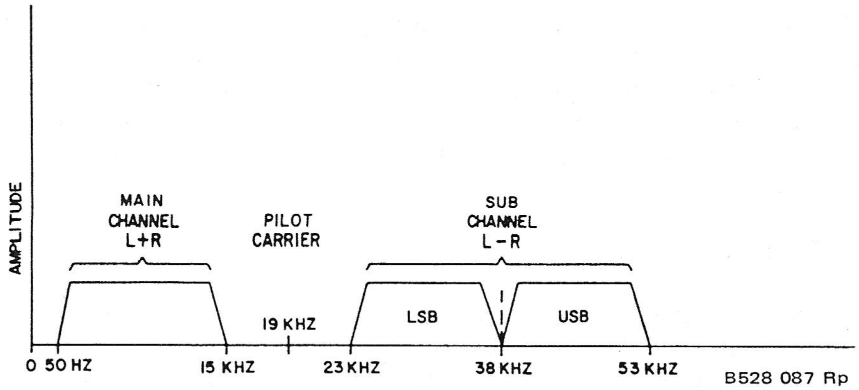



Figure 4-2. Spectrum of Signals in Stereo Baseband Audio.

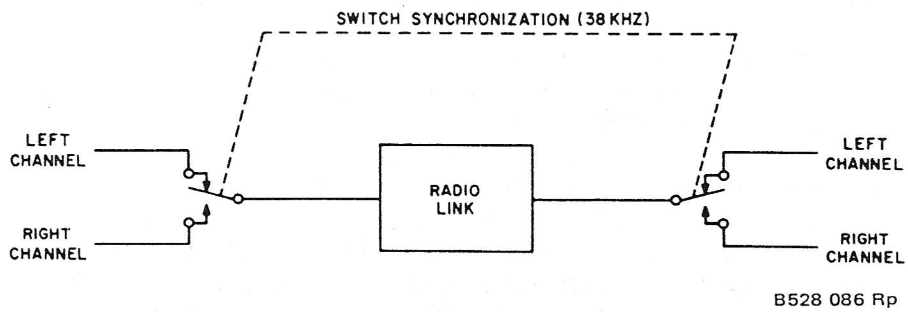



Figure 4-3. Elementary Time-Division Multiplex System.

a crystal-controlled oscillator is used to generate a 76-kHz signal. This 76-kHz signal is divided by 2 in a micrologic flip-flop circuit; and by using both the logic 1 and the logic 0 outputs of the flip-flop, two 38-kHz square waves are obtained that will be exactly 180° out of phase. One of the 38-kHz square-wave signals is used to trigger another micrologic flip-flop (A4) to obtain a phase-locked 19-kHz pilot carrier signal.

To generate the baseband stereo signals, the 786V-1 Stereo Generator utilizes the basic circuits and functions of a balanced modulator. Refer to figure 4-1, the exciter block diagram, for component relationship and signal flow; refer to figure 7-4, the stereo generator schematic, for circuit detail. Although transistors Q2 and Q5 and their associated circuits function as a balanced modulator, several additional considerations affect the overall operation of the circuits to produce the desired stereo output signal. Separate input channels couple the two different modulating audio signals, L and R (left and right), to the modulator. Emitter follower Q1 applies the right audio signal to the balanced modulator, and emitter follower Q4 couples the left audio signal to the balanced modulator. The 38-kHz subcarrier signals are applied to the balanced modulator transistor switches, Q3 and Q6. Because the two 38-kHz signals are of opposite phase, modulator transistors Q2 and Q5 are switched on and off at 38 kHz. Furthermore, when the ouputs from Q2 and Q5 are combined, the subcarrier signals cancel and the 38-kHz subcarrier does not appear in the output signal. Transistor Q2 conducts during one half-cycle of the subcarrier frequency, and during this half-cycle one excursion of the square wave is modulated by the audio signal in the right channel. During the next half-cycle of the subcarrier, Q5 conducts and the next excursion of the square wave is modulated by the audio signal in the left channel. As stated previously, the 38-kHz subcarrier signals are balanced out in the modulator, and only the two modulating audio frequencies and the desired modulation sidebands of the carrier frequency are combined in the output.

### 4.3.3 Analysis of Signals Generated

If can be demonstrated by mathematical analysis that if a square wave is modulated alternately by two audio signals, two significant components are in the resultant signal. One component is directly proportional to the sum of the two audio signals (L + R), and the other component is a double-sideband (DSB) signal centered on the switching frequency or subcarrier frequency (38 kHz). Mathematical analysis in detail is hardly within the scope of this manual. One other fact derived from such analysis is necessary, however, to an understanding of the 786V-1 operation. Because the peak amplitude of the fundamental sine-wave components of a square wave is $4/\pi$ times the peak amplitude of the square wave itself, the L - R component mentioned above is $4/\pi$ times the L + R component.

To make L + R = L - R, as required by the FCC, small portions of the L and R signals are added directly in the 786V-1, shunted around the balanced modulator through R9, R25, R16, and C13, and added to the modulator output.

Development of the FCC required signal in the 786V-1 may also be demonstrated by an analysis of the waveforms generated. Figure 4-4 represents the circuit operation when the inputs to each of the audio channels (L and R) are identical sine waves. On one half-cycle of the square-wave switching frequency (subcarrier frequency), Q5 conducts and the L signal is utilized (or sampled). On the next half-cycle, Q2 conducts and the R signal is utilized. Expressing the same action in a different way, on one half-cycle of the switching frequency an excursion of the subcarrier square wave is modulated by the left channel audio signal; and on the next half-cycle the next excursion of the subcarrier square wave is modulated by the right channel audio signal. As may be seen in figure 4-4, the 38-kHz subcarrier switching frequency is balanced out, and with equal sinewave input to both audio channels (L - R = sine wave) no sidebands are generated. The spikes shown on the composite sine wave in the third illustration of figure 4-4 are caused by imperfect switching and must be filtered out. The output of the modulator is then a sine wave identical to the original sine-wave input in either channel (L - R or [L + R]/2). Equal sine-wave input seldom occurs in an actual broadcast but is shown here for analysis.

Figure 4-5 shows the balanced modulator output when L = 1 and R = 0. The output of the balanced modulator is an audio component plus DSB components centered on the switching frequency, and odd harmonics. When the odd harmonics are filtered out by a phase-linear low-pass filter, the third waveform results. The audio component is then increased by $4/\pi$ and the fourth illustration results.

Figure 4-6 shows the time-division multiplex signal when L = -R, or L + R = 0, and L - R = 2L (or 2R). The composite waveform from the balanced modulator is shown in the third illustration. This waveform is composed of equal but opposite audio components, DSB components centered on the switching frequency, and odd harmonics. The audio components balance out; and when the odd harmonics are removed by filtering, the waveform in the fourth illustration results. This waveform is a DSB signal, which equals L - R as required.

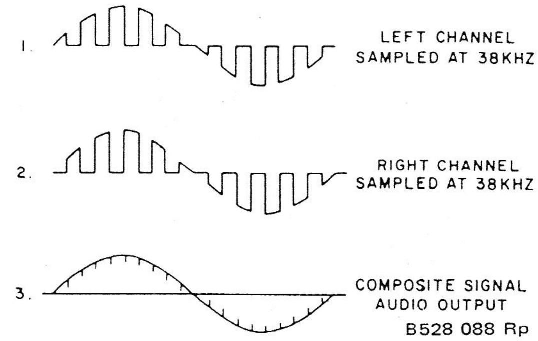



Figure 4-4. Balanced Modulator Output When L + R = 2; L - R = 0.

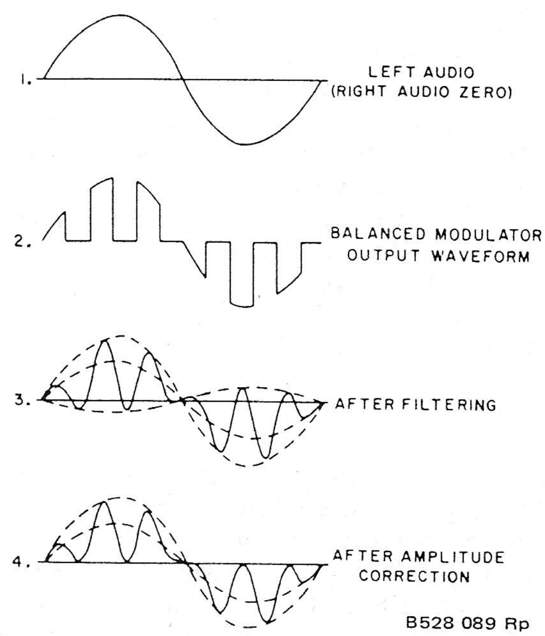



Figure 4-5. Balanced Modulator Output When L + R = 1; L - R = 1.

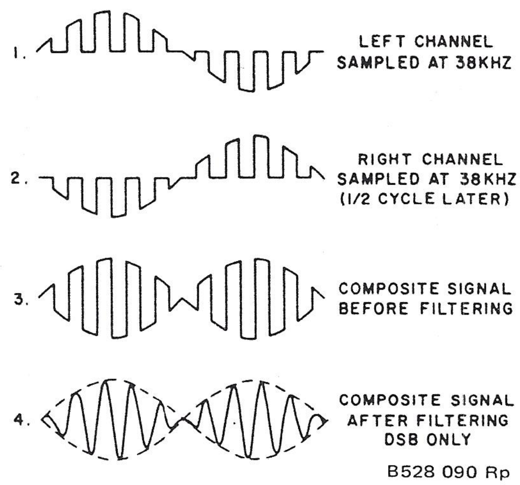



Figure 4-6. Balanced Modulator Output When L + R = 0; L - R = 2.

Perhaps the relationship of the L + R and L - R signals should be noted again here in connection with the above analysis. The L + R main channel component of the composite signal represents the sound that would be heard if only one microphone is used for input, and it is also the sound that would be heard from a microphonic receiver tuned to a stereo broadcast. The L - R component is a difference signal only. It may be a positive value, may be equal to zero, or may be a negative value (in the case where R is greater than L). When the composite signal is detected in a stereo receiver that is exactly synchronized with the transmitter, the L + R component is split and routed to both left and right audio channels in the receiver. The L - R difference signal is split also, and in effect is added to the left channel audio component and subtracted from the right. The result is (L + R)/2 + (L - R)/2 = L in the left channel, and (L + R)/2 - (L - R)/2 = R, in the right channel. In this way the receiver gives a perfect reproduction of the stereo input to the transmitter.

### 4.3.4 Circuit Analysis

Both left and right audio signals are fed through preemphasis networks in the exciter before application to the right and left audio inputs of the stereo generator, connector pins 13 and 29, (figure 7-4). Within the generator the left and right audio channels are identical. The audio signals are fed through 15-kHz low-pass filters (FL1 and FL2), which sharply attenuate frequencies above 15 kHz. From FL1, capacitor C1 couples the right audio signal to the base of emitter follower Q1 and then to the modulator at the junction of resistors R9 and R10. The right channel audio signal is divided so that the signal through R9 adds to the left channel signal and the signal through R10 modulates the 38-kHz subcarrier. A similar circuit couples the left audio signal to emitter follower Q6 and to the other side of the balanced modulator at the junction of resistors R25 and R26. The signal through R25 adds to the right channel signal (through R9) and is routed around the modulator to increase the L + R component of the modulator output. Variable resistor R16 provides a control for the amplitude of the L + R component to control channel separation.

The 38-kHz subcarrier signals for the balanced modulator are produced from the output of the 76-kHz oscillator, transistor Q7 and its associated circuits. The oscillator frequency is controlled by crystal Y1, and after amplification by amplifier Q8 the 76-kHz signal triggers a flip-flop (micrologic A1). By using both the logic 1 and the logic 0 from this flip-flop, two 38-kHz signals are obtained that are 180° apart in phase. The output signals from flip-flop A1 are first amplified by the inverters (micrologics A2 and A3) and then applied to the modulator through transistor switches Q3 and Q6. Capacitor C26 helps maintain balance between Q3 and Q6 and improves the switching operation. The 38-kHz signals combine with the right and left channel audio signals at the base of Q2 and Q5 respectively. As a result, Q2 and Q5 alternately conduct at a 38-kHz rate and produce the stereo signals, which are coupled through C12. The 38-kHz output from micrologic inverter A3 triggers micrologic flip-flop A4. With both the set side (pin 1) and the reset side (pin 3) of the flip-flop grounded, the flip-flop functions as a complementary flip-flop. Thus, the output from the logic 1 side (pin 7) is a 19-kHz signal that is phase-locked to the 38-kHz subcarrier signals. The 19-kHz pilot carrier signal is routed through the PILOT CARRIER switch (S1) to a filter network (C29, C23, L2, and C24), which removes the undesired third harmonic of 19 kHz. From the filter the signal is fed through potentiometer R49, which provides control of the pilot carrier amplitude, through capacitor C14 and a resistor network to the output of the balanced modulator.

Bypass capacitors C25 and C4 provide an ac ground for any signal through Q3 when the transistor conducts. Similar capacitors (C27 and C11) perform the same function in relation to Q6. Potentiometers R12 and R28 provide a means for adjusting the sideband suppression. Of special importance in this circuit is suppression of the 76-kHz harmonics of the 38-kHz subcarrier. The L - R double-sideband signal from the balanced modulator and the 19-kHz pilot carrier signal are combined, and capacitor C12 couples the combined signal to the multiplex output, connector pin 16. The L + R amplitude correction (from R16 through C13) adds to the signal coupled through C12, to form the composite stereo baseband signal at the multiplex output.

## 4.4 SCA GENERATOR A1/A2

### 4.4.1 General

Signals from the 786W-1 SCA Generator become part of the audio baseband signal that is used to modulate the carrier. The subcarrier oscillator is a free-running multivibrator, which generates a 67-kHz center frequency that is frequency modulated by the sca audio input signal. During normal stereo broadcast operation, modulation is limited to ±3.5-kHz deviation to avoid interference with the stereo frequencies in the baseband signal. During monophonic broadcasts, ±7.5-kHz deviation is used. The modulation output from the oscillator is filtered to remove unwanted harmonics. Refer to figure 4-1, the exciter simplified block diagram, for component relationship and signal flow; refer to figure 7-3, sca generator schematic for circuit detail.

### 4.4.2 Circuit Analysis

The sca audio input is applied to the sca generator through connector pins 17 and 19 (figure 7-3). The main signal path is through T1 to audio amplifier Q2, but a portion of the input signal is also applied through S2 to the sca audio input of the vu meter, and through the mute level control (potentiometer R1) to the carrier mute circuits.

Modulation level control R3 selects the sca audio input level, which is coupled through C1 to impedance-matching emitter follower Q1. A standard 75-microsecond preemphasis network (consisting of R7, R8, and C3) and capacitor C4 couple the input signal to audio amplifier Q2. Capacitor C30 and switch S2 couple the amplified audio signal to the modulation input of the vu meter. Switch S2 selects the correct attenuation (R46 or R47) of the modulation input signal to provide a 0-vu indication for either 3.5-kHz or 7.5-kHz frequency deviation. The audio signal used to modulate the subcarrier frequency is applied through CR1 to the subcarrier oscillator circuit. Transistors Q4 through Q7 and their associated circuits comprise the astable multivibrator circuit that generates the 67-kHz center frequency subcarrier. Deviation of the subcarrier frequency, as adjusted by modulation level R3, is within the range selected (±3.5 kHz or ±7.5 kHz). The modulated rf output from the oscillator is coupled through C10 and R3 to the base of amplifier Q8.

The carrier mute circuit is connected to the collector circuit of amplifier Q8 through MUTE ENABLE switch S1. Whenever the carrier mute circuit is being used (normally) and the audio input level drops below the level selected by MUTE LEVEL control R1, the output from the sca generator is grounded at the collector of Q8. Positive pulses that are normally applied to the base of Q12 are removed, and Q12 is turned off. As a result, C27 charges through R43 toward +20 volts; and when a potential of +10 volts is reached (in 3 seconds), diode CR9 breaks down and a positive voltage is applied to the base of Q13. Consequently, the collector of Q13 is at ground potential and this ground is applied through S1 to the collector of Q8.

Assuming that the input level is greater than the threshold level selected by MUTE LEVEL control R1, the modulated signal from the subcarrier oscillator is amplified by the direct-coupled amplifier (Q8 and Q9) and applied through CR7, R32, and R51 to the filter network. Capacitors C12 through C21 and inductors L1 through L3 comprise a 2-section band-shaping filter that removes the unwanted harmonics of the 67-kHz subcarrier. Capacitor C22 couples the filtered signal to emitter follower Q10, which provides a low output impedance to feed the SCA subcarrier signal through capacitor C23 and connector pin 43 to the input of the FM modulator card of the exciter.

## 4.5 FM MODULATOR A4

The FM modulator is a direct FM modulator operating at carrier frequency. A phase-lock automatic frequency control system controls the output frequency within very tight tolerances. Refer to figure 7-5, modulator schematic, for circuit details.

Transistor Q1 is operated class A as a Clapp oscillator with inductor L5 as the oscillator tank coil. The frequency of oscillation is determined by L5 and the net capacitive reactance formed by CR3, CR4, CR5, CR6, C4, C15, C7, C8 and C9. Elements CR3, CR4, CR5 and CR6 are voltage-variable capacitors, or varicaps, whose terminal capacitance is an inverse function of applied voltage. Varicaps CR3 and CR4 are operated with a fixed dc bias as modulators. The bias is adjustable by R5 and is set for best linearity in final test. Varicaps CR5 and CR6 are operated with two independent bias voltages chosen in a manner such that the devices cannot be forward biased. The more positive of the two voltages is controlled by AFC ADJUST control R7 and is used as a fine frequency or phase adjustment for the modulator. The lower of the two voltages is derived from the phase detector loop filter or from a fixed dc voltage for test purposes.

The modulator circuits are temperature compensated by capacitors C7, C8 and C9 to reduce drift. Isolation from the load is enhanced by a T-pad consisting of resistors R18, R19, and R20. Buffer stage Q2 is operated at approximately 500 milliwatts. The collector circuit is coupled to the load through a Pi network consisting of L8, C24, and C25. A resistive pad consisting of R26, R27, and R28 further isolates load variations from the modulator circuits. An rf sample is derived from the buffer through C22, clipped by diodes CR10 and CR11, and then coupled to U1, a high-speed ECL (emitter-coupled logic) binary divider. The output of the divider is amplified and shaped in an amplifier composed of Q3, Q4 and associated circuits and applied to complementary-MOS divider U2. Divider U1 divides the carrier frequency input by a factor of 16 while divider U2 divides its input by 1024 for a total division of 16,384.

The reference crystal is enclosed in an oven at 75° centigrade and operates at 1/64 of carrier frequency. The reference oscillator is an untuned device consisting of integrated circuit U5 and associated components. A vernier frequency adjustment is included in the form of a screwdriver adjustment, C38, accessible from the front panel. The capacitor provides sufficient adjustment range to compensate for aging of the crystal.

The output of the oscillator is divided by a factor of 128 in divider U4 and further divided by a factor of 2 in one-half of divider U3. The other half of U3 is a simple flip-flop that acts as a phase detector. The device is clocked by the divided reference frequency signal at a rate 1/256th of the crystal frequency. The flip-flop is then reset by a narrow pulse derived from the divided modulator output signal. The large division ratio of the modulator divider effectively removes the phase shift associated with the frequency modulation process. The resultant phase deviation at the output of the divider is a very small fraction of the available phase detector range at the lowest modulating frequency of interest.

The output of phase detector U3B is a rectangular phase with a duty cycle that is a function of the time difference of the input clock and reset pulses; hence, a function of the phase angle between the modulator and reference oscillator zero crossings. This pulse is amplified by transistor Q7 and filtered by a network consisting of R53, R54, C33, and C34 to reject the comparison frequency and retain the dc component of the pulse. This dc voltage is displayed on meter M1 as an aid in initial setup and maintenance. A green band is shown on the meter as a recommended operating range, and the meter is set by the AFC ADJUST control R7, a front panel adjustment.

The dynamic characteristics of the loop are established by a loop filter consisting of R15, R16, C10, and C11. The time constants are chosen for best compromise between minimum lock acquisition time and minimum disturbance of low-frequency phase response of the modulator system.

If phase-lock is lost, the input frequencies to the phase detector will be unequal and a beat note will appear at the output of the detector. This beat note is ac coupled from amplifier Q8 to a 3.5-kHz low-pass filter and further amplified by amplifier Q9. A series of constant-amplitude pulses with a repetition rate proportional to the difference frequency appear at Q9 collector. These pulses are rectified and used to turn on transistor Q5, which activates ALARM lamp CR16 and turns off transistor switch Q6. Switch Q6 applies a dc bias to the power amplifier regulator, which squelches the exciter rf output, thus preventing off-frequency operation. A charging current is applied to the AFC loop filter causing capacitor C10 to charge to a value much greater than its normal value. Four-layer diode CR18 conducts when this charge reaches a certain value and discharges C10 to a value much lower than its normal value. The charging current then slowly recharges C10 and sweeps the oscillator frequency through its normal operating frequency. When the correct frequency is reached, the loop is locked and the charging current is removed. At this time ALARM lamp CR16 is extinguished and the dc bias is removed from the pa power supply allowing normal operation to resume. This circuit allows much faster lock acquisition and more optimum loop time constants for the application to be employed.

Transistors Q10, Q11 and associated components are used to provide a "soft" turn-on and turnoff for the crystal oven heater to minimize transients in the modulator. The circuit is straight forward with Q10 operating as a current amplifier and Q11 operating as a saturated switch.

## 4.6 AUDIO/REGULATOR CARD A7

Audio preemphasis for both monaural and stereo operating modes is obtained from feedback shaping in a pair of high-gain, integrated circuit, operational amplifiers. Both channels are fed from balanced 600-ohm lines through H pads and transfomers to eliminate effects of uneven source impedances. The left channel response is determined by components R57, R58, R59, R60, C20, C21, and C22. All are fixed low tolerance components. Right channel response is determined by similar components with the addition of three vernier elements R41, R45, and R42, which allow trimming overall gain, mid-frequency and high-frequency gain, respectively to permit matching of response of both channels to a very high degree. This is done to minimize linear crosstalk in the stereo mode, which results from uneven gain and phase tracking of the left and right channels.

Variable resistor R30 provides a vernier setting of monaural gain to permit matching that mode to stereo operation.

Relay K1 is included to permit selection of stereo or monaural operation either locally or by remote control.

## 4.7 785E-1 STL INTERFACE CARD A3

The 785E-1 STL Interface Card provides an interface between commonly used composite STL systems or other operating modes such as quadraphonic operation requiring an external baseband input to the modulator. The 785E-1 provides input processing and the necessary gain and phase linearity to accommodate these systems. Refer to figure 7-7. A bridging input of approximately 4700 ohms is provided in a differential input configuration to avoid any degradation of signal-to-noise ratio through ground loops. An adjustable common mode rejection control, R4, is provided to minimize hum. A high frequency phase adjustment, C7, is provided to compensate for minor phase degradation at high frequencies due to receiver and transmitter bandwidth limitation.

Integrated circuit U1 is a low-noise wideband operational amplifier connected as a balanced differential input amplifier. A complementary symmetry power booster stage composed of transistors Q1 and Q2 raises the load impedance to a value suitable for U1. An output pad consisting of R16 and R17 reduces the output level of the amplifier to approximately 200 mV required by the modulator. Capacitor C7 provides a minor phase adjustment at the high end of the spectrum to compensate for phase errors in the system.

## 4.8 RF AMPLIFIER A5

The rf amplifier card of the 310Z-2 contains a broadband, solid-state, 3-stage rf amplifier. The FM signal from the rf mixer is amplified to provide an rf output power level of 10 to 20 watts. Refer to figure 7-6 for circuit details.

The first amplifier stage (Q1, figure 7-6) receives the FM input signal (through jack J1) and operates as a class A amplifier, using 20-volt dc power supplied through filter FL1. The second and third stages (Q2 and Q3) operate as class C amplifiers so that greater efficiency is obtained. All three amplifier stages are set for gain saturation, which is permissible with an FM input signal and provides higher efficiency. Both Q2 and Q3 use a variable 10- to 26-volt dc power input through FL2. The rf output power level of the amplifier (adjustable from 10 to 20 watts) is controlled by the level of this variable dc power, which is adjustable by the POWER ADJUST control mounted on the front panel. The rf amplifier output is coupled through J2 to J1 on the exciter main chassis.

## 4.9 POWER SUPPLIES

Three power supplies are used in the 310Z-2 exciter. Two are fixed, regulated supplies capable of supplying 24 volts at approximately 700 mA each. One is a variable supply for the rf amplifier. The variable supply supplies up to 26 volts at approximately 2 amperes. All three power supplies are derived from a common, power transformer, rectifier, and filter system. Separate regulators are utilized for each function.

Regulators U1 and U2 are each fixed 24-volt 3-terminal regulators, which supply the basic exciter requirements. Regulator U1 supplies power to the audio and meter amplifier circuits, A1 card, and A4 card. Regulator U2 supplies power to the A2 card, A3 card, and the fixed voltage requirements of the A5 card.

Power for the driver and rf amplifier stages is supplied by an adjustable regulated power supply. This supply consists of an integrated circuit regulator (U2 on the A6 card) and associated components. The regulator supplies base bias voltage for current amplifier transistor Q1, which in turn supplies series pass transistor Q2. The power supply incorporates foldback current limiting to prevent damage to components in the event of short circuits. Overvoltage protection is provided by scr Q7 on the A6 card. Zener diode VR1 sets the point at which the scr fires. This circuit prevents possible damage to the power amplifier transistors in the event of failure of the regulator circuit. When the threshold is exceeded, the scr fires placing a short circuit across the pa power supply. If there is a failure of regulator transistor Q2, then fuse F2 will blow. If the trouble is of a transient nature only, the scr will fire and cause the power supply to go into the current-limiting mode. In this case, simply turning the power supply off and then on will restore proper operation.

Two external control inputs are provided for remote power control and muting purposes. Transistor Q10 on the A6 card serves as an inverter amplifier. The alarm circuit of the modulator supplies a fixed output voltage under alarm conditions, which is coupled to the base of transistor Q10 causing it to saturate and remove the base driver to the power transistors, thus muting the rf output of the exciter.

External mute input, TB1-16, is provided for external power control or muting purposes. It is coupled to the inverting input of regulator U2 on the A6 card. Full or partial muting of the power output is possible by adjustment of the applied voltage.

## 4.10 METER AMPLIFIER

The peak voltmeter circuit is contained on audio/regulator card A7 and is used to monitor the following audio levels in the 310Z-2:

Left audio level

Right audio level

Stereo generator baseband output

SCA-1 modulation

SCA-2 modulation

The peak voltmeter circuit is an automatic slideback peak voltmeter type that determines the peak voltage of the complex waveforms monitored by the meter. A basic slideback voltmeter operates by reverse-biasing a diode to a point where the incoming signal can no longer switch on the diode. The reverse dc bias voltage is then equal to the incoming peak voltage (disregarding the intrinsic standoff voltage of the diode). The automatic slideback voltmeter operates in a similar manner by taking the signal voltage that is conducted through the reverse-biased diode, amplifying the signal, rectifying it, and applying the resultant dc as a reverse bias to the diode. The diode will conduct until the dc reverse bias from the amplifiers cuts off diode conduction.

Grounded emitter amplifier Q1 amplifies the wideband complex waveform and feeds it to emitter follower amplifier Q2. The resultant signal is applied to peak detector Q2. At the instant that the first half-cycle of the input complex waveform appears on the base of Q2, the transistor conducts, causing the base signal to appear across load resistor R14. Capacitor C7 couples the signal to peak amplifier Q4. The signal output from Q4 is fed to rectifier Q5, which rectifies the signal and charges capacitor C10 in the negative direction. Capacitor C10 averages the negative output from Q5 into a negative dc potential that appears at the base of feedback bias amplifier Q6. With this negative bias present at the base of PNP transistor Q6 the transistor conducts, increasing the voltage drop across resistor R21. This drives the emitter of Q2 in the negative direction, biasing the transistor to the point where only a small signal peak is conducted by Q2. This reduces the signal voltage across load resistor R14 when the succeeding half-cycles of the wideband input waveform arrive at the base of the peak detector transistor. Due to the gain of transistor stages Q2 and Q4, any conduction of transistor Q2 causes the voltage at the base of Q6 to be sustained at a level that permits Q2 to conduct only during a small portion of the signal peaks. The voltage at the collector of Q2 is then proportional to the peak voltage of the complex wideband waveform. In positions 1 through 5, meter switch S3 connects this voltage through dropping resistor R23 to the front panel meter.

## 5.1 GENERAL

The 310Z-2 FM Broadcast Exciter, which contains all solid-state circuits, has been carefully inspected and adjusted at the factory by skilled technicians using special test equipment. Therefore, the 310Z-2 should not be readjusted as part of routine maintenance procedures, but instead should be readjusted only after trouble has definitely been traced to misadjustment. When the 310Z-2 is readjusted, adjustments should be performed in accordance with the procedures outlined in paragraph 5.6 using the recommended test equipment listed in table 5-1.

To ensure peak performance and maximum service life, a regular schedule of routine maintenance should be carried out. For the 310Z-2 this routine maintenance should consist only of cleaning and inspecting, and should occasionally include a check of the minimum performance standards for the 310Z-2 in accordance with paragraph 5.7.

**CAUTION**

> The 310Z-2 exciter should not be operated without a load connected to the rf output, and should not be operated over any extended period of time into vswr greater than 2:1.

## 5.2 CLEANING

Clean the 310Z-2 whenever a perceptible quantity of dust accumulates at any point inside the equipment. A solvent consisting of the following mixture may be used as a cleaning material.

Methylene chloride, 25 percent

Perchlorethylene, 5 percent

Drycleaning solvent, 70 percent by volume

Use the following procedure:

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

b. Clean flat surfaces and accessible areas with a lintless cloth moistened with solvent, removing any foreign matter adhering to the equipment. Dry with a clean, dry, lintless cloth.

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

Table 5-1. Required Test Equipment.

| ITEM | MANUFACTURERS DESIGNATION |
|---|---|
| Wideband FM modulation monitor | Collins 900C-3, part no. 758-5812-001 |
| Distortion and noise meter | Hewlett-Packard 334A |
| Audio vtvm | Hewlett-Packard 400L |
| Vtvm | Hewlett-Packard 410B |
| Wattmeter | Sierra 164B with 181A/250 plug-in element |
| Stereo test circuit | Fabricated per figure 5-3 |
| Low-distortion af signal generator | Hewlett-Packard 306A |
| Oscilloscope | Tektronix 581A |
| Vertical amplifier | Tektronix type 81 |
| Crosstalk test circuit | Fabricated per figure 5-6 |
| FM frequency monitor | Collins 54N-1 |
| SCA monitor | Collins 900F-1 |

d. Use a burnishing tool on relay contacts if contacts are corroded or pitted. Apply solvent lightly to relay contacts with a small soft-bristled brush. Dry with a clean, dry, soft-bristled brush.

e. Use a dry, oil-free jet of air to remove any dust accumulated on the modules, circuit cards, in the card cage, or on components located in the area above the cage.

## 5.3 LUBRICATION

No lubrication is required.

## 5.4 INSPECTION

Perform periodic visual inspection of the 310Z-2 at least once each month. Inspect all metal parts for rust, corrosion, and general deterioration. Check circuit cards, wiring, and components for signs of overheating. Check the blower and cabinet fan for normal operation. Check all operating controls for smoothness of operation. Check all connections.

## 5.5 TEST EQUIPMENT REQUIRED

The test equipment listed in table 5-1, or its equivalent, is required to perform the adjustment and test procedures given in this section.

## 5.6 ALIGNMENT AND ADJUSTMENT

The maintenance controls for the 310Z-2 that are referenced in the following procedures are shown on figure 5-1 and their function is described in table 5-2.

**CAUTION**

Do not attempt to make any adjustment to the 310Z-2 unless trouble has been definitely traced to misadjustment and the recommended test equipment is available.

### 5.6.1 Power Supply Checks and Adjustments

a. Remove exciter from transmitter or equipment rack, remove rear cover, and connect equipment as shown in figures 5-2 and 5-3.

b. Measure voltage across C3. It should be between 22.5 and 25.5 V dc.

c. Measure voltage across C5. It should be between 22.5 and 25.5 V dc.

d. Connect vtvm across XA5-26 and place POWER switch to ON.

e. Vtvm indication should be between +10 and +26 V dc.

f. Mark position of POWER ADJUST control (R1), and then turn it fully clockwise. Vtvm should indicate +24 to +27 V dc.

g. Turn POWER ADJUST control fully counterclockwise and ensure that vtvm indicates +6 to +10 V dc.

h. Return POWER ADJUST control to its original position, place POWER switch to OFF, and remove vtvm.

i. Replace rear cover.

### 5.6.2 Modulator Tests

#### 5.6.2.1 AFC Adjustment

Check to see that meter M1 on the modulator module A4 reads in the green area. If not, adjust the AFC ADJUST potentiometer A4R7 so that meter is in the green area. If it cannot be adjusted to the green area, remove the modulator from the card cage and place it on the extender module. Remove the cover and carefully adjust A4R7 to the center of its range (five turns from end stop) then carefully adjust oscillator card A4L5 to center the meter in the green portion of the range. Check adjustment of the AFC ADJUST potentiometer to see that it has control of the meter and that the alarm light is extinguished. Reinstall the cover and replace the module in the card cage.

#### 5.6.2.2 Frequency Adjustment

Adjust FREQ ADJUST capacitor C38 for assigned frequency.

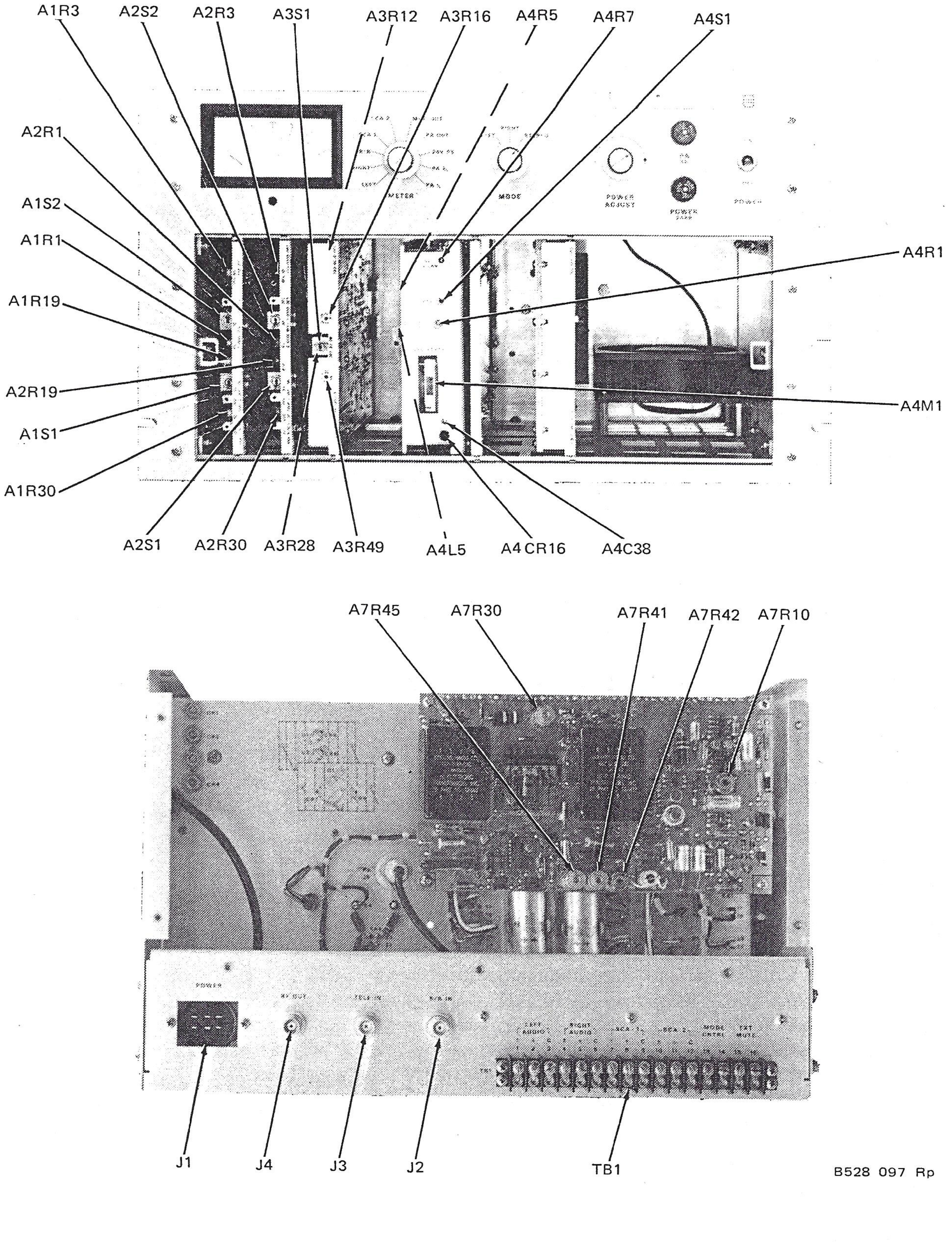



Figure 5-1. 310Z-2 FM Exciter, Maintenance Controls.

Table 5-2. Maintenance Controls.

| CONTROL | FUNCTION |
|---|---|
| 786W-1 SCA Generator Card A1/A2 | |
| R3 - modulation level | Sets the sca audio input levels to the sca modulator. |
| R1 - mute level | Sets the minimum audio level that will activate the sca subcarrier mute circuit. |
| R30 - output level | Sets the sca subcarrier output level. |
| R19 - frequency | Sets the sca subcarrier frequency. |
| S1 - mute enable | ON position enables mute circuit to remote the 67-kHz sca oscillator output when there is no sca audio input. OFF position disables mute circuit for maintenance. |
| S2 - 7.5-KHZ DEV/3.5-KHZ DEV sca deviation switch | 7.5-KHZ position causes the front panel meter to indicate 0 vu when S3 is in the corresponding SCA-( ) position and sca subcarrier deviation is 7.5 kHz.<br><br>3.5-KHZ position causes the front panel meter to indicate 0 vu when S3 is in the corresponding SCA-( ) position and sca subcarrier deviation is 3.5 kHz. |
| 786V-1 Stereo Generator Card A3 | |
| R12 - sideband suppression | Sets the switching point of Q3. |
| R28 - sideband suppression | Sets the switching point of Q6. |
| R16 - channel separation | Sets the level of the L + R signal from Q1 and Q4 applied to the multiple output to give proper levels for good stereo channel separation. |
| R49 - pilot carrier level | Sets the level of the 19-kHz pilot carrier applied to the multiplex output. |
| S1 - pilot on/off switch | Switches the 19-kHz pilot carrier to the multiplex output. |
| Modulator Card A4 | |
| R1 - B/B LEVEL | Adjusts baseband modulation sensitivity. |
| R7 - AFC ADJUST | Adjusts free-running frequency of modulator. |

Table 5-2. Maintenance Controls (Cont).

| CONTROL | FUNCTION |
|---|---|
| C38 - FREQ adjust | Sets exciter center frequency. |
| S1 - AFC ON/OFF | Disables AFC system for test purposes. |
| R5 - mod bias | Sets bias voltage on modulator diodes for best linearity. |
| L5 - oscillator frequency | Sets coarse frequency modulator. |
| CR16 - ALARM | Provides out-of-lock indication for AFC circuit. |
| M1 - AFC LEVEL meter | Displays AFC voltage. |
| Audio/Meter Regulator Card A7 | |
| R30 - monaural gain vernier | Matches monaural mode to stereo operation |
| R10 - meter amplifier adjust | Adjusts meter deflections by 10 percent |
| R41 - overall gain vernier | Allows matching of both stereo channels |
| R45 - mid-frequency gain vernier | Same. |
| R42 - high-frequency gain vernier | Same. |

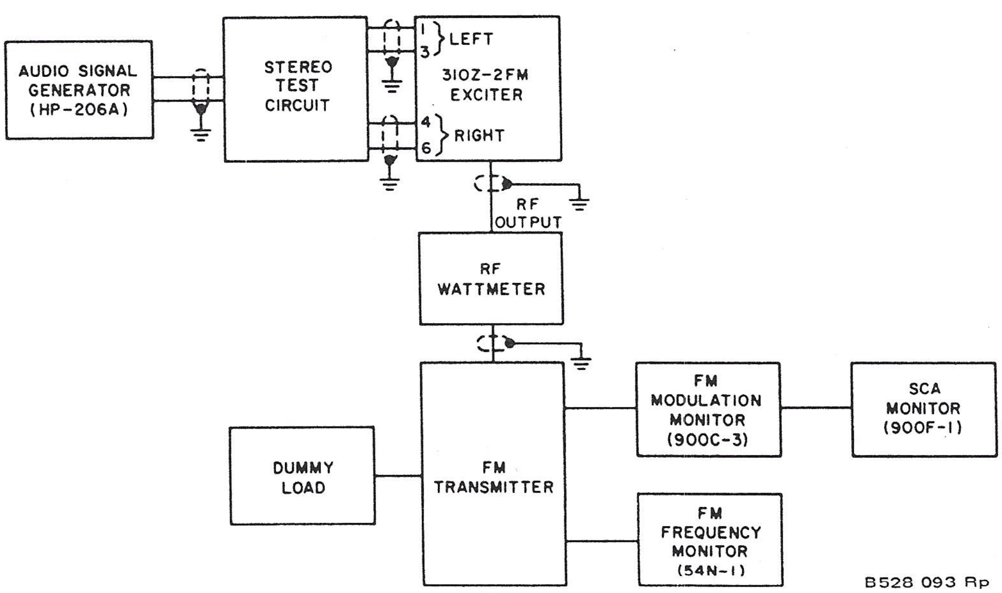



Figure 5-2. Test Equipment Connections to 310Z-2 for Adjustment and Test Procedures.

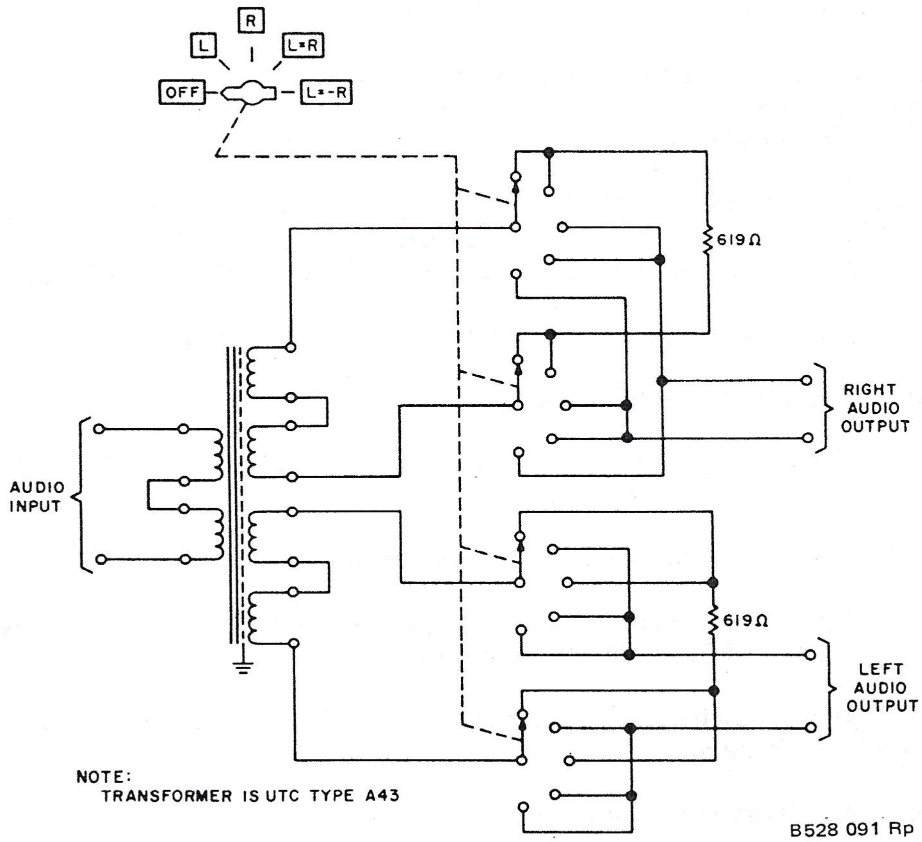



Figure 5-3. Stereo Test Circuit, Schematic Diagram.

5.6.3 Audio Adjustments - Preemphasis Tracking and Linear Crosstalk

Read and understand procedures for measurement of main and subchannel audio in modulation monitor instruction manual. Connect 310Z-2 exciter as shown in figure 5-2, and set S2 to stereo mode.

a. Set A7R41, A7R42, and A7R45 to midrange.

b. Set stereo selector to L = R and set audio oscillator for 100 percent total modulation with pilot switch off at 150 Hz.

c. Set monitor to read L = -R or subchannel audio. Adjust A7R41 for minimum reading.

d. Set audio oscillator to 1500 Hz and adjust oscillator for 100 percent total modulation. Read subchannel audio and adjust A7R45 for minimum reading.

e. Readjust audio oscillator to 15 kHz and modulation to 100 percent total. Set monitor to read subchannel audio. Adjust A7R42 for minimum reading.

f. Repeat steps b. through e. and optimize all three adjustments for best overall crosstalk.

g. Repeat steps b. through e. without readjustment of A7R41, A7R42, and A7R45 feeding L = -R and reading main channel audio.

h. Make minor readjustments to A7R41, A7R42, and A7R45 if necessary for best overall crosstalk measurements from subchannel to main channel and main channel to subchannel. They should exceed 45 dB for all frequencies from 50 Hz to 15 kHz.

i. Set up exciter in STEREO mode and feed +10 dB mW at 400 Hz into the left channel. Turn on the 19-kHz pilot and adjust it to 9 percent. Read total modulation on the modulation monitor. Adjust B/B LEVEL control A4R1 on the modulator for 100 percent.

j. Set exciter to left mono mode and adjust A7R30 for 100-percent modulation.

5.6.4 SCA Generator Output Level Adjustment

a. With equipment connected as shown in figure 5-2, set MODULATOR METER switch on FM modulation monitor to SCA MOD.

b. Place MUTE ENABLE switch (on sca generator card) to OFF.

c. Adjust OUTPUT LEVEL control R30 for 10-percent modulation as indicated on the 0- to 30-percent scale on FM modulator monitor.

d. Turn MUTE ENABLE switch to ON and note that indication on the FM modulation monitor decreases to zero.

5.6.5 SCA Generator Frequency Adjustment

a. With equipment connected as shown in figure 5-2, turn stereo test circuit switch to OFF.

b. Check the sca output frequency as indicated on the sca frequency monitor (Collins 900F-1 or equivalent).

c. Adjust A1R19 until sca frequency monitor indicates 67 kHz.

5.6.6 Stereo Generator Adjustment

a. Connect equipment as shown in figure 5-2.

b. Set MODE switch on 310Z-2 front panel to STEREO.

c. Set MODULATION METER switch on FM modulator monitor to TOTAL MOD.

d. Place 19-kHz pilot carrier switch on stereo generator card to ON.

e. Turn stereo test circuit (figure 5-3) switch to L position (left modulation only).

f. Set audio oscillator (HP206A or equivalent) to 5000 Hz and adjust the output amplitude for 100-percent total modulation on FM modulation monitor.

g. Read separation on monitor and adjust R16 on the stereo generator for best separation.

## 5.7 MINIMUM PERFORMANCE STANDARDS

The 310Z-2 should be tested in accordance with the following procedures after alignment and adjustment. In addition, the following tests should be used to determine if the 310Z-2 is operating properly. Table 5-3 lists those tests that are applicable to monaural, stereo, and SCA functions of the 310Z-2. If it is desired to test the 310Z-2 for monaural only, perform only those tests listed in table 5-3 for monaural, etc.

### 5.7.1 Output Frequency

a. Connect the equipment as shown in figure 5-2, and turn stereo test circuit switch to OFF.

b. Place POWER switch to ON and measure output frequency. Allow 10 minutes warmup.

c. If the output frequency is incorrect (should be the customer-selected frequency of 88 to 108 MHz), readjust the frequency control on the FM modulator.

### 5.7.2 Output Power

a. Connect equipment as shown in figure 5-2.

b. Adjust OUTPUT POWER control until rf wattmeter indicates desired power output.

### 5.7.3 FM Noise

a. Connect the equipment as shown in figure 5-2.

b. Turn MODE switch on 310Z-2 to LEFT.

c. Turn MODULATION METER switch on the FM modulation monitor to TOTAL MOD.

d. Turn stereo test circuit switch to L.

e. Set output of audio oscillator to 400 Hz and 100-percent modulation as indicated on the FM modulation monitor.

f. Turn DECIBELS switch on FM modulation monitor to 0 and METER switch to MAIN CHAN AUDIO.

g. Turn METER ADJUST control until 0 dB is indicated on FM modulation monitor front panel meter.

h. Remove 400-Hz monaural input signal and turn the DECIBELS switch clockwise until a reading is observed on the meter.

i. The main channel FM noise is the algebraic sum of the DECIBELS switch and the meter indication, and should be no more than -65 dB.

j. Turn METER switch to SUB CHAN AUDIO.

k. The subchannel FM noise is the algebraic sum of the DECIBELS switch setting and the meter indication, and it should be no more than -65 dB.

Table 5-3. Tests.

| MONAURAL (PARA NO.) | STEREO (PARA NO.) | SCA (PARA NO.) | TEST |
|---|---|---|---|
| 5.7.1 | 5.7.1 | 5.7.1 | Output frequency |
| 5.7.2 | 5.7.2 | 5.7.2 | Output power |
| 5.7.3 | 5.7.3 | 5.7.3 | FM noise |
| 5.7.4 | | | Frequency response (monaural) |
| 5.7.5 | | | Harmonic distortion (monaural) |
| | 5.7.6 | | Frequency response (stereo) |
| | 5.7.7 | | Harmonic distortion (stereo) |
| | 5.7.8 | | Subcarrier suppression |
| | 5.7.9 | | Channel separation |
| | 5.7.10 | | Main-to-subchannel crosstalk |
| | 5.7.11 | | Subchannel-to-main crosstalk |
| | | 5.7.12 | Sca input test |
| | | 5.7.13 | Sca noise test |
| | | 5.7.14 | Sca mute test |
| | | 5.7.15 | Sca frequency response |

5.7.4 Frequency Response (Monaural)

a. With the equipment connected as shown in figure 5-2, set the MOD switch on the 310Z-2 to LEFT and the stereo test circuit switch to L.

b. Set the audio generator (HP206A or equivalent) for a frequency of 50 Hz.

c. Adjust the output of the audio generator for 100-percent modulation as indicated on the FM modulation monitor.

d. Vary the audio generator and maintain 100-percent modulation for frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz.

e. Ensure that attenuator settings for each frequency are within the limits of the 75-microsecond preemphasis curve as defined by the FCC.

5.7.5 Harmonic Distortion (Monaural)

a. Connect the equipment as shown in figure 5-2.

b. Turn MODE switch on the 310Z-2 to the LEFT position.

c. Turn MODULATION METER switch on the FM modulation monitor (900C-3) to TOTAL MOD and the DE-EMPHASIS switch to IN.

d. Turn stereo test circuit switch to L.

e. Set the audio oscillator (HP206A) to 50 Hz, and adjust the output amplitude for 100-percent total modulation on the FM modulation monitor.

f. Turn MODULATION METER switch on FM modulation monitor to MAIN CHAN AUDIO.

g. Connect distortion meter (HP334A or equivalent) to the DISTORTION METER jack on the FM modulation monitor.

h. Ensure that the distortion meter indication is not more than 0.25 percent.

i. Repeat steps e. through h. for modulating frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz.

5.7.6 Frequency Response (Stereo)

a. With equipment connected as shown in figure 5-2, set the MODULATION switch on the 310Z-2 to STEREO and the stereo test circuit switch to LEFT.

b. Turn on 19-kHz pilot.

c. Repeat steps b. through e. of paragraph 5.7.4.

d. Place STEREO TEST CIRCUIT switch to RIGHT.

e. Repeat steps b. through e. of paragraph 5.7.4.

5.7.7 Harmonic Distortion (Stereo)

a. With equipment connected as shown in figure 5-2, place PILOT CARRIER switch to ON.

b. Turn MODE switch on 310Z-2 to STEREO.

c. Turn MODULATION METER switch on 900C-3 to TOTAL MOD, and place DE-EMPHASIS switch to OUT.

d. Set switch on stereo test circuit (figure 5-3) to L = R.

e. Set audio oscillator (HP206A) to 50 Hz, and adjust output amplitude for 100-percent total modulation on 900C-3.

f. Connect distortion meter (HP334A or equivalent) to LEFT AUDIO jack on the 900C-3.

g. Measure and record total distortion for modulating frequencies of 50, 100, 400, 1000, 5000 and 7500 Hz. Maintain modulation on 900C-3 at 100 percent for all frequencies, and distortion should be not more than 0.5 percent.

h. Connect distortion meter to RIGHT AUDIO jack on 900C-3 and repeat step g.

5.7.8 Subcarrier Suppression

a. With equipment connected as shown in figure 5-2, place PILOT CARRIER switch to OFF.

b. Ensure that there is no input to the SCA generator of the 310Z-2 exciter.

c. Turn DECIBELS switch on FM modulation monitor to 0.

d. Turn METER switch on FM modulation monitor to TOTAL MOD.

e. Adjust the audio generator for a frequency of 15,000 Hz, and adjust the amplitude for 90-percent modulation indication on the FM modulation monitor.

f. Turn METER switch on FM modulation monitor to MAIN CHAN AUDIO, and adjust METER ADJUST control until meter indicates 0 dB.

g. Turn METER switch on FM modulation monitor to SUBCAR, and rotate the DECIBELS switch in a clockwise direction until a meter indication is observed.

h. The setting of the DECIBELS switch indicates the subcarrier suppression; it should be at least -45 dB.

5.7.9 Channel Separation

It is recommended that the channel separation test be performed using the Collins 900C-3 FM Modulation Monitor.

a. Connect equipment as shown in figure 5-2.

b. Turn MODULATION switch on front panel of 310Z-2 to STEREO.

c. Turn MODULATION METER switch on FM modulation monitor (900C-3) to TOTAL MOD.

d. Place 19-kHz PILOT CARRIER switch A2A1 to ON.

e. Turn stereo test circuit switch to L.

f. Set audio generator (HP206A) to 5000 Hz, and adjust output amplitude for 100-percent total modulation on FM modulation monitor.

g. Set METER switch on front panel of FM modulation monitor to LEFT AUDIO.

h. Set DECIBELS switch on front panel of FM modulation monitor to 0, and turn METER ADJUST control until an indication of 0 dB is obtained on the front panel meter.

i. Switch from left channel modulation to right channel modulation, and turn DECIBELS switch in a clockwise direction until an indication is observed on the front panel meter.

j. Adjust A3R16 for best channel separation indicated on meter. The channel separation is the algebraic sum of the DECIBELS switch setting and the meter indication.

k. Repeat steps f. through j. for frequencies of 50, 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz, except do not readjust A3R16.

l. To obtain channel separation measurements with audio applied to the right channel and measurements taken in the left channel, repeat steps e. through i. and substitute left for right and right for left where these instructions are indicated, but do not readjust A3R16.

5.7.10 Main Channel to Subchannel Nonlinear Crosstalk

a. Connect the equipment as shown in figure 5-4. The crosstalk test circuit shown on figure 5-5 must be fabricated for this test.

b. Set the crosstalk test circuit switch to MAIN and the FREQ RANGE SELECT switch to 50/400.

c. Turn the MODULATION switch on the 310Z-2 to STEREO.

d. Adust the audio generator (HP206A or equivalent) to a frequency of 50 Hz, and adjust the output level for 90-percent main channel modulation as indicated on the FM modulation monitor.

e. On the FM modulation monitor, place the METER switch to MAIN CHAN AUDIO, turn the DECIBELS switch to 0, and turn the METER ADJUST control until 0 dB is indicated on the meter.

f. Turn METER switch to SUB CHAN AUDIO, and turn DECIBELS switch clockwise until an indication on the front panel meter of the FM modulation monitor is observed.

g. Turn adjustments on crosstalk test circuit until a null is observed on the FM modulation monitor meter.

NOTE

These adjustments are critical and require special attention to achieve the proper null.

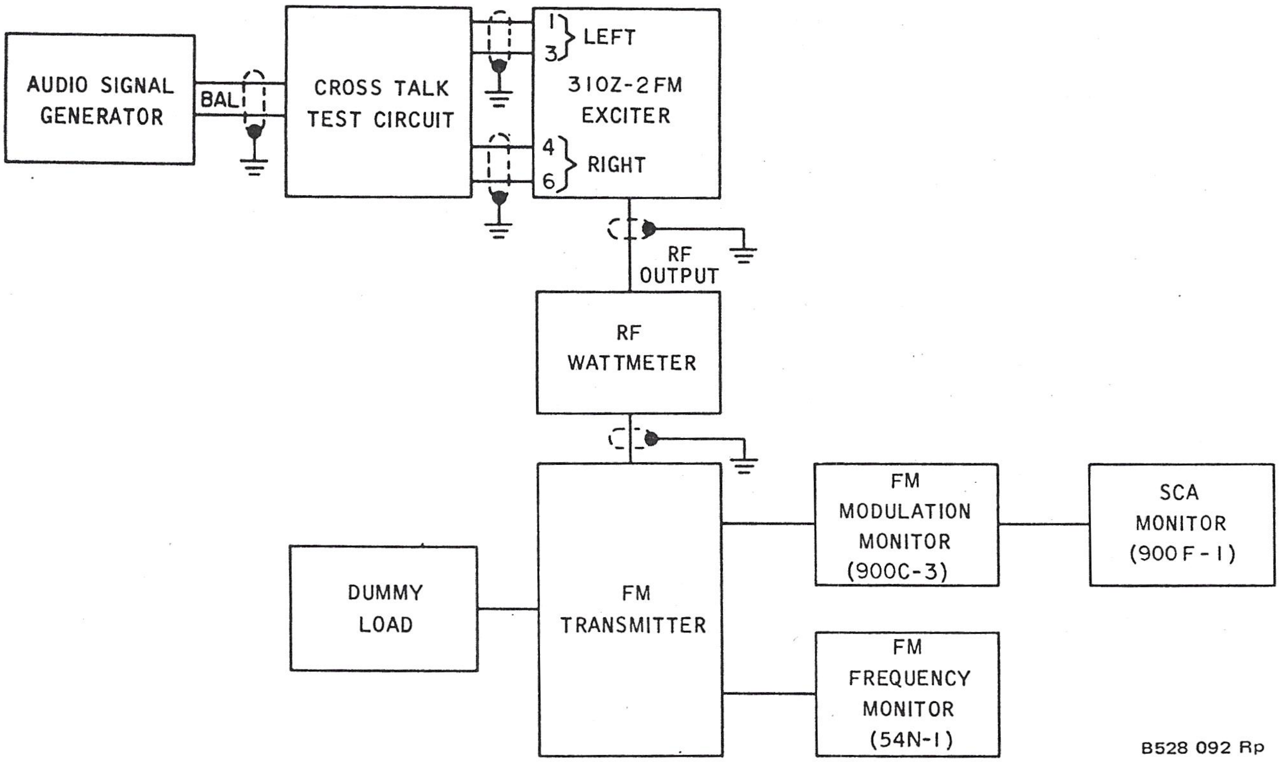



Figure 5-4. Test Equipment Connections to 310Z-2 for Crosstalk Test.

h. Crosstalk is the algebraic sum of the DECIBELS switch setting and the meter indication. The main channel into subchannel crosstalk should be not more than -50 dB from 50 to 15,000 Hz.

i. Repeat the above procedure for frequencies of 100, 400, 1000, 5000, 7500, 10,000 and 15,000 Hz. Ensure that the proper frequency range is selected by the FREQ RANGE SELECT switch of the crosstalk test circuit.

5.7.11 Subchannel to Main Channel Nonlinear Crosstalk

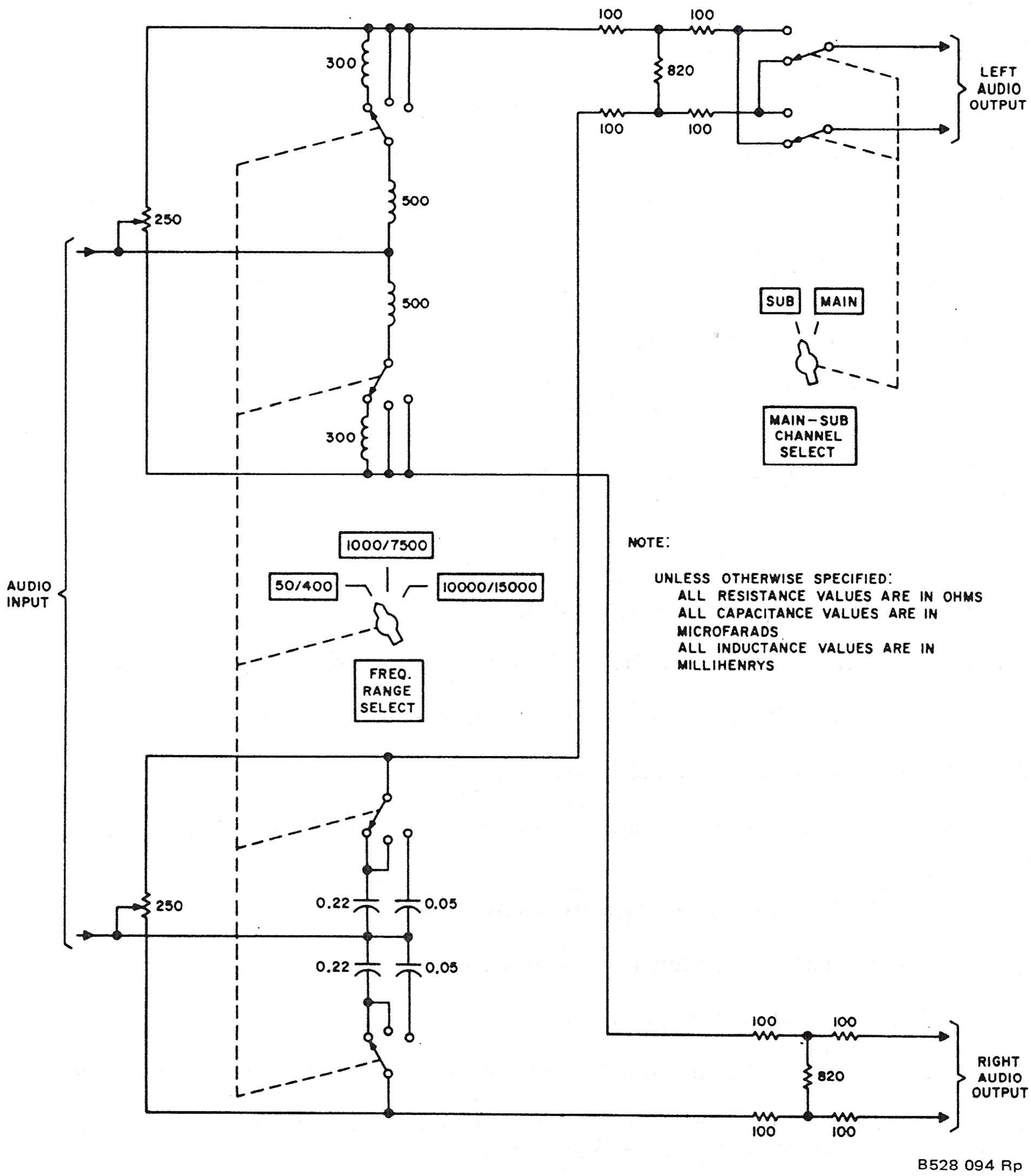
a. With the test equipment connected as shown in figure 5-4, set the crosstalk test circuit switch to SUB and the FREQ RANGE SELECT switch to 50/400.

b. Adjust the audio generator (HP206A or equivalent) to a frequency of 50 Hz, and adjust the output level for 90-percent subchannel modulation as indicated on the FM modulation monitor.

c. Turn METER switch to MAIN CHAN AUDIO, and turn DECIBELS switch clockwise until an indication is observed.

5.7.12 SCA Input Test

a. With the equipment connected as shown in figure 5-2, place the MODULATION METER switch on the FM modulation monitor to SCA MOD.




NOTE:

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

Figure 5-5. Nonlinear Crosstalk Test Circuit, Schematic Diagram.

b. Place MUTE ENABLE switch (on sca generator card) to OFF.

c. Place POWER switch to ON, and adjust SCA OUTPUT LEVEL control A1R30 for an indication of 10-percent modulation on the 0- to 30-percent scale on the meter of the FM modulation monitor.

5.7.13 SCA Noise Test

a. With equipment connected as in figure 5-2, place MUTE DISABLE switch to OFF.

b. Connect audio generator (HP206A) to sca input terminals of exciter.

c. Set the audio generator for a frequency of 400 Hz and an output level of +10 dB mW.

d. Connect ac voltmeter (HP403B) across the audio output (TB1-1 and TB1-2) of the sca modulation monitor (900F-1).

e. Record the 400-Hz reference signal level as indicated on the ac voltmeter.

f. Remove the sca input signal from the 310Z-2 exciter, and increase the sensitivity of the ac voltmeter until a reading is indicated.

g. The difference between the levels recorded in steps e. and f. should be not less than 55 dB.

5.7.14 SCA Mute Circuit Test

a. Connect equipment as shown in figure 5-2.

b. Connect audio signal generator (HP206A) to terminals TB1-10 and TB1-12.

c. Place PILOT CARRIER switch on stereo generator card to OFF.

d. Turn stereo test circuit switch to OFF.

e. Adjust audio signal generator connected to terminals TB1-10 and TB1-12 for 400 Hz at 6 dB mW.

f. Turn MUTE LEVEL control A1R1 fully counterclockwise.

g. Observe the sca subcarrier level on the sca monitor.

h. Place MUTE ENABLE switch to ON.

i. After a few seconds, note that the sca subcarrier level is still indicated on sca monitor.

j. Remove input to sca generator card, and observe that sca subcarrier indicated on sca monitor is (decreased to zero) within 3 to 4 seconds.

k. Adjust audio signal generator for 400 Hz at 6-dB mW input to exciter.

l. Adjust attenuator on signal generator to reduce input level 30 dB.

m. Observe the sca subcarrier on sca monitor, and ensure that is still present after 3 to 4 seconds indicating that mute circuit did not cut off carrier.

n. Remove audio signal generator.

5.7.15 SCA Frequency Response

a. With equipment connected as in figure 5-2, place the pilot carrier switch on stereo generator card to OFF.

b. Connect audio generator (HP206A) to sca input terminals TB1-7 and TB1-9 (21 kHz) or TB1-10 and TB1-12 (67 kHz) of exciter.

c. Turn stereo test circuit switch to OFF.

d. Turn METER switch on sca modulation monitor (900F-1) to sca modulation monaural mode.

e. Set audio generator frequency to 50 Hz, and adjust output amplitude for 3.5-kHz deviation on the sca modulation monitor.

f. While maintaining 3.5-kHz deviation, vary the audio generator frequency to 100, 400, 1000, and 5000 Hz. The audio generator attenuator settings for each frequency should follow the 75-microsecond preemphasis curve as specified by the FCC.

5.8 FREQUENCY CHANGE

If it is desired to change the output frequency of the 310Z-2, crystal A4Y1 located in the oven on the modulator card must be changed. Table 5-4 lists the channel frequency versus crystal frequency and the Collins part number for each crystal.

Table 5-4. Crystal Part Number.

| CHANNEL FREQ (MHz) | CRYSTAL FREQ (kHz) | COLLINS PART NUMBER | CHANNEL FREQ (MHz) | CRYSTAL FREQ (kHz) | COLLINS PART NUMBER |
|---|---|---|---|---|---|
| 88.1 | 1376.5625 | 289-7246-010 | 96.1 | 1501.5625 | 289-7246-410 |
| 88.3 | 1379.6875 | 289-7246-020 | 96.3 | 1504.6875 | 289-7246-420 |
| 88.5 | 1382.8125 | 289-7246-030 | 96.5 | 1507.8125 | 289-7246-430 |
| 88.7 | 1385.9375 | 289-7246-040 | 96.7 | 1510.9375 | 289-7246-440 |
| 88.9 | 1389.0625 | 289-7246-050 | 96.9 | 1514.0625 | 289-7246-450 |
| 89.1 | 1392.1875 | 289-7246-060 | 97.1 | 1517.1875 | 289-7246-460 |
| 89.3 | 1395.3125 | 289-7246-070 | 97.3 | 1520.3125 | 289-7246-470 |
| 89.5 | 1398.4375 | 289-7246-080 | 97.5 | 1523.4375 | 289-7246-480 |
| 89.7 | 1401.5625 | 289-7246-090 | 97.7 | 1526.5625 | 289-7246-490 |
| 89.9 | 1404.6875 | 289-7246-100 | 97.9 | 1529.6875 | 289-7246-500 |
| 90.1 | 1407.8125 | 289-7246-110 | 98.1 | 1532.8125 | 289-7246-510 |
| 90.3 | 1410.9375 | 289-7246-120 | 98.3 | 1535.9375 | 289-7246-520 |
| 90.5 | 1414.0625 | 289-7246-130 | 98.5 | 1539.0625 | 289-7246-530 |
| 90.7 | 1417.1875 | 289-7246-140 | 98.7 | 1542.1875 | 289-7246-540 |
| 90.9 | 1420.3125 | 289-7246-150 | 98.9 | 1545.3125 | 289-7246-550 |
| 91.1 | 1423.4375 | 289-7246-160 | 99.1 | 1548.4375 | 289-7246-560 |
| 91.3 | 1426.5625 | 289-7246-170 | 99.3 | 1551.5625 | 289-7246-570 |
| 91.5 | 1429.6825 | 289-7246-180 | 99.5 | 1554.6875 | 289-7246-580 |
| 91.7 | 1432.8125 | 289-7246-190 | 99.7 | 1557.8125 | 289-7246-590 |
| 91.9 | 1435.9375 | 289-7246-200 | 99.9 | 1560.9375 | 289-7246-600 |
| 92.1 | 1439.0625 | 289-7246-210 | 100.1 | 1564.0625 | 289-7246-610 |
| 92.3 | 1442.1825 | 289-7246-220 | 100.3 | 1567.1875 | 289-7246-620 |
| 92.5 | 1445.3125 | 289-7246-230 | 100.5 | 1570.3125 | 289-7246-630 |
| 92.7 | 1448.4375 | 289-7246-240 | 100.7 | 1573.4375 | 289-7246-640 |
| 92.9 | 1451.5625 | 289-7246-250 | 100.9 | 1576.5625 | 289-7246-650 |
| 93.1 | 1454.6875 | 289-7246-260 | 101.1 | 1579.6875 | 289-7246-660 |
| 93.3 | 1457.8125 | 289-7246-270 | 101.3 | 1582.8125 | 289-7246-670 |
| 93.5 | 1460.9375 | 289-7246-280 | 101.5 | 1585.9375 | 289-7246-680 |
| 93.7 | 1464.0625 | 289-7246-290 | 101.7 | 1589-0625 | 289-7246-690 |
| 93.9 | 1467.1875 | 289-7246-300 | 101.9 | 1592.1875 | 289-7246-700 |
| 94.1 | 1470.3125 | 289-7246-310 | 102.1 | 1595.3125 | 289-7246-710 |
| 94.3 | 1473.4375 | 289-7246-320 | 102.3 | 1598.4375 | 289-7246-720 |
| 94.5 | 1476.5625 | 289-7246-330 | 102.5 | 1601.5625 | 289-7246-730 |
| 94.7 | 1479.6875 | 289-7246-340 | 102.7 | 1604.6875 | 289-7246-740 |
| 94.9 | 1482.8125 | 289-7246-350 | 102.9 | 1607.8125 | 289-7246-750 |
| 95.1 | 1485.9375 | 289-7246-360 | 103.1 | 1610.9375 | 289-7246-760 |
| 95.3 | 1489.0625 | 289-7246-370 | 103.3 | 1614.0625 | 289-7246-770 |
| 95.5 | 1492.1875 | 289-7246-380 | 103.5 | 1617.1875 | 289-7246-780 |
| 95.7 | 1495.3125 | 289-7246-390 | 103.7 | 1620.3125 | 289-7246-790 |
| 95.9 | 1498.4375 | 289-7246-400 | 103.9 | 1623.4375 | 289-7246-800 |

Table 5-4. Crystal Part Number (Cont).

| CHANNEL FREQ (MHz) | CRYSTAL FREQ (kHz) | COLLINS PART NUMBER | CHANNEL FREQ (MHz) | CRYSTAL FREQ (kHz) | COLLINS PART NUMBER |
|---|---|---|---|---|---|
| 104.1 | 1626.5625 | 289-7246-810 | 106.1 | 1657.8125 | 289-7246-910 |
| 104.3 | 1629.6875 | 289-7246-820 | 106.3 | 1660.9375 | 289-7246-920 |
| 104.5 | 1632.8125 | 289-7246-830 | 106.5 | 1664.0625 | 289-7246-930 |
| 104.7 | 1635.9375 | 289-7246-840 | 106.7 | 1667.1875 | 289-7246-940 |
| 104.9 | 1639.0625 | 289-7246-850 | 106.9 | 1670.3125 | 289-7246-950 |
| 105.1 | 1642.1875 | 289-7246-860 | 107.1 | 1673.4375 | 289-7246-960 |
| 105.3 | 1645.3125 | 289-7246-870 | 107.3 | 1676.5625 | 289-7246-970 |
| 105.5 | 1648.4375 | 289-7246-880 | 107.5 | 1679.6875 | 289-7246-980 |
| 105.5 | 1651.5625 | 289-7246-890 | 107.7 | 1682.8125 | 289-7246-990 |
| 105.9 | 1654.6875 | 289-7246-900 | 107.9 | 1685.9375 | 289-7247-010 |

## 6.1 GENERAL

This section provides parts lists and parts locations for all electrical components of the 310Z-2 FM Exciter. Figures 6-1 through 6-3 provide general views of the 310Z-2 FM Exciter with various access panels removed. The remaining figures with their corresponding parts lists identify all electrical components. These figures and parts lists are in order according to assembly reference designation.

## 6.2 ORDERING REPLACEMENT PARTS

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

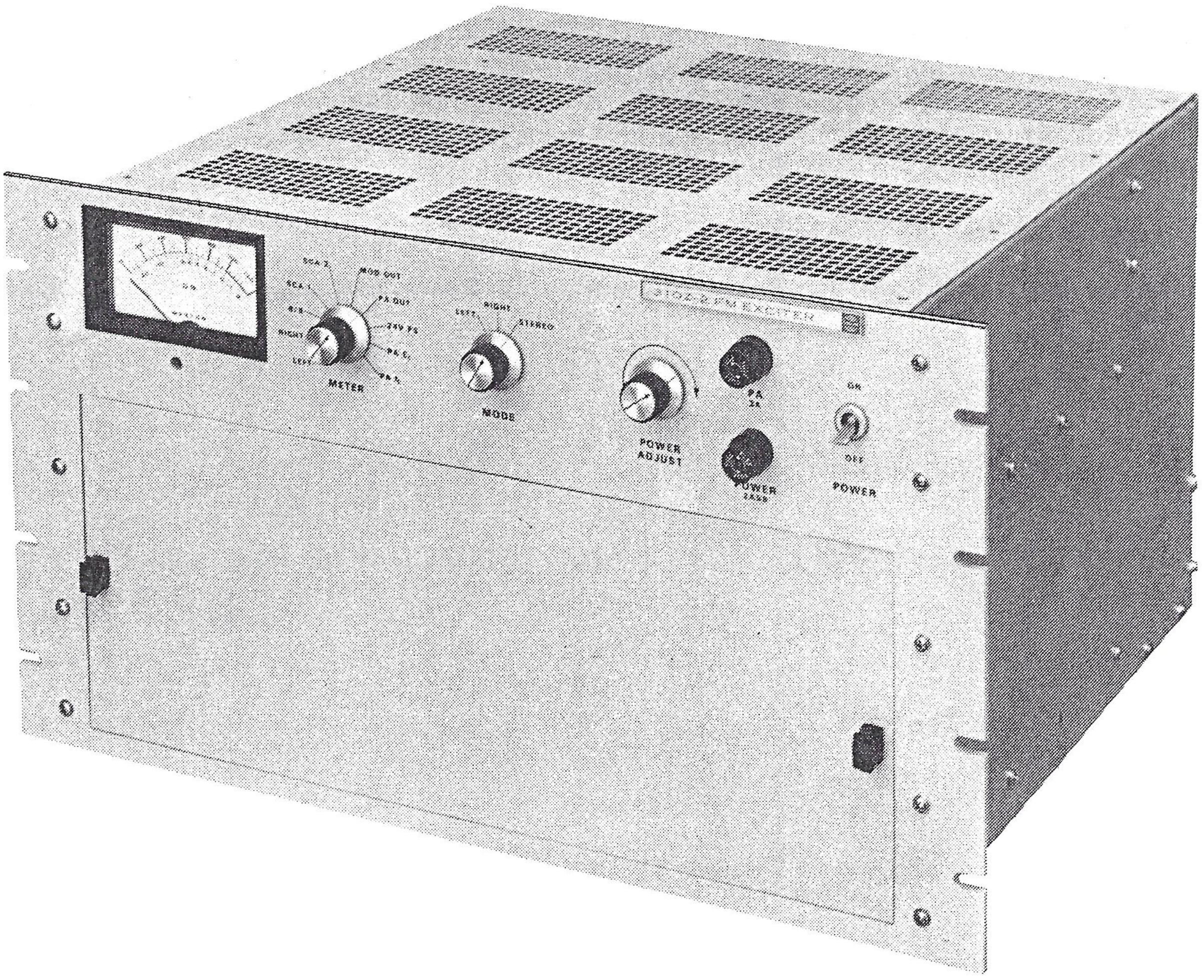



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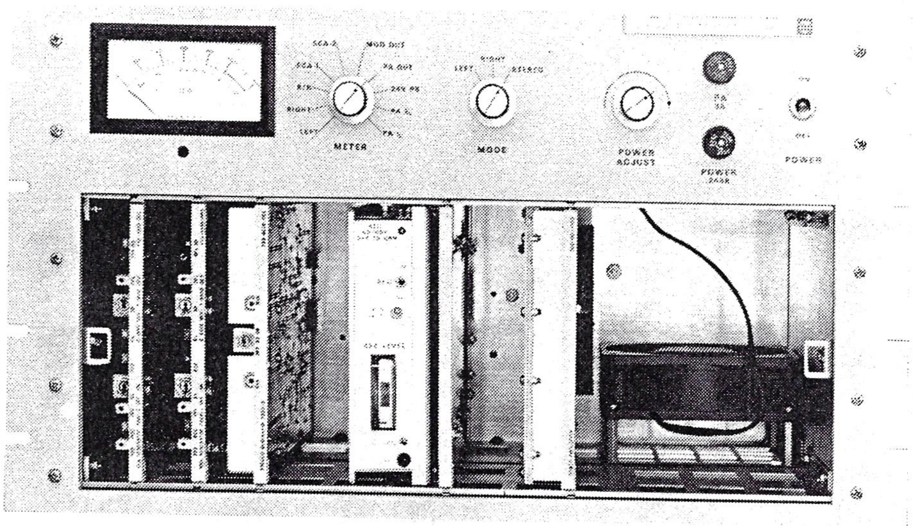
Figure 6-1. 310Z-2 FM Exciter (Sheet 1 of 3).



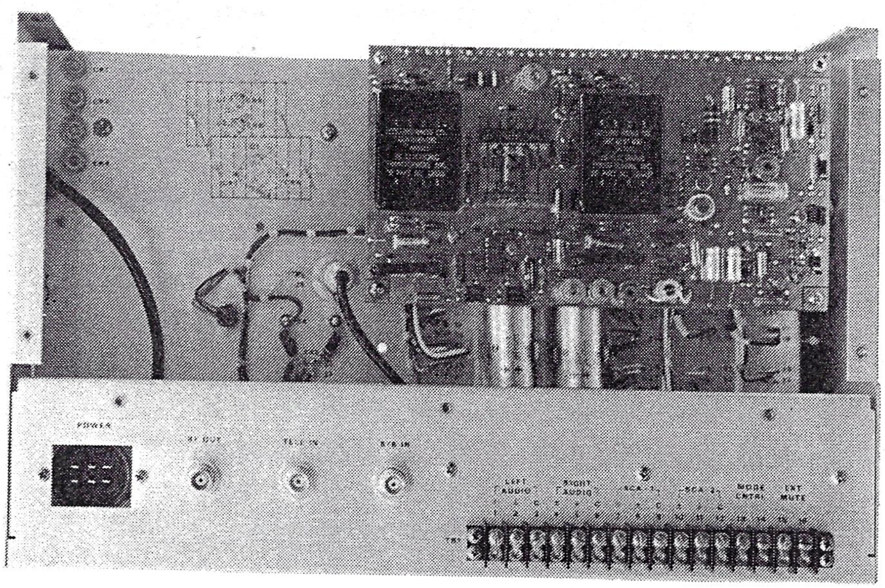




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Figure 6-2. 310Z-2 FM Exciter (Sheet 2 of 3).

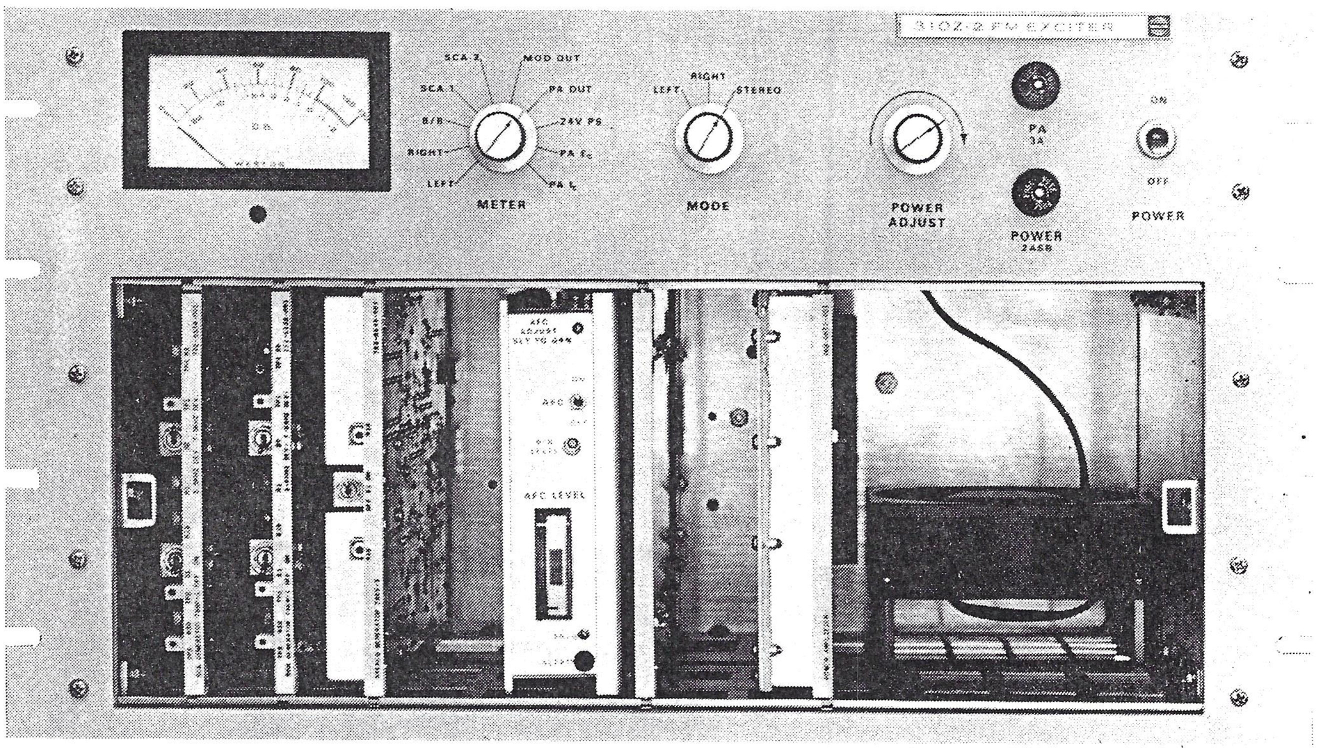


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Figure 6-3. 310Z-2 FM Exciter (Sheet 3 of 3).

| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| | 310Z-2 FM EXCITER | | | 622-2184-001 |
| | EXTENDER BOARD | | | 781-5365-001 |
| A1 | SCA GENERATOR 786W-1 | | | 772-5338-001 |
| A2 | SCA GENERATOR 786W-1 | | | 772 5338-001 |
| A3 | STL INTERFACE 785E-1 | | | 622-2374-001 |
| A3 | STEREO GENERATOR 786V-1 | | | 783-6648-001 |
| A4 | MODULATOR/EXCITER | | | 627-6695-001 |
| A5 | POWER AMPLIFIER | | | 769-0830-001 |
| A6 | AUDIO/MTR REGULATOR | | | 627-9773-001 |
| B1 | BLOWER | | | 009-1829-030 |
| C1 | CAPACITOR | 3900UF | 50 V | 183-1278-370 |
| C2 | CAPACITOR | 3900UF | 50 V | 183 1278-370 |
| C3 | CAPACITOR | 1000PF | 500 V | 913-1292-000 |
| C4 | CAPACITOR | 1000UF | 50 V | 183-1282-140 |
| C5 | CAPACITOR | 1000UF | 50 V | 183 1282-140 |
| C6 | CAPACITOR | 1000UF | 50 V | 183-1282-140 |
| C7 | CAPACITOR | 1000PF | 500 V | 913-1292-000 |
| C8 | CAPACITOR | 1000PF | 500 V | 913 1292-000 |
| C9 | CAPACITOR | 1000PF | 500 V | 913-1292-000 |
| C10 | CAPACITOR | 1000PF | 500 V | 913 1292-000 |
| C11 | CAPACITOR | 1000PF | 500 V | 913-1292-000 |
| C12 | CAPACITOR | 1000PF | 500 V | 913 1292-000 |
| C13 | CAPACITOR | 1000PF | 500 V | 913-1292-000 |
| C14 | CAPACITOR | 1000PF | 500 V | 913 1292-000 |
| C15 | CAPACITOR | 1000PF | 500 V | 913-1292-000 |
| C16 | CAPACITOR | 1000PF | 500 V | 913 1292-000 |
| C17 | CAPACITOR | 1000PF | 500 V | 913-1292-000 |
| C18 | CAPACITOR | 0.1UF | 200 V | 913-3681-000 |
| C19 | CAPACITOR | 0.1UF | 200 V | 913 3681-000 |
| C20 | CAPACITOR | 0.1UF | 200 V | 913-3681-000 |
| C21 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| CR1 | DIODE | 1N1202 | | 353-1889-000 |
| CR2 | DIODE | 1N1202 | | 353 1889-000 |
| CR3 | DIODE | 1N1202 | | 353-1889-000 |
| CR4 | DIODE | 1N1202 | | 353 1889-000 |
| CR5 | DIODE | 1N4003 | | 353-6442-030 |
| CR6 | DIODE | 1N4003 | | 353 6442-030 |
| CR7 | DIODE | 1N4003 | | 353-6442-030 |
| CR8 | DIODE | 1N4003 | | 353 6442-030 |
| E1 | TERMINAL | | | 547-5305-002 |
| E2 | TERMINAL | | | 304-2800-000 |
| E3 | TERMINAL | | | 304 2800-000 |
| E4 | TERMINAL | | | 304-2800-000 |
| E5 | TERMINAL | | | 304 2800-000 |
| E6 | TERMINAL | | | 304-2800-000 |
| E7 | TERMINAL | | | 304 2800-000 |
| E8 | TERMINAL | | | 304-0116-000 |
| E9 | TERMINAL | | | 304 0116-000 |
| E10 | TERMINAL | | | 304-1089-000 |
| E11 | TERMINAL | | | 304-0116-000 |
| E12 | TERMINAL | | | 304 0116-000 |
| F1 | FUSE | 2ASB | | 264-0297-000 |
| F2 | FUSE | 3A | | 264-0928-050 |
| FL1 | FILTER, LP | | | 673-1162-020 |
| HT1 | HEATSINK | | | 015-3612-010 |
| HT2 | HEATSINK | | | 015-3612-020 |
| J1 | CONNECTOR | | | 365-0034-000 |
| J2 | BNC CONNECTOR | | | 357-9248-010 |
| J3 | BNC CONNECTOR | | | 357 9248-010 |
| J4 | BNC CONNECTOR | | | 357-9248-010 |
| J5 | CONNECTOR | | | 357-7109-000 |
| J6 | CONNECTOR | | | 357 7109-000 |
| J7 | CONNECTOR | | | 357-7109-000 |
| P2 | TNC CONNECTOR | | | 357-9666-000 |
| P3 | TNC CONNECTOR | | | 357 9666-000 |
| P4 | TNC CONNECTOR | | | 357-9666-000 |
| Q1 | TRANSISTOR | 2N3054 | | 352-0581-010 |

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| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| Q2 | TRANSISTOR | 2N3055 | | 352-0583-010 |
| R1 | RESISTOR, VARIABLE | 5 K | | 376-2487-000 |
| R2 | RESISTOR, VARIABLE | 10 K | | 380-2264-000 |
| R3 | RESISTOR | 0.1 | 3 W | 747-5115-000 |
| R4 | RESISTOR | 68.1 K | 1 W | 705-7184-000 |
| R5 | RESISTOR | 1.5 | 10 W | 747-8531-000 |
| R6 | RESISTOR | 10 | 10 W | 747-8954-000 |
| R7 | RESISTOR | 10 | 10 W | 747-8954-000 |
| R8 | RESISTOR | 22 | 1 W | 745-3282-000 |
| R9 | RESISTOR | 3.83 K | 1/2 W | 705-7124-000 |
| R10 | RESISTOR | 464 | 1/2 W | 705-7080-000 |
| R11 | RESISTOR | 2700 | 1 W | 745-3370-000 |
| R12 | RESISTOR | 2.2 K | 1/4 W | 745-0761-000 |
| R13 | RESISTOR | 47 K | 1/4 W | 745-0809-000 |
| S1 | SWITCH | | | 266-5376-010 |
| S2 | SWITCH MODE | | | 359-9475-130 |
| S3 | SWITCH METER | | | 359-9475-310 |
| T1 | TRANSFORMER POWER | | | 662-0318-010 |
| TB1 | TERMINAL BOARD | | | 367-0024-000 |
| U1 | REGULATOR | 7824KC | | 351-1120-040 |
| U2 | REGULATOR | 7824KC | | 351 1120-040 |
| XF1 | FUSEHOLDER | | | 265-1171-000 |
| XF2 | FUSEHOLDER | | | 265 1171-000 |
| XFL1 | SOCKET | | | 220-1005-000 |
| XQ1 | SOCKET | TO-66 | | 220-0968-020 |
| XQ2 | SOCKET | TO-3 | | 220-0968-010 |
| XU1 | SOCKET | TO-3 | | 220 0968-010 |
| XU2 | SOCKET | TO-3 | | 220-0968-010 |

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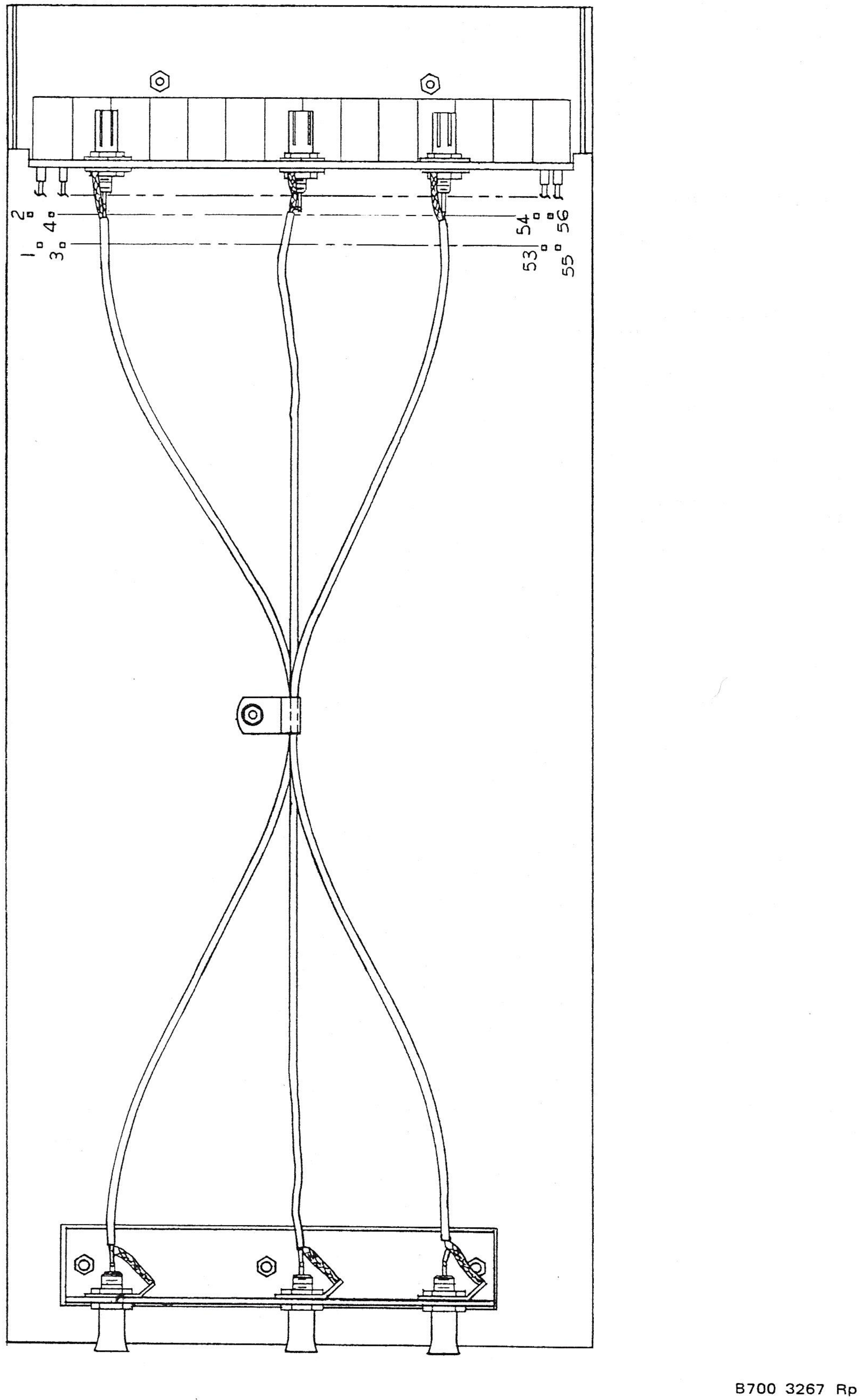


Figure 6-4. Extender Board.

| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | EXTENDER BOARD | 781-5365-001 |
| J1 | CONNECTOR | 357-9210-000 |
| J2 | CONNECTOR | 357 9210-000 |
| J3 | CONNECTOR | 357-9210-000 |
| J4 | CONNECTOR | 357-9211-000 |
| J5 | CONNECTOR | 357 9211-000 |
| J6 | CONNECTOR | 357-9211-000 |
| J7 | CONNECTOR | 372-2426-010 |
| J8 | CONNECTOR | 372 2426-010 |
| J9 | CONNECTOR | 372-2426-010 |
| J10 | CONNECTOR | 372 2426-010 |
| J11 | CONNECTOR | 372-2426-010 |
| J12 | CONNECTOR | 372 2426-010 |
| J13 | CONNECTOR | 372-2426-010 |
| J14 | CONNECTOR | 372 2426-010 |
| J15 | CONNECTOR | 372-2426-010 |
| J16 | CONNECTOR | 372 2426-010 |
| J17 | CONNECTOR | 372-2426-010 |
| J18 | CONNECTOR | 372 2426-010 |
| J19 | CONNECTOR | 372-2426-010 |
| J20 | CONNECTOR | 372 2426-010 |

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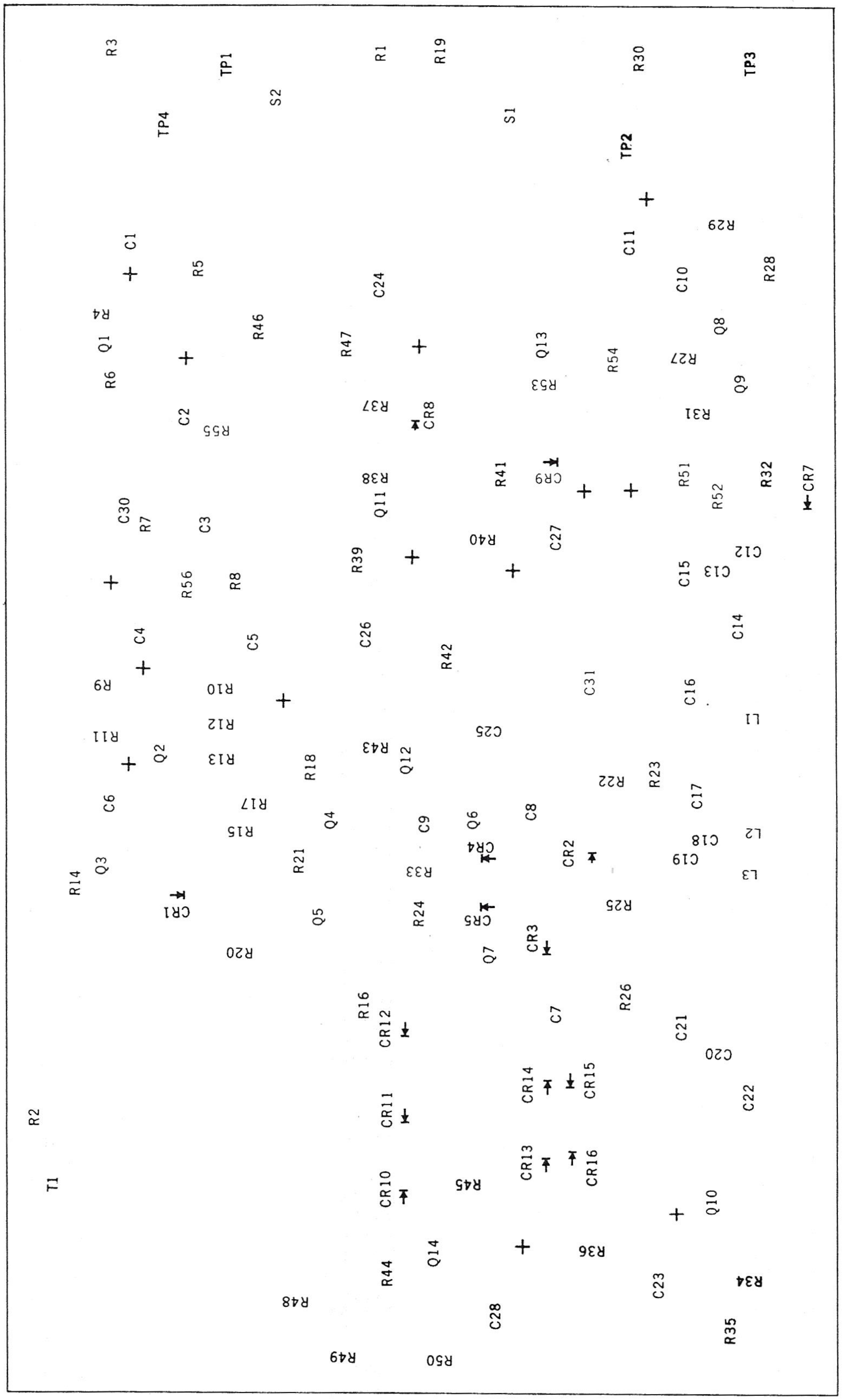


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Figure 6-5. SCA Generator 786W-1 A1, A2.

| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| | SCA GENERATOR 786W-1 A1,A2 | | | 772-5338-001 |
| C1 | CAPACITOR | 6.8UF | 35 V | 184-6216-000 |
| C2 | CAPACITOR | 6.8UF | 35 V | 184 6216-000 |
| C3 | CAPACITOR | 0.022UF | 50 V | 933-0858-000 |
| C4 | CAPACITOR | 6.8UF | 35 V | 184-6216-000 |
| C5 | CAPACITOR | 250UF | 40 V | 183-2355-150 |
| C6 | CAPACITOR | 6.8UF | 35 V | 184-6216-000 |
| C7 | CAPACITOR | 3900PF | 500 V | 912-3046-000 |
| C8 | CAPACITOR | 3900PF | 500 V | 912 3046-000 |
| C9 | CAPACITOR | 6.8UF | 35 V | 184-6216-000 |
| C10 | CAPACITOR | 2PF | 500 V | 916-0076-000 |
| C11 | CAPACITOR | 6.8UF | 35 V | 184-6216-000 |
| C12 | CAPACITOR | 500UUF | 500 V | 912-2977-000 |
| C13 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C14 | CAPACITOR | 47PF | 500 V | 912-2792-000 |
| C15 | CAPACITOR | 5PF | 500 V | 916-0118-000 |
| C16 | CAPACITOR | 820PF | 500 V | 912-2995-000 |
| C17 | CAPACITOR | 22PF | 500 V | 912-2768-000 |
| C18 | CAPACITOR | 120PF | 500 V | 912-2822-000 |
| C19 | CAPACITOR | 18PF | 500 V | 912-2763-000 |
| C20 | CAPACITOR | 470PF | 500 V | 912-2974-000 |
| C21 | CAPACITOR | 47PF | 500 V | 912-2792-000 |
| C22 | CAPACITOR | 0.0075UF | 75 V | 184-9062-040 |
| C23 | CAPACITOR | 0.033UF | 100 V | 184-6326-580 |
| C24 | CAPACITOR | 22UF | 50 V | 184-6257-000 |
| C25 | CAPACITOR | 250UF | 40 V | 183-2355-150 |
| C26 | CAPACITOR | 47UF | 35 V | 184-6231-000 |
| C27 | CAPACITOR | 5UF | 50 V | 183-1162-000 |
| C28 | CAPACITOR | 6.8UF | 35 V | 184-6216-000 |
| C29 | NOT USED | | | |
| C30 | CAPACITOR | 15UF | 35 V | 184-6222-000 |
| C31 | CAPACITOR | 220UF | 25 V | 183-2338-000 |
| CR1 | DIODE | 1N914 | | 353-2906-000 |
| CR2 | DIODE | 1N995 | | 353-2042-000 |
| CR3 | DIODE | 1N995 | | 353 2042-000 |
| CR4 | DIODE | 1N995 | | 353-2042-000 |
| CR5 | DIODE | 1N995 | | 353 2042-000 |
| CR6 | NOT USED | | | |
| CR7 | DIODE | 1N995 | | 353-2042-000 |
| CR8 | DIODE | 1N914 | | 353-2906-000 |
| CR9 | DIODE | 1N758 | | 353-2723-000 |
| CR10 | DIODE | 1N914 | | 353-2906-000 |
| CR11 | DIODE | 1N756A | | 353-2983-000 |
| CR12 | DIODE | 1N756A | | 353 2983-000 |
| CR13 | DIODE | 1N914 | | 353-2906-000 |
| CR14 | DIODE | 1N914 | | 353 2906-000 |
| CR15 | DIODE | 1N914 | | 353-2906-000 |
| CR16 | DIODE | 1N754A | | 353-2981-000 |
| E1 | TERMINAL | | | 306-2222-100 |
| E2 | TERMINAL | | | 306 2222-100 |
| E3 | TERMINAL | | | 306-2222-100 |
| L1 | INDUCTOR | 5000UH | | 240-0843-000 |
| L2 | INDUCTOR | 1000UH | | 240-0839-000 |
| L3 | INDUCTOR | 5000UH | | 240-0843-000 |
| Q1 | TRANSISTOR | 2N3569 | | 352-0629-030 |
| Q2 | TRANSISTOR | 2N3565 | | 352-0638-010 |
| Q3 | TRANSISTOR | 2N718A | | 352-0318-000 |
| Q4 | TRANSISTOR | 2N3638A | | 352-0636-020 |
| Q5 | TRANSISTOR | 2N3638A | | 352 0636-020 |
| Q6 | TRANSISTOR | 2N3563 | | 352-0630-010 |
| Q7 | TRANSISTOR | 2N3563 | | 352 0630-010 |
| Q8 | TRANSISTOR | 2N3563 | | 352-0630-010 |
| Q9 | TRANSISTOR | 2N3646 | | 352-0680-010 |
| Q10 | TRANSISTOR | 2N3565 | | 352-0638-010 |
| Q11 | TRANSISTOR | 2N3643 | | 352-0713-030 |
| Q12 | TRANSISTOR | 2N3643 | | 352 0713-030 |
| Q13 | TRANSISTOR | 2N3643 | | 352-0713-030 |

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| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| Q14 | TRANSISTOR | 2N3643 | | 352 0713-030 |
| R1 | RESISTOR | 50 K | 3/4 W | 382-0012-130 |
| R2 | RESISTOR | 4700 | 1/4 W | 745-0773-000 |
| R3 | RESISTOR | 5 K | 3/4 W | 382-0012-090 |
| R4 | RESISTOR | 39 K | 1/4 W | 745-0806-000 |
| R5 | RESISTOR | 56 K | 1/4 W | 745-0812-000 |
| R6 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R7 | RESISTOR | 6800 | 1/4 W | 745-0779-000 |
| R8 | RESISTOR | 820 | 1/4 W | 745-0746-000 |
| R9 | RESISTOR | 39 K | 1/4 W | 745-0806-000 |
| R10 | RESISTOR | 4700 | 1/4 W | 745-0773-000 |
| R11 | RESISTOR | 3900 | 1/4 W | 745-0770-000 |
| R12 | RESISTOR | 390 | 1/4 W | 745-0734-000 |
| R13 | RESISTOR | 270 | 1/4 W | 745-0728-000 |
| R14 | RESISTOR | 7500 | 1/2 W | 705-7138-000 |
| R15 | RESISTOR | 6190 | 1/2 W | 705-7134-000 |
| R16 | RESISTOR | 1780 | 1/2 W | 705-7108-000 |
| R17 | RESISTOR | 2.15 K | 1/2 W | 705-7112-000 |
| R18 | RESISTOR | 33 K | 1/4 W | 745-0803-000 |
| R19 | RESISTOR | 5 K | 3/4 W | 382-0012-090 |
| R20 | RESISTOR | 2.15 K | 1/2 W | 705-7112-000 |
| R21 | RESISTOR | 33 K | 1/4 W | 745-0803-000 |
| R22 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R23 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R24 | RESISTOR | 1.96 K | 1/4 W | 705-6610-000 |
| R25 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R26 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R27 | RESISTOR | 27 K | 1/4 W | 745-0800-000 |
| R28 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R29 | RESISTOR | 470 | 1/4 W | 745-0737-000 |
| R30 | RESISTOR | 50 K | 3/4 W | 382-0012-130 |
| R31 | RESISTOR | 3300 | 1/4 W | 745-0767-000 |
| R32 | RESISTOR | 1800 | 1/4 W | 745-0758-000 |
| R33 | RESISTOR | 1.62 K | 1/4 W | 705-6606-000 |
| R34 | RESISTOR | 3900 | 1/4 W | 745-0770-000 |
| R35 | RESISTOR | 8200 | 1/4 W | 745-0782-000 |
| R36 | RESISTOR | 820 | 1/4 W | 745-0746-000 |
| R37 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R38 | RESISTOR | 220 K | 1/4 W | 745-0833-000 |
| R39 | RESISTOR | 2700 | 1/4 W | 745-0764-000 |
| R40 | RESISTOR | 68 | 1/4 W | 745-0707-000 |
| R41 | RESISTOR | 33 | 1/4 W | 745-0695-000 |
| R42 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R43 | RESISTOR | 61.9 K | 1/4 W | 705-6682-000 |
| R44 | RESISTOR | 180 | 1/4 W | 745-0722-000 |
| R45 | RESISTOR | 180 | 1/2 W | 745-1321-000 |
| R46 | RESISTOR | 82.5 K | 1/4 W | 705-6688-000 |
| R47 | RESISTOR | 26.1 | 1/4 W | 705-6664-000 |
| R48 | RESISTOR | 5110 | 1/2 W | 705-7130-000 |
| R49 | RESISTOR | 5110 | 1/2 W | 705 7130-000 |
| R50 | RESISTOR | 1330 | 1/2 W | 705-7102-000 |
| R51 | RESISTOR | 1800 | 1/4 W | 745-0758-000 |
| R52 | RESISTOR | 3900 | 1/4 W | 745-0770-000 |
| R53 | SELECT R53 FROM THE FOLLOWING LIST | | | |
| | RESISTOR | 100 K | 1/4 W | 705-6692-000 |
| | RESISTOR | 121 K | 1/4 W | 705-6696-000 |
| | RESISTOR | 147 K | 1/4 W | 705-6700-000 |
| | RESISTOR | 178 K | 1/4 W | 705-6704-000 |
| | RESISTOR | 215 K | 1/4 W | 705-6708-000 |
| | RESISTOR | 274 K | 1/4 W | 705-6713-000 |
| | RESISTOR | 348 K | 1/4 W | 705-6718-000 |
| | RESISTOR | 422 K | 1/4 W | 705-6722-000 |
| | RESISTOR | 511 K | 1/4 W | 705-6726-000 |
| | RESISTOR | 619 K | 1/4 W | 705-6730-000 |
| | RESISTOR | 750 K | 1/4 W | 705-6734-000 |
| R54 | RESISTOR | 6800 | 1/4 W | 745-0779-000 |
| R55 | RESISTOR | 3300 | 1/4 W | 745-0767-000 |
| R56 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |

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| SYMBOL | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| S1 | SWITCH, TOGGLE | 266-5321-980 |
| S2 | SWITCH, TOGGLE | 266 5321-980 |
| T1 | TRANSFORMER, AF | 667-0187-020 |
| TP1 | JACK, TIP | 360-0434-100 |
| TP2 | JACK, TIP | 360 0434-100 |
| TP3 | JACK, TIP | 360-0434-100 |
| TP4 | JACK, TIP | 360-0434-010 |

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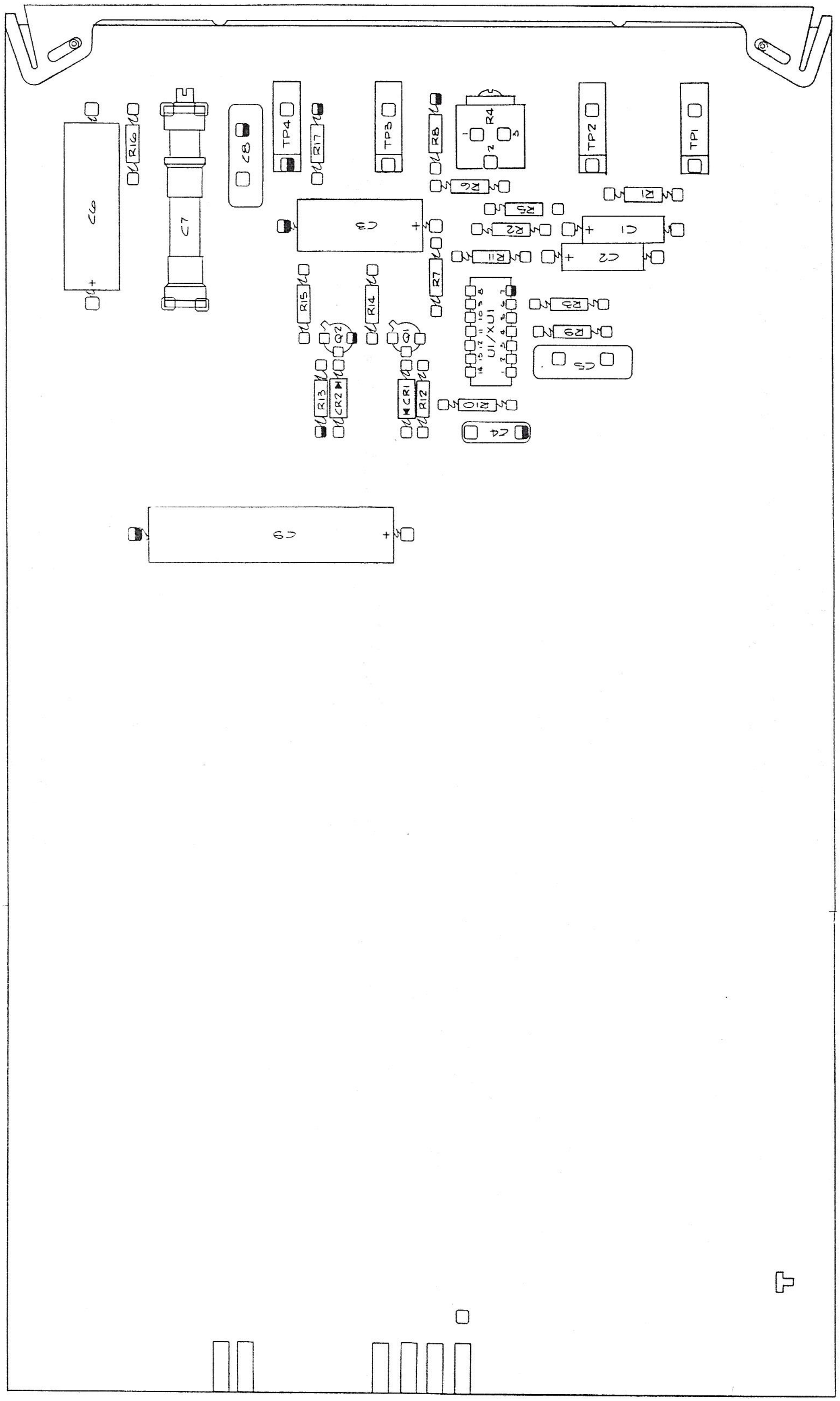


B700 3264 Rp

Figure 6-6. STL Interface 785E-1 A3.

| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| | STL INTERFACE 785E-1 A3 | | | 622-2374-001 |
| C1 | CAPACITOR | 22UF | 15 V | 184-9086-320 |
| C2 | CAPACITOR | 22UF | 15 V | 184 9086-320 |
| C3 | CAPACITOR | 100UF | 20 V | 184-9086-620 |
| C4 | CAPACITOR | 1UF | 50 V | 913-3279-590 |
| C5 | CAPACITOR | 1000PF | 500 V | 912-3001-000 |
| C6 | CAPACITOR | 180UF | 25 V | 184-8664-000 |
| C7 | CAPACITOR, VARIABLE | 1-60PF | 1000V | 922-0609-000 |
| C8 | CAPACITOR | 510PF | 500 V | 912-2980-000 |
| C9 | CAPACITOR | 100UF | 50 V | 183-1281-080 |
| CR1 | DIODE | 1N914 | | 353-2906-000 |
| CR2 | DIODE | 1N914 | | 353 2906-000 |
| Q1 | TRANSISTOR | 2N2222A | | 352-0661-023 |
| Q2 | TRANSISTOR | 2N2907A | | 352-0551-013 |
| R1 | RESISTOR | 4.7 K | 1/4 W | 745-0773-000 |
| R2 | RESISTOR | 47 K | 1/4 W | 745-0809-000 |
| R3 | RESISTOR | 47 K | 1/4 W | 745 0809-000 |
| R4 | RESISTOR, VARIABLE | 10 K | | 376-0254-070 |
| R5 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R6 | RESISTOR | 100 K | 1/4 W | 745-0821-000 |
| R7 | RESISTOR | 8.2 K | 1/4 W | 745-0782-000 |
| R8 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R9 | RESISTOR | 100 | 1/4 W | 745-0713-000 |
| R10 | RESISTOR | 100 | 1/4 W | 745 0713-000 |
| R11 | RESISTOR | 100 K | 1/4 W | 745-0821-000 |
| R12 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R13 | RESISTOR | 10 K | 1/4 W | 745 0785-000 |
| R14 | RESISTOR | 10 | 1/4 W | 745-0677-000 |
| R15 | RESISTOR | 10 | 1/4 W | 745 0677-000 |
| R16 | RESISTOR | 4.7 K | 1/4 W | 745-0773-000 |
| R17 | RESISTOR | 270 | 1/4 W | 745-0728-000 |
| TP1 | JACK, TIP | | | 360-0434-040 |
| TP2 | JACK, TIP | | | 360-0434-020 |
| TP3 | JACK, TIP | | | 360-0434-030 |
| TP4 | JACK, TIP | | | 360-0434-010 |
| U1 | INTEGRATED CIRCUIT | UA739 | | 351-1175-010 |
| XU1 | SOCKET | | | 220-0001-010 |

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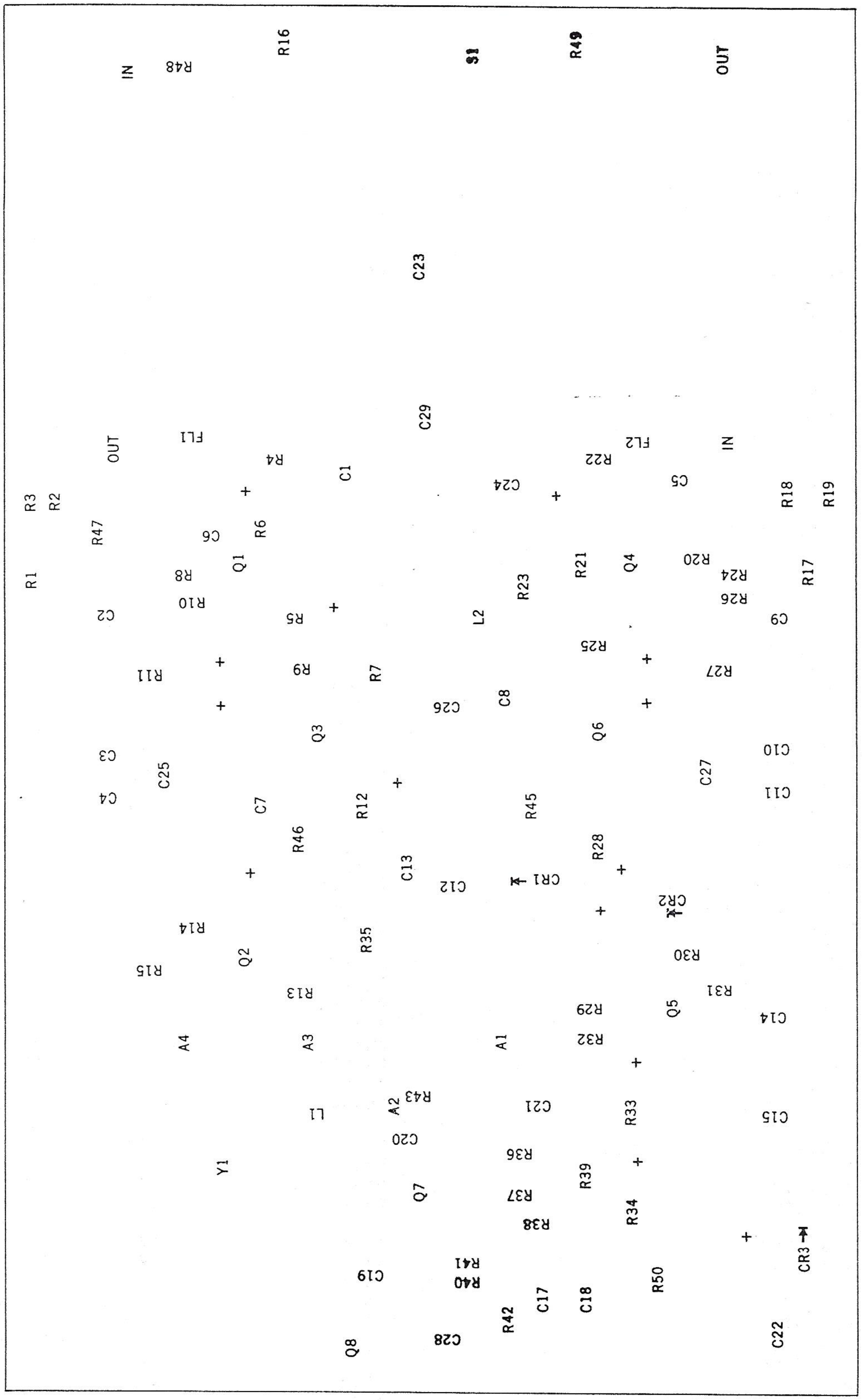


B700 3266 Rp

Figure 6-7. Stereo Generator 786V-1 A3.

| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| | STEREO GENERATOR 786V-1 A3 | | | 783-6648-001 |
| A1 | INTEGRATED CIRCUIT | ML923 | | 351-7121-010 |
| A2 | INTEGRATED CIRCUIT | ML900 | | 351-7121-030 |
| A3 | INTEGRATED CIRCUIT | ML900 | | 351 7121-030 |
| A4 | INTEGRATED CIRCUIT | ML923 | | 351-7121-010 |
| C1 | CAPACITOR | 47 UF | 35 V | 184-6231-000 |
| C2 | CAPACITOR | 47 UF | 35 V | 184 6231-000 |
| C3 | CAPACITOR | 47 UF | 35 V | 184-6231-000 |
| C4 | CAPACITOR | 1000 UF | 16 V | 183-2355-090 |
| C5 | CAPACITOR | 47 UF | 35 V | 184-6231-000 |
| C6 | CAPACITOR | 47 UF | 35 V | 184 6231-000 |
| C7 | CAPACITOR | 1000 PF | 500 V | 912-3001-000 |
| C8 | CAPACITOR | 1000 PF | 500 V | 912 3001-000 |
| C9 | CAPACITOR | 47 UF | 35 V | 184-6231-000 |
| C10 | CAPACITOR | 47 UF | 35 V | 184 6231-000 |
| C11 | CAPACITOR | 1000 UF | 16 V | 183-2355-090 |
| C12 | CAPACITOR | 250 UF | 40 V | 183-2355-150 |
| C13 | CAPACITOR | 22 UF | 35 V | 184-6225-000 |
| C14 | CAPACITOR | 250 UF | 40 V | 183-2355-150 |
| C15 | CAPACITOR | 250 UF | 40 V | 183 2355-150 |
| C16 | NOT USED | | | |
| C17 | CAPACITOR | 2.2 UF | 25 V | 913-3812-000 |
| C18 | CAPACITOR | 2.2 UF | 25 V | 913 3812-000 |
| C19 | CAPACITOR | 33 PF | 500 V | 912-2780-000 |
| C20 | CAPACITOR | 820 PF | 500 V | 912-2995-000 |
| C21 | CAPACITOR | 3300 PF | 500 V | 912-3040-000 |
| C22 | CAPACITOR | 47 UF | 35 V | 184-6231-000 |
| C23 | CAPACITOR | 30,000 PF | 500 V | 912-3131-000 |
| C24 | CAPACITOR | 3900 PF | 500 V | 912-3044-000 |
| C25 | CAPACITOR | 2.2 UF | 25 V | 913-3812-000 |
| C26 | CAPACITOR | 33 PF | 500 V | 912-2780-000 |
| C27 | CAPACITOR | 2.2 UF | 25 V | 913-3812-000 |
| C28 | CAPACITOR | 47 PF | 500 V | 912-2792-000 |
| C29 | CAPACITOR | 1800 PF | 500 V | 912-3018-000 |
| CR1 | DIODE | 1N914 | | 353-2906-000 |
| CR2 | DIODE | 1N914 | | 353 2906-000 |
| CR3 | DIODE | 1N747A | | 353-2702-000 |
| FL1 | FILTER, LOW PASS | 15 KHZ | | 673-1167-010 |
| FL2 | FILTER, LOW PASS | 15 KHZ | | 673 1167-010 |
| L1 | CHOKE, RF | 6800 UH | | 240-2560-000 |
| L2 | COIL, RF | 2 MH | | 240-0882-010 |
| Q1 | TRANSISTOR | 2N3643 | | 352-0713-030 |
| Q2 | TRANSISTOR | 2N3643 | | 352 0713-030 |
| Q3 | TRANSISTOR | 2N3153 | | 352-0776-010 |
| Q4 | TRANSISTOR | 2N3643 | | 352-0713-030 |
| Q5 | TRANSISTOR | 2N3643 | | 352 0713-030 |
| Q6 | TRANSISTOR | 2N3153 | | 352-0776-010 |
| Q7 | TRANSISTOR | 2N3643 | | 352-0713-030 |
| Q8 | TRANSISTOR | 2N3643 | | 352 0713-030 |
| R1 | RESISTOR | 226 | 1/8 W | 705-0965-000 |
| R2 | RESISTOR | 226 | 1/8 W | 705 0965-000 |
| R3 | RESISTOR | 681 | 1/8 W | 705-0988-000 |
| R4 | RESISTOR | 649 | 1/8 W | 705-0987-000 |
| R5 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R6 | RESISTOR | 100 | 1/8 W | 705-0948-000 |
| R7 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R8 | RESISTOR | 3300 | 1/4 W | 745-0767-000 |
| R9 | RESISTOR | 10 K | 1/8 W | 705-1044-000 |
| R10 | RESISTOR | 464 | 1/8 W | 705-0980-000 |
| R11 | RESISTOR | 61.9 | 1/8 W | 705-0938-000 |
| R12 | RESISTOR | 1 K | 1/2 W | 382-0008-070 |
| R13 | RESISTOR | 120 K | 1/4 W | 745-0824-000 |
| R14 | RESISTOR | 21.5 K | 1/8 W | 705-1060-000 |
| R15 | RESISTOR | 348 | 1/8 W | 705-0974-000 |
| R16 | RESISTOR | 20 K | 1/2 W | 382-0008-450 |
| R17 | RESISTOR | 226 | 1/8 W | 705-0965-000 |
| R18 | RESISTOR | 226 | 1/8 W | 705 0965-000 |

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| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| R19 | RESISTOR | 681 | 1/8 W | 705-0988-000 |
| R20 | RESISTOR | 649 | 1/8 W | 705-0987-000 |
| R21 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R22 | RESISTOR | 100 | 1/8 W | 705-0948-000 |
| R23 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R24 | RESISTOR | 3300 | 1/4 W | 745-0767-000 |
| R25 | RESISTOR | 10 K | 1/8 W | 705-1044-000 |
| R26 | RESISTOR | 464 | 1/8 W | 705-0980-000 |
| R27 | RESISTOR | 61.9 | 1/8 W | 705-0938-000 |
| R28 | RESISTOR | 1 K | 1/2 W | 382-0008-070 |
| R29 | RESISTOR | 120 K | 1/4 W | 745-0824-000 |
| R30 | RESISTOR | 21.5 K | 1/8 W | 705-1060-000 |
| R31 | RESISTOR | 348 | 1/8 W | 705-0974-000 |
| R32 | RESISTOR | 619 | 1/4 W | 705-6586-000 |
| R33 | RESISTOR | 560 | 1/4 W | 745-0740-000 |
| R34 | RESISTOR | 56 | 1/4 W | 745-0704-000 |
| R35 | RESISTOR | 470 | 1/4 W | 745-0737-000 |
| R36 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R37 | RESISTOR | 68 K | 1/4 W | 745-0815-000 |
| R38 | RESISTOR | 100 | 1/4 W | 745-0713-000 |
| R39 | RESISTOR | 820 | 1/4 W | 745-0746-000 |
| R40 | RESISTOR | 100 K | 1/4 W | 745-0821-000 |
| R41 | RESISTOR | 3900 | 1/4 W | 745-0770-000 |
| R42 | RESISTOR | 470 | 1/4 W | 745-0737-000 |
| R43 | RESISTOR | 680 | 1/4 W | 745-0743-000 |
| R44 | NOT USED | | | |
| R45 | RESISTOR | 147 | 1/8 W | 705-0956-000 |
| R46 | RESISTOR | 147 | 1/8 W | 705 0956-000 |
| R47 | RESISTOR | 470 | 1/4 W | 745-0737-000 |
| R48 | RESISTOR | 330 | 1/4 W | 745-0731-000 |
| R49 | RESISTOR | 50 | 1/2 W | 382-0008-370 |
| R50 | RESISTOR | 270 | 3W | 747-5349-000 |
| S1 | SWITCH, TOGGLE | | | 266-5059-000 |
| XY1 | SOCKET, CRYSTAL | | | 292-0215-000 |
| Y1 | CRYSTAL UNIT, QUARTZ | | | 289-7095-020 |

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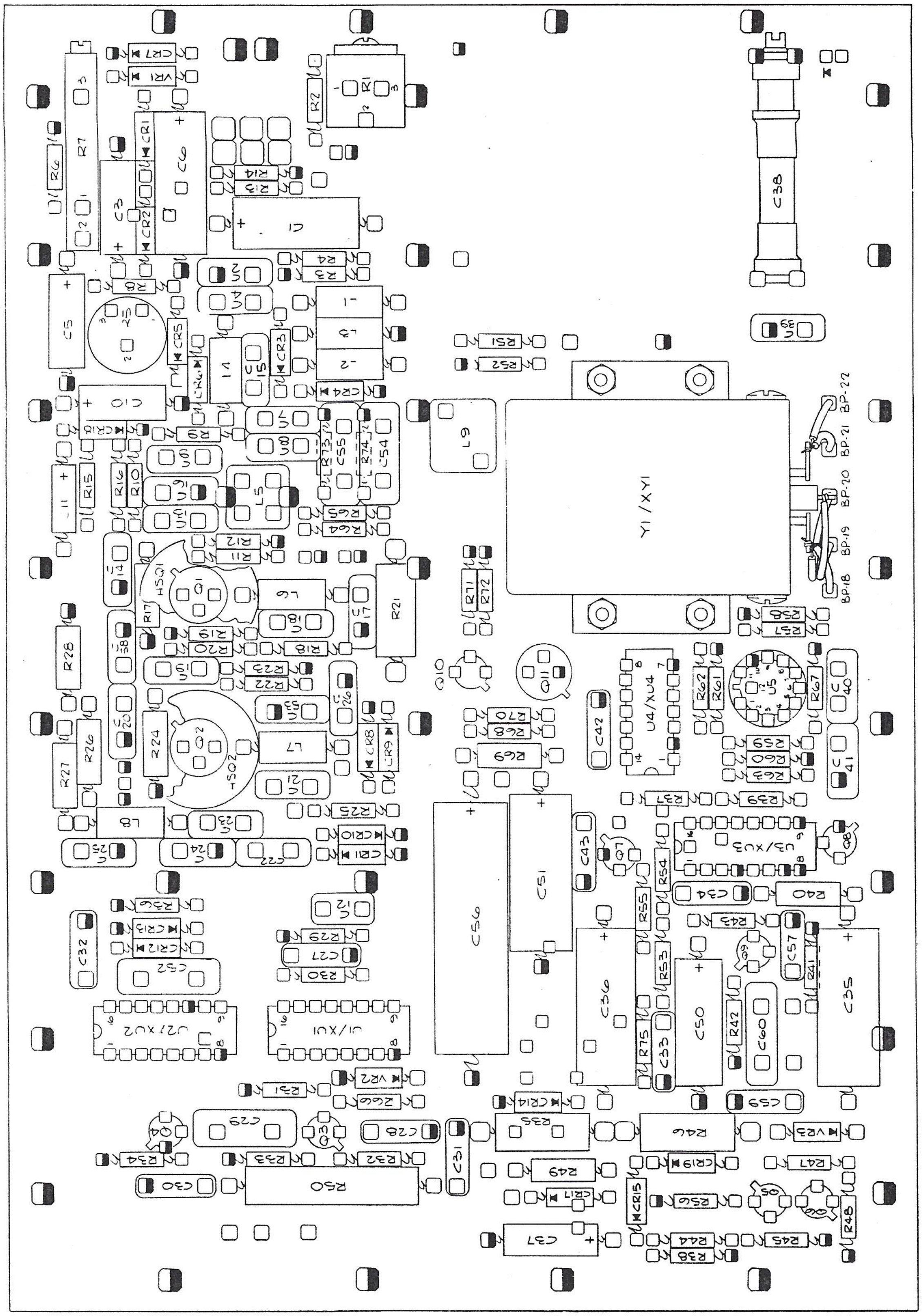


B700 3263 Rp

Figure 6-8. Modulator/Exciter A4 (Sheet 1 of 2).

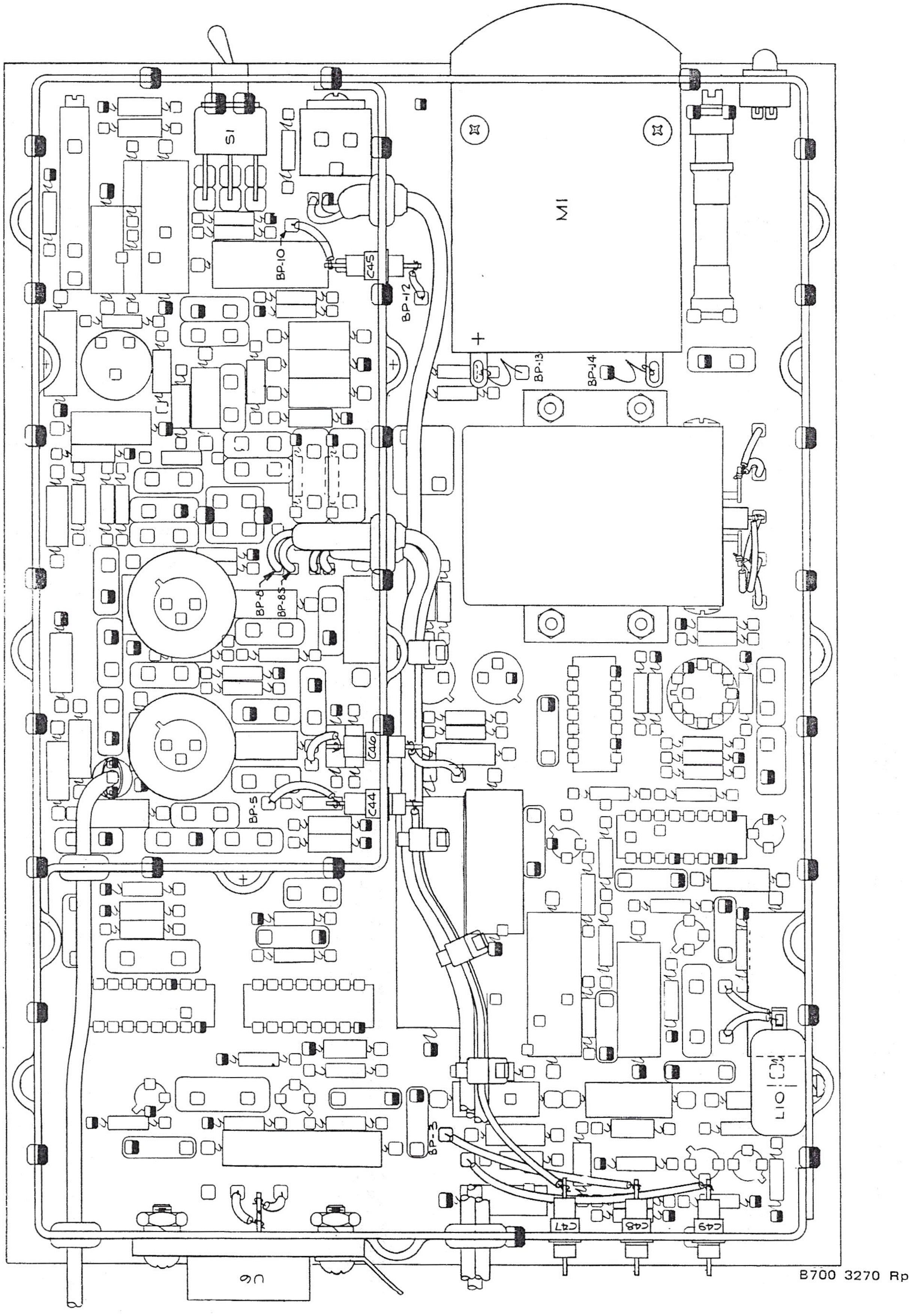


Figure 6-9. Modulator/Exciter A4 (Sheet 2 of 2).

| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| | MODULATOR/EXCITER A4 | | | 627-6695-001 |
| C1 | CAPACITOR | 100UF | 25 V | 184-9103-570 |
| C2 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C3 | CAPACITOR | 10UF | 25 V | 184-9103-530 |
| C4 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C5 | CAPACITOR | 10UF | 25 V | 184-9103-530 |
| C6 | CAPACITOR | 100UF | 25 V | 184-9103-570 |
| C7 | CAPACITOR | 51PF | 500 V | 916-0476-000 |
| C8 | CAPACITOR | 22PF | 500 V | 916-0432-000 |
| C9 | CAPACITOR | 47PF | 500 V | 912-2792-000 |
| C10 | CAPACITOR | 2.2UF | 50 V | 184-9087-500 |
| C11 | CAPACITOR | 1UF | 50 V | 184-9087-440 |
| C12 | CAPACITOR | 220PF | 500 V | 912-2840-000 |
| C13 | CAPACITOR | 47PF | 500 V | 912-2792-000 |
| C14 | CAPACITOR | 47PF | 500 V | 912 2792-000 |
| C15 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C16 | CAPACITOR | 100PF | 500 V | 912 2816-000 |
| C17 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C18 | CAPACITOR | 18PF | 500 V | 912-2762-000 |
| C19 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C20 | CAPACITOR | 100PF | 500 V | 912 2816-000 |
| C21 | CAPACITOR | 5PF | 500 V | 912-2751-000 |
| C22 | CAPACITOR | 5PF | 500 V | 912 2751-000 |
| C23 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C24 | CAPACITOR | 22PF | 500 V | 912-2768-000 |
| C25 | CAPACITOR | 39PF | 500 V | 912-2786-000 |
| C26 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C27 | CAPACITOR | 1UF | 25 V | 913-3810-000 |
| C28 | CAPACITOR | 1UF | 25 V | 913 3810-000 |
| C29 | CAPACITOR | 1000PF | 500 V | 912-3001-000 |
| C30 | CAPACITOR | 0.1UF | 25 V | 912-3806-000 |
| C31 | CAPACITOR | 0.1UF | 200 V | 913-3681-000 |
| C32 | CAPACITOR | 1UF | 25 V | 913-3810-000 |
| C33 | CAPACITOR | 0.1UF | 25 V | 912-3806-000 |
| C34 | CAPACITOR | 0.1UF | 25 V | 912 3806-000 |
| C35 | CAPACITOR | 180UF | 25 V | 184-8664-000 |
| C36 | CAPACITOR | 180UF | 25 V | 184 8664-000 |
| C37 | CAPACITOR | 10UF | 25 V | 184-9103-530 |
| C38 | CAPACITOR | 1-60PF | 1000V | 922-0609-000 |
| C39 | CAPACITOR | 18PF | 500 V | 912-2762-000 |
| C40 | CAPACITOR | 180PF | 500 V | 912-2834-000 |
| C41 | CAPACITOR | 180PF | 500 V | 912 2834-000 |
| C42 | CAPACITOR | 1UF | 25 V | 913-3810-000 |
| C43 | CAPACITOR | 1UF | 25 V | 913 3810-000 |
| C44 | CAPACITOR | 1000PF | 500 V | 913-3208-000 |
| C45 | CAPACITOR | 1000PF | 500 V | 913 3208-000 |
| C46 | CAPACITOR | 1000PF | 500 V | 913-3208-000 |
| C47 | CAPACITOR | 1000PF | 500 V | 913 3208-000 |
| C48 | CAPACITOR | 1000PF | 500 V | 913-3208-000 |
| C49 | CAPACITOR | 1000PF | 500 V | 913 3208-000 |
| C50 | CAPACITOR | 100UF | 10 V | 184-9086-610 |
| C51 | CAPACITOR | 180UF | 25 V | 184-8664-000 |
| C52 | CAPACITOR | 1000PF | 500 V | 912-3001-000 |
| C53 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C54 | CAPACITOR | 510PF | 500 V | 912-2980-000 |
| C55 | CAPACITOR | 510PF | 500 V | 912 2980-000 |
| C56 | CAPACITOR | 100UF | 50 V | 183-1281-080 |
| C57 | CAPACITOR | 0.1UF | 25 V | 912-3806-000 |
| C58 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C59 | CAPACITOR | 0.1UF | 25 V | 912-3806-000 |
| C60 | CAPACITOR | 560PF | 500 V | 912-2983-000 |
| CR1 | DIODE | 1N914 | | 353-2906-000 |
| CR2 | DIODE | 1N914 | | 353 2906-000 |
| CR3 | DIODE | MV1404 | | 922-6100-020 |
| CR4 | DIODE | MV1404 | | 922 6100-020 |
| CR5 | DIODE | MV1650 | | 922-6109-020 |
| CR6 | DIODE | MV1650 | | 922 6109-020 |

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| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| CR7 | DIODE | 1N914 | | 353-2906-000 |
| CR8 | DIODE | 1N914 | | 353 2906-000 |
| CR9 | DIODE | 1N914 | | 353-2906-000 |
| CR10 | DIODE | 1N914 | | 353 2906-000 |
| CR11 | DIODE | 1N914 | | 353-2906-000 |
| CR12 | DIODE | 1N914 | | 353 2906-000 |
| CR13 | DIODE | 1N914 | | 353-2906-000 |
| CR14 | DIODE | 1N914 | | 353 2906-000 |
| CR15 | DIODE | 1N914 | | 353-2906-000 |
| CR16 | DIODE | | | 353-3725-060 |
| CR17 | DIODE | 1N914 | | 353-2906-000 |
| CR18 | DIODE | 1N5159 | | 353-6549-020 |
| CR19 | DIODE | 1N914 | | 353-2906-000 |
| HSQ1 | HEATSINK | | | 352-2619-030 |
| HSQ2 | HEATSINK | | | 352 2619-030 |
| L1 | INDUCTOR | 1.5 UHY | | 240-2715-150 |
| L2 | INDUCTOR | 1.5 UHY | | 240 2715-150 |
| L3 | INDUCTOR | 1.5 UHY | | 240-2715-150 |
| L4 | INDUCTOR | 1.5 UHY | | 240 2715-150 |
| L5 | INDUCTOR, VARIABLE | | | 278-1969-620 |
| L6 | INDUCTOR | 0.47 UHY | | 240-2715-090 |
| L7 | INDUCTOR | 1.5 UHY | | 240-2715-150 |
| L8 | INDUCTOR | 0.1 UHY | | 240-2715-010 |
| L9 | INDUCTOR | 10 HY | | 678-0205-010 |
| L10 | INDUCTOR | 150 MHY | | 240-0276-000 |
| M1 | METER | 0-50 UA | | 458-0908-020 |
| P1 | CONNECTOR BOARD | | | 627-9766-001 |
| P2 | CONNECTOR | | | 357-9210-000 |
| Q1 | TRANSISTOR | 2N5109 | | 352-0766-010 |
| Q2 | TRANSISTOR | 2N5109 | | 352 0766-010 |
| Q3 | TRANSISTOR | 2N2907A | | 352-0551-013 |
| Q4 | TRANSISTOR | 2N2222A | | 352-0661-023 |
| Q5 | TRANSISTOR | 2N2222A | | 352 0661-023 |
| Q6 | TRANSISTOR | 2N2222A | | 352-0661-023 |
| Q7 | TRANSISTOR | 2N2222A | | 352 0661-023 |
| Q8 | TRANSISTOR | 2N2222A | | 352-0661-023 |
| Q9 | TRANSISTOR | 2N2222A | | 352 0661-023 |
| Q10 | TRANSISTOR | 2N2222A | | 352-0661-023 |
| Q11 | TRANSISTOR | 2N3053 | | 352-0613-010 |
| R1 | RESISTOR, VARIABLE | 500 | | 376-0254-030 |
| R2 | RESISTOR | 100 | 1/4 W | 745-0713-000 |
| R3 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R4 | RESISTOR | 47 K | 1/4 W | 745-0809-000 |
| R5 | RESISTOR, VARIABLE | 25 K | | 380-3761-080 |
| R6 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R7 | RESISTOR, VARIABLE | 10 K | 3/4 W | 381-1802-000 |
| R8 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R9 | RESISTOR | 22 K | 1/4 W | 745 0797-000 |
| R10 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R11 | RESISTOR | 4.7 K | 1/4 W | 745-0773-000 |
| R12 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R13 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R14 | RESISTOR | 8.2 K | 1/4 W | 745-0782-000 |
| R15 | RESISTOR | 47 K | 1/4 W | 745-0809-000 |
| R16 | RESISTOR | 470 K | 1/4 W | 745-0845-000 |
| R17 | RESISTOR | 100 | 1/2 W | 745-1310-000 |
| R18 | RESISTOR | 15 | 1/4 W | 745-0683-000 |
| R19 | RESISTOR | 68 | 1/4 W | 745-0707-000 |
| R20 | RESISTOR | 15 | 1/4 W | 745-0683-000 |
| R21 | RESISTOR | 150 | 1 W | 745-3317-000 |
| R22 | RESISTOR | 3.3 K | 1/4 W | 745-0767-000 |
| R23 | RESISTOR | 470 | 1/4 W | 745-0737-000 |
| R24 | RESISTOR | 47 | 1/2 W | 745-1296-000 |
| R25 | RESISTOR | 4.7 K | 1/4 W | 745-0773-000 |
| R26 | RESISTOR | 22 | 1/2 W | 745-1282-000 |
| R27 | RESISTOR | 22 | 1/2 W | 745 1282-000 |
| R28 | RESISTOR | 47 | 1/2 W | 745-1296-000 |
| R29 | RESISTOR | 3.9 K | 1/4 W | 745-0770-000 |
| R30 | RESISTOR | 1.2 K | 1/4 W | 745-0752-000 |

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| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| R31 | RESISTOR | 470 | 1/4 W | 745-0737-000 |
| R32 | RESISTOR | 100 | 1/4 W | 745-0713-000 |
| R33 | RESISTOR | 270 | 1/4 W | 745-0728-000 |
| R34 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R35 | RESISTOR | 220 | 1 W | 745-3324-000 |
| R36 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R37 | RESISTOR | 10 K | 1/4 W | 745 0785-000 |
| R38 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R39 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R40 | RESISTOR | 2.2 K | 1/2 W | 745-1366-000 |
| R41 | RESISTOR | 2.2 K | 1/4 W | 745-0761-000 |
| R42 | RESISTOR | 470 | 1/4 W | 745-0737-000 |
| R43 | RESISTOR | 4.7 K | 1/4 W | 745-0773-000 |
| R44 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R45 | RESISTOR | 2.7 K | 1/4 W | 745-0764-000 |
| R46 | RESISTOR | 1 K | 1 W | 745-3352-000 |
| R47 | RESISTOR | 4.7K | 1/4 W | 745-0773-000 |
| R48 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R49 | RESISTOR | 2.7 K | 1/2 W | 745-1370-000 |
| R50 | RESISTOR | 39 | 2 W | 745-5593-000 |
| R51 | RESISTOR | 100 K | 1/4 W | 745-0821-000 |
| R52 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R53 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R54 | RESISTOR | 10 K | 1/4 W | 745 0785-000 |
| R55 | RESISTOR | 4.7 K | 1/4 W | 745-0773-000 |
| R56 | RESISTOR | 15 | 1/4 W | 745-0683-000 |
| R57 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R58 | RESISTOR | 10 K | 1/4 W | 745 0785-000 |
| R59 | RESISTOR | 270 | 1/4 W | 745-0728-000 |
| R60 | RESISTOR | 470 | 1/4 W | 745-0737-000 |
| R61 | RESISTOR | 470 | 1/4 W | 745 0737-000 |
| R62 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R63 | RESISTOR | 1 K | 1/4 W | 745 0749-000 |
| R64 | RESISTOR | 27 K | 1/4 W | 745-0800-000 |
| R65 | RESISTOR | 27 K | 1/4 W | 745 0800-000 |
| R66 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R67 | RESISTOR | 100 | 1/4 W | 745-0713-000 |
| R68 | RESISTOR | 15 K | 1/4 W | 745-0791-000 |
| R69 | RESISTOR | 1.2 K | 1/2 W | 745-1356-000 |
| R70 | RESISTOR | 15 K | 1/4 W | 745-0791-000 |
| R71 | RESISTOR | 2.2 K | 1/4 W | 745-0761-000 |
| R72 | RESISTOR | 4.7 K | 1/4 W | 745-0773-000 |
| R73 | RESISTOR | 2.2 K | 1/4 W | 745-0761-000 |
| R74 | RESISTOR | 2.2 K | 1/4 W | 745 0761-000 |
| R75 | RESISTOR | 15 K | 1/4 W | 745-0791-000 |
| S1 | SWITCH | | | 266-5321-990 |
| U1 | INTEGRATED CIRCUIT | MC10178 | | 351-1520-020 |
| U2 | INTEGRATED CIRCUIT | CD4020 | | 351-8159-090 |
| U3 | INTEGRATED CIRCUIT | CD4027 | | 351-8159-180 |
| U4 | INTEGRATED CIRCUIT | CD4024 | | 351-8159-100 |
| U5 | INTEGRATED CIRCUIT | CA3018 | | 351-1016-010 |
| U6 | INTEGRATED CIRCUIT | 7805KC | | 351-1120-080 |
| VR1 | ZENER DIODE | 1N4744A | | 353-6481-330 |
| VR2 | ZENER DIODE | 1N4744A | | 353 6481-330 |
| VR3 | ZENER DIODE | 1N4740A | | 353-6481-250 |
| XCR16 | RING, RETAINING | | | 353-3725-060 |
| XU1 | SOCKET | | | 220-0001-020 |
| XU2 | SOCKET | | | 220 0001-020 |
| XU3 | SOCKET | | | 220-0001-020 |
| XU4 | SOCKET | | | 220-0001-010 |
| XU5 | INSULATOR DISC | | | 352-9552-040 |
| XY1 | OVEN CRYSTAL | | | 292-0328-010 |

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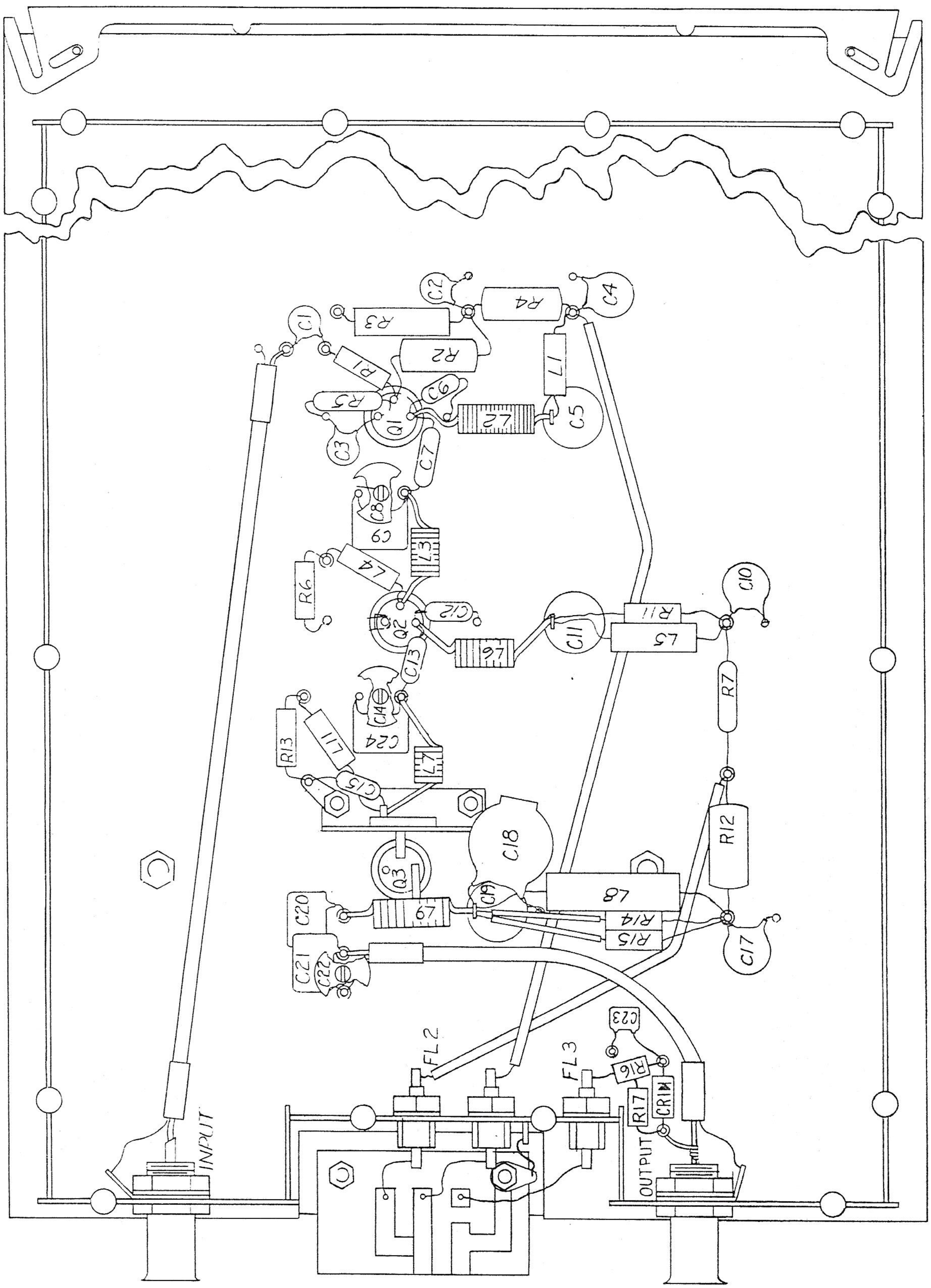


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Figure 6-10. Power Amplifier A5.

| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| | POWER AMPLIFIER A5 | | | 769-0830-001 |
| C1 | CAPACITOR | 680PF | 1000V | 913-1194-000 |
| C2 | CAPACITOR | 470PF | 500 V | 913-1189-000 |
| C3 | CAPACITOR | 470PF | 500 V | 913 1189-000 |
| C4 | CAPACITOR | 0.01UF | 100 V | 913-3680-000 |
| C5 | CAPACITOR | 1000PF | 500 V | 912-4115-330 |
| C6 | CAPACITOR | 15PF | 500 V | 912-2759-000 |
| C7 | CAPACITOR | 15PF | 500 V | 912 2759-000 |
| C8 | CAPACITOR | 5.5-18PF | 350 V | 917-1222-000 |
| C9 | CAPACITOR | 33PF | 500 V | 912-2781-000 |
| C10 | CAPACITOR | 0.01UF | 100 V | 913-3680-000 |
| C11 | CAPACITOR | 1000PF | 500 V | 912-4115-330 |
| C12 | CAPACITOR | 10PF | 500 V | 912-2753-000 |
| C13 | CAPACITOR | 18PF | 500 V | 912-2762-000 |
| C14 | CAPACITOR | 5.5-18PF | 350 V | 917-1222-000 |
| C15 | CAPACITOR | 82PF | 500 V | 912-2810-000 |
| C16 | CAPACITOR | 500PF | 500 V | 912-0667-000 |
| C17 | CAPACITOR | 0.01UF | 100 V | 913-3680-000 |
| C18 | CAPACITOR | 0.1UF | 100 V | 913-4240-050 |
| C19 | CAPACITOR | 1000PF | 500 V | 912-4115-330 |
| C20 | CAPACITOR | 110PF | 500 V | 912-2819-000 |
| C21 | CAPACITOR | 27PF | 500 V | 912-2774-000 |
| C22 | CAPACITOR | 5.5-18PF | 350 V | 917-1222-000 |
| C23 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C24 | CAPACITOR | 22PF | 500 V | 912-2769-000 |
| CR1 | DIODE | 1N914 | | 353-2906-000 |
| FL1 | FILTER, RI | 1300PF | 200 V | 241-0332-000 |
| FL2 | FILTER, RI | 1300PF | 200 V | 241 0332-000 |
| FL3 | FILTER, RI | 1300PF | 200 V | 241-0332-000 |
| J1 | CONNECTOR | VG1051 | | 357-9210-000 |
| J2 | CONNECTOR | VG1051 | | 357 9210-000 |
| L1 | COIL, RF | 1 UH | | 240-1590-000 |
| L2 | COIL | 0.082 UH | | 776-1882-001 |
| L3 | COIL | 0.048 UH | | 776-1910-001 |
| L4 | COIL, RF | 0.15 UH | | 240-1585-000 |
| L5 | COIL, RF | 2.2 UH | | 240-1654-000 |
| L6 | COIL | 0.056 UH | | 776-1911-001 |
| L7 | COIL | 0.05 UH | | 776-1912-001 |
| L8 | CHOKE, RF | 1.2 UH | | 240-1605-000 |
| L9 | COIL | 0.092 UH | | 776-1883-001 |
| L11 | COIL, RF | 0.15 UH | | 240-1585-000 |
| Q1 | TRANSISTOR | 2N3866 | | 352-0671-010 |
| Q2 | TRANSISTOR | 2N3375 | | 352-0611-010 |
| Q3 | TRANSISTOR | 2N5102 | | 352-0747-010 |
| R1 | RESISTOR | 39 | 1/2 W | 745-1293-000 |
| R2 | RESISTOR | 22 | 3 W | 747-5327-000 |
| R3 | RESISTOR | 23.7 | 1/2 W | 705-7018-000 |
| R4 | RESISTOR | 270 | 3 W | 747-5349-000 |
| R5 | RESISTOR | 10 | 1/4 W | 705-6500-000 |
| R6 | RESISTOR | 100 | 1/2 W | 745-1310-000 |
| R7 | RESISTOR | 2 | 1 W | 747-4230-300 |
| R11 | RESISTOR | 10 | 1/2 W | 745-1268-000 |
| R12 | RESISTOR | 0.5 | 2.5 W | 746-9457-000 |
| R13 | RESISTOR | 4.7 | 1/2 W | 745-6279-000 |
| R14 | RESISTOR | 10 | 1/2 W | 745-1268-000 |
| R15 | RESISTOR | 10 | 1/2 W | 745 1268-000 |
| R16 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R17 | RESISTOR | 470 | 1/4 W | 745-0737-000 |

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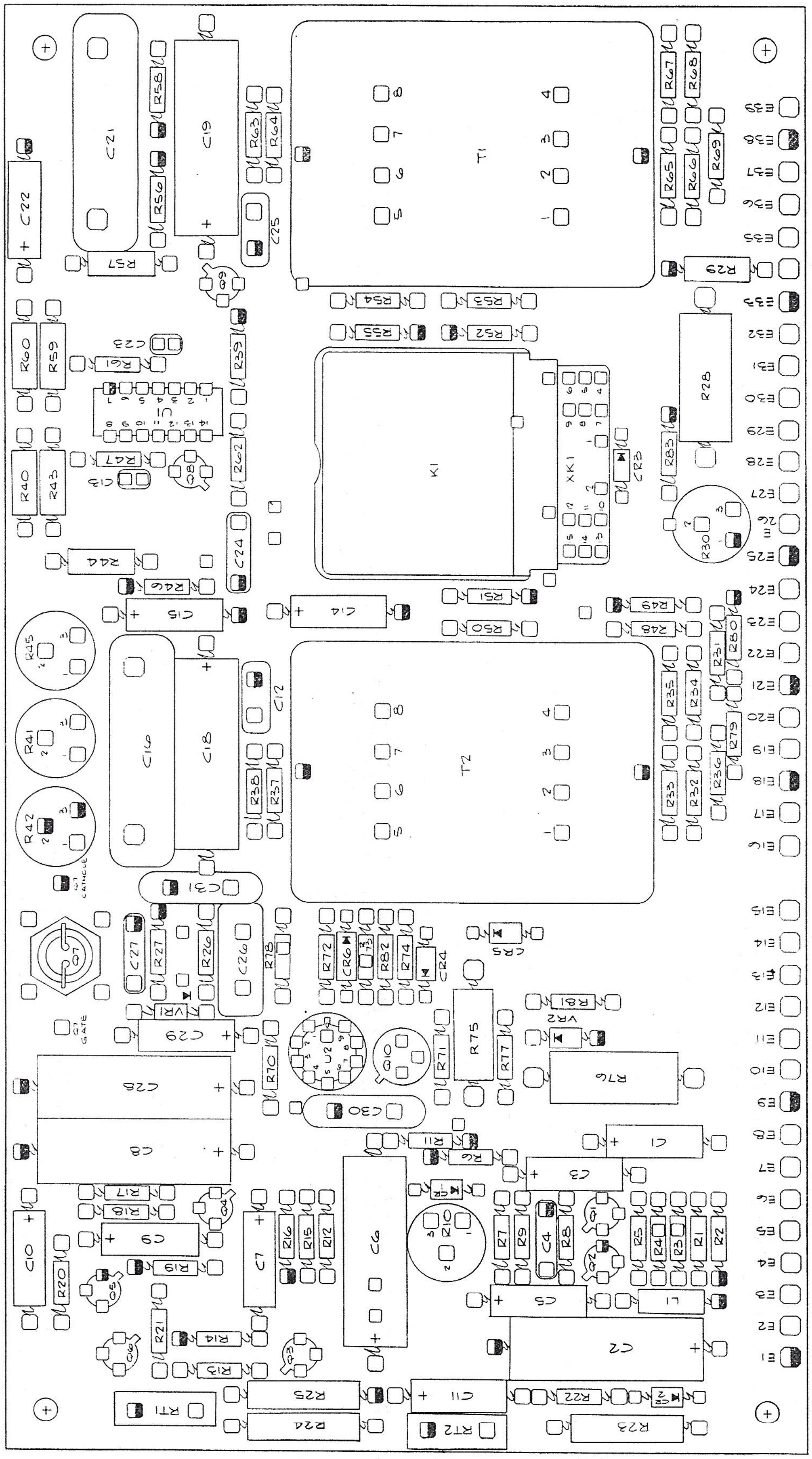

B700 3269 Rp

Figure 6-11. Audio/Mtr Regulator A6.

| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| | AUDIO/MTR REGULATOR A6 | | | 627-9773-001 |
| C1 | CAPACITOR | 22UF | 15 V | 184-9086-320 |
| C2 | CAPACITOR | 180UF | 25 V | 184-8664-000 |
| C3 | CAPACITOR | 22UF | 15 V | 184-9086-320 |
| C4 | CAPACITOR | 0.1UF | 25 V | 913-3806-000 |
| C5 | CAPACITOR | 10UF | 20 V | 184-9086-470 |
| C6 | CAPACITOR | 150UF | 30 V | 184-8673-000 |
| C7 | CAPACITOR | 22UF | 15 V | 184-9086-320 |
| C8 | CAPACITOR | 180UF | 25 V | 184-8664-000 |
| C9 | CAPACITOR | 22UF | 15 V | 184-9086-320 |
| C10 | CAPACITOR | 22UF | 15 V | 184 9086-320 |
| C11 | CAPACITOR | 10UF | 20 V | 184-9086-470 |
| C12 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C13 | CAPACITOR | 0.01UF | 50 V | 913-3279-110 |
| C14 | CAPACITOR | 22UF | 15 V | 184-9086-320 |
| C15 | CAPACITOR | 22UF | 15 V | 184 9086-320 |
| C16 | CAPACITOR | 0.030UF | 500 V | 912-3133-000 |
| C17 | NOT USED | | | |
| C18 | CAPACITOR | 180UF | 25 V | 184-8664-000 |
| C19 | CAPACITOR | 180UF | 25 V | 184 8664-000 |
| C20 | NOT USED | | | |
| C21 | CAPACITOR | 0.030UF | 500 V | 912-3133-000 |
| C22 | CAPACITOR | 22UF | 15 V | 184-9086-320 |
| C23 | CAPACITOR | 0.01UF | 50 V | 913-3279-110 |
| C24 | CAPACITOR | 1UF | 25 V | 913-3810-000 |
| C25 | CAPACITOR | 100PF | 500 V | 912-2816-000 |
| C26 | CAPACITOR | 2200PF | 500 V | 913-3025-000 |
| C27 | CAPACITOR | 1UF | 25 V | 913-3810-000 |
| C28 | CAPACITOR | 180UF | 25 V | 184-8664-000 |
| C29 | CAPACITOR | 22UF | 15 V | 184-9086-320 |
| C30 | CAPACITOR | 0.1UF | 200 V | 913-3681-000 |
| C31 | CAPACITOR | 0.1UF | 200 V | 913 3681-000 |
| CR1 | DIODE | 1N914 | | 353-2906-000 |
| CR2 | DIODE | 1N914 | | 353 2906-000 |
| CR3 | DIODE | 1N4003 | | 353-6442-030 |
| CR4 | DIODE | 1N914 | | 353-2906-000 |
| CR5 | DIODE | 1N914 | | 353 2906-000 |
| CR6 | DIODE | 1N914 | | 353-2906-000 |
| K1 | RELAY | | | 970-2420-040 |
| L1 | INDUCTOR | 6.8 MHY | | 240-1578-000 |
| Q1 | TRANSISTOR | 2N2907A | | 352-0551-013 |
| Q2 | TRANSISTOR | 2N2907A | | 352 0551-013 |
| Q3 | TRANSISTOR | 2N2907A | | 352-0551-013 |
| Q4 | TRANSISTOR | 2N2907A | | 352 0551-013 |
| Q5 | TRANSISTOR | 2N2907A | | 352-0551-013 |
| Q6 | TRANSISTOR | 2N2907A | | 352 0551-013 |
| Q7 | TRANSISTOR, SCR | 2N4168 | | 353-6485-020 |
| Q8 | TRANSISTOR | 2N2222A | | 352-0661-023 |
| Q9 | TRANSISTOR | 2N2222A | | 352 0661-023 |
| Q10 | TRANSISTOR | 2N3053 | | 352-0613-010 |
| R1 | RESISTOR | 8.2 K | 1/4 W | 745-0782-000 |
| R2 | RESISTOR | 47 K | 1/4 W | 745-0809-000 |
| R3 | RESISTOR | 1.2 K | 1/4 W | 745-0752-000 |
| R4 | RESISTOR | 82 | 1/4 W | 745-0710-000 |
| R5 | RESISTOR | 5.6 K | 1/4 W | 745-0776-000 |
| R6 | RESISTOR | 8.2 K | 1/4 W | 745-0782-000 |
| R7 | RESISTOR | 5.6 K | 1/4 W | 745-0776-000 |
| R8 | RESISTOR | 23.7 K | 1/4 W | 705-6662-000 |
| R9 | RESISTOR | 1.2 K | 1/4 W | 745-0752-000 |
| R10 | RESISTOR, VARIABLE | 100 | | 380-3761-010 |
| R11 | RESISTOR | 390 K | 1/4 W | 745-0842-000 |
| R12 | RESISTOR | 5.6 K | 1/4 W | 745-0776-000 |
| R13 | RESISTOR | 1.2 K | 1/4 W | 745-0752-000 |
| R14 | RESISTOR | 5.6 K | 1/4 W | 745-0776-000 |
| R15 | RESISTOR | 3.9 K | 1/4 W | 745-0770-000 |
| R16 | RESISTOR | 12 K | 1/4 W | 745-0788-000 |
| R17 | RESISTOR | 2.2 K | 1/4 W | 745-0761-000 |

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| SYMBOL | DESCRIPTION | | | COLLINS PART NUMBER |
|---|---|---|---|---|
| R18 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R19 | RESISTOR | 5.6 K | 1/4 W | 745-0776-000 |
| R20 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R21 | RESISTOR | 390 | 1/4 W | 745-0734-000 |
| R22 | RESISTOR | 1.5 K | 1/4 W | 745-0755-000 |
| R23 | RESISTOR | 12.1 K | 1/4 W | 705-6648-000 |
| R24 | RESISTOR | 1.78 K | 1/4 W | 705-1418-250 |
| R25 | RESISTOR | 511 | 1/4 W | 705-1417-690 |
| R26 | RESISTOR | 100 | 1/4 W | 745-0713-000 |
| R27 | RESISTOR | 220 | 1/4 W | 745-0725-000 |
| R28 | RESISTOR | 390 | 2 W | 745-5635-000 |
| R29 | RESISTOR | 100 K | 1/4 W | 745-0821-000 |
| R30 | RESISTOR, VARIABLE | 1 K | | 380 3761-040 |
| R31 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R32 | RESISTOR | 274 | 1/8 W | 705-0969-000 |
| R33 | RESISTOR | 274 | 1/8 W | 705 0969-000 |
| R34 | RESISTOR | 274 | 1/8 W | 705-0969-000 |
| R35 | RESISTOR | 274 | 1/8 W | 705 0969-000 |
| R36 | RESISTOR | 154 | 1/8 W | 705-0957-000 |
| R37 | RESISTOR | 2.7 K | 1/4 W | 745-0764-000 |
| R38 | RESISTOR | 10 K | 1/8 W | 705-1454-630 |
| R39 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R40 | RESISTOR | 2.67 K | 1/4 W | 705-1418-420 |
| R41 | RESISTOR, VARIABLE | 2.5 K | | 380-3761-050 |
| R42 | RESISTOR, VARIABLE | 100 | | 380-3761-010 |
| R43 | RESISTOR | 4.64 K | 1/4 W | 705-1418-650 |
| R44 | RESISTOR | 2.87 K | 1/4 W | 705-1418-450 |
| R45 | RESISTOR, VARIABLE | 2.5 K | | 380-3761-200 |
| R46 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R47 | RESISTOR | 33 | 1/4 W | 745-0695-000 |
| R48 | RESISTOR | 12.1 K | 1/8 W | 705-1454-650 |
| R49 | RESISTOR | 237 | 1/8 W | 705-1454-240 |
| R50 | RESISTOR | 4.22 K | 1/8 W | 705-1454-540 |
| R51 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R52 | RESISTOR | 10 K | 1/4 W | 745 0785-000 |
| R53 | RESISTOR | 4.22 K | 1/8 W | 705-1454-540 |
| R54 | RESISTOR | 12.1 K | 1/8 W | 705-1454-650 |
| R55 | RESISTOR | 237 | 1/8 W | 705-1454-240 |
| R56 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R57 | RESISTOR | 3.32 K | 1/4 W | 705-1418-510 |
| R58 | RESISTOR | 100 | 1/4 W | 745-0713-000 |
| R59 | RESISTOR | 6.81 K | 1/4 W | 705-1418-810 |
| R60 | RESISTOR | 3.32 K | 1/4 W | 705-1418-510 |
| R61 | RESISTOR | 33 | 1/4 W | 745-0695-000 |
| R62 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R63 | RESISTOR | 10 K | 1/8 W | 705-1454-630 |
| R64 | RESISTOR | 2.7 K | 1/4 W | 745-0764-000 |
| R65 | RESISTOR | 274 | 1/8 W | 705-0969-000 |
| R66 | RESISTOR | 274 | 1/8 W | 705 0969-000 |
| R67 | RESISTOR | 274 | 1/8 W | 705-0969-000 |
| R68 | RESISTOR | 274 | 1/8 W | 705 0969-000 |
| R69 | RESISTOR | 154 | 1/8 W | 705-0957-000 |
| R70 | RESISTOR | 1.5 K | 1/4 W | 745-0755-000 |
| R71 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R72 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R73 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R74 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R75 | RESISTOR | 470 | 1 W | 745-3338-000 |
| R76 | RESISTOR | 100 | 2 W | 745-5610-000 |
| R77 | RESISTOR | 1.8 K | 1/4 W | 745-0758-000 |
| R78 | RESISTOR | 100 | 1/4 W | 745-0713-000 |
| R79 | RESISTOR | 22 K | 1/4 W | 745-0797-000 |
| R80 | RESISTOR | 39 | 1/4 W | 745-0698-000 |
| R81 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| R82 | RESISTOR | 1 K | 1/4 W | 745-0749-000 |
| R83 | RESISTOR | 10 K | 1/4 W | 745-0785-000 |
| RT1 | RESISTOR, THERMAL | 1 K | 1 W | 714-1732-000 |
| RT2 | RESISTOR, THERMAL | 10 K | 1 W | 714-0182-000 |
| T1 | TRANSFORMER, AUDIO INPUT | | | 667-0187-030 |

D 2041 (9 65)

| SYMBOL | DESCRIPTION | | COLLINS PART NUMBER |
|---|---|---|---|
| T2 | TRANSFORMER, AUDIO INPUT | | 667 0187-030 |
| U1 | INTEGRATED CIRCUIT | A739C | 351-1175-010 |
| U2 | INTEGRATED CIRCUIT | uA723 | 351-1035-040 |
| VR1 | ZENER DIODE | 1N4751A | 353-6481-470 |
| VR2 | ZENER DIODE | 1N4753A | 353-6481-510 |
| XK1 | SOCKET, RELAY | | 220-0027-010 |
| XU1 | SOCKET, INTEGRATED CIRCUIT | | 220-0001-010 |
| XU2 | INSULATOR, DISC | | 352-9552-060 |

O 2041 (9 65)

Diagrams

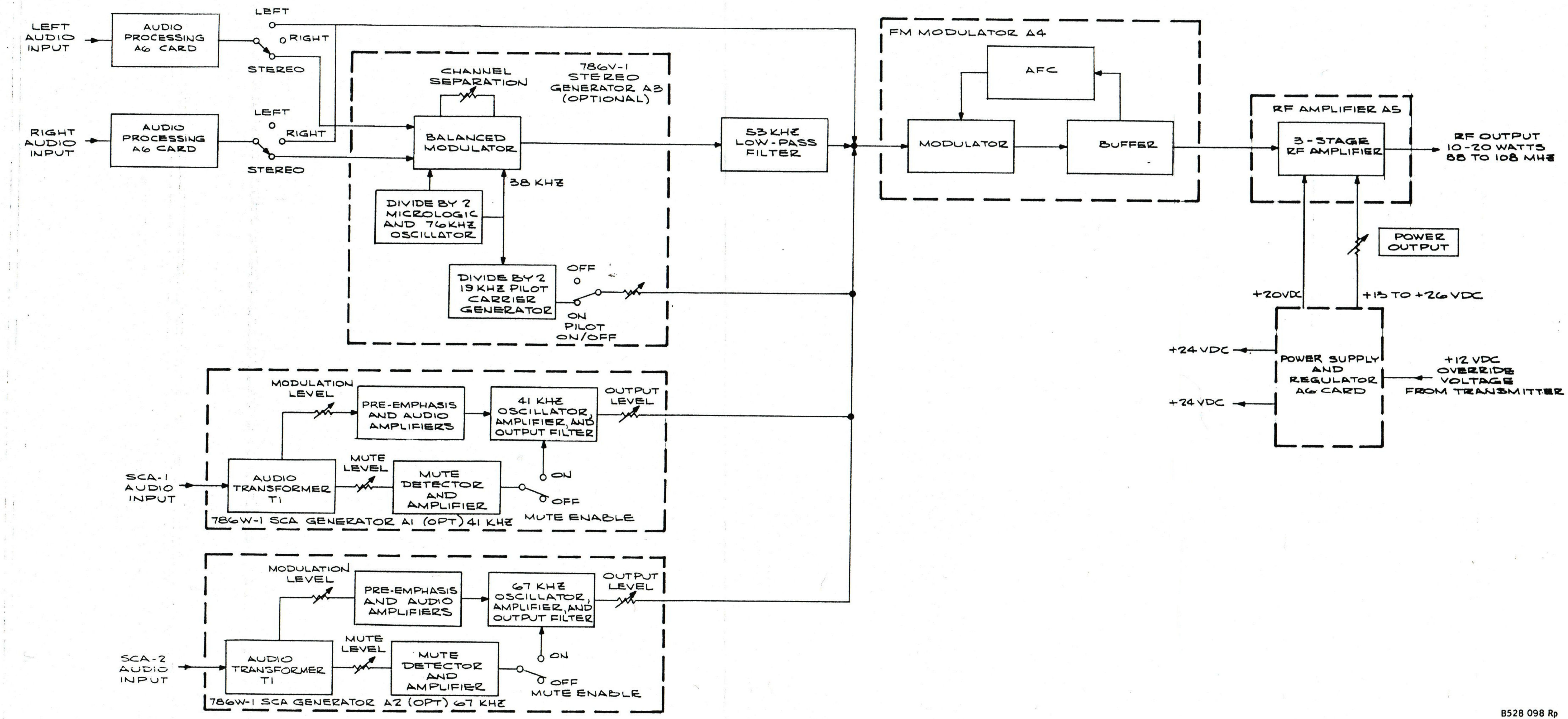





Figure 4-1. 310Z-2 FM Exciter, Simplified Block Diagram.

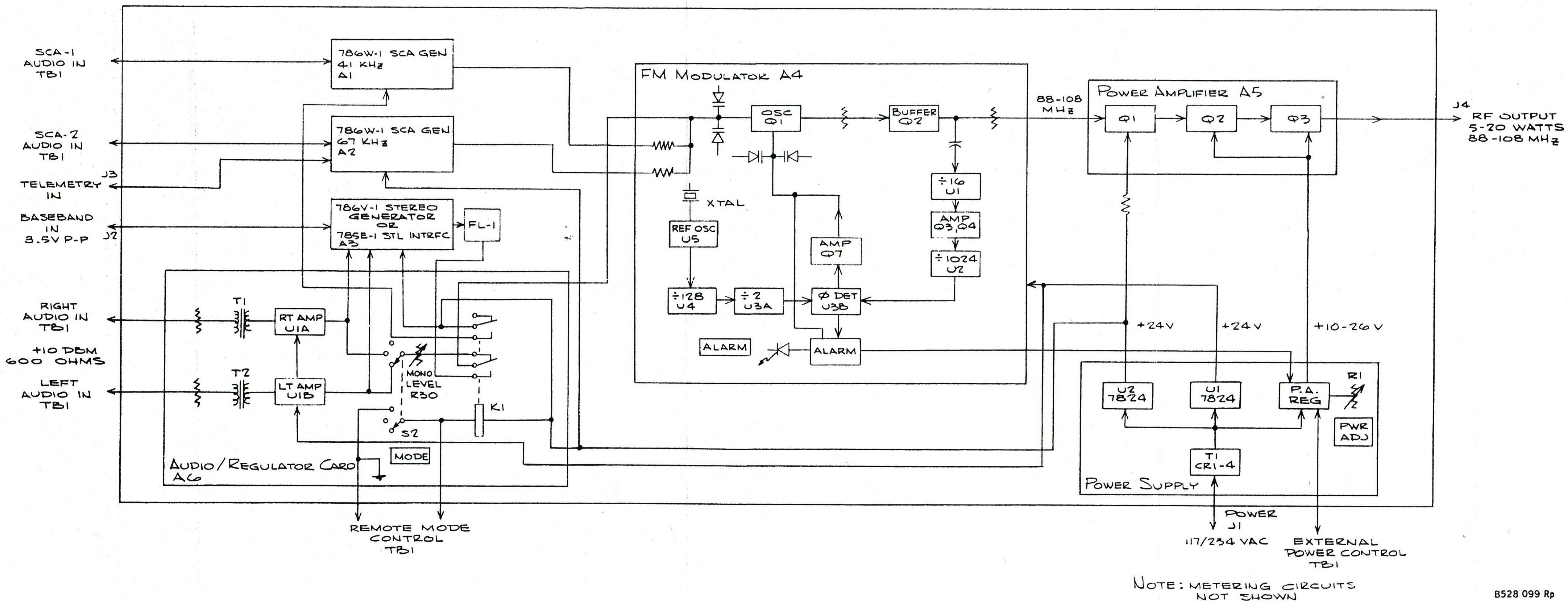





Figure 7-1. 310Z-2 FM Exciter, Detail Block Diagram.

NOTES:

1. FUNCTIONS CONTAINED IN BLOCKS DENOTE FRONT PANEL MOUNT COMPONENTS (WITH EXCEPTION OF J1 POWER CONN)
2. UNLESS OTHERWISE SPECIFIED RESISTORS ARE 1/4 WATT 10% CARBON
3. CAPACITORS C3,7-17 ARE 1000 PF, 500 V FEED-THRU TYPE

POWER CONNECTIONS

| VOLTAGE | LINE | JUMPER |
|---|---|---|
| 117 VAC | 1-5 | 1-3, 2-4 |
| 234 VAC | 1-5 | 2-3 |

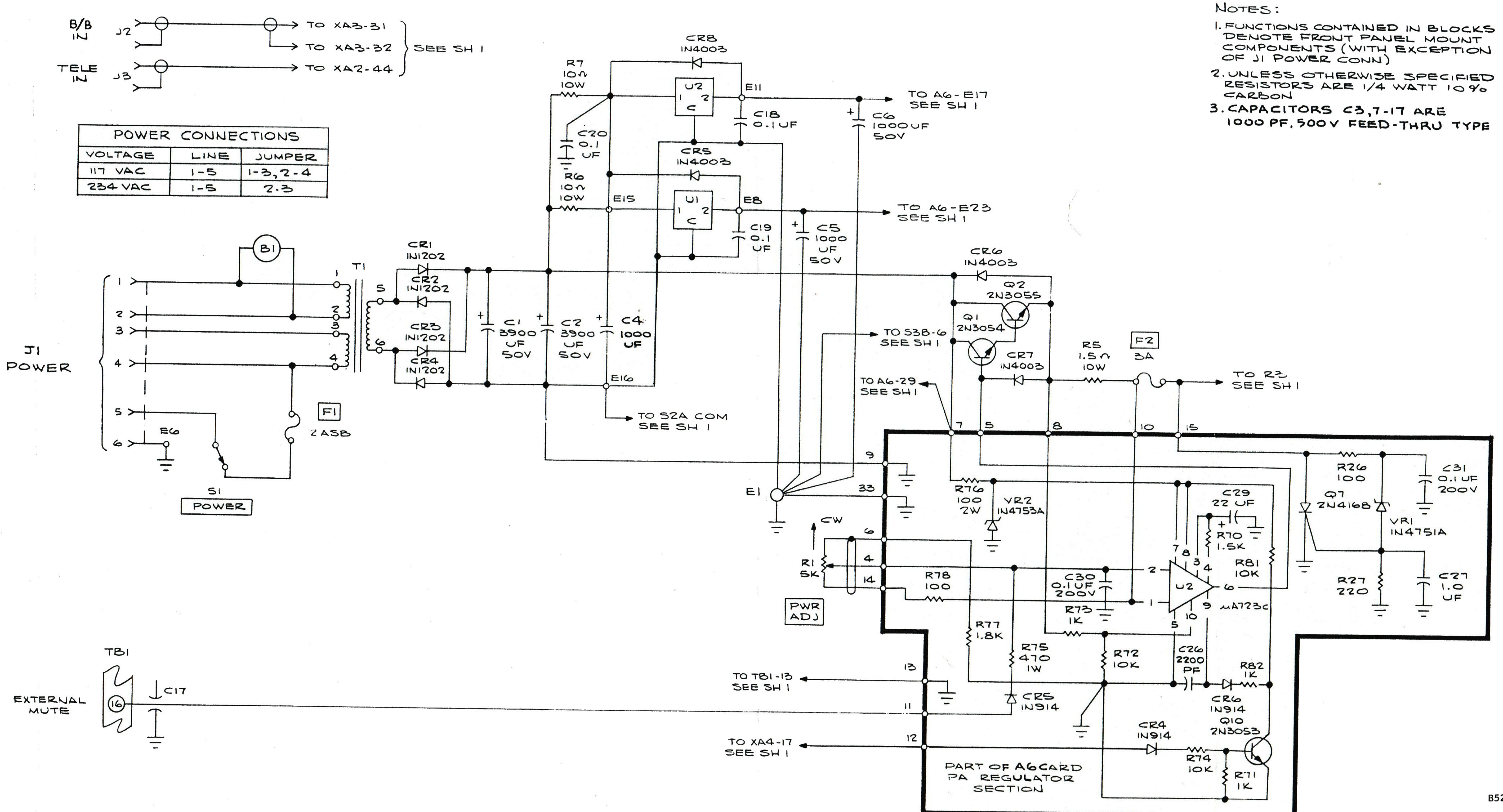





Figure 7-2. 310Z-2 FM Exciter Main Frame, Schematic Diagram (Sheet 2 of 2).

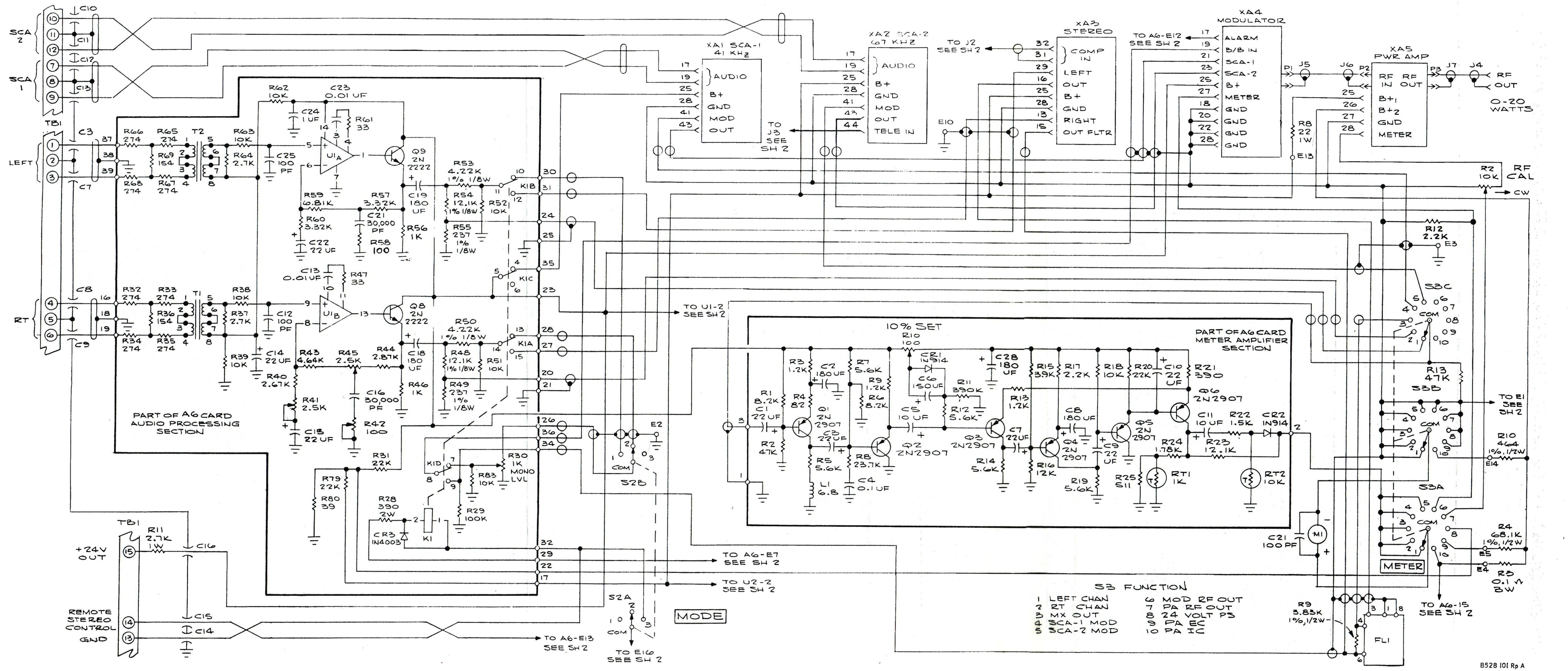
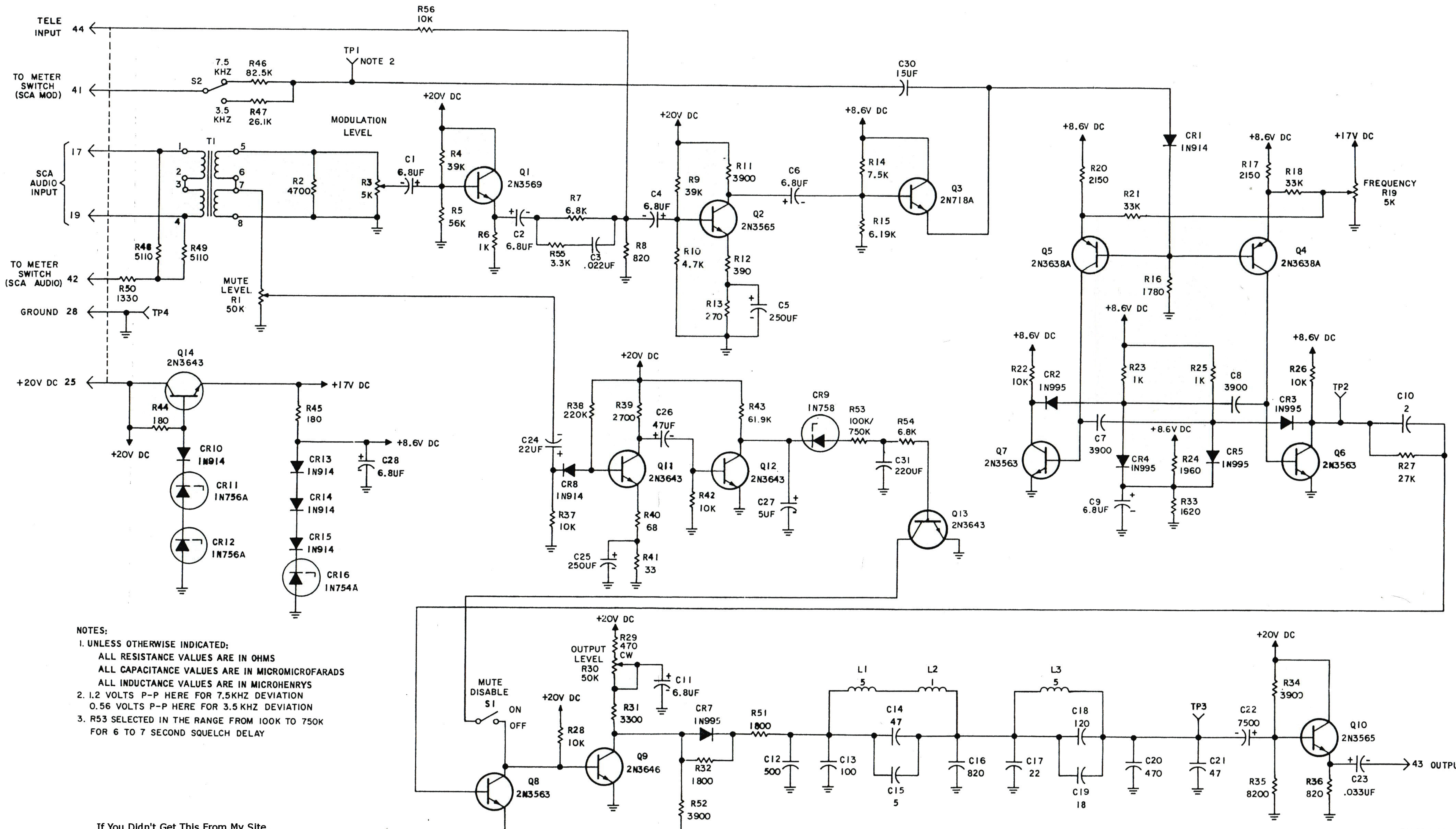





Figure 7-2. 310Z-2 FM Exciter Main Frame, Schematic Diagram (Sheet 1 of 2).




NOTES:
1. UNLESS OTHERWISE INDICATED:
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
ALL INDUCTANCE VALUES ARE IN MICROHENRYS
2. 1.2 VOLTS P-P HERE FOR 7.5KHZ DEVIATION
0.56 VOLTS P-P HERE FOR 3.5 KHZ DEVIATION
3. R53 SELECTED IN THE RANGE FROM 100K TO 750K
FOR 6 TO 7 SECOND SQUELCH DELAY



Figure 7-3. 786W-1 SCA Generators A1/A2, Schematic Diagram.

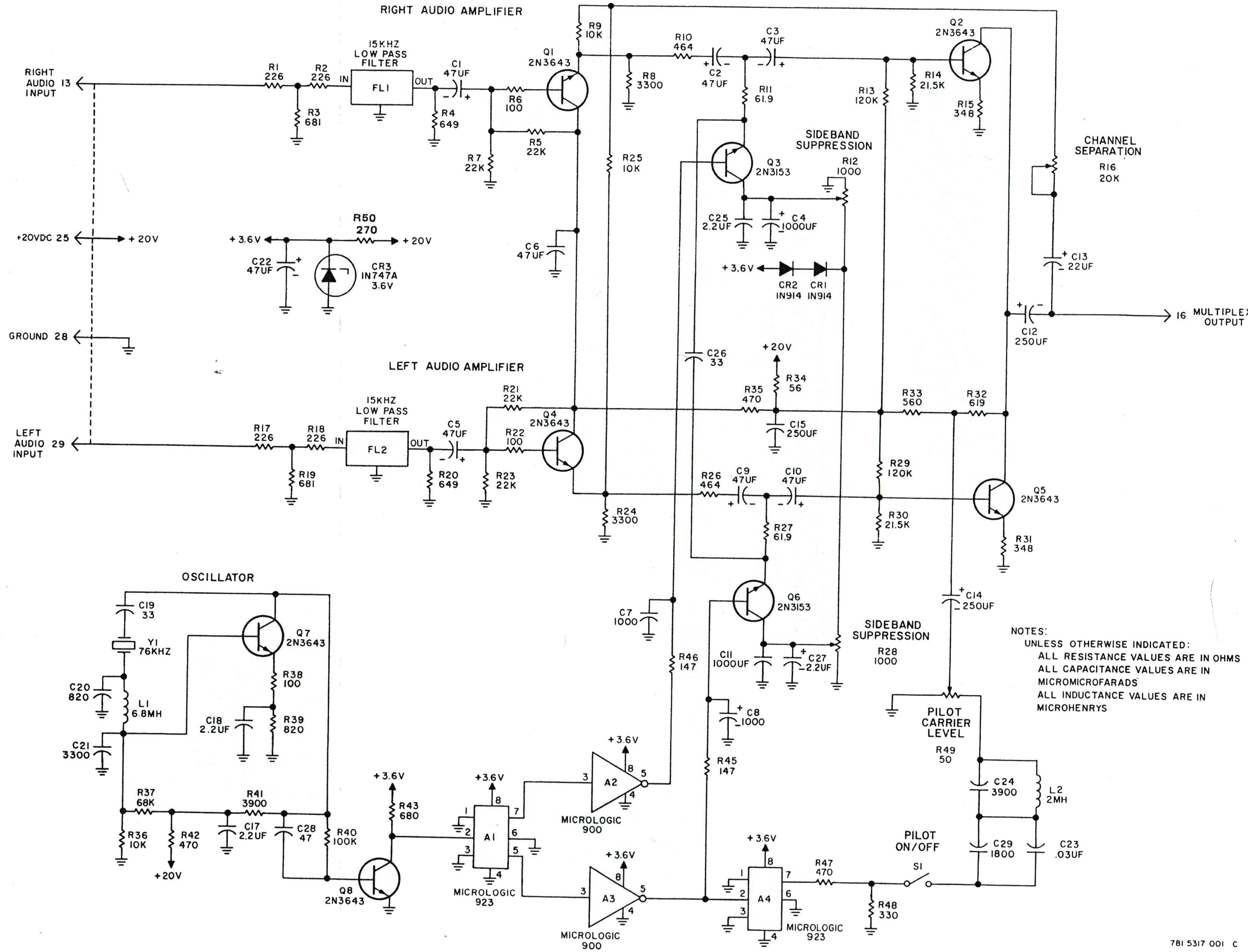
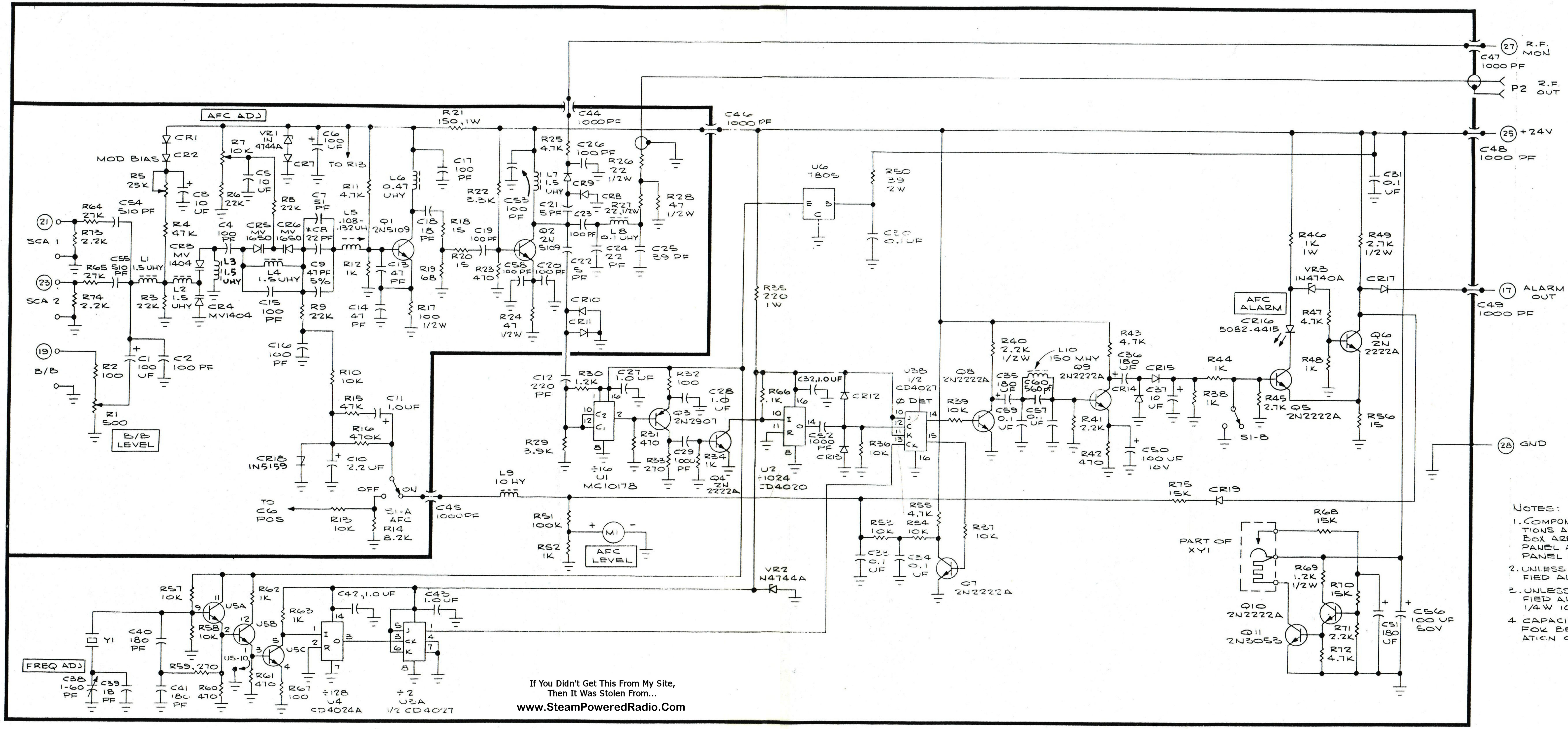





Figure 7-4. 786V-1 Stereo Generator A3, Schematic Diagram.





NOTES:

1. COMPONENTS WHOSE FUNCTIONS ARE ENCLOSED IN A BOX ARE EITHER FRONT PANEL ADJUST OR FRONT PANEL MOUNT
2. UNLESS OTHERWISE SPECIFIED ALL DIODES ARE IN914
3. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4 W 10 %
4. CAPACITOR C8 IS USED FOR BELOW 92 MHZ OPERATION ONLY

B528 I02 Rp

Figure 7-5. FM Modulator A4, Schematic Diagram.

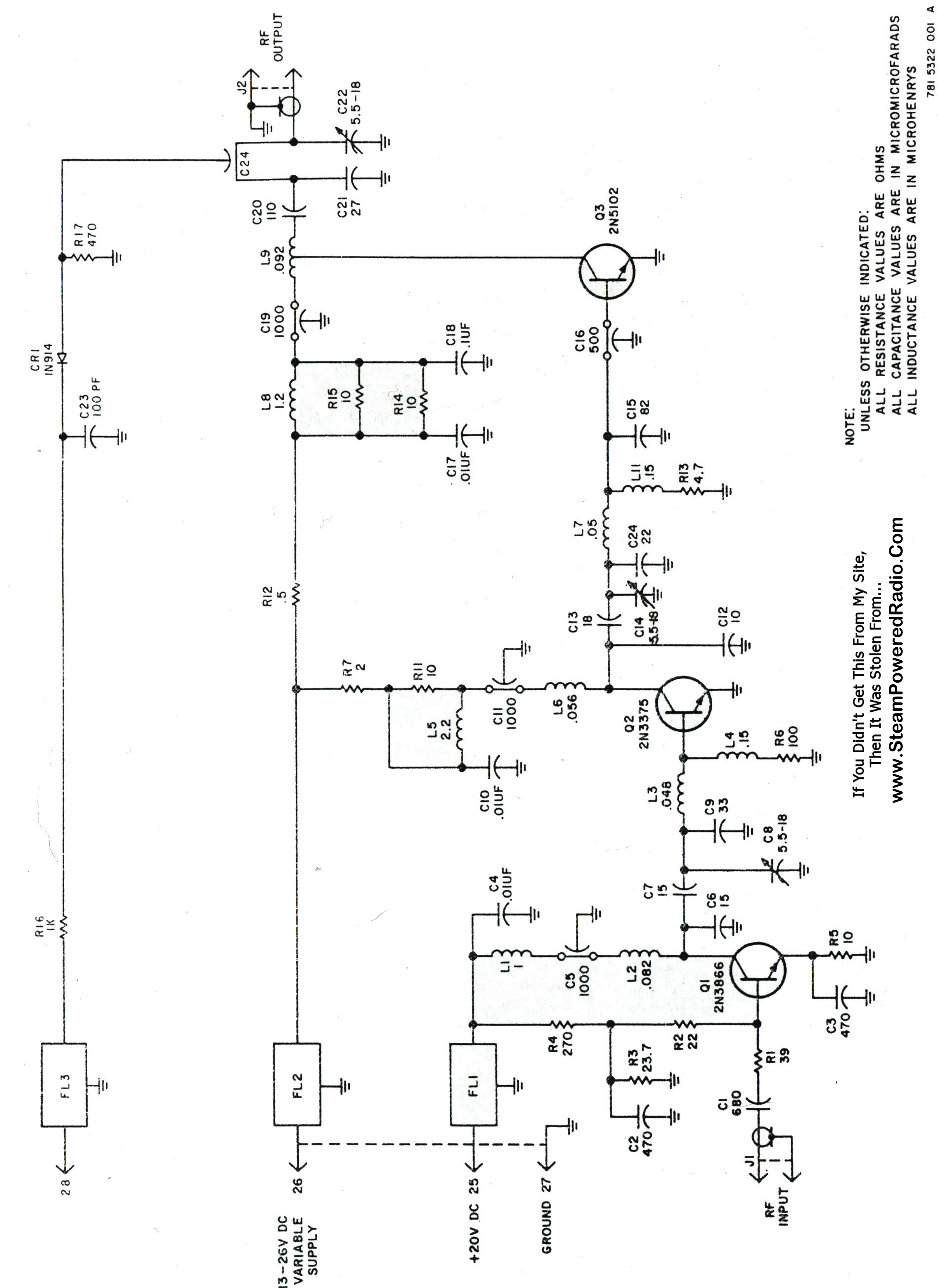



Figure 7-6. RF Amplifier A5, Schematic Diagram.

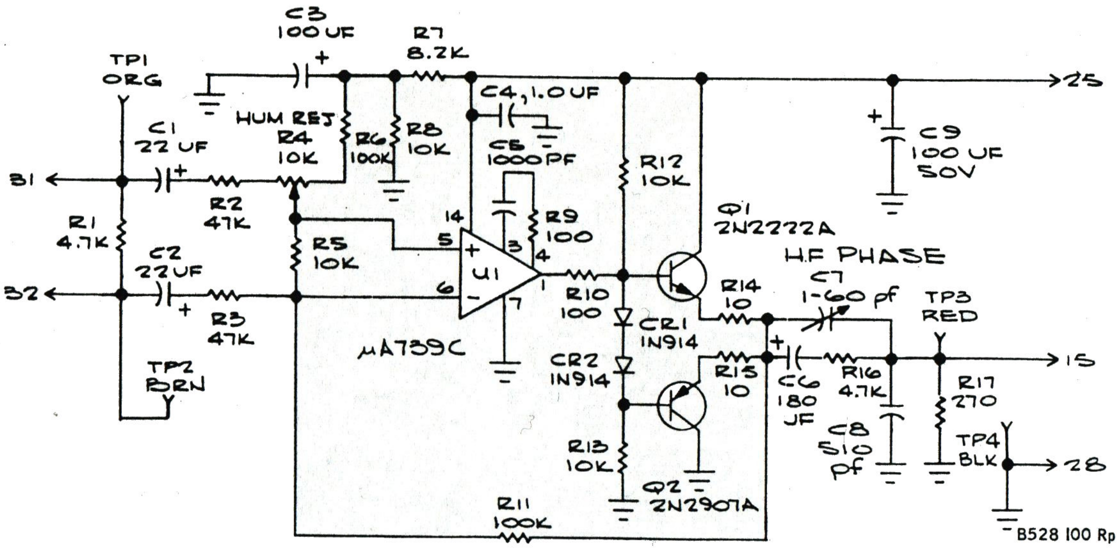



Figure 7-7. 785E-1 STL Interface Card A3, Schematic Diagram.