HEWLETT-PACKARD

MODULATION SECTION

86632A

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1141A.

For additional important information about serial numbers see INSTRUMENTS COVERED BY MANUAL in Section I.

Manual Part No. 86632-90009
Microfiche Part No. 86632-90010
Operating Information Supplement Part No. 86632-90011

Printed MAY 1972

HEWLETT hp PACKARD

COPYRIGHT AND DISCLAIMER NOTICE

MANUAL CHANGES

MANUAL IDENTIFICATION

Model Number: 86632A
Date Printed: May 1972
Part Number: 86632-90009

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes
1141A00151, 156, 159	1
1141A00161 to 00200	1, 2
1214A	1, 2, 3
1236A	1 through 4
1238A	1 through 5
1240A	1 through 6

Serial Prefix or Number	Make Manual Changes
1305A	1 through 7
1318A	1 through 8

► NEW ITEM

ERRATA

Page 1-4, Table 1-3:
Change the alignment tool SUGGESTED MODEL to HP 8830-0024.
Add, under MINIMUM SPECIFICATIONS and SUGGESTED MODEL:
Adapter, OSM/OSM right angle HP 1250-1249
Adapter, OSM/BNC HP 1250-1200

Page 8-10, Figure 8-9:
The answers to the question, "Is the AM interconnection from the Model 86632A to the RF Section continuous?", should be transposed.

Page 8-13, Figure 8-10:
Add Note 4: The waveforms and voltages are normal for the following control settings:
SOURCE ..... INTERNAL -- 400
MODE ..... FM X10
MODULATION LEVEL 50

Page 8-15, Figure 8-12 (Service Sheet 2):
Change the figure as shown in the partial schematic diagram.

► Change A7J1 pin P to R and pin R to P;
XA2 pin 1 to B and pin B to 1.

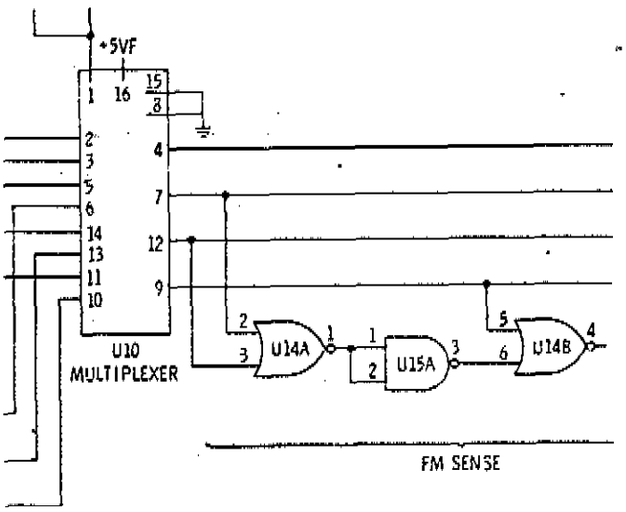


Figure 8-12. Partial Schematic of the A2 Assembly

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

18 September 1973
6 pages

Printed in U.S.A.

HEWLETT hp PACKARD

ERRATA (cont'd)

► Page 8-17, Figure 8-14 (Service Sheet 3):
Change the pin numbers of A5K2: 4 to 3, 3 to 4, E to 2, 5 to 1, and place a 5 on the unumbered terminal.

► Page 8-19, Figure 8-16 (Service Sheet 4):
Change the designator of A4Q2 to A4Q1; A4Q1 to A4Q2.
Change the position of the zener diode A4CR9. The anode should be connected to ground.
Change A4Q8 to represent a PNP transistor with the emitter connected to A4R28.

Page 8-21, Figure 8-18:
► Change the figure as shown in the partial schematic diagram.

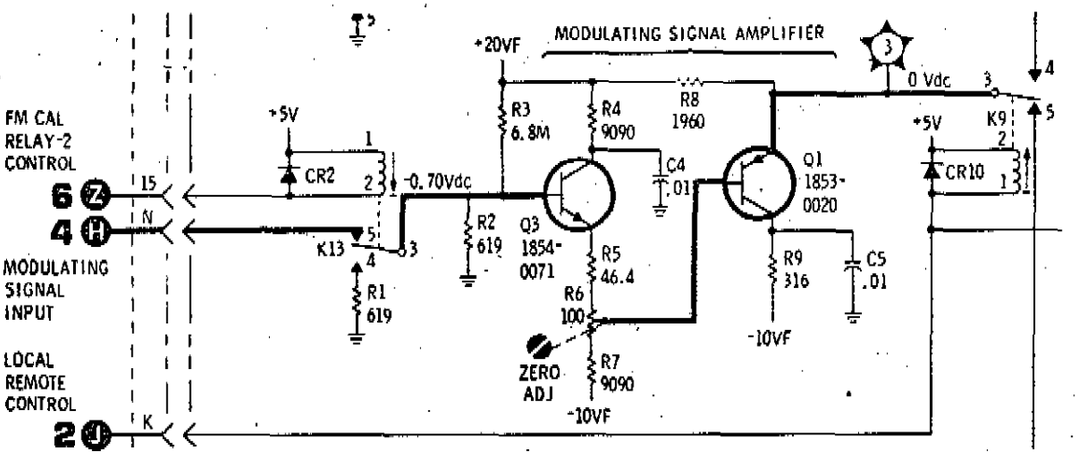


Figure 8-18. Partial Schematic of the A3 Assembly

Page 8-22, Figure 8-19:
Change the lower voltage of the Q5 collector waveform from 0 to +0.6 Vdc.

Page 8-23, Figure 8-21:
Change the polarity and reverse the symbol of C14.

Page 8-25, Figure 8-22:
Change the A7A1 Mixer Output to A7A3 (in the lower righthand corner), to A7A1 Input from A7A3 VCO.

Page 8-25, Figure 8-24:
Change A7A3Q4 part number to 1853-0020.

Change the gray cable reference designation, at the 20 MHz REFERENCE FROM MAINFRAME input to the A7A2 assembly, from W1 to W2.

Page 8-15, Figure 8-12 (Service Sheet 2):
Change:
XA2 pin 1 to pin B
XA2 pin B to pin 1
U13A to an AND gate (delete the inverting symbol at pin 3).

Page 8-17, Figure 8-14 (Service Sheet 3):
Change relay K2 pin numbers from 5 to 1, E to 2, 4 to 3, 3 to 4.
Add number 5 to the remaining pin of relay K2.

Page 8-19, Figure 8-16 (Service Sheet 4):
Change transistor Q8 to a PNP with the emitter coupled to the 10 Ohm resistor.

ERRATA (cont'd)

Page 8-23, Figure 8-21 (Service Sheet 6):
Change:
The off-page connector symbol (lower left-hand corner) from 4, 2 (Z) to 4, 2 (Y);
U2A pin 8 to pin 13.

CHANGE 1

Page 6-8, Table 6-3:
Add Reference Designation, HP Part Number, Qty, Description, Mfr Code and Mfr Part Number:
A6R38, 0698-7212, 2, R: Fxd Flm
100 ohm 2% 1/8W, 28480, 0698-7212.
A6R39, 0698-7212, R: Fxd Flm
100 ohm 2% 1/8W, 28480, 0698-7212.

Page 8-21, Figure 8-21.
► Change Figure 8-21 as shown in the partial schematic.

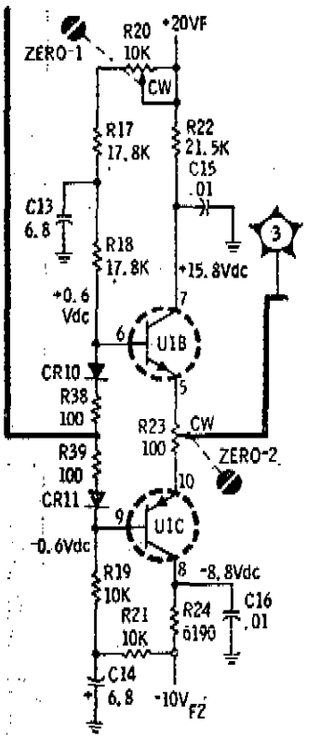


Figure 8-21. Partial Schematic (P/O Change 1)

CHANGE 2

Page 6-3, Table 6-3.
Change A1MP2 HP Part Number, Qty, Description, Mfr. Code, Mfr. Part Number:
0370-2195, 1, Mode Control Knob: Skirted (Jade Gray), 28480, 0370-2195.
Add Reference Designator, HP Part Number, Qty, Description, Mfr. Code, Mfr. Part Number:
A1MP8, 0370-2196, 1, Source Control Knob: Skirted, 28480, 0370-2196.

CHANGE 3

Page 6-3, Table 6-3.
Change HP Part Number and Mfr. Part Number of:
A1MP3 to 86601-40018,
A1MP4 to 86632-00011,
A1MP6 to 86632-20023,
A1MP7 to 86632-20024.
Change HP Part Number, Mfr. Code, and Mfr. Part Number of A1M1 to 1120-1562, 32171, 820564A.

Page 6-11/6-12, Table 6-3.
Change the HP Part Number, Description, Mfr. Part Number of MP8 to 86601-00036, Meter Mount, 86601-00036.

Note

For instruments with prefix 1141A, the Meter Replacement Kit 86632-60021 must be ordered. This kit contains all the parts listed under Change 3. The applicable Service Note, 86632A-1, and the Meter Replacement Kit may be ordered from your nearest Hewlett-Packard office.

CHANGE 4

Page 6-8, Table 6-3:

Add A7A1R13, 2100-1788, 1, R: VAR FLM 500 OHM 10% LIN 1/2W, 28480, 2100-1788.

Change A7A1R8 to HP 0698-3438, 1, R: FXD MET FLM 147 OHM 1% 1/8W, 28480, 0698-3438.

Delete A7A1C2.

Page 8-25, Figure 8-24:

Change the figure as shown in the partial schematic diagram.

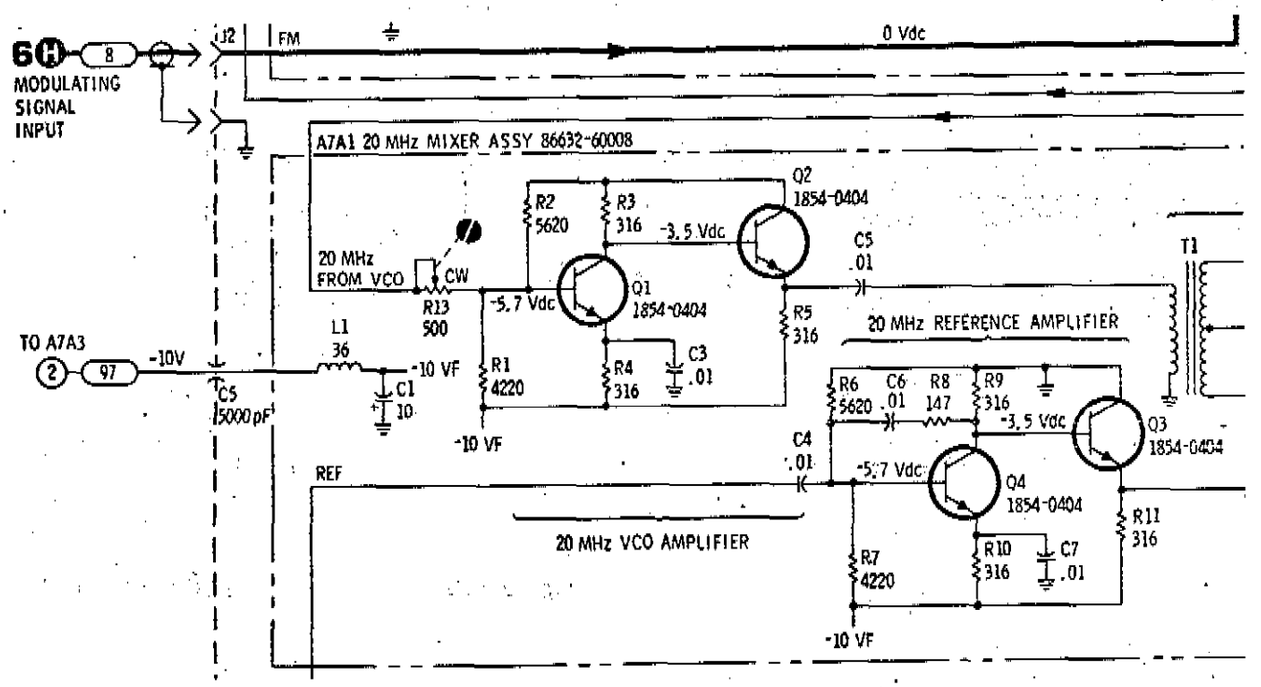


Figure 8-24. Partial Schematic of A7A1 Assembly

CHANGE 5

A7J1 has been modified and the coaxial connectors which are inserted into A7J1 have a different retainer clip. *On instruments with serial prefixes 1236A and below, if A7J1W1, W2, or W3 are replaced, A7J1 must be* modified by enlarging the sockets with a #34 drill. If A7J1 is replaced the retainer clips must also be replaced. Order three (3) of HP Part Number 1251-3044. Refer to Service Note 86632A-3.

CHANGE 6

► Page 6-1, Table 6-1, and Page 6-3, Table 6-3:
Change A3 Assembly Part No. to 86632-60035; A3 Exchange Part No. to 86632-60036.

► Page 6-3, Table 6-3:
Change A1M1 HP and Mfr. Part Number to 1120-0541.

Page 6-4, Table 6-3:
Delete A3R31 and A3R32.
Add:
A3Q4, 1854-0071, TSTR:SI NPN (Selected from 2N3704), 28480, 1854-0071.
A3R33, 0757-0445, R:FXD FLM 13K OHM 1% 1/8W, 28480, 0757-0445.
A3R34, 0757-0280, R:FXD MET FLM 1K OHM 1% 1/8W, 28480, 0757-0280.
A3R35, 0757-0280, R:FXD MET FLM 1K OHM 1% 1/8W, 28480, 0757-0280.
A3R36, 2100-1757, R:VAR WW 500 OHM 5% TYPE V 1W, 28480, 2100-1757.
A3R37, 0757-0401, R:FXD MET FLM 100 OHM 1% 1/8W, 28480, 0757-0401.

Page 8-21, Figure 8-18 (Service Sheet 5)
Change the diagram as shown in the partial schematic.

NOTE
For instruments with prefix 1214A, 1236A, and 1238A, the meter replacement kit 86632-60022 must be ordered. This kit contains the parts listed in Change 6. The Applicable Service Note 86632A-1A and the Meter Replacement Kit may be ordered from your nearest Hewlett-Packard office.

CHANGE 7

Page 6-11, Table 6-3:
Change MP9 to 86632-00013, 2, Cover: Half, 28480, 86632-00013.
Add:
MP 11, 86632-00013, Cover: Half, 28480, 86632-00013.
MP12 and 13, 86632-20032, 2, Guide: Plug-in, 28480, 86632-20032.

► CHANGE 8

Page 6-3, Table 6-3:
Change A1MP8 to 0370-2499 (same description).

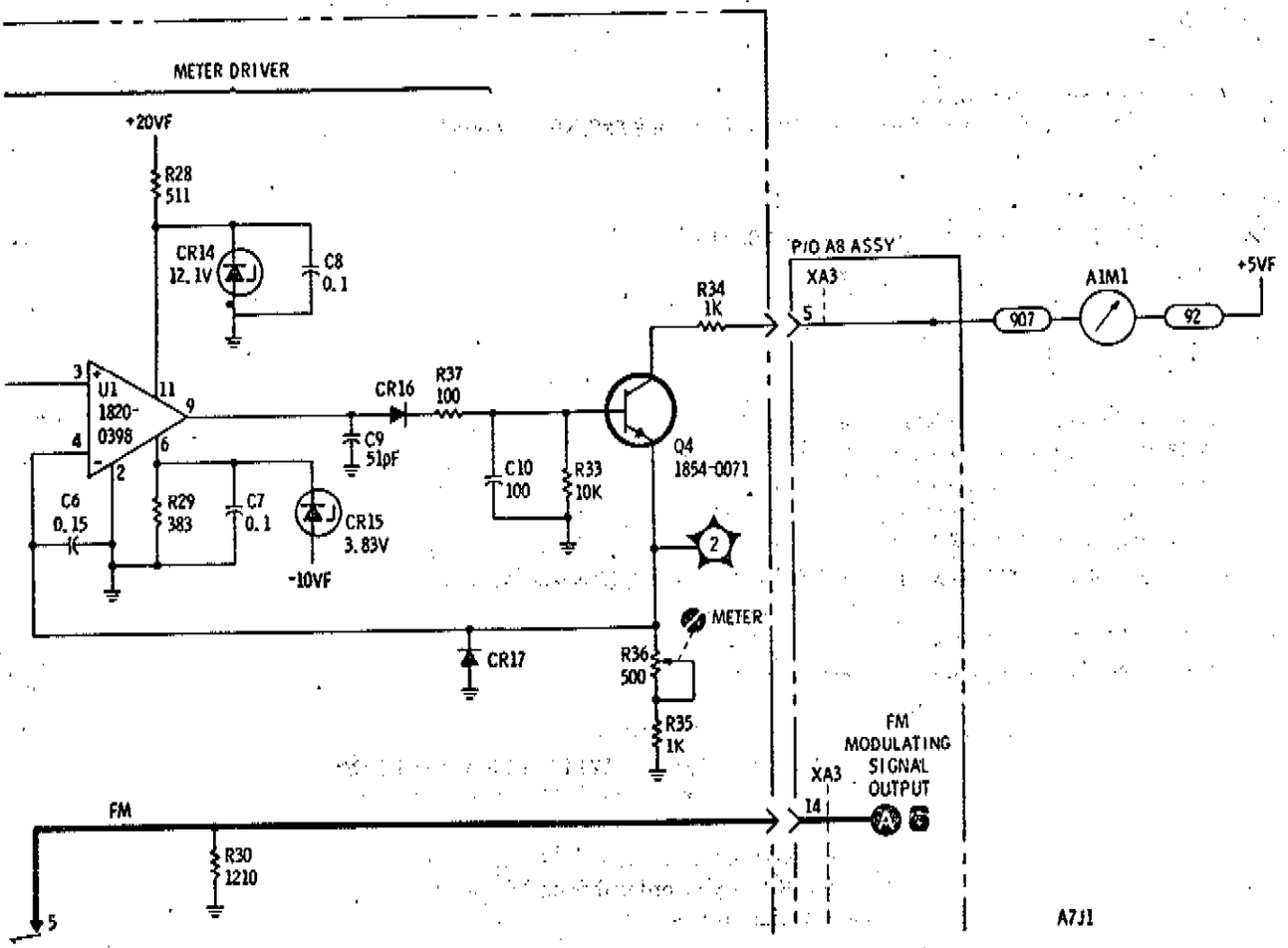


Figure 8-18. Remote Attenuation Assembly Partial Schematic
(Part of Change 6)

CONTENTS

ILLUSTRATIONS

TABLES

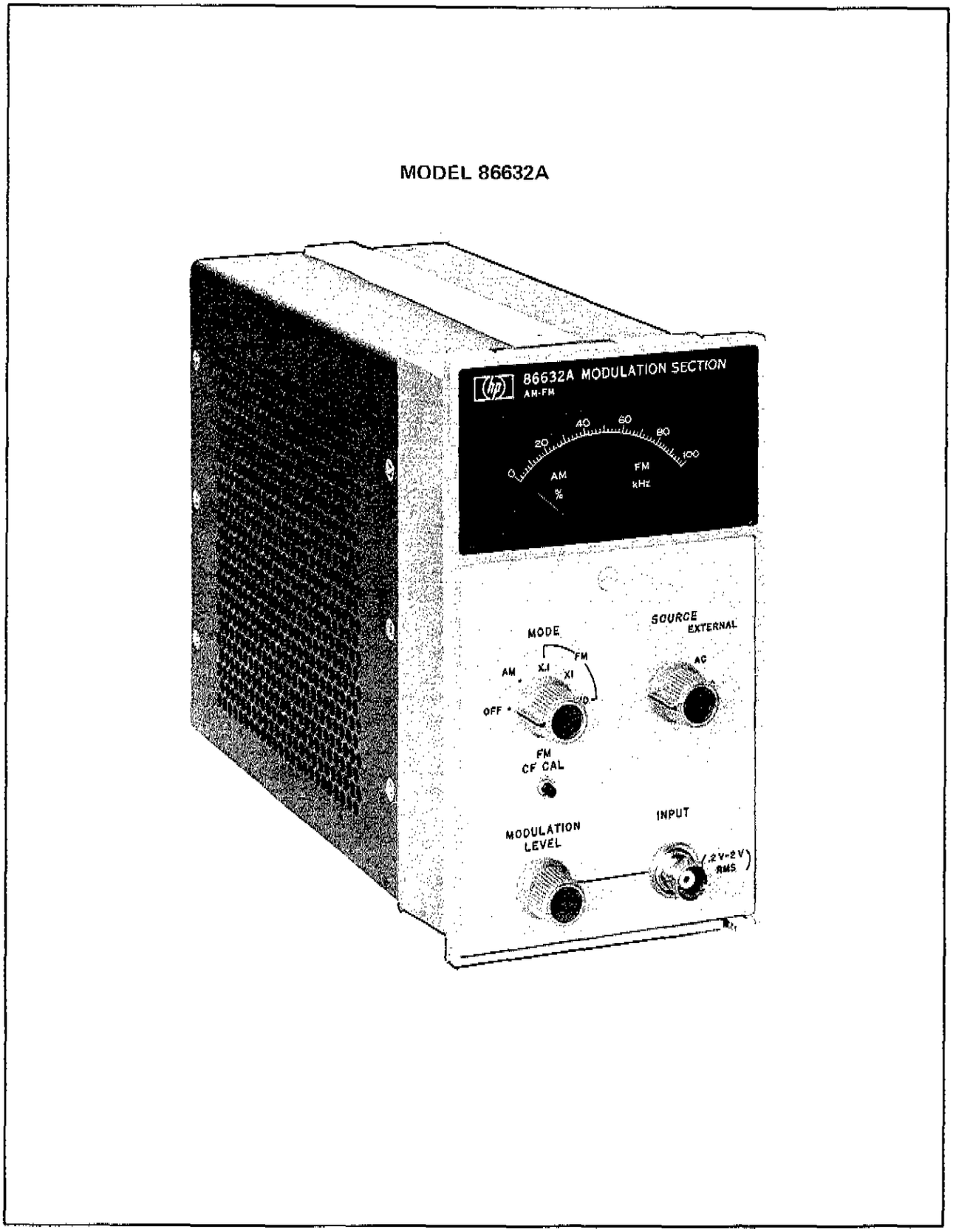


Figure 1-1. HP Model 86632A

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test, adjust and service the HP Model 86632A Modulation Section plug-in.

1-3. The various sections of this manual provide information as follows:

a. SECTION I, GENERAL INFORMATION such as description, specifications, accessories and recommended test equipment.

b. SECTION II, INSTALLATION, provides information relative to incoming inspection, preparation for use, mounting, packing and shipping.

c. SECTION III, OPERATION, provides information relative to operating the instrument.

d. SECTION IV, PERFORMANCE TESTS, provides information required to ascertain that the instrument is performing in accordance with published specifications.

e. SECTION V, ADJUSTMENTS, provides information required to properly adjust and align the instrument after repairs are made.

f. SECTION VI, REPLACEABLE PARTS, provides ordering information for all parts and assemblies.

g. SECTION VII, MANUAL CHANGES, normally contains no information in the original issue of the manual. This section is reserved to provide backdated and up-dated information in manual revisions or reprints.

h. SECTION VIII, SERVICE, includes information required to service the instrument.

1-4. Figure 1-1 shows the HP Model 86632A Modulation Section.

1-5. INSTRUMENTS COVERED BY MANUAL

1-6. This instrument has a two-part serial number. The number preceding and including the letter is the prefix. (Refer to Figure 1-2.) The contents of this manual apply directly to instruments having the same serial number prefix as listed after SERIAL NUMBERS on the title page.

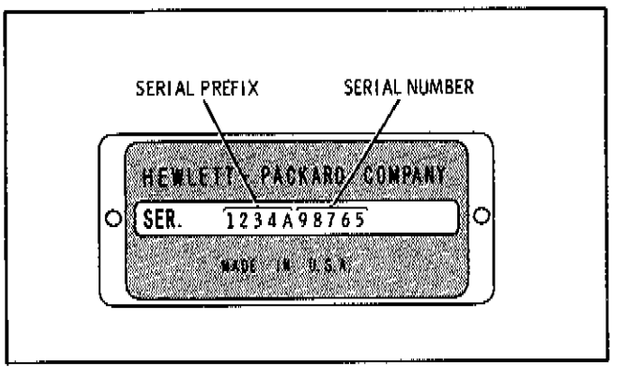


Figure 1-2. Instrument Identification

1-7. For information concerning serial number prefixes not listed on the title page or in a Manual Change supplement, contact the nearest Hewlett-Packard office.

1-8. MANUAL CHANGE SUPPLEMENTS

1-9. Manual Change Supplements provide information to aid in up-dating the manual. The Errata Section of the supplement provides corrective information. The change information will specify the differences between the original manual and the later serial-prefix instruments.

1-10. DESCRIPTION

1-11. The Hewlett-Packard Model 86632A is an AM-FM Modulation Section plug-in designed for use with the Hewlett-Packard Model 8660 Synthesized Signal Generator Mainframes.

1-12. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-13. Mainframes

1-14. The Model 8660 Mainframe series provides the power, the control voltages and frequencies for the RF Section, and the interconnections to the plug-ins.

1-15. RF Sections

1-16. The Model 86600 RF Section series takes the inputs from the Mainframe and Model 86632A Modulation Section and uses them to produce a cw, amplitude modulated (AM) or frequency modulated (FM) output.

1-17. EQUIPMENT AVAILABLE

1-18. Accessories

1-19. Extender boards for the Model 86632A Modulation Section are supplied with the Model 8660 Mainframe.

1-20. Service Kit

1-21. The complete service kit for the Mainframe and plug-ins may be ordered under part number HP 11672A. Individual components of the service kit, listed in Table 1-3, may be ordered separately.

1-22. RECOMMENDED TEST EQUIPMENT

1-23. The recommended test equipment for servicing the Model 86632A Modulation Section is listed in Table 1-3.

Table 1-1. Model 86632A Modulation Section Specifications

SPECIFICATIONS

INTERNAL MODULATION

AM:

Rate: 400 Hz and 1 kHz ±5%.

Modulation Depth: Continuously adjustable from 0 to 100% or maximum specified for RF section installed.

Meter: Range 0 to 100% modulation; accuracy ±5% of full scale.

FM:

Rate: 400 Hz and 1 kHz ±5%.

Deviation: Adjustable from 0 to 1 MHz peak of maximum specified for RF section installed.

Meter: Indicates peak deviation in 3 ranges: 0 to 10 kHz, 0 to 100 kHz, or 0 to 1 MHz. Accuracy ±5% of full scale.

Distortion:

Maintains minimum AM/FM distortion specified for RF section used.

Modulating Signal Output:

Selected internal modulation signal provided at front panel BNC connector at level of 100 mVrms minimum into 10 kilohm resistive load.

EXTERNAL MODULATION

Input Level Required:

AC Coupled Mode: External modulating signal must be between 0.2 V and 2 Vrms to provide full vernier control range and calibrated remote programming of modulation.

DC Coupled Mode: External modulation signal must 1.8 Vrms ±50 mV to maintain full vernier range and calibrated remote programming of modulation.

AM:

Rate: DC to 1 MHz maximum in dc mode or 20 Hz to 1 MHz maximum in ac mode. Maximum usable modulation rate depends on specifications for RF section installed.

Modulation Depth: Continuously adjustable from 0 to 100% or maximum specified for RF section installed.

Meter: Range 0 to 100% modulation; accuracy ±5% of full scale.

FM:

Rate: DC to 1 MHz in dc mode, or 20 Hz to 1 MHz in ac mode. Maximum usable rate depends on specifications for RF section installed.

Deviation: Adjustable from 0 to 1 MHz peak or maximum specified for RF section installed. Three ranges allow peak deviations of 0 to 10 kHz, 0 to 100 kHz, and 0 to 1 MHz. Vernier provides continuous control of deviation.

Meter: Indicates peak deviation in 3 ranges: 0 to 10 kHz, 0 to 100 kHz, or 0 to 1 MHz. Accuracy ±5% of full scale.

Distortion: Partially determined by external modulating signal distortion. Modulating signal distortion must be less than 0.3% to meet RF section distortion specification.

REMOTE PROGRAMMING

Functions: All 86632A front panel controls are programmable through the 8660A or 8660B mainframe programming interface.

Remote Modulation Setting Resolution: Modulation level can be remotely set in steps of 1/100 of the range selected.

Remote Modulation Setting Accuracy: ±5% of setting.

Table 1-2. Model 86632A Modulation Section Supplemental Performance Characteristics

PERFORMANCE CHARACTERISTICS

86632A AM/FM MODULATION SECTION

Functions: Internal and external AM and FM modulation selected by rotary switches. Meter indicates percent AM or FM peak deviation. Both AM and FM modes are programmable.

FM CF CAL: In the FM mode, depressing the front panel CF CAL button initiates a 5-second internal calibration cycle to correct any VCO drift. The CF CAL control is also remotely programmable. After 6 hours warmup the drift rate is 200 Hz/hour.

Input Impedance: 600 ohms.

GENERAL

Size: Plug-in for 8660A or 8660B Mainframe.
Weight: Net 7 lb (3,2 kg).

Table 1-3. Test Equipment and Accessories List

ITEM	MINIMUM SPECIFICATIONS	SUGGESTED MODEL	USE*
Digital Voltmeter	Accuracy ± 0.2% Range .00 to ±30 Vdc	HP 3440A with HP 3443A plug-in	A,S
High Frequency dB Voltmeter	±0.2 dB from 100 Hz to 500 kHz 1 mVrms to 1 Vrms	HP 400 GL	A,S
Oscilloscope	DC to 50 MHz, delayed sweep, time base 50 ns to 1s	HP 180A with HP 1801A and HP 1821A plug-ins	P,A,S
10:1 Oscilloscope divider probes	10:1 divider 10 Megohm 10 pF	HP 10004A	P,A,S
Spectrum Analyzer	±0.5 dB from 10 kHz to 110 MHz Measurement accuracy ±2 dB	HP 140S with HP 8553B and HP 8552B plug-ins	P
Test Oscillator	10 Hz to 1 MHz 0.2 to 2 Vrms	HP 651B	P,A,S
Electronic Counter	Range 0-50 MHz	HP 5245M	P,A
Wave Analyzer	20 Hz to 10 kHz	HP 302A	P
Marked Card Programmer	Output: ground-true +5 Vdc-false	HP 3260A- Opt. 001 (only)	P
Frequency Meter FM Discriminator	100 kHz to 1 MHz with 1V sensitivity	HP 5210A	P,A
BNC Tee		UG 274 BU	P,A,S

* USE A = Adjustment P = Performance S = Service

Table 1-3. Test Equipment and Accessories List (cont'd)

ITEM	MINIMUM SPECIFICATIONS	SUGGESTED MODEL	USE*
50 ohm Dummy Load		HP 11593A	A,S
Service Kit	Consisting of:	HP 11672A	A,S
	Extender Cable for output plug-in	HP 11672-60001	
	Extender Cable for Modulator and accessory 11661A	HP 11672-60002	
	Adaptor, Sealectro to 5 prong connector	HP 1250-0835	
	Coax adaptor, Sealectro to BNC (female)	HP 1250-1236	
	Coax Adaptor, Sealectro to BNC (male)	HP 1250-1237	
	Alignment Tool	HP 8710-1010	
	Adaptor, N plug to BNC jack	HP 1250-0780	
	Sealectro Tee	HP 1250-0838	
	Sealectro Cable, (female to female) 8" long	HP 11672-60004	
	Sealectro Cable, sealectro female to BNC male 36" long	HP 11672-60003	
	Sealectro Cable, sealectro male to female 8" long	HP 11672-60005	

*USE A = Adjustment P = Performance S = Service

SECTION II
INSTALLATION

2-1. INITIAL INSPECTION

2-2. This instrument met all of its performance specifications when packaged for shipment. If the shipping container or cushioning material is damaged it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping material for the carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-3. PREPARATION FOR USE

2-4. Meter Zeroing

2-5. With the power off, the Model 86632A Modulation Section meter indicator needle should be positioned on zero. If the needle is not on zero, turn the zero set screw adjustment counterclockwise to bring the needle below zero. Slowly rotate the zero set clockwise until the indicator is on zero. Rotate the zero set about 1/8 turn (45 degrees) counterclockwise.

2-6. Power Requirements

2-7. The power required for operation of the Model 86632A Modulation Section is furnished by the Mainframe.

2-8. Power consumption of the Model 86632A Modulation Section is approximately 5 watts.

2-9. Operating Environment

2-10. Cooling is provided to the Model 86632A Modulation Section by a fan in the Mainframe. This assures the ambient temperature of the instrument stays within reasonable limits when the instrument is operated at temperatures between 0 and 55 degrees C (32 to 131 degrees F).

2-11. Interconnections

2-12. Mating the Model 86632A Modulation Section to the Model 8660 Mainframe. Insert the Modulation Section into the left drawer in the Mainframe and push it about half way in. The latch, at the lower right corner of the front panel, should be rotated to the left until it protrudes, perpendicular to the front panel. Push the plug-in all the way in and rotate the latch to the right until it snaps into place.

2-13. STORAGE AND SHIPMENT

2-14. If the instrument is to be stored for an extended period of time, it should be enclosed in a clean sealed enclosure.

2-15. Packaging

2-16. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-17. Other Packaging. The following general instructions should be used for repackaging with commercially available materials:

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.

c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

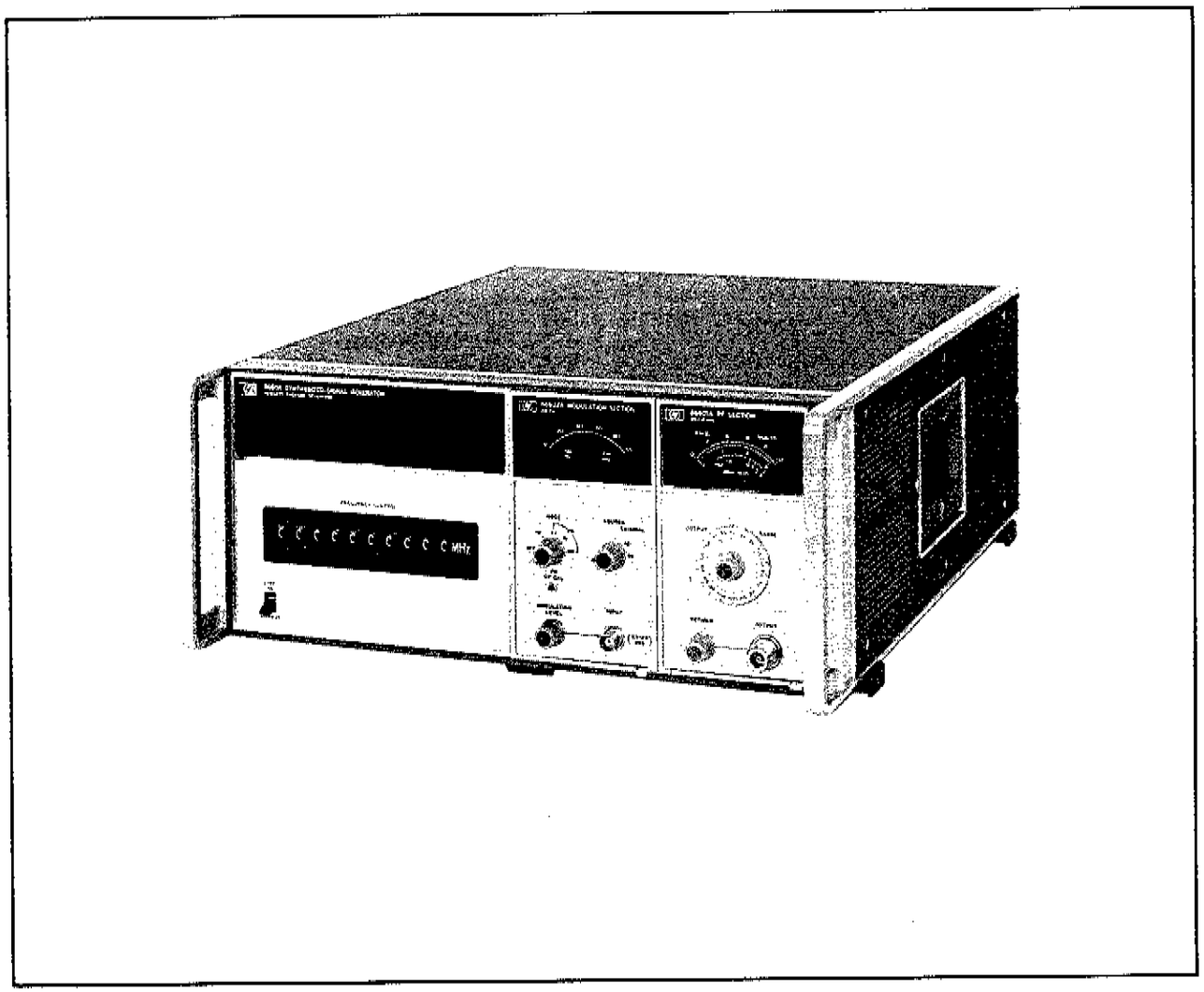


Figure 2-1. Model 86632A Shown Installed in Mainframe

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section provides operating instructions for the Hewlett-Packard Model 86632A Modulation Section.

3-3. The Model 86632A is designed to control the AM, FM, or cw output of the RF Section.

NOTE

Operating information is contained in the Mainframe and RF Section manuals under Section III.

3-4. PANEL FEATURES

3-5. Front and rear panel controls, indicators and connectors of the Model 86632A are shown in Figure 3-1.

3-6. OPERATOR'S CHECKS

NOTE

By performing the operator checks, the operator may become familiar with the instrument while verifying its operation.

3-7. During checkout at the factory, the Model 86632A Modulation Section is adjusted for proper operation. No adjustment should be required when the instrument is received.

3-8. An Oscilloscope and a Spectrum Analyzer with a frequency range of up to 40 MHz are used in the operator checks of the Model 86632A Modulation Section.

3-9. Set the Spectrum Analyzer controls as follows: center frequency, 30 MHz; bandwidth, 100 kHz; scan width per division, 1 MHz; input attenuation, 20 dB; scan time per division, 2 ms; and log reference level, 10 dBm.

3-10. Set the Model 8660 mainframe frequency to 30 MHz. Set the RF Section output level to 0 dBm.

3-11. Set the Model 86632A Modulation Section MODE control to OFF (cw) and the SOURCE control to INTERNAL 1000.

3-12. The following procedures verify proper operation of the Model 86632A Modulation Section.

a. Connect the RF Section OUTPUT to the Spectrum Analyzer RF input. Verify the presence of the 30 MHz CW signal.

b. Change the Model 86632A MODE control to AM and adjust the MODULATION LEVEL to 50% by setting the meter to 50.

c. Change the Spectrum Analyzer controls as follows: bandwidth, 0.1 kHz; scan width per division, 0.5 kHz; scan time per division, 0.2 s, and enable the signal stabilizing circuits. Verify that the display is similar to Figure 3-2.

d. Change the Model 86632A Modulation Section SOURCE control to INTERNAL 400. The sidebands should be 400 Hz from the carrier.

e. Connect the Oscilloscope to the RF Section OUTPUT and verify the modulation envelope is similar to that of Figure 3-3.

f. Change the Model 86632A Modulation Section MODE control to FM X10 and adjust the MODULATION LEVEL to 1 MHz peak deviation (meter reading of 100).

g. Change the Spectrum Analyzer controls as follows: bandwidth, 100 kHz; scan width per division, 0.5 MHz; and scan time per division, 20 ms.

h. Connect the RF Section OUTPUT to the Spectrum Analyzer RF input and verify the display is similar to that of Figure 3-4.

i. Change the Model 86632A Modulation Section MODE control to FM X1.

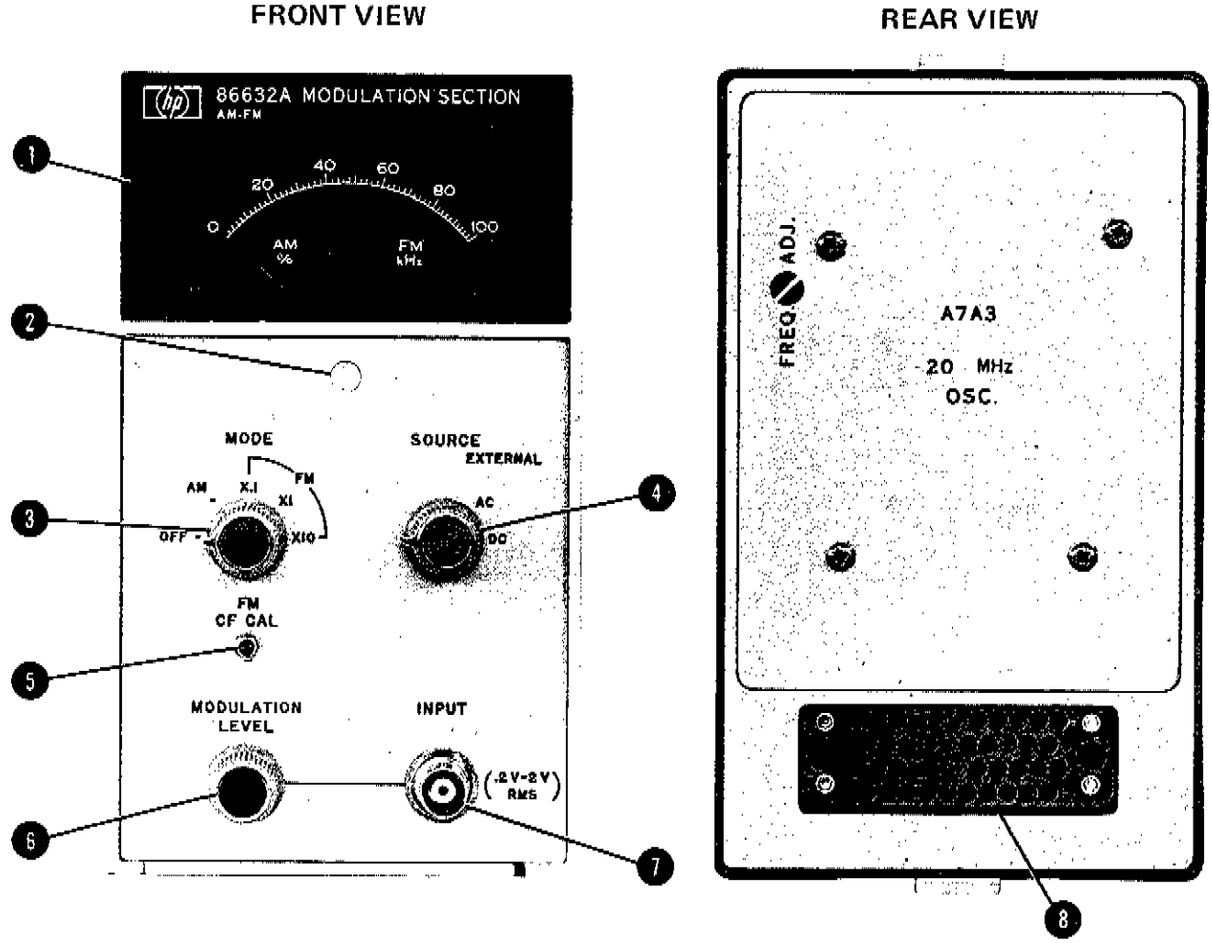
j. Change the Spectrum Analyzer controls as follows: bandwidth, 10 kHz; scan width per division, 0.05 MHz. Verify the display is similar to Figure 3-4.

k. Change the Model 86632A MODE control to FM X.1.

l. Change the Spectrum Analyzer controls as follows: bandwidth, 1 kHz; and scan width per division, 5 kHz. Verify the display is similar to Figure 3-4.

m. Push FM CF CAL button. Verify: FM sidebands disappear leaving cw output, the illumi-

PANEL FEATURES



1. The modulation level meter indicates amplitude modulation depth directly in percent and FM peak deviation in kHz when multiplied by the FM MODE range.
2. The zero set screw is used to zero the modulation level meter needle with no power applied to the Model 8660 system.
3. The MODE control selects amplitude modulated (AM), frequency modulated (FM), or cw (OFF) outputs from the RF Section.
4. The SOURCE control selects an INTERNAL 400 or 1000 Hz sine wave oscillator,or an EXTERNAL source that may be ac or dc coupled to the INPUT jack.
5. FM CF CAL button operates only in the FM MODE. It activates a 5 second calibrate cycle that resets the VCO frequency to 20 MHz and thus resets the RF Section output frequency to that indicated by the Model 8660 Mainframe.
6. The MODULATION LEVEL control allows the Operator to select any Modulation Depth (AM) between 0 and 100%, or any peak deviation frequency (FM) between 0 and 1 MHz.
7. The INPUT, OUTPUT BNC connector is used as the output when the SOURCE control is set INTERNAL, and is used as the INPUT when the SOURCE control is set to EXTERNAL.
8. The plug-in connector to the Mainframe provides power inputs and output control signals to the RF Section.

Figure 3-1. Front and Rear Panel Controls, Connectors and Indicators

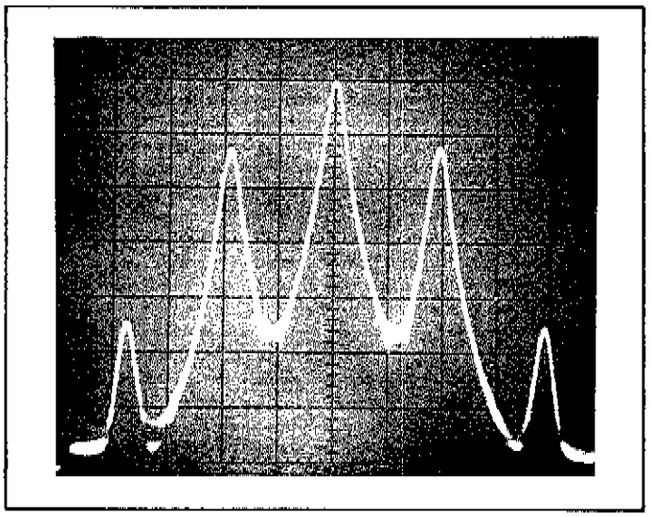


Figure 3-2. Amplitude Modulated (AM) Output

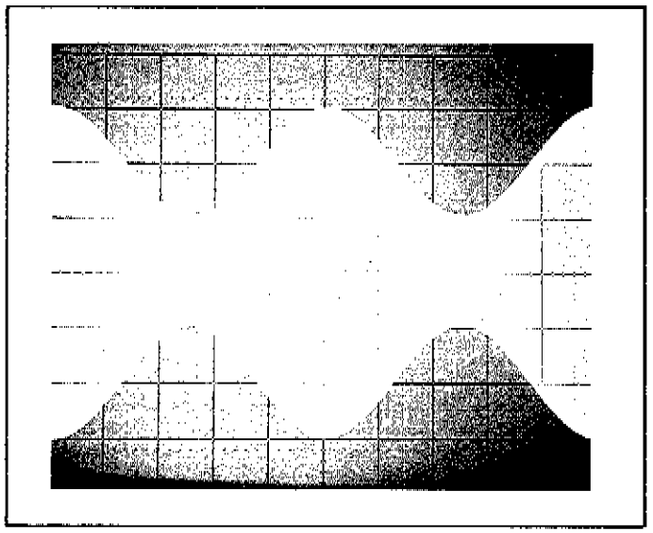


Figure 3-3. Amplitude Modulation Envelope

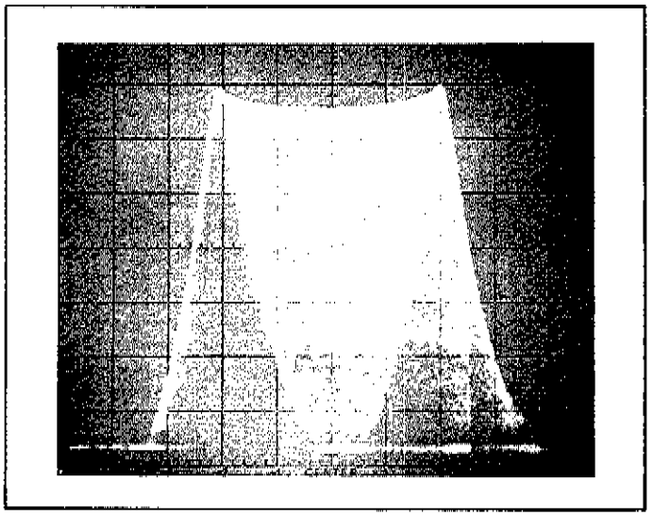


Figure 3-4. Frequency Modulation (FM) Output

nated FM MODE indicator on the mainframe goes out and the meter indicator drops to zero. After approximately 5 seconds the FM MODE indicator is illuminated, the FM sidebands reappear on the Spectrum Analyzer display and the meter indicator returns to 100.

3-13. OPERATING INSTRUCTIONS

3-14. The Model 86632A Modulation Section may be operated by front panel controls or externally programmed in the remote mode.

NOTE

Programming instructions for the Model 86632A Modulation Section may be found in the Model 8660 Mainframe manual under Section III.

3-15. CW MODE

3-16. Normally, in the cw mode, the MODE control is set in the OFF position.

3-17. In AM MODE, a cw signal will be obtained when the MODULATION LEVEL vernier is full counterclockwise or the SOURCE mode is set on EXTERNAL with no signal coupled to the INPUT.

NOTE

In FM MODE, the difference between the Mainframe frequency readout and the actual output is due to VCO error and drift. The FM CF CAL button must be pressed to reset the VCO.

3-18. INTERNAL AM AND FM

3-19. Modulation Rate

3-20. A 400 or 1000 Hz sinusoidal modulation rate may be selected.

3-21. Amplitude Modulation (AM) Depth

3-22. The modulation depth may be selected by adjusting the MODULATION LEVEL control until the correct level (in percent) is read directly on the meter.

3-23. Frequency Modulation (FM) Peak Deviation

3-24. The peak deviation frequency is determined by multiplying the meter reading by the FM range multiplier.

NOTE

For maximum accuracy, the lowest FM MODE range for a specific deviation should be selected.

3-25. Modulating Signal Output

3-26. The internally selected modulating signal is coupled to the front panel BNC connector and can supply a minimum 100 mVrms to a 10K resistive load.

3-27. EXTERNAL AM AND FM

3-28. Modulation Rate

3-29. DC Mode. An external source with a modulation rate of dc to 1 MHz or the maximum specified for the RF Section may be used.

3-30. AC Mode. An external source with a modulation rate of 20 Hz to 1 MHz or the maximum specified for the RF Section may be used.

3-31. AM Depth and Peak Deviation

NOTE

Refer to paragraphs 3-21 thru 24 for interpreting meter readings.

3-32. DC Mode. To ensure the MODULATION LEVEL control is calibrated and continuously variable from 0 to 100 in local and remote operation, an external signal of 1.80 ±0.05Vrms must be coupled to the INPUT connector.

3-33. AC Mode. To ensure the MODULATION LEVEL control is calibrated and continuously variable from 0 to 100 in local and remote operation, an external signal of 0.2 to 2.0Vrms must be coupled to the INPUT connector.

CAUTION

Do not allow the input voltage to go over 2.0Vrms. The modulation depth or peak deviation may be changed only by the MODULATION LEVEL control.

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section are used to verify that the electrical performance of the Model 86632A Modulation Section meets the specifications listed in Table 1-1. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in Section III under Operators Checks.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for the performance tests is listed in Table 1-3, Recommended Test Equipment. Equipment that satisfies the critical specifications given in the table may be substituted for the equipment recommended.

4-5. TEST RECORD

4-6. Results of the performance tests may be tabulated on the Test Record at the end of the procedures. The Test Record lists all of the tested specifications and their acceptable limits. Test results recorded at incoming inspection may be used for comparison in periodic maintenance, troubleshooting, and after repairs or adjustments have been made.

4-7. MODULATION RATE AND OUTPUT LEVEL

SPECIFICATION: AM and FM Rate: 400 Hz and 1 kHz ±5%. Modulating Signal Output: Selected internal modulation signal provided at front panel BNC connector at level of 100 mV rms minimum into 10 kilohm resistive load.

DESCRIPTION: This test verifies the internal modulation capabilities and the output level.

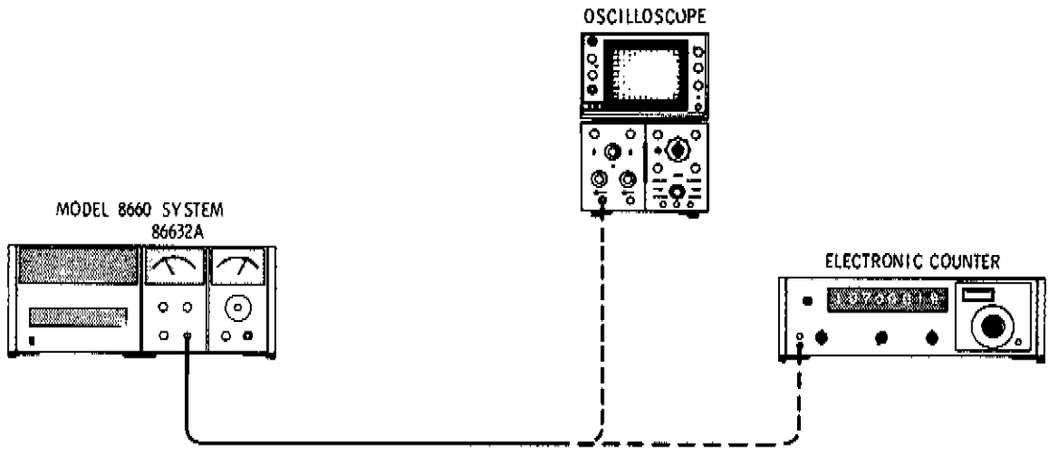


Figure 4-1. Modulation Rate and Output Level Test Setup

EQUIPMENT:

Oscilloscope	HP 180A/1801A/1821A
Electronic Counter	HP 5245M

PROCEDURE:

1. Connect the Modulation Section OUTPUT to the counter input.

PERFORMANCE TESTS

4-7. MODULATION RATE AND OUTPUT LEVEL (cont'd)

2. Set the Model 86632A controls as follows; MODE - AM, SOURCE - INTERNAL 400. The counter readout should be 400 ± 20 Hz.

_____ Hz

3. Change the Model 86632A SOURCE control to INTERNAL 1000. The counter readout should be 1000 ±50 Hz.

_____Hz

4. Connect the Modulation Section OUTPUT to the oscilloscope input through a BNC Tee. Load the remaining BNC Tee port with a 10 K resistor. The signal displayed on the oscilloscope should be a minimum of 280 mV p-p (100 mVrms).

_____mV p-p

5. Change the Model 86632A SOURCE control to INTERNAL 400. The signal displayed on the oscilloscope should be a minimum of 280 mV p-p (100 mVrms).

_____mV p-p

4-8. MODULATION DEPTH AND METER ACCURACY

SPECIFICATION: Modulation Depth: Continuously adjustable from 0 to 100% or maximum specified for RF Section installed. Meter: Range 0 to 100% modulation; accuracy ±5% of full scale.

DESCRIPTION: This test verifies Amplitude Modulation Depth and meter accuracy at 20%, 50% and 90% modulation.

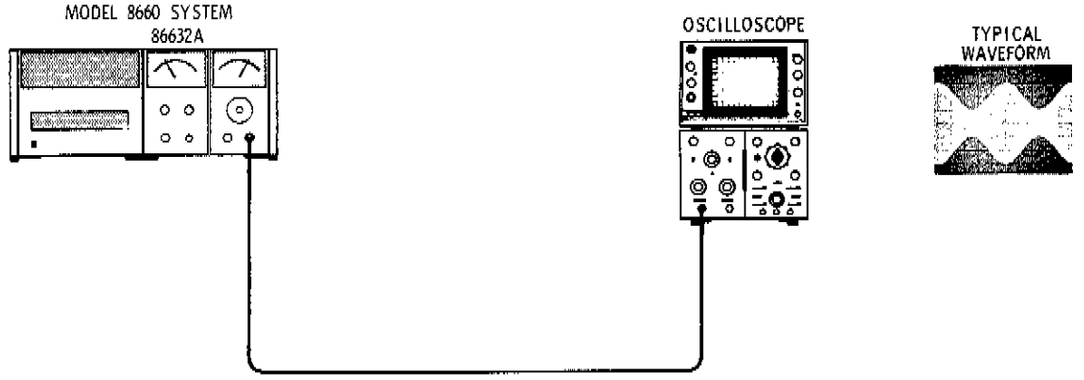


Figure 4-2. Modulation Depth and Meter Accuracy Test Setup

EQUIPMENT:
Oscilloscope . . . . . HP 180A/1801A/1821A

PROCEDURE:
1. Connect the equipment as shown in Figure 4-2.

PERFORMANCE TESTS

4-8. MODULATION DEPTH AND METER ACCURACY (cont'd)

2. Set the mainframe frequency to 10 MHz and the RF Section output level to 0 dBm.

3. Set the Model 86632A MODE control to OFF.

4. Set the oscilloscope time base to 0.2 ms per division and the vertical sensitivity to 0.1 V per division. Adjust the RF Section VERNIER control for an oscilloscope display of 4 divisions peak-to-peak.

5. Set the Model 86632A MODE control to AM and the SOURCE control to INTERNAL 1000. Adjust the MODULATION LEVEL control for 2 divisions between peak and valley of the AM envelope display on the oscilloscope. See Figure 4-2 for a typical waveform.

6. Verify that the Model 86632A meter reads between 45 and 55%. _____%

7. Adjust the Model 86632A MODULATION LEVEL control for an oscilloscope display with 0.8 division between peak and valley. The meter should read between 15 and 25%. _____%

8. Adjust the Model 86632A MODULATION LEVEL control for an oscilloscope display with 3.6 divisions between peak and valley. The meter should read between 85 and 95%. _____%

9. Repeat steps 5 through 8 with the SOURCE control set to INTERNAL 400.

6. _____% 7. _____% 8. _____%

4-9. FM DEVIATION AND METER ACCURACY

SPECIFICATION: FM Deviation: Adjustable from 0 to 1 MHz peak or maximum specified for RF Section installed. Meter: Indicates peak deviation in 3 ranges; 0 to 10 kHz, 0 to 100 kHz, or 0 to 1 MHz. Accuracy ±5% of full scale.

DESCRIPTION: This test verifies peak deviation and meter accuracy at 10 kHz, 100 kHz and 1 MHz.

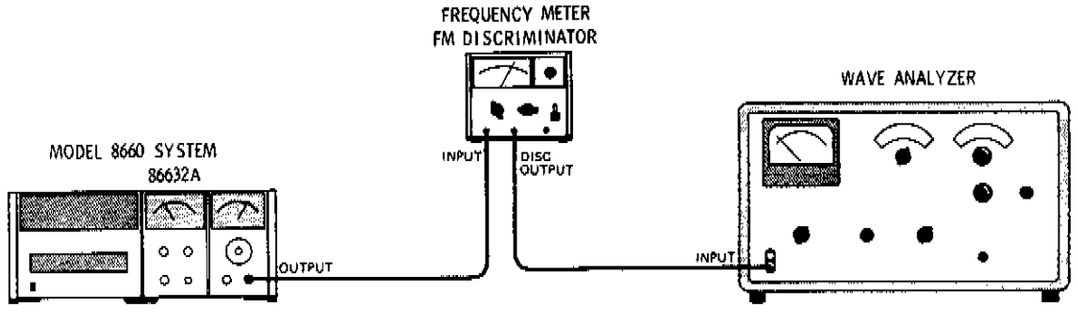


Figure 4-3. FM Deviation and Meter Accuracy Test Setup

EQUIPMENT:

Frequency Meter FM Discriminator	HP 5210A
Wave Analyzer	HP 302A

PROCEDURE:

1. Set the mainframe frequency to 8.5 MHz and the RF Section OUTPUT to +13 dBm.

PERFORMANCE TESTS

4-9. FM DEVIATION AND METER ACCURACY (cont'd)

2. Set the Model 86632A controls as follows: MODE - FM X10, SOURCE - INTERNAL 1000, MODULATION LEVEL control for a meter reading of 100 (1 MHz) and push the FM CF CAL switch.

3. Calibrate the Frequency Meter FM Discriminator output. (If the HP 5210A is used, refer to the Operating and Service Manual, Section III.)

4. Install a 20 kHz Lowpass Filter in the FM Discriminator output. If the HP 5210A is used, see Table 4-1 for component values.

5. Set the Frequency Meter FM Discriminator to a sensitivity of 1 volt and a frequency range of 10 MHz.

Table 4-1. HP 5210A 20 kHz Lowpass Filter Resistors

Resistor No.	Resistor values (series connection)
R1	13.3K and 287 ohms
R2	42.4K and 152 ohms
R3	5.11K and 196 ohms
R4	23.7K and 196 ohms

6. Connect the equipment as shown in Figure 4-3.

7. Tune the Wave Analyzer to 1 kHz (absolute) and verify that the Wave Analyzer shows an output of 70.7 ±3.5 mVrms. _____ mVrms

8. Set the Model 86632A MODE control to FM X1, and the MODULATION LEVEL for a meter reading of 100 (100 kHz).

9. Set the mainframe center frequency to 850 kHz.

10. Set the Frequency Meter FM Discriminator frequency range to 1 MHz. The Wave Analyzer should show an amplitude of 70.7 ±3.5 mVrms. _____ mVrms

11. Set the Model 86632A MODE control to FM X0.1 and the MODULATION LEVEL to 100 (10kHz).

12. Change the mainframe center frequency to 85 kHz.

13. Set the Frequency Meter FM Discriminator frequency range to 100 kHz. Verify that the Discriminator output is 70.7 ±3.5 mVrms. _____ mVrms.

4-10. MODULATION DISTORTION

SPECIFICATION: Internal: Maintains minimum AM/FM distortion specified for RF Section used. External: Partially determined by external modulating signal distortion. Modulating signal distortion must be less than 0.3% to meet RF Section distortion specification.

NOTE

Refer to the RF Section Operating and Service Manual, Section IV for the distortion checks.

PERFORMANCE TESTS

4-11. AM INPUT LEVEL AND RATE

SPECIFICATION: AC Coupled Mode: External modulating signal must be between 0.2 and 2 Vrms to provide full vernier control range and calibrated remote programming of modulation.

DC Coupled Mode: External modulation signal must be 1.8 Vrms ±50 mV to maintain full vernier range and calibrated remote programming of modulation.

AM Rate: DC to 1 MHz maximum in dc mode or 20 Hz to 1 MHz maximum in ac mode. Maximum usable modulation rate depends on specifications for the RF Section installed.

DESCRIPTION: The modulation depth as read on the meter is checked against the envelope displayed on the oscilloscope. This verifies proper AM operation at the extreme frequency and voltage limits of both and AC and DC coupled modes.

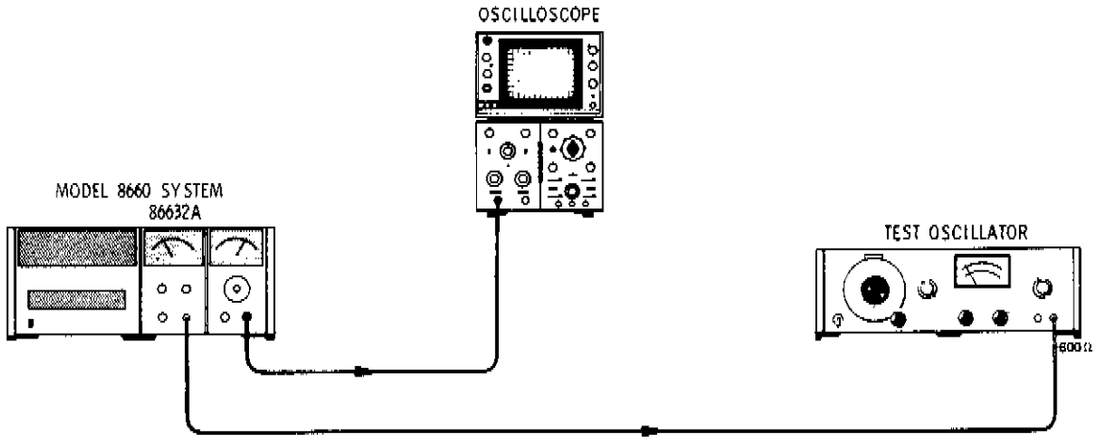


Figure 4-4. AM Input Level and Rate Test Setup

EQUIPMENT:

Oscilloscope	HP 180A/1801A/1821A
Test Oscillator	HP 651B

PROCEDURE:

1. Set the mainframe center frequency to 1 MHz and the RF Section OUTPUT to 0 dBm.
2. Set the Model 86632A Modulation Section MODE control to OFF.
3. Connect the equipment as shown in Figure 4-4.
4. Adjust the oscilloscope horizontal and vertical controls for a display of 4 divisions peak-to-peak.
5. Set the Test Oscillator to a frequency of 20 Hz with an output level of 1.80 ± 0.05 Vrms.
6. Set the Model 86632A MODE control to AM and the SOURCE control to EXTERNAL DC.
7. Adjust the Model 86632A MODULATION LEVEL control until the AM envelope displayed on the oscilloscope shows 2 divisions between peak and valley. See Figure 4-2 and verify that the meter reading is between 45 and 55%.

_____%

PERFORMANCE TESTS

4-11. AM INPUT LEVEL AND RATE (cont'd)

8. Set the Model 86632A SOURCE control to EXTERNAL AC and adjust the MODULATION LEVEL control until the AM envelope displayed on the oscilloscope shows 2 divisions between peak and valley. Verify that the meter still reads between 45 and 55%.

_____%

9. Set the Test Oscillator output signal level to 0.2 Vrms. Verify that the meter still reads between 45 and 55%.

_____%

10. Set the Test Oscillator frequency to 10 kHz with an output level of 2 Vrms.

11. Set the mainframe center frequency to 10 MHz and the Model 86632A MODE control to OFF.

12. Adjust the oscilloscope horizontal and vertical controls for a display of 4 divisions peak-to-peak.

13. Set the Model 86632A MODE control to AM. Adjust the MODULATION LEVEL control until the AM envelope displayed on the oscilloscope shows 2 divisions between peak and valley. Verify that the meter reads between 45 and 55%.

_____%

14. Set the Test Oscillator output to 1.80 ±0.05 Vrms.

15. Set the Model 86632A SOURCE control to EXTERNAL DC and repeat step 13.

_____%

4-12. FM INPUT LEVEL AND RATE

SPECIFICATION: AC Coupled Mode: External modulating signal must be between 0.2 and 2 Vrms to provide full vernier control range and calibrated remote programming of modulation.

DC Coupled Mode: External modulation signal must be 1.8 Vrms ±50 mV to maintain full vernier range and calibrated remote programming of modulation.

FM Rate: DC to 1 MHz in dc mode, or 20 Hz to 1 MHz in ac mode. Maximum usable rate depends on specifications for RF Section installed.

DESCRIPTION: This test verifies FM operation at the frequency extremes in AC and DC coupled modes.

PERFORMANCE TESTS

4-12. FM INPUT LEVEL AND RATE (cont'd)

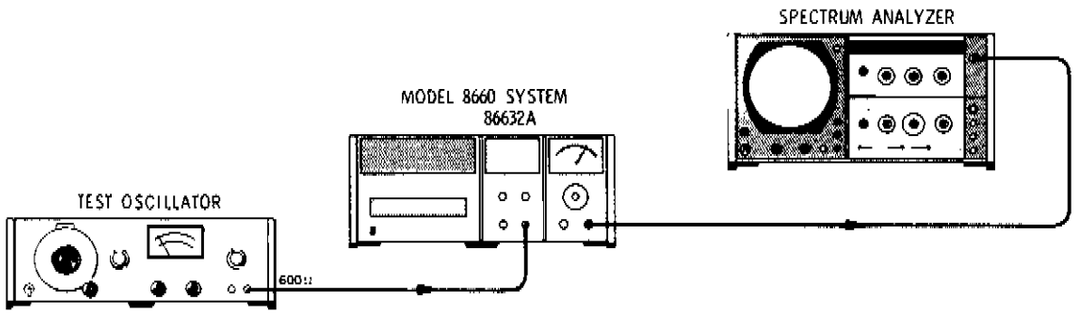


Figure 4-5. FM Input Level and Rate Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 140S/8553B/8552B
Test Oscillator	HP 651B

PROCEDURE:

1. Connect the equipment as shown in Figure 4-5.
2. Set the mainframe center frequency to 10 MHz and the RF Section output to 0 dBm.
3. Set the Spectrum Analyzer controls as follows; frequency - 10 MHz, bandwidth - 3 kHz, scan width per division - .05 MHz, input attenuation - 30 dB, and scan time per division - 0.5 second.
4. Adjust the test oscillator controls for an output of 20 Hz at 1.80 ±0.05 Vrms.
5. Set the Model 86632A Modulation Section MODE control to FM X1, the SOURCE control to EXTERNAL DC and adjust the MODULATION LEVEL control to 100, then close the FM CF CAL switch to calibrate the FM oscillator.
6. Verify the 100 kHz peak deviation on the Spectrum Analzyer display.

   Deviation_____ kHz

7. Set the Model 86632A SOURCE control to EXTERNAL AC and readjust the MODULATION LEVEL control to 100. The Spectrum Analyzer display should show 100 kHz deviation (See Figure 3-4 for a typical waveform).

   Deviation_____kHz

8. Set the Model 86632A MODE control to FM X10, the SOURCE control to EXTERNAL DC, the MODULATION LEVEL to 100 and push the FM CF CAL switch.
9. Readjust the Test Oscillator output to 10 kHz at 1.80 ± 0.05 Vrms.
10. Set the Spectrum Analyzer controls as follows; bandwidth - 10 kHz, scan width per divison - 1 MHz and scan time per division - 20 ms.
11. The peak deviation should be 1 MHz.

    Deviation_____ MHz

PERFORMANCE TESTS

4-12. FM INPUT LEVEL AND RATE (cont'd)

12. Set the Model 86632A SOURCE control to EXTERNAL AC and verify that the peak deviation is 1 MHz.

Deviation_____MHz

4-13. REMOTE PROGRAMMING

SPECIFICATION: Remote Modulation Setting Resolution: Modulation level can be remotely set in steps of 1/100 of the range selected.

Remote Modulation Setting Accuracy: ±5% of setting.

DESCRIPTION: Operation of the instrument in remote control mode is verified by programming a series of modulation functions with a remote device.

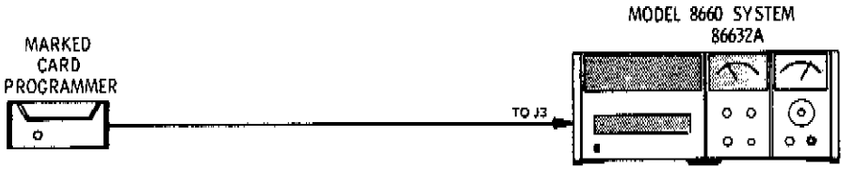


Figure 4-6. Remote Programming Test Setup

EQUIPMENT:

Marked Card Programmer . . . . . HP 3260A - Option 001

PROCEDURE:

1. Connect the Marked Card Programmer to the mainframe programming input connector (J3) on the rear panel of the mainframe. Refer to Section III of the mainframe manual for programming instructions.

2. Program the Model 86632A to AM mode, Internal 400 source and a modulation level of 0%.

3. In sequence, on separate cards, program 1, 2, 11, 22, 44 and 88% modulation levels into the Model 86632A. As each level is programmed into the system, verify that the change in meter reading is proportional to the change in the programmed level.

Table 4-2. Performance Test Record

Hewlett-Packard Model 86632A
Modulation Section

Tested by _____

Serial Number _____ Date _____

Paragraph Number	Test			Min	Results Actual	Max
4-7	**INTERNAL MODULATION RATE AND OUTPUT LEVEL**					
		Step 2	Hz	380	_____	420
		Step 3	Hz	950	_____	1050
		Step 4	mV p-p	280	_____	
		Step 5	mV p-p	280	_____	
4-8	**INTERNAL MODULATION DEPTH AND METER ACCURACY**					
		Step 6	%	45	_____	55
	1000 Hz	Step 7	%	15	_____	25
		Step 8	%	85	_____	95
		Step 6	%	45	_____	55
	400 Hz	Step 7	%	15	_____	25
		Step 8	%	85	_____	95
4-9	**INTERNAL MODULATION FM DEVIATION AND METER ACCURACY**					
		Step 7	mVrms	67.2	_____	74.2
		Step 10	mVrms	67.2	_____	74.2
		Step 13	mVrms	67.2	_____	74.2
4-11	**EXTERNAL MODULATION INPUT LEVEL REQUIRED: AM MODE**					
		Step 7	%	45	_____	55
		Step 8	%	45	_____	55
		Step 9	%	45	_____	55
		Step 13	%	45	_____	55
		Step 15	%	45	_____	55
4-12	**EXTERNAL MODULATION INPUT LEVEL REQUIRED: FM MODE**					
		Step 6	kHz		_____	
		Step 7	kHz		_____	
		Step 11	MHz		_____	
		Step 12	MHz		_____	

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes adjustments and checks required to return the Model 86632A to peak operating capability when repairs have been made. Adjustment locatiosn are identified pictorially on Section VIII foldout service sheets referred to in the individual tests.

5-3. RECOMMENDED TEST EQUIPMENT

5-4. Each adjustment procedure in this section contains a list of test equipment and accessories required to perform the procedure. Each test setup identifies test equipment and accessories by call-outs.

5-5. To ensure that the Model 86632A is operating at peak capability, it is important that the test equipment used meets the minimum specifications stipulated in Table 1-3.

5-6. The HP 11672 Service Kit (itemized in Table 1-3) and the extender boards (supplied with the mainframe) provide access to test points and components to aid in maintenance.

5-7. FACTORY SELECTED COMPONENTS

5-8. Factory selected components are identified on the schematics by an asterisk following the reference designator. The nominal value is listed on the schematic, in Tables 5-1 and 6-3. Usually these values are not extremely critical; they are selected to provide optimum compatability with associated components.

Table 5-1. Factory Selected Components

Reference Designator	Selected for	Normal Value Range	Service Sheet
A6R32	Compensation for V_{be} offset	18 - 24 Ohms	6

5-9. RELATED ADJUSTMENTS

5-10. The amplitude leveling output (paragraph 5-15) should be checked, and if necessary, adjusted before other adjustment procedures are performed.

5-11. ADJUSTMENT LOCATIONS

5-12. The location of each adjustable component is shown on the service sheet referenced in the individual procedures.

NOTE

For all adjustments the Model 86632A, with the cover removed, should be connected to the mainframe with the extender cable (HP 11672-60002).

ADJUSTMENTS

5-13. MODULATION OSCILLATOR

REFERENCE: Service Sheet 3.

DESCRIPTION: The INTERNAL 400 and 1000 Hz oscillators are adjusted to the correct frequency.

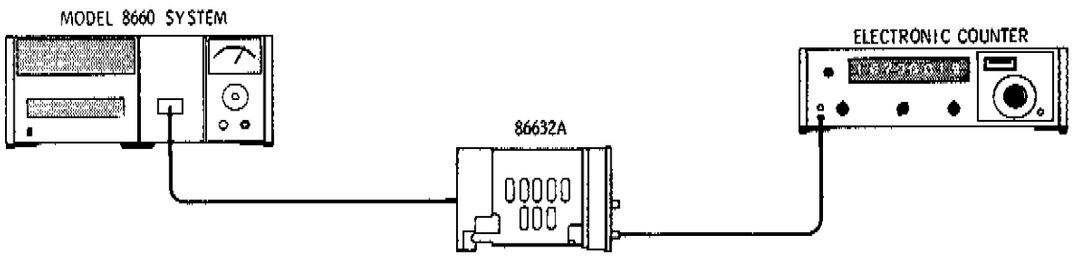


Figure 5-1. Modulation Oscillator Adjustment Setup

EQUIPMENT:

Electronic Counter	HP 5245M
Extender Cable	HP 11672-60002

PROCEDURE:

1. Connect the equipment as shown in Figure 5-1.
2. Set the Electronic Counter to 0.1 V sensitivity.
3. Set the Model 86632A MODE control to AM and the SOURCE control to INTERNAL 400.
4. Adjust A5R15 for a counter reading of 400 ±4 Hz.
5. Set the Model 86632A SOURCE control to INTERNAL 1000.
6. Adjust A5R16 for a counter reading of 1000 ±10 Hz.

5-14. METER

REFERENCE: Service Sheet 5.

DESCRIPTION: The modulation level meter is adjusted at 0 and 100 to ensure tracking across the MODULATION LEVEL control range.

ADJUSTMENTS

5-14. METER (cont'd)

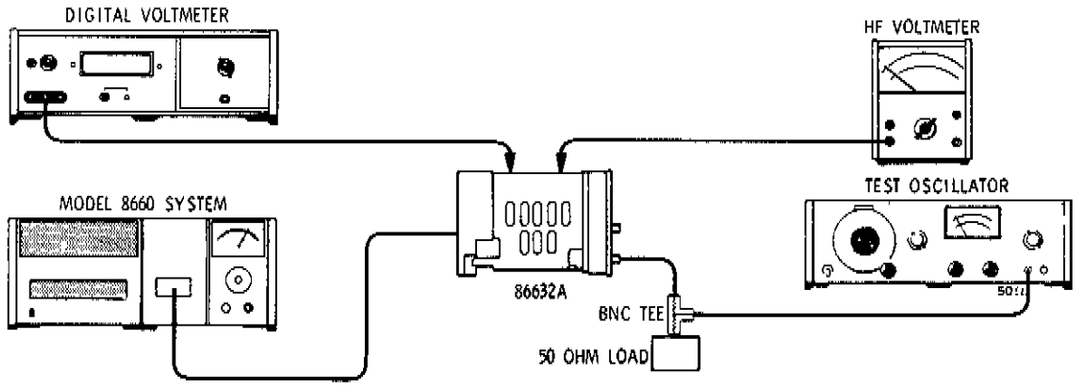


Figure 5-2. Meter Adjustment Setup

EQUIPMENT:

Test Oscillator	HP 651B
Digital Voltmeter	HP 3440A
High Frequency dB Voltmeter	HP 400GL
Extender Cable	HP 11672-60002
50 ohm Load	HP 11593A
BNC Tee	UG 274B/U

NOTE

With the power off, the Model 86632A meter indicator needle should be positioned on zero. If the needle is not on zero, turn the zero setscrew adjustment counter-clockwise to bring the needle below zero. Slowly rotate the zero set clockwise until the indicator needle is on zero. Rotate the zero setscrew about 1/8 turn (45°) counterclockwise.

PROCEDURE:

1. Remove the A3 assembly and reinstall it using an extender board.
2. Set the Model 86632A MODE control to AM, the SOURCE control to EXTERNAL DC and the MODULATION LEVEL full counterclockwise.
3. With no input signal, monitor TP3 with the digital voltmeter and adjust A3R6 0 ADJ for a meter reading of 0 ±1 mV after a sixty second warmup of the Model 86632A.
4. Set the Model 86632A MODE control to FM X0.1 and set the SOURCE control to EXTERNAL DC.
5. Connect the 50 ohm output of the Test Oscillator through a BNC Tee to the Model 86632A INPUT. Terminate the other BNC port with a 50 ohm load.
6. Set the Test Oscillator output to 1 kHz at 1.85 Vrms.
7. Connect the High Frequency dB Voltmeter to A3TP1 and adjust the Model 86632A MODULATION LEVEL vernier for a meter reading of 1 Vrms.
8. Adjust A3R32 for a reading of 100 on the modulation level meter.
9. Remove the extender board and reinstall the A3 assembly.

ADJUSTMENTS

5-15. AMPLITUDE LEVELING

REFERENCE: Service Sheet 4.

DESCRIPTION: When properly adjusted, a constant output of 1.80 ± .05 Vrms is provided by the leveling amplifier with an EXTERNAL AC input of 0.2 to 2 Vrms.

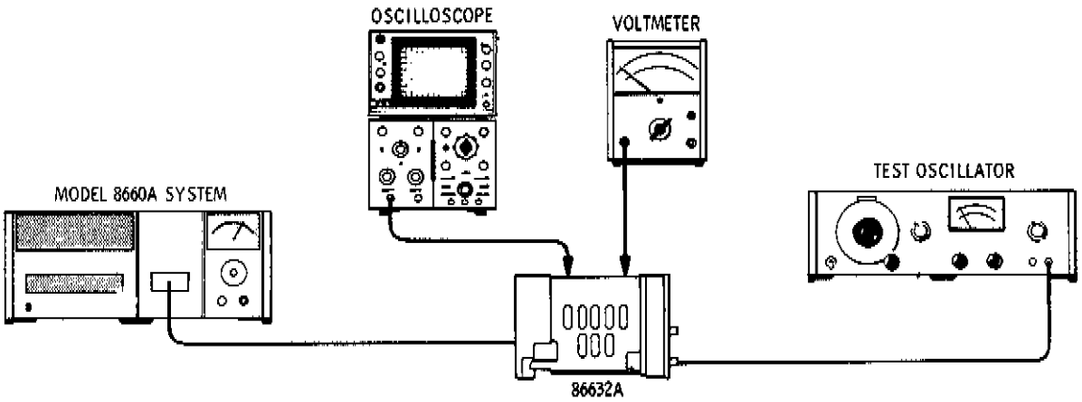


Figure 5-3. Amplitude Leveling Adjustment Setup

EQUIPMENT:

Test Oscillator	HP 651B
Oscilloscope	HP 180A/1801A/1821A
High Frequency dB Voltmeter	HP 400GL
Extender Cable	HP 11672-60002

PROCEDURE:

NOTE

Unless A4U1 or an associated component has been replaced, A4R45, which has been adjusted at the factory, should not have to be readjusted.

1. Remove the A4 assembly and reinstall it using an extender board.
2. Connect the Test Oscillator 50 ohm output to the Model 86632A INPUT.
3. Set the Test Oscillator frequency to 15 Hz with an output level of 2.0 Vrms.
4. Set the oscilloscope vertical sensitivity to 0.1 volts per divison.
5. Connect the oscilloscope to the negative side of A4C11 through a 10:1 divider probe.
6. Adjust A4R45 for maximum gain without oscillation. The signal should be greater than 4.65 Vp-p.

NOTE

If remote programming is available proceed to step 7, otherwise, proceed to step 9.

7. Program the instrument as follows: mainframe center frequency-20 MHz, Model 86632A MODE-AM, SOURCE-EXTERNAL AC, MODULATION LEVEL-90%.
8. Adjust A4R35 for a reading of 90 on the MOdel 86632A meter. (End of adjustment.)

ADJUSTMENTS

5-15. AMPLITUDE LEVELING (cont'd)

9. Manually set the instrument as specified in step 7. Disconnect the oscilloscope and connect the voltmeter to the negative side of A4C11.

10. Adjust A4R35 for a reading of 1.80 ±0.05 Vrms on the High Frequency dB Voltmeter.

5-16. FM DEVIATION ATTENUATOR

REFERENCE: Service Sheet 6.

DESCRIPTION: The FM range selector circuit is set to zero with no modulation input and the FM peak deviation is calibrated at 1 MHz.

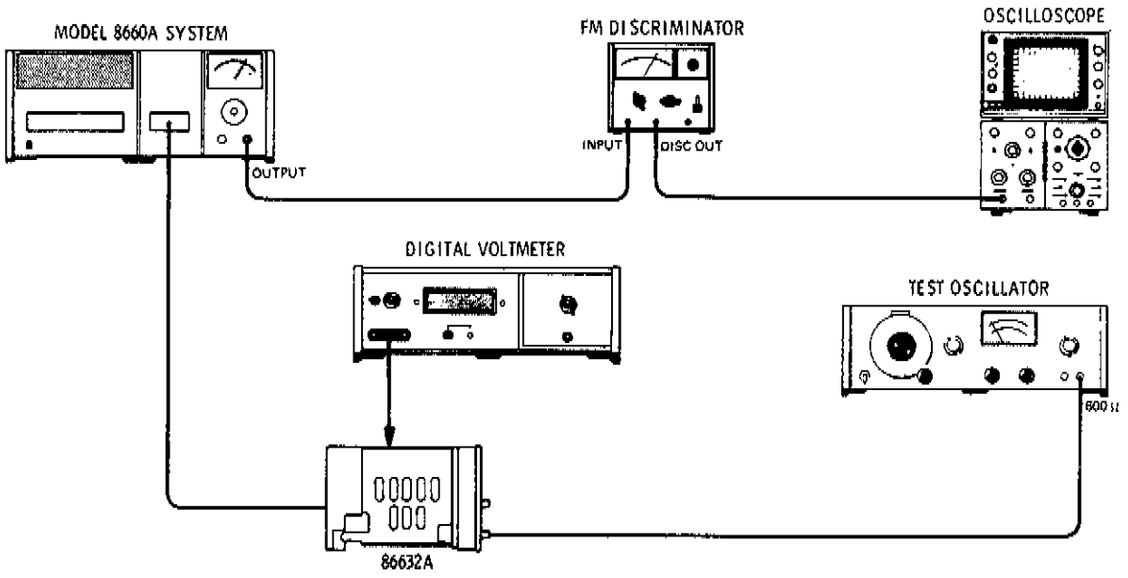


Figure 5-4. FM Deviation Attenuator Adjustments Setup

EQUIPMENT:

Digital Voltmeter	HP 3440A
Test Oscillator	HP 651B
Oscilloscope	HP 180A/1801A/1821A
Extender Cable	HP 11672-60002
Frequency Meter, FM Discriminator	HP 5210A

PROCEDURE:

1. Set the Model 86632A MODE control to FM X 0.1 the SOURCE control to EXTERNAL DC and the MODULATION LEVEL control full clockwise.

NOTE

There is no input to the Model 86632A for the next two steps.

ADJUSTMENTS

5-16. FM DEVIATION ATTENUATOR (cont'd)

2. Connect the Digital Voltmeter to A6TP2 and adjust A6R20 'ZERO-1' for a reading of 0 ±1 mV.
3. Connect the Digital Voltmeter to A6TP3 and adjust A6R23 'ZERO 2' for a reading of 0 ±1 mV. Disconnect the Digital Voltmeter.
4. Set the Frequency Meter, FM Discriminator to a sensitivity of 1 V and a range of 10 MHz.
5. Calibrate the Frequency Meter, FM Discriminator output. (Refer to the Operating and Service Manual for instructions.)
6. Set the mainframe center frequency to 8 MHz and the RF Section output to +13 dBm.
7. Set the Model 86632A MODE control to FM X10 and the SOURCE control to EXTERNAL AC.
8. Set the Test Oscillator frequency to 1 kHz and the output amplitude to 1 Vrms.
9. Connect the equipment as shown in Figure 5-4.
10. Adjust the Model 86632A MODULATION LEVEL control for a reading of 100 on the meter.
11. Adjust A6R25 'FM-SEN' to show a 0.2 Vp-p display on the oscilloscope.

5-17. VCO CENTER FREQUENCY

REFERENCE: Service Sheet 7.

DESCRIPTION: The Model 86632A 20 MHz VCO frequency is adjusted as the output of the RF Section is monitored on an Electronic Counter. With the Model 86632A in the FM mode (0 deviation) the counter readout should be the same as the mainframe center frequency ±5 kHz.

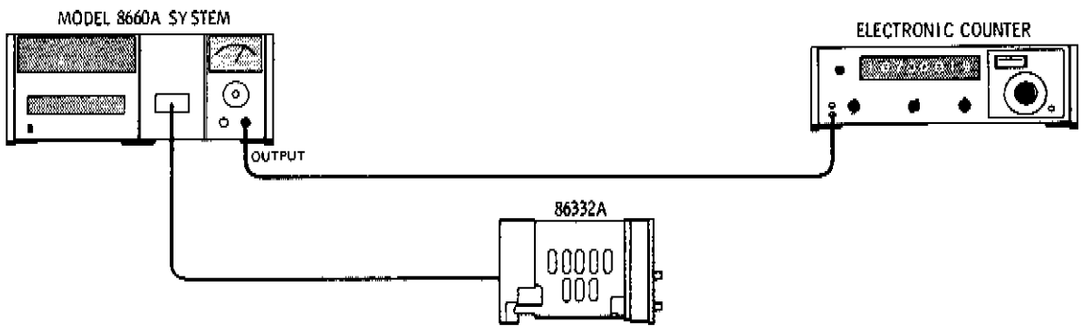


Figure 5-5. VCO Center Frequency Adjustment Setup

EQUIPMENT:

Electronic Counter	HP 5245M
Extender Cable	HP 11672-60002

PROCEDURE:

1. Connect the equipment as shown in Figure 5-5.

ADJUSTMENTS

5-17. VCO CENTER FREQUENCY (cont'd)

2. Remove the A7A3 VCO cover on the rear panel of the Model 86632A.
3. Turn the Model 86632A MODE control OFF.
4. Set the mainframe center frequency to 10 MHz and the RF Section output to +13 dBm
5. Set the Model 86632A MODE control to FM X1 and the SOURCE control to EXTERNAL AC with no input applied.
6. Ground the teflon insulated standoff on A7A3 and record the counter reading.

_____ MHz

7. Remove the ground clip, replace the A7A3 cover with two screws, and record the counter reading.

_____ MHz

8. Record the difference frequency between steps 6 and 7.

_____ MHz

9. Remove the A7A3 cover. If the frequency in step 6 was higher than that in step 7, adjust A7A3R8 for a reading on the counter of 10 MHz plus the difference frequency. If the frequency in step 6 was lower than that in step 7, adjust A7A3R8 for a reading on the counter of 10 MHz less the difference frequency.
10. Replace the A7A3 cover and recheck the frequency. The counter readout should display 10.000 ±0.005 MHz. If the frequency is not within tolerance, repeat steps 6 through 10.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information relative to ordering replacement parts and assemblies.

6-3. Table 6-1 provides correct stock numbers for use when ordering assemblies on an exchange basis.

6-4. Table 6-2 provides an index of reference designations and abbreviations used in the preparation of Hewlett-Packard manuals.

6-5. Table 6-3 is the table of replaceable parts and is arranged as follows:

a. Electrical assemblies and their component parts in alpha-numerical order by reference designation.

b. Chassis parts in alpha-numerical order by reference designation.

c. Miscellaneous parts.

6-5. The information given for each part consists of the following:

a. The reference designator.

b. The Hewlett-Packard part number.

c. Total quantity (TQ) in the instrument. Total quantity for each part is given only once - at the first appearance of the part number.

d. Description of the part.

e. Manufacturer of the part, in a five-digit code.

f. The manufacturer's part number for the part.

6-7. Table 6-4 contains the names and addresses that correspond to the manufacturers code number.

6-8. ORDERING INFORMATION

6-9. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

6-10. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

Table 6-1. Part Numbers for Assembly Exchange Orders

Assembly No.	Assembly Name	Assembly Part No.	Exchange Part No.
A2	Switch Logic	86632-60004	86632-60104
A3	Remote Attenuation	86632-60006	86632-60006
A4	Leveling Amplifier	86632-60005	86632-60105
A5	Modulation Oscillator	86632-60009	86632-60108
A6	FM Deviation Attenuation	86632-60003	86632-60103
A7A2	20 MHz Switch	86632-60001	86632-60101
A7A3	20 MHz VCO	86632-60002	86632-60102

Table 6-2. Reference Designators and Abbreviations used in Parts List

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	P	= plug	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor	FL	= Filter	Q	= transistor		
BT	= battery	J	= jack	R	= resistor		
C	= capacitor	K	= relay	RT	= thermistor	VR	= voltage regulator
CP	= coupler	L	= inductor	S	= switch		
CR	= diode	LS	= loud speaker	T	= transformer	W	= cable
DL	= delay line	M	= meter	TB	= terminal board	X	= socket
DS	= device signaling (lamp)	MK	= microphone	TP	= test point	Y	= crystal
E	= misc electronic part	MP	= mechanical part	U	= integrated circuit	Z	= tuned cavity, network

ABBREVIATIONS

A	= amperes	H	= henries	N/O	= normally open	RMO	= rack mount only
AFC	= automatic frequency control	HDW	= hardware	NOM	= nominal	RMS	= root-mean square
		HEX	= hexagonal	NPO	= negative positive zero (zero temperature coefficient)	RWV	= reverse working voltage
AMPL	= amplifier	HG	= mercury			S-B	= slow-blow
		HR	= hour(s)			SCR	= screw
BFO	= beat frequency oscillator	Hz	= Hertz	NPN	= negative-positive-negative	SE	= selenium
		IF	= intermediate freq			SECT	= section(s)
BE CU	= beryllium copper	IMPG	= impregnated	NRFR	= not recommended for field replacement	SEMICON	= semiconductor
BH	= binder head	INCD	= incandescent			SI	= silicon
BP	= bandpass	INCL	= include(s)			SIL	= silver
BRS	= brass	INS	= insulation(ed)	NSR	= not separately replaceable	SL	= slide
BWO	= backward wave oscillator	INT	= internal			SPG	= spring
				OBD	= order by description	SPL	= special
CCW	= counterclockwise	K	= kilo = 1000			SST	= Stainless steel
CER	= ceramic			OH	= oval head	SR	= split ring
CMO	= cabinet mount only			OX	= oxide	STL	= steel
COEF	= coefficient	LH	= left hand				
COM	= common	LIN	= linear taper	P	= peak	TA	= tantalum
COMP	= composition	LK WASH	= lock washer	PC	= printed circuit	TD	= time delay
COMPL	= complete	LOG	= logarithmic taper	PF	= picofarads = 10^{-12} farads	TGL	= toggle
CONN	= connector	LPF	= low pass filter			THD	= thread
CP	= cadmium plate			PH BRZ	= phosphor bronze	TI	= titanium
CRT	= cathode-ray tube			PHL	= Phillips	TOL	= tolerance
CW	= clockwise	M	= milli = 10^{-3}	PIV	= peak inverse voltage	TRIM	= trimmer
		MEG	= meg = 10^{6}			TWT	= traveling wave tube
DEPC	= deposited carbon	MET FLM	= metal film	PNP	= positive-negative-positive		
DR	= drive	MET OX	= metallic oxide				
		MFR	= manufacturer	P/O	= part of		
ELECT	= electrolytic	MHz	= mega Hertz	POLY	= polystrene	μ	= micro = 10^{-6}
ENCAP	= encapsulated	MINAT	= miniature	PORC	= porcelain		
EXT	= external	MOM	= momentary	POS	= position(s)	VAR	= variable
		MOS	= metalized substrate	POT	= potentiometer	VDCW	= dc working volts
F	= farads			PP	= peak-to-peak		
FH	= flat head	MTG	= mounting	PT	= point	W/	= with
FIL H	= Fillister head	MY	= "mylar"	PWV	= peak working voltage	W	= watts
FXD	= fixed					WIV	= working inverse voltage
		N	= nano (10^{-9})	RECT	= rectifier		
G	= giga (10^{9})	N/C	= normally closed	RF	= radio frequency	WW	= wirewound
GE	= germanium	NE	= neon	RH	= round head or right hand	W/O	= without
GL	= glass	NI PL	= nickel plate				
GRD	= ground(ed)						

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1			FRONT PANEL ASSY		
A1J1	1250-0913	1	CONNECTOR:RF BNC (D-TYPE)	24931	28JR170-1
A1M1	1120-1548	1	METER	28480	1120-1548
A1MP1	0370-1091	1	KNOB:JADE GREY	28480	0370-1091
A1MP2	0370-1099	2	KNOB:JADE GREY	28480	0370-1099
A1MP3	86601-40017	1	SCREW:METER ADJUST	28480	86601-40017
A1MP4	86632-00008	1	PANEL:FRONT	28480	86632-00008
A1MP5	86632-20014	1	HOUSING:FRONT	28480	86632-20014
A1MP6	86632-20015	1	PANEL:SUB	28480	86632-20015
A1MP7	86632-20016	1	WINDOW:METER	28480	86632-20016
A1R1	2100-2728	1	R:VAR CERMET 1K OHM 20% LIN 2W	28480	2100-2728
A1S1	3100-3030	1	SWITCH:ROTARY 5 POSITION	76854	TYPE A
A1S1			(MODE)		
A1S2	3100-3031	1	SWITCH:ROTARY 4 POSITION	76854	TYPE A
A1S2			(SOURCE)		
A1S3	3101-0044	1	SWITCH:PUSHBUTTON SPST	81073	39-1 N.O.
A1W1	8120-1733	1	CABLE ASSY:26 GA 16-PIN	28480	8120-1733
A1A1	86632-20011	1	BOARD:FRONT HARNESS	28480	86632-20011
A2	86632-60004	1	BOARD ASSY:SWITCHING LOGIC	28480	86632-60004
A2C1	0160-2055	43	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A2C2	0180-0228	2	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A2C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A2C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A2C5	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A2L1	9140-0142	1	COIL:FXD RF 2.20 UH 10%	82142	09-4436-4K
A2R1	0698-0084	5	R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A2R2	0757-0416	13	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2R3	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2R4	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2R5	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2R6	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2R7	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2R8	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2R9	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2U1	1820-0256	3	IC:DTL QUAD 2-INPUT POWER GATE	04713	MC858P
A2U2	1820-0659	4	IC:TTL,LOW POWER 4-BIT SHIFT REGISTER	07263	SL17145
A2U3	1820-0659		IC:TTL,LOW POWER 4-BIT SHIFT REGISTER	07263	SL17145
A2U4	1820-0328	3	IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A2U5	1820-0256		IC:DTL QUAD 2-INPUT POWER GATE	04713	MC858P
A2U6	1820-0659		IC:TTL,LOW POWER 4-BIT SHIFT REGISTER	07263	SL17145
A2U7	1820-0659		IC:TTL,LOW POWER 4-BIT SHIFT REGISTER	07263	SL17145
A2U8	1820-0328		IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A2U9	1820-0174	1	IC:TTL HEX INVERTER	01295	SN7404N
A2U10	1820-0710	2	IC:DIGITAL TTL+LOGIC 5V 5%	07263	SL17315
A2U11	1820-0710		IC:DIGITAL TTL+LOGIC 5V 5%	07263	SL17315
A2U12	1820-0256		IC:DTL QUAD 2-INPUT POWER GATE	04713	MC858P
A2U13	1820-0535	1	IC:TTL DUAL 2-INPT DRIVER(OPEN COLL)	01295	SN75451
A2U14	1820-0328		IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A2U15	1820-0054	1	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2XA1	1200-0767	1	SOCKET IC:16 CONTACT DUAL LINE	91506	316AG5D-3R
A3	86632-60006	1	BOARD ASSY:REMOTE ATTENUATOR	28480	86632-60006
A3C1	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C2	0180-0116	11	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A3C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C5	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C6	0160-2290	1	C:FXD MY 0.15 UF 10% 80VDCW	56289	292P1549R8-PTS
A3C7	0160-0168	3	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3C8	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3C9	0160-2201	2	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A3C10	0180-0094	6	C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A3CR1	1901-0040	46	DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR14	1902-3182	1	DIODE BREAKDOWN:SILICON 12.1V 5%	28480	1902-3182
A3CR15	1902-3059	2	DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3CR16	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR17	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3K1	0490-1013	17	RELAY:500 OHM 10% 5V	15636	R2846-1
A3K2	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K3	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K4	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K5	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K6	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K7	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K8	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K9	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K10	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K11	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3K12	0490-0916	8	RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A3K13	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A3L1	9140-0179	10	COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A3L2	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A3L3	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A3Q1	1854-0071	14	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q3	1853-0020	8	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3R1	0757-0418	3	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A3R2	0757-0418		R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A3R3	0683-6855	1	R:FXD COMP 6.8 MEGOHM 5% 1/4W	01121	CB 6855
A3R4	0757-0288	4	R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A3R5	0698-4037	2	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A3R6	2100-1984	1	R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-1984
A3R7	0757-0288		R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A3R8	0698-0083	2	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R9	0698-3444	15	R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A3R10	0757-0401	7	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R11	0698-3446	2	R:FXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446
A3R12	0757-0420	1	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A3R13	0757-1094	3	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A3R14	0757-0280	12	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R15	0698-3153	2	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A3R16	0757-0440	2	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A3R17	0698-3156	3	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R18	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R19	0757-0294	1	R:FXD MET FLM 17.8 OHM 1% 1/8W	28480	0757-0294
A3R20	0757-0394	1	R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A3R21	0698-3437	3	R:FXD MET FLM 133 OHM 1% 1/8W	28480	0698-3437
A3R22	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R23	0698-3439	1	R:FXD MET FLM 178 OHM 1% 1/8W	28480	0698-3439
A3R24	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A3R25	0757-0317	2	R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A3R26	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R27	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A3R28	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A3R29	0698-3446		R:FXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446
A3R30	0757-0274	2	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A3R31	0757-0443	1	R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A3R32	2100-1760	2	R:VAR WW 5K OHM 5% TYPE V 1W	28480	2100-1760
A3U1	1820-0398	1	IC:DIFF COMPARATOR AVOL=1K MIN.	12040	LM710C
A4	86632-60005	1	BOARD ASSY:LEVELING AMPL	28480	86632-60005
A4C1	0160-2204	1	C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A4C2	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A4C3	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A4C4	0180-0058	1	C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A4C5	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C6	0180-2215	4	C:FXD AL ELECT 170 UF +75-10% 170VDCW	56289	30D177G015DD2-DSM
A4C7	0180-1743	1	C:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A4C8	0180-0291	3	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C9	0160-2150	3	C:FXD MICA 33 PF 5%	28480	0160-2150
A4C10	0160-2150		C:FXD MICA 33 PF 5%	28480	0160-2150
A4C11	0180-2215		C:FXD AL ELECT 170 UF +75-10% 170VDCW	56289	30D177G015DD2-DSM
A4C12	0160-2453	1	C:FXD MY 0.22 UF 10% 80VDCW	56289	192P2249R8-PTS
A4C13	0180-0094		C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A4C14	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A4C15	0160-2150		C:FXD MICA 33 PF 5%	28480	0160-2150
A4C16	0140-0196	1	C:FXD MICA 150 PF 5%	72136	RDM15F151J3C
A4C17	0180-0094		C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A4CR1	1902-3139	2	DIODE:BREAKDOWN 8.25V 5%	04713	SZ10939-158
A4CR2	1901-0022	3	DIODE:SILICON 0.56V AT 1 MA	28480	1901-0022
A4CR3	1901-0022		DIODE:SILICON 0.56V AT 1 MA	28480	1901-0022

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4CR4	1901-0022		DIODE:SILICON 0.56V AT 1 MA	28480	1901-0022
A4CR5	1902-3149	1	DIODE BREAKDOWN:9.09V 5%	28480	1902-3149
A4CR6	1901-0025	2	DIODE:SILICON 100MA/1V	07263	FD 2387
A4CR7	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A4CR8	1901-0047	4	DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A4CR9	1902-3059		DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A4CR10	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A4CR11	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A4CR12	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A4K1	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A4L1	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A4L2	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A4L3	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A4Q1	1853-0001	1	TSTR:SI PNP(SELECTED FROM 2N1132)	28480	1853-0001
A4Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A4Q3	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A4Q4	1854-0404	11	TSTR:SI NPN	28480	1854-0404
A4Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q8	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A4Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q11	1854-0404		TSTR:SI NPN	28480	1854-0404
A4Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4R1	0757-0421	1	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A4R2	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R3	0757-0279	6	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A4R4	0757-0442	9	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R5	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R6	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A4R7	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A4R8	0698-3161	2	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A4R9	0698-3152	4	R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A4R10	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A4R11	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A4R12	0698-3152		R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A4R13	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R14	1990-0322	1	RAYISTOR	28480	1990-0322
A4R15	0698-3155	4	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A4R16	0757-0419	1	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A4R17	0698-3152		R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A4R18	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A4R19	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A4R20	0757-0438	2	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A4R21	0757-0346	3	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A4R22	0757-0467	2	R:FXD MET FLM 121K OHM 1% 1/8W	28480	0757-0467
A4R23	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R24	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A4R25	0698-3430	2	R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A4R26	0757-0400	1	R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A4R27	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A4R28	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A4R29	0757-0199	3	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A4R30	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A4R31	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A4R32	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R33	0698-3454	2	R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A4R34	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A4R35	2100-1758	2	R:VAR WW 1K OHM 5% TYPE V 1W	28480	2100-1758
A4R36	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A4R37	0757-0465	1	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A4R38	0698-3452	1	R:FXD MET FLM 147K OHM 1% 1/8W	28480	0698-3452
A4R39	0757-0467		R:FXD MET FLM 121K OHM 1% 1/8W	28480	0757-0467
A4R40	0698-3154	5	R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A4R41	0698-3454		R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A4R42	0757-0441	1	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A4R43	0757-0278	5	R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A4R44	0698-3160	3	R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A4R45	2100-0942	1	R:VAR FLM 50K OHM 20% 3/4W	28480	2100-0942
A4R46	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A4R47	0698-3157	6	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A4R48	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A4R49	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A4U1	1820-0223	4	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4U2	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A5	86632-60009	1	BOARD ASSY:MODULATION OSCILLATOR	28480	86632-60009
A5C1	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A5C2	0180-0094		C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A5C3	0180-0094		C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A5C4	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A5C5	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A5C6	0160-2199	3	C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A5C7	0180-2206	1	C:FXD ELECT 60 UF 10% 6VDCW	56289	150D606X9006B2
A5C8	0180-2205	1	C:FXD ELECT 0.33 UF 10% 35VDCW	56289	150D334X9035A2-DYS
A5C9	0160-0937	1	C:FXD MICA 1000 PF 2%	14655	RDM19F102G3S
A5C10	0160-2671	1	C:FXD MY 0.1 UF 5% 80VDCW	56289	192P1045R8-PTS
A5C11	0180-2215		C:FXD AL ELECT 170 UF +75-10% 170VDCW	56289	30D177G015DD2-DSM
A5C12	0160-2226	1	C:FXD MICA 2200 PF 5% 300VDCW	28480	0160-2226
A5C13	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A5C14	0180-1704	1	C:FXD ELECT 47 UF 10% 6VDCW	28480	0180-1704
A5CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR2	1902-0025	1	DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A5CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5K1	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A5K2	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A5L1	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A5L2	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A5Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A5Q2	1854-0404		TSTR:SI NPN	28480	1854-0404
A5Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5R1	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5R2	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R3	0698-3152		R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A5R4	0757-0418		R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A5R5	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5R7	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5R8	0757-0462	1	R:FXD MET FLM 75.0K OHM 1% 1/8W	28480	0757-0462
A5R9	0757-1094		R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A5R10	0757-0439	1	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5R11	0757-0458	3	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A5R12	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A5R13	0757-0288		R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A5R14	0698-3457	1	R:FXD MET FLM 316K OHM 1% 1/8W	28480	0698-3457
A5R15	2100-1761	2	R:VAR WW 10K OHM 5% TYPE V 1W	28480	2100-1761
A5R16	2100-1760		R:VAR WW 5K OHM 5% TYPE V 1W	28480	2100-1760
A5R17	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A5R18	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A5R19	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A5R20	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A5R21	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A5R22	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5R23	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5U1	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6	86632-60003	1	BOARD ASSY:FM DEVIATION ATTENUATION	28480	86632-60003
A6C1	0160-2199		C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A6C2	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A6C3	0180-0374	5	C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A6C4	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A6C5	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C6	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C7	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C8	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C9	0180-2214	1	C:FXD ELECT 90 UF +75-10% 15VDCW	56289	30D906G015CC2-DSM
A6C10	0160-0174	1	C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C1187S-CML
A6C11	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A6C12			NOT ASSIGNED		
A6C13	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A6C14	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A6C15	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C16	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C17	0160-3455	11	C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6C18	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A6C19	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A6C20	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C21	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C22	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C23	0180-2215		C:FXD AL ELECT 170 UF +75-10% 170VDCW	56289	30D177G015DD2-DSM
A6C24	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A6CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR6			NOT ASSIGNED		
A6CR7			NOT ASSIGNED		
A6CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR10	1901-0450	2	DIODE:SILICON	28480	1901-0450
A6CR11	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6J1	1250-1255	2	CONNECTOR:RF JACK, SERIES SMB	98291	51-051-0000
A6K1	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A6K2	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A6K3	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A6K4	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A6L1	9140-0158	1	COIL:FXD RF 1 UH 10%	99800	1025-20
A6L2	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A6L3	9140-0114	6	COIL:FXD RF 10 UH	28480	9140-0114
A6L4	9100-1629	2	COIL/CHOKE 47.0 UH 5%	28480	9100-1629
A6L5	9140-0144	14	COIL:FXD RF 4.7 UH	28480	9140-0144
A6L6	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A6L7	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A6L8	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A6L9	9140-0114		COIL:FXD RF 10 UH	28480	9140-0114
A6L10	9140-0114		COIL:FXD RF 10 UH	28480	9140-0114
A6L11	9140-0114		COIL:FXD RF 10 UH	28480	9140-0114
A6Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q3	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6R1	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A6R2	0698-3447	5	R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A6R3	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A6R4	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R5	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A6R6	0698-3161		R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A6R7	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A6R8	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A6R9	0698-3440	2	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A6R10	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R11	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A6R12	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A6R13	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A6R14	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A6R15	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R16	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A6R17	0698-3136	2	R:FXD MET FLM 17.8K OHM 1% 2/8W	19701	MF4C T-0
A6R18	0698-3136		R:FXD MET FLM 17.8K OHM 1% 2/8W	19701	MF4C T-0
A6R19	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6R20	2100-1761		R:VAR WW 10K OHM 5% TYPE V 1W	28480	2100-1761
A6R21	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6R22	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A6R23	2100-1755	1	R:VAR WW 100 OHM 5% TYPE V 1W	28480	2100-1755
A6R24	0757-0290	1	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A6R25	2100-1758		R:VAR WW 1K OHM 5% TYPE V 1W	28480	2100-1758
A6R26	0757-0317		R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A6R27	0698-3437		R:FXD MET FLM 133 OHM 1% 1/8W	28480	0698-3437
A6R28	0698-3428	1	R:FXD MET FLM 14.7 OHM 1% 1/8W	28480	0698-3428
A6R29	0698-3132	1	R:FXD FLM 261 OHM 1% 1/8W	28480	0698-3132
A6R30	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R31	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A6R32	0698-3430		R:FXD MET FLM 21.5 OHM 1% 1/8W (NOMINAL) FACTORY SELECTED PART	28480	0698-3430
A6R33	0698-3437		R:FXD MET FLM 133 OHM 1% 1/8W	28480	0698-3437
A6R34	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A6R35	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A6R36	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A6R37	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A6U1	1858-0008	1	TSTR ARRAY:SI NPN,PNP 14-PIN	28480	1858-0008
A6U2	1820-0068	1	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A7	86632-60020	1	PANEL ASSY:REAR	28480	86632-60020
A7C1	0160-2437	8	C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A7C2	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A7C3	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A7C4	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A7C5	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A7C6	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A7C7	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A7C8	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A7C9	0360-1749	3	FEED-THRU:<1 PF	28480	0360-1749
A7C10 & C11	0360-1749		FEED-THRU:<1 PF	28480	0360-1749
A7J1	86632-60013	1	CONNECTOR ASSY:REAR	28480	86632-60013
A7J1MP1 THRU A7J1MP15	1251-1909	15	CONTACT:R & P CONNECTOR,FEMALE	81312	100-10225
A7J1W1	86632-60014	1	CABLE ASSY:20 MHZ INPUT	28480	86632-60014
A7J1W2	86632-60015	1	CABLE ASSY:AM OUTPUT WHITE/GREEN	28480	86632-60015
A7J1W3	86632-60019	1	CABLE ASSY:20 MHZ OUTPUT	28480	86632-60019
A7J2 THRU A7J4	1250-0901	3	CONNECTOR:RF BULKHEAD	15558	1104/D
A7MP1	86632-00003	1	COVER:OSCILLATOR	28480	86632-00003
A7MP2	86632-00004	1	COVER:MIXER	28480	86632-00004
A7MP3	86632-20012	4	SPACER COVER	28480	86632-20012
A7MP4	86632-20013	1	HOUSING:REAR	28480	86632-20013
A7W1	86632-60017	2	CABLE ASSY:REF/SWITCH BOARD	28480	86632-60017
A7A1	86632-60008	1	BOARD ASSY:20 MHZ MIXER	28480	86632-60008
A7A1C1	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A7A1C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A1C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A1C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A1C5	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A1C6	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A1C7	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A1C8	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A1C9	0160-3456	9	C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A7A1C10	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A7A1CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A1CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A1L1	9100-1626	2	COIL/CHOKE 36 UH 5%	82142	15-1315-1J
A7A1L2	9100-1626		COIL/CHOKE 36 UH 5%	82142	15-1315-1J
A7A1Q1	1854-0404		TSTR:SI NPN	28480	1854-0404
A7A1Q2	1854-0404		TSTR:SI NPN	28480	1854-0404
A7A1Q3	1854-0404		TSTR:SI NPN	28480	1854-0404
A7A1Q4	1854-0404		TSTR:SI NPN	28480	1854-0404
A7A1R1	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A7A1R2	0757-0200	6	R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A7A1R3	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A1R4	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A1R5	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A1R6	0757-0200		R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A7A1R7	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A7A1R8	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7A1R9	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A1R10	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A1R11	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A1R12	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A1T1	08552-6044	1	TRANSFORMER:RF (5 PIN)	28480	08552-6044
A7A2	86632-60001	1	BOARD ASSY:20 MHZ SWITCH	28480	86632-60001
A7A2C1	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A2C2	0180-0197	2	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A7A2C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A2C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A2C5	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A2C6	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A7A2C7	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A7A2J1	1250-1255		CONNECTOR:RF JACK, SERIES SMB	98291	51-051-0000

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7A2K1	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A7A2K2	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A7A2K3	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A7A2K4	0490-1013		RELAY:500 OHM 10% 5V	15636	R2846-1
A7A2L1	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A7A2L2	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A7A2L3	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A7A2L4	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A7A2L5	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A7A2L6	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A7A2L7	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A7A3	86632-60002	1	BOARD ASSY:20 MHZ VCO	28480	86632-60002
A7A3C1	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A7A3C2	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A7A3C3	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A7A3C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C5	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A7A3C6	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C7	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A7A3C8	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C9	0160-2199		C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A7A3C10	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C11	0180-0094		C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A7A3C12	0150-0059	1	C:FXD CER 3.3-0.25 PF 500VDCW	72982	301-000-COJO-339C
A7A3C13	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C14	0160-0945	1	C:FXD MICA 910 PF 5%	28480	0160-0945
A7A3C15	0160-2266	1	C:FXD CER 24 PF 5% 500VDCW	72982	301-000-COGO-240J
A7A3C16	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C17	0160-2253	3	C:FXD CER 6.8 PF 500VDCW	72982	301-NPO-6.8 PF
A7A3C18	0160-2253		C:FXD CER 6.8 PF 500VDCW	72982	301-NPO-6.8 PF
A7A3C19	0160-2253		C:FXD CER 6.8 PF 500VDCW	72982	301-NPO-6.8 PF
A7A3C20	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C21	0160-2201		C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A7A3C22	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C23	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A7A3C24	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A7A3C25	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C26	0160-3536	2	C:FXD MICA 620 PF 5% 100VDCW	00853	RDM15F621JIC
A7A3C27	0160-3536		C:FXD MICA 620 PF 5% 100VDCW	00853	RDM15F621JIC
A7A3C28	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C29 - 31			NOT ASSIGNED		
A7A3C32	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A7A3C33	0160-3184	1	C:FXD POLY 0.47 UF 10% 50VDCW	56289	114P295-PYP
A7A3CR1	1902-3193	1	DIODE BREAKDOWN:13.3V 5%	28480	1902-3193
A7A3CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3CR9	0122-0058	2	DIODE VOLT VAR MATCHED SET OF 3	28480	0122-0058
A7A3CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3CR11			NSR PART OF CR9		
A7A3CR12			NSR PART OF CR9		
A7A3CR13	1902-3104	1	DIODE:BREAKDOWN 5.62V 5%	04713	SZ10939-110
A7A3CR14	1902-3139		DIODE:BREAKDOWN 8.25V 5%	04713	SZ10939-158
A7A3CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7A3K1	0490-0782	1	RELAY:REED 1K OHM 9VDC	28480	0490-0782
A7A3K2	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A7A3L1	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A7A3L2	9100-1629		COIL/CHOKE 47.0 UH 5%	28480	9100-1629
A7A3L3	9100-2816	1	INDUCTOR:FXD 1.00 UH 5%	73899	LF4W100
A7A3L4	9140-0180	1	COIL/CHOKE 2.70 UH 10%	28480	9140-0180
A7A3L5	9140-0114		COIL:FXD RF 10 UH	28480	9140-0114
A7A3L6	9140-0114		COIL:FXD RF 10 UH	28480	9140-0114
A7A3Q1	1855-0081	1	TSTR:SI FET	80131	2N5245
A7A3Q2	1854-0404		TSTR:SI NPN	28480	1854-0404
A7A3Q3	1854-0345	1	TSTR:SI NPN	80131	2N5179
A7A3Q4	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7A3Q5	1854-0404		TSTR:SI NPN	28480	1854-0404
A7A3Q6	1854-0404		TSTR:SI NPN	28480	1854-0404
A7A3Q7	1855-0098	1	TSTR:SI FET	28480	1855-0098
A7A3Q8	1854-0404		TSTR:SI NPN	28480	1854-0404
A7A3R1	0757-0200		R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A7A3R2	0757-0444	3	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7A3R3	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7A3R4	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A7A3R5	0757-0444		R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A7A3R6	0757-0444		R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A7A3R7	0757-0200		R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A7A3R8	2100-1776	1	R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A7A3R9	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A7A3R10	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7A3R11	0698-3151	1	R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A7A3R12	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7A3R13	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A7A3R14	0757-0288		R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A7A3R15	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A7A3R16	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A7A3R17	0757-1094		R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A7A3R18	0757-0398	1	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A7A3R19	0757-0470	1	R:FXD MET FLM 162K OHM 1% 1/8W	28480	0757-0470
A7A3R20	0683-7545	1	R:FXD COMP 750K OHM 5% 1/4W	01121	CB 7545
A7A3R21	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A7A3R22	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A7A3R23	0757-0200		R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A7A3R24	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A7A3R25	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7A3R26	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A7A3R27	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7A3R28	0757-0200		R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A7A3R29	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7A3R30	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A3R31	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A3R32	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A3R33	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7A3U1	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A8	86632-60007	1	BOARD ASSY:MOTHER	28480	86632-60007
A8C1	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A8C2	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A8C3	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A8C4	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A8C5	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A8C6	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A8C7	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A8C8	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A8C9	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A8C10	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A8C11	0160-3455		C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A8C12	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KE12-CDH
A8C13	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A8C14	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A8C15	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A8L1	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A8L2	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A8L3	9100-2259	1	COIL/CHOKE 1.50 UH 10%	99800	1025-24
A8L4	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A8R1	0698-7219	1	R:FXD FLM 196 OHM 2% 1/8W	28480	0698-7219
A8R2	0698-7210	6	R:FXD FLM 82.5 OHM 2% 1/8W	28480	0698-7210
A8R3	0698-7214	5	R:FXD FLM 121 OHM 2% 1/8W	28480	0698-7214
A8R4	0698-7210		R:FXD FLM 82.5 OHM 2% 1/8W	28480	0698-7210
A8R5	0698-7210		R:FXD FLM 82.5 OHM 2% 1/8W	28480	0698-7210
A8R6	0698-7214		R:FXD FLM 121 OHM 2% 1/8W	28480	0698-7214
A8R7	0698-7214		R:FXD FLM 121 OHM 2% 1/8W	28480	0698-7214
A8R8	0698-7214		R:FXD FLM 121 OHM 2% 1/8W	28480	0698-7214
A8R9	0698-7214		R:FXD FLM 121 OHM 2% 1/8W	28480	0698-7214
A8R10	0698-7210		R:FXD FLM 82.5 OHM 2% 1/8W	28480	0698-7210
A8R11	0698-7210		R:FXD FLM 82.5 OHM 2% 1/8W	28480	0698-7210
A8R12	0698-7210		R:FXD FLM 82.5 OHM 2% 1/8W	28480	0698-7210
A8XA2	1251-2026	1	CONNECTOR:PC 36 CONTACT	71785	252-18-30-300
A8XA3	1251-2035	4	CONNECTOR:PC EDGE (2 X 15) 30 CONTACT	71785	252-15-30-300
A8XA4	1251-2035		CONNECTOR:PC EDGE (2 X 15) 30 CONTACT	71785	252-15-30-300
A8XA5	1251-2035		CONNECTOR:PC EDGE (2 X 15) 30 CONTACT	71785	252-15-30-300
A8XA6	1251-2035		CONNECTOR:PC EDGE (2 X 15) 30 CONTACT	71785	252-15-30-300
MP1	0570-0011	1	SCREW:THUMB 8-32 X 0.750" LG	00000	OBD#
MP2	1460-0092	1	SPRING,0.245 OD, 0.5 LG	91961	OBD#
MP3	86601-00002	1	MOUNT:METER	28480	86601-00002
MP4	86601-00013	1	LATCH	28480	86601-00013
MP5	86601-20019	1	STUD LATCH	28480	86601-20019
MP6	86601-20020	1	WASHER:LATCH	28480	86601-20020

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP7	86632-00001	1	FRAME:RIGHT	28480	86632-00001
MP8	86632-00002	1	FRAME:LEFT	28480	86632-00002
MP9	86632-00010	1	COVER:OUTER	28480	86632-00010
MP10	86632-20017	1	LATCH:REAR	28480	86632-20017
W1	86632-60016	1	CABLE ASSY:FM MODULE	28480	86632-60016
W2	86632-60017		CABLE ASSY:REF/SWITCH BOARD	28480	86632-60017
W3	86632-60018	1	RF FEED-THRU ASSY	28480	86632-60018

Table 6-4. Code List of Manufacturers

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00853	SANGAMO ELECTRIC CO.PICKENS DIV.	PICKENS, S.C.	29671
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
04713	MOTOROLA SEMICONDUCTOR PROD.INC.	PHOENIX, ARIZ.	85008
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
12040	NATIONAL SEMICONDUCTOR CORP.	DANBURY, CONN.	06810
14655	CORNELL DUBLIER ELECT. DIV.FEDERAL PACIFIC ELECT. CO.	NEWARK, N.J.	07105
15558	MICON ELECTRONICS INC.	GARDEN CITY LONG IS., N.Y.	11530
15636	ELEC-TROL INC.	NORTHRIDGE,CALIF.	91325
19701	ELECTRA/MIDLAND CORP.	MINERAL WELLS, TEX.	76067
24931	SPECIALTY CONNECTOR CO. INC.	INDIANAPOLIS, IND.	46227
28480	HEWLETT-PACKARD COMPANY	PALO ALTO, CALIF.	94304
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
73899	JFD ELECTRONICS CORP.	BROOKLYN, N.Y.	11219
76854	OAK MFG. CO. DIV. OAK ELECTRO/NETICS CORP.	CRYSTAL LAKE, ILL.	60014
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
81073	GRAYHILL	LA GRANGE, ILL.	60525
82142	AIRCO SPEER ELECT. COMP.	DU BOIS, PA.	15801
91506	AUGAT INC.	ATTLEBORO, MASS.	02703
91961	NAHM-BROS. SPRING CO.	OAKLAND, CALIF.	94604
96291	SEALECTRO CORP.	MAMARONECK, N.Y.	10544
99800	DELEVAN ELECTRONICS CORP.	E. AURORA, N.Y.	14052

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section normally contains information for adapting this manual to instruments for which the content does not apply directly. Since this manual does apply directly to instruments having serial numbers listed on the title page, no change information is given here. Refer to INSTRUMENTS COVERED BY MANUAL in Section I for additional important information about serial number coverage.

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for testing, troubleshooting and repairing the Hewlett-Packard Model 86632A Modulation Section.

8-3. PRINCIPLES OF OPERATION

8-4. Figure 8-1, Simplified Block Diagram and the following discussion illustrates the basic principles of operation of the Model 86632A. More detailed information about principles of operation of the instrument appears on Service Sheet 1. In addition, detailed information to the circuit level is provided on individual Service Sheets.

8-5. When the internal oscillator is used as the modulating signal source (400 or 1000 Hz) the oscillator output is coupled to a leveling amplifier which provides a constant output level. In the EXTERNAL AC mode, the externally generated modulating signal is also coupled to the input of the leveling amplifier. In the EXTERNAL DC mode, the leveling amplifier is bypassed and the signal is coupled to the remote attenuator assembly in the Model 86632A.

8-6. The primary function of the remote attenuator assembly is to control the modulation level (AM% or FM deviation) in the remote mode. In the local mode of operation the remote attenuator is bypassed and the modulation level is controlled by the front panel MODULATION LEVEL control.

8-7. In the AM mode the signal output of the remote attenuator assembly is coupled directly to the input of the RF Section in use. In the FM mode the signal output of the remote attenuator assembly is applied to the input of the FM deviation attenuator assembly.

8-8. In the FM mode the FM deviation attenuator assembly selects one of three FM deviation levels (FM x0.1, FM x1 and FM x10). The output of the FM deviation attenuator assembly is an alternating bias signal to the 20 MHz VCO; the amplitude of this signal controls the FM deviation, the frequency of the signal controls the FM rate. The 20 MHz VCO is used only when the instrument is operating in the FM mode.

8-9. When the instrument is operated in the CW or AM modes the 20 MHz reference from the mainframe is coupled directly to the RF Section.

8-10. The Switching Logic Assembly provides interface facilities between the front panel controls or remote programming device and the modulator circuits.

8-11. All front panel control functions can be remotely controlled.

8-12. RECOMMENDED TEST EQUIPMENT

8-13. Test equipment and accessories required to maintain the Model 86632A are listed in Table 1-3. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted.

8-14. TROUBLESHOOTING

8-15. Troubleshooting procedures are divided into two maintenance levels in this manual.

8-16. The first maintenance level is designed to utilize the Hewlett-Packard Module Exchange Program. A troubleshooting tree enables a relatively inexperienced technician to isolate the cause of a malfunction to a circuit board or assembly. A factory-repaired replacement for the defective circuit board or assembly may be ordered through the nearest H-P Sales/Service office using the special part numbers listed in Table 6-1. Refer to paragraph 8-20 and to Figure 8-2 for additional information relative to the Module Exchange Program.

8-17. The second maintenance level involves repairing the instrument to the component level. The troubleshooting tree, in addition to aiding in the detection of faulty circuit boards or assemblies, also refers the technician to the appropriate service sheets to be used if repairs are to be accomplished to the component level. Circuit descriptions and test procedures for this maintenance level are located on the page facing the schematic diagram of the circuit to be repaired.

8-18. If the cause of a malfunction is found and remedied in any circuit containing adjustable components, the applicable adjustment procedure in Section V of this manual should be performed.

8-19. REPAIR

8-20. Module Exchange. This instrument, because of its modular design, may be repaired by simply replacing a defective module. Modular design is a

method of construction that groups individual circuits on a replaceable assembly. Modular design, coupled with a factory-repaired module exchange program, eliminates the need to repair to the component level. Factory-repaired modules are available on an exchange-for-credit bases that reduces module cost substantially below the cost of a new module.

8-21. This manual provides a procedure which enables the technician to quickly isolate the cause of a malfunction to a defective module.

8-22. Exchange modules should be ordered by the exchange numbers shown in Table 6-1 from the nearest H-P Sales/Service office.

8-23. Figure 8-2 illustrates the module exchange program.

NOTE

Do not send a defective module to the H-P office until the replacement module is received.

8-24. Voltage Requirements. All power required to operate the Model 86632A is provided by the mainframe.

8-25. Servicing Aids on Printed Circuit Boards. Servicing aids on printed circuit boards include test points, transistor and integrated circuit reference designations, adjustment callouts and assembly stock numbers.

8-26. Circuit Board Extenders. Circuit board extenders are provided with the mainframe. These extender boards enable the technician to extend plug-in boards clear of the assembly to provide easy access to components and test points. See Figure 8-3 for a typical example of extender board use.

8-27. Diagram Notes. Table 8-1, Schematic Diagram Notes, provides information relative to symbols and values shown on the schematic diagrams.

8-28. Part Location Aids. The locations of chassis mounted parts and major assemblies are shown in Figure 8-4. The locations of individual components mounted on printed circuit boards or other assemblies are shown on the appropriate schematic page or on the page opposite it. The part reference designator (as listed in Section VI) is the assembly designation plus the part designation. (Example: A10R1 is R1 on the A10 assembly). For specific component descriptions refer to the parts list in Section VI of this manual.

8-29. Table 8-2 lists all assemblies and provides location information for photos, schematics, etc.

8-30. Integrated Circuits. Integrated circuit packaging is shown in Figure 8-21. Many types of IC's are used in the Model 86632A. In order to avoid duplicating information on the individual schematics, all IC outlines and pin numbers are shown in Figure 8-22.

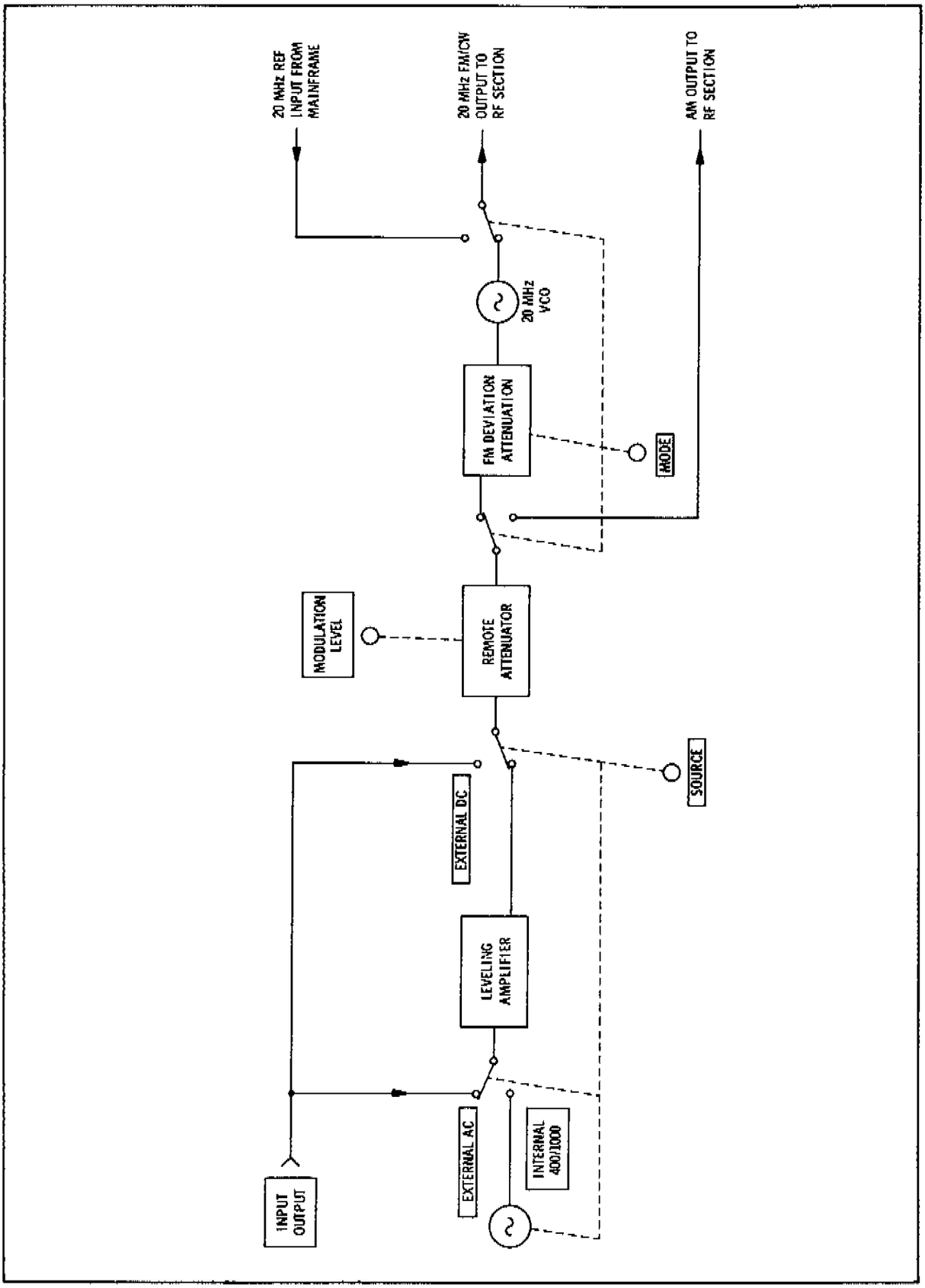
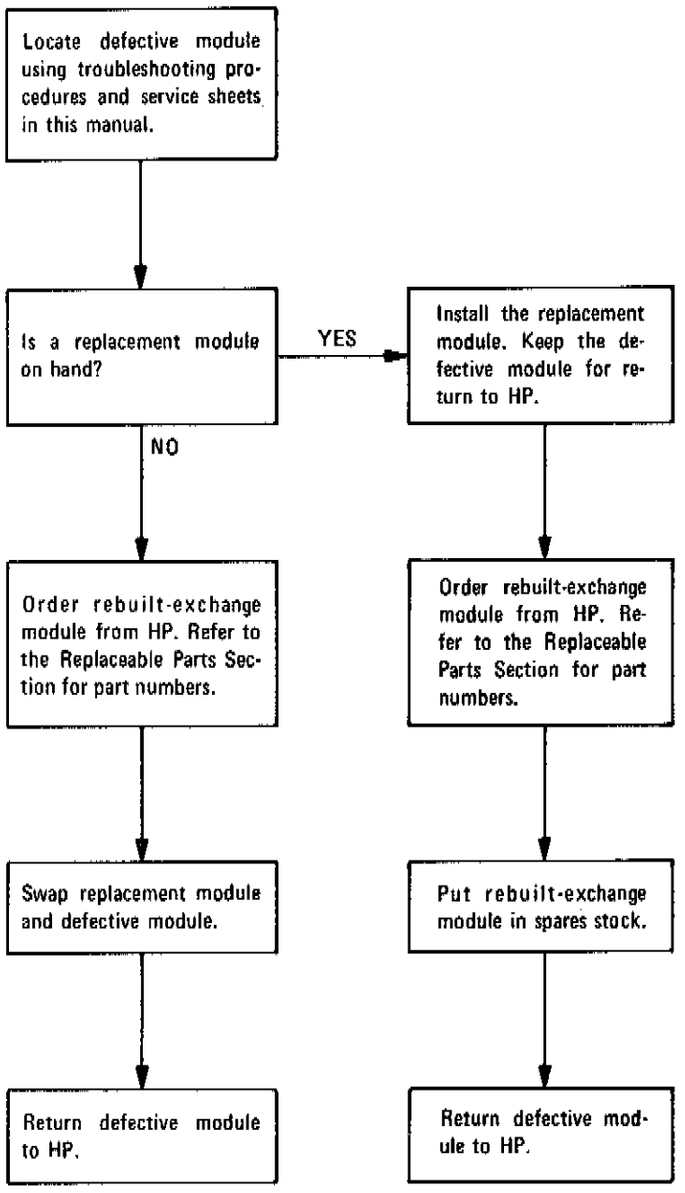


Figure 8-1. Model 86632A Simplified Block Diagram

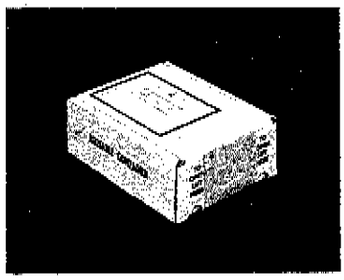
Module Exchange Repair Program

The Module exchange program described here is a method of keeping your Hewlett-Packard instrument in service without repairing the instrument to the component level.



*HP pays postage on boxes mailed in U.S.A.

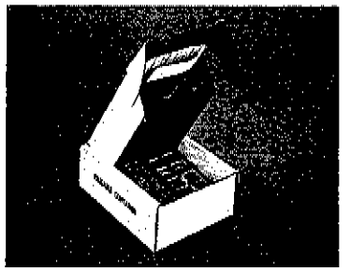
A.



Rebuilt-exchange modules are shipped individually in boxes like this. In addition to the circuit module, the box contains:

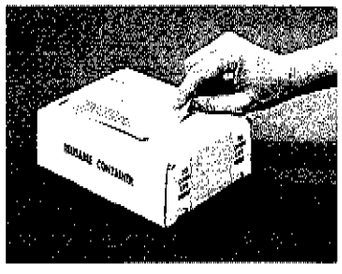
- Module repair report
- Return address label
- Tape for resealing box

B.



Open box carefully - it will be used to return defective module to HP. Complete repair report. Place it and defective module in box. Be sure to remove enclosed return address label.

C.



Seal box with tape provided. Inside U.S.A.*, stick preprinted return address label over label already on box, and return box to HP. Outside U.S.A., do not use address label; instead, address box to the nearest HP office.

Figure 8-2. Diagram of Module Exchange Program

Table 8-1. Schematic Diagram Notes

SCHEMATIC DIAGRAM NOTES

Inductance is in microhenries, Resistance is in ohms and Capacitance is in micro farads unless otherwise noted.

P/O = part of.

Screwdriver Adjustment

Panel Control

Encloses Front Panel designations

Encloses Rear Panel designations

Circuit assembly border line.

Other assembly border line.

Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.

Encloses wire color code. Code used (MIL-STD -681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number the narrower stripe. Example; (947) denotes white base, yellow wide stripe, violet narrow stripe.

A4

Indicates an output from a schematic that goes to an input identified as A on Service Sheet 4.

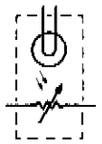
2X

Indicates an input to a schematic that comes from an output identified as X on Service Sheet 2.

Indicates Circuit ground.

Numbers in stars on circuit assemblies show locations of test points.

Letters in stars on Circuit assemblies show locations of phantom test points.



Light sensitive resistor.

On page connector. This point is connected to another point on this page with the symbol (3)

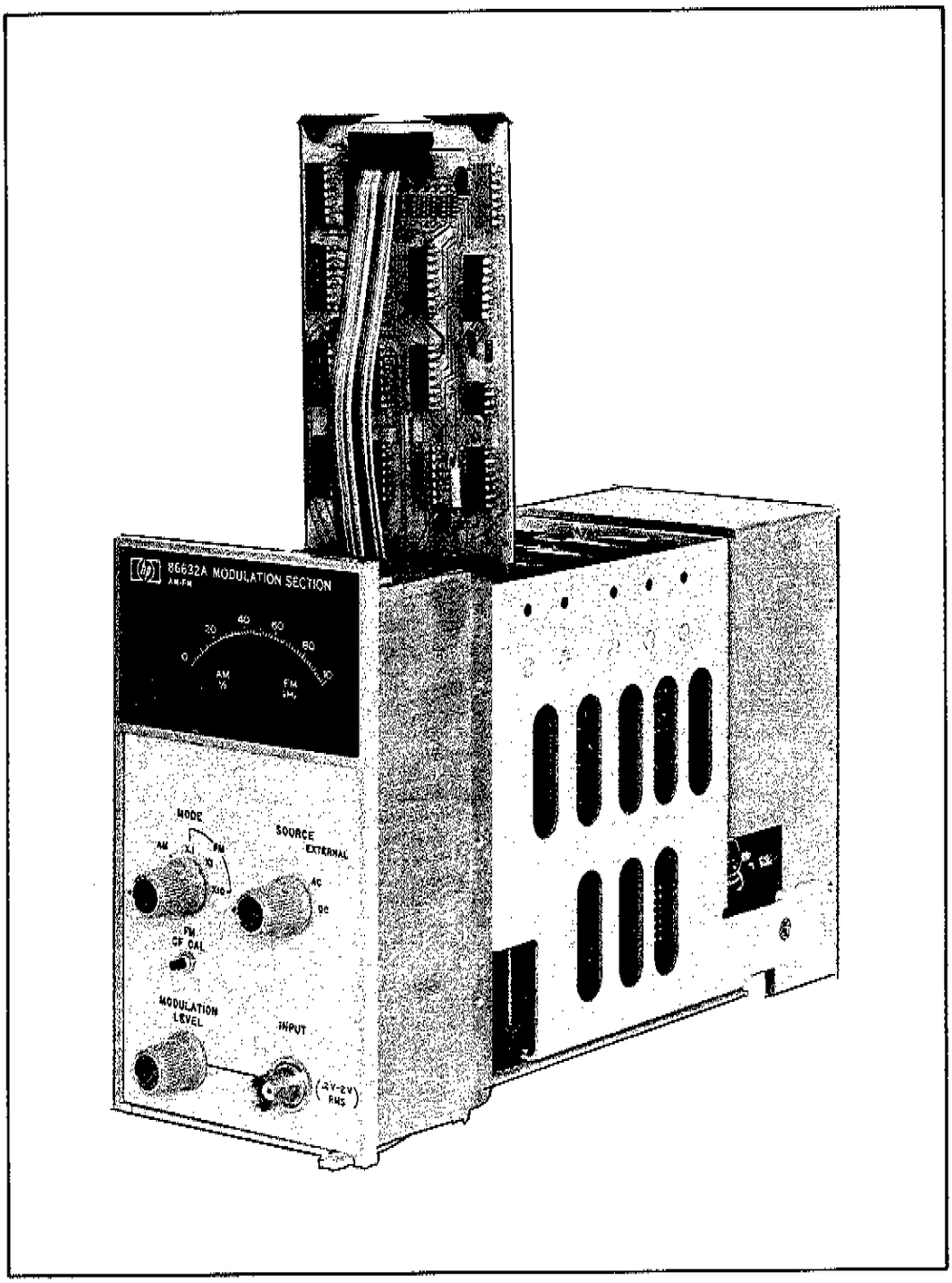


Figure 8-3. Model 86632A with Circuit Board Extended for Maintenance

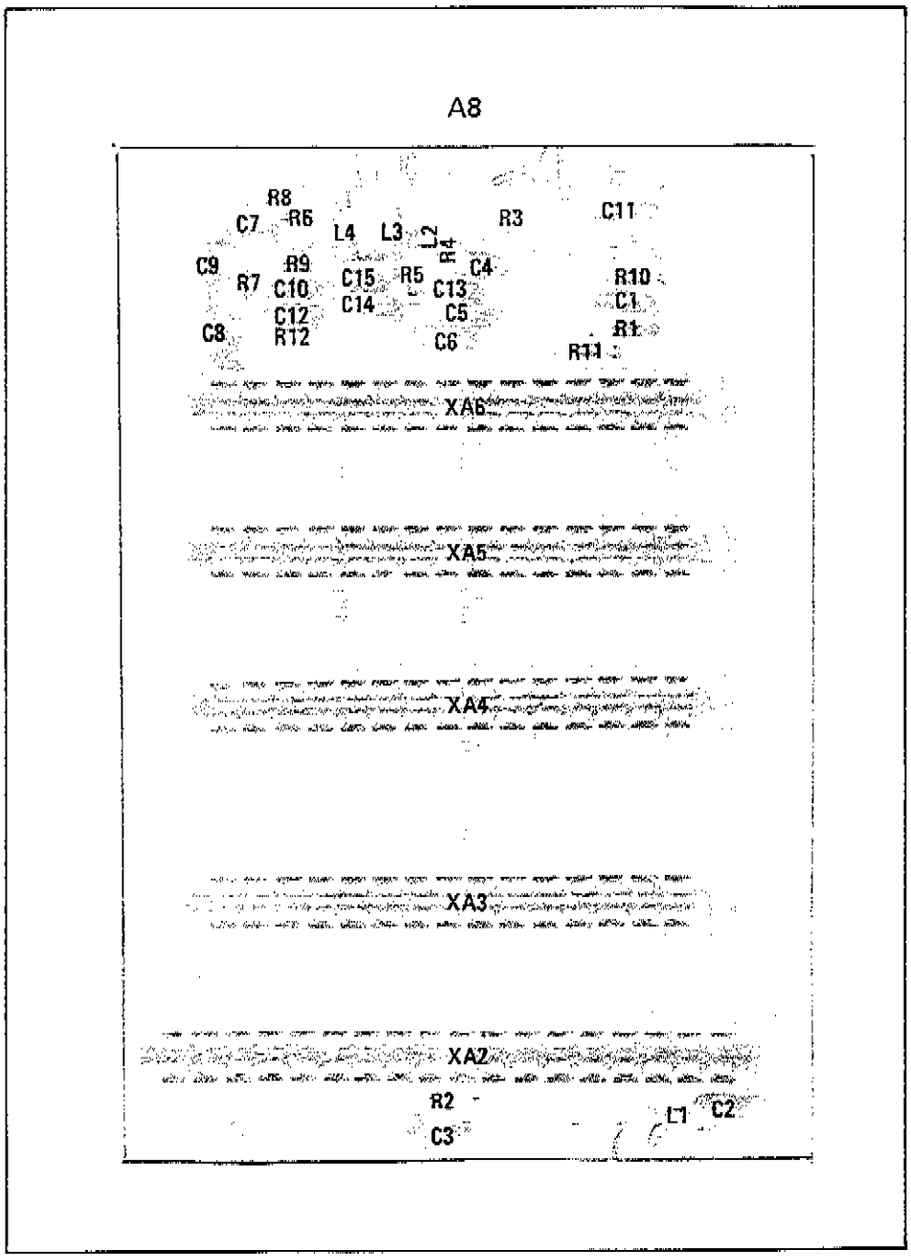


Figure 8-4. Mother Board Component Locations

FIG. 8-5
Sht 1 of 3

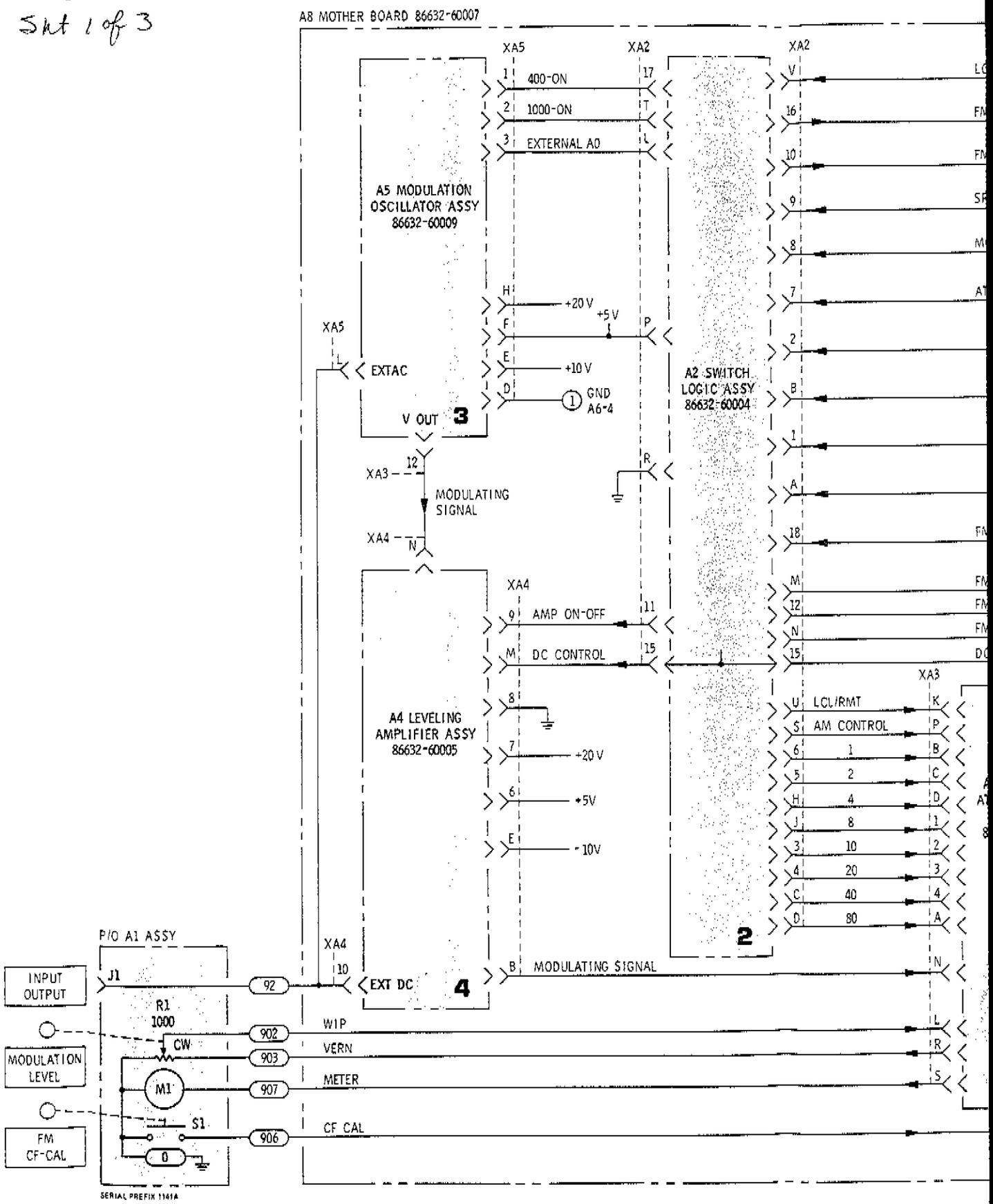


FIG. 8-5
Sht 2 of 3

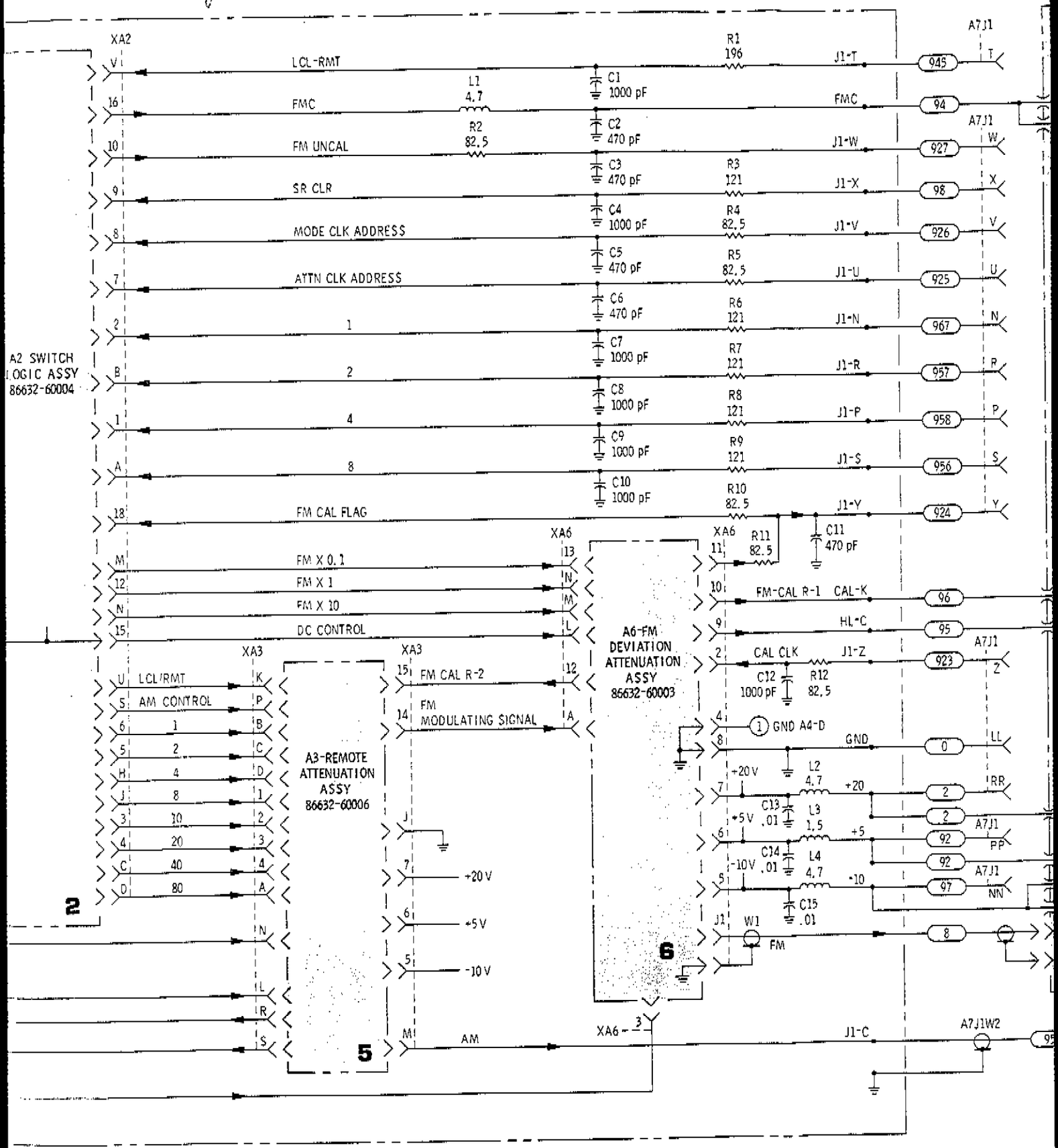


FIG. 8-5
Sht 3 of 3

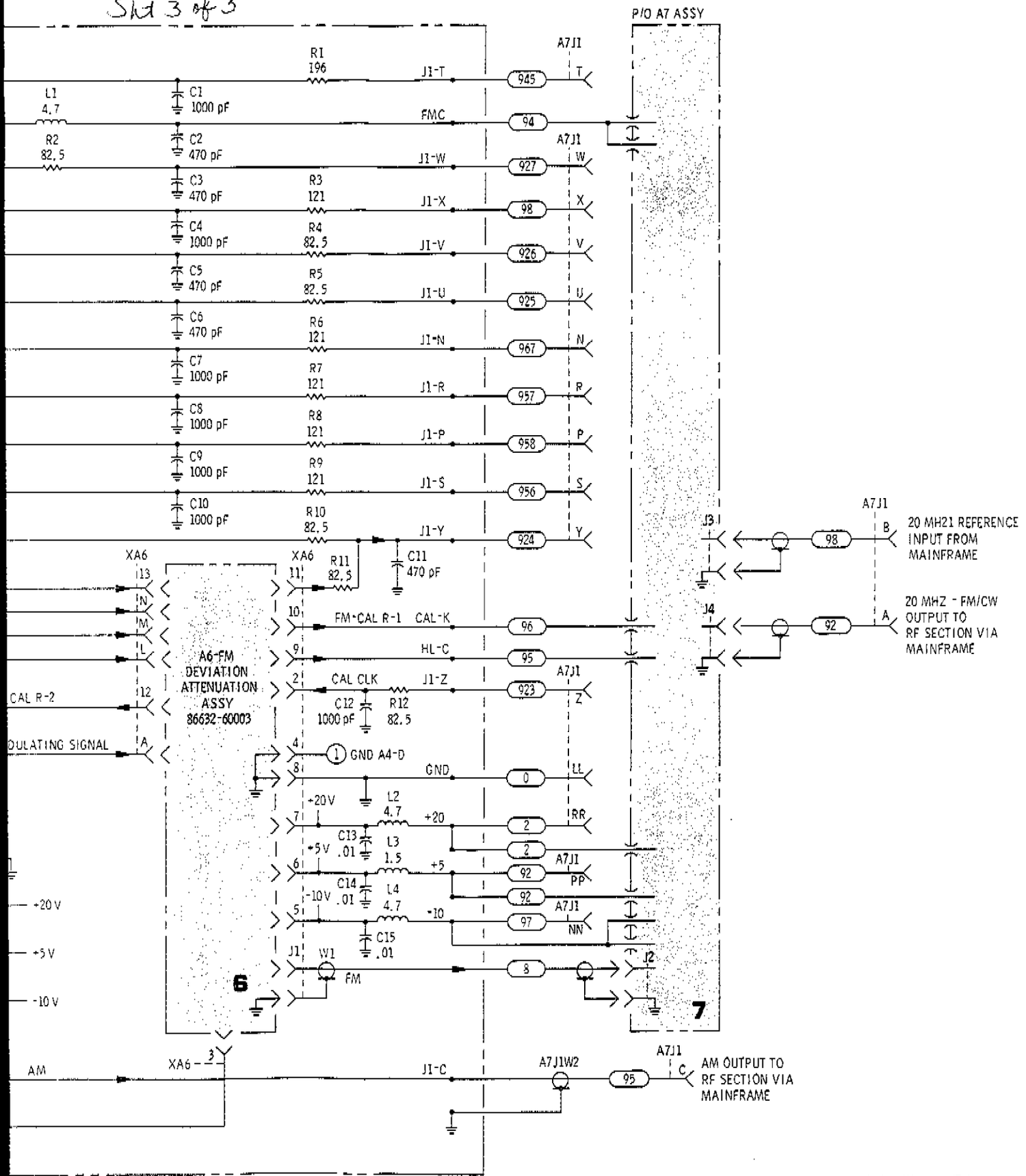


Figure 8-5. Model 86632A Wiring Diagram

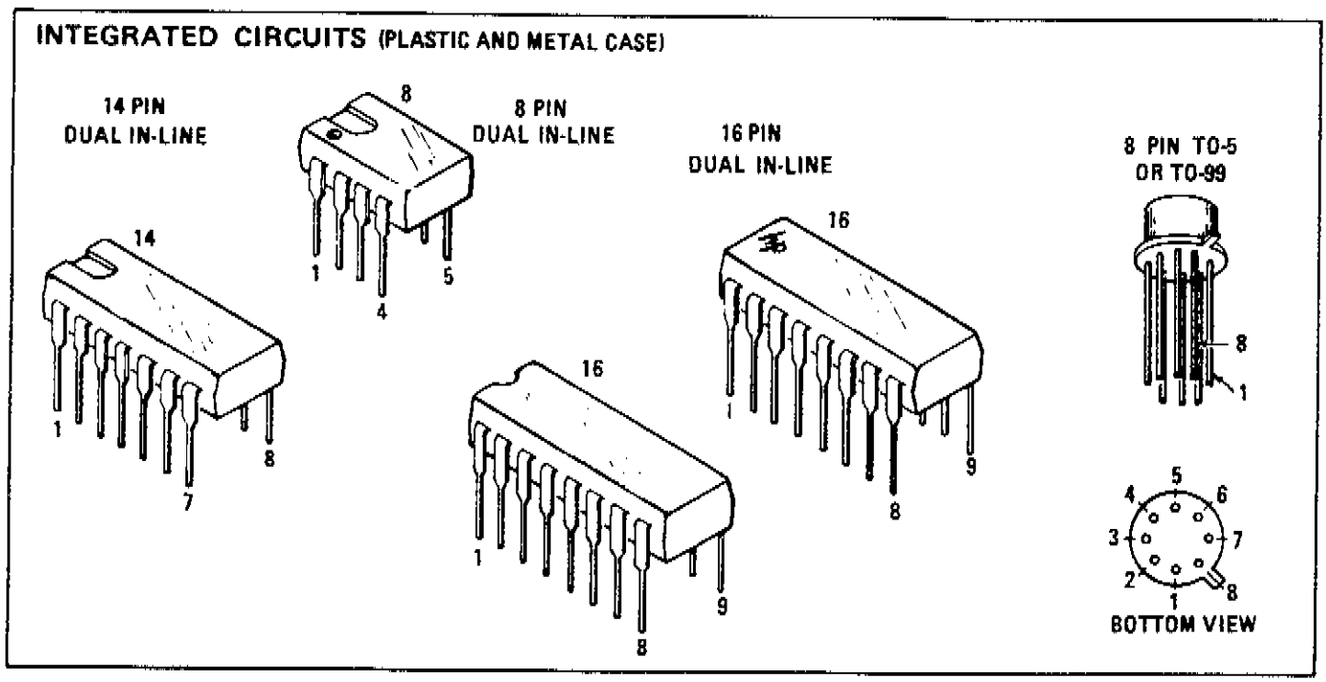
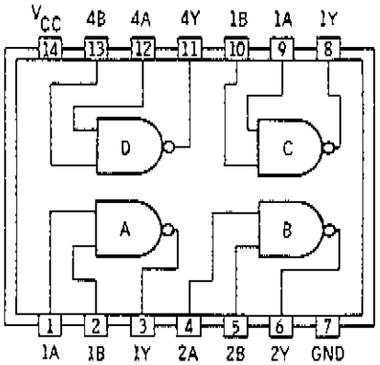
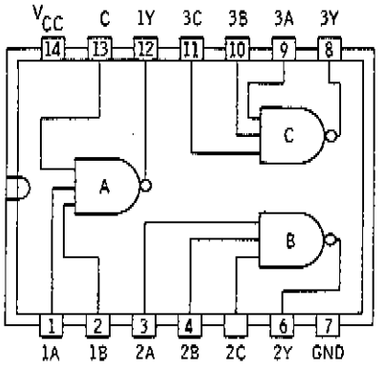


Figure 8-6. Integrated Circuit Packaging

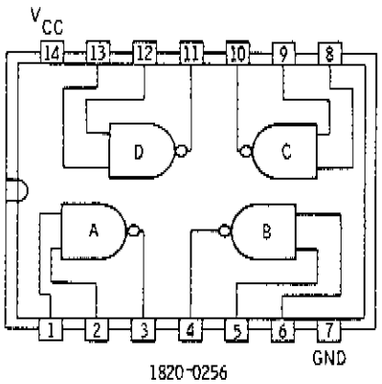
FIG. 8-7
Sht 1 of 2



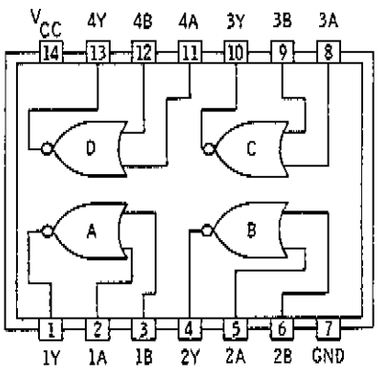
1820-0054



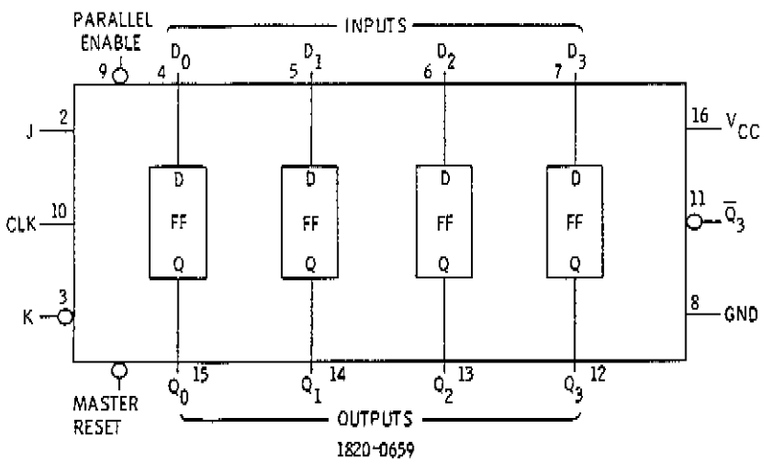
1820-0068



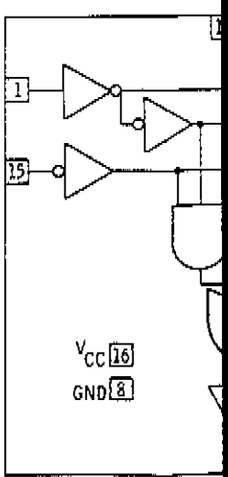
1820-0256



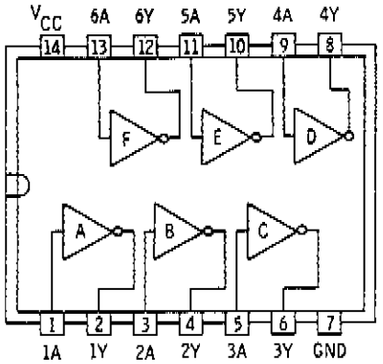
1820-0328



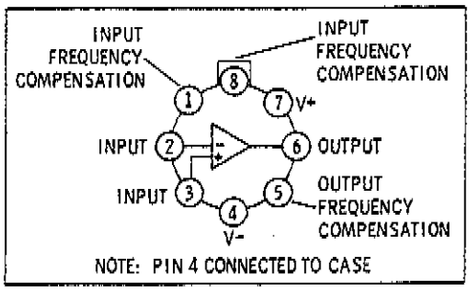
1820-0659



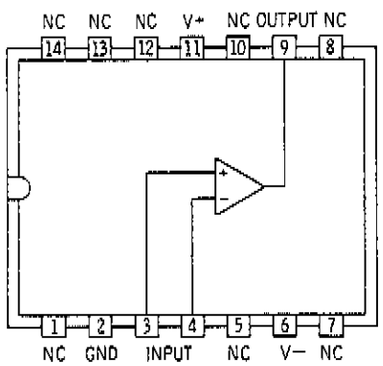
8-8b



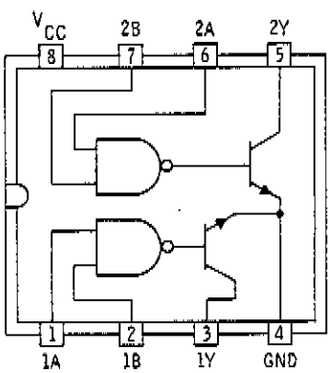
1820-0174



1820-0223



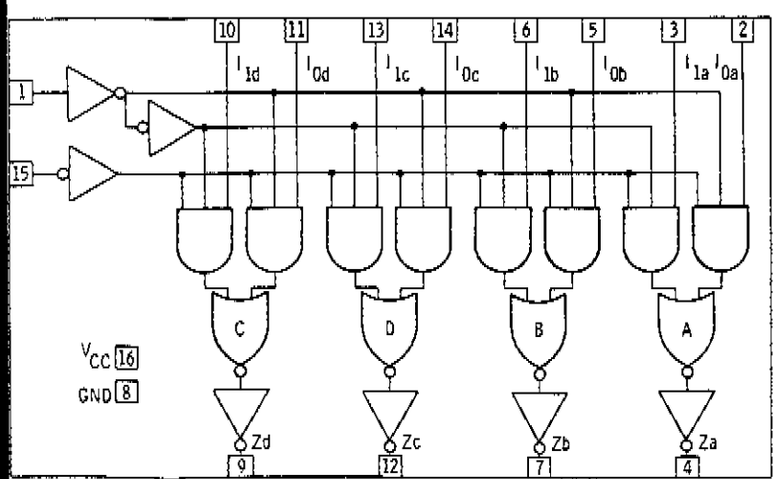
1820-0398



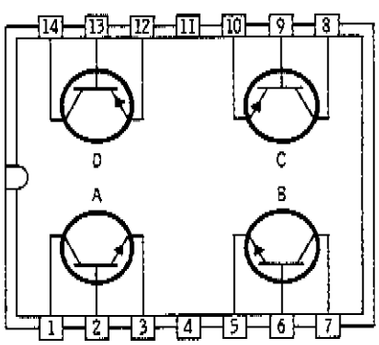
1820-0535

TRUTH TABLE

A	B	Y
L	L	L (ON STATE)
L	H	L (ON STATE)
H	L	L (ON STATE)
H	H	H (OFF STATE)



1820-0616



1858-0008

Figure 8-7. Integrated Circuits Used in the Model 86632A

FIG. 8-8
Sht 1 of 4

Table 8-2. Assembly Locations

Assembly Numbers and Description	Service Sheet Number	Photograph Figure 8-
A1-Front Panel Assembly	2, 3, 5, 6	8
A2-Switch Logic Assembly	2	8, 11
A3-Remote Attenuation Assembly	5	8, 17
A4-Leveling Amplifier Assembly	4	8, 15
A5-Modulation Oscillator Assembly	3	8, 13
A6-FM Attenuation Deviation Assembly	6	8, 20
A7A1-20 MHz Mixer Assembly	7	8, 22
A7A2-20 MHz Switch Assembly	7	8, 22
A7A3-20 MHz VCO Assembly	7	8, 23
A8-Mother Board Assembly	8	4, 8

FIG. 8-8
Sht 2 of 4

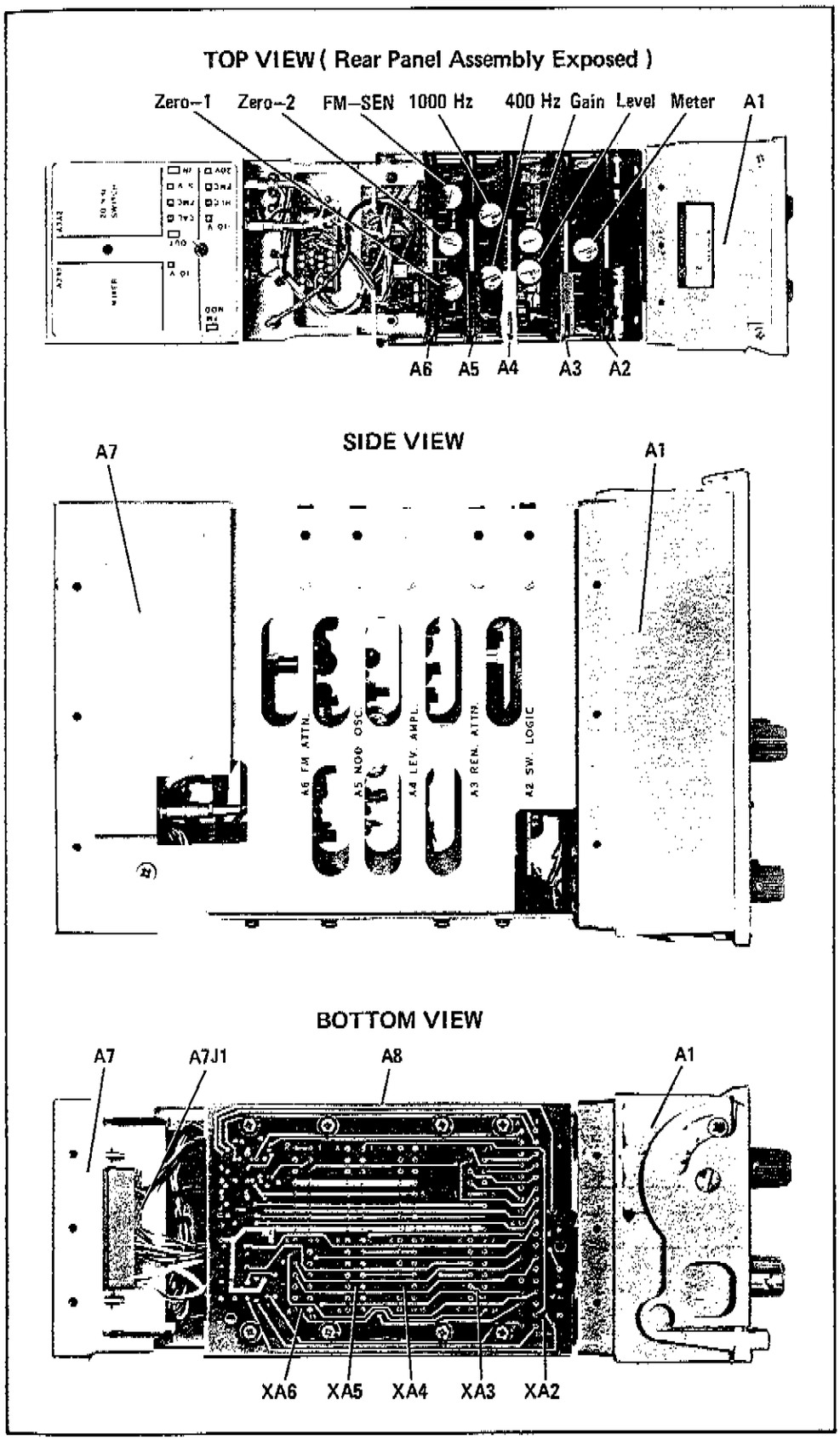


FIG. 8-8
SHT 3 of 4

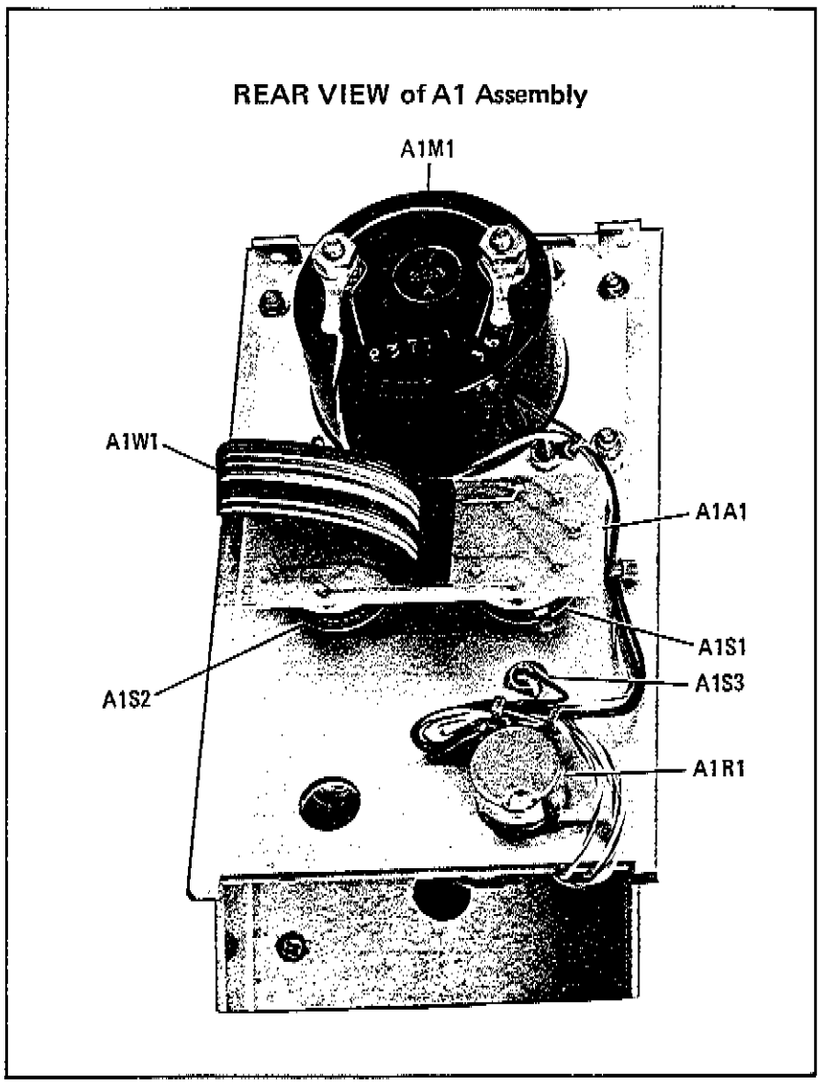


FIG. 8-8
Sht 4 of 4

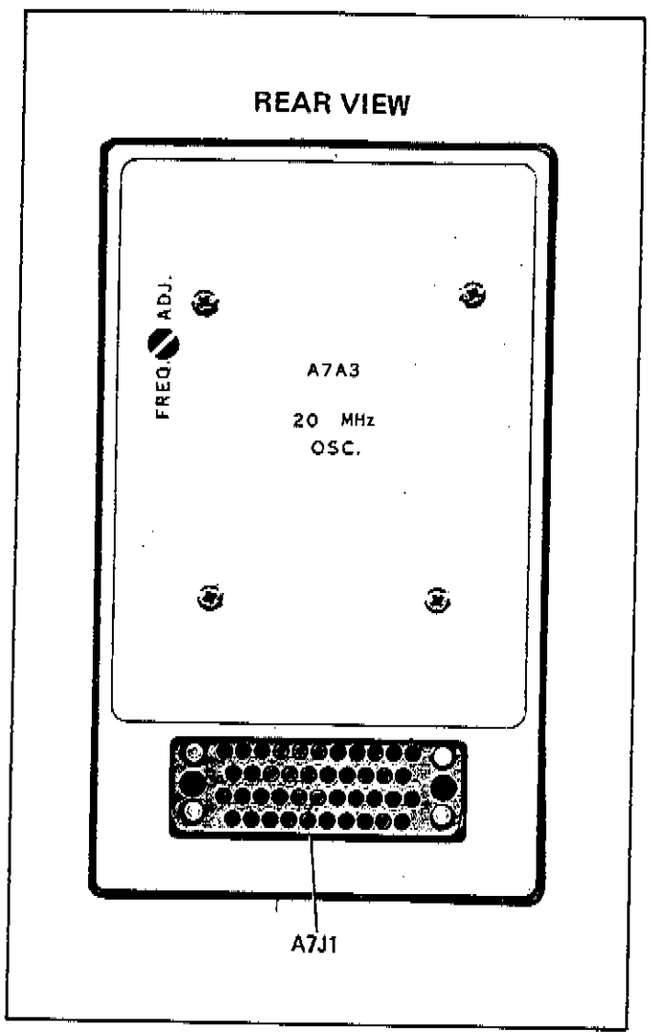


Figure 8-8. Chassis Mounted Parts, Assembly and Adjustment Locations

FIG. 8-9
Sht 1 of 4

NOTES:

1. Proceed to the RF Section trouble-shooting tree unless the problem has already been isolated to the Model 86632A.
2. Remove outer cover of Model 86632A.

START HERE

In OFF Mode, the correct amplitude CW signal is present at the RF Section output as displayed by the Spectrum Analyzer.

YES → Is the problem present in re

NO

Verify that >+2 Vdc is present on the FMC line into the A7 Assembly.

YES

NO

Replace or repair the A2 assembly. For repairs refer to Service Sheet 2.

YES

The dc voltage on the CAL input into the A7 assembly is > +2 Vdc.

NO

Replace or repair the A6 assembly. For repairs see Service Sheet 2.

The A7A2 assembly must be repaired or replaced. For repairs, refer to Service Sheet 7.

N

Change to local mode. Verify
trum Analyzer display is viewe
and SOURCE control settings.
50. Set external source to 2 KH
Figures 3-2 (AM) and 3-3 (FM)
display.

Condition	MODE
1	AM
2	AM
3	FM
4	FM

The display is correct only in

Y

The display is correct in condi
only.

N

The display is correct in con

N

Remove the A5 assembly and
extender board. The voltage at
Vdc in the INTERNAL 400 Co

N

FIG. 8-9
Sht 2 of 4

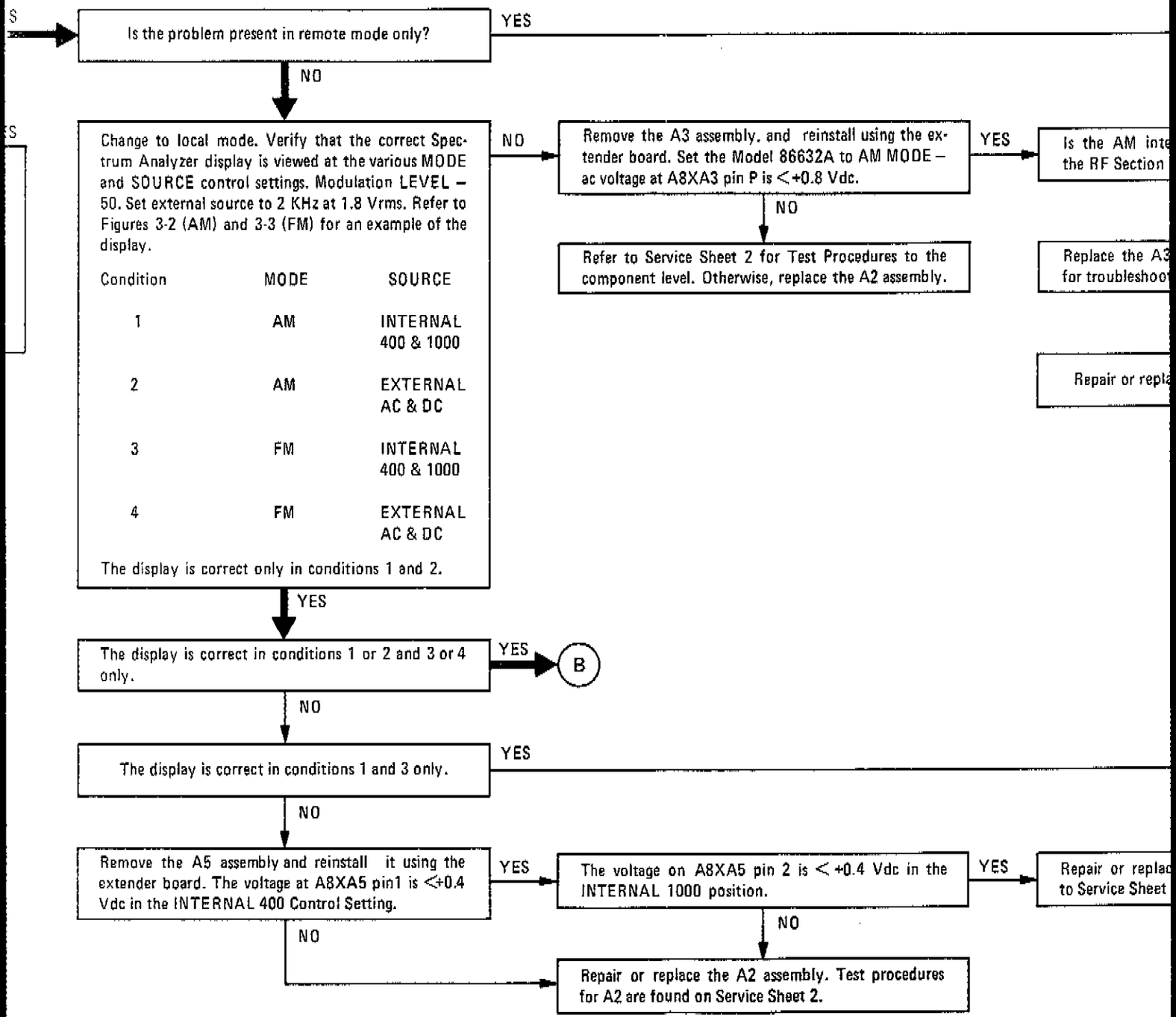


FIG. 8-9
Sht 3 of 4

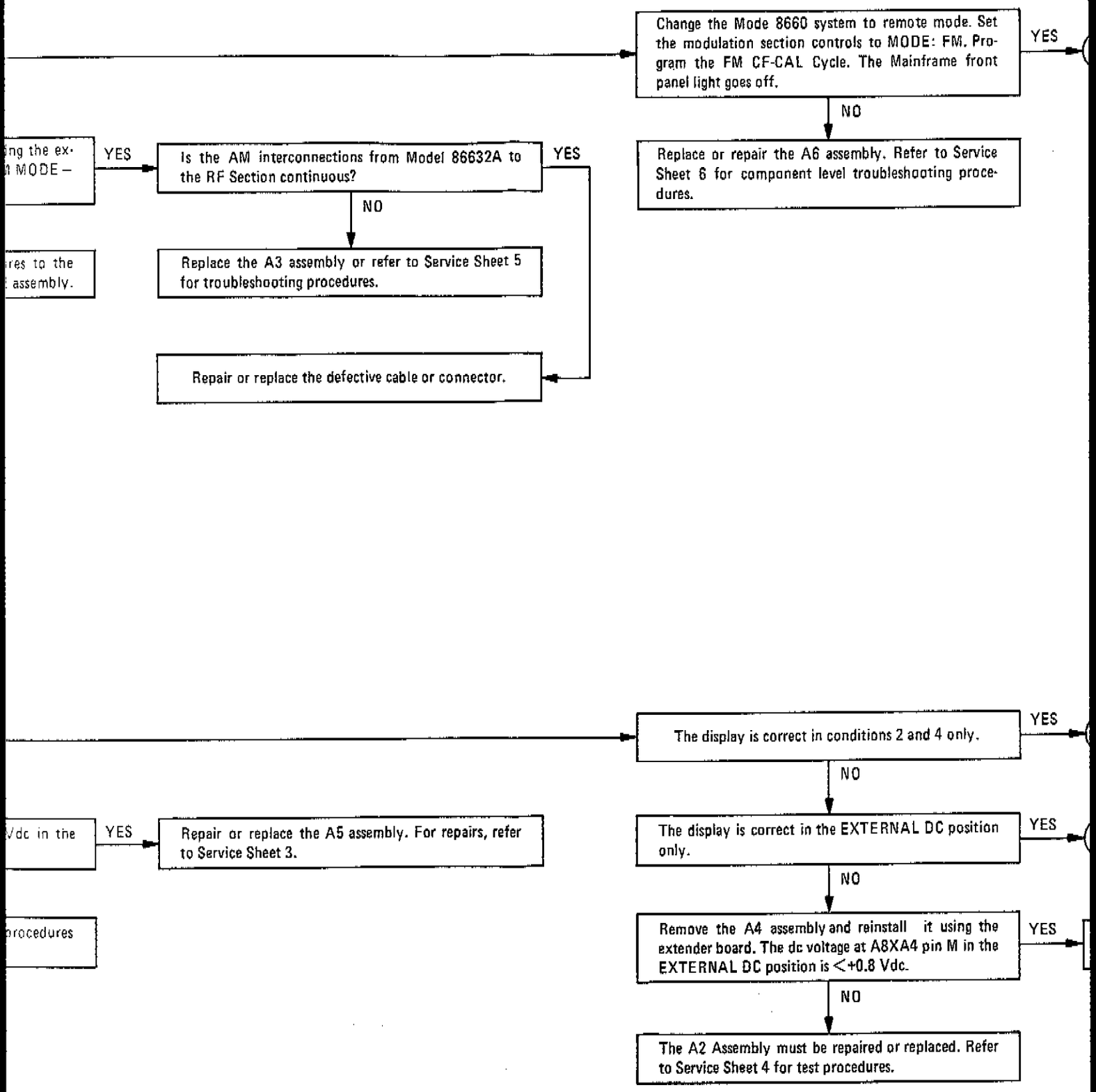


Figure 8-9. Model 86632A Troubleshooting Tree (1 of 2)

FIG. 8-9
Sht 4 of 4

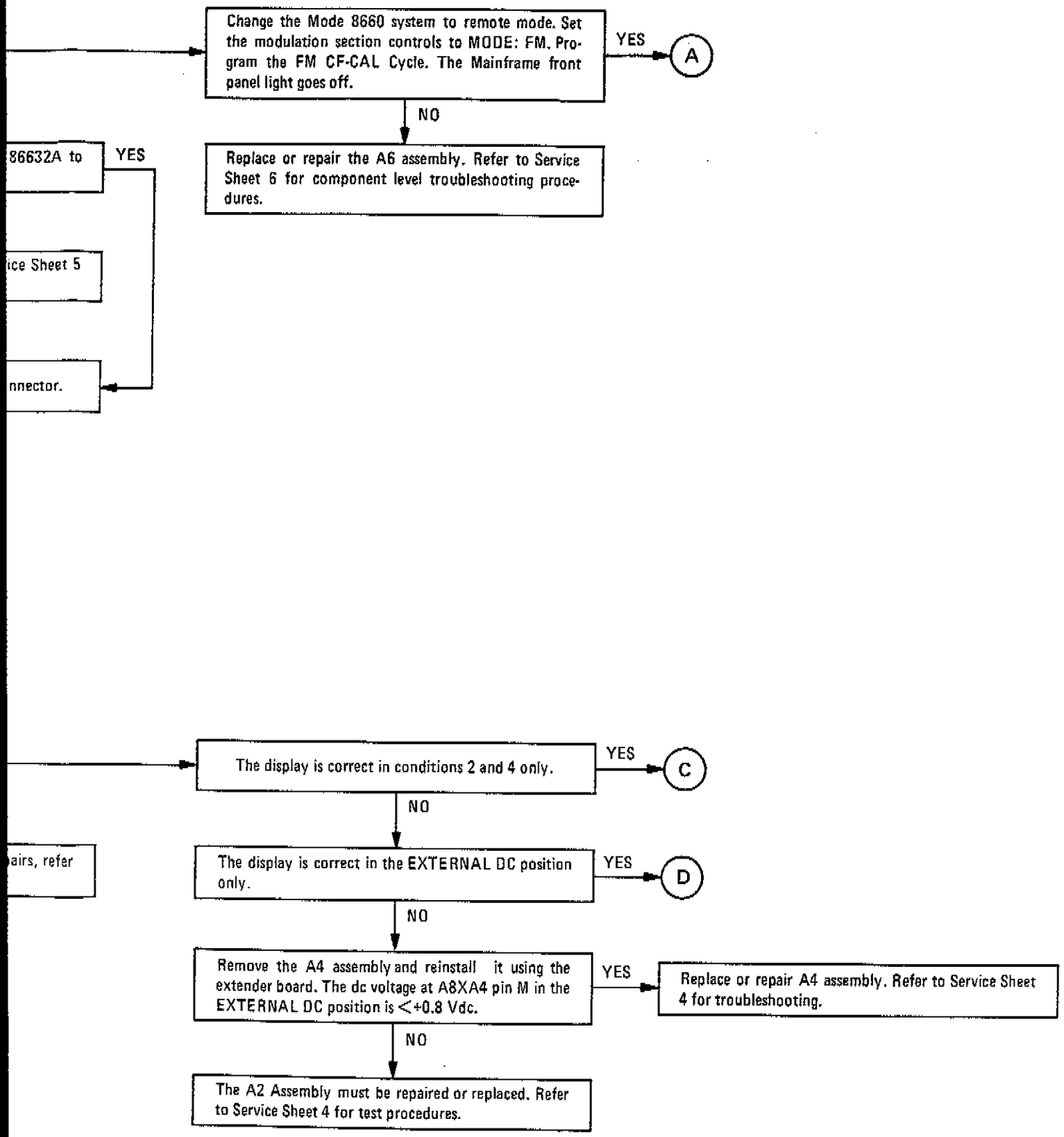
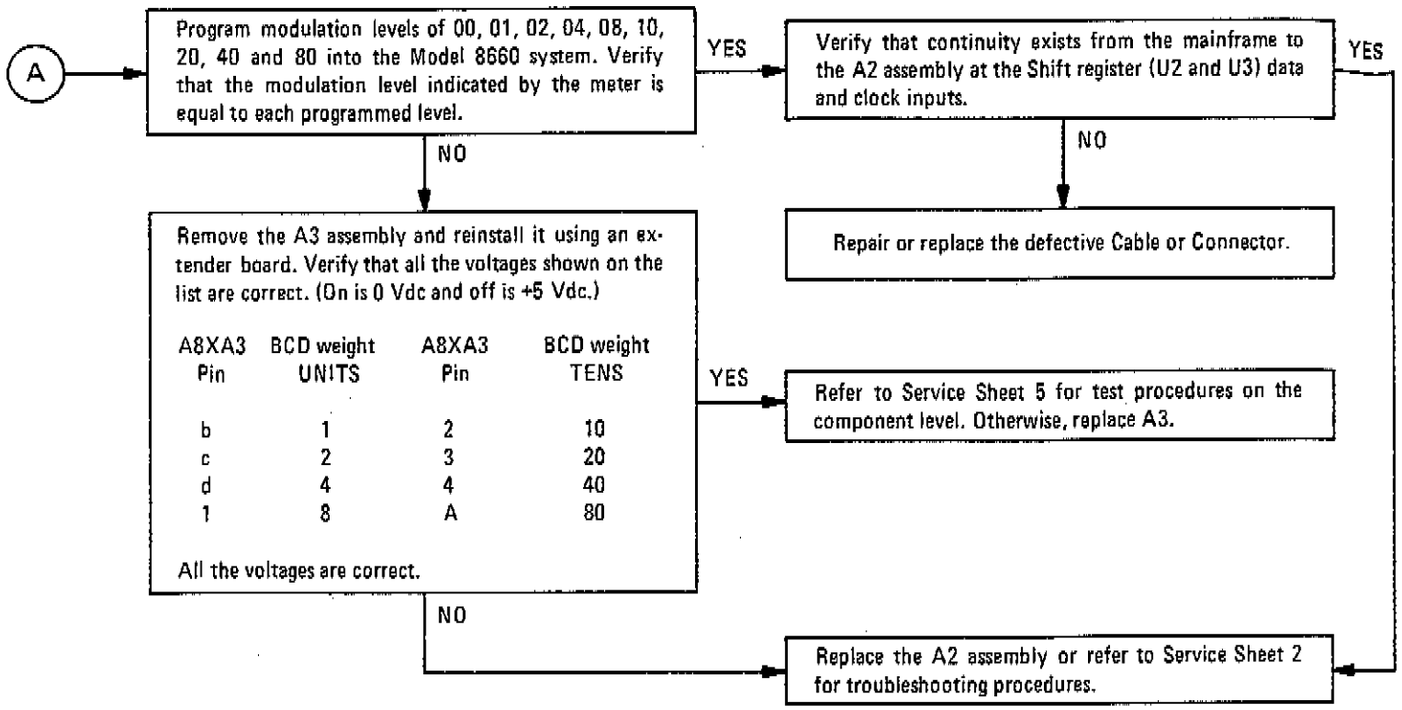


Figure 8-9. Model 86632A Troubleshooting Tree (1 of 2)

FIG. 8-9A
SHT 1 of 4



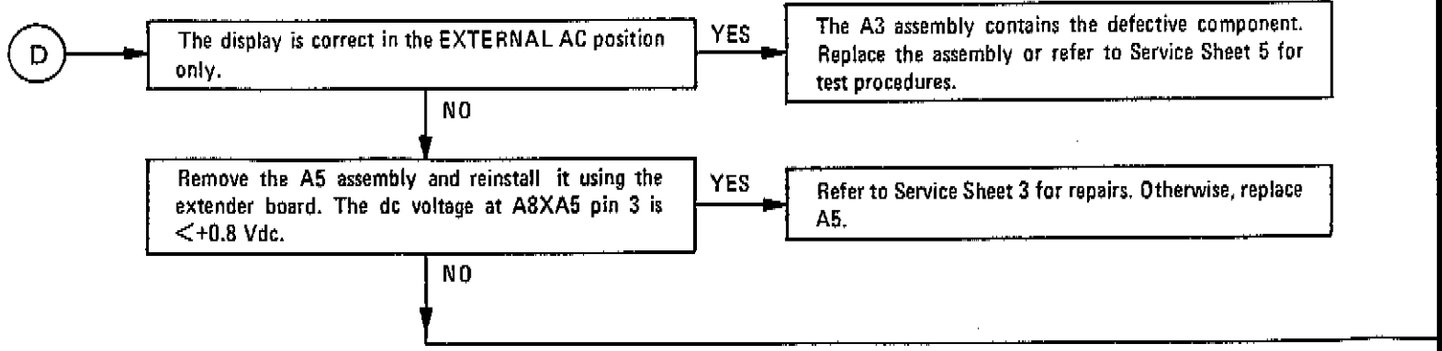


FIG. 8-9A
Sht 2 of 4

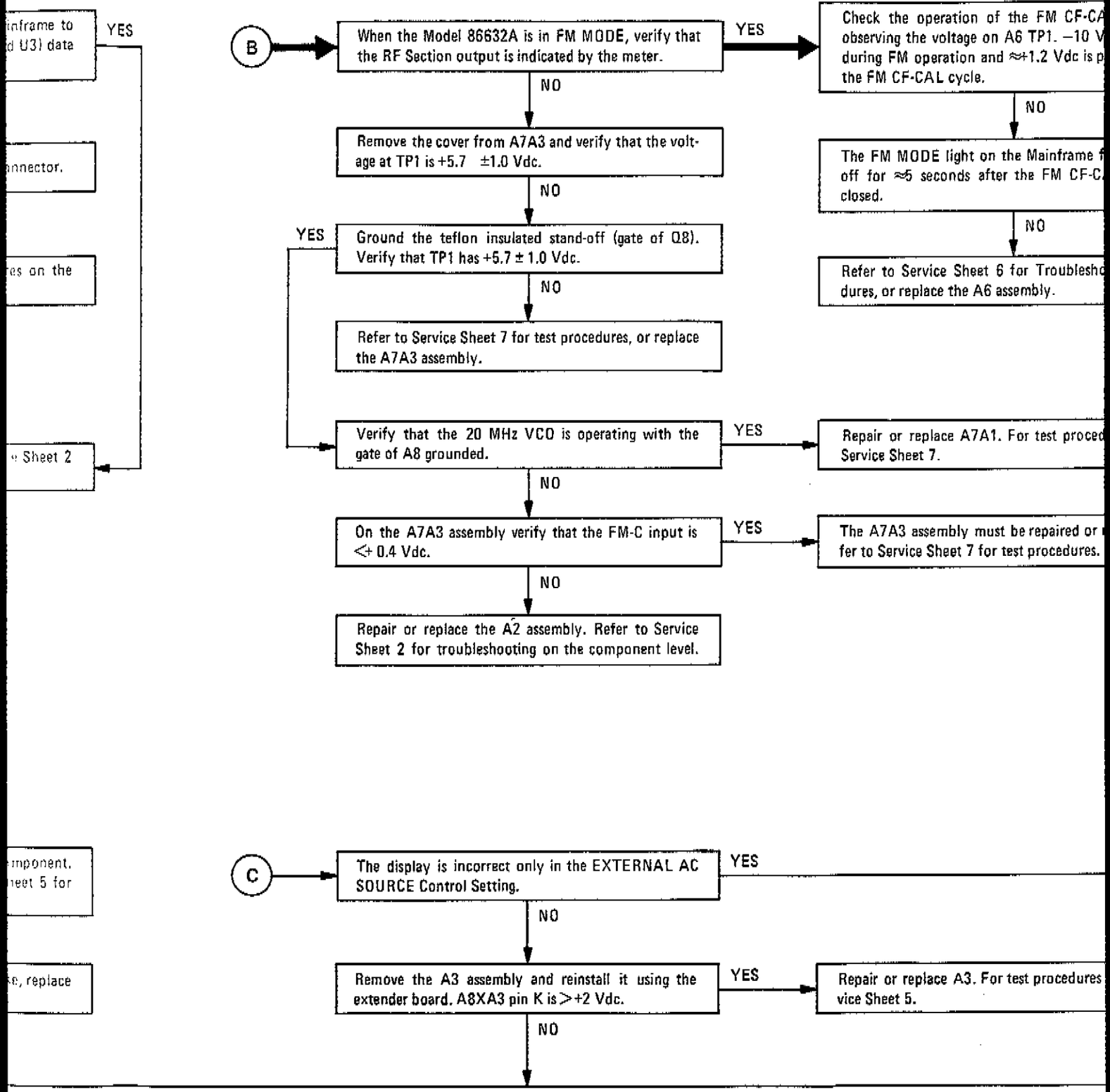


FIG. 8-9A
Sht 3 of 4

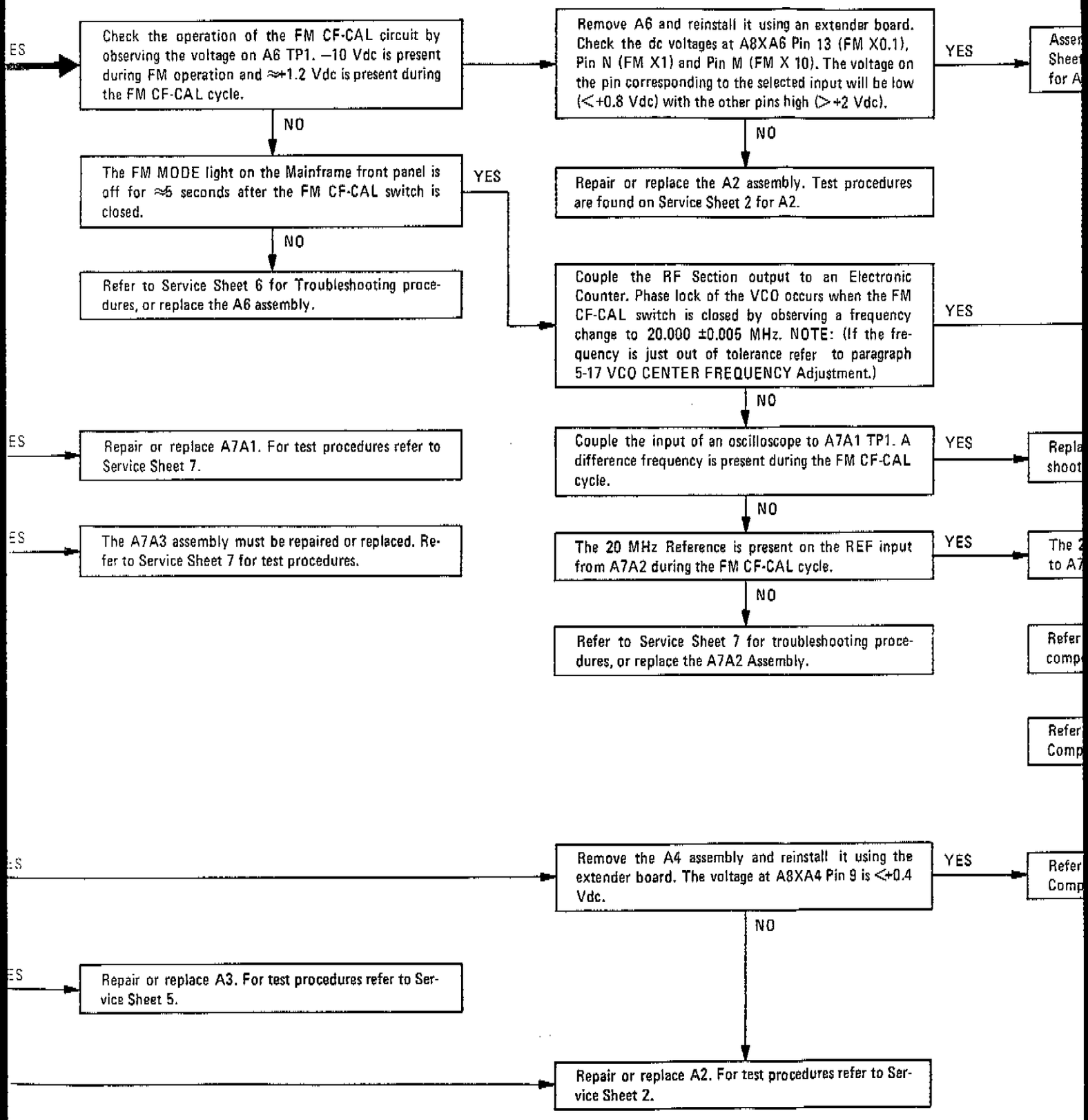


Figure 8-9.

FIG. 8-9A
Sht 4 of 4

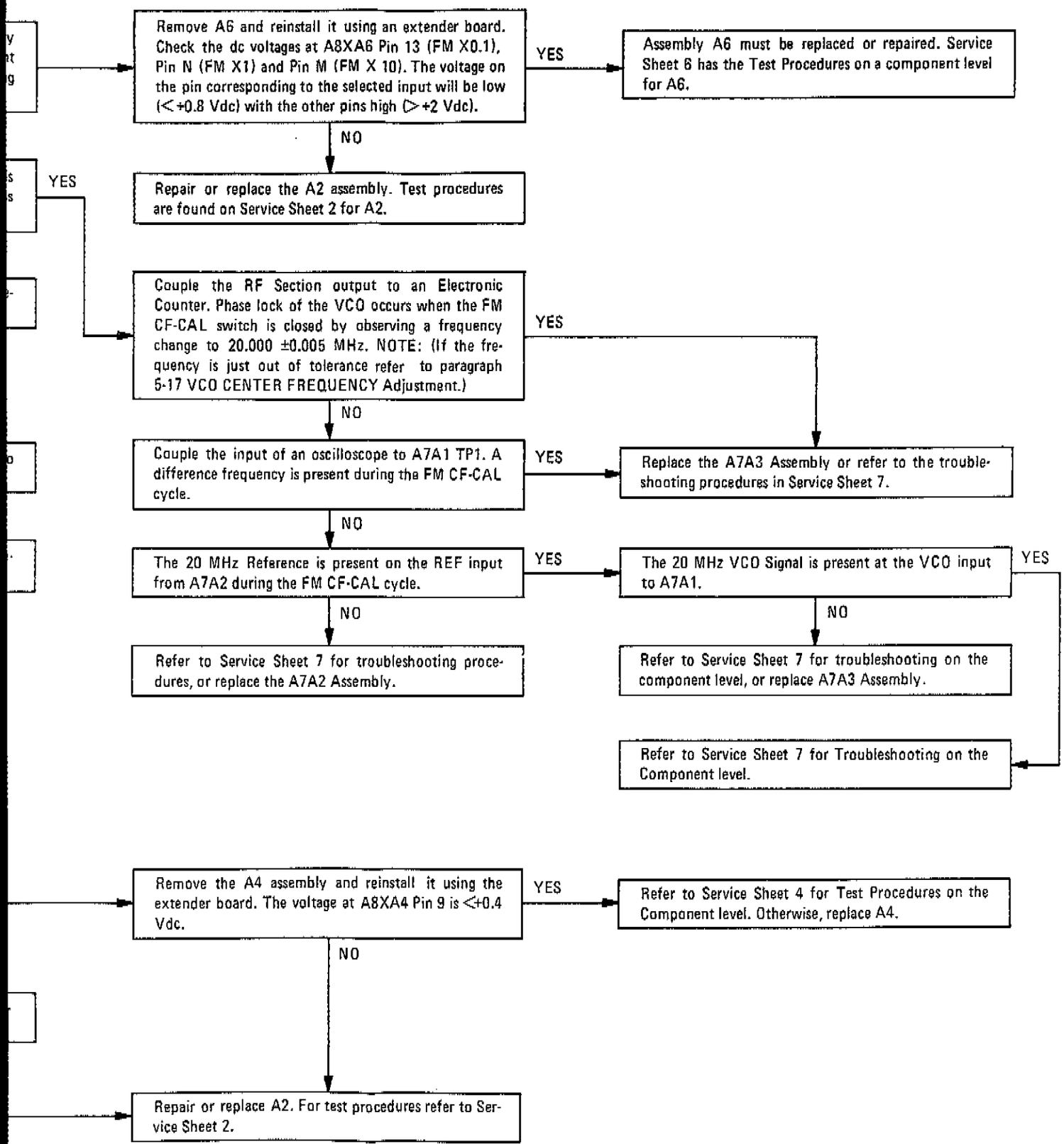


Figure 8-9. Model 86632A Troubleshooting Tree (2 of 2)

SERVICE SHEET 1

BLOCK DIAGRAM

This block diagram is an aid to understanding the overall operation of the Model 86632A. Used in conjunction with the troubleshooting tree and this text, it will also help the technician to isolate the cause of a malfunction to a circuit or assembly.

The large numbers in the lower right corner of each of the major blocks identify the Service Sheet which provides schematics and theory for that block.

GENERAL

When interconnected with a Model 8660 series mainframe and a Model (86600 RF) Section, the Model 86632A provides a means to AM or FM modulate the rf output from the RF Section.

A2 SWITCH LOGIC ASSEMBLY

The switch logic assembly provides the interface capabilities to operate the Model 86632A with either front panel controls or remotely programmed data.

The assembly contains the following major circuits:

Two serial to parallel BCD shift registers, U2/U6 and U3/U7. These convert the four-line serial input to two four-line parallel outputs. The outputs of one shift register, in the remote mode, controls all mode and source functions through multiplexers. The second shift register controls the AM-FM% in the remote mode.

Two multiplexers which are used to select the local or remote inputs. The outputs of these multiplexers control all source and mode functions in both the local and remote modes.

A gating circuit which is controlled by the LCL/RMT (local/remote) input. This gate enables the correct multiplexer input gates through inverters in the multiplexers.

The only function of the instrument not controlled by the A2 assembly is the FM CF-CAL (FM center frequency calibration) which is controlled by the A6 assembly.

Refer to Service Sheet 2 for a schematic and a more complete explanation of the circuits.

A5 MODULATION OSCILLATOR ASSEMBLY

The modulation oscillator assembly provides a 400 Hz or 1000 Hz signal which may be used for amplitude or frequency modulation. The output of the oscillator is also applied through a buffer amplifier to the front panel INPUT/OUTPUT connector for use in external equipment if desired. The A5 assembly also contains a relay to switch external ac coupled signals to the input of the A4 assembly.

SERVICE SHEET 1 (cont'd)

Refer to Service Sheet 3 for a schematic diagram and a more complete description of the circuits.

A4 LEVELING AMPLIFIER ASSEMBLY

The leveling amplifier maintains a constant level output when the Model 86632A is operated in the internal or external ac modes. The output level of the signal is controlled by a light sensitive resistive element in the signal path. The intensity of the light element is controlled by a feedback circuit.

The leveling amplifier is not used when the Model 86632A is operated in the external dc mode.

Refer to Service Sheet 4 for a schematic diagram and a more complete explanation of the circuits.

A3 REMOTE ATTENUATION ASSEMBLY

The A3 remote attenuation assembly processes the signal from the A4 assembly. The output of the A3 assembly is applied to the plug-in RF Section (AM mode), or to the A6 assembly (FM mode).

In the remote mode the modulation level (AM percentage or FM deviation) is controlled by 8 relays and a network of resistive attenuators. The relays are, in turn, controlled by 8 input lines which provide 2 four-line BCD (1, 2, 4, 8) inputs. These inputs are programmable from 00 to 99 in linear steps.

In the local mode the modulation level (AM percentage or FM deviation) is controlled by the front panel MODULATION LEVEL control.

The Model 86632A front panel meter indicates modulation percentage or deviation in both remote and local modes.

Refer to Service Sheet 5 for a schematic diagram and a more complete circuit description.

A6 FM DEVIATION ATTENUATION ASSEMBLY

The A6 FM deviation attenuation assembly contains a gating circuit, a 5 second one/shot and two amplifiers which are separated by the range select relays.

The gating circuit in the A6 assembly is inhibited in the AM mode. In the FM mode the gate is enabled and the 5 second one/shot can be triggered by the front panel FM CF CAL switch or by means of remote programming.

When the 5 second one/shot is triggered it provides outputs which operate relays in the A3 and A7 assemblies. It also operates a gate in the A2 assembly to provide a "FLAG" signal to the mainframe and the remote programming device. This "FLAG" signal simply indicates that the Model 86632A is not in a condition to receive programming inputs.

SERVICE SHEET 1 (cont'd)

The three range select relays provide:

1) FM X10 0-1 MHz peak deviation
2) FM X1 Attenuation to 10% of FM X10 deviation
3) FM X0.1 Attenuation to 1% of FM X 10 deviation

Refer to Service Sheet 6 for schematic and a more complete description of the circuit.

A7 REAR PANEL ASSEMBLY

GENERAL

The rear panel assembly contains three circuit boards; its purpose is to frequency modulate the 20 MHz input to the RF Section when the Model 86632A is operated in the FM mode.

A7A1 20 MHz MIXER ASSEMBLY

During the FM CF-CAL cycle the A7A1 assembly uses a pulse generated from the 20 MHz reference signal to open a sampling gate which samples the output of the A7A3 VCO. The phase detector provides an output to bring the frequency of the A7A3 VCO to exactly 20 MHz. When a frequency difference exists, the output of A7A1 is a beat note which is equal to the difference of the two inputs to the sampler. When phase lock has been achieved, the output of the A7A1 assembly is a dc level which is stored in a memory circuit in the A7A3 assembly, where it is used to maintain the center frequency of the VCO at 20 MHz.

A7A2 20 MHz SWITCH ASSEMBLY

The A7A2 assembly contains 4 relays which route the 20 MHz reference signal from the mainframe to the A7A1 assembly or to the RF Section. In the FM mode it also couples the output from the A7A3 VCO to the RF Section.

A7A3 20 MHz VOLTAGE CONTROLLED OSCILLATOR ASSEMBLY

The A7A3 assembly contains a memory circuit, a voltage controlled oscillator and two buffer amplifiers.

When operated in the FM mode the A7A3 VCO center frequency may be phase locked (temporarily) to a stable 20 MHz reference from the mainframe. After the VCO center frequency is phase locked the instantaneous output frequency is controlled by the ouput of the A6 assembly.

Refer to Service Sheet 7 for a schematic diagram and a more complete description of the circuit.

FIG. 8-10
Sht 1 of 5

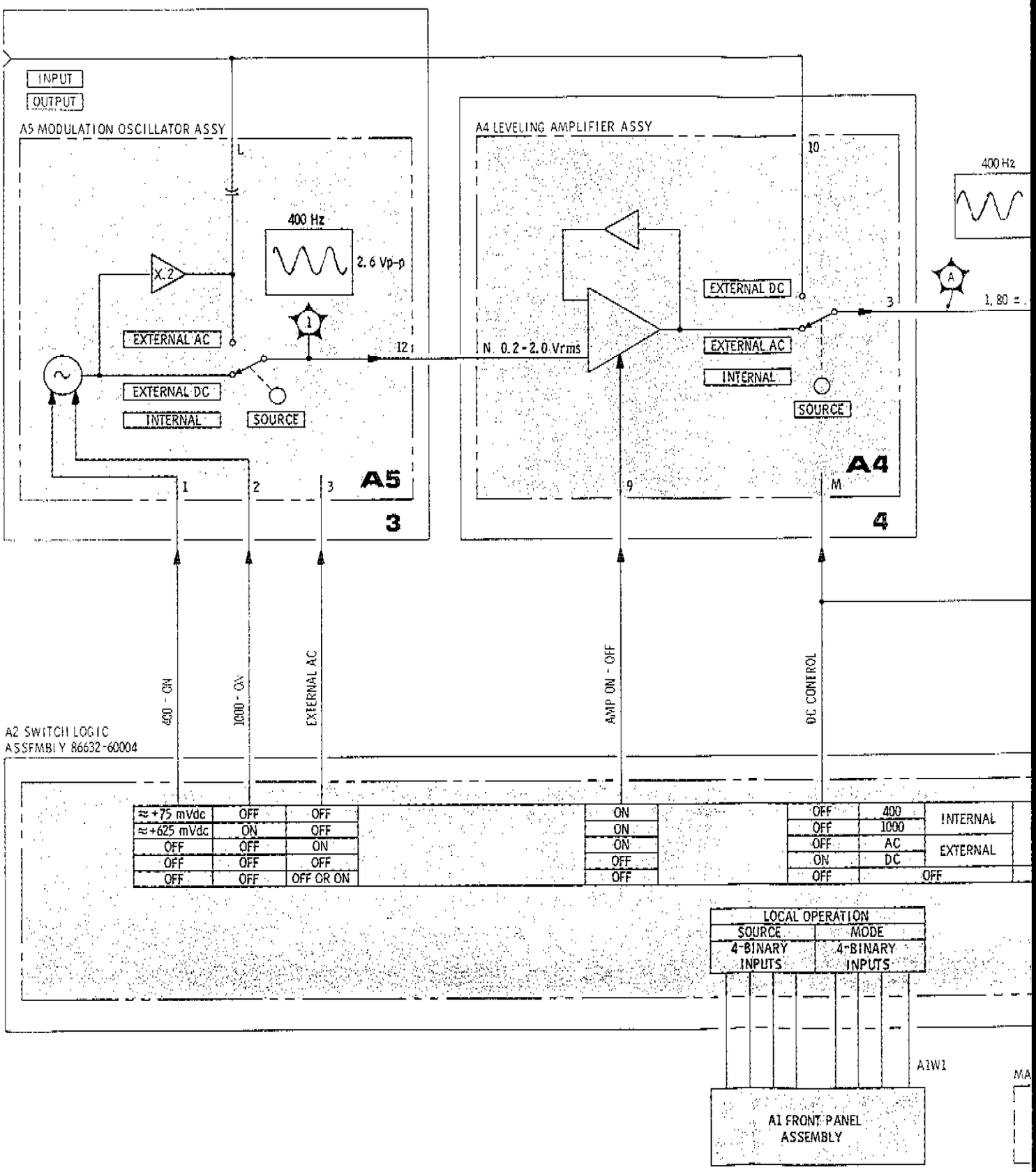


FIG. 8-10
Sht 2 of 5

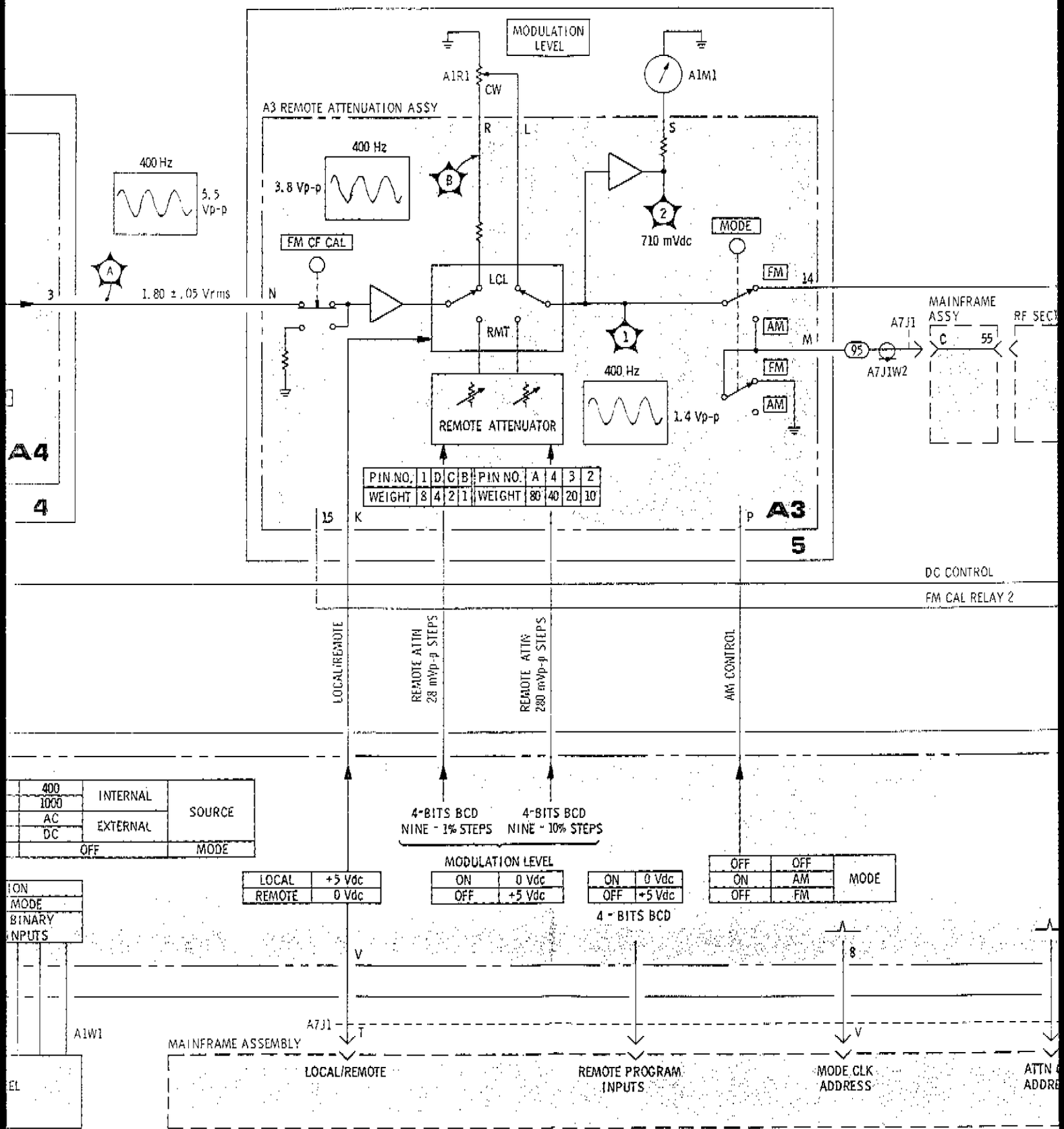


FIG. 8-10
Sht 3 of 5

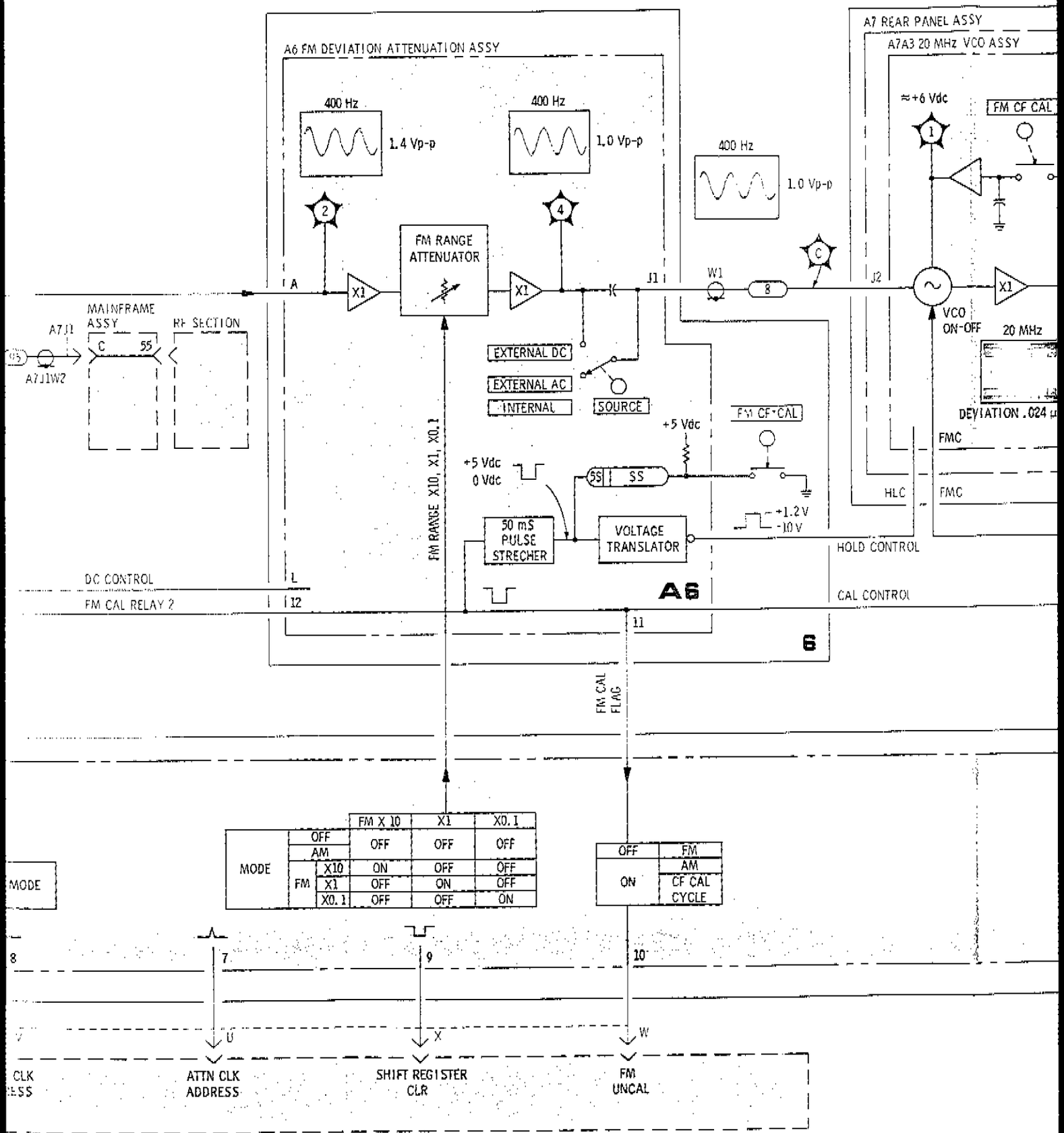
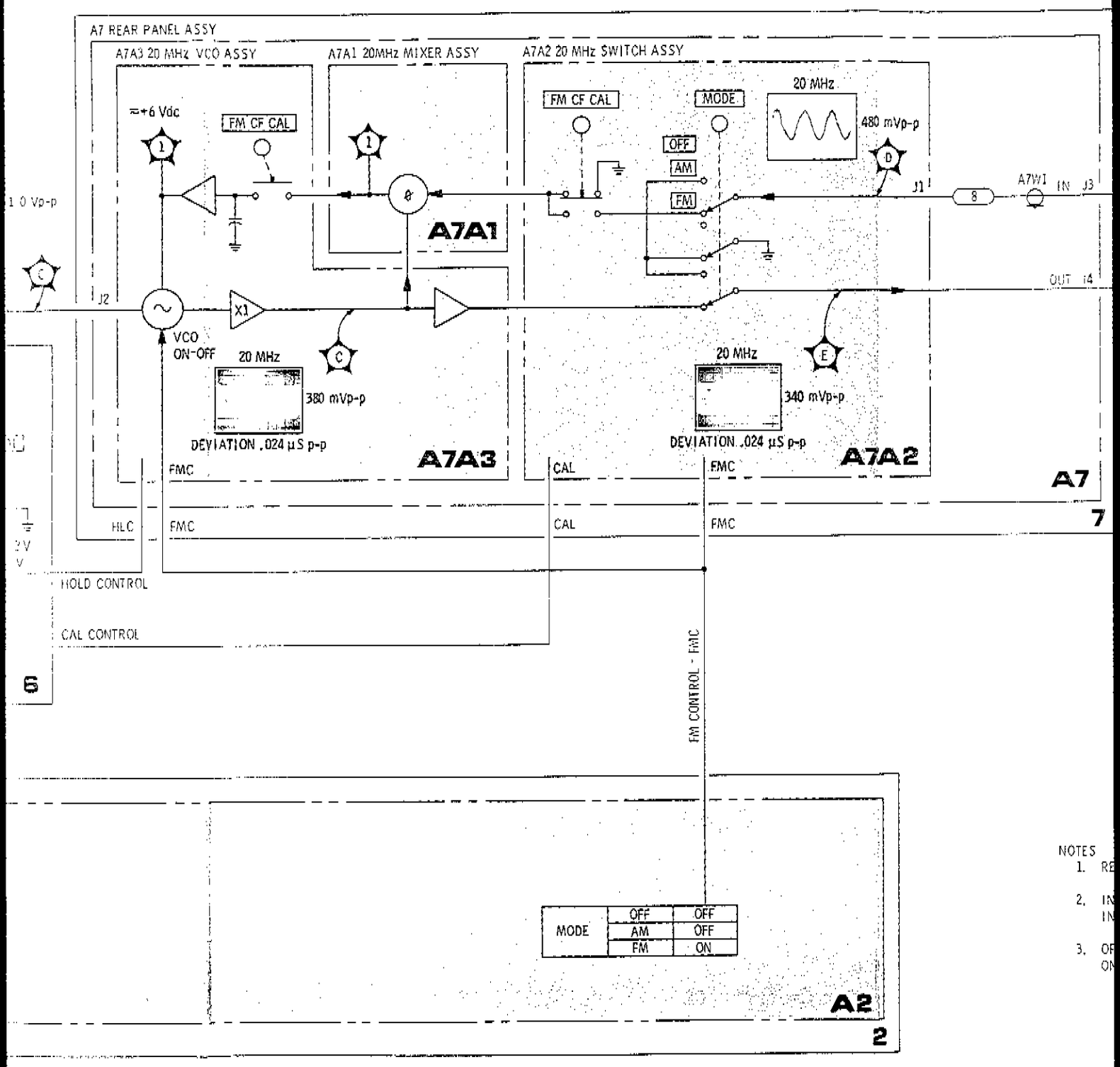
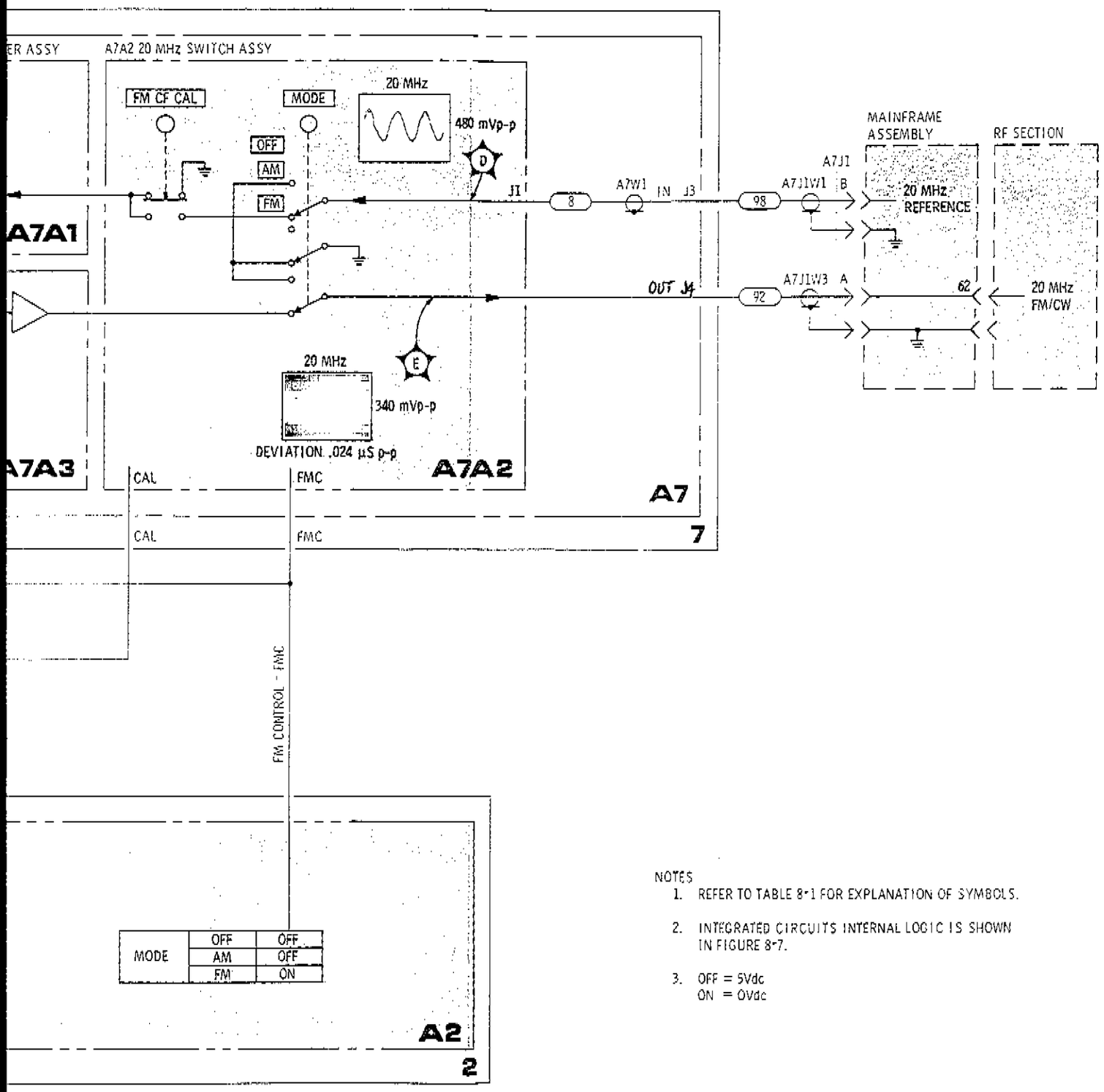


FIG. 8-10
SH 4 of 5



NOTES
1. RE
2. IN
IN
3. OF
ON

FIG. 8-10
SHT 5 OF 5



NOTES

1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
2. INTEGRATED CIRCUITS INTERNAL LOGIC IS SHOWN IN FIGURE 8-7.
3. OFF = 5Vdc
   ON = 0Vdc

1

Figure 8-10. Troubleshooting Block Diagram

SERVICE SHEET 2

SWITCH LOGIC ASSEMBLY

Normally, causes of malfunctions in the Model 86632A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree and the troubleshooting block diagram.

TEST EQUIPMENT REQUIRED (see Table 1-3)

Digital Voltmeter

GENERAL

The switch logic assembly provides the interface capabilities to operate the Model 86632A from either front panel controls or remotely programmed data.

LOCAL OPERATION

General

In the local mode of operation all functions of the Model 86632A are controlled by front panel controls. These consist of:

the MODE control which selects modulation OFF, AM, FM X0.1, FM X1, or FM X10.

the SOURCE control which selects INTERNAL, 400 Hz or 1000 Hz; or EXTERNAL AC or DC inputs.

the MODULATION LEVEL control which sets the AM modulation percentage or FM deviation.

the FM CF-CAL switch which is used to temporarily phase lock the internal FM VCO to a 20 MHz reference from the mainframe.

In the local mode the LCL/RMT input is high. U13B output is high, which inhibits NOR gate U4C, and therefore, Shift Registers U2/U6 and U3/U7 are also inhibited. The high level to pin 1 of U10 and U11 inhibits the inputs from the shift registers and enables the local inputs, pins 3, 6, 13 and 10, from the front panel switches. The high LCL/RMT output is also coupled to a relay on the A3 Assembly which enables the front panel MODULATION LEVEL control and inhibits the remote attenuator.

When a particular MODE or SOURCE function is chosen, the front panel control is rotated to the proper position and the switch couples a high dc level (>+2 Vdc) to the appropriate multiplexer. The other inputs to the multiplexer are low (<+0.8 Vdc). Because the local mode inputs to U10 and U11 multiplexers have been enabled by the high level from the LCL/RMT control line to pins 1, the multiplexer input levels appear at their corresponding outputs.

MODE CONTROL

The U10 multiplexer outputs are inverted and the outputs from the A2 assembly are coupled to relays in the A3 assembly where AM or

FM mode is selected, and to the A6 assembly where the FM range is selected.

FM SENSE

A low output from U14B pin 4, the FM sense circuit, verifies that an FM range has been selected as the mode of operation.

FM CONTROL

The FM sense output is coupled through U13A buffer to activate the three 20 MHz FM/CW relays on the A7A2 assembly.

FM UNCAL

The inverted FM sense output is coupled to U15C pin 10. When any FM range is selected, U15C is enabled and the normally high input from the FM center frequency calibration timing circuit in the A6 assembly causes U15C pin 9 to go low. The high output from U9C pin 6 causes the FM MODE light on the Mainframe front panel to be illuminated. During the FM center frequency calibration cycle the input from the A6 assembly is low, the output to the mainframe is low and the FM MODE light is off.

MODE SENSE

The U14D NOR gate has a low output to enable NOR gates U14C, U4D, U8A and U8D when either AM or FM MODE is selected. If the OFF MODE is selected, the output of U14D is high which inhibits U14C, U4D, U8A and U8D and the outputs of U9B, U12B, U12C and U12D are held high (OFF).

SOURCE CONTROL

As long as TP2 (MODE SENSE output) is low, the SOURCE outputs from A2 are dependent on the U11 multiplexer outputs. The Amp On-Off output turns the A4 Leveling Amplifier on (low) in any SOURCE mode except EXTERNAL DC. The EXTERNAL DC, Internal 400 and Internal 1000 control outputs from the A2 assembly are inverted with respect to the U11 multiplexer output pins 7, 12 and 9 respectively and therefore low (<+0.8 Vdc) when selected as the SOURCE mode. These outputs activate relays on A3 (INTERNAL 400/1000 Hz oscillator) and A4 and A6 dc coupling of the external source).

NOTE

The Internal 400 control voltage at A8XA2 pin 17 is on when the dc voltage is less than +0.4 Vdc and off at greater than +0.4 Vdc.

The External AC output is independent of the Mode Sense circuit. U9A inverts the U11 pin 4 output and couples it to a relay in the A5 assembly which selects an Internal (high) or External AC (low) modulating source.

SERVICE SHEET 2 (cont'd)

REMOTE MODE

AM-FM Function Shift Register

In the remote mode the Model 86632A front panel controls are inhibited, the LCL/RMT input at XA2 pin V is low and the output of AND gate U13B is low. The low output of AND gate U13B is applied to pin 1 fo multiplexers U10 and U11. U10 and U11 pins 2, 5, 14 and 11 are coupled to the shift register output and therefore the outputs of U3 and U7 now control the outputs of U10 and U11.

The programmed input information at XA2 pins A, 1, B and 2 consists of two serial inputs of BCD (8, 4, 2, 1) data. This data input is processed by U3 and U7 to control both the mode and source gates. When the information is programmed into the mainframe DCU storage register, the source control data is entered first, then the mode control data is entered.

When the mainframe receives the remote transfer command, and the data is addressed to the AM-FM function, a series of 10 clock pulses is received at XA2 pin 8. Since only two digits are required to program the AM-FM function, the first eight clock pulses will be ignored.

When the 9th clock pulse appears the source data is stored in U3 (Q outputs follow D inputs). The 10th (and last) clock pulse transfers the source data from U3 to U7 and simultaneously stores the mode data in U3.

The outputs of multiplexers U10 and U11 now follow the data stored in U3 and U7. Operation of the mode and source gates is the same as it was in the local mode.

AM-FM % Shift Register

U2 and U6 convert the two serial BCD at XA2 pins A, 1, B and 2 to two four-line parallel outputs to control the AM percentage and FM deviation when the data stored in the mainframe is addressed to the AM-FM % at XA2 pin 7. A series of 10 clock pulses is received at XA2 pin 7. Since only two digits are required to program the AM-FM %, the first eight clock pulses will be ignored.

The 9th clock pulse causes the "UNITS" data to be temporarily stored in U2. The 10th (and last) clock pulse transfers the "UNITS" data to U6 and also clocks the "TENS" data into U2. NAND gates U1 and U5 invert the data stored in U2 and U6 to drive appropriate relays in the A3 assembly.

The input at XA2 pin 9 is used to reset U2, U3 and U6 and U7 when the instrument is first turned on.

Table 8-3. Truth Table for Mode Functions

MODE	AM Control	FM X0.1	FM X1	FM X10	FMC	FM Uncal
OFF	off	off	off	off	off	off
AM	on	off	off	off	off	off
FM X0.1	off	on	off	off	on	on
FM X1	off	off	on	off	on	on
FM X10	off	off	off	on	on	on

Table 8-4. Truth Table for Source Functions

MODE	SOURCE		AMP on-off	EXT AC	EXT DC	INT 400	INT 1000
OFF	any		off	X	off	off	off
AM	EXT	AC	on	on	off	off	off
		DC	off	off	on	off	off
or							
FM	INT	400	on	off	off	on	off
		1000	on	off	off	off	on

X-may be on or off. The level is dependent on the SOURCE control only.

TEST PROCEDURE 1

Before attempting to troubleshoot the A2 Assembly, verify that the power supply voltages are present.

If the Model 8660 system is being operated in the local mode, and the malfunctioning component has been isolated to the A2 assembly, proceed to Test 1-b.

Test 1-a. Change from remote mode to local mode and set the front panel controls to correspond to the programmed functions. If the instrument functions properly in local mode, proceed to Test Procedure 2 . If the problem is still present, proceed to test 1-b.

Test 1-b. Measure the voltage at TP1. If the voltage is low (<+0.8 Vdc), proceed to Test 1c. If the voltage is incorrect, measure the dc voltage at U13B pin 6. If the voltage is high, U4 or an associated component is probably defective. If the voltage is low, verify that the dc level at U13B pin 5 is high. If the voltage is correct, U13 or an associated component is defective. If the voltage is incorrect verify that continuity exists from U13 pin 6 to the mainframe. If continuity does exist, refer to the DCU troubleshooting tree in the Mainframe manual. If continuity does not exist, repair or replace the defective connectors or cables.

Test 1-c. Verify that the correct dc voltage level exists at TP 2. The level should be high in OFF mode and low in AM or FM mode. If the levels are correct, proceed to Test 1e. If the voltages are incorrect, proceed to Test 1d.

Test 1-d. Measure the dc voltages at U10 pins 4, 7, 12 and 9. Refer to Table 8-3. (On is high and off is low.) If all the voltages are correct, proceed to Test 1-g. If any of the voltages are incorrect, check the voltage levels at the inputs to U10 pins 3, 6, 13 and 10. Refer to Table 8-3. (On is high and off is low.) If the voltages are correct, U10 is probably defective. If the voltages are incorrect, the mode control switch A1S2, a connector or the wiring may be defective.

Test 1-e. Verify that the correct dc levels are found at U12A pin 3, U9D pin 8, U9E pin 10 and U9F pin 12. Refer to Table 8-3. (On is low and off is high.) If the dc levels are correct, proceed to test 1-f. If any level from U12 is incorrect, U12 is probably defective.

Otherwise, U9 is probably defective.

Test 1-f. Measure the outputs of U11 at pins 4, 7, 12 and 9. Refer to Table 8-4. (On is high and off is low.) If the levels are correct, proceed to Test 1-h. If the output levels are incorrect, measure the inputs to U11 at pins 3, 6, 13 and 10. Refer to Table 8-4. (On is high and off is low.) If any of the inputs are incorrect, A1S1 switch, the connector or the cable may be defective. If the inputs are correct U11 is probably defective.

Test 1-g. Measure the dc voltage at U14D pin 12. The level should be low in the OFF or AM modes and high in the FM mode. If the voltage is correct, U14 is probably defective. If the voltage is incorrect, U14 or U15 is probably defective.

Test 1-h. Check the output of U9B pin 4, U9A pin 2, U12B pin 4, U12C pin 10 nd U12D pin 11. Refer to Table 8-4. (On is low and off is high.) If the voltages are correct, proceed to Test 1-j. If U9A pin 2 output was incorrect, U9 is probably defective. If any other voltages were incorrect, proceed to Test 1-i.

Test 1-i. Refer to Table 8-4 and verify that the voltage levels at U9B pin 3, U12B pin 5, U12C pin 8 and U12D pin 12 are correct. (On is high and off is low.) If the voltages are correct and:

a. the Amp On-Off is the defective control line, then U9 is probably defective.

b. Internal 400 or 1000, or External DC is the defective control line, then U12 is probably defective.

If any voltages are incorrect and:

a. U9B pin 3 is where the incorrect voltage was found, then U14 is probably defective.

b. U12B pin 5 is where the incorrect voltage was found, then U4 is probably defective.

c. U12C pin 8 or U12D pin 12 is where the incorrect voltage was found, then U8 is probably defective.

Test 1-j. Verify that the voltage at U13A pin 3 is correct. The voltage is high in OFF and AM mode, and the voltage is low in the FM mode. If the levels are correct, proceed to test 1-k. If the levels are incorrect, U13 is probably defective.

Test 1-k. Verify that the Mainframe panel light, FM MODE, is illuminated in the FM mode and is off in OFF and AM modes and during the FM center frequency calibration cycle. If the light is operating correctly, proceed to Test 1-m. If the light is not operating correctly, proceed to Test 1-l.

Test 1-l. Check the voltage at U9C pin 6. The voltage is low in OFF and AM modes and during the FM center frequency calibration cycle and is high in the FM mode. If the voltage is correct, proceed to Test 1-m. Otherwise, verify that the voltage at U15C pin 9 is high in FM mode and low during the FM CF-CAL cycle. If the level is incorrect,

SERVICE SHEET 2 (cont'd)

the A6 FM CF-CAL timing circuit, associated components on the A8 assembly, or continuity between A6 and A2 is probably the cause. If the level is correct, U15 or U9 is probably defective.

Test 1-m. If there still is a problem associated with a specific input or output, the connectors, printed circuits and wiring must be checked for continuity. When an output or input has components on the A8 assembly, they should be checked for proper operation.

TEST PROCEDURE 2

Test 2-a. Verify the dc voltage at TP1 is high. If the voltage is correct, proceed to Test 2-d. If the voltage is incorrect, proceed to Test 2-b.

Test 2-b. Check the dc level at U4B pin 5 for a high. If the level is correct, proceed to Test 2-c. Otherwise, verify that continuity to the mainframe from U4B pin 5 exists, and that the components on the A8 assembly are operating properly. If continuity does exist and the components on A8 are functioning properly, refer to the DCU troubleshooting tree in the mainframe manual. If there is a problem with the components or the cables and connectors, repair or replace the defective part.

Test 2-c. The dc voltage at U4 pin 8 should be low. If the voltage level is correct, U4 is probably defective. If the voltage level is incorrect, measure U13B pin 6 and verify that the dc voltage is low. If the level is correct, U13 or an associated component is probably defective. If the level is incorrect, check the A8 components and continuity to the mainframe from U13B pin 6. If they are OK, refer to the mainframe manual DCU troubleshooting tree. If the components are defective, or if continuity to the mainframe does not exist, repair or replace the defective part.

Test 2-d. Change to local mode and then change back to remote mode. Verify that the outputs of U2, U3, U6 and U7; pins 12, 13, 14 and 15 are all low. If any output is high, the integrated circuit where the problem is found is probably defective. If the outputs are all correct, proceed to Test 2-e.

Test 2-e. Verify that the outputs of U1 and U5 pins 3, 4, 10 and 11 are all high. If any outputs of U1 are incorrect, U1 is probably defective. If any outputs of U5 are incorrect, U5 is probably defective. If all the outputs are correct, proceed to Test 2-f.

Test 2-f. The outputs of U10 and U11 pins 4, 7, 12 and 9 should all be low. If this is true, proceed to Test 2-g. If this is not true and the incorrect output is from U10, then U10 is probably defective. Otherwise, U11 is probably defective.

Test 2-g. Connect +5 Vdc to U2 pins 4, 5, 6 and 7. Momentarily connect +5 Vdc to U2 pin 10 twice. Now, momentarily connect +5 Vdc to U3 pin 10 twice. The outputs U2, 3, 6 and 7 should all be high. If the outputs are correct, proceed to Test 2-h. If any of the outputs are incorrect and:

a. U2 and U6 have identical outputs that are incorrect, U2 is probably defective.

b. U3 and U7 have identical outputs that are incorrect, U3 is probably defective.

c. U6 has an incorrect output, U6 is probably defective.

d. U7 has an incorrect output, U7 is probably defective.

Test 2-h. Verify that the outputs of U1 and U5 pins 3, 4, 10 and 11 are all low. If any outputs of U1 are incorrect, U5 is probably defective. If all the outputs are correct, proceed to Test 2-i.

Test 2-i. The outputs of U10 and U11, pins 4, 7, 12 and 9 should all be high. If this is true, proceed to Test 2-j. If this is not true and the incorrect output is from U10, and U10 is probably defective. Otherwise, U11 is probably defective.

Test 2-j. Verify that continuity to the mainframe exists from the shift register inputs and that the associated components on the A8 Assembly are operating properly. If continuity does exist and the components on A8 are operating properly, go to the DCU troubleshooting tree in the mainframe manual. If continuity does not exist or the components on the A8 Assembly are defective, repair or replace the defective item.

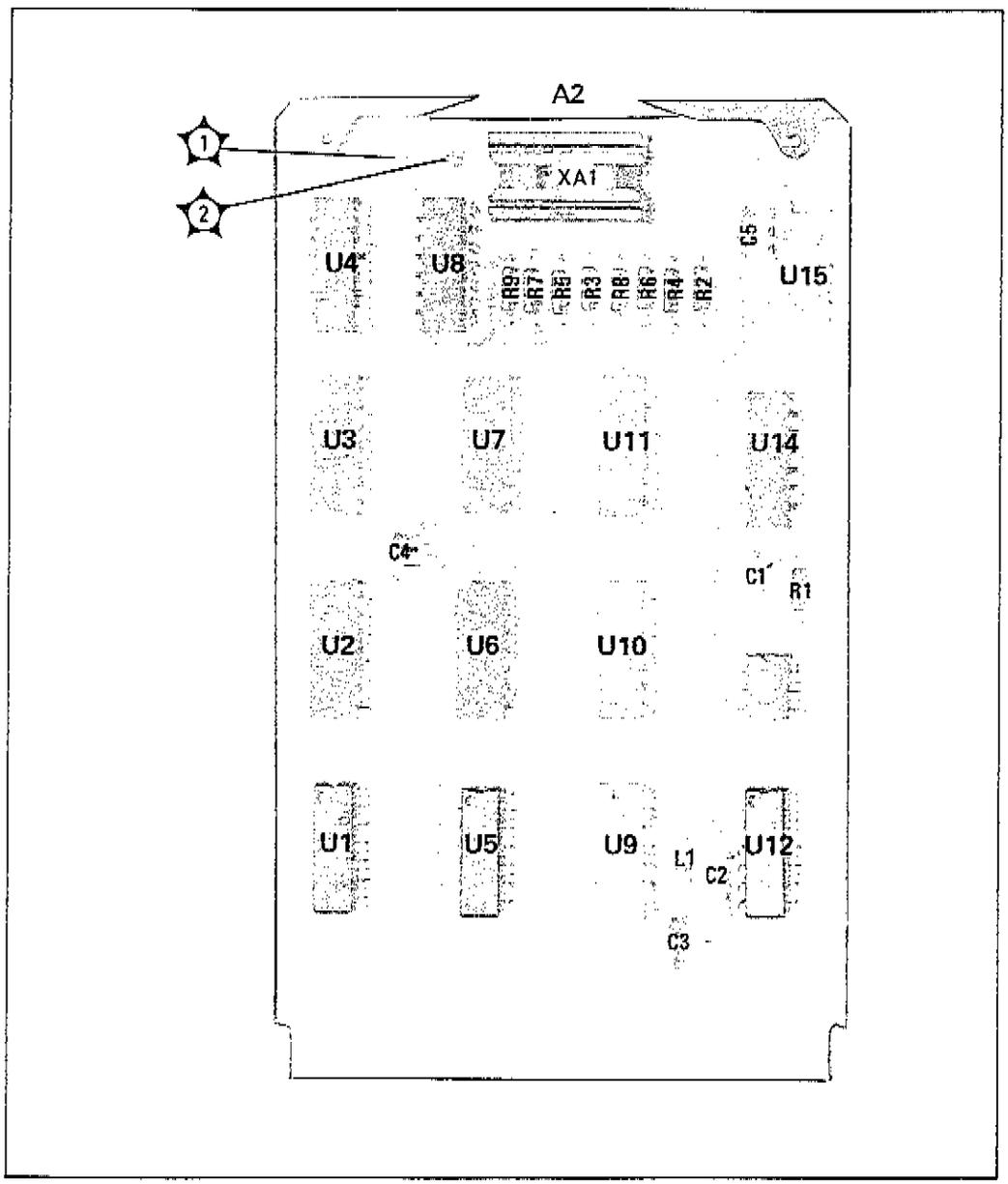


Figure 8-11. Switch Logic Assembly Component Locations

SERVICE
SHEET 2

FIG. 8-12
Sht 1 of 3

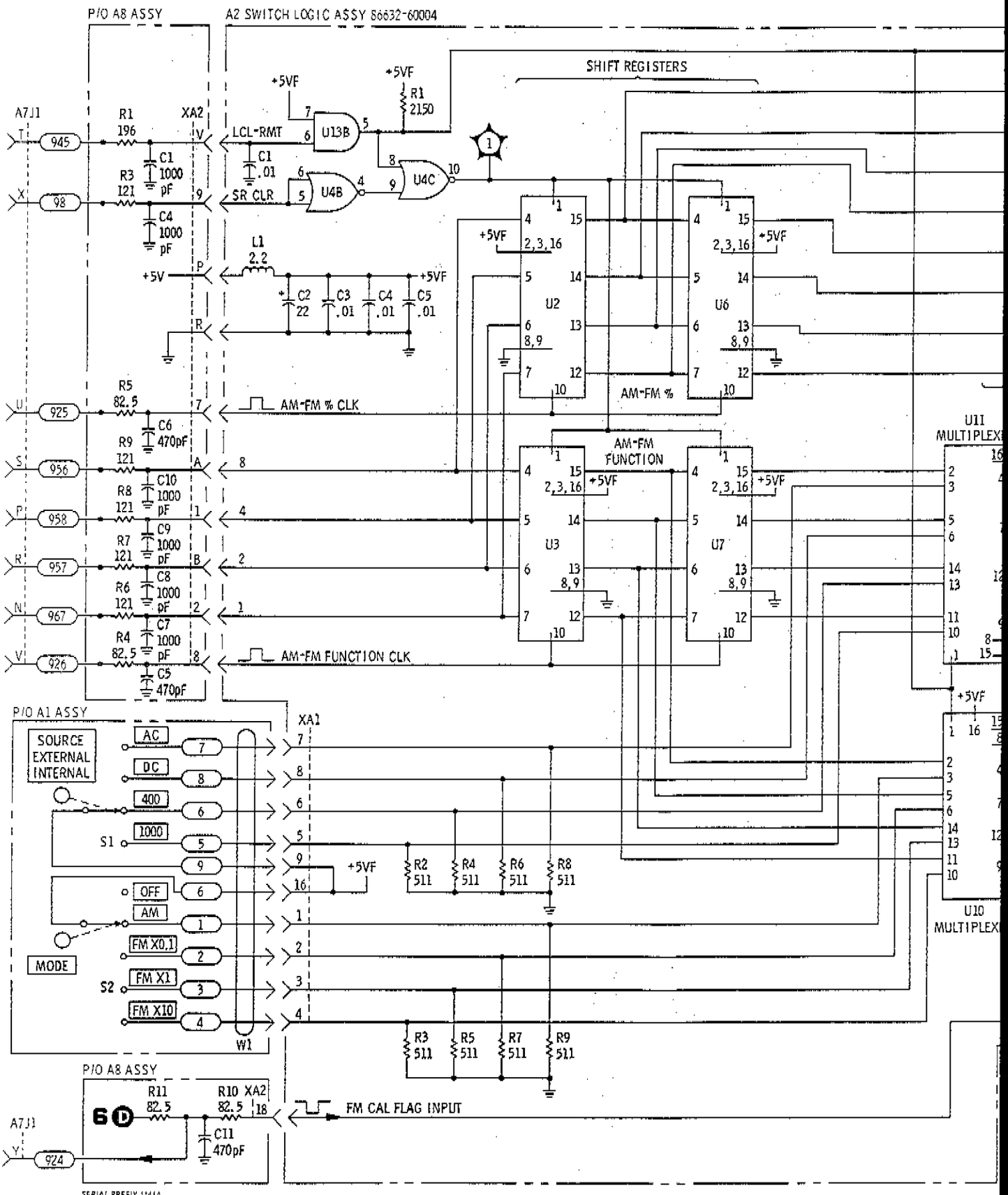
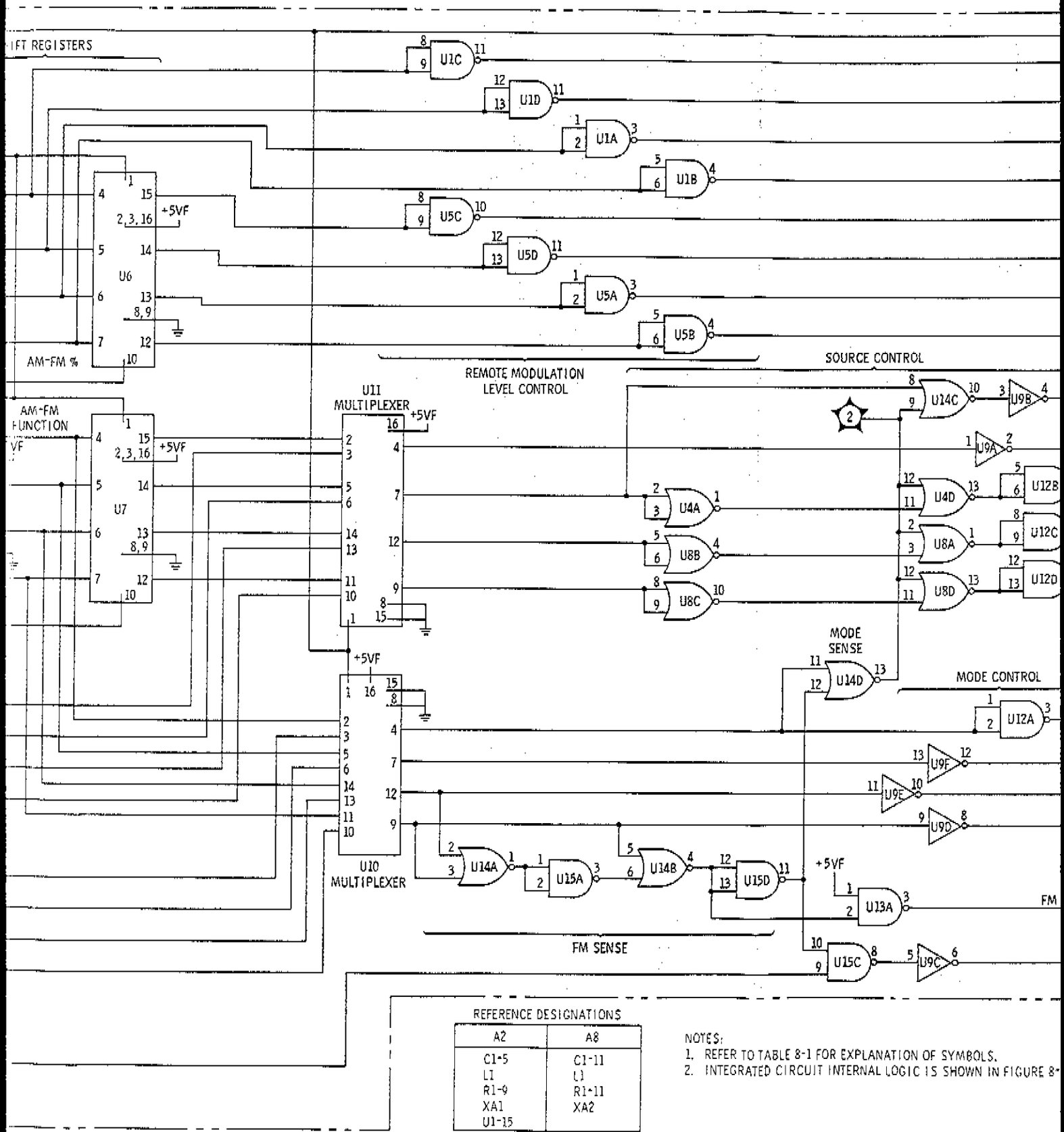


FIG. 8-12
SM2 of 3



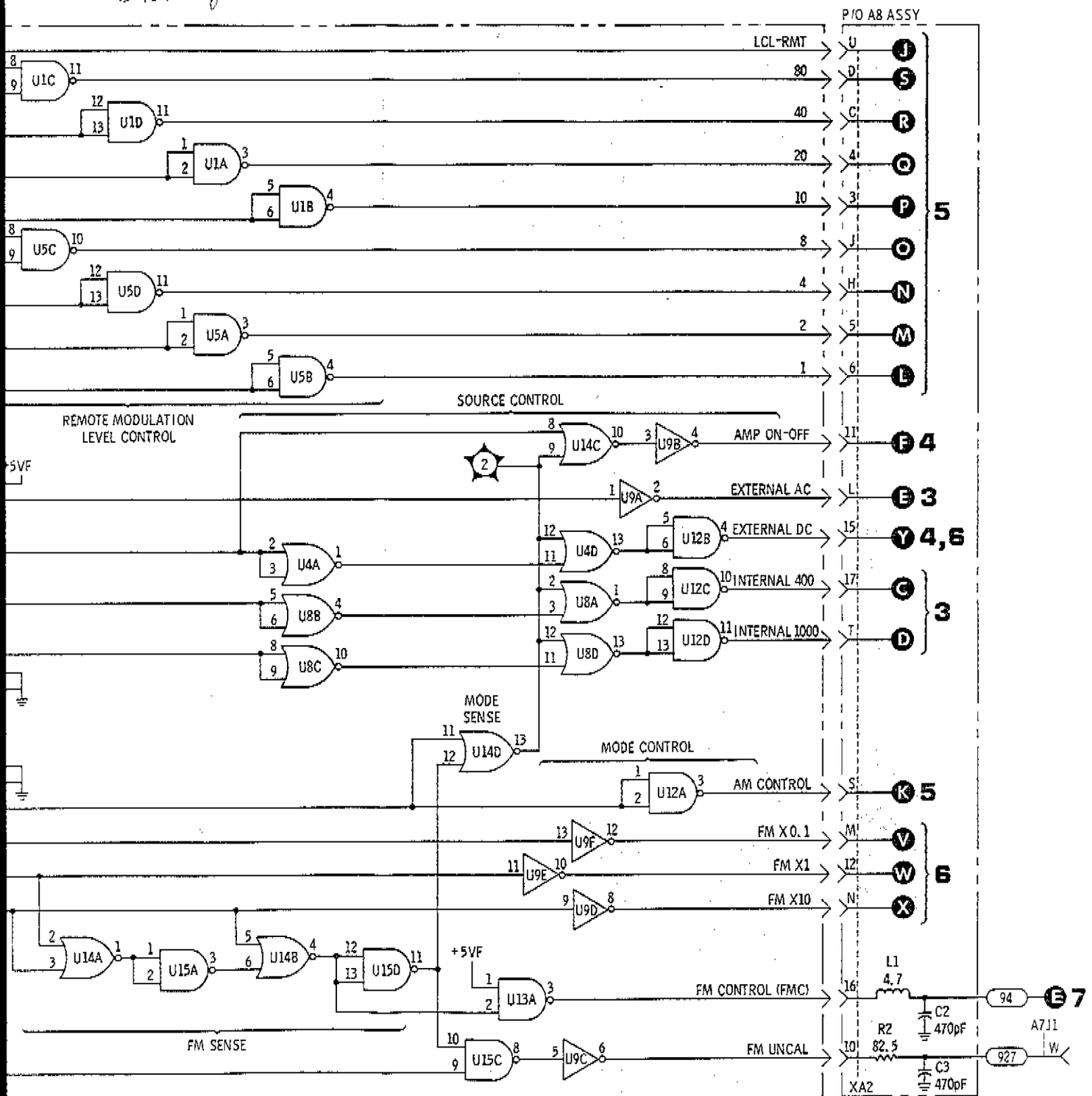
REFERENCE DESIGNATIONS

A2	A8
C1-5	C1-11
L1	L1
R1-9	R1-11
XA1	XA2
U1-15	

NOTES:
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
2. INTEGRATED CIRCUIT INTERNAL LOGIC IS SHOWN IN FIGURE 8-

Figure 8-12. S

FIG. 8-12
SHT 3 of 3



REFERENCE DESIGNATIONS

A2	A8
C1-5	C1-11
L1	L1
R1-9	R1-11
XA1	XA2
U1-15	

NOTES:
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
2. INTEGRATED CIRCUIT INTERNAL LOGIC IS SHOWN IN FIGURE 8-7.

2
A2

Figure 8-12. Switch Logic Assembly Schematic Diagram

SERVICE SHEET 3

MODULATION OSCILLATOR ASSEMBLY

Normally, causes of malfunctions in the Model 86632A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree and block diagram.

NOTE

After making repairs in any part of the modulation oscillator circuits adjustment procedures specified in Section V paragraph 5-13 should be performed to ensure proper operation of the instrument.

GENERAL

The A5 Modulation Oscillator Assembly contains the internal oscillator and couples its output, or the signal from an external source, to the A4 Leveling Amplifier Assembly. The output from the internal oscillator is also coupled to the front panel BNC connector.

TEST EQUIPMENT REQUIRED: (See Table 1-3)

Digital Voltmeter
Oscilloscope
10:1 Oscilloscope probe

1 OSCILLATOR CONTROL CIRCUITS

A low level (<+0.8 Vdc) at either XA5 pin 1 (400-on) or XA5 pin 2 (1000-on) will turn on both Q1 and Q2, thus coupling −9 Vdc to the modulation oscillator U1. The low level at XA5 pin 2 also closes relay K1 and connects parallel resistance into the RC frequency control network and the oscillator frequency is changed from 400 to 1000 Hz.

2 MODULATION OSCILLATOR

The output of the modulation oscillator amplifier U1 is governed by the AGC circuit and the RC frequency control network.

The bridged-Tee feedback circuit reduces the negative feedback with a notch filter at 400 or 1000 Hz, which are the output frequencies of the modulation oscillator.

3 OUTPUT CIRCUITS

The output of the modulation oscillator is coupled to Q3 front panel output buffer amplifier and to K2 pin 1. In the internal source mode, a high (>+2.0 Vdc) is coupled to the relay and the signal is directed to the A4 Assembly. When an external ac coupled source is used, the signal is coupled directly to the output through K2 and the internal modulation oscillator is turned off.

TEST PROCEDURE 1

Test 1-a. With an oscilloscope, observe the output signal at TP1. See the table below.

SOURCE	TP1 Voltage	Frequency
INTERNAL EXTERNAL AC	2.8 Vp-p 0.56 - 5.6 Vp-p	400 or 1000 Hz NOTE

SERVICE SHEET 3 (cont'd)

NOTE

The frequency of the modulating signal in the external ac coupled mode, is determined by the frequency of the external oscillator and is limited by the bandwidth of the RF Section being used.

If the TP1 output level and frequency are correct, proceed to Test 1-b. If the output level is correct and the frequency is incorrect, proceed to Test 1-c. If the output amplitude is incorrect, proceed to Test 1-f.

Test 1-b. If the RF Section output is not being modulated, the interconnections to the A4 Assembly should be checked for continuity. If the front panel output level is incorrect, (280 mVp-p minimum with a 10K resistive load), Q3 or an associated component is probably defective.

Test 1-c. If an external ac coupled source is being used, change the frequency of the external souce. If an internal source is being used, proceed to Test 1-d.

Test 1-d. If the internal 1000 Hz oscillator is selected, and the frequency is 400 Hz, proceed to Test 1-e. If the frequency is other than 400 Hz or 1000 Hz, U1 or a component associated with the RC frequency control network (between U1 pin 6 and pin 2) is probably defective.

Test 1-e. Verify that the voltage at XA5 pin 2 is $<+0.8$ Vdc. If the voltage is incorrect, the interconnections with the A2 Assembly or a component on the A2 Assembly is probably defective. If the voltage is correct, K1 or an associated component is probably defective.

Test 1-f. If an external ac coupled source is being used, K2, the connections to the front panel BNC or an associated component is probably defective. If an internal modulating source is used, proceed to Test 1-g.

Test 1-g. Measure the ac voltage at U1 pin 6. If the voltage is 2.8 Vp-p, K2, C14 or an associated component is probably defective. If the voltage is incorrect, proceed to Test 1-h.

Test 1-h. If the oscillator output amplitude is zero, proceed to Test 1-i. If the output is other than 2.8 Vp-p but not zero, check the dc voltage on CR9 cathode. If the oscillator output is low and the dc voltage on CR9 is low, or if the output amplitude is high and the dc voltages are high, U1 is probably defective. If the output amplitude is high and the dc voltage is low, or if the output amplitude is low and the dc voltage is high, than a component associated with CR9 and AGC loop is probably defective.

Test 1-i. Measure the dc voltage on U1 pin 4. If the voltage is ≈ -8.1 Vdc, U1 or an associated component is probably defective. If the voltage is incorrect, proceed to Test 1-j.

Test 1-j. Verify that the voltage at XA5 pin 1 (INTERNAL 400) or XA5 pin 2 (INTERNAL 1000) is ≈ 0 Vdc. If this voltage is correct, Q1, Q2 or an assocaited component is probably defective. If the voltage is incorrect, the interconnections to the A2 Assembly or a component on the A2 Assembly or a component on the A2 Assembly is probably defective.

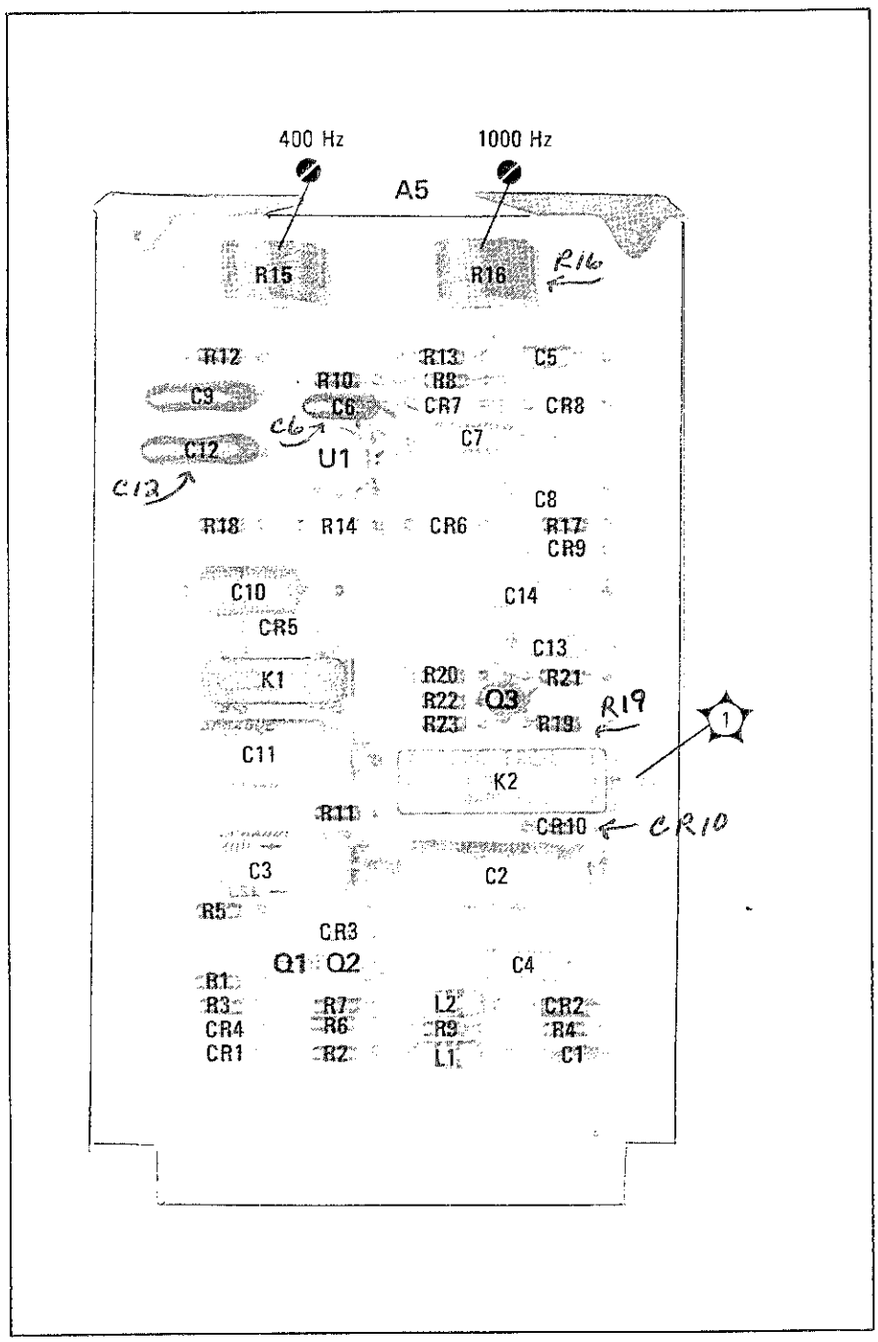


Figure 8-13. Modulation Oscillator Assembly Component Locations

Fig. 8-14
Sht 1 of 3

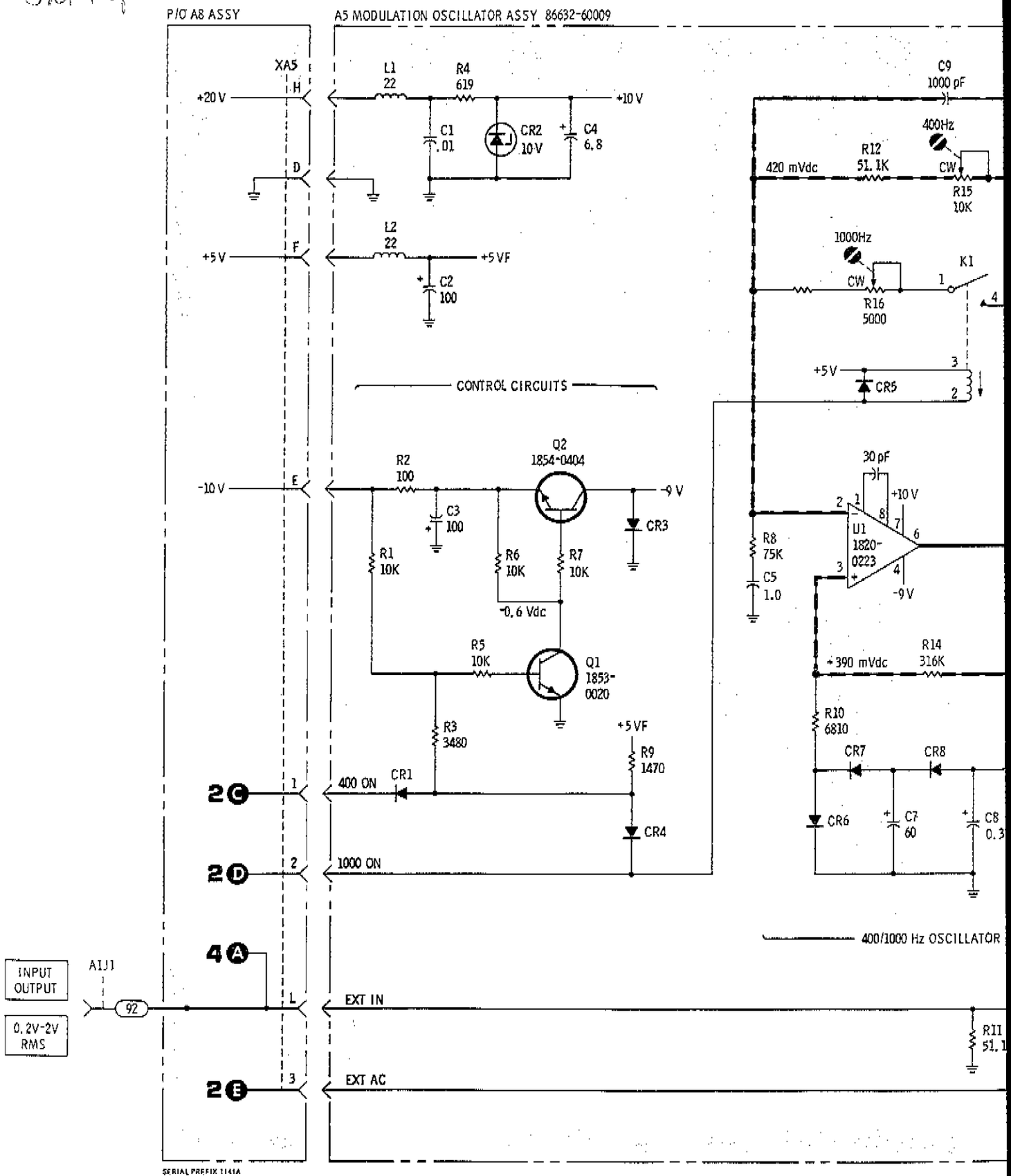


FIG. 8-14
SHT 2 of 3

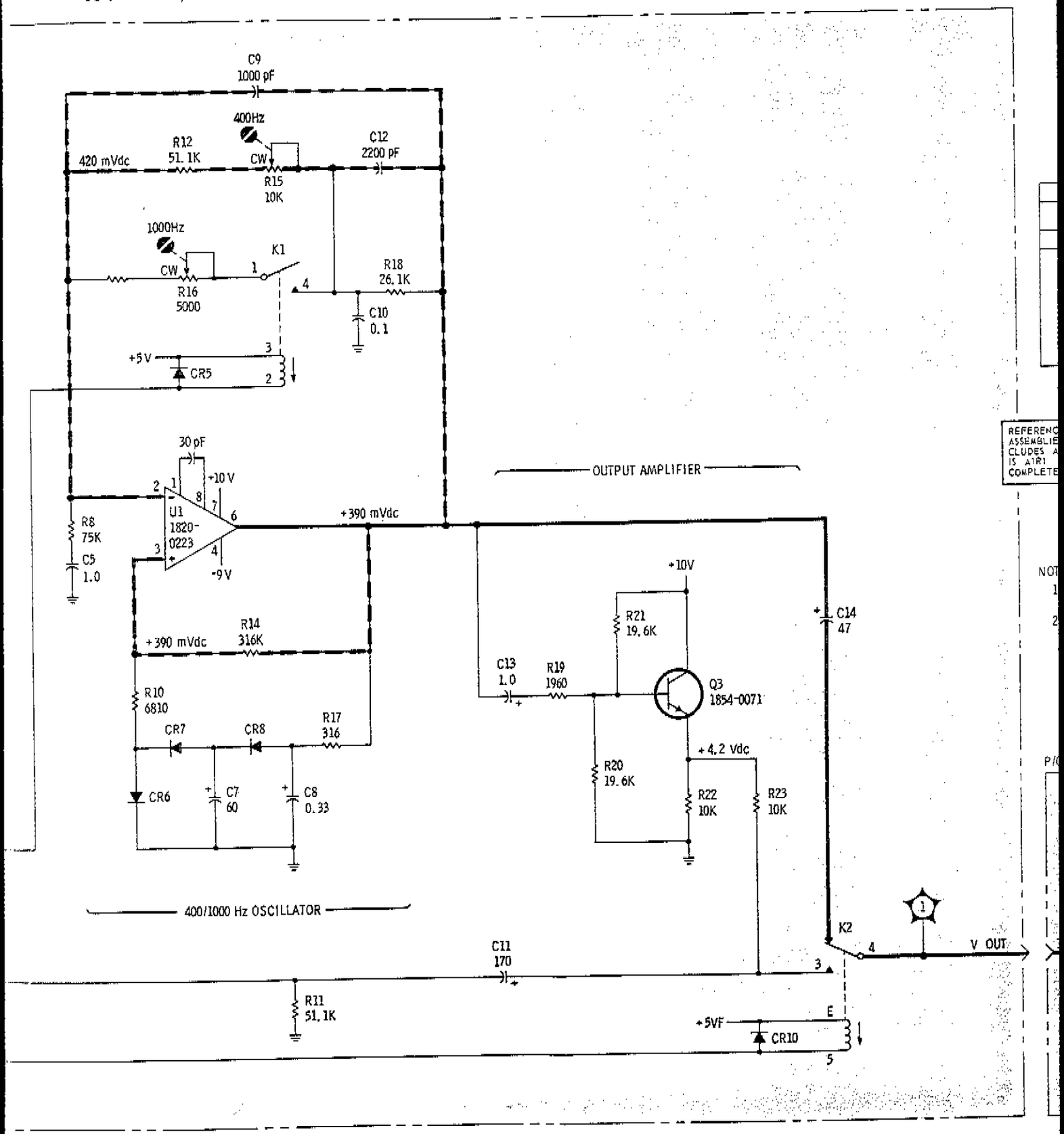


Figure 8-14. Modulation Oscillator

FIG. 8-14
Sht 3 of 3

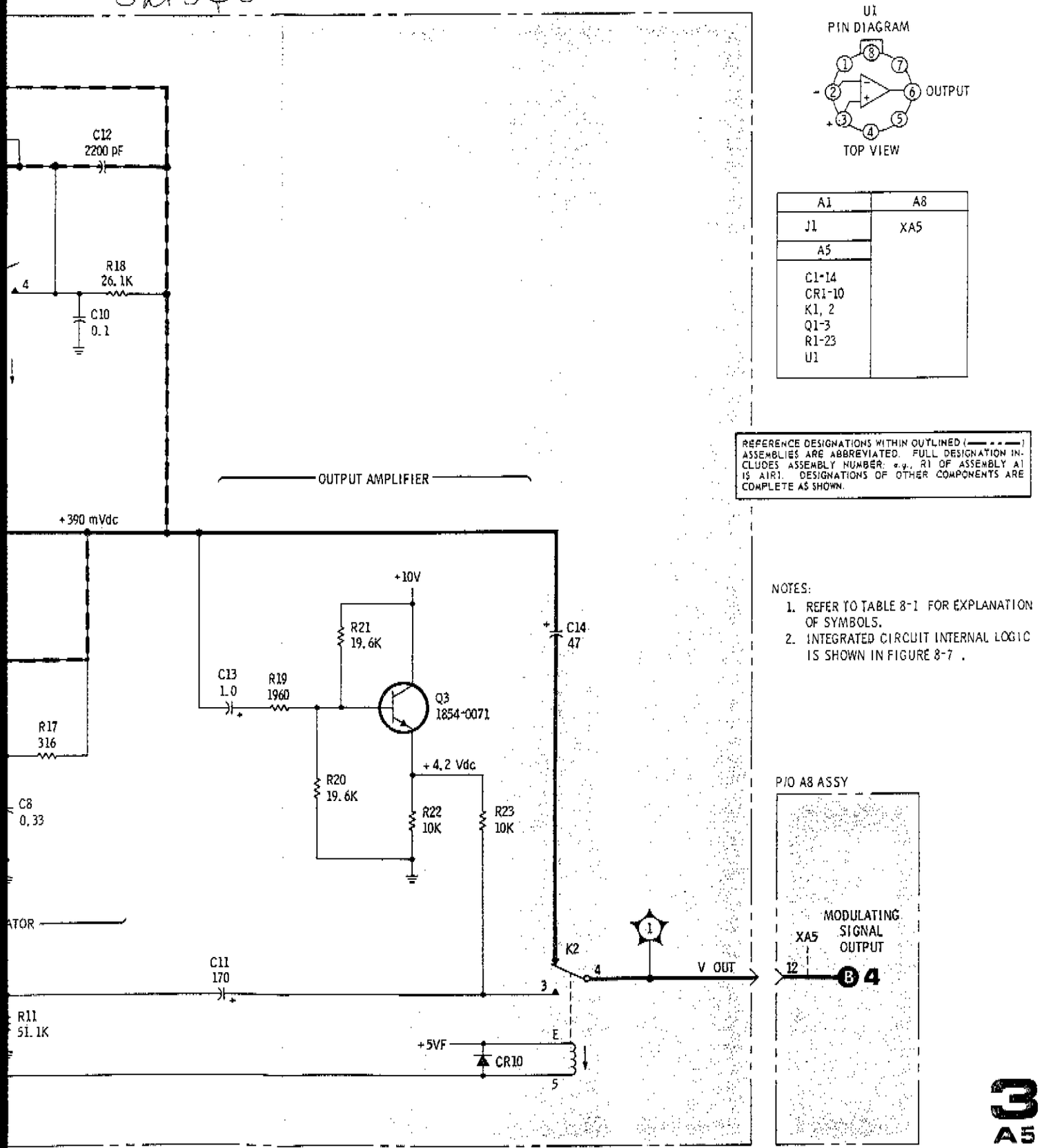


Figure 8-14. Modulation Oscillator Assembly Schematic Diagram

SERVICE SHEET 4

LEVELING AMPLIFIER ASSEMBLY

Normally, causes of malfunctions in the Model 86632A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree and block diagram.

NOTE

After making repairs in any part of the leveling amplifier circuits the adjustment procedures specified in Section V paragraph 5-14 should be performed to ensure proper operation of the instrument.

GENERAL

The leveling amplifier input is coupled from the A5 modulation oscillator assembly or an external ac coupled source. If the input signal is between 0.2 and 2.0 Vrms and from 20 Hz to 1 MHz the output of the leveling amplifier circuit is held to a constant 1.80 Vrms by the feedback loop.

In external dc coupled mode, the leveling amplifier is turned off.

TEST EQUIPMENT REQUIRED: (See Table 1-3)

Digital Voltmeter
Test Oscillator
Oscilloscope
10:1 Oscilloscope probe

1 CONTROL CIRCUITS

The leveling amplifier is turned on in the internal or external ac coupled modes. A low level (<+0.8 Vdc) is coupled to XA4 pin 9. Q12 is turned off which turns Q11 on; Q3 and Q4 are turned on, and the power supplies are coupled to the leveling amplifier.

In the external dc mode, the voltage on pin 9 is high; the power supplies to the leveling amplifier at Q1 and is fed directly to the A3 Remote Attenuation Assembly.

TEST PROCEDURE 1

The Model 86632A SOURCE control is set to INTERNAL or EXTERNAL AC.

Test 1-a. Verify that about +10.2 Vdc is found on TP2. If the voltage is correct, proceed to Test 1-d. If the voltage is incorrect, proceed to Test 1-b.

Test 1-b. Measure the dc voltage on Q11 emitter. If the voltage is about +18.6 Vdc, CR1 or an associated component is probably defective. If the voltage is incorrect, proceed to Test 1-c.

Test 1-c. Verify that the correct input level (≈0 Vdc) is found at XA4 pin 9. If the level is correct, Q11, Q12 or an associated componemt is probably defective. If the level is incorrect, the problem is on the A2 Assembly or the interconnections between A2 and A4.

Test 1-d. The voltage at Q4 collector should be ≈—9.7 Vdc. If the voltage is correct the problem is in the leveling amplifier circuits. Proceed to Test Procedure 2 . If the voltage is incorrect, proceed to Test 1-e.

Test 1-e. Verify that ≈0 Vdc is found on Q3 collector. If this voltage is incorrect, proceed to Test 1-f. If the voltage is correct, Q4 or an associated component is probably defective.

Test 1-f. Verify that the voltage on XA4 pin 9 is ≈0 Vdc. If this voltage is incorrect, the interconnections between A4 and A2, or a component on the A2 Assembly is defective. If the voltage is correct, Q3 or an associated component is defective.

2 MODULATING SIGNAL AMPLIFIER

The modulating signal input from the A5 Assembly is amplified in five transistor stages. The output of the first stage Q10, is coupled (in series) with the R14 photo-resistor. The output of the next amplifier stage Q6 is coupled to Q5. Q5 and Q7 with the associated feedback loop has a voltage gain of about 30. The power amplifier stage Q8/Q9 is coupled to the A3 Modulation Level Control Assembly through relay Q1.

TEST PROCEDURE 2

Test 2-a. If the external dc mode is being used and there is no output from the A4 Assembly, K1, an associated component, or the input connections from the front panel BNC is probably defective.

Test 2-b. Observe the signal at the output of the Q8/Q9 stage with an oscilloscope. If the amplitude is 5.0 Vp-p, C11, K1 or an associated component is probably defective. If the voltage is incorrect, proceed to Test 2-c.

Test 2-c. With an oscilloscope observe the ac signal at TPA. The amplitude should be one-half the input level. If this voltage is correct proceed to Test 2-d. If the level is incorrect, Q10 or an associated component is probably defective.

Test 2-d. Change the leveling amplifier input signal to 2.8 Vp-p (1.0 Vrms) by setting the SOURCE control to INTERNAL. TP1 should have a voltage of ≈—0.8 Vdc and the output of Q8/Q9 should be about 5.0 Vp-p.

If the dc voltage at TP1 is more negative than normal and the output from Q8/Q9 is low, or if the TP1 voltage is less negative than normal and the output from Q8/Q9 is high, proceed to test 2-e.

If the dc voltage at TP1 is more negative than normal and the output from Q8/Q9 is low, or if the TP1 is less negative than normal and the output level is low, then proceed to Test Procedure 3 .

Test 2-e. Observe the ac voltage at TP3 with an oscilloscope.

If the TP3 amplitude is greater than 168 mVp-p and the TP1 dc voltage is more negative than normal, Q5, Q7, Q8/Q9 or an associated component is probably defective. Check the dc voltages to help isolate the malfunctioning component.

If the TP3 amplitude is greater than 168 mVp-p and the TP1 dc voltage is less negative than normal, or if the TP3 amplitude is less than 168 mVp-p with TP1 dc voltage more negative than normal, then R14, Q6 or an associated component is probably defective.

If the TP3 amplitude is less than 168 mVp-p with the TP1 dc voltage less negative than normal, proceed to Test 2-f.

Test 2-f. Find the ratio of the ac amplitude at Q7 collector to the TP3 ac voltage. If the ratio is approximately 30, Q8/Q9 or an associated component is probably defective. If the ratio is incorrect Q5, Q6 or an associated component is probably defective.

3 FEEDBACK AMPLIFIER

The output signal from the modulating signal amplifier is coupled to a peak detector circuit consisting of CR10, CR11 and C14. The detector output is

proportional to the peak voltage of the Q8/Q9 output amplifier stage.

U2 reference amplifier is used to set the leveling amplifier output. The difference voltage, between pin 3 (set by R35) and the peak detector output, is inverted and amplified by a factor of two.

The output of U2 (pin 6) is coupled to R45 the input to the summing amplifier U1. The offset voltage, found at the junction of R42 and 43, and the output of U2 are summed, amplified and inverted by U1. The gain of U1 (normally about 1) is dependent on the setting of the gain control R45. The output of U1 is coupled through R47 to Q1 and Q2, the photo-resistor drivers.

As the input signal to the modulating signal amplifier increases, the driving current to the R14 photo-resistor is decreased. The signal coupled from Q10 to Q6 is decreased, and the amplifier provides a constant output level of 1.80 Vrms.

TEST PROCEDURE 3

Set the Model 86632A SOURCE control to EXTERNAL AC. Connect a test oscillator to the front panel BNC connector and set the output to 1 kHz at 1.0 Vrms. Refer to the Table below.

NOTE

The third column of the Table shows the dc voltage at the location shown with a normal output voltage from the leveling amplifier of 5.0 Vp-p. The fourth column shows which way the dc voltage normally changes when the output voltage goes higher than normal.

Output	Location	Normal Output Voltage	High Output Voltage
detector	CR11 cathode	+3.5 Vdc	more positive
differential amplifier	U2 pin 6	+0.4 Vdc	less positive
summing amplifier	U1 pin 6	—2.1 Vdc	more positive
TP1	TP1	—0.8 Vdc	more positive

Test 3-a. Increase the output from the test oscillator while watching the dc level at each of the locations shown on the Table beginning with the detector. If the voltages all change in the proper direction as the test oscillator output is increased, proceed to Test 3-b. If there is a level that doesn't change, or changes in the wrong direction, check the preceeding circuit for the faulty component.

Test 3-b. Each of the dc voltages in the feedback amplifier have a definite relationship with each other, and the Q8/Q9 output. Each section may be checked independently of the others.

NOTE

1. The voltages shown are approximate but under normal conditions will be within 0.2 Vdc of the value shown.

SERVICE SHEET 4 (cont'd)

2. If a voltage is greater than 0.2 Vdc from that shown, check the components in that circuit for correct dc voltages.
3. The maximum voltage difference between the inputs to an operational amplifier is 10 mVdc.

DETECTOR

1)	leveling amplifier output (TPB)	___.___
2)	add	1.5
3)	divide by	___.___ ÷2
4)	detector output (TPC)	___.___Vdc

U2 DIFFERENTIAL AMPLIFIER

1)	detector output (TPC)	___.___Vdc
2)	subtract U2 pin 3 voltage	___.___Vdc
3)	difference voltage	___.___Vdc
4)	multiply by 2.1	X 2.1
5)	amplified difference voltage	___.___Vdc
2)	U2 pin 3 voltage	___.___Vdc
5)	subtract the amplified difference voltage	___.___Vdc
6)	U2 pin 6 voltage (TPD)	___.___Vdc

U1 SUMMING AMPLIFIER

1)	offset voltage (verify 1.7 Vdc) (TPE)	+ 1.7 Vdc
2)	add U2 pin 6 output (TPD)	___.___Vdc
3)	output of U1 pin 6 (TPF)	−___.___±0.4 Vdc

TP1

1)	U1 pin 6 output (TPF)	−___.___Vdc
2)	add	1.3 Vdc
3)	TP1 dc voltage	−___.___Vdc

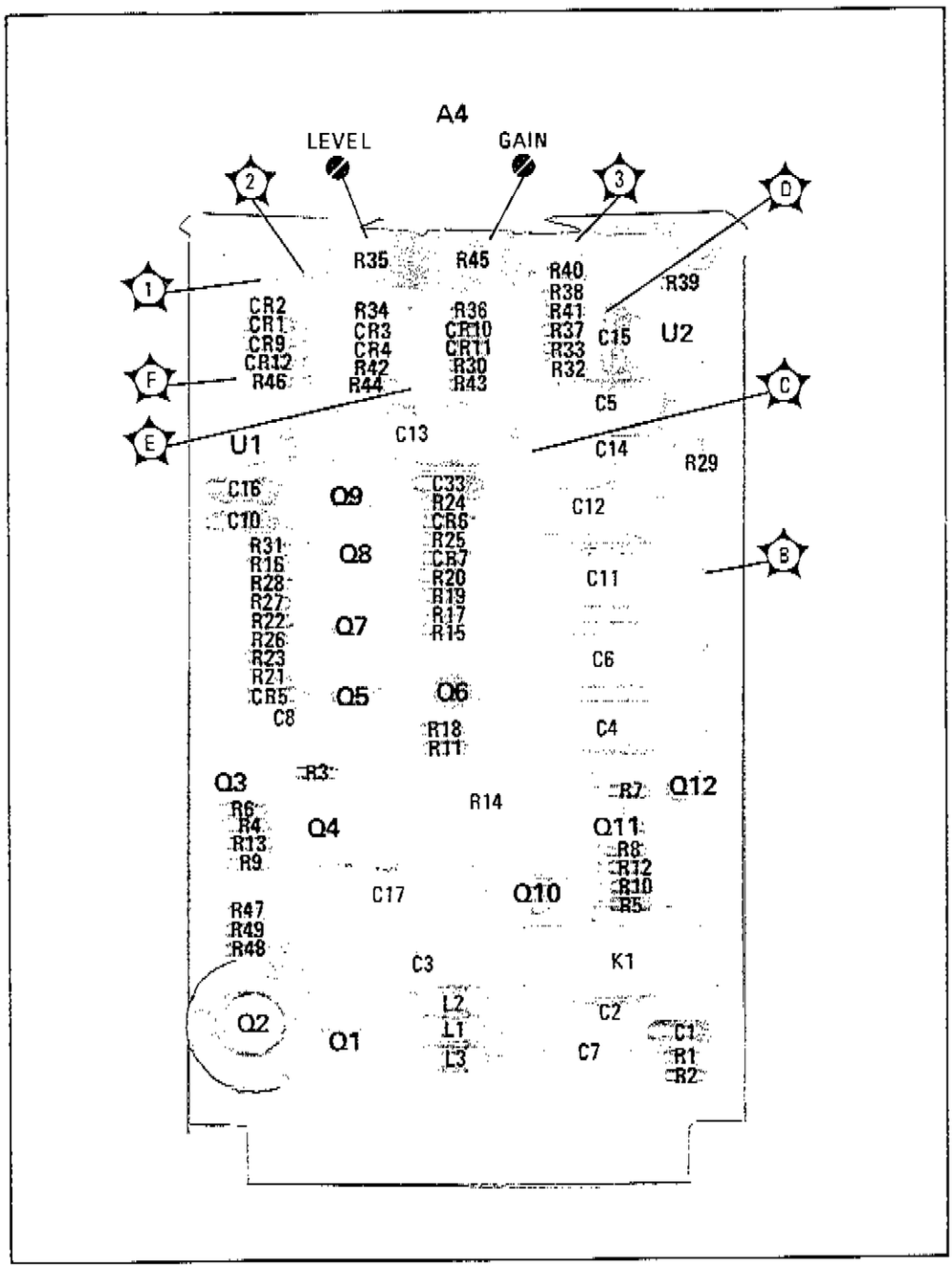


Figure 8-15. Leveling Amplifier Assembly Component Locations

SERVICE
SHEET 4

FIG. 8-16
Sht 1 of 3

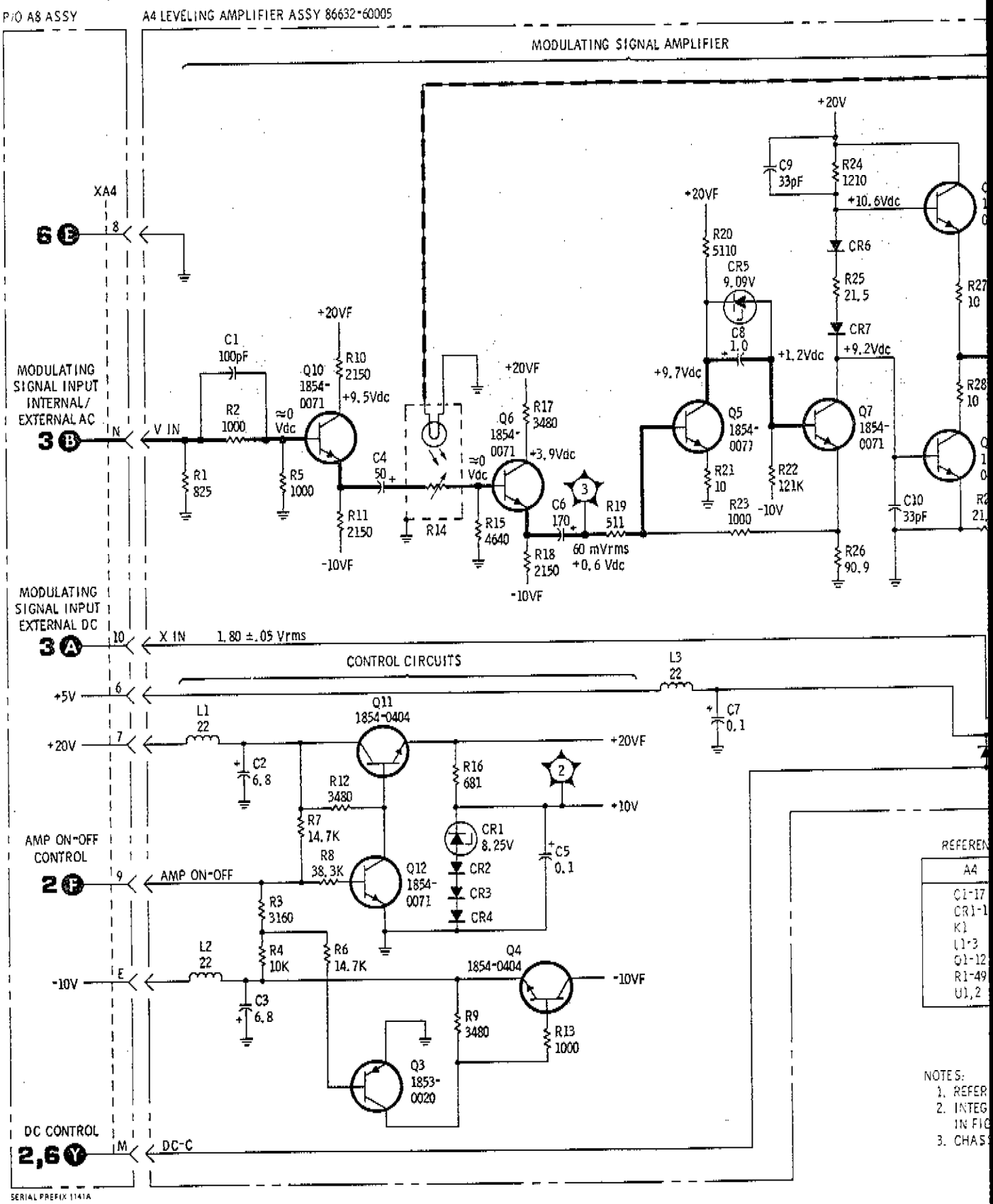
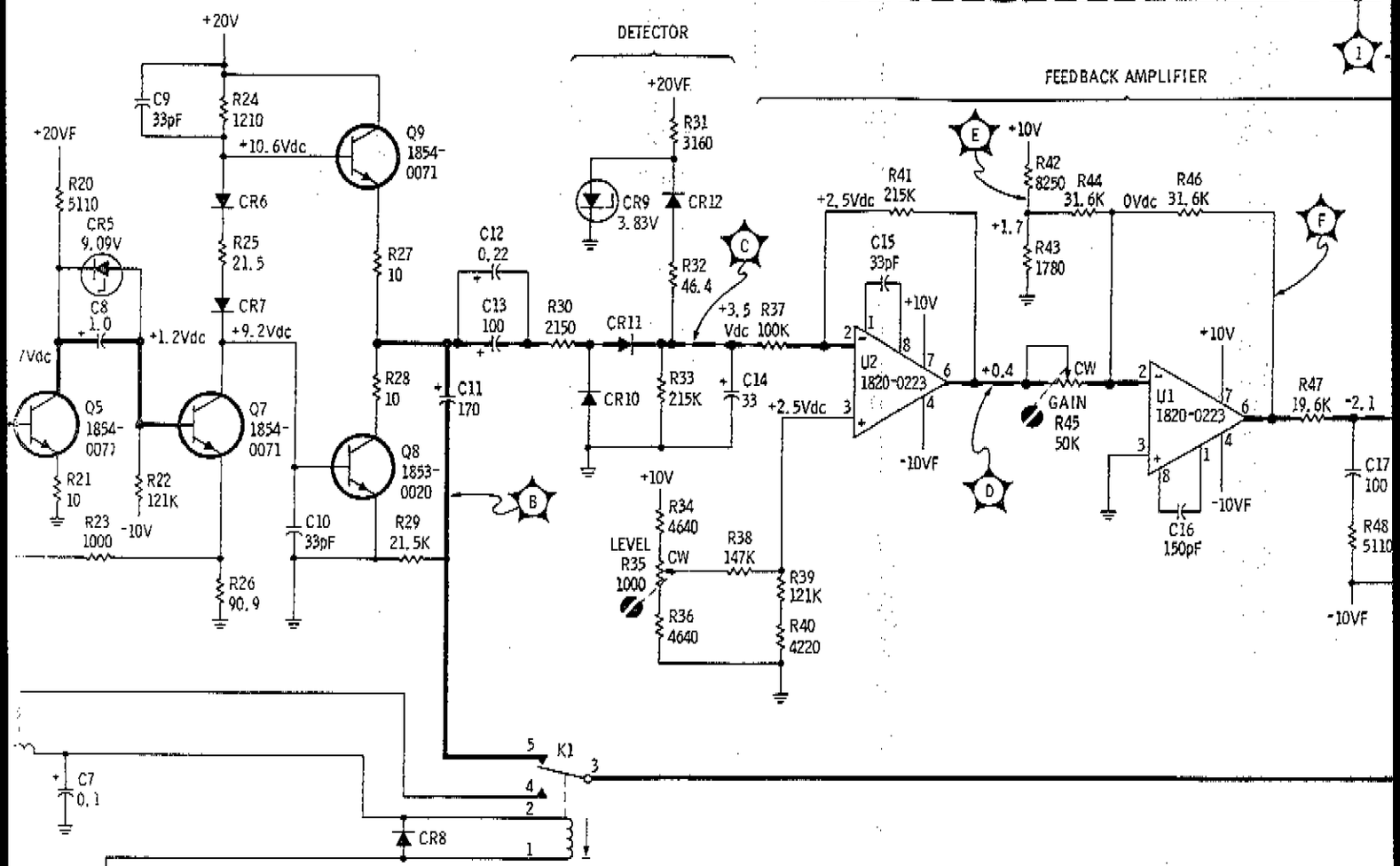


FIG. 8-16
Sht 2 of 3

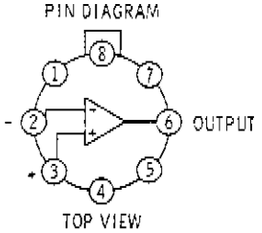
AMPLIFIER



REFERENCE DESIGNATIONS

A4	A8
C1-17	XA4
CR1-12	
K1	
L1-3	
Q1-12	
R1-49	
U1,2	

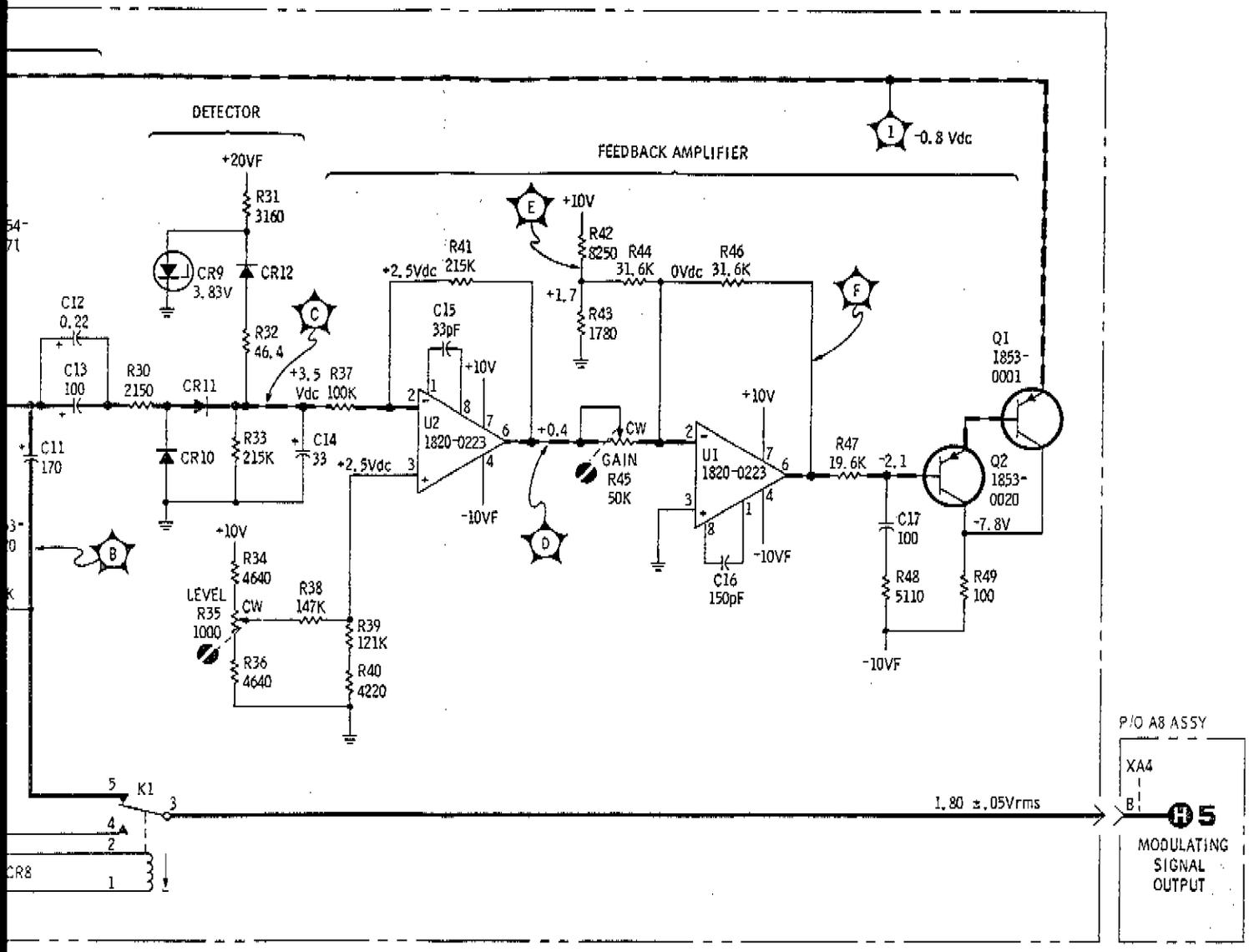
U1, U2
PIN DIAGRAM



NOTES:
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
2. INTEGRATED CIRCUITS INTERNAL LOGIC IS SHOWN IN FIGURE 8-7.
3. CHASSIS GROUND IS COUPLED THROUGH A6 TO A4.

Figure 8-16. Leveling Amplifie

FIG. 8-16
SHT 3 of 3



DESIGNATIONS

	A8
	XA4

U1, U2
PIN DIAGRAM

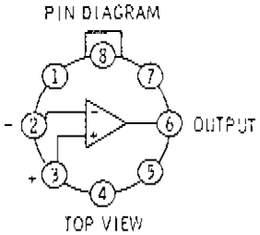


TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
TED CIRCUITS INTERNAL LOGIC IS SHOWN
RE 8-7.
GROUND IS COUPLED THROUGH A6 TO A4.

4
A4

Figure 8-16. Leveling Amplifier Assembly Schematic Diagram

SERVICE SHEET 5

REMOTE ATTENUATION ASSEMBLY

Normally, causes of malfunctions in the Model 86632A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree and block diagram.

NOTE

After making repairs in any part of the modulation level control circuits, the adjustment procedures specified in Section V paragraph 5-15 should be performed to ensure proper operation of the instrument.

GENERAL

The modulating signal from the leveling amplifier assembly is amplified by Q1 and Q3. The modulating signal is attenuated by the remote modulation level control (remote mode) or the MODULATION LEVEL control (local mode). The attenuated signal is coupled to the meter driver, and the RF Section (AM MODE) or the A6 Assembly (FM MODE).

TEST EQUIPMENT REQUIRED: (see Table 1-3)

Digital Voltmeter
10:1 Oscilloscope probe
Oscilloscope

1 REMOTE MODULATION LEVEL CONTROL

The modulating signal is normally coupled from the leveling amplifier output to Q1 through relay K13. The signal is amplified by Q1 and Q3 emitter followers and is coupled to the remote modulation level control or the front panel MODULATION LEVEL control by relay K9.

In the remote mode, a low dc voltage (<+0.8 Vdc) is coupled to relays K9 and K10 which are activated and the modulating signal from K9 is coupled to the remote modulation level control. Modulation level is controlled by changing the series and parallel resistance in the path of the modulating signal. When a certain modulation level has been programmed, the control voltages from A2 activate the relays which correspond to the programmed levels.

The MODULATION LEVEL control is used, in place of the remote modulation level control, in the local mode.

The attenuated output from the remote attenuator is coupled to the meter driver and relays K11 and K12. K11 couples the signal to the RF Section in AM MODE, and to the A6 FM Range Control Assembly in FM MODE. Relay K12 grounds the output to the RF Section in FM MODE.

TEST PROCEDURE 1

Test 1-a. Verify that the dc power supply voltages are present. If the voltages are correct, proceed to Test 1-b. If the voltages are not reaching the A5 Assembly, find and repair the defect before further troubleshooting is attempted.

Test 1-b. Measure the ac voltage at TP3 with an oscilloscope. If the level is 5.0 Vp-p, proceed to Test 1-c. If the level is incorrect, K13, Q1, Q3 or an associated component is probably defective.

SERVICE SHEET 5 (cont'd)

Test 1-c. If the problem occurs in the remote mode, proceed to Test 1-d. Otherwise, proceed to Test 1-e.

Test 1-d. Program modulation levels of 00, 01, 02, 04, 08, 10, 20, 40 and 80 one at a time. Observe the modualtion level meter as each level is programmed. When the modulation meter does not respond to the programming, the problem has been isolated to the relay or an associated component (possibly on the A2 Assembly) that corresponds to the programmed level.

Test 1-e. Observe the ac voltage at TP1 with an oscilloscope after a modualtion level of 99 has been programmed, or the MODULATION LEVEL control has been set to 100. If the voltage is ≈3.0 Vp-p, proceed to Test 1-f. If the voltage is incorrect, K9, K10, the remote modulation level control, the front panel MODULATION LEVEL control or an associated component is probably defective.

Test 1-f. If the meter does not operate properly, proceed to Test Procedure 2 Otherwise proceed to Test 1-g.

Test 1-g. Check XA3 pin 14 (FM MODE) or XA3 pin M (AM MODE) with the oscilloscope for 2.8 Vp-p. If the voltage is correct, the interconnections leading to the A6 Assembly or to the RF Section should be checked for continuity and repaired if necessary. If the voltage is not the same, K11, K12, Q2 or an associated component is probably defective.

2 METER DRIVER

U1 and its associated components is basically a voltage follower circuit. With the addition of CR16 and C10, the circuit becomes a peak detector. The dc output level is proportional to the positive peak ac output from the remote modulation level control or front panel MODULATION LEVEL control.

TEST PROCEDURE 2

Measure the dc voltage at TP2 with a modulation level of 99 programmed or with the front panel MODULATION LEVEL control full clockwise. The voltage should be ≈+1.5 Vdc. If the voltage is correct, A1M1 modulation level meter or an associated component is probably defective. If the voltage is incorrect, U1 or an associated component is probably defective.

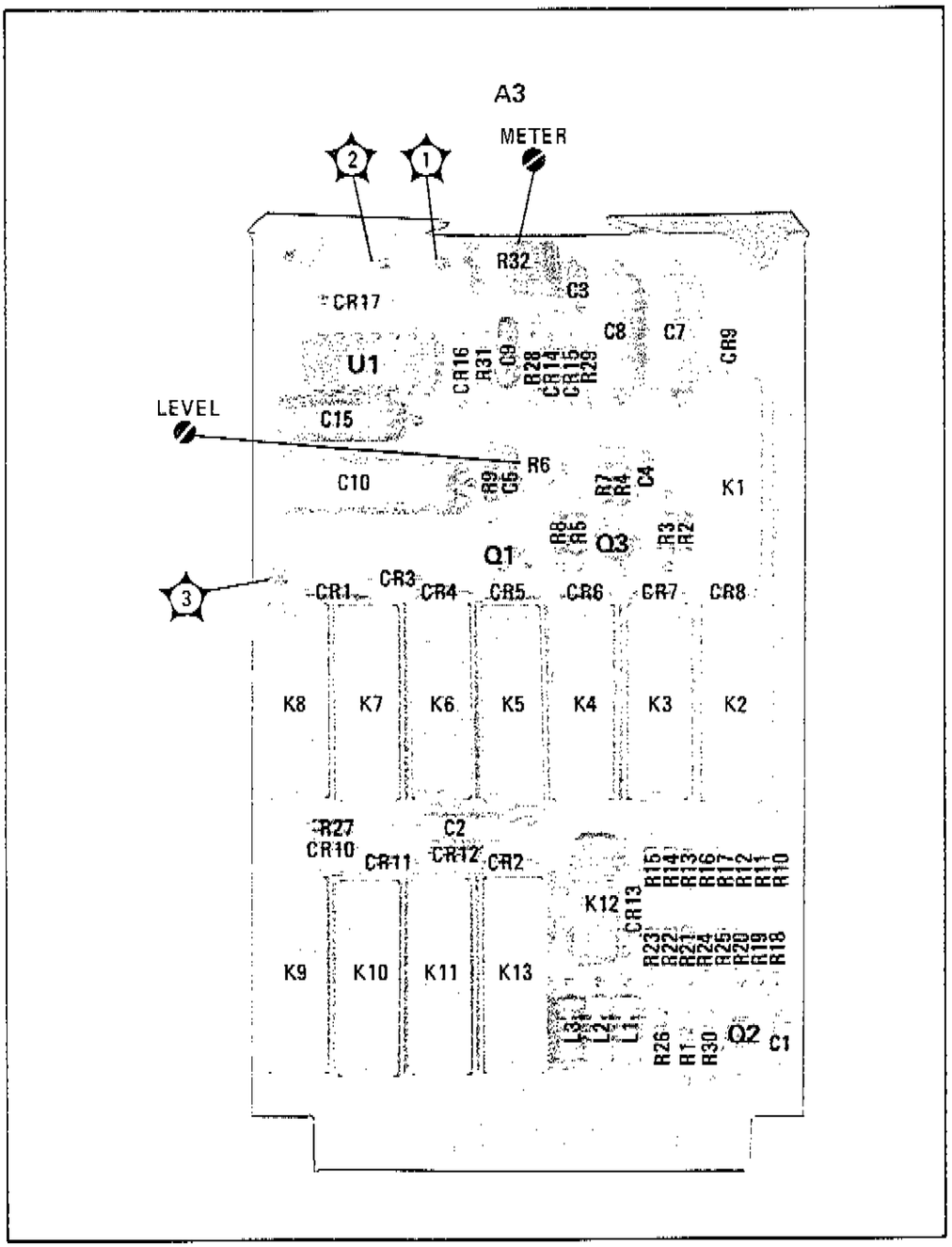


Figure 8-17. Remote Attenuation Assembly Component Location

8-21a

FIG. 8-18
Sht 1 of 3

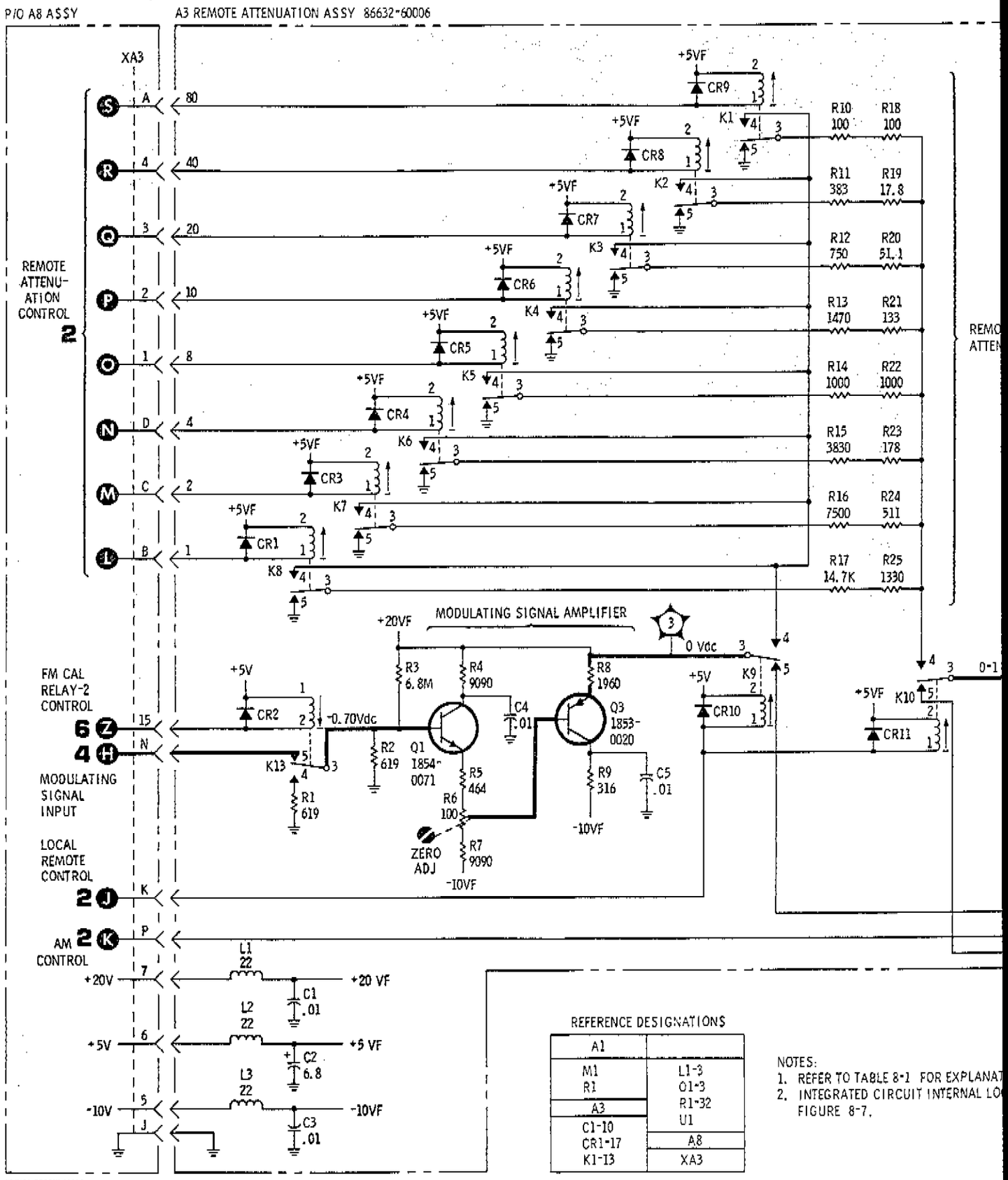
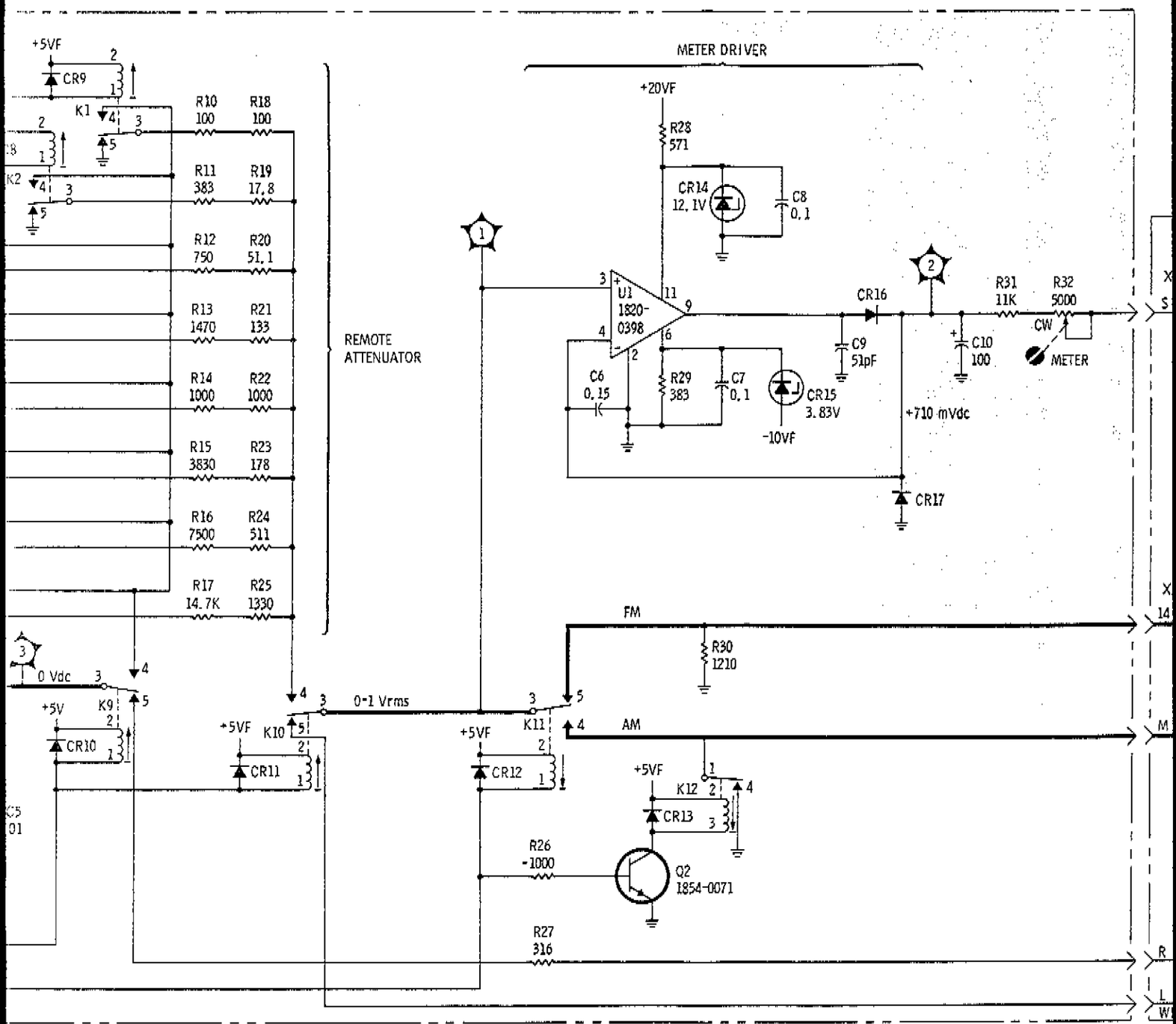


FIG. 8-18
Sht 2 of 3



DESIGNATIONS

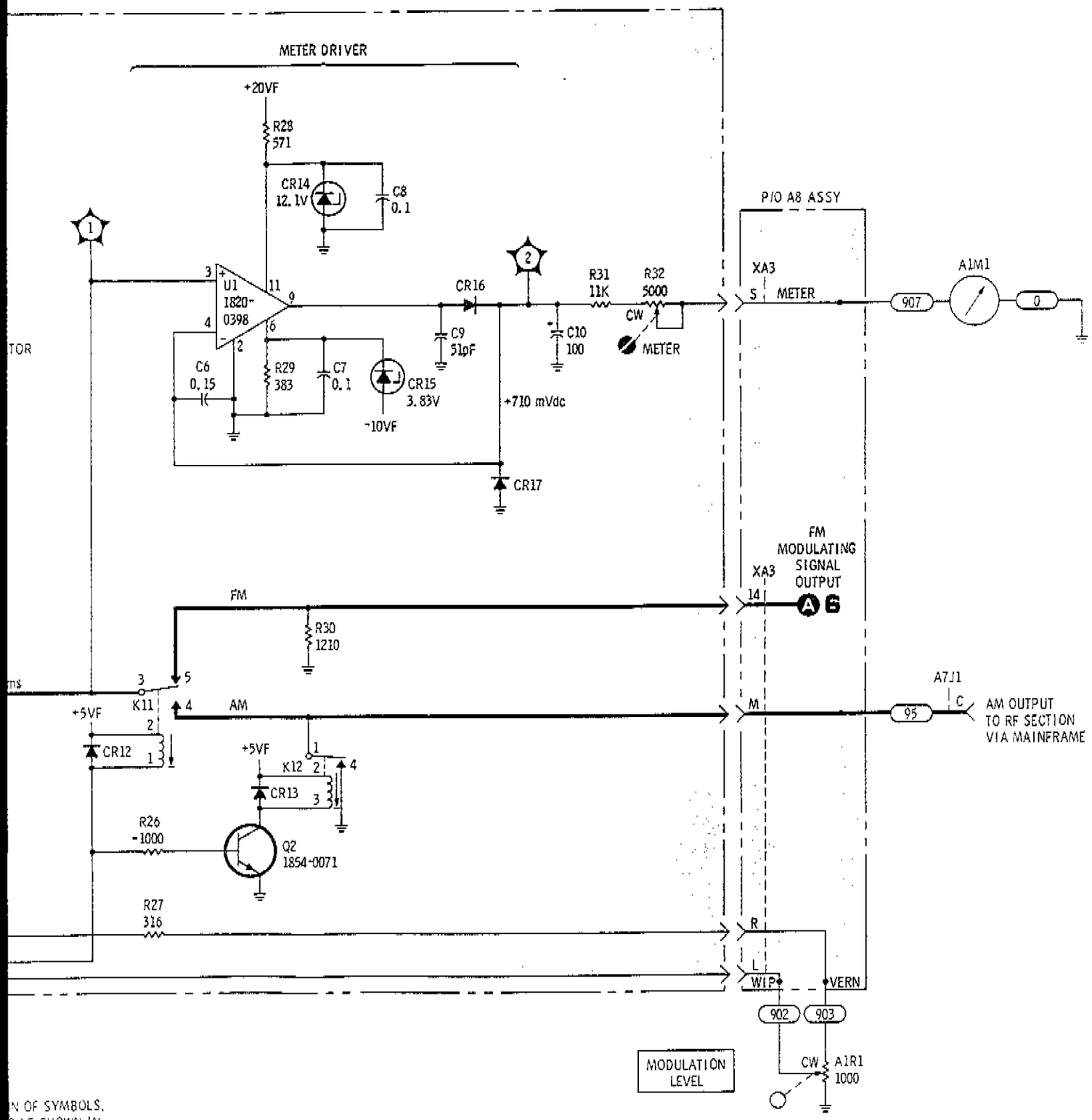
C1-3
CR1-3
R1-32
U1
A8
XA3

NOTES:
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
2. INTEGRATED CIRCUIT INTERNAL LOGIC IS SHOWN IN FIGURE 8-7.

MODULATION LEVEL

Figure 8-18. Remote Atte

FIG. 8-18
Sht 3 of 3



N OF SYMBOLS,
C IS SHOWN IN

5
A3

Figure 8-18. Remote Attenuation Assembly Schematic Diagram

SERVICE SHEET 6

FM DEVIATION ATTENUATION ASSEMBLY

Normally, causes of malfunctions in the Model 86632A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree and block diagram.

NOTE

After making repairs in any part of the FM deviation attenuation circuits, the adjustment procedures specified in Section V paragraph 5-16 should be performed to ensure proper operation of the instrument.

GENERAL

The A9 FM Deviation Attenuation Assembly consists of the FM center frequency calibration timing circuits which ensure the proper sequence and timing of calibration events, and the FM range circuits which attenuates the amplitude of the modulating signal to predetermined levels in setting the FM range.

TEST EQUIPMENT: (see Table 1-3)

Digital Voltmeter
10:1 Oscilloscope probe
Oscilloscope
High Freuqency dB Voltmeter

1 FM CF-CAL CIRCUIT

In off or AM mode, U2 pins 1, 2 and 3 are high which causes the output, pin 12, to go low. This places +0.6 Vdc at Q6 base making it impossible to trigger Q4/Q5 multivibrator. In any FM mode, U2 pin 12 is high, but the low at U2 pin 8 continues to keep the multivibrator from being triggered. When the FM CF-CAL front panel switch is closed or when a clock pulse is received at U2 pins 2, 4 and 6, U2 pin 8 goes high and triggers Q6.

When Q6 is turned on, several events take place simultaneously.

a) The multivibrator Q4/Q5 is triggered. Q5 which is normally conducting is turned off and Q4 is turned on. This condition remains until the charge on C9 builds up to the combined threshold of Q5 and CR5. At this point the multivibrator returns to its steady-state condition.

b) Q3 is turned on, the collector voltage (normally −10 Vdc) goes to ≈+1.2 Vdc and the hold control relay (HLC) in the A7 assembly is closed.

c) Q1 and Q2 are turned on which causes the FM Cal Flag to go low. This output to the Mainframe inhibits programmed data meant for the Model 86632A. The output which is coupled to the A2 assembly turns out the FM UNCAL light on the mainframe front panel.

d) When Q5 is turned off, the collector voltage goes high. C11 begins to charge through R3, R10 and CR4. After approximately 10 ms, Q7 turns on, the collector goes low which activates:

1) FM Cal Relay 2 in the A3 assembly and grounds the input.

2) FM Cal Relay 1 in the A7 Assembly and couples the 20 MHz reference signal to the phase detector.

When the multivibrator Q4/Q5 returns to its steady-state, the HLC output immediately returns to its normal level. The FM Cal Relay 1 and 2 and FM Cal Flag outputs take about 50 ms to return to their normal operating state because C11 must now discharge through R11 and R12. Once the threshold voltage of Q7 is reached it turns off and the FM Cal Relays return to their normal state.

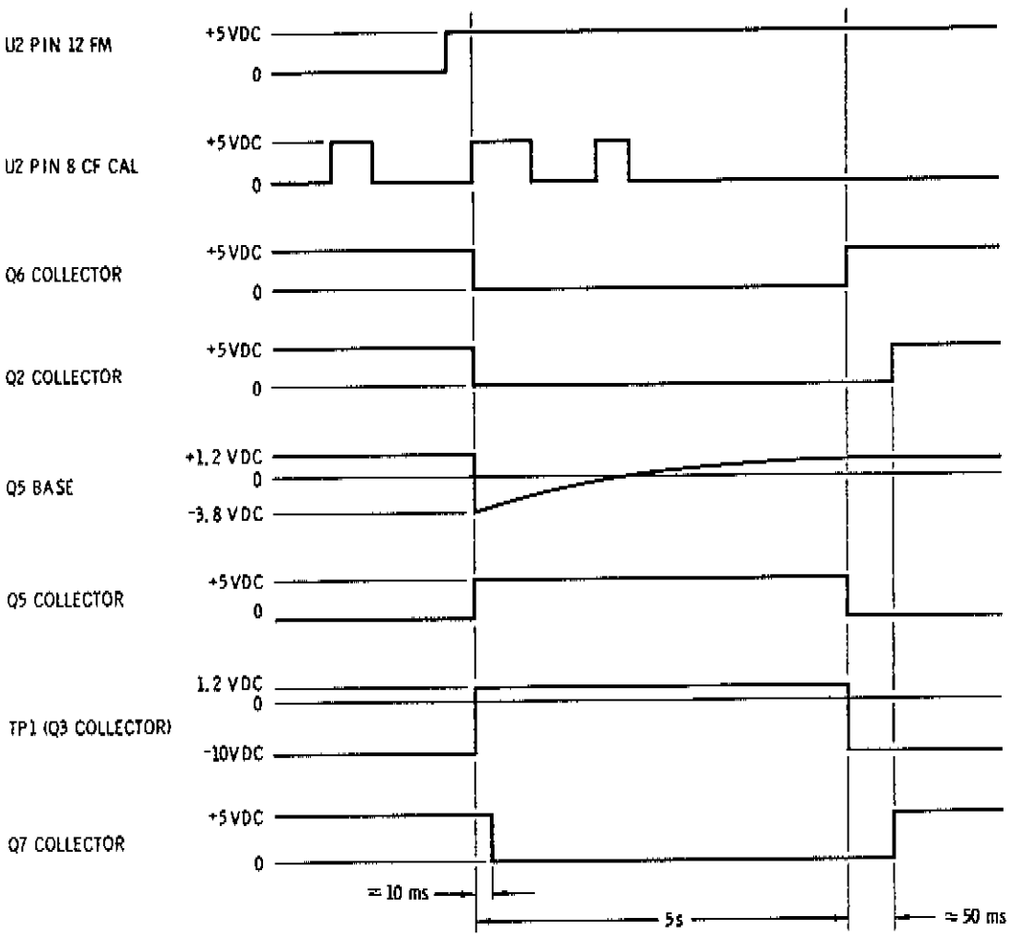


Figure 8-19. FM Center Frequency Calibration Time Sequence

TEST PROCEDURE 1

If the problem is not with the FM Calibration circuits, proceed to Test Procedure 2.

NOTES

1. Before attempting to troubleshoot the A6 Assembly, verify that the dc power supply voltages are present.
2. Refer to Figure 8-15 for Test Procedure 1. All the measurements should be made with an oscilloscope with the time base set to 0.5 seconds per division (10 divisions = 5 seconds).

Test 1-a. Observe the voltage at TP1. Close the FM CF-CAL switch. If the correct display is observed, proceed to Test 1-b. If an incorrect display is observed,

proceed to Test 1-c.

Test 1-b. Observe the voltage at Q7 collector. Press the FM CF-CAL switch. If the display is correct, Q1, Q2 or an associated component is probably defective.

Test 1-c. Measure the dc voltage at Q6 collector. If the voltage is correct, Q3 or an associated component is probably defective. If the voltage is incorrect proceed to Test 1-d.

Test 1-d. Measure the voltage at Q2 base. This voltage is normally +0.6 Vdc but goes to +1.2 Vdc when the FM CF-CAL switch is closed if the Model 86632A is in the FM mode. If the voltages are correct, proceed to Test 1-h. If the voltage is incorrect, proceed to Test 1-e.

Test 1-e. Observe the voltage at U2 pin 12. The voltage should be high. If the voltage is correct, proceed to Test 1-f. If the voltage is incorrect, U2 is probably defective.

Test 1-f. If the Model 86632A is being operated in: local mode, ground U2 pin 10; remote mode, ground U2 pin 9. If the FM CF-CAL cycle begins (modulation level meter reading drops to zero), check the connections to that pin including the components A8R12 and A8C12 (remote mode) and A1S3 (local mode). If nothing happens, U2 or an associated component is probably defective.

Test 1-g. If Q6 collector is always low Q4, Q5, Q6 or an associated component is probably defective. If Q6 collector stays high when the FM CF-CAL switch has been closed, Q6 is probably defective. If Q6 goes low when the FM CF-CAL switch is depressed, Q4, Q5 or an associated component is probably defective.

2 FM RANGE SELECTOR

The attenuated modulating signal from the A3 Remote Attenuator Assembly is coupled to the input of the U1B/U1C amplifier. The amplified signal is coupled to the FM range selector.

In the FM X10 range, the signal is passed through to U1A and U1D emitter follower amplifiers with no attenuation. In the FM X1 and FM X0.1 ranges the output amplitude (to U1A) is 1/10th and 1/100th the output of the FM X10 range.

The output from the A6 Assembly is coupled to the A7A3 Assembly where it frequency modulates the 20 MHz VCO.

TEST PROCEDURE 2

Initial settings of the Model 86632A controls for Test Procedure 2 are: MODULATION LEVEL-50, MODE-FM X10 and SOURCE-INTERNAL.

Test 2-a. With an oscilloscope, observe the ac voltage at TP2. If the amplitude is ≈1.4 Vp-p, proceed to Test 2-b. If the amplitude is incorrect, check for continuity to the A3 Assembly. Also check the components associated with the input.

Test 2-b. Observe the ac voltage at TP3 with an oscilloscope. If the voltage is ≈1.4 Vp-p, proceed to Test 2-c. If the voltage is incorrect, U1B/U1C or an associated component is probably defective.

Test 2-c. Observe the ac voltage at TP4 with an oscilloscope. If the voltage is ≈1.0 Vp-p, proceed to Test 2-e. If the voltage is incorrect, proceed to Test 2-d.

SERVICE SHEET 6 (cont'd)

Test 2-d. With the oscilloscope, observe the voltage at U1 pin 2. If the amplitude is about 1.4 Vp-p, U1A, U1D or an associated component is probably defective. If the amplitude is incorrect, proceed to Test 2-e.

Test 2-e. With the High Frequency dB Voltmeter, measure the voltage at U1 pin 2. Verify that the voltage in the FM X1 and the FM X0.1 ranges are 1/10 and 1/100 of the FM X10 reading. If these voltages are correct, the cables, connectors or a component associated with the output is probably defective. If one of the voltage levels is incorrect, the relay or an associated component, which is related to the incorrect range level, is probably defective.

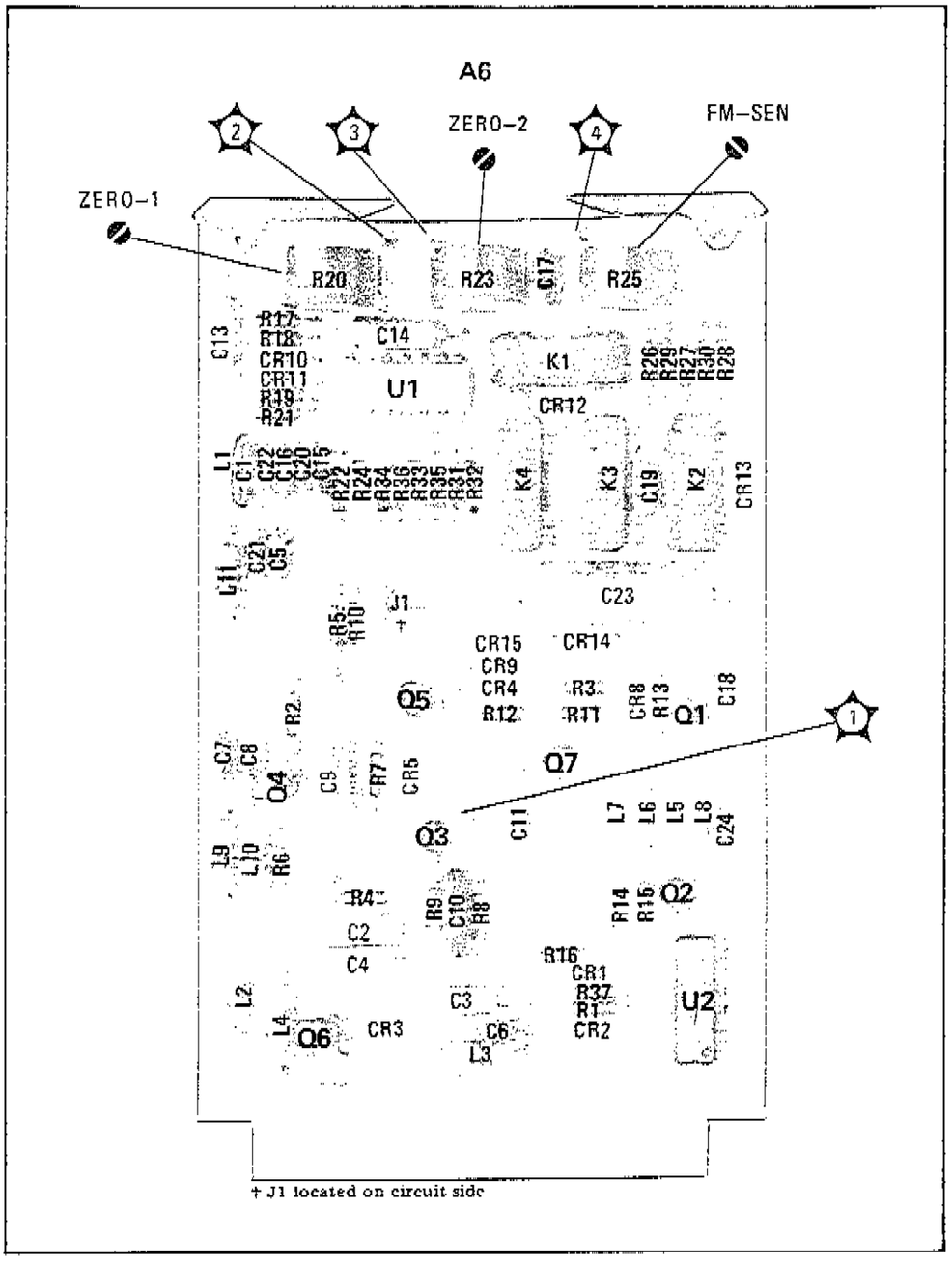


Figure 8-20. Deviation Attenuation Assembly Component Locations

8-23a

FIG. 8-21
SHT 1 of 3

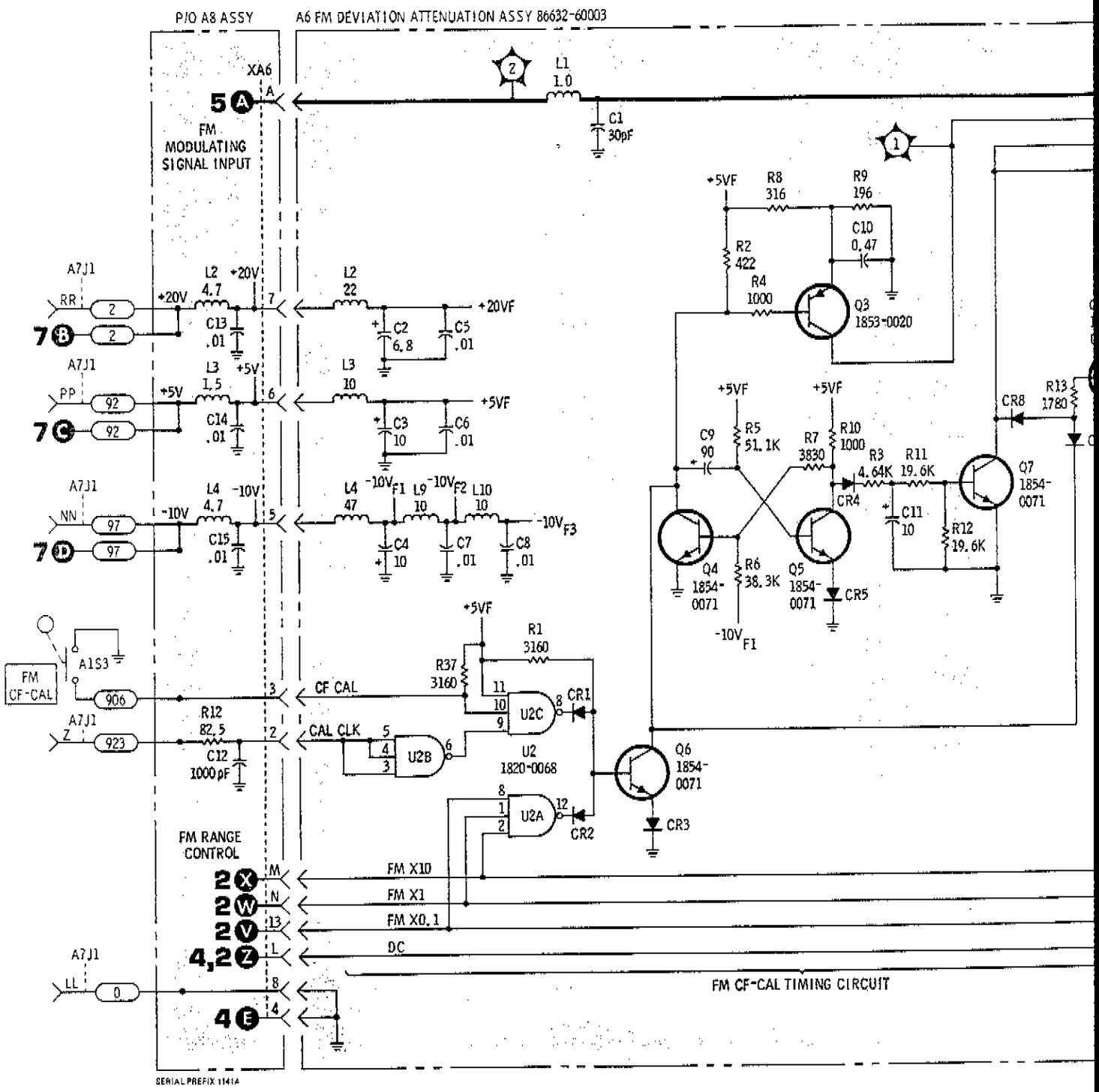


FIG. 8-21
Sht 2 of 3

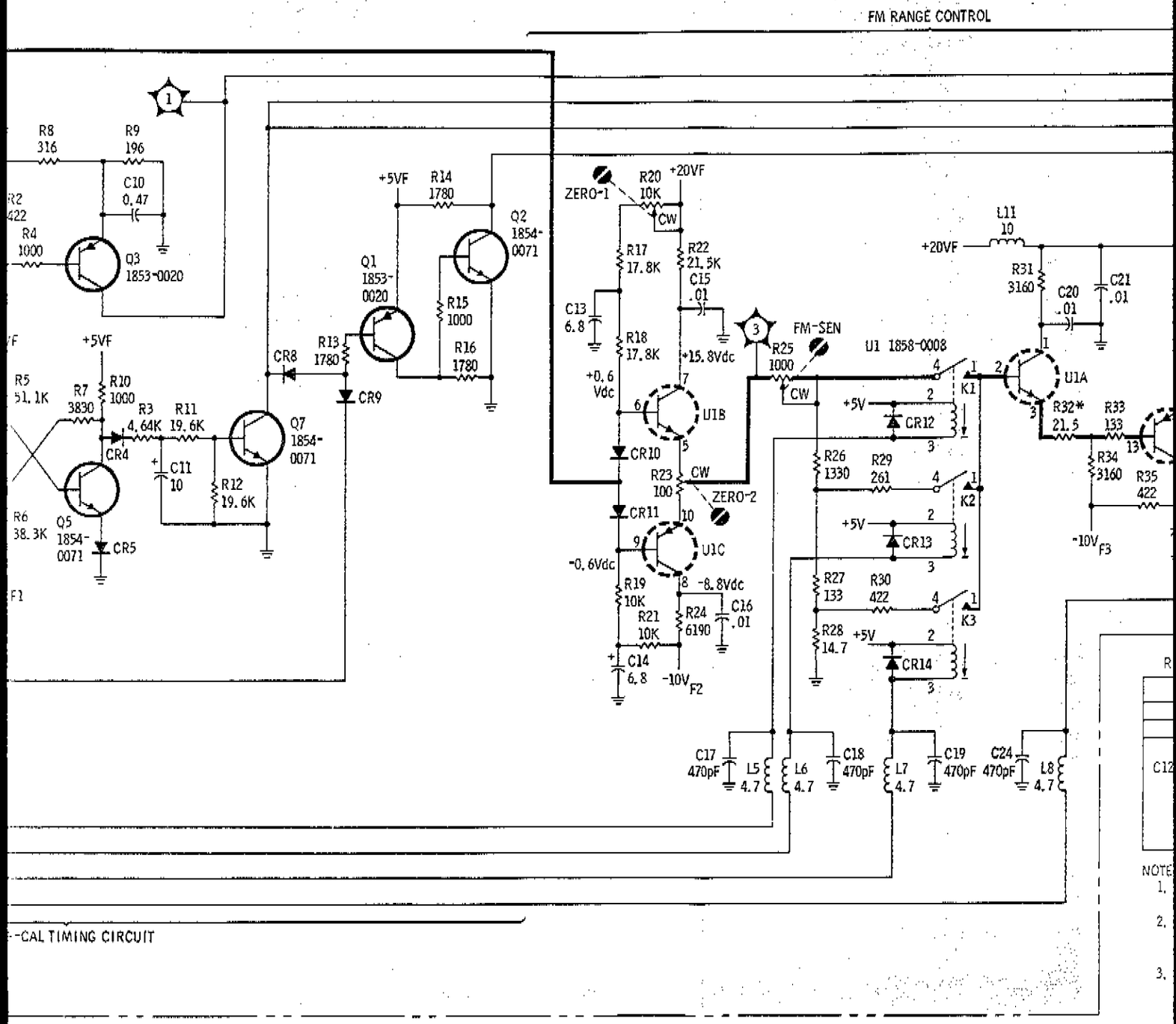
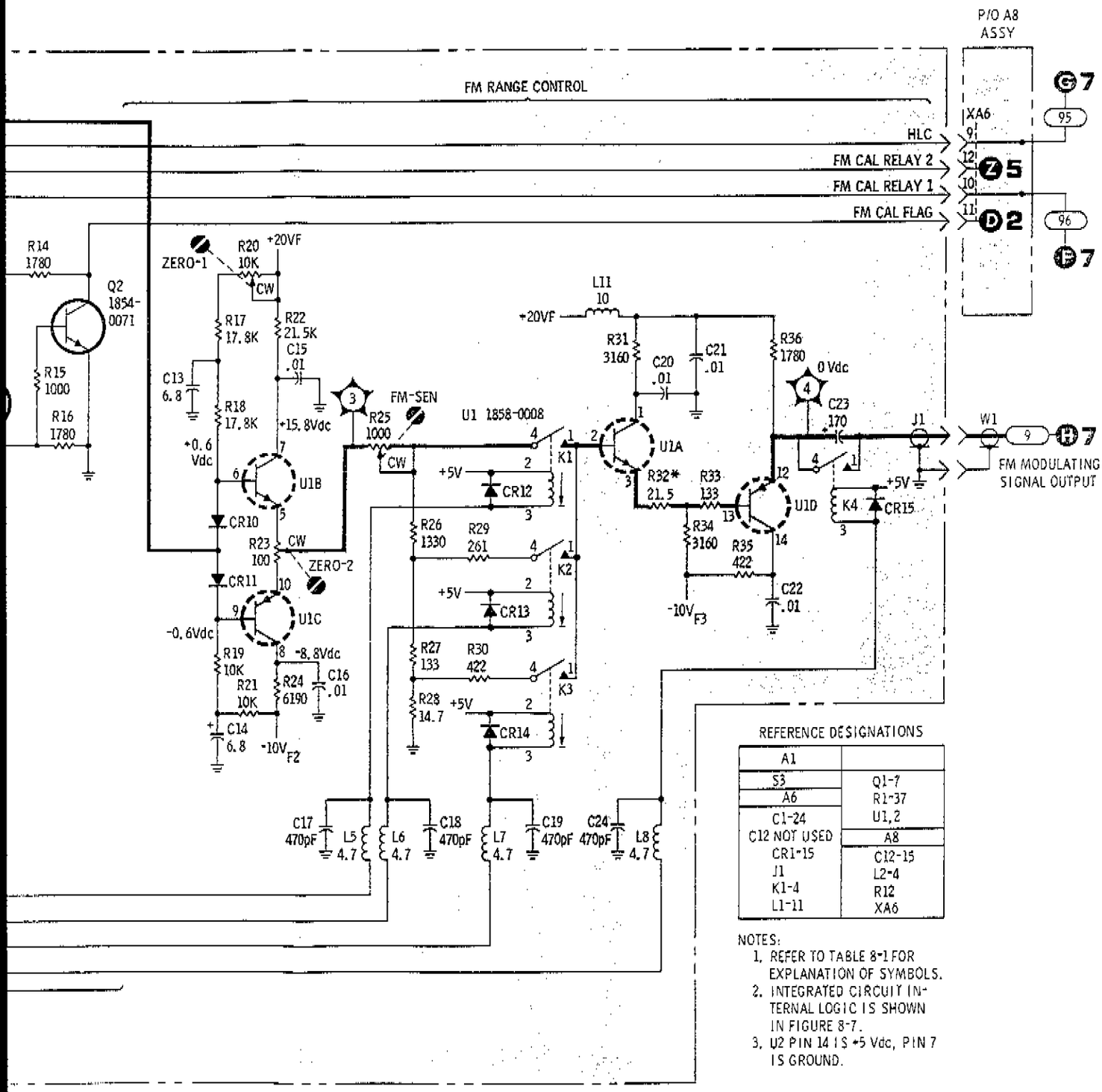


Figure 8-21. FM Deviat

FIG. 8-21
SH 3 of 3



REFERENCE DESIGNATIONS

A1	
S3	Q1-7
A6	R1-37
C1-24	U1,2
C12 NOT USED	A8
CR1-15	C12-15
J1	L2-4
K1-4	R12
L1-11	XA6

NOTES:
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
2. INTEGRATED CIRCUIT INTERNAL LOGIC IS SHOWN IN FIGURE 8-7.
3. U2 PIN 14 IS +5 Vdc, PIN 7 IS GROUND.

6
A6

Figure 8-21. FM Deviation Attenuation Schematic Diagrams

SERVICE SHEET 7

REAR PANEL ASSEMBLY

Normally, causes of malfunctions in the Model 86632A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree and block diagram.

NOTES

1. After making repairs in any part of the rear panel circuits, the adjustment procedures specified in Section V paragraph 5-17 should be performed to ensure proper operation of the instrument.
2. Before attempting to troubleshoot the A7 Rear Panel Assembly, verify that the power supply voltages are present.

GENERAL

During the AM or OFF (cw) modes, the VCO is turned off and the 20 MHz cw reference signal from the mainframe is coupled directly to the RF section by the relays on A7A2.

In FM mode, the VCO is frequency modulated by the signal from the A6 Assembly. The 20 MHz FM signal is coupled to the RF Section through relays on A7A2.

When the FM center frequency calibration cycle has been initiated, the FM modulating signal input is grounded and the VCO output and the 20 MHz reference signal are compared in A7A1 20 MHz Phase Detector. The dc error voltage from the phase detector is amplified and is used to reset the VCO frequency to 20 MHz.

TEST EQUIPMENT REQUIRED: (see Table 1-3)

Digital Voltmeter
10:1 Oscilloscope Probe
Oscilloscope

1 A7A1 20 MHz Mixer Assembly

The 20 MHz VCO output is coupled to Q1 and Q2 amplifiers and the output is coupled to the phase detector circuit.

During the FM center frequency calibration cycle, the 20 MHz reference signal is coupled to Q4 and Q3 where it is amplified and coupled to the phase detector.

The phase detector consists of T1, CR1/CR2 and a low pass filter. The 20 MHz signals are compared in the phase detector circuit and the dc output is coupled to the error voltage storage capacitor A7A3C33.

TEST PROCEDURE 1

Verify that the power supply voltages are present on the A7A1 assembly before proceeding with the test procedures.

The initial settings of the Model 86632A for troubleshooting the A7 assembly are MODE-FM X10, SOURCE-INTERNAL 400, MODULATION LEVEL-50.

Test 1-a. With an oscilloscope verify that the VCO signal is coupled to T1. The signal is normally about 2.6 Vp-p at 20 MHz/FM. If the signal amplitude or frequency is incorrect, proceed to Test 1-b. If the signal is correct, proceed to Test 1-d.

Test 1-b. Observe the VCO input from the A7A3 Assembly with an oscilloscope (See Figure 8-18). If the signal is about 420 mVp-p at 20 MHz/FM, Q1, Q2 or an associated

components is probably defective. If the signal is incorrect proceed to Test 1-c.

Test 1-c. Verify that continuity exists between the 20 MHz VCO input from A7A1 to A7A3. If the connection is continuous, proceed to Test Procedure 3. If continuity does not exist, the input must be repaired before further troubleshooting is attempted.

Test 1-d. Verify that the 20 MHz reference voltage is found on the center-tap of T1 during the calibration cycle. The signal is normally a 20 MHz sine wave with 3 Vp-p amplitude. If the signal is correct, proceed to Test 1-g. If the signal is incorrect, proceed to Test 1-e.

Test 1-e. Check the REF input signal from the A7A2 with an oscilloscope (see Figure 8-10), and verify that the voltage is ≈480 mVp-p during the calibration cycle. If the signal is correct, Q3, Q4 or an associated component is probably defective. If the signal is incorrect, proceed to Test 1-f.

Test 1-f. Verify continuity from A7A1 to A7A2 at the 20 MHz REF input. If continuity does exist, proceed to Test Procedure 2. If continuity does not exist, repair the interconnection.

Test 1-g. Connect the oscilloscope to TP1 and verify that phase lock occurs. (The difference frequency between the 20 MHz reference and the 20 MHz VCO is zero.) If the difference frequency can be observed on the oscilloscope, proceed to Section V paragraph 5-17 for the VCO center frequency adjustment. If phase lock still does not occur, proceed to Test 1-h. If phase lock occurs, proceed to Test Procedure 3.

Test 1-h. Verify that continuity exists between the A7A1 and A7A3 Assemblies at the phase detector output. If continuity exists, proceed to Test Procedure 3. Otherwise, repair or replace the defective item.

2 A7A2 20 MHz SWITCH ASSEMBLY

During the OFF or AM mode, the 20 MHz reference signal from the mainframe is coupled through relays K1 and K3 to the RF section.

In FM mode, the frequency modulated 20 MHz VCO signal is coupled through K1 to the RF section.

Relay K4 directs the 20 MHz reference signal to the phase detector on A7A1 during the FM center frequency calibration cycle.

TEST PROCEDURE 2

Test 2-a. Observe the 20 MHz reference signal at TP D. The signal should show ≈480 mVp-p at 20 MHz. If the signal is correct, proceed to Test 2-b. If the signal is incorrect, go to Test 2-f.

Test 2-b. Observe the signal at TP E with a oscilloscope.

NOTE

TP E will show a 20 MHz cw signal at ≈480 mVp-p in OFF or AM mode. In FM mode TP E will show a 20 MHz FM signal at 340 mVp-p.

If the signal is correct, proceed to Test 2-e. If the signal is incorrect and:

a) the instrument is being operated in OFF or AM mode, K1, K2, K3 or an associated component is probably defective.

b) the instrument is being operated in the FM mode, proceed to Test 2-c.

Test 2-c. With an oscilloscope observe the signal at the input from the A7A3 Assembly to K3 pin 3. If the signal is approximately 340 mVp-p at 20 MHz-FM, then K1 or an associated component is probably defective. If the signal is incorrect, proceed to Test 2-d.

Test 2-d. Verify that continuity exists between A7A3 and A7A2 at the 20 MHz VCO input to A7A2. If continuity does exist, go to Test Procedure 3 . If the input is discontinuous, repair or replace the defective item.

Test 2-e. Close the FM CF-CAL switch on the front panel and verify that the 20 MHz reference signal is coupled through K4 to TP E on A7A2 Phase Detector Assembly. If this occurs, proceed to Test 2-f. If this does not occur, K4, K3 or an associated component is probably defective.

Test 2-f. Verify that continuity exists between K1 pin 3 and the RF section.

NOTE

It is assumed that the malfunction has been isolated to the Model 86632A.

If continuity exists, proceed to Test 2-g. If continuity does not exist, the problem must be repaired before troubleshooting is continued.

Test 2-g. Determine if the connections from K4 pin 3 to the A7A1 Assembly is continuous. If so, proceed to Test Procedure 1 . If not, repairs must be made to remedy the problem before continuing to troubleshoot the Model 86632A.

3 A7A3 20 MHz VCO ASSEMBLY

During normal FM operation, a dc error voltage is stored on C33. This voltage is amplified by U1 and is coupled to the varacitor diodes in the VCO (voltage controlled oscillator) and is used to set the VCO center frequency to 20 MHz.

The frequency modulating signal from the A6 FM Deviation Attenuation Assembly is also coupled to the varactor diodes through L4 and C15. The change in voltage on the varactors changes their capacity and therefore changes the VCO frequency at a rate determined by the modulating signal frequency. The amplitude of the modulating signal determines the modulation level (peak deviation) of the RF output from the RF section.

The VCO circuit is made up of the Q3 oscillator and a tuned circuit consisting of L3, CR9, 11 and 12, and C17. C18 and 19 do add some capacitance to the tuned circuit but are mainly used for coupling theVCO output to Q1. C14 is a trimmer capacitor which helps to make the frequency-versus-voltage curve more linear. When a dc voltage is coupled to the varactor diodes the capacitance and therefore the frequency of the VCO changes.

The VCO tuned circuit is coupled to Q1. Positive feedback from Q1 source is coupled to Q3 and the drain is coupled to buffer amplifier Q2. The output of the buffer is coupled to the A7A1 20 MHz Phase Detector Assembly and to Q6 and Q5 output amplifiers. The 20 MHz output from Q5 is coupled to the RF Section through the A7A2 20 MHz Switch Assembly.

SERVICE SHEET 7 (cont'd)

TEST PROCEDURE 3

Test 3-a. Verify that the dc voltage at TP1 is 6 ±1Vdc. If the voltage is correct, proceed to Test 3-d. If the voltage is incorrect, proceed to Test 3-b.

Test 3-b. Measure the dc voltage at U1 pin 3. If the voltage is +3 to +5Vdc, U1 or an associated component is probably defective. If the voltage is incorrect proceed to Test 3-c.

Test 3-c. Ground the teflon insulated standoff and verify the voltage at U1 pin 3 is +3 to +5 Vdc. If this voltage is incorrect, Q7 is probably defective. If the voltage is correct K1, Q8 or an associated component is probably defective.

Test 3-d. Set the Model 86632A to: MODE-FM X10, SOURCE-INTERNAL, MODULATION LEVEL-50. Verify that the modulating signal input observed at the FM input from the A6 Assembly is approximately 1.0 Vp-p. If the voltage is incorrect, proceed to Test 3-e. If the voltage is correct, proceed to Test 3-f.

Test 3-e. Verify that continuity exists between A6 and A7A3 at the modulating signal input. If continuity does exist, proceed to Service Sheet 5. If continuity does not exist, repair or replace the defective component.

Test 3-f. With an oscilloscope, observe the output signal from A7A3 to the A7A2 20 MHz Switch Assembly. If the signal is 330mVp-p at 20 MHz-FM, proceed to Test 3-g. If the output signal is incorrect, proceed to Test 3-h.

Test 3-g. Verify that continuity exist between A7A3 and A7A2 at the VCO output to A7A2. If continuity does exist, proceed to Test Procedure 2 . Otherwise repair or replace the defective item that causes the discontinuity.

Test 3-h. Observe the A7A3 VCO signal with an oscilloscope at TP C. If the output is not ≈420 mVp-p, proceed to Test 3-i. If the output signal is correct, Q5, Q6 or an associated component is probably defective.

Test 3-i. If the signal measured at Q1-drain with an oscilloscope is ≈480 mVp-p, Q2 is probably defective. If the signal is not correct, proceed to Test 3-j.

Test 3-j. Measure the dc voltage at Q1 drain. If the voltage is ≈−1.8 Vdc, a component associated with the VCO is probably defective. If the voltage is incorrect, K2 or an associated component is probably defective.

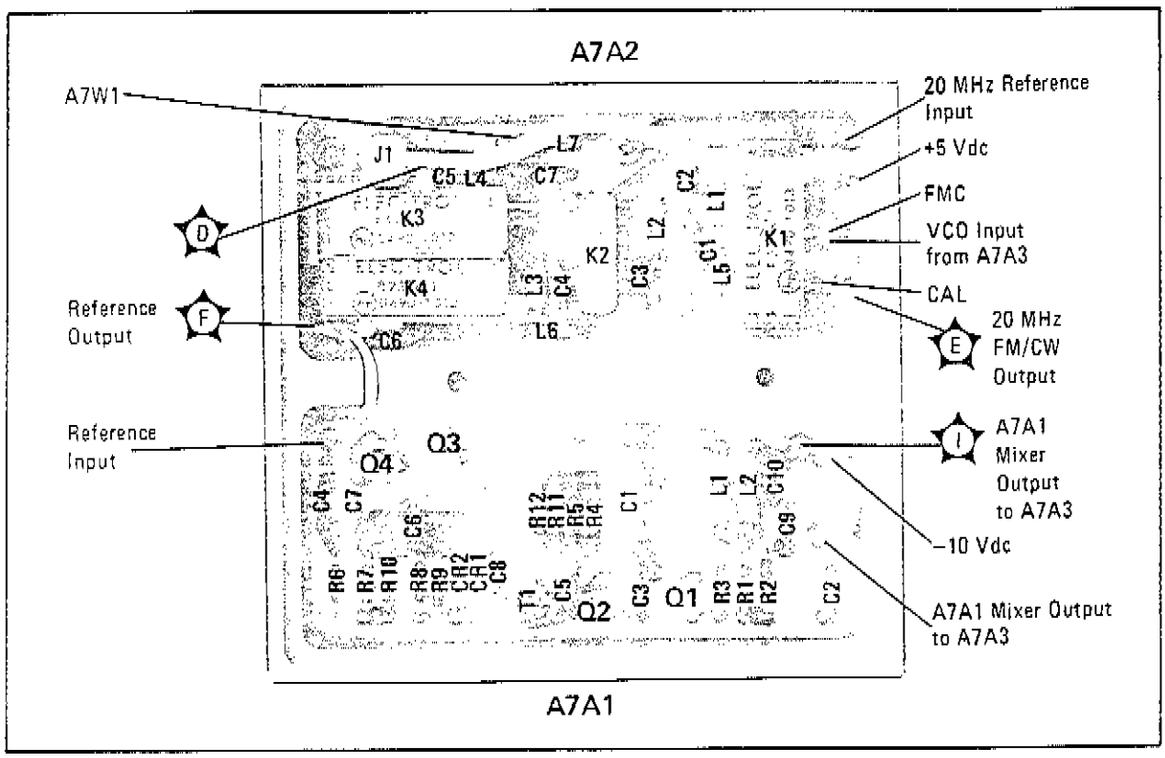


Figure 8-22. 20 MHz MIXER and 20 MHz Switch Assembly Component Locations

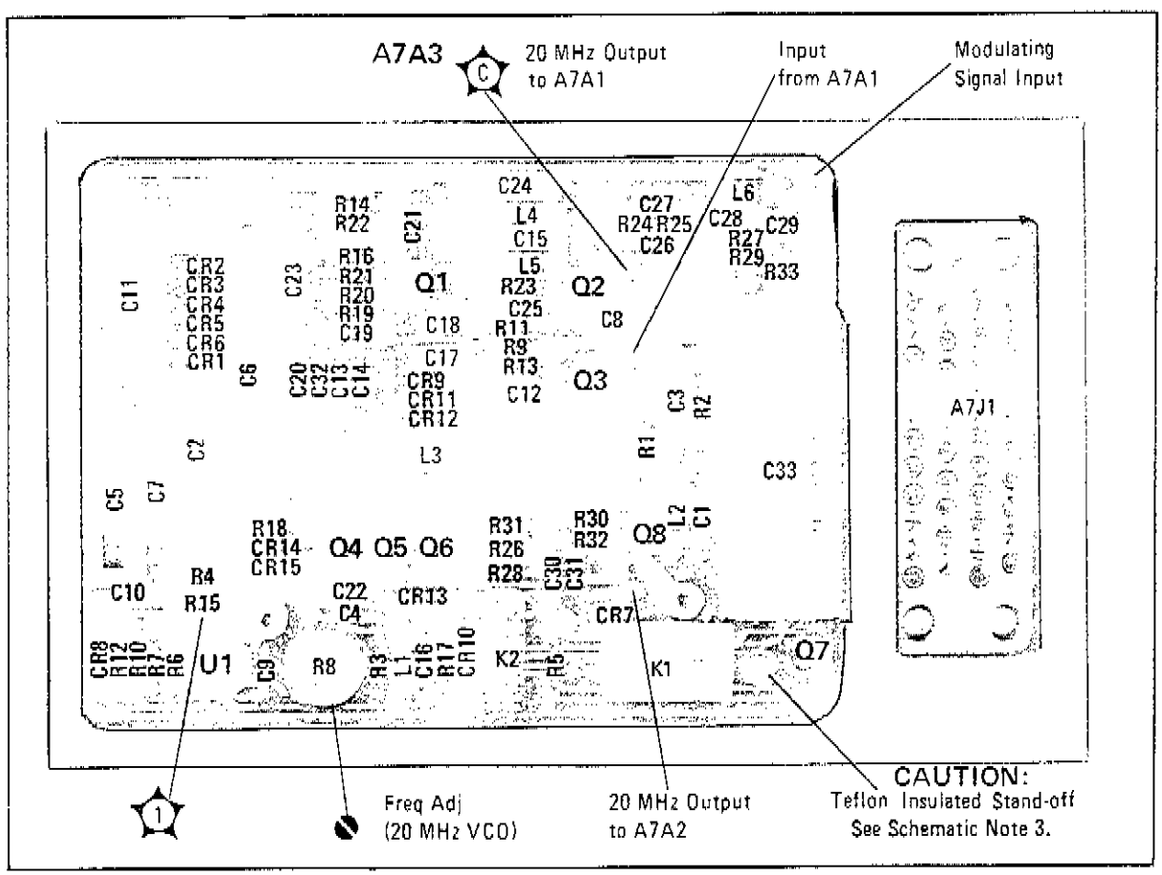


Figure 8-23. 20 MHz VCO Assembly Component Locations

FIG. 8-24
Sht 1 of 3

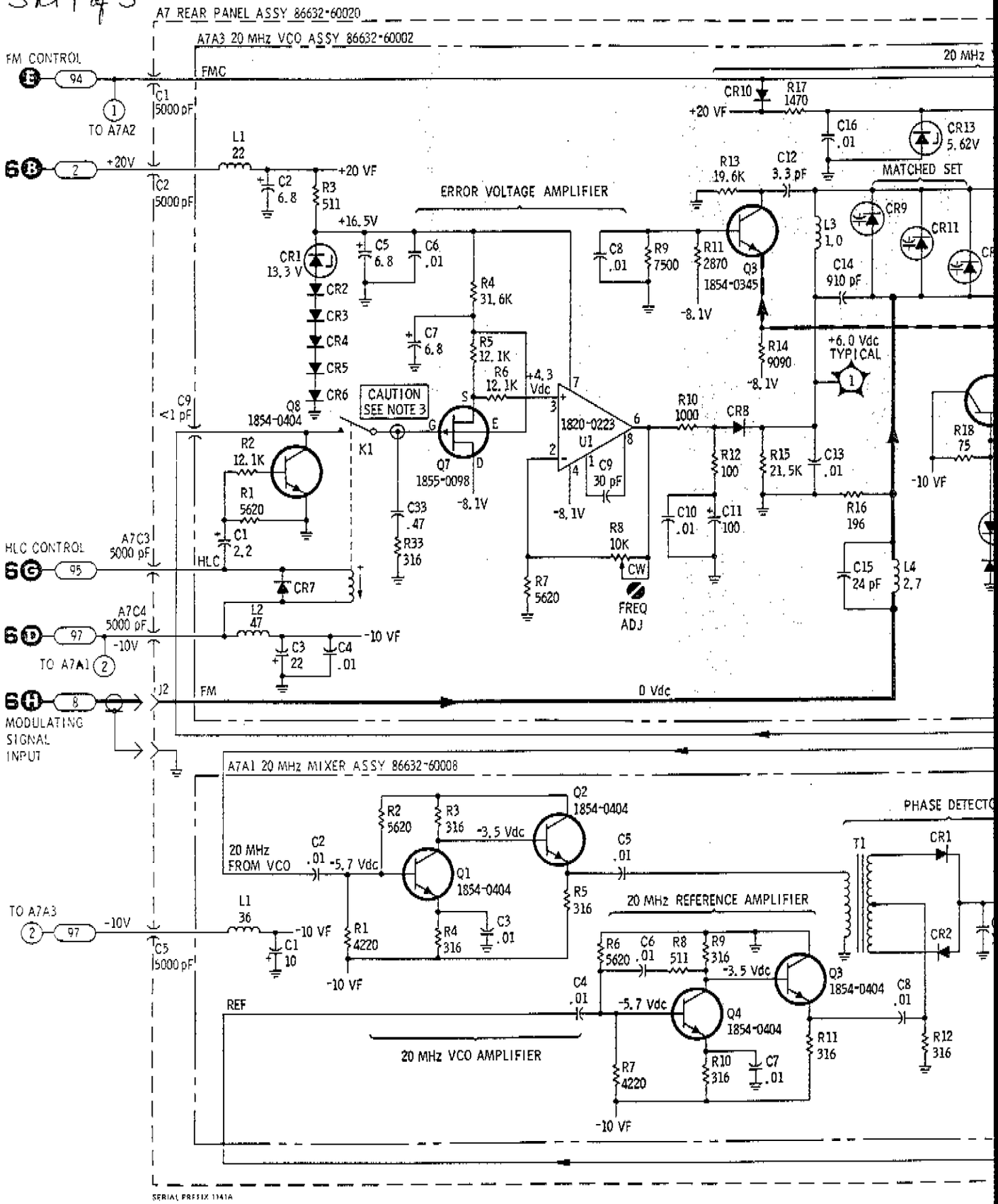


FIG. 8-24
SHT 2 of 3

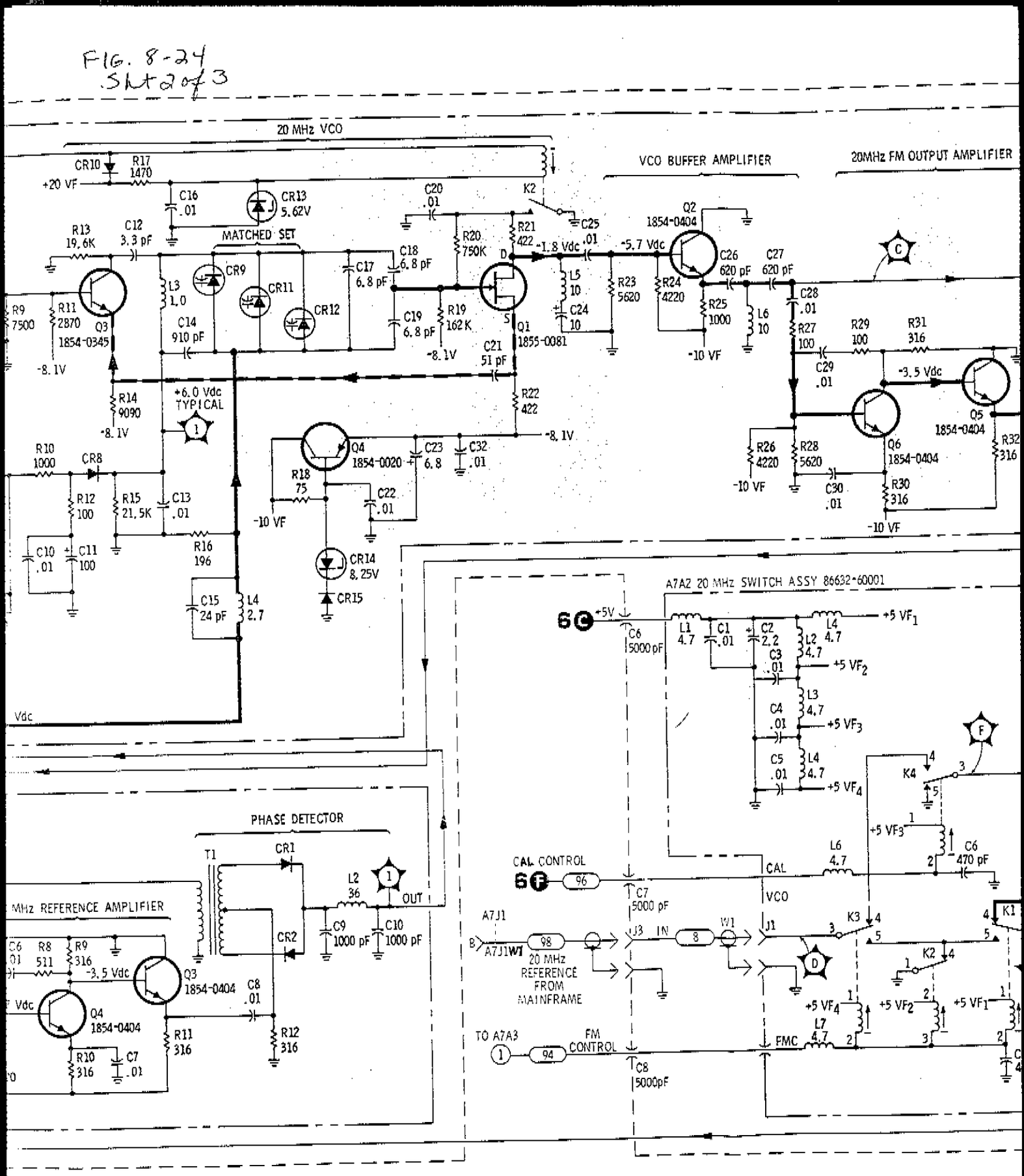
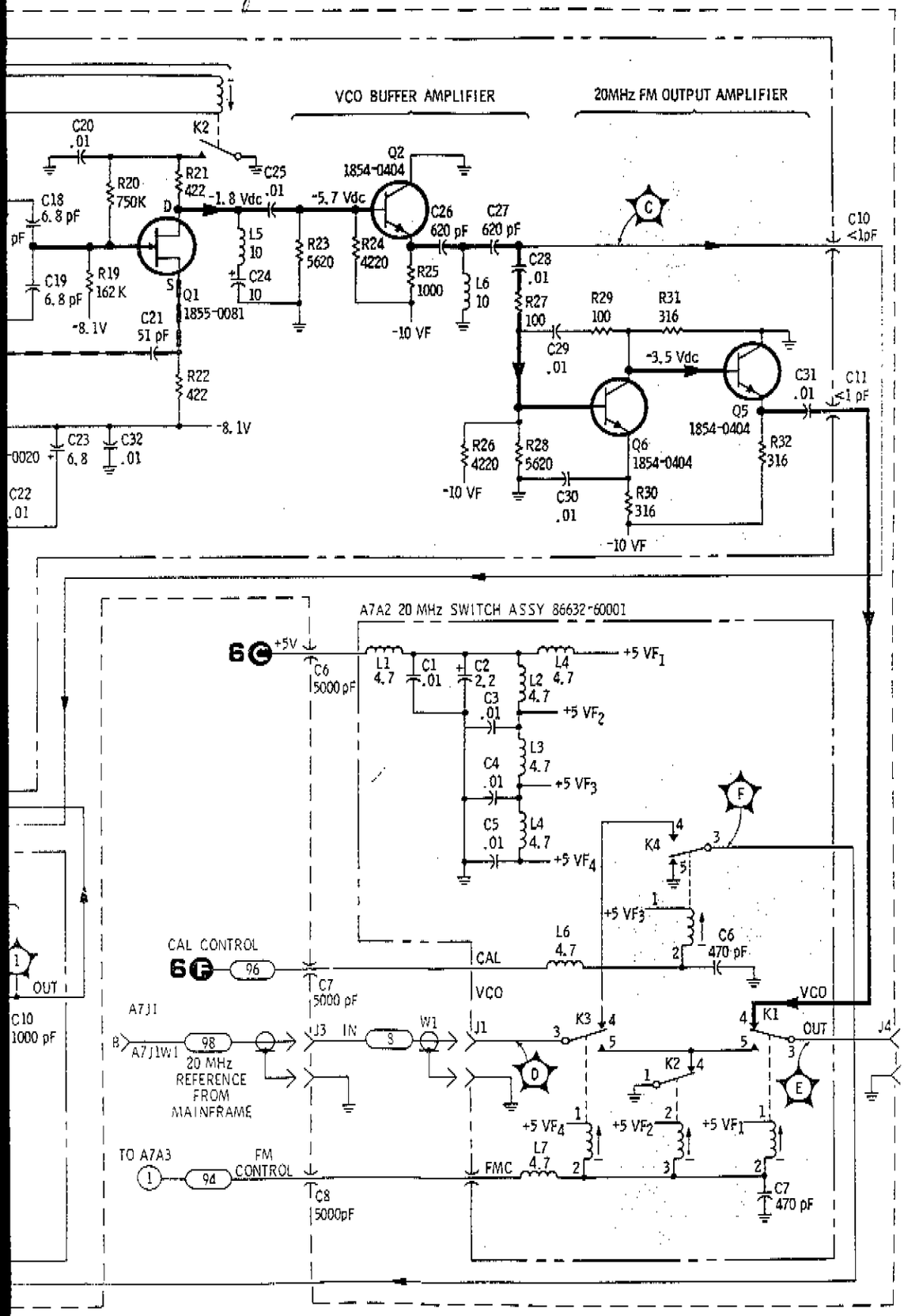


Figure 8-24.

FIG. 8-24
SH 3 of 3



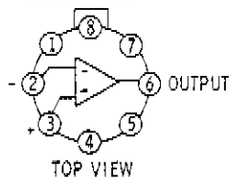
NOTES:

1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
2. INTEGRATED CIRCUIT INTERNAL LOGIC IS SHOWN IN FIGURE 8-7.
3. CAUTION: DAMAGE TO A7A3Q7 MAY OCCUR IF ANYTHING EXCEPT A GROUND CLIP IS CONNECTED TO THE TEFLON INSULATED STAND-OFF.

REFERENCE DESIGNATIONS

A7	A7A2
C1-11 J2-4	C1-7 J1 K1-4 L1-7
	A7A3
C1-10 CR1-2 L1-2 Q1-4 R1-12 T1	C1-33 CR1-15 K1-2 L1-6 Q1-8 R1-33 U1

U1 PIN DIAGRAM



7 A7

Figure 8-24. Rear Panel Assembly Schematic Diagram