COLLINS

instruction book

Collins Radio Company

900F-1 67-kHz SCA Monitor

TONNE

BROADCAST EQUIPMENT GUARANTEE

The equipment described herein is sold under the following guarantee:

a. Except as set forth in paragraph b. of this section, Collins agrees with Buyer to repair or replace, without charge, any properly maintained equipment, parts or accessories which are defective as to design, materials, or workmanship and which are returned in accordance with Collins instructions by Buyer to Collins factory, transportation prepaid, provided:
   1. Notice of a claimed defect in the design, materials or workmanship of the equipment manufactured by Collins is given by Buyer to Collins within five (5) years from date of delivery, with exception of rotating machinery such as blowers, motors, and fans whereby notice must be given by Buyer to Collins within two (2) years from date of delivery.
   2. Notice of a claimed defect in the design, materials or workmanship of the following described Collins manufactured equipment is given by Buyer to Collins within two (2) years from the date of delivery:

20V-3	26U-2	81M	172G-2	216C-2	313T-4	642A-2	820F-1	830D-1	830F-2A
26J-1	42E-7	144A-1	212H-1	313T-1	356H-1	786M-1	A830-2	830E-1	830H-1A
26U-1	42E-8	172G-1	212Z-1	313T-3	564A-1	820E-1	830B-1	830F-1	830N-1A

b. The above guarantee does not extend to other equipment, accessories, tubes, lamps, fuses, and tape heads manufactured by others which are subject to only adjustment as Collins may obtain from the supplier thereof.

c. Collins further guarantees that any radio transmitter described herein will deliver full radio frequency power output at the antenna lead when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range of said apparatus.

d. The guarantee of this section is void if:
   1. The equipment malfunctions or becomes defective as a result of alterations or repairs by others than Collins or its authorized service center, or
   2. The equipment is exposed to environmental conditions more severe than specified by Collins in equipment manuals.

e. NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR INTENDED PURPOSE, SHALL BE APPLICABLE TO ANY EQUIPMENT SOLD HEREUNDER.

f. THE FOREGOING SHALL CONSTITUTE THE BUYER'S SOLE RIGHT AND REMEDY UNDER THE AGREEMENTS IN THESE SECTIONS. IN NO EVENT SHALL COLLINS HAVE ANY LIABILITY FOR CONSEQUENTIAL DAMAGES, OR FOR LOSS, DAMAGE OR EXPENSE DIRECTLY OR INDIRECTLY ARISING FROM THE USE OF THE PRODUCTS, OR ANY INABILITY TO USE THEM EITHER SEPARATELY OR IN COMBINATION WITH OTHER EQUIPMENT OR MATERIALS, OR FROM ANY OTHER CAUSE.

g. The guarantees of this section and limitations thereon will also accrue to the benefit of any purchaser of Buyer's F.C.C. license, provided:
   1. Notice of the sale of the F.C.C. license is given by Buyer to Collins in writing within thirty (30) days after the consummation of said sale; and
   2. No greater rights are granted to the purchaser of Buyer's F.C.C. license than are granted herein to Buyer.

How to Return Material or Equipment If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. (With respect to tubes we suggest that your adjustments can be speeded up if you give notice of defect directly to the tube manufacturer.) Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in the handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Customer Returned Goods, 412-023
1225 North Alma Road
Richardson, Texas 75080

INFORMATION NEEDED:

(A) Type number, name and serial number of equipment
(B) Date of delivery of equipment
(C) Date placed in service
(D) Number of hours of service
(E) Nature of trouble
(F) Cause of trouble if known
(G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
(H) Item or symbol number of same obtained from parts list or schematic
(I) Collins number (and name) of unit subassemblies involved in trouble
(J) Remarks

How to Order Replacement Parts When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable. To enable us to give you better replacement service, please be sure to give us complete information.

ADDRESS:

Collins Radio Company
Service Parts, 412-024
1225 North Alma Road
Richardson, Texas 75080

INFORMATION NEEDED:

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

1 December 1967

broadcast

COLLINS

TECHNICAL BULLETIN

COLLINS RADIO COMPANY / DALLAS, TEXAS

523-0561268-011431
22 March 1969

CHANGE NOTICE NO. 1

PUBLICATION: Instruction Book 523-0561268-001431, dated 15 March 1969

EQUIPMENT: 900F-1 67-kHz SCA Monitor

1. REASON FOR CHANGE NOTICE

This addendum provides the following:

a. Information on additional capability of equipment.
b. Instructions for connecting an external meter.

2. EQUIPMENT CHANGES

If your 900F-1 SCA Monitor was delivered with a 619-ohm resistor connected between terminals 4 and 5 of TB1, no changes are required. If this resistor is not in place, and remote monitoring capability is required, Collins Radio Company will make all necessary modifications.

3. REMOTE MONITORING CAPABILITY

If the 619-ohm resistor is in place, provisions are made for connection of an external meter. This meter will allow remote monitoring of the function selected by the front panel METER switch. The meter, CPN 458-0820-030, may be ordered from the following address:

Collins Radio Company
Service Parts, 412-024
1225 North Alma Road
Richardson, Texas 75080

4. REMOTE METER CONNECTIONS

a. Remove the 619-ohm resistor from terminals 4 and 5 of TB1.
b. Using no. 16 wire, the remote meter may be placed up to 100 feet from the monitor. The negative meter lead should be connected to terminal 4 and the positive lead to terminal 5 of TB1.

NOTE

If the remote meter is not used, or removed, a 619-ohm resistor must be connected between terminals 4 and 5 of TB1.

523-0561268-001431
15 March 1969

COLLINS

instruction book

900F-1 67-kHz SCA Monitor

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table of contents

table of contents (cont)

list of illustrations

list of tables

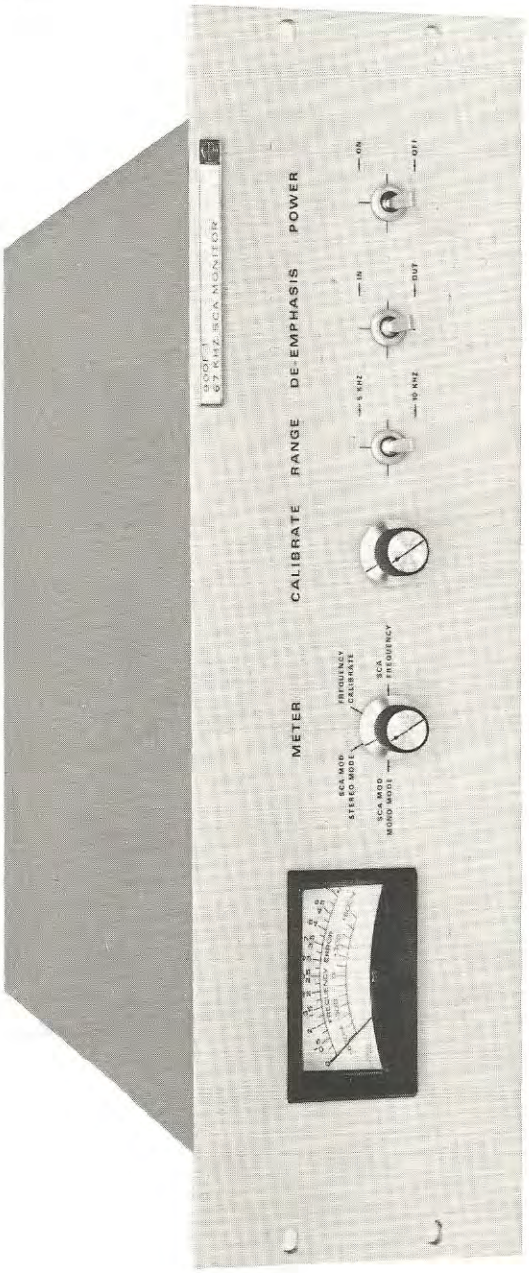

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Figure 1-1. 900F-1 67-kHz SCA Monitor.

section 1
general description

1.1 PURPOSE OF INSTRUCTION BOOK

This instruction book contains information for the installation, adjustment, operation, and maintenance of the 900F-1 67-kHz SCA Monitor (figure 1-1).

1.2 PURPOSE OF EQUIPMENT

The 900F-1 67-kHz SCA Monitor, when used with the 900C-1/2/3 FM Modulation Monitor, allows monitoring of deviation and average frequency of a 67-kHz subcarrier authorization (SCA) subcarrier. The 900F-1 also provides an audio output for distortion measurements.

1.3 PHYSICAL DESCRIPTION

The 900F-1 is housed in a metal case 5-1/4 inches high, 19 inches wide, and 15 inches deep and weighs approximately 15 pounds. The front panel supports an enclosed housing for the printed circuit card and power supply that are hard-wired into the assembly. The rf input and outputs for external monitoring are located on the rear panel.

1.4 FUNCTIONAL DESCRIPTION

The input signal for the 900F-1 consists of baseband audio recovered from the first demodulation process in the 900C-1, 2, or 3 FM Modulation Monitor. Frequencies in the 50-Hz to 75-kHz range are present.

Refer to figure 1-2. The input amplifier amplifies the composite signal and drives a bandpass filter that passes only the SCA subchannel information. This filter may be bypassed by the METER switch.

After filtering, the SCA signal is further amplified and then limited. The resulting signal drives an integrated-circuit, one-shot multivibrator. The output of the one-shot is fed into a muting switch circuit consisting of three integrated circuits. The muting switch prevents transients due to the loss of the SCA carrier. The one-shot output is also fed to a carrier sense circuit that senses carrier presence.

A similar one-shot multivibrator is driven by a 67-kHz reference signal obtained from a crystal oscillator. The resulting signal, along with the SCA signal, is fed into both sides of a low-pass filter that derives a difference between the incoming SCA signal and the reference signal. Both ac and dc information are present, with the dc being used to indicate average SCA carrier frequency, and the ac used to drive the modulation monitoring circuits. The one-shot multivibrator driven by the incoming SCA signal and the low-pass filter make up a pulse-counting FM demodulator.

The dc output, proportional to average frequency error, is amplified by an integrated circuit differential amplifier and drives the front panel meter when the METER switch is set to the SCA FREQUENCY position. Frequency calibration is provided by switching the crystal reference to both demodulators simultaneously and zeroing the meter with the front panel CALIBRATE control.

The ac output of the low-pass filter is amplified by a single-ended amplifier and drives a peak reading voltmeter circuit. The front panel meter is switched to the output of this voltmeter for modulation monitoring.

The amplified audio signal is delivered to an output terminal through switchable deemphasis and an output buffer amplifier.

An indication of carrier presence is also brought out to an output terminal. This output may be used to drive a subcarrier presence indicator, if desired.

1.5 TECHNICAL CHARACTERISTICS

Frequency Range:
67 kHz ±500 Hz

Number of Channels and How Selected:
One, fixed-tuned

Input Impedance:
Greater than 3,000 ohms resistance and paralleled by not more than 100-pf capacitance

Input Signal Required:
10 mv peak-to-peak minimum

Oscillator, Frequency and Type:
One 67-kHz crystal oscillator

Modulation Meter Sensitivity:
5 to 10 kHz full scale

Modulation Meter Accuracy:
±1 kHz for modulating frequencies between 50 Hz and 5 kHz and peak deviations up to 10 kHz with the input filter switched out (METER switch set to SCA MODULATION MONAURAL MODE)
±1 kHz for modulating frequencies between 50 Hz and 5 kHz and peak deviations up to 5 kHz with the input filter switched in (METER switch set to SCA MODULATION STEREO (MODE)

Frequency Meter Sensitivity:
±600 Hz full-scale deflection

Frequency Meter Accuracy:
±50 Hz (Must be calibrated before reading.)

Total Distortion:
1% maximum with METER switch set to SCA MODULATION MONAURAL MODE and for peak deviations up to 10 kHz
10% maximum with METER switch set to SCA MODULATION STEREO MODE and for peak deviations up to 5 kHz

Signal/Crosstalk Ratio:
Combined crosstalk from stereo or monaural modulation into SCA audio output with an SCA injection level of 10% shall be at least 50 db below 5-kHz peak deviation

Residual Noise Level:
60 db below 5-kHz peak deviation

Ambient Temperature Range:
0° to +55°C

Ambient Humidity Range:
0 to 95%

Altitude:
Up to 10,000 feet

Shock and Vibration Conditions:
Normal handling and transportation

Power Source:
117 vac ±10%, 50/60 Hz, single phase, 40 watts maximum

Type of Service:
Continuous

Audio Output Level:
10 ±2 dbm into 600-ohm load at either 5- or 10-kHz peak deviation (switched simultaneously with meter sensitivity)

Fuse:
Equipped with a 1/2-ampere, slo-blo, post-mounted fuse

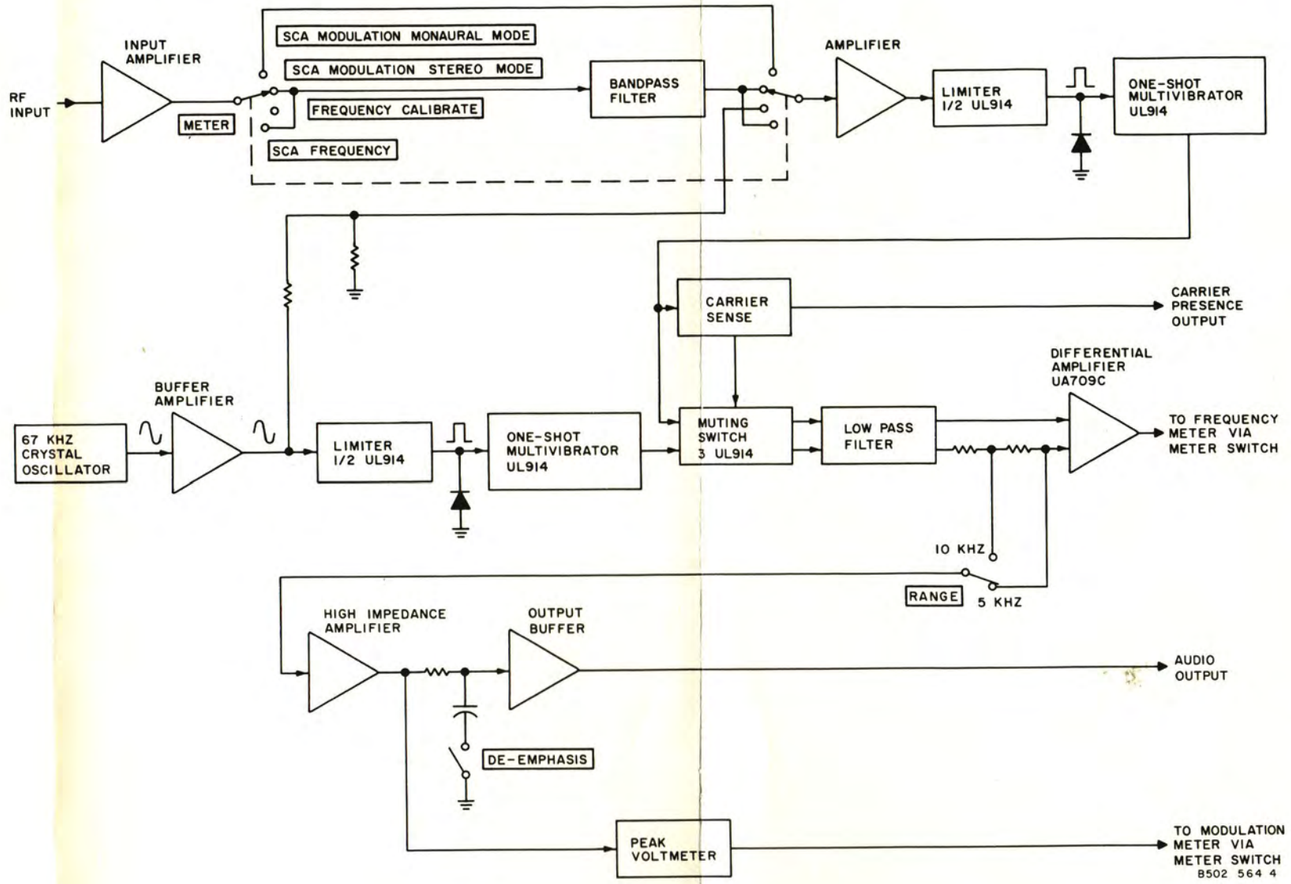

Figure 1-2. 900F-1 67-kHz SCA Monitor, Functional Block Diagram.

section 2
installation and adjustment

2.1 UNPACKING AND INSPECTING THE EQUIPMENT

Remove all packing material and carefully lift the unit from the package. Check the equipment against the packing slips. Visually inspect the unit for damaged or missing components. Check for proper operation of 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.

2.2 INSTALLATION

2.2.1 Mounting

Mount the 900F-1 in a standard 19-inch rack or cabinet and secure.

2.2.2 Connections

Before connecting the 900F-1 primary power and external inputs and outputs, set POWER switch to OFF.

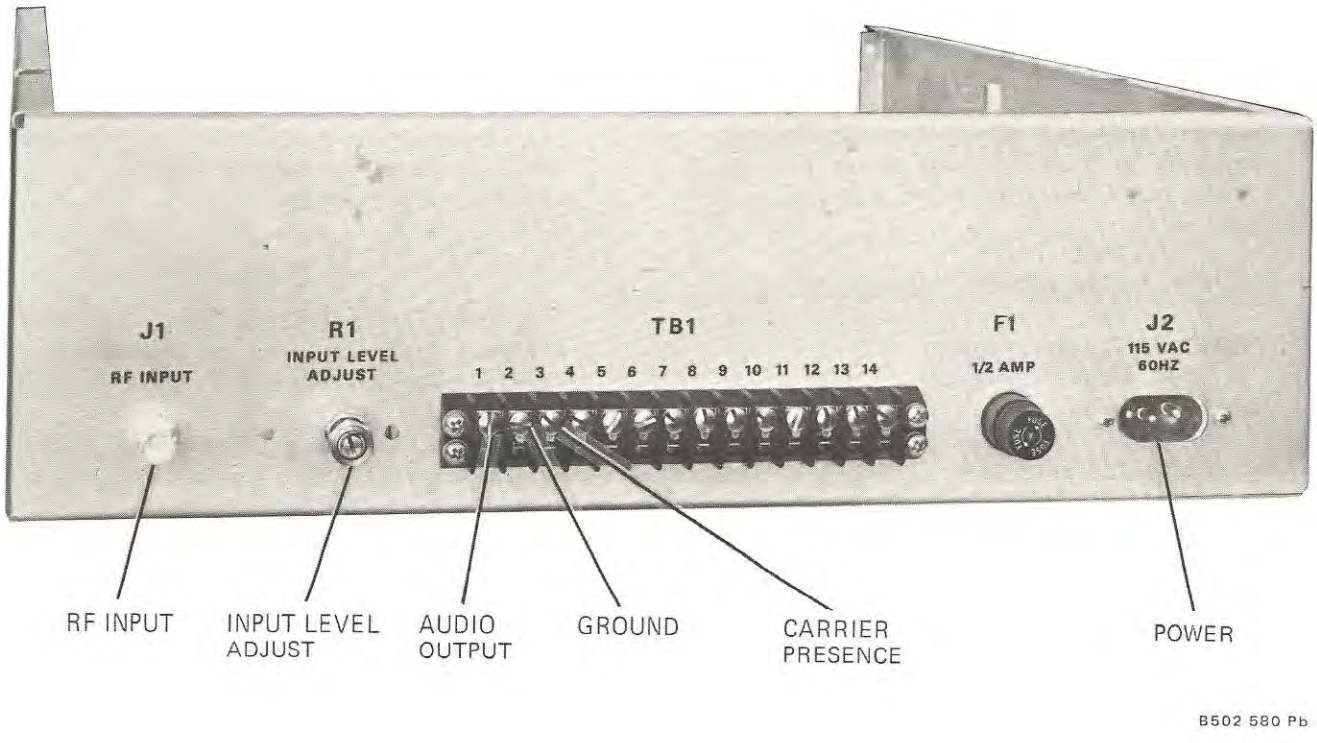

Figure 2-1. Rear Panel Connections.

2.2.2.1 Audio Output and Carrier Presence Connections

Connect the desired signal outputs and alarms to the terminal block on rear panel of the 900F-1 (figure 2-1) as listed in table 2-1. (Refer to paragraph 1.5 for audio output characteristics.)

2.2.2.2 Remote Carrier Presence Connection

Provision is made for connection of a remote SCA carrier presence indicator. Carrier absence is indicated by a positive 0- to 5-vdc level across 5K on pin 3 of terminal block 1.

2.2.2.3 RF Cable and Primary Power Connections

Connect the 900F-1 power cord to a 115-vac, 50/60 Hz source. Obtain the SCA input signal from the wide-band output of the 900C-1/2/3 FM Modulation Monitor.

2.2.3 Installation Checks

a. Connect the wide-band output of the 900C-1/2/3 FM Modulation Monitor to the rf input (J1) of the 900F-1 67-kHz SCA Monitor.
b. Connect earphones or ac vtvm to audio output terminals of TB1 (500-ohm minimum load).
c. Set the panel controls to the following positions:

   METER to FREQUENCY CALIBRATE

   CALIBRATE to midposition

   RANGE to 5 kHz

   DE-EMPHASIS to IN

Table 2-1. Audio Output and Carrier Indicator Connections.

SIGNAL NOMENCLATURE	THERMAL NO.
Audio output	1
Ground	2
Carrier presence	3

   INPUT LEVEL ADJUST (back panel) fully counterclockwise

d. Set POWER switch to ON.
e. Adjust the SCA injection level to the percentage used in normal operation.
f. Starting with the INPUT LEVEL ADJUST control fully counterclockwise, gradually rotate it clockwise until threshold is noted by a sudden increase in audio noise level. Continue clockwise rotation, noting that the noise level decreases as the input level is increased. Stop rotating the control at the point where further rotation causes no further decrease in audio noise voltage.

   Note

   The 900F-1 input level must be readjusted each time the SCA injection level is changed.

g. Disconnect earphones or ac vtvm. Refer to section 3 for operating instructions.

section 3
operation

3.1 PANEL CONTROLS AND INDICATORS

This section locates, illustrates, and describes the function of each front panel control (figure 3-1 and table 3-1).

3.2 OPERATING INSTRUCTIONS

To operate the 900F-1, set POWER switch to ON. Calibrate the 900F-1 for frequency monitoring by setting the METER switch to FREQUENCY CALIBRATE and adjusting the CALIBRATE control for an indicated frequency error of zero.

3.3 USE AS 67-kHz SCA FREQUENCY MONITOR

a. Calibrate the 900F-1 per paragraph 3.2.
b. Set METER switch to SCA FREQUENCY.
c. Frequency error may now be read directly from the panel meter.

3.4 USE AS SCA MODULATION MONITOR

a. If stereo programming is being used, set METER switch to SCA MODULATION STEREO MODE. If monaural programming is used, set METER switch to SCA MODULATION MONAURAL MODE.
b. Set RANGE switch for most accurate meter indication.
c. Peak SCA deviation may now be read directly from the front panel meter.

3.5 SCA FREQUENCY ADJUSTMENT

If the SCA generator frequency drifts, it may be adjusted as follows:

a. Calibrate the 900F-1 per paragraph 3.2.
b. Set METER switch to SCA FREQUENCY.

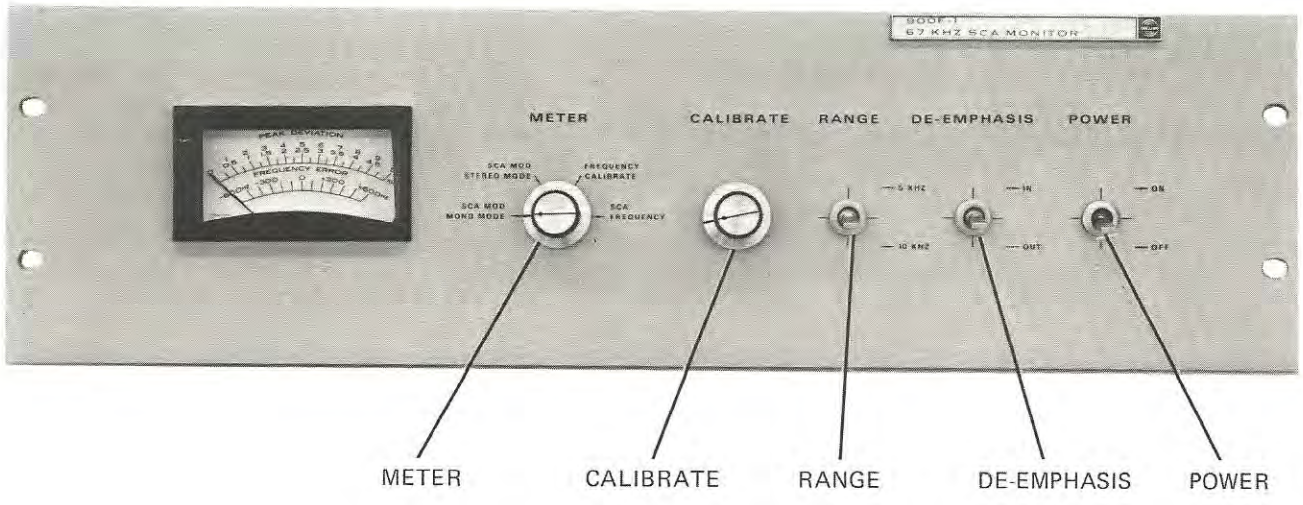

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Figure 3-1. Panel Controls and Indicators.

c. Observe meter and adjust SCA generator for an indicated frequency error of zero.

3.6 DISTORTION MEASUREMENTS

The 900F-1 may be used for distortion measurements. For evaluation of distortion in SCA audio circuits, perform the following steps.

a. Remove stereo programming.
b. Replace SCA programming with a 1-kHz audio signal.
c. Set METER switch to SCA MODULATION MONAURAL MODE.
d. The audio output of the monitor may now be evaluated by standard distortion measurement techniques.

Table 3-1. Controls and Indicators.

NAME	PANEL MARKING	FUNCTION
Power switch	POWER ON/OFF	Turns monitor on and off.
Deemphasis network switching	DE-EMPHASIS IN/OUT	Places a standard deemphasis network in the audio circuit.
Meter range switch	RANGE 10KHZ/5KHZ	Selects full-scale deflection range of meter for more accurate measurements of deviation.
Calibration control	CALIBRATION	Calibrates meter for SCA frequency error measurements.
Meter function switch	METER	Selects desired monitor function.
	SCA MODULATION STEREO MODE	Monitors amount of peak deviation during stereo transmission.
	SCA MODULATION MONAURAL MODE	Monitors amount of peak deviation during monaural transmission.
	FREQUENCY CALIBRATE	Used in conjunction with CALIBRATE control for calibration of 900F-1.
	SCA FREQUENCY	Provides indication of SCA input carrier and frequency.
Input level adjustment	INPUT LEVEL ADJUST	Provides control over amount of wide-band input signal supplied to the monitor circuits.

section 4
principles of operation

4.1 GENERAL

The 900F-1 is an FM monitor capable of monitoring and displaying the modulation characteristics and carrier frequency error of a 67-kHz SCA subcarrier. A meter is provided to display either frequency error (from the desired frequency) or peak frequency deviation (modulation level). A 600-ohm audio output is provided for monitoring or distortion measurements. An output to indicate carrier presence is also provided.

4.2 PRINCIPLES OF OPERATION

The following paragraphs are keyed to the attached overall schematic diagram.

4.2.1 Input Amplifier

The input amplifier has a voltage gain of 8 db. It provides the small amount of gain required and gives isolation between the input and the front-end filters in the monitor. The amplifier is tuned to the SCA carrier frequency of 67 kHz by L1 and C4 in the emitter circuit of Q2. Decoupling is provided from both the -12- and +20-volt power supplies.

4.2.2 Front-End Filters

The output of the input amplifier drives either a sharp cutoff bandpass filter centered at 67 kHz or a high-pass filter with a cutoff frequency of 30 kHz, depending on the position of S1. The bandpass filter provides subchannel attenuation when the 900F-1 input signal contains the 23- to 53-kHz stereo subchannel. If the stereo subchannel is not present at the input, S1 may be set to the SCA MOD MONO MODE position. Setting S1 inserts the 3-pole, high-pass filter into the signal path. The filter rejects main channel monaural information at frequencies below 15 kHz.

4.2.3 Amplifier-Limiters

After filtering, the signal is amplified by Q4. Amplifier Q4 has a gain of 30 db and is tuned to 67 kHz by L7 and C20. Decoupling is provided from both power supplies. Limiter Q5 partially squares the waveform. Final wave shaping is done in NOR gate A1, which drives a wave-shaping network consisting of CR18 and C31. The NOR gate output triggers one-shot multivibrator A1. The output of this multivibrator consists of a series of pulses with constant width and spacing dependent on the incoming frequency.

4.2.4 Reference Channel

The reference oscillator (Q3, Y1, C26, C27, and L8) generates a 67-kHz signal that is compared with the SCA carrier to determine the frequency error. The oscillator output drives transistor Q6, a buffer-limiter. A4 further amplifies and limits the signal, thus providing a square-wave output. This output passes through a wave-shaping network consisting of CR19 and C32, which triggers a one-shot multivibrator. The output of this multivibrator and the SCA carrier includes two pulse trains, with the frequency difference detected in subsequent circuits. In addition, the audio is recovered from the output of the signal multivibrator. Setting the meter switch to CALIBRATE connects the output of buffer-limiter Q6 to both the reference channel and signal channel. The pulse widths of the multivibrators in both channels can be varied by R32 and R36. In addition, R33 in the reference channel provides a fine adjustment of pulse width. This is a front panel control and is used to center the meter when calibrating the 900F-1 to read frequency error.

4.2.5 Squelch Circuit

The squelch circuit consists of two parts: a carrier sensing circuit consisting of Q7, Q8, and Q9, and a series of UL914 gates that switch the reference channel into the signal channel when the carrier is removed. The squelch prevents damage to the meter when the carrier is removed and eliminates the loud "pop" that would appear at the audio output. With no carrier present, Q7 is off, Q8 is on, and Q9 is off. Capacitor C45 is charged to a positive voltage. When the carrier is applied, the pulse train from the multivibrator causes Q7 to conduct, discharging C45. The voltage change

across C45 causes Q8 and Q9 to change states; Q8 turns off and Q9 turns on. As long as the pulses continue, Q7 will conduct until the voltage across C45 reaches a value large enough to cause Q8 and Q9 to change states. When the carrier is removed, C45 charges to a value great enough to turn on Q8 and turn off Q9. The sensing circuit stays in this condition until the carrier returns. When the carrier returns, the sensing circuit changes, after a time delay determined by C47 and R45. The time delay makes the circuit immune to erratic inputs.

The sensing circuit produces a control voltage at CR15. This control signal is applied through R41 and R42 to A1 and A6. The control signal also appears on the back panel terminal strip as a subcarrier presence alarm. In A1 the control signal is gated with the output of the signal multivibrator. In A6 it undergoes a polarity reversal and is then applied to A4, where it is gated with the output of the reference multivibrator. When the SCA carrier is present, the control voltage from the sensing circuit allows the signal to appear at the output of A1, where it is applied to A6. The control signal polarity reversal through A6 causes the reference signal at the input of A4 not to appear at the output of A4. As a result, the signal appears at the output of A6. When the carrier is absent, there is no output of A1, but the reference does appear at the output of A4 and therefore at the output of A6. Gate A3 is used as a driver for the low-pass filter and produces an identical path for the reference signal, which is not gated.

4.2.6 Audio and Metering Circuits

After passing through the squelch circuits, the reference channel and signal channel are applied to the low-pass filter. The output of the low-pass filter contains a dc voltage representing the difference in frequency between the SCA subcarrier and the reference. It also contains audio that was present on the subcarrier. The low-pass filter passes frequencies below 5.5 kHz.

The dc voltage at the filter output is amplified by the UA709C integrated circuit amplifier that is used as a differential amplifier. The dc error voltage present at the input to this amplifier is 7 mv/kHz or 8.2 mv/1.2 kHz. The gain of this amplifier is 34 db. Capacitors C55 and C56 and resistor R69 provide frequency compensation for the amplifier. A voltage divider consisting of R94 and R95 provides a positive supply of about 15 volts for the amplifier. The negative voltage required is taken directly from the -12-volt supply. The output of the amplifier is monitored through S1B by the meter.

The RANGE switch selects one of two possible inputs to the audio amplifier. The audio amplifier consists of Q10, Q11, Q12, and Q13. It has a voltage gain of 40 db. The amplified audio is delivered to the audio output terminals through a buffer stage composed of Q14 and Q15. Switchable 75-ms deemphasis is by R63 and C50. The gain of the amplifier can be varied by R56 in the emitter circuit of Q10. The peak voltmeter is driven by the audio amplifier at a point not affected by deemphasis, and consists of another UA709C integrated circuit used as a peak detector. A voltage representing the peaks of the audio signal appears across capacitor C61. This voltage is applied to the meter through R80, a meter speedup circuit consisting of C62, R81, and CR16, and switch S1B.

4.2.7 Power Supply

Dc power for circuit operation is supplied from a self-contained power supply. Power transformer T1 provides +20 and +3.6 volts dc. Diodes CR8 and CR9 form a full-wave rectifier circuit. R82 prevents damage to the diodes due to high initial charging current of the filter capacitors. After filtering, the dc flows through current-limiting resistors R85 and R89, which establish the reference currents for CR12 and CR14 respectively. Cr12, a 20-volt zener diode, regulates the +20-volt dc supply. CR14, a 3.6-volt zener diode, regulates the +3.6-volt dc supply.

Transformer terminals 6, 7, and 8 supply the ac voltage for the negative 12-volt dc power supply. The rectified and filtered negative dc voltage is regulated by CR13, a 12-volt zener diode.

section 5
maintenance

5.1 GENERAL

The following paragraphs contain maintenance procedures for the 900F-1 67-kHz SCA Monitor. Maintenance personnel should become familiar with the principles of operation before attempting to service the 900F-1.

5.2 PREVENTIVE MAINTENANCE

Many electronic equipment malfunctions are caused by accumulated dirt or corrosion. Inspect the equipment at regular intervals, depending upon environmental conditions. Remove the 900F-1 from its enclosure and use a soft brush and a low-pressure air hose or vacuum cleaner to remove dirt and lint. The low-pressure air should be dry and oil-free. Inspect all metal parts for rust, corrosion, and general deterioration. Check wiring and components for signs of overheating, and check the power connector and terminal strip on the rear of the unit for broken or loose pins and terminals. Check all operating controls for smoothness of operation. In addition, check all connections and tighten any nuts, bolts, or screws that are loose.

5.3 SPARE PARTS

Spare parts may be ordered from the following address:

Collins Radio Company
Service Parts Department
1225 North Alma Road
Richardson, Texas 75080

5.4 RECOMMENDED TEST EQUIPMENT

The test equipment recommended for trouble analysis and adjustment procedures of the 900F-1 is listed in table 5-1. Test equipment having characteristics equivalent to those listed may be used.

5.5 TROUBLESHOOTING

Before starting troubleshooting, be sure the 900F-1 is actually defective. Check the input level adjustment and operation of controls. A little time spent here could save a lot of trouble.

Troubleshooting procedure for the 900F-1 consists of isolating the trouble to a stage and then making resistance and/or voltage measurements until the trouble source is found. Test points are assigned in various locations to aid the technician in trouble isolation. Table 5-2 lists the voltages measured and the test equipment used for each measurement. These voltages are typical and do not represent absolute values. Other 900F-1's may contain voltages that vary slightly from the values given with no loss of performance.

Figure 5-1 shows the expected waveforms at various points throughout the 900F-1. Only significant waveforms are given.

5.5.1 Preliminary Adjustments

Perform the following steps to prepare the 900F-1 for troubleshooting.

a. Remove the SCA programming and replace with a 1-kHz audio signal.
b. Adjust INPUT LEVEL ADJUST (rear panel) fully clockwise.
c. Terminate audio output (rear panel) with 619 ohms.
d. Position the 900F-1 controls as follows:

   Power ON/OFF to ON

   DE-EMPHASIS IN/OUT to OUT

   CALIBRATION fully clockwise

   METER to SCA FREQUENCY

5.5.2 Troubleshooting Procedure

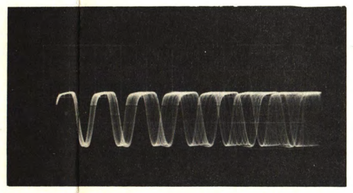
Using the schematic diagram and figure 6-3, perform the measurements listed in table 5-2. Once the trouble is located to a particular stage, use the HP-410B as an ohmmeter to locate the defective component. After a repair is made, check the

Table 5-1. Recommended Test Equipment.

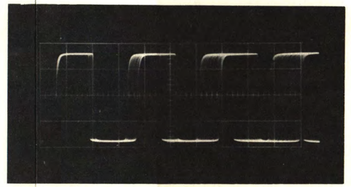
EQUIPMENT	MANUFACTURER AND TYPE NO.
SCA generator card (786W-1)	Collins 772-5338-001 (used in 310Z-1)
Frequency counter	Hewlett-Packard 5245L
Oscilloscope	Hewlett-Packard 130C
Audio voltmeter	Hewlett-Packard 400L
Wave analyzer	Hewlett-Packard 310A
Distortion analyzer	Hewlett-Packard 332A
Audio generator	Hewlett-Packard 206A
Audio step attenuator	Daven T-693-R
Power supply	Hewlett-Packard 721A
Vtvm	Hewlett-Packard 410B
Resistor	619 ohms, 1/2 watt

Table 5-2. Troubleshooting Procedure.

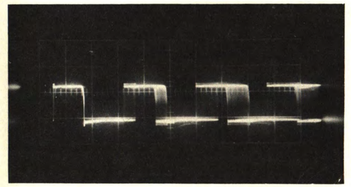
STEP	TEST EQUIPMENT USED	LOCATION OF TEST	INDICATION	NOTES
1	HP 410B	Cathode CR12	+20 vdc	All measurements made in respect to ground
2	HP 410B	Cathode CR14	+3.6 vdc	
3	HP 410B	Anode CR13	-12 vdc	
4	HP 400L	Base Q4	0.0085 vrms	
5	HP 400L	Collector Q2	0.52 vrms	
6	HP 400L	Base Q4	0.024 vrms	
7	HP 130C	Collector Q5	See figure 5-1(A).	
8	HP 130C	A1 pin 6	See figure 5-1(B).	
9	HP 130C	A2 pin 6	See figure 5-1(C).	
10	HP 130C	Collector Q7	See figure 5-1(D).	
11	HP 130C	A1 pin 7	See figure 5-1(E).	
12	HP 410B	Collector Q9	Less than 1 vdc	
13	HP 130C	Collector Q6	See figure 5-1(F).	
14	HP 130C	A4 pin 7	See figure 5-1(G).	
15	HP 130C	A5 pin 6	See figure 5-1(H).	
16	HP 130C	A4 pin 6	See figure 5-1(I).	SCA carrier removed
17	HP 130C	A6 pin 7	See figure 5-1(J).	
18	HP 130C	A3 pin 6	See figure 5-1(K).	
19	HP 410B	A8 pin 2	1.35 vdc	
20	HP 410B	A8 pin 3	1.35 vdc	
21	HP 400L	Base Q10	0.032 vrms	
22	HP 400L	Emitter Q13	2.7 vrms	
23	HP 400L	Collector Q14	2.7 vrms	



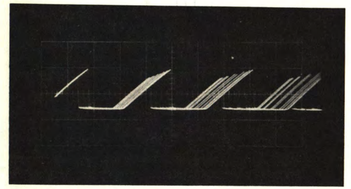
A Vertical Sensitivity, 1 volt/cm
Sweep Time, 10 us/cm



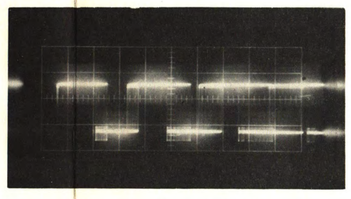
B Vertical Sensitivity, 1 volt/cm
Sweep Time, 5 us/cm



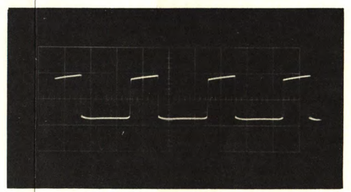
C Vertical Sensitivity, 1 volt/cm
Sweep Time, 5 us/cm



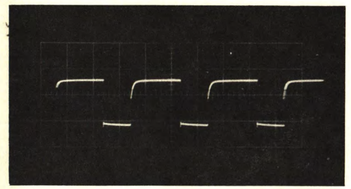
D Vertical Sensitivity, 2 volt/cm
Sweep Time, 5 us/cm



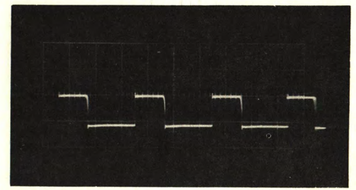
E Vertical Sensitivity, 1 volt/cm
Sweep Time, 5 us/cm



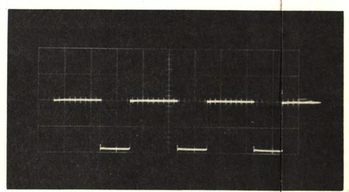
F Vertical Sensitivity, 1 volt/cm
Sweep Time, 5 us/cm



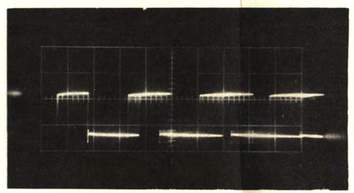
G Vertical Sensitivity, 2 volt/cm
Sweep Time, 5 us/cm



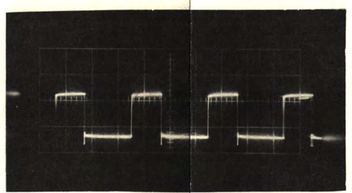
H Vertical Sensitivity, 1 volt/cm
Sweep Time, 5 us/cm



I Vertical Sensitivity, 1 volt/cm
Sweep Time, 5 us/cm



J Vertical Sensitivity, 2 volt/cm
Sweep Time, 5 us/cm



K Vertical Sensitivity, 2 volt/cm
Sweep Time, 5 us/cm

Figure 5-1. Test-Point Indications.

900F-1 in operation before attempting any recalibration. In most cases replacement of a defective component will not necessitate recalibration.

5.5.3 Repair

Caution

Exercise extreme care during component replacement to avoid damge to the circuit board. Heat applied for more than 5 seconds may cause the plated thru holes to become loose or broken and severely damage the board. Do not attempt to repair a damaged board. Return the damaged board to the factory for repair.

a. Replace components with accessible leads (resistors, capacitors, etc.) in accordance with the following procedure.
   1. Cut the component lead beyond the bend (nearest the board). Make sure the cut lead is straight.
   2. Remove all burrs by rounding or squeezing the lead with the long-nosed pliers.
   3. Apply heat (500°F for 5 seconds maximum) to the lead on the backside of the board and remove the molten solder with a solder sipper (Collins part number 024-0676-010).
   4. Allow the board to cool completely between heatings and repeat step 3 as necessary.
   5. Carefully break the lead loose from the hole, and gently remove the cold lead. If necessary, slightly heat the lead from the component side of the board while carefully removing the lead from the bottom.
   6. Carefully insert the lead of the replacement component into the hole. Be sure the lead is straight.
   7. Apply heat to the lead on the backside of the board (5 seconds maximum) and allow fresh solder to flow into the hole. Cut off any excess lead. Do not bend the lead.

b. Replace components without accessible leads (transistors, relays, board-mounted potentiometers, etc.) in accordance with the following procedure.
   1. Apply heat (500°F for 5 seconds maximum) to the component lead on the backside of the board and remove the molten solder with a solder sipper.
   2. Allow the board to cool completely between heatings and repeat step 1 as necessary.
   3. Use long-nosed pliers to gently straighten the lead if it is bent. The lead must be as straight as possible.
   4. If possible, cut the lead and remove all burrs by rounding or squeezing the lead with the long-nosed pliers.
   5. Repeat steps 1 and 2 until the lead can be carefully broken loose from the hole.
   6. Slowly and very gently remove the component from the board.
   7. Carefully insert the replacement component. Be sure the lead is straight.
   8. Apply heat to the lead on the backside of the board (5 seconds maximum) and allow fresh solder to flow into the hole. Cut off any excess lead. Do not bend the lead.

5.6 ADJUSTMENT PROCEDURES

Note

The following procedures tell how to change or reset adjustments R32, R36, and R56. These adjustments have been made at the factory to optimize the performance of the 900F-1. Under no circumstances should the following adjustments be made without first determining that the source of trouble is positively caused by one of these adjustments. Indiscriminate adjustment or adjustment without the recommended test equipment will result in serious loss of equipment performance.

5.6.1 Initial Adjustments

Set the panel controls to the following positions:

METER to FREQUENCY CALIBRATE

CALIBRATE to midposition

RANGE to 5 kHz

DE-EMPHASIS to IN

INPUT LEVEL ADJUST (back panel) fully clockwise

POWER ON/OFF to ON

5.6.2 Demodulator Gain Adjustment

Assemble the test setup shown in figure 5-2A. Set the step attenuator and the SCA generator output level control to read 5.5 mv on the HP-400L. Move the METER switch to SCA FREQUENCY. Adjust the frequency control on the SCA generator

until the counter reads 67.000 kHz. Set R36 on the 900F-1 printed circuit board for a center-scale (0 Hz) reading on the meter.

a. Set the SCA generator frequency for a -600-Hz reading on the 900F-1 meter. Observe the counter readout and then increase the frequency until the meter reads +600 Hz. Observe this frequency on the counter and determine the difference between this reading and the previous reading.
b. If the frequency difference is more than 1220 Hz, turn R32 on the 900F-1 printed circuit board counterclockwise to run the meter off scale to the right. Bring the meter back to the +600-Hz reading by turning R36 counterclockwise. Check the gain as in step a. If the frequency difference is still more than 1200 Hz, repeat the above procedure. If the difference is less than 1180 Hz, perform step c. If the difference is 1200 ±20 Hz, the gain is set correctly.
c. If the frequency difference is less than 1180 Hz, turn R36 on the 900F-1 printed circuit board clockwise to run the meter off scale to the right. Now turn R32 clockwise until the meter returns to +600 Hz. Check the gain as in step a. If the frequency difference is still less than 1180 Hz, repeat the above procedure. If the difference is now more than 1220 Hz, repeat step b. If the difference is 1200 ±20 Hz, the gain is set correctly. Record counter readings for +600 and -600-Hz meter readings on the 900F-1. Set the METER switch to FREQUENCY CALIBRATE and center the meter, if necessary, with R36. Now check the operation of the CALIBRATE control. Turning it clockwise should run the meter off scale to the right and turning it counterclockwise should run the meter off scale to the left.

5.6.3 Audio Amplifier Gain Adjustment

Assemble the test setup as shown in figure 5-2B. Connect a 619-ohm resistor (Collins part number 705-7086-000) across audio output terminals TB1-1 and TB1-2 of the 900F-1. Check to see that the input level is still 5.5 mv as read on the HP-400L. If necessary, readjust for a correct level. Set the METER switch to SCA FREQUENCY and adjust the frequency on the SCA generator card for a 0-Hz reading. Set the 900F-1 METER switch to the SCA MODULATION MONAURAL MODE position and the RANGE switch to 5 kHz. Tune the HP-310A wave analyzer to the 67-kHz subcarrier. Using the counter, set the HP-205A audio generator frequency to 2.07 kHz. Starting at zero, increase the output level of the HP-206A slowly until the 67-kHz reading on the HP-310A disappears. Careful adjustment is required as this is a sharp null. Now adjust R56 on the 900F-1 printed circuit board until the meter reads full scale.

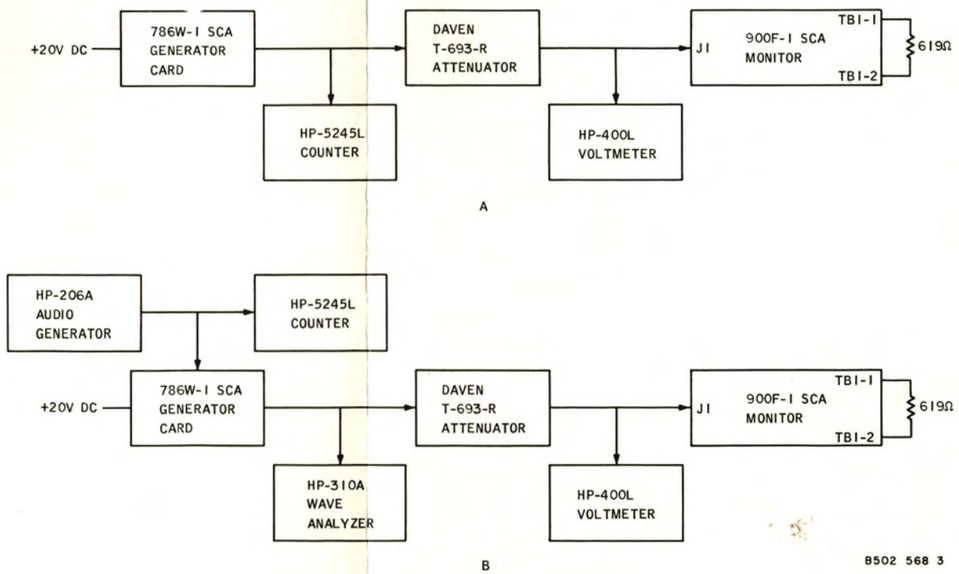


Figure 5-2. Test Equipment Setups.

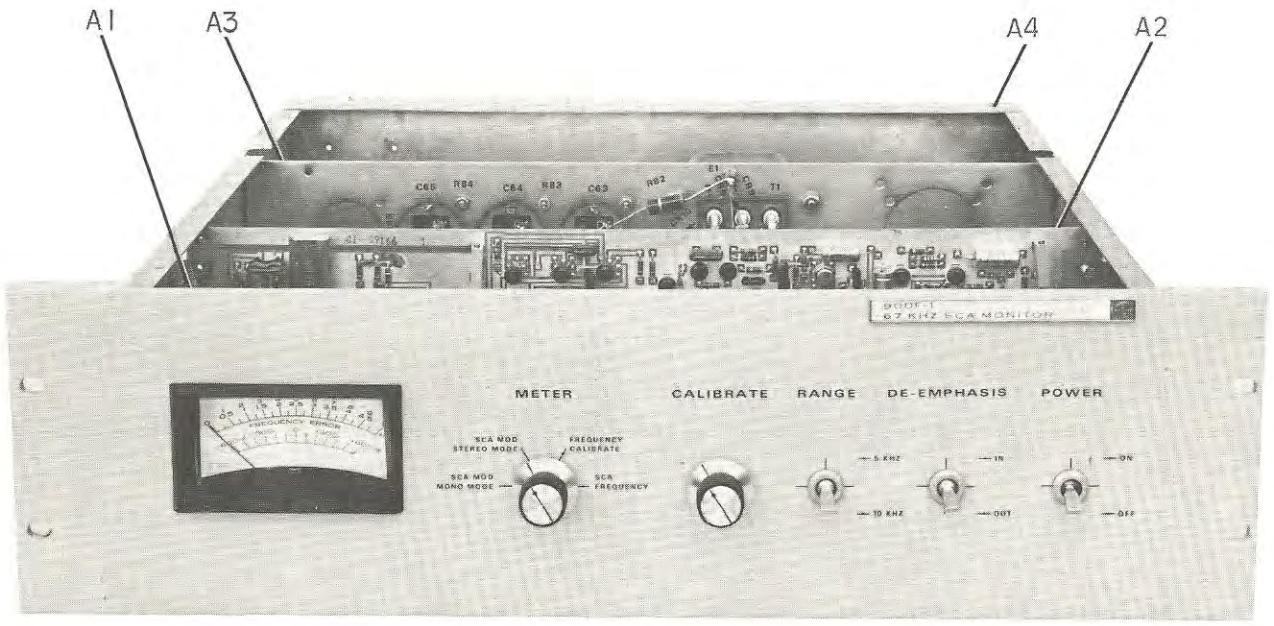
section 6
parts list

6.1 GENERAL

This section contains a list of all replaceable electrical, electronic, and critical mechanical parts for the 900F-1 67-kHz SCA Monitor.

The manufacturers' codes appearing in the MFR CODE column of the parts list are listed in numerical order at the end of the parts list. The code list provides the manufacturer's name and address as shown in the Federal Supply Code for Manufacturers' Handbook H4-1. Manufactuerers not listed in Handbook H4-1 are assigned a 5-letter code and appear first in the code list.

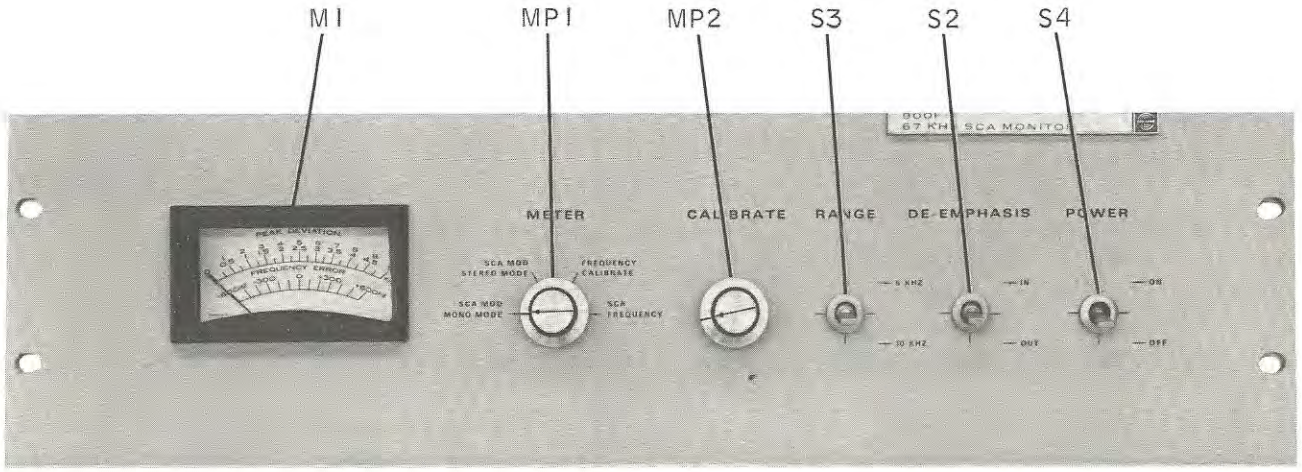
6.2 LIST OF EQUIPMENT



B700 206 Bx

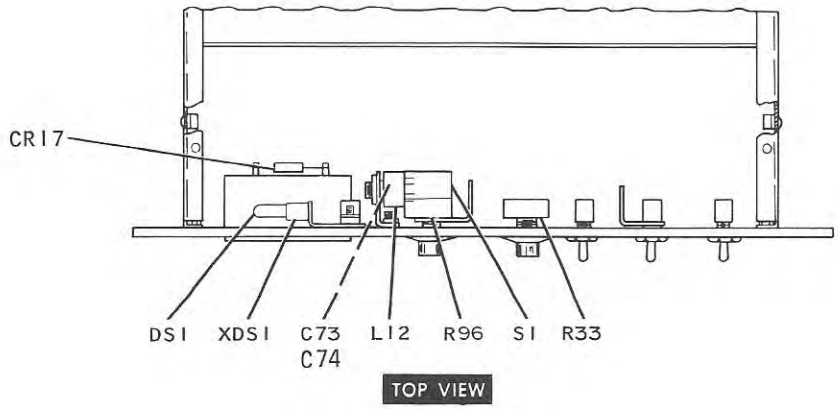
Figure 6-1. 900F-1 67-kHz SCA Monitor.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	900F-1 67 KHZ SCA MONITOR			758-5741-001
A1	FRONT PANEL ASSEMBLY SEE BREAKDOWN ON PAGE 6-2			781-5284-001
A2	PRINTED CIRCUIT BOARD SEE BREAKDOWN ON PAGE 6-2			781-5285-001
A3	POWER SUPPLY ASSEMBLY SEE BREAKDOWN ON PAGE 6-2			776-1972-001
A4	WRAPAROUND CHASSIS SEE BREAKDOWN ON PAGE 6-2			781-5258-001



FRONT VIEW

B700 207 Pb

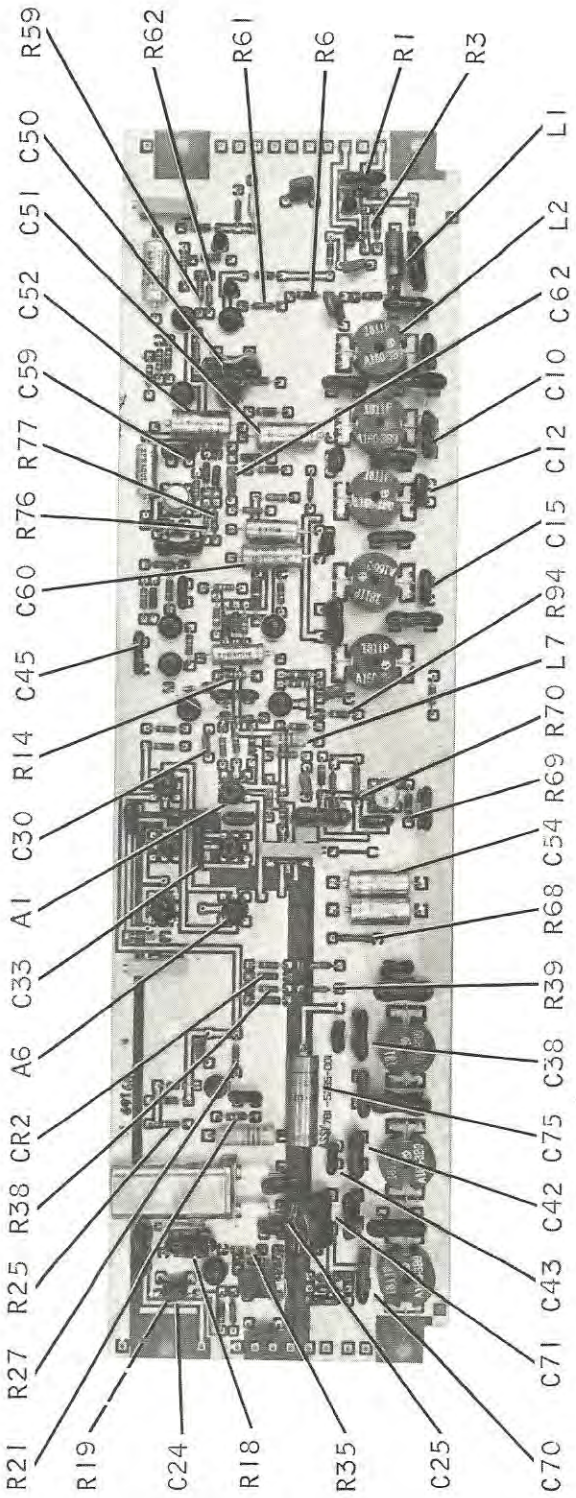


TOP VIEW

B700 208 Bx

Figure 6-2. Front Panel Assembly.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	FRONT PANEL ASSEMBLY			781-5284-001
C1 THROUGH C72	NOT USED			
C73	CAPACITOR, FXD, MICA 2200 UUF, 5% TOL, 500 VDCW	CM06FD222J03	81349	912-3025-000
C74	CAPACITOR, FXD, MICA 0.01 UF, 5% TOL, 500 VDCW	CM07FD103J03	81349	912-2735-000
CR1 THROUGH CR16	NOT USED			
CR17	SEMICONDUCTOR DEVICE, DIODE	1N914	07688	353-2906-000
DS1	LAMP, INCANDESCENT 0.04 AMPERE CURRENT RATING	MS25231-1819	96906	262-1863-000
L1 THROUGH L11	NOT USED			
L12	INDUCTOR 13 MH			781-5272-001
M1	METER, AMPERE 0-500 MICROAMPERE METER RANGE	1125-145BEZEL	80145	458-0820-030
MP1	KNOB, SKIRTED BLACK PHENOLIC			757-0233-001
MP2	SAME AS MP1			
R1 THROUGH R32	NOT USED			
R33	RESISTOR, VARIABLE 100 OHMS, 20% TOL, 1 WATT	RV2NAYSD101B	81349	380-2501-000
R34 THROUGH R95	NOT USED			
R96	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/4 WATT	RC07GF472J	81349	745-0773-000
S1	SWITCH, ROTARY DT4P CONTACT ARRANGEMENT			259-1755-000
S2	SWITCH, TOGGLE SPDT CONTACT ARRANGEMENT	83052C	95691	266-5330-000
S3	SAME AS S1			
S4	SWITCH, TOGGLE DPST CONTACT ARRANGEMENT	81024SR	04009	266-5376-010
XDS1	LAMPHOLDER BAYONET TYPE BASE	LH22	81349	262-0913-000



B700 210 Pb

Figure 6-3. Printed Circuit Board (Sheet 1 of 5).

B700 210 Pb

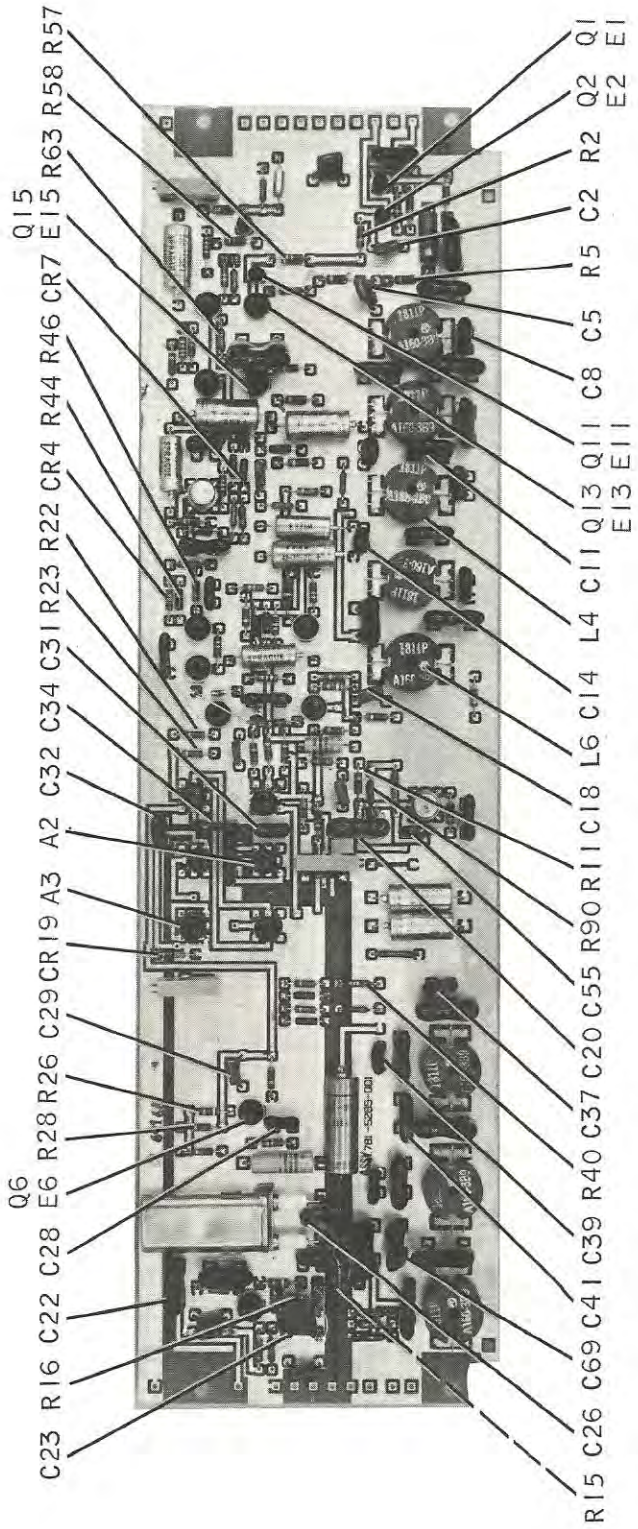
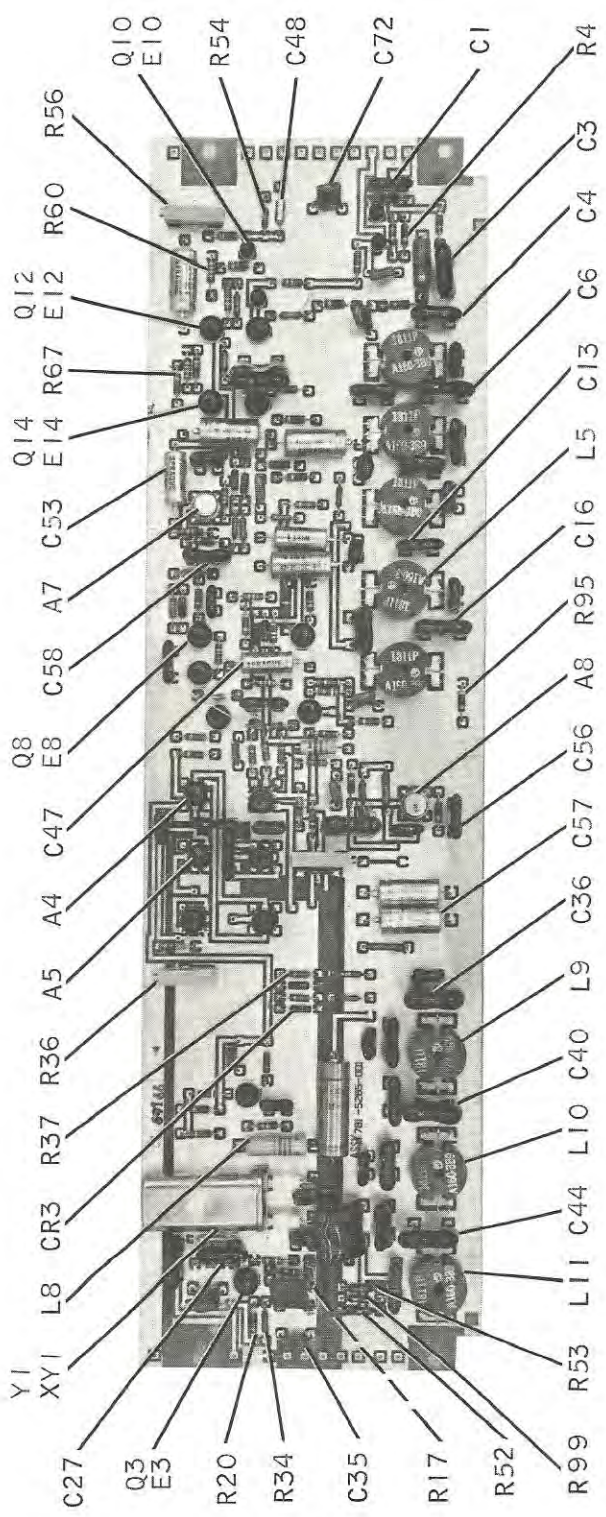


Figure 6-3. Printed Circuit Board (Sheet 2 of 5).



B700 210 Pb

Figure 6-3. Printed Circuit Board (Sheet 3 of 5).

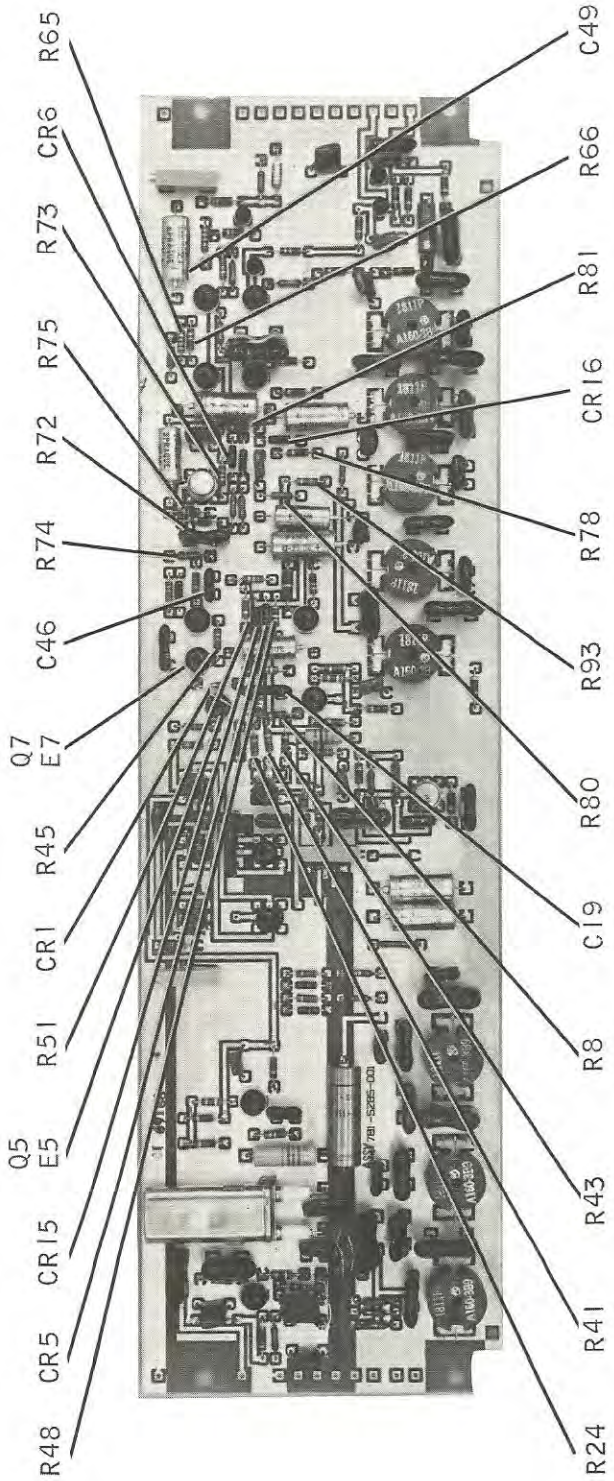


Figure 6-3. Printed Circuit Board (Sheet 4 of 5).

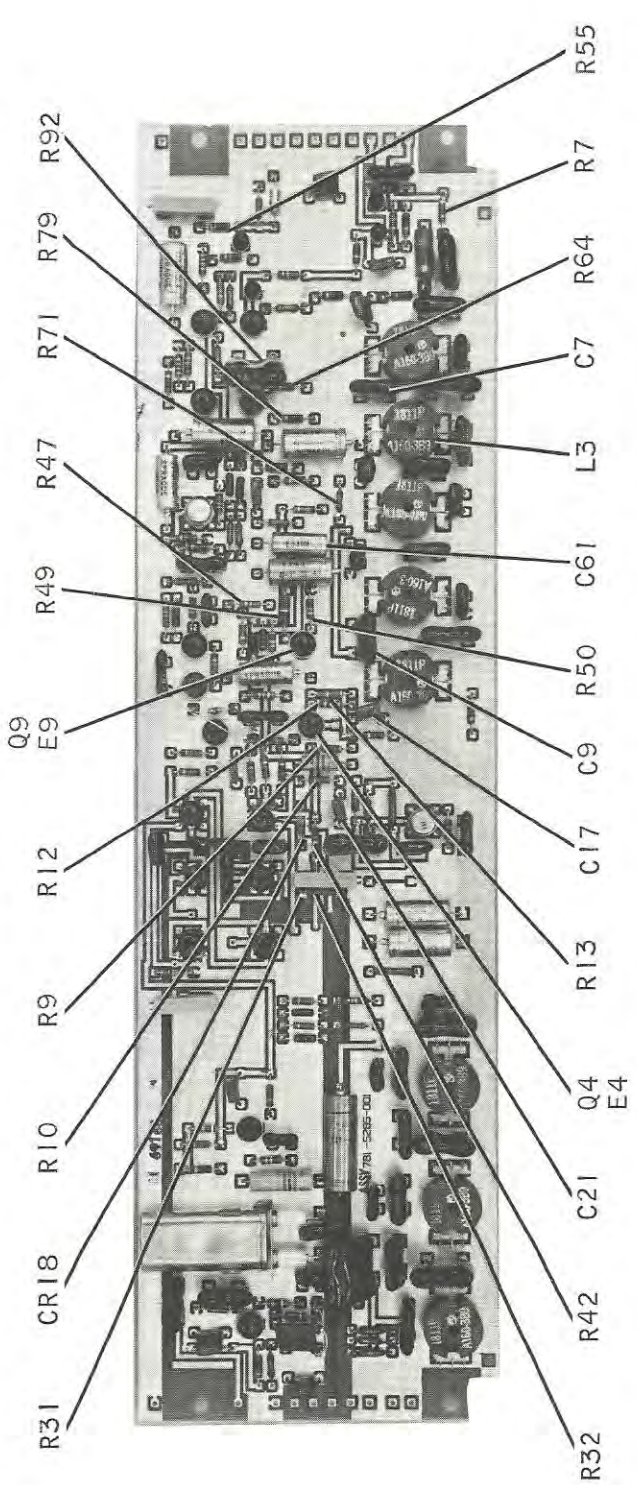


Figure 6-3. Printed Circuit Board (Sheet 5 of 5).

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	PRINTED CIRCUIT BOARD			781-5285-001
A1	INTEGRATED CIRCUIT, UL914 GATE	SL3978	07263	351-7121-020
A2 THROUGH A6	SAME AS A1			
A7	INTEGRATED CIRCUIT, UA709C OPERATIONAL AMPLIFIER	U5B770939X	07263	351-7140-010
A8	SAME AS A7			
C1	CAPACITOR, FXD, MICA 680 UUF, 5% TOL, 500 VDCW	CM06FD681J03	81349	912-2989-000
C2	CAPACITOR, FXD, CERAMIC 2.2 UF, PLUS 80% MINUS 20%, 25 VDCW	5C14A	56289	913-3812-000
C3	CAPACITOR, FXD, MICA 3300 UUF, 5% TOL, 500 VDCW	CM06FD332J03	81349	912-3040-000
C4	SAME AS C3			
C5	SAME AS C2			
C6	CAPACITOR, FXD, MICA 3300 UUF, 1% TOL, 500 VDCW	DM30F432F03	72136	912-3059-000
C7	CAPACITOR, FXD, MICA 1500 UUF, 1% TOL, 500 VDCW	CM06FD152F03	81349	912-3011-000
C8	CAPACITOR, FXD, MICA 270 UUF, 5% TOL, 500 VDCW	CM05FD271J03	81349	912-2846-000
C9	CAPACITOR, FXD, MICA 200 UUF, 1% TOL, 500 VDCW	CM04FD201F03	81349	912-3902-000
C10	CAPACITOR, FXD, MICA 1200 UUF, 1% TOL, 500 VDCW	CM06FD122F03	81349	912-3005-000
C11	CAPACITOR, FXD, MICA 750 UUF, 1% TOL, 500 VDCW	CM06FD751F03	81349	912-2990-000
C12	CAPACITOR, FXD, MICA 39 UUF, 5% TOL, 500 VDCW	CM05ED390J03	81349	912-2786-000
C13	SAME AS C10			
C14	SAME AS C9			
C15	SAME AS C8			
C16	SAME AS C6			
C17	SAME AS C7			
C18	SAME AS C2			
C19	CAPACITOR, FXD, MICA 1000 UUF, 5% TOL, 500 VDCW	CM06FD102J03	81349	912-3001-000
C20	CAPACITOR, FXD, MICA 6800 UUF, 5% TOL, 500 VDCW	CM07FD682J03	81349	912-2723-000
C21	SAME AS C2			
C22	SAME AS C3			
C23	SAME AS C2			
C24	SAME AS C2			
C25	CAPACITOR, FXD, MICA 33 UUF, 5% TOL, 500 VDCW	CM05ED330J03	81349	912-2780-000
C26	CAPACITOR, FXD, MICA 820 UUF, 5% TOL, 500 VDCW	CM06FD821J03	81349	912-2995-000
C27	SAME AS C3			
C28	CAPACITOR, FXD, MICA 47 UUF, 5% TOL, 500 VDCW	CM05ED470J03	81349	912-2792-000
C29	CAPACITOR, FXD, CERAMIC 0.1 UF, PLUS 80% MINUS 20%, 25 VDCW	5C7A	56289	913-3806-000
C30	SAME AS C29			
C31	CAPACITOR, FXD, MICA 390 UUF, 5% TOL, 500 VDCW	CM05FD391J03	81349	912-2858-000
C32	SAME AS C31			
C33	SAME AS C19			
C34	SAME AS C19			
C35	SAME AS C2			
C36	CAPACITOR, FXD, MICA 9100 UUF, 1% TOL, 500 VDCW	DM30F752F03	72136	912-3065-000
C37	SAME AS C8			
C38	CAPACITOR, FXD, MICA 510 UUF, 1% TOL, 500 VDCW	CM06FD511F03	81349	912-2978-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
C39	CAPACITOR, FXD, MICA 18 UUF, 5% TOL, 500 VDCW	DM15C180K500WV4 CR	72136	912-2763-000
C40	CAPACITOR, FXD, MICA 0.01 UF, 1% TOL, 500 VDCW	DM30F103F03	72136	912-3068-000
C41	SAME AS C7			
C42	CAPACITOR, FXD, MICA 2400 UUF, 1% TOL, 500 VDCW	CM06FD242F03	81349	912-3026-000
C43	CAPACITOR, FXD, MICA 120 UUF, 5% TOL, 500 VDCW	CM05FD121J03	81349	912-2822-000
C44	SAME AS C40			
C45	CAPACITOR, FXD, MICA 820 UUF, 5% TOL, 500 VDCW	CM06FD821J03	81349	912-2995-000
C46	SAME AS C28			
C47	CAPACITOR, FXD, ELECTROLYTIC 10 UF, 20% TOL, 50 VDCW	CS13BG106M	81349	184-6251-000
C48	CAPACITOR, FXD, ELECTROLYTIC 0.22 UF, 20% TOL, 75 VDCW	CS13BH224M	81349	184-6326-080
C49	CAPACITOR, FXD, ELECTROLYTIC 220 UF, 20% TOL, 20 VDCW	CS13BC227M	81349	184-6154-000
C50	SAME AS C40			
C51	CAPACITOR, FXD, ELECTROLYTIC 47 UF, 20% TOL, 35 VDCW	CS13BF476M	81349	184-6231-000
C52	SAME AS C51			
C53	CAPACITOR, FXD, ELECTROLYTIC 22 UF, 20% TOL, 50 VDCW	CS13BF226M	81349	184-6225-000
C54	SAME AS C49			
C55	CAPACITOR, FXD, MICA 100 UUF, 5% TOL, 500 VDCW	CM05FD101J03	81349	912-2816-000
C56	CAPACITOR, FXD, MICA 560 UUF, 5% TOL, 500 VDCW	CM06FD561J03	81349	912-2983-000
C57	SAME AS C49			
C58	SAME AS C19			
C59	CAPACITOR, FXD, MICA 75 UUF, 5% TOL, 500 VDCW	CM05ED750J03	81349	912-2807-000
C60	SAME AS C51			
C61	CAPACITOR, FXD, ELECTROLYTIC 33 UF, 20% TOL, 20 VDCW	CS13BE336M	81349	184-6181-000
C62	SAME AS C2			
C63 THROUGH C68	NOT USED			
C69	CAPACITOR, FXD, MICA 620 UUF, 5% TOL, 500 VDCW	CM06FD621J03	81349	912-2986-000
C70	CAPACITOR, FXD, MICA 1800 UUF, 1% TOL, 500 VDCW	CM06FD182F03	81349	912-3017-000
C71	CAPACITOR, FXD, ELECTROLYTIC 6800 UUF, 1% TOL, 500 VDCW	DM30F682F03	72136	912-3064-000
C72	SAME AS C2			
C73	NOT USED			
C74	NOT USED			
CR1	SEMICONDUCTOR DEVICE, DIODE	1N914	07688	353-2906-000
CR2 THROUGH CR7	SAME AS CR1			
CR8 THROUGH CR14	NOT USED			
CR15	SEMICONDUCTOR DEVICE, DIODE	1N756	07688	353-2709-000
CR16	SEMICONDUCTOR DEVICE, DIODE	1N751	07688	353-2704-000
CR17	NOT USED			
CR18	SEMICONDUCTOR DEVICE, DIODE	1N270	07688	353-2018-000
CR19	SAME AS CR18			
E1	PEDESTAL, TRANSISTOR	7717-64N	13103	352-9552-550
E2 THROUGH E11	SAME AS E1			
E12	PEDESTAL, TRANSISTOR	7717-13DAP	13103	352-9552-580

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
E13 THROUGH E15	SAME AS E12			
L1	INDUCTOR 2 MH, 5% TOL	MS90540-07	96906	240-2547-000
L2	INDUCTOR 5 MH			781-5282-001
L3 THROUGH L6	SAME AS L2			
L7	INDUCTOR 1 MH	MS90539-15	96906	240-2540-000
L8	INDUCTOR 8.2 MH	MS90541-09	96906	240-2562-000
L9	INDUCTOR 180 MH			781-5278-001
L10	INDUCTOR 151.5 MH			781-5281-001
L11	SAME AS L10			
Q1	TRANSISTOR	2N3565	07688	352-0638-010
Q2	TRANSISTOR	2N4121	07688	352-0743-010
Q3	TRANSISTOR	2N3643	07688	352-0713-030
Q4 THROUCH Q9	SAME AS Q3			
Q10	TRANSISTOR	2N4250	07263	352-0773-030
Q11	SAME AS Q1			
Q12 THROUGH Q15	SAME AS Q3			
R1	RESISTOR, VAR 5K OHMS, 10% TOL, 2 WATTS	RV4NAYSD502	81349	380-2678-000
R2	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 1/4 WATT	RC07GF102K	81349	745-0749-000
R3	RESISTOR, FXD, COMPOSITION 5600 OHMS, 10% TOL, 1/4 WATT	RC07GF562K	81349	745-0776-000
R4	SAME AS R2			
R5	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/4 WATT	RC07GF222K	81349	745-0761-000
R6	SAME AS R2			
R7	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/4 WATT	RC07GF472K	81349	745-0773-000
R8	SAME AS R3			
R9	RESISTOR, FXD, COMPOSITION 470 OHMS, 10% TOL, 1/4 WATT	RC07GF471K	81349	745-0737-000
R10	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10% TOL, 1/4 WATT	RC07GF332K	81349	745-0767-000
R11	SAME AS R2			
R12	RESISTOR, FXD, COMPOSITION 3900 OHMS, 10% TOL, 1/4 WATT	RC07GF392K	81349	745-0770-000
R13	SAME AS R9			
R14	RESISTOR, FXD, COMPOSITION 390K OHMS, 10% TOL, 1/4 WATT	RC07GF394K	81349	745-0842-000
R15	SAME AS R9			
R16	SAME AS R12			
R17	RESISTOR, FXD, COMPOSITION 68K OHMS, 10% TOL, 1/4 WATT	RC07GF683K	81349	745-0815-000
R18	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/4 WATT	RC07GF103K	81349	745-0785-000
R19	RESISTOR, FXD, COMPOSITION 820 OHMS, 10% TOL, 1/4 WATT	RC07GF821K	81349	745-0746-000
R20	RESISTOR, FXD, COMPOSITION 100 OHMS, 10% TOL, 1/4 WATT	RC07GF101K	81349	745-0713-000
R21	RESISTOR, FXD, COMPOSITION 100K OHMS, 10% TOL, 1/4 WATT	RC07GF104K	81349	745-0821-000
R22	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 1/4 WATT	RC07GF681K	81349	745-0743-000
R23	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/4 WATT	RC07GF472K	81349	745-0773-000
R24	SAME AS R22			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R25	RESISTOR, FXD, COMPOSITION 270 OHMS, 10% TOL, 1/4 WATT	RC07GF271K	81349	745-0728-000
R26	RESISTOR, FXD, COMPOSITION 390 OHMS, 10% TOL, 1/4 WATT	RC07GF391K	81349	745-0734-000
R27	SAME AS R22			
R28	SAME AS R23			
R29	NOT USED			
R30	NOT USED			
R31	RESISTOR, FXD, FILM 3.83K OHMS, 1% TOL, 1/8 WATT	RN55D3831F	81349	705-1024-000
R32	RESISTOR, VARIABLE 5K OHMS, 10% TOL, 3/4 WATT	79PR5K	73138	382-0012-280
R33	NOT USED			
R34	SAME AS R31			
R35	SAME AS R5			
R36	SAME AS R32			
R37	SAME AS R22			
R38	SAME AS R22			
R39	RESISTOR, FXD, FILM 14.7K OHMS, 1% TOL, 1/8 WATT	RN55D1472F	81349	705-1052-000
R40	RESISTOR, FXD, FILM 4.22K OHMS, 1% TOL, 1/8 WATT	RN55D4221F	81349	705-1026-000
R41	RESISTOR, FXD, COMPOSITION 5.6K OHMS, 10% TOL, 1/4 WATT	RC07GF562K	81349	745-0776-000
R42	SAME AS R41			
R43	SAME AS R3			
R44	SAME AS R17			
R45	RESISTOR, FXD, COMPOSITION 18K OHMS, 10% TOL, 1/4 WATT	RC07GF183K	81349	745-0794-000
R46	RESISTOR, FXD, COMPOSITION 1500 OHMS, 10% TOL, 1/4 WATT	RC07GF152K	81349	745-0755-000
R47	SAME AS R45			
R48	RESISTOR, FXD, COMPOSITION 470K OHMS, 10% TOL, 1/4 WATT	RC07GF474K	81349	745-0845-000
R49	RESISTOR, FXD, COMPOSITION 1500 OHMS, 10% TOL, 1/2 WATT	RC20GF152K	81349	745-1359-000
R50	SAME AS R18			
R51	SAME AS R9			
R52	RESISTOR, FXD, FILM 2.37K OHMS, 1% TOL, 1/8 WATT	RN55D2371F	81349	705-1014-000
R53	SAME AS R52			
R54	RESISTOR, FXD, FILM 133K OHMS, 1% TOL, 1/8 WATT	RN55D1333F	81349	705-1098-000
R55	RESISTOR, FXD, COMPOSITION 1 MEGOHM, 10% TOL, 1/4 WATT	RC07GF105K	81349	745-0857-000
R56	RESISTOR, VARIABLE 500 OHMS, 10% TOL, 3/4 WATT	79PR500	73138	382-0012-250
R57	SAME AS R1			
R58	SAME AS R1			
R59	SAME AS R41			
R60	RESISTOR, FXD, COMPOSITION 33K OHMS, 10% TOL, 1/4 WATT	RC07GF333K	81349	745-0803-000
R61	RESISTOR, FXD, FILM 909 OHMS, 10% TOL, 1/8 WATT	RN55D9090F	81349	705-0994-000
R62	SAME AS R61			
R63	RESISTOR, FXD, FILM 8.25K OHMS, 1% TOL, 1/8 WATT	RN55D8251F	81349	705-1040-000
R64	SAME AS R19			
R65	SAME AS R60			
R66	SAME AS R18			
R67	RESISTOR, FXD, COMPOSITION 150 OHMS, 10% TOL, 1/4 WATT	RC07GF151K	81349	745-0719-000
R68	RESISTOR, FXD, FILM 511K OHMS, 1% TOL, 1/4 WATT	RN60D5113F	81349	705-6726-000
R69	SAME AS R46			
R70	SAME AS R68			
R71	RESISTOR, FXD, FILM 1K OHMS, 1% TOL, 1/8 WATT	RN55D1001F	81349	705-0996-000
R72	SAME AS R18			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R73	RESISTOR, FXD, COMPOSITION 56K OHMS, 10% TOL, 1/4 WATT	RC07GF563K	81349	745-0812-000
R74	RESISTOR, FXD, FILM 121K OHMS, 1% TOL, 1/8 WATT	RN55D1213F	81349	705-1096-000
R75	SAME AS R46			
R76	RESISTOR, FXD, FILM 4.75K OHMS, 1% TOL, 1/8 WATT	RN55D4751F	81349	705-3605-320
R77	SAME AS R74			
R78	SAME AS R2			
R79	SAME AS R20			
R80	RESISTOR, FXD, FILM 6.81K OHMS, 1% TOL, 1/8 WATT	RN55D6811F	81349	705-1036-000
R81	SAME AS R2			
R82 THROUGH R89	NOT USED			
R90	RESISTOR, FXD, FILM 5110 OHMS, 1% TOL, 1/8 WATT	RN55D5111F	81349	705-1030-000
R91	NOT USED			
R92	SAME AS R2			
R93	SAME AS R3			
R94	SAME AS R2			
R95	SAME AS R7			
R96 THROUGH R97	NOT USED			
R98	RESISTOR, FXD, COMPOSITION 15K OHMS, 10% TOL, 1/4 WATT	RC07GF153K	81349	745-0791-000
R99	RESISTOR, FXD, FILM 56.2K OHMS, 1% TOL, 1/8 WATT	RN55D5622F	81349	705-1080-000
R100	RESISTOR, FXD, FILM 619 OHMS, 1% TOL, 1/2 WATT	RN65D619F	71034	707-7086-000
XY1	SOCKET, CRYSTAL 2 CONTACTS	8000DG2	91506	292-0305-020
Y1	CRYSTAL UNIT QUARTZ, 67 KHZ	289-7095-010	71034	289-7095-010

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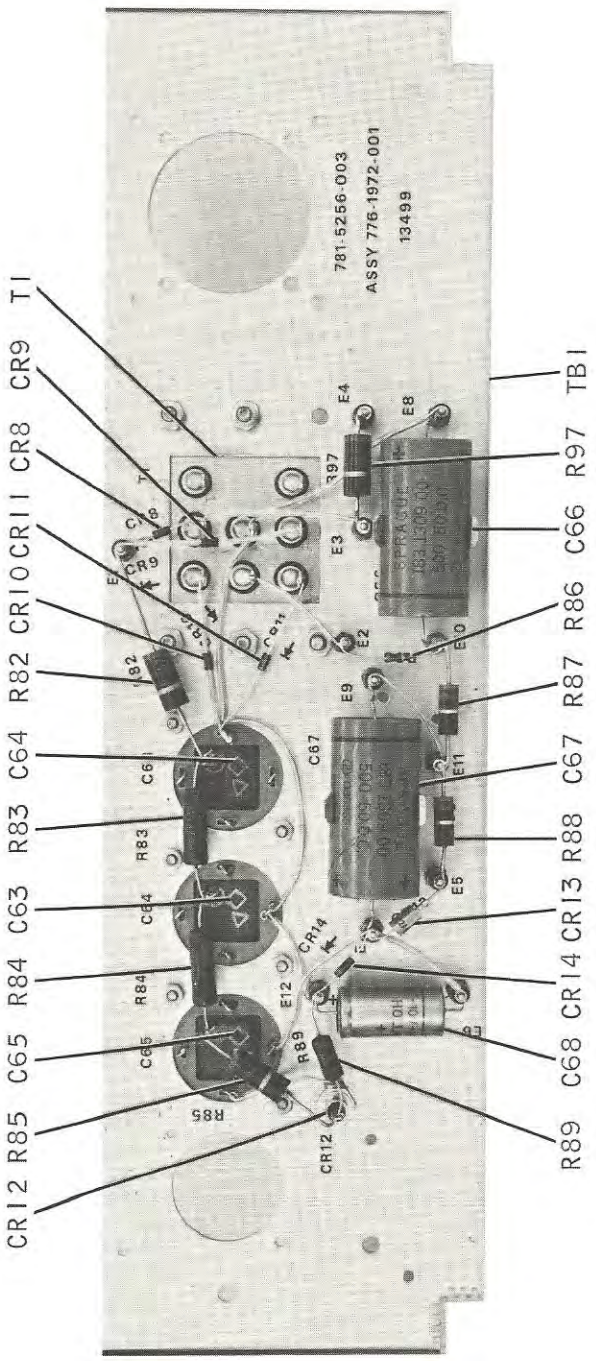
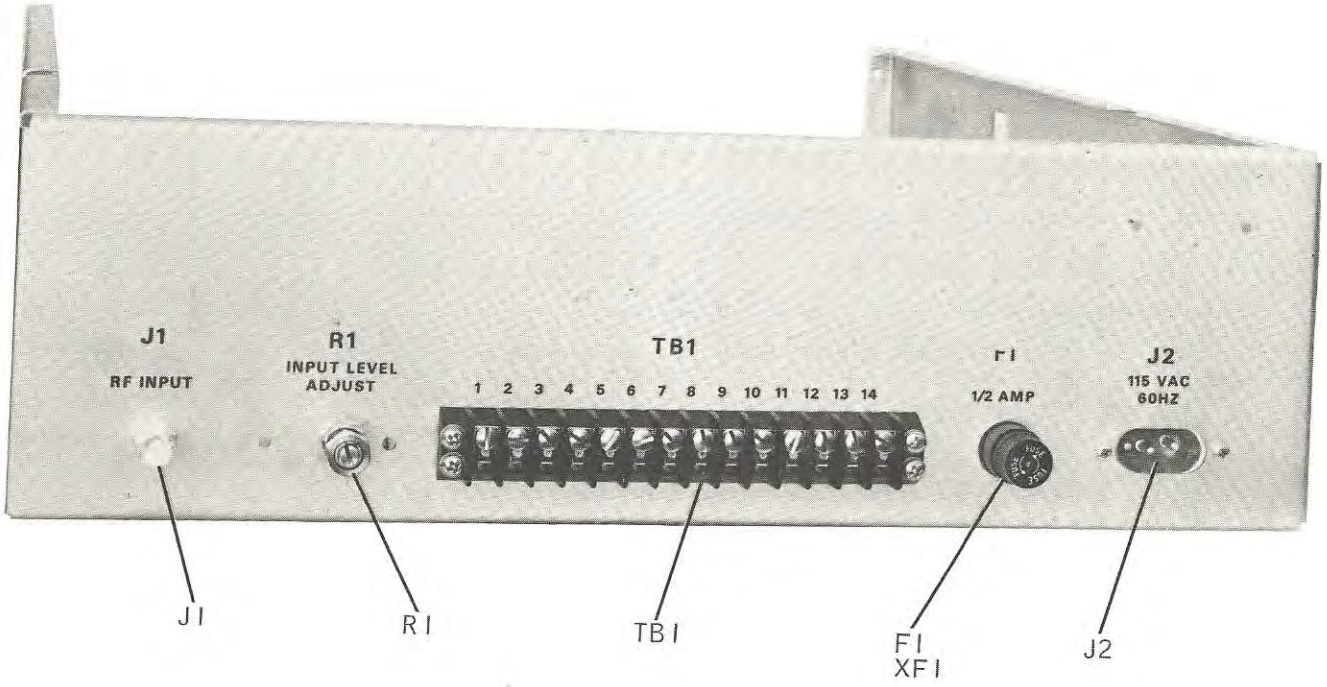


Figure 6-4. Power Supply Assembly.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	POWER SUPPLY ASSEMBLY			776-1972-001
C1 THROUGH C62	NOT USED			
C63	CAPACITOR, FXD, ELECTROLYTIC 1000 UF, PLUS 100% MINUS 10%, 50 VDCW	D33643	56289	183-1403-000
C64	SAME AS C63			
C65	SAME AS C63			
C66	CAPACITOR, FXD, ELECTROLYTIC 500 UF, PLUS 100% MINUS 10%, 5 VDCW	C437ARD400	73445	183-1309-000
C67	SAME AS C66			
C68	CAPACITOR, FXD, ALUMINUM 400 UF, PLUS 50% MINUS 10%, 10 VDCW	C437ARD400	73445	183-2355-030
CR1 THROUGH CR7	NOT USED			
CR8	SEMICONDUCTOR DEVICE, DIODE	1N4003	07688	353-6442-030
CR9	SAME AS CR8			
CR10	SAME AS CR8			
CR11	SAME AS CR8			
CR12	SEMICONDUCTOR DEVICE, DIODE	1N2984B	07688	353-1365-000
CR13	SEMICONDUCTOR DEVICE, DIODE	1N3022A	07688	353-1317-000
CR14	SEMICONDUCTOR DEVICE, DIODE	1N747A	07688	353-2702-000
R1 THROUGH R81	NOT USED			
R82	RESISTOR, FXD, COMPOSITION 10 OHMS, 10% TOL, 2 WATTS	RC42GF100K	81349	745-5568-000
R83	RESISTOR, FXD, WIREWOUND 18 OHMS, 5% TOL, 6.5 WATTS	RW67V180	81349	747-5425-000
R84	SAME AS R83			
R85	SAME AS R82			
R86	RESISTOR, FXD, COMPOSITION 10 OHMS, 10% TOL, 1/4 WATT	RC07GF100K	81349	745-0677-000
R87	RESISTOR, FXD, COMPOSITION 68 OHMS, 10% TOL, 1 WATT	RC32GF680K	81349	745-3303-000
R88	SAME AS R87			
R89	RESISTOR, FXD, WIREWOUND 180 OHMS, 5% TOL, 3 WATTS	RW69V181	81349	747-5345-000
R90 THROUGH R96	NOT USED			
R97	RESISTOR, FXD, COMPOSITION 1200 OHMS, 10% TOL, 2 WATTS	RC42GF122K	81349	745-5656-000
T1	TRANSFORMER, PWR, STEP-DOWN 800 VRMS, 50/60 HZ	31214	97965	662-0048-000
TB1	TERMINAL BOARD -WITHOUT COMPONENTS-			781-5256-003

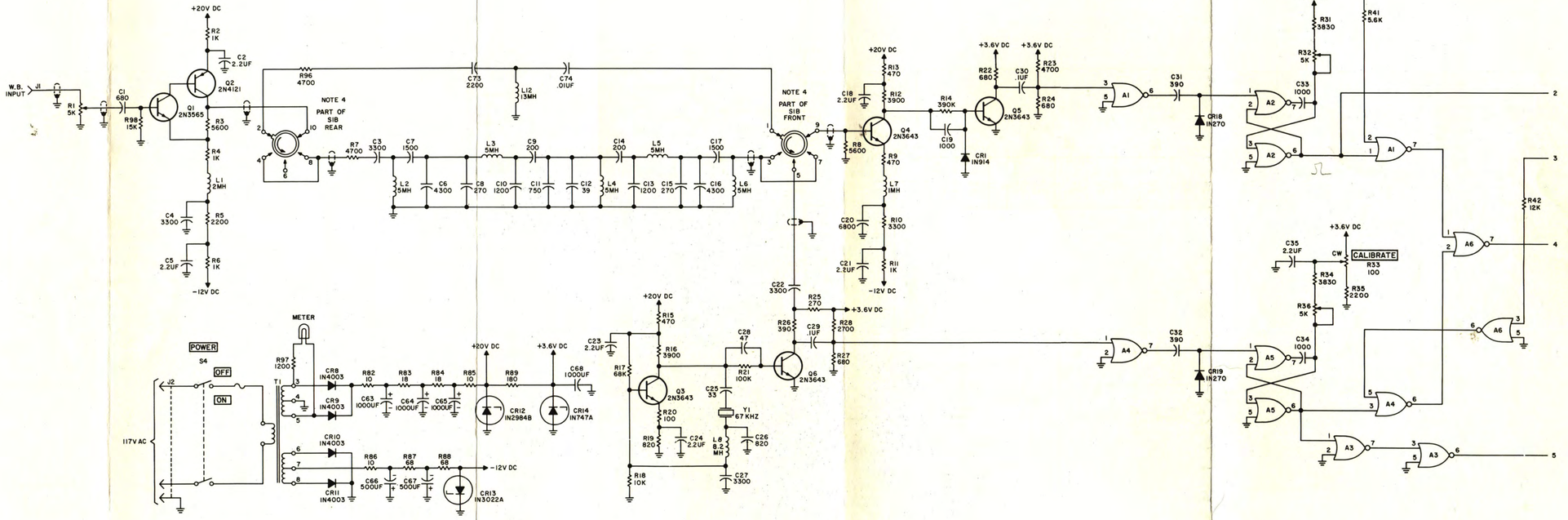


B700 220 Pb

Figure 6-5. Wraparound Chassis.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	WRAPAROUND CHASSIS			781-5258-001
F1	FUSE, CARTRIDGE 1/2 AMPERE CURRENT RATING	MDL1-2	71400	264-0293-000
J1	CONNECTOR, RECEPTACLE 1 CONTACT	UG1094AU	80058	357-9804-000
J2	CONNECTOR, RECEPTACLE 3 CONTACTS	1061-1	87930	368-0207-000
R1	RESISTOR, VARIABLE 5K OHMS, 10% TOL, 2 WATTS	RV4LAYSA502A	81349	380-2769-000
TB1	TERMINAL BLOCK 14 TERMINALS	670A3000-14	75382	367-1852-140
XF1	FUSEHOLDER 30 AMPERE CURRENT RATING AT 250 VDC	HKPH	71400	265-1171-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	MANUFACTURERS CODES			
CODE	MANUFACTURER			
04009	ARROW-HART AND HEGEMAN ELECTRIC CO HARTFORD, CONN 06106			
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIVISION MOUNTAIN VIEW, CALIF			
07688	JOINT ELECTRON DEVICE ENGINEERING COUNCIL WASHINGTON, D.C.			
13103	THERMALLOY CO DALLAS, TEX 75247			
56289	SPRAGUE ELECTRIC CO NORTH ADAMS, MASS. 01247			
71034	BLILEY ELECTRIC CO ERIE, PA. 16512			
71400	BUSSMANN MFG DIVISION OF MCGRAW-EDISON ST LOUIS, MO 63017			
72136	ELECTRO MOTIVE MFG CO INC WILLIMANTIC, CONN 06226			
73138	BECKMAN INSTRUMENTS INC HELIPOT DIVISION FULLERTON, CALIF 92634			
73386	FREED TRANSFORMER CO INC BROOKLYN, N.Y. 11227			
73445	AMPEREX ELECTRONIC CORP HICKSVILLE, LONG ISLAND, N.Y. 11801			
75382	KULKA ELECTRIC CORP MT VERNON, N.Y. 10550			
76854	OAK MFG CO CRYSTAL LAKE, ILL. 60014			
80058	JOINT ELECTRONIC TYPE DESIGNATION SYSTEM			
80145	ASSEMBLY PRODUCTS INC CHESTERLAND, OHIO			
81349	MILITARY SPECIFICATIONS			
87930	TOWER MFG CORP PROVIDENCE, R.I. 02903			
91506	AUGAT INC ATTLEBORO, MASS. 02703			
95691	ARROW-HART AND HEGEMAN ELECTRIC CO LOS ANGELES, CALIF			
96906	MILITARY SPECIFICATIONS			
97965	STANCOR ELECTRIC, INC. CHICAGO, ILL.			



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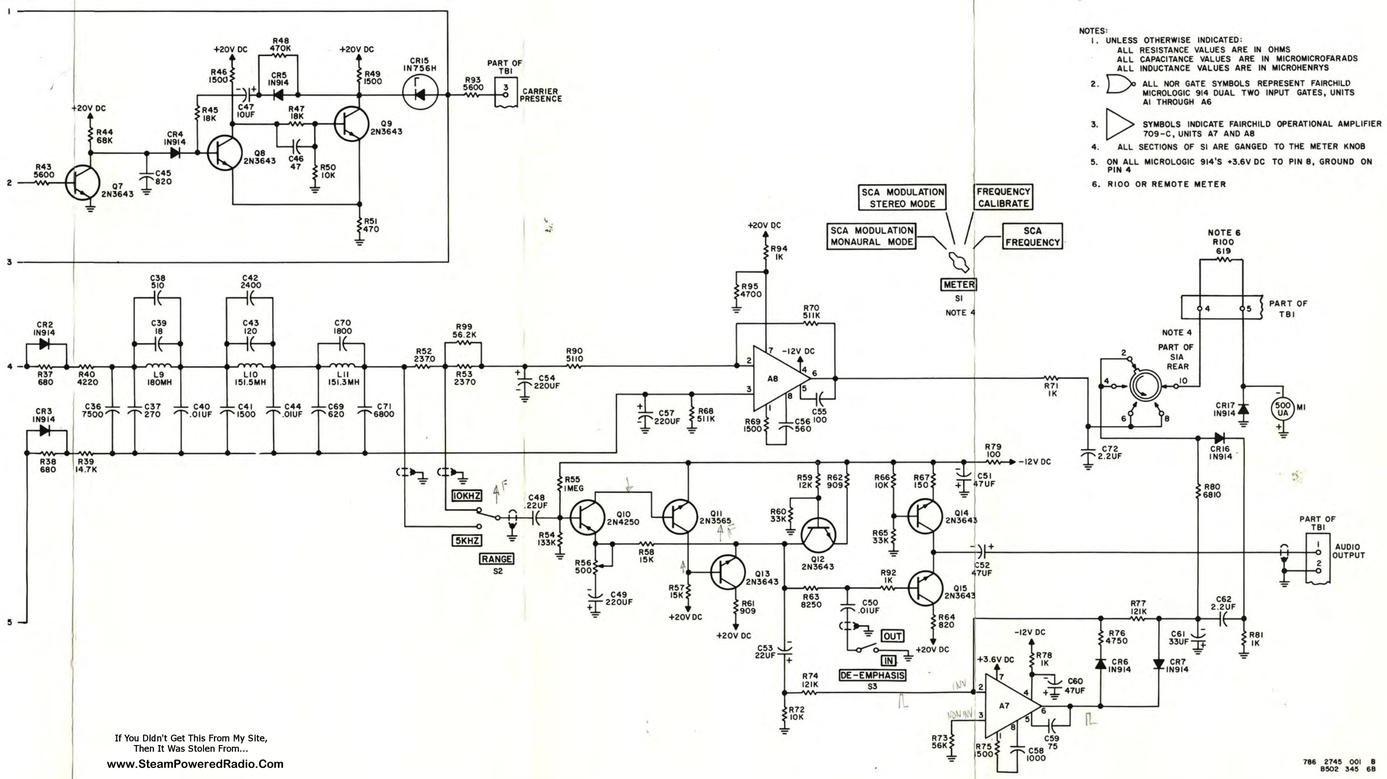

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