Errata

Title & Document Type: 8340A Synthesized Sweeper Service Manual
Volume 2 - 4

Manual Part Number: 08340-90020

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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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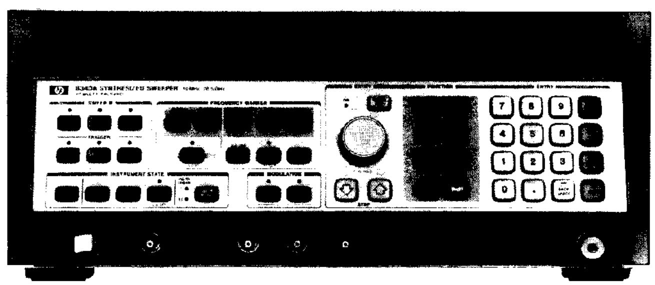
Agilent Technologies

SERVICE MANUAL

HP 8340A SYNTHESIZED SWEEPER

10 MHz to 26.5 GHz



HEWLETT PACKARD

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

⚠ Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

ϟ Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SAFETY EARTH GROUND

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an autotransformer make sure the common terminal is connected to the neutral (grounded side of mains supply).

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

VOLUME 2 CONTENTS

TABLES

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for the Model 8340A Synthesized Sweeper. These procedures should not be performed as routine maintenance but should be used (1) after replacement of a part or component, or (2) when performance tests show that the specifications of Table 1-1 cannot be met. Before attempting any adjustment, allow 1 hour warm-up time for the instrument. Table 5-1 lists the adjustment procedures by paragraph number in the order they appear in this Section. Table 5-2 lists all adjustable components by reference designator, name, and the function adjusted by each. Table 5-3 lists all factory selected components. Table 5-4 lists adjustment procedures that interact between assemblies. This table lists the adjustment paragraphs that must be checked when an assembly is adjusted, parts replaced, or the assembly replaced.

5-3. SAFETY CONSIDERATIONS

5-4. Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

WARNING

Adjustments in this section are performed with power supplied to the instrument while protective covers are removed. There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Adjustments should be performed only by trained service personnel.

Power is still applied to this instrument with the LINE switch in STANDBY. There is no OFF position on the LINE switch. Before removing or installing any assembly or printed circuit board, remove the power cord from the rear of both instruments.

Capacitors inside the instrument may still be charged, even if the instrument has been disconnected from its source of supply. Use a non-metallic adjustment tool whenever possible.

5-5. EQUIPMENT REQUIRED

5-6. Table 1-4 lists the equipment required for the adjustment procedures. If the test equipment recommended is not available, other equipment may be used if its performance meets the "Critical Specifications" listed in the table. The test setup used for an adjustment procedure is referenced in each procedure.

5-7. ADJUSTMENT TOOLS

5-8. For adjustments requiring a non-metallic tuning tool, use fiber tuning tool, HP Part Number 8710-0033. In situations not requiring non-metallic tuning tools, an ordinary small screwdriver or other suitable tool is sufficient. However, use of a non-metallic adjustment tool whenever possible is recommended. Never try to force any adjustment control in the instrument. This is especially critical when tuning variable slug-tuned inductors and variable capacitors.

5-9. FACTORY SELECTED COMPONENTS

5-10. Factory selected components are identified with an asterisk on the schematic diagram. The range of their values and functions are listed in Table 5-3. Part Numbers for selected values are located in Table 5-5.

5-11. RELATED ADJUSTMENTS

5-12. Any adjustments which interact with or are related to other adjustments are indicated in the adjustment procedures. It is important that adjustments so noted are performed in the order indicated to ensure the instrument meets its specifications.

5-13. LOCATION OF TEST POINTS AND ADJUSTMENTS

5-14. Illustrations showing the locations of assemblies containing adjustments and locations of those adjustments within the assemblies are contained within the adjustment procedures where they apply. Also, major assembly and component location illustrations are located at the rear of Volumes 2 and 3 of this manual.

5-15. ACCESSING AND STORING CALIBRATION CONSTANTS

5-16. Introduction

5-17. The 8340A contains three memory areas reserved for calibration constants. These areas are (1) working, (2) protected, and (3) default. A detailed description of these memory areas is contained in Section 8 under the heading "General Service Information". When performing adjustments in Section 5, some calibration constants in the "working memory area" are changed or "adjusted" to optimize performance parameters. Once these calibration constants are set for best instrument performance, the new values should be copied from the "working memory area" to the "protected memory area". This calibration data then may be used later in case of loss of valid calibration constants data in the "working memory area".

5-18. Procedure to Access Calibration Constants

5-19. In the adjustment procedures, calibration constants stored in 8340A working memory will be changed (adjusted). A calibration constant can be accessed by pushing the following key sequence:

[SHIFT] [GHz] [number of the Cal. Constant, 0 to 63] [Hz]

[SHIFT] [MHz] [1] [2] [Hz]

[SHIFT] [kHz] [2] [2] [Hz]

The ENTRY DISPLAY will indicate the calibration constant number on the left and the present value on the right. Use the STEP keys to select a different calibration constant number. The ENTRY keyboard or the front panel rotary knob can be used to change the value. After the new value has been entered, press the **[Hz]** key to retain the new values in "working memory area".

5-20. Procedure to Store the Calibration Constants

5-21. After adjustments of the calibration constants are completed, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence:

[SHIFT] [MHz] [1] [4] [Hz]

[SHIFT] [kHz] [5] [3] [4] [9] [Hz] [INSTR PRESET]

Table 5-1. Adjustment Procedures in Paragraph Order

Table 5-2. Adjustable Components in Alpha-Numeric Order (1 of 5)

Reference Designator	Adjustment Name	Adjustment Paragraph Number	Adjustment Function
A8C4	PEAK	5-32	Peaks 100 MHz amplifier.
A8R8	BAL	5-32	Adjusts balance in Sampler.
A14A1R11	G1		Factory adjustment only. Sets gate bias on Bands 1–4 Power Amplifier.
A14A1R13	G3L		
A14A1R14	G2		
A14A1R15	G3R		
A14A1R16	G4L		
A14A1R18	G4R		
A16A1R4	G1		Factory adjustment only. Sets gate bias on Band 0–4 Modulator Splitter.
A16A1R6	G2		
A21R21	ON DELAY	5-39	Sample/Hold on delay is set to 100 to 180 nSec width at TP1.
A21R23	OFF DELAY	5-39	Sample/Hold off delay is set to 60 to 130 nSec width at TP1.
A24R1	OFF A	5-35, 5-37	Sets offset of modulator voltage clamp at beginning of band.
A24R2	OFF B	5-35, 5-37	Sets offset of modulator voltage clamp at end of band.
A24R3	X2A	5-35	Sets SRD Bias at maximum power at beginning of Band 2.
A24R4	X2B	5-35	Sets SRD bias at maximum power at end of Band 2.
A24R5	X2C	5-35, 5-37	Adjusts the relationship between bias voltage and power.
A24R6	X3A	5-35	Sets SRD Bias at maximum power at beginning of Band 3.
A24R7	X3B	5-35	Sets SRD Bias at maximum power at end of Band 3.

Table 5-2. Adjustable Components in Alpha-Numeric Order (2 of 5)

Reference Designator	Adjustment Name	Adjustment Paragraph Number	Adjustment Function
A24R8	X3C	5-35, 5-37	Adjusts the relationship between bias voltage and power.
A24R9	X4A	5-35	Sets SRD Bias at maximum power at beginning of Band 4.
A24R10	X4B	5-35	Sets SRD Bias at maximum power at end of Band 4.
A24R11	X4C	5-36, 5-37	Adjusts the relationship between bias voltage and power.
A24R12	MIN	5-36, 5-37	Sets minimum SRD Bias voltage.
A25R24	+20	5-36	Adjusts for +20 dBm.
A25R33	L-20	5-36	Adjusts for −20 dBm in Band 0.
A25R34	H-20	5-36	Adjusts for −20 dBm in Bands 1 through 4.
A25R38	L+10	5-36	Adjusts for +10 dBm in Band 0.
A25R39	H+10	5-36	Adjusts for +10 dBm in Bands 1 through 4.
A25R58	BAL	5-39	Adjusted to balance out charge injection in Sample/Hold circuit.
A25R80	EX−	5-36	Adjusts offset of U10 for negative input. (This must be adjusted before A25R84 EX+.
A25R84	EX+	5-36	Adjusts offset of U6 for positive input. (A25R80 EX− must be adjusted before making this adjustment.)
A25R88	EXHI	5-36	Sets high power level in External Leveling mode.
A25R108	LOFS	5-36, 5-38	Adjusts the logger output in Band 0 to equal the logger output in Bands 1 through 4 at 0 dBm.
A26R7	BAL	5-39	Adjusted to balance out charge injection in Sample/Hold circuit.
A26R43	HET	5-37	Adjusts ALC Loop Gain for Band 0.
A26R45	X1	5-37	Adjusts Loop Gain for Band 1.
A26R47	X2	5-37	Adjusts ALC Loop Gain for Band 2.
A26R49	X3	5-37	Adjusts ALC Loop Gain for Band 3.

Table 5-2. Adjustable Components in Alpha-Numeric Order (3 of 5)

Reference Designator	Adjustment Name	Adjustment Paragraph Number	Adjustment Function
A26R51	X4	5-37	Adjusts ALC Loop Gain for Band 4.
A26R88	MO	5-35, 5-37	Offsets current into Modulator Driver.
A26R91	AM GAIN	5-36	Sets gain of AM Modulation for 70.7% Modulation.
A26R96	SLOW PULSE	5-36a	Adjusts Slow Pulse rise/fall time, overshoot.
A27R4	BKPT1	5-38	Sets break point 1.
A27R8	BKPT2	5-38	Sets break point 2.
A28R1	OFF	5-35, 5-37	Sets overall offset for SYTM tracking.
A28R2	BP1	5-35, 5-37	Sets slope of the 13.5 GHz break point.
A28R3	BP2	5-35, 5-37	Sets slope of 20 GHz break point.
A28R4	BP3	5-35, 5-37	Sets slope of adjustable break point.
A28R5	BP3FRQ	5-35, 5-37	Sets frequency of adjustable break point. (Approximate range is 22 to 26.5 GHz.)
A28R6	DYO	5-35	Sets delay offset.
A28R7	DYS	5-35	Sets delay slope.
A28R8	GAIN	5-35, 5-37	Sets overall SYTM tracking gain.
A28R9	LKCK	5-35	Sets threshold of low frequency kick pulse.
A28R10	HKCK	5-35	Sets threshold of high frequency kick pulse.
A28R85	+10 ADJ	5-35	Sets +10V Reference Voltage.
A28R113	B1OFF	5-35, 5-37	Sets offset of Band 1.
A30C1	400 MHz	5-25	Peaks 400 MHz Amplifier.
A30C2	400 MHz	5-25	Peaks 400 MHz Amplifier.

Table 5-2. Adjustable Components in Alpha-Numeric Order (4 of 5)

Reference Designator	Adjustment Name	Adjustment Paragraph Number	Adjustment Function
A30C3	400 MHZ	5-25	Sets Quadrupler to 400 MHz output.
A30C4	100 MHZ	5-25	Sets 100 MHz Oscillator Frequency.
A32A2C1	FREQ ADJ	5-26	Adjusts frequency of oscillator for range of 355 to 395 MHz.
A32A2C5	PWR	5-26	Adjusts power output of VCO ≥0 dBm at output of A32.
A35R3	+22 ADJ	5-22	Sets regulated +22 V power supply output voltage.
A36L7	50 kHz NULL	5-27	Adjusts for maximum null at 50 kHz.
A36L8	50 kHz NULL	5-27	Adjusts for maximum null at 50 kHz.
A38L11	165 MHZ NULL	5-27	Adjusts for maximum null of 165 MHz signal.
A38L12	160 MHZ NULL	5-27	Adjusts for maximum null of 160 MHz signal.
A38L13	170 MHZ NULL	5-27	Adjusts for maximum null of 170 MHz signal.
A39C50	160 MHZ PEAK	5-27	Peaks 160 MHz output of X1.6 multiplier.
A39L11	VCO CENTER FREQUENCY	5-27	Centers PLL3 VCO frequency for range of 160 to 166 MHz output.
A39L16	160 MHZ PEAK	5-27	Peaks circuit at 160 MHz. Interacts with L17.
A39L17	160 MHZ PEAK	5-27	Peaks circuit at 160 MHz. Interacts with L16.
A40R2	150 MHZ ADJUST	5-27	Adjusts VCO TUNE voltage at 150 MHz.
A40R4	100 MHZ ADJUST	5-27	Adjusts VCO TUNE voltage at 100 MHz.
A43R9	0.3 MHZ ADJUST	5-27	Sets discriminator gain at 0.3 MHz.
A43R25	0.5 MHZ ΔF	5-27	Adjusts 20/30 sweep frequency ΔF accuracy.
A43R27	5 MHZ ΔF	5-27	Adjusts 20/30 sweep frequency ΔF accuracy.
A43R41	0.2 MHZ ADJUST	5-27	Sets pretune DAC offset at 0.2 MHz.

Table 5-2. Adjustable Components in Alpha-Numeric Order (5 of 5)

Reference Designator	Adjustment Name	Adjustment Paragraph Number	Adjustment Function
A48C1	Response	5-30	Adjusts Sampler Drive Amplifier output network for best response.
A48C2	Response	5-30	Adjusts Sampler Drive Amplifier output network for best response.
A48R1	IF GAIN	5-30	Adjusts IF gain for 0 to +8 dBm output from Output Amplifier.
A51	COURSE	5-23	Adjusts 10 MHz Reference Oscillator frequency.
A51	FINE	5-23	Adjusts 10 MHz Reference Oscillator frequency.
A54R14	PGN	5-28	Adjusts pretune gain for +2.10V/GHz.
A54R22	POFF	5-28	Adjusts pretune offset for −2.5V/GHz at output of Summing Amplifier.
A54R30	CGN	5-31	Adjusts gain compensation for YO delay.
A54R32	COFF	5-31	Adjusts offset compensation for YO delay.
A54R36	PW	5-31	Adjusts pulse width of YO Retrace Kick Pulse.
A55R4	GAIN	5-29	Adjusts input level of Pretune signal for −2.34V/GHz at TP5.
A55R47	OFFSET	5-29	Sets crossover point of Summing Amplifier.
A57R32	10V END OF SWP ADJ	5-33	Adjusts marker ramp for 10V at end of sweep.
A57R1	MAN GAIN	5-33	Adjusts output range of manual sweep DAC.
A58R4	SWP TIME	5-34	Adjusts sweep time of ramp generator.
A58R13	SWP GAIN	5-34	Adjusts gain of summing amplifier for +2V/GHz ramp.
A58R33	RESET	5-34	Adjusts Reset DAC for minimum at error test point.

Table 5-3. Factory Selected Components

Reference Designator	Range of Values	Adjustment Paragraph Number	Function of Component
A25C11	Either 0 or 1000 PF	5-36	Selected for optimum Log-Amp speed and stability.
A25R36 A25R37	4640–9090 Ohms 3830–6190 Ohms	5-36 5-36	} Adjusts temperature compensation of HI Band detector.
A25R109 A25R115	1620–3830 Ohms 4640–9090 Ohms	5-36 5-36	} Adjusts temperature compensation of LO Band detector.
A30C8	5.6–11 PF	5-25	Sets range of C4 so midposition is 100 MHz.
A30L4	0.22–0.68 mH	5-25	Centers Oscillator at 100 MHz.
A30R67	110–825 Ohms	5-25	Part of attenuator to set 400 MHz output at −10 dBm.
A30R68	6.8–61.9 Ohms	5-25	Part of attenuator to set 400 MHz output at −10 dBm.
A30R69	110–825 Ohms	5-25	Part of attenuator to set 400 MHz output at −10 dBm.
A39C49	8.2–16 PF	5-27	Sets range of C50 so midposition is 160 MHz.
A48C22	100–160 PF	5-30	Selected to tune RLC network at input of Buffer Amplifier to 25 MHz passband.
A48R22	6.2–23.7 Ohms	5-30	Selected to adjust resistance of RLC network at input of Buffer Amplifier for passband bandwidth of 18 to 32 MHz.
A60C10	51–110 PF	5-24	Selects Frequency of Clock at 10 MHz for an output from divide–by–two of 5 MHz.

Table 5-4. Adjustment Interdependence Between Assemblies (1 of 4)

Assembly Adjusted or Replaced	Associated Adjustments That Must Be Made	Procedure Paragraphs
A1 Alpha Display	None	
A2 Display Driver	None	
A3 Display Processor	None	
A4 Not Assigned		
A5 Keyboard	None	
A6 Keyboard Interface	None	
A7 Lower Keyboard	None	
A8 3.7GHz Oscillator	Band Zero ALC Loop Gain	5-32; 5-37, steps 19 thru 21.
A9 Band Zero Pulse Modulator	None	
A10 Directional Coupler	Flatness Adjustment	5-38, steps 10 thru 31.
A11 Bands 1-4 Detector	A25R36 and A25R37; Hi Band and Lo Band ALC Adjustment; Flatness; ADC Adjustment; Pulse.	5-36, steps 1 thru 9, 15 thru 20; 5-38, steps 24 thru 31, 33 thru 37; 5-39.
A12 Band Zero Detector	Lo Band ALC, ADC, Flatness, A25R109, and A25R115.	5-36, steps 1 thru 4, 10 thru 14, 15 thru 20; 5-38, steps 29 thru 31, 36, and 37.
A13 SYTM	SYTM Tracking and SRD Bias Adjustment	5-35 and 5-37.
A14 Band 1–4 Power Ampl.	SRD Bias and ALC Loop Gain.	5-35 and 5-37, A24 and A26 adjustments only.
A15 Band Zero Low-Pass Filter	None	
A16 Band 1–4 Modulator/Splitter	SRD Bias and ALC Loop Gain.	5-35 and 5-37, A24 and A26 adjustments only.

Table 5-4. Adjustment Interdependence Between Assemblies (2 of 4)

Assembly Adjusted or Replaced	Associated Adjustments That Must Be Made	Procedure Paragraphs
A17 Band Zero Mixer	None	
A18 Band Zero Power Ampl.	None	
A19 Capacitor Assembly	None	
A20 RF Section Filter	None	
A21 Pulse Modulator Driver	Pulse Adjustment	5-39.
A22 Not Assigned		
A23 Not Assigned		
A24 Attenuator Driver/SRD Bias	SRD Bias Adjustment	5-35 and 5-37, A24 adjustments only.
A25 ALC Detector	ALC, ADC, Pulse, and External Leveling Adjustment	5-36; 5-38, steps 33 thru 37; 5-39.
A26 Linear Modulator	Loop Gain, SRD Bias, Integrator Gate Balance.	5-37; 5-39, steps 14 and 15.
A27 Level Control	Flatness, ALC, and ADC Adjustment	5-36 and 5-38.
A28 SYTM Driver	SYTM Tracking and SRD Bias Adjustment	5-35 and 5-37.
A29 Reference Phase Detector	None	
A30 100 MHz VCXO	A30C1 thru C4	5-25.
A31 M/N Phase Detector	None	
A32 M/N VCO	A32A2C1, A32A2C5	5-26.
A33 M/N Output	None	
A34 Reference—M/N Mother Board	None	

Table 5-4. Adjustment Interdependence Between Assemblies (3 of 4)

Assembly Adjusted or Replaced	Associated Adjustments That Must Be Made	Procedure Paragraphs
A35 Rectifier	+22V Supply	5-22.
A36 PLL1 VCO	A36L7, A36L8	5-27, steps 44 thru 61
A37 PLL1 Divider	None	
A38 PLL1 IF	A38L11 thru A38L13.	5-27, steps 62 thru 76
A39 PLL3 Upconverter	A39C50, A39L4, L16, L17	5-27, steps 32 thru 43
A40 PLL2 VCO	PLL2 Adjustments	5-27, steps 1 thru 31.
A41 PLL2 Phase Detector	None	
A42 PLL2 Divider	None	
A43 PLL2 Discriminator	PLL2 Adjustments	5-27, steps 1 thru 31.
A44 YIG Oscillator	YO Adjustment, Delay Adjustment, and YTM Delay.	5-29; 5-31; and 5-35, steps 13 thru 24.
A45 Pre-Leveler	YTM Bias	5-35 and 5-37, A24 adjustments only.
A46 7 GHz Low-Pass Filter	None	
A47 Sense Resistor Assembly	YO Adjustment and Delay, and YTM Adjustment and Delay.	5-29, 5-31, 5-35, and 5-37.
A48 YO Loop Sampler	Sampler Adjustment	5-30
A49 YO Loop Phase Detector	None	
A50 YO Loop Interconnect	None	
A51 Reference Oscillator	10 MHz Standard Adjustment	5-23
A52 Positive Regulator	None	

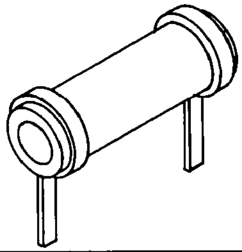
Table 5-4. Adjustment Interdependence Between Assemblies (4 of 4)

Assembly Adjusted or Replaced	Associated Adjustments That Must Be Made	Procedure Paragraphs
A53 Negative Regulator	None	
A54 YO Pretune DAC/Delay Compensation	YO Pretune, YO Main Driver, and YO Delay Compensation, SYTM Delay Compensation.	5-28, 5-29, 5-31, 5-35 and 5-37.
A55 YO Driver	YO Adjustment	5-29.
A56−15V Regulator	None	
A57 Marker/ Bandcross	Marker Bandcrossing Adjustment	5-33.
A58 Sweep Generator	Sweep Generator Adjustment	5-34.
A59 Digital Interface	None	
A60 Processor	None	
A61 Memory	None	
A62 Main Mother Board	None	
A63 70 dB RF Attenuator	Flatness RF Attenuator Calibration	5-38, steps 10 thru 31. For RF Attenuator Calibration, see manual supplement titled "Automated Test Procedures".

Table 5-5. HP Part Numbers of Standard Value Components (1 of 4)

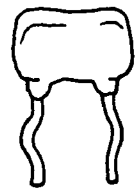
CAPACITORS

RANGE: 1 to 24 pF
TYPE: Tubular
TOLERANCE:
1 to 9.1 pF = ±.25 pF
10 to 24 pF = ±5%



Value (pF)	HP Part Number	CD
1.0	0160-2236	8
1.2	0160-2237	9
1.5	0150-0091	8
1.8	0160-2239	1
2.0	0160-2240	4
2.2	0160-2241	5
2.4	0160-2242	6
2.7	0160-2243	7
3.0	0160-2244	8
3.3	0150-0059	8
3.6	0160-2246	0
3.9	0160-2247	1
4.3	0160-2248	2
4.7	0160-2249	3
5.1	0160-2250	6
5.6	0160-2251	7
6.2	0160-2252	8
6.8	0160-2253	9
7.5	0160-2254	0
8.2	0160-2255	1
9.1	0160-2256	2
10.0	0160-2257	3
11.0	0160-2258	4
12.0	0160-2259	5
13.0	0160-2260	8
15.0	0160-2261	9
16.0	0160-2262	0
18.0	0160-2263	1
20.0	0160-2264	2
22.0	0160-2265	3
24.0	0160-2266	4

RANGE: 27 to 680 pF
TYPE: Dipped Mica
TOLERANCE: ±5%



Value (pF)	HP Part Number	CD
27	0160-2306	8
30	0160-2199	2
33	0160-2150	5
36	0160-2308	5
39	0140-0190	7
43	0160-2200	6
47	0160-2307	4
51	0160-2201	7
56	0140-0191	8
62	0140-0205	5
68	0140-0192	9
75	0160-2202	8
82	0140-0193	0
91	0160-2203	9
100	0160-2204	0
110	0140-0194	1
120	0160-2205	1
130	0140-0195	2
150	0140-0196	3
160	0160-2206	2
180	0140-0197	4
200	0140-0198	5
220	0160-0134	1
240	0140-0199	6
270	0140-0210	2
300	0160-2207	3
330	0160-2208	4
360	0160-2209	5
390	0140-0200	0
430	0160-0939	4
470	0160-3533	0
510	0160-3534	1
560	0160-3535	2
620	0160-3536	3
680	0160-3537	4

Table 5-5. HP Part Numbers of Standard Value Components (2 of 4)

RESISTORS

RANGE: 10 to 464K Ohms
TYPE: Fixed-Film
WATTAGE: .125 at 125°C
TOLERANCE: ±1.0%

Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D
10.0	0757-0346	2	464	0698-0082	7	21.5K	0757-0199	3
11.0	0757-0378	0	511	0757-0416	7	23.7K	0698-3158	4
12.1	0757-0379	1	562	0757-0417	8	26.1K	0698-3159	5
13.3	0698-3427	0	619	0757-0418	9	28.7K	0698-3449	6
14.7	0698-3428	1	681	0757-0419	0	31.6K	0698-3160	8
16.2	0757-0382	6	750	0757-0420	3	34.8K	0757-0123	3
17.8	0757-0294	9	825	0757-0421	4	38.3K	0698-3161	9
19.6	0698-3429	2	909	0757-0422	5	42.2K	0698-3450	9
21.5	0698-3430	5	1.0K	0757-0280	3	46.4K	0698-3162	0
23.7	0698-3431	6	1.1K	0757-0424	7	51.1K	0757-0458	7
26.1	0698-3432	7	1.21K	0757-0274	5	56.2K	0757-0459	8
28.7	0698-3433	8	1.33K	0757-0317	7	61.9K	0757-0460	1
31.6	0757-0180	2	1.47K	0757-1094	9	68.1K	0757-0461	2
34.8	0698-3434	9	1.62K	0757-0428	1	75.0K	0757-0462	3
38.3	0698-3435	0	1.78K	0757-0278	9	82.5K	0757-0463	4
42.2	0757-0316	6	1.96K	0698-0083	8	90.9K	0757-0464	5
46.4	0698-4037	0	2.15K	0698-0084	9	100K	0757-0465	6
51.1	0757-0394	0	2.37K	0698-3150	6	110K	0757-0466	7
56.2	0757-0395	1	2.61K	0698-0085	0	121K	0757-0467	8
61.9	0757-0276	7	2.87K	0698-3151	7	133K	0698-3451	0
68.1	0757-0397	3	3.16K	0757-0279	0	147K	0698-3452	1
75.0	0757-0398	4	3.48K	0698-3152	8	162K	0757-0470	3
82.5	0757-0399	5	3.83K	0698-3153	9	178K	0698-3243	8
90.0	0757-0400	9	4.22K	0698-3154	0	196K	0698-3453	2
100	0757-0401	0	4.64K	0698-3155	1	215K	0698-3454	3
110	0757-0402	1	5.11K	0757-0438	3	237K	0698-3266	5
121	0757-0403	2	5.62K	0757-0200	7	261K	0698-3455	4
133	0698-3437	2	6.19K	0757-0290	5	287K	0698-3456	5
147	0698-3438	3	6.81K	0757-0439	4	316K	0698-3457	6
162	0757-0405	4	7.50K	0757-0440	7	348K	0698-3458	7
178	0698-3439	4	8.25K	0757-0441	8	383K	0698-3459	8
196	0698-3440	7	9.09K	0757-0288	1	422K	0698-3460	1
215	0698-3441	8	10.0K	0757-0442	9	464K	0698-3260	9
237	0698-3442	9	11.0K	0757-0443	0			
261	0698-3132	4	12.1K	0757-0444	1			
287	0698-3443	0	13.3K	0757-0289	2			
316	0698-3444	1	14.7K	0698-3156	2			
348	0698-3445	2	16.2K	0757-0447	4			
383	0698-3446	3	17.8K	0698-3136	8			
422	0698-3447	4	19.6K	0698-3157	3			

Table 5-5. HP Part Numbers of Standard Value Components (3 of 4)

RESISTORS

RANGE: 10 to 1.47M Ohms
TYPE: Fixed-Film
WATTAGE: .5 at 125°C
TOLERANCE: ±1%

Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D
10.0	0757-0984	4	215	0698-3401	0	4.64K	0698-3348	4	110K	0757-0859	2
11.0	0575-0985	5	237	0698-3102	8	5.11K	0757-0833	2	121K	0757-0860	5
12.1	0757-0986	6	261	0757-1090	5	5.62K	0757-0834	3	133K	0757-0310	0
13.3	0757-0001	6	287	0757-1092	7	6.19K	0757-0196	0	147K	0698-3175	5
14.7	0698-3388	2	316	0698-3402	1	6.81K	0757-0835	4	162K	0757-0130	2
16.2	0757-0989	9	348	0698-3403	2	7.50K	0757-0836	5	178K	0757-0129	9
17.8	0698-3389	3	383	0698-3404	3	8.25K	0757-0837	6	196K	0757-0063	0
19.6	0698-3390	6	422	0698-3405	4	9.09K	0757-0838	7	215K	0757-0127	7
21.5	0698-3391	7	464	0698-0090	7	10.0K	0757-0839	8	237K	0698-3424	7
23.7	0698-3392	8	511	0757-0814	9	12.1K	0757-0841	2	261K	0757-0064	1
26.1	0757-0003	8	562	0757-0815	0	13.3K	0698-3413	4	287K	0757-0154	0
28.7	0698-3393	9	619	0757-0158	4	14.7K	0698-3414	5	316K	0698-3425	8
31.6	0698-3394	0	681	0757-0816	1	16.2K	0757-0844	5	348K	0757-0195	9
34.8	0698-3395	1	750	0757-0817	2	17.8K	0698-0025	8	383K	0757-0133	5
38.3	0698-3396	2	825	0757-0818	3	19.6K	0698-3415	6	422K	0757-0134	6
42.2	0698-3397	3	909	0757-0819	4	21.5K	0698-3416	7	464K	0698-3426	9
46.4	0698-3398	4	1.00K	0757-0159	5	23.7K	0698-3417	8	511K	0757-0135	7
51.1	0757-1000	7	1.10K	0757-0820	7	26.1K	0698-3418	9	562K	0757-0868	3
56.2	0757-1001	8	1.21K	0757-0821	8	28.7K	0698-3103	9	619K	0757-0136	8
61.9	0757-1002	9	1.33K	0698-3406	5	31.6K	0698-3419	0	681K	0757-0869	4
68.1	0757-0794	4	1.47K	0757-1078	9	34.8K	0698-3420	3	750K	0757-0137	9
75.0	0757-0795	5	1.62K	0757-0873	0	38.3K	0698-3421	4	825K	0757-0870	7
82.5	0757-0796	6	1.78K	0698-0089	4	42.2K	0698-3422	5	909K	0757-0138	0
90.0	0757-0797	7	1.96K	0698-3407	6	46.4K	0698-3423	6	1M	0757-0059	4
100	0757-0198	2	2.15K	0698-3408	7	51.1K	0757-0853	6	1.1M	0757-0139	1
110	0757-0798	8	2.37K	0698-3409	8	56.2K	0757-0854	7	1.21M	0757-0871	8
121	0757-0799	9	2.61K	0698-0024	7	61.9K	0757-0309	7	1.33M	0757-0194	8
133	0698-3399	5	2.87K	0698-3101	7	68.1K	0757-0855	8	1.47M	0698-3464	5
147	0698-3400	9	3.16K	0698-3410	1	75.0K	0757-0856	9			
162	0757-0802	5	3.48K	0698-3411	2	82.5K	0757-0857	0			
178	0698-3334	8	3.83K	0698-3412	3	90.9K	0757-0858	1			
196	0757-1060	9	4.22K	0698-3346	2	100K	0757-0367	7			

Table 5-5. HP Part Numbers of Standard Value Components (4 of 4)

FIXED COIL					
Tolerance: 10% Unshielded					
Value	**HP Part Number**	**C D**	**Value**	**HP Part Number**	**C D**
1 MH	9140-0137	1	390 NH	9100-2254	3
5 MH	9140-0072	3	470 NH	9100-2255	4
10 MH	9140-0131	5	560 NH	9100-2232	7
24 MH	9100-2867	4	680 NH	9140-0141	7
50 NH	9100-2891	4	820 NH	9100-2257	6
51 NH	9135-0073	3	1.2 UH	9100-2258	7
68 NH	9135-0081	3	1.8 UH	9100-2260	1
100 NH	9100-2247	4	2.2 UH	9140-0098	3
120 NH	9100-2248	5	3.3 UH	9140-0111	1
			4.7 UH	9140-0144	0
150 NH	9100-2249	6			
180 NH	9100-2250	9	5.6 UH	9100-1618	1
220 NH	9100-2251	0			
270 NH	9100-2252	1			
330 NH	9100-0368	6			

5-22. +22 VDC POWER SUPPLY, A35

Reference:

Performance Test: None
Service Section: Power Supplies

Description:

The +22V supply is adjusted for +22 Vdc.

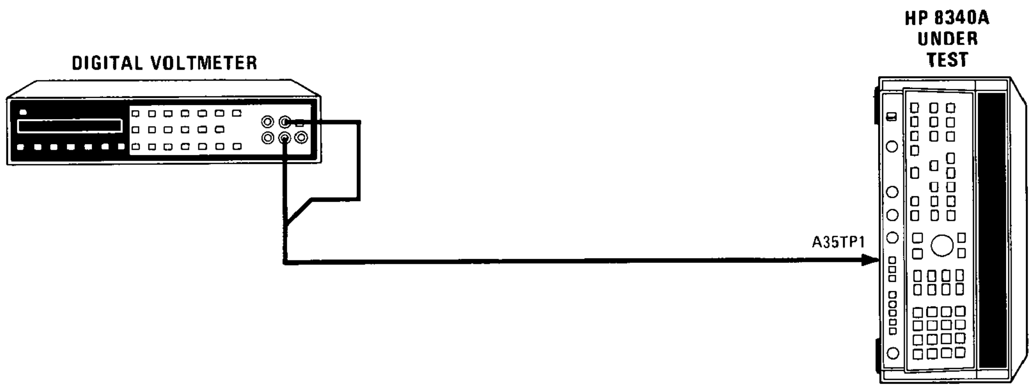


Figure 5-1. +22 Volt Power Supply Adjustments Setup

Equipment Required:

Digital Voltmeter .... HP 3455A

Procedure:

1. Position 8340A in the test position and connect equipment as shown in Figure 5-1.
2. Set LINE switch to ON.
3. The yellow +22V indicator on A35 should be lit.
4. The DVM indication should be +22.000 ±0.010 Vdc. If the indication is out of tolerance, adjust A35R3 +22 ADJ control for the specified voltage.

5-22. +22 VDC POWER SUPPLY, A35 (Cont'd)

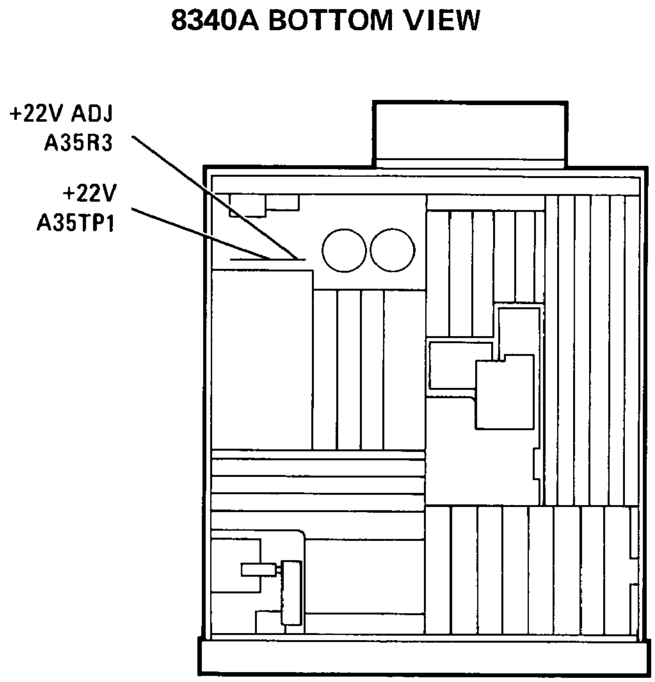


Figure 5-2. +22V Power Supply Adjustment Locations

5-23. 10 MHz STANDARD ADJUSTMENT, A51

Reference:

Performance Test: None
Service Section: Reference — M/N Loops

Description:

The internal 10 MHz time base is adjusted for frequency accuracy. This procedure does not adjust for long-term drift or aging rate. It adjusts only short-term accuracy. To properly adjust the time base, a frequency standard whose accuracy is known to be better than that of the 8340A Time Base is required. Refer to Frequency Reference specifications in Section I, Table 1-1 for aging rate specifications for the internal time base.

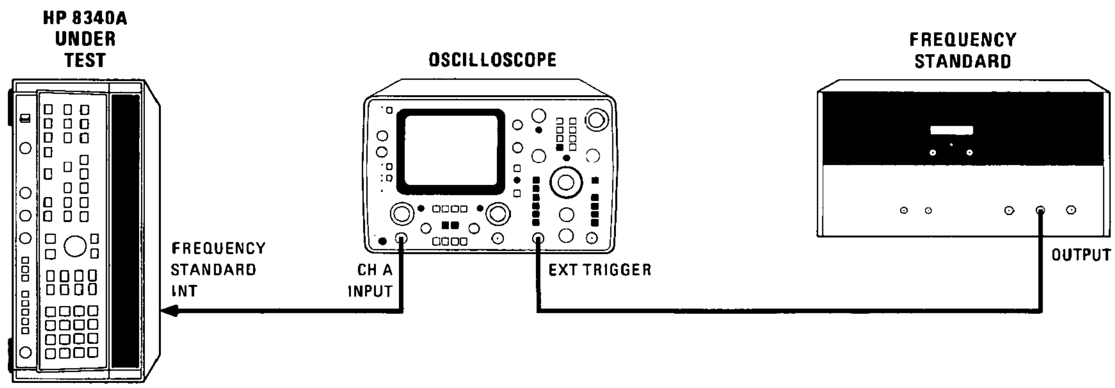


Figure 5-3. 10 MHz Standard Adjustment Setup

Equipment Required:

Oscilloscope .... HP 1741A
Frequency Standard .... any 1, 2, 5, or 10 MHz Frequency Standard with aging rate of $\pm 1x10^{-9}$/day or better such as HP 5061A

Procedure:

NOTE

Primary power must have been applied to the instrument for at least 30 days before adjusting the internal time base. If the instrument was disconnected from ac power less than 24 hours (after it had its initial 30 day warmup), the warmup time is 24 hours before adjusting internal time base.

NOTE

If front-panel red OVEN annunciator is lighted, do not make internal time base adjustments. This annunciator lights when the oven for the reference crystal oscillator is not at operating temperature. A cold oven can take 30 minutes to reach operating temperature; a warm oven that suddenly goes cold has lost power and requires service. Section VIII (Service) describes the action required to repair a faulty oven.

5-23. 10 MHz STANDARD ADJUSTMENT, A51 (Cont'd)

1. Connect equipment as shown in Figure 5-3 as follows:

   a. At the 8340A, disconnect jumper from rear-panel FREQUENCY STANDARD INT connector.

   b. Connect oscilloscope CH A to the 8340A FREQUENCY STANDARD INT connector. (If the oscilloscope being used does not have a 50 Ohm input like the Model 1741A, connect Channel A through a 50 Ohm feedthrough.)

   c. Set switch adjacent to the INT connector to INT position.

   d. Connect a frequency standard whose accuracy is known to be better than that of the internal time base, such as an HP 5061A Cesium Beam, to the EXT TRIGGER input of the oscilloscope.

   e. Set LINE switch to ON.

2. Set oscilloscope controls as follows:

TIME/DIV	0.05μsec
CHAN A VOLTS/DIV	0.5
MAG x 10 pushbutton	OUT
DISPLAY A pushbutton	IN
TRIGGER COMP A/B	A
INT/EXT trigger pushbutton	IN
EXT Divide By 10	OUT
SWEEP VERNIER control	CAL
TRIGGER HOLDOFF	Fully Counterclockwise
AC/DC trigger pushbutton	OUT (AC)
POS/NEG trigger pushbutton	OUT (POS)
Main TRIGGER LEVEL control	Centered

3. Adjust Main TRIGGER LEVEL control as necessary to display sine-wave signal on oscilloscope.

4. Remove dust cap screws used to seal the adjustments from A51 10 MHz Standard.

5. Adjust A51 COARSE frequency adjust for minimum sideways movement of the displayed signal. Adjust A51 FINE frequency adjust for no sideways movement of displayed signal. Refer to Figure 5-4 for location of A51 10 MHz Standard.

6. Observe the sine wave signal on the oscilloscope for 100 seconds. The sine wave trace should move less than 1 cycle or 360 degrees.

7. Disconnect oscilloscope and reinstall dust cover screws over A51 adjustments. Reconnect rear panel cable between FREQUENCY STANDARD INT and EXT connectors.

5-23. 10 MHz STANDARD ADJUSTMENT, A51 (Cont'd)

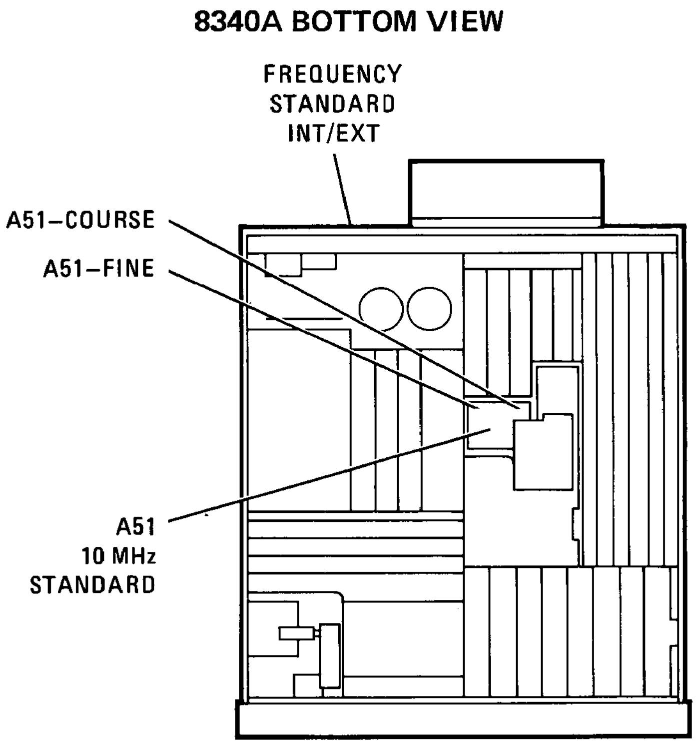


Figure 5-4. 10 MHz Standard Adjustments Location

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5-25. 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO), A30

Reference:

Performance Test: None
Service Section: Reference — M/N Loops

Description:

The open loop frequency and maximum power output of the 100 MHz VCXO is centered around 100 MHz. The 400 MHz signal is adjusted for maximum 400 MHz output with minimum spurious output. The 400 MHz output is set to −10 dBm by selecting proper resistor values for the attenuator network A30R67, R68, and R69.

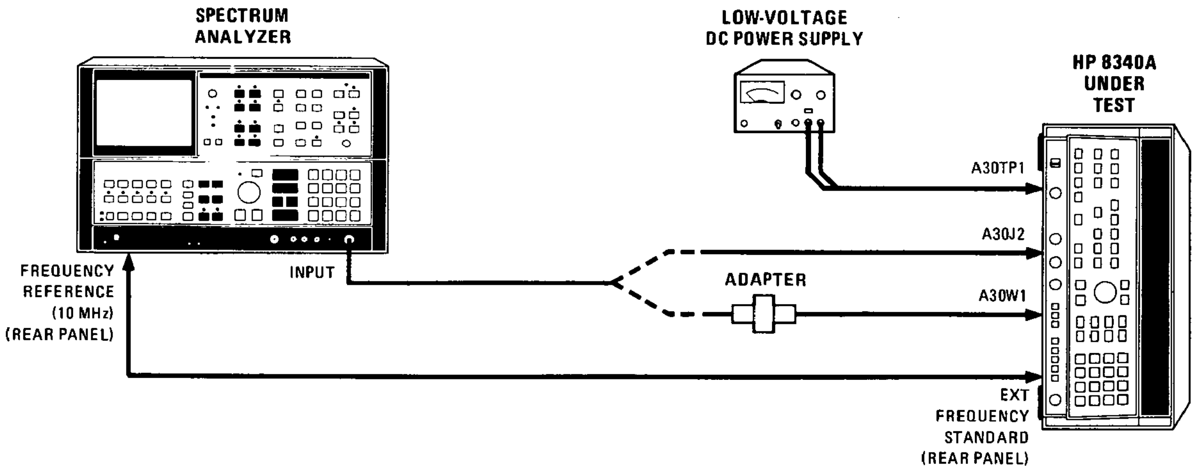


Figure 5-6. 100 MHz VCXO Adjustment Setup

Equipment Required:

Spectrum Analyzer	HP 8566A
Low-Voltage DC Power Supply	HP 6294A
BNC to SMB Snap-On Test Cable (2 required)	HP P/N 85680-60093
Adapter, SMB Snap-On Male-to-Male	HP P/N 1250-0069

Procedure:

1. Position 8340A in the Test Position as shown in Figure 5-6 with bottom cover removed. Connect equipment as shown in Figure 5-6. On the 8340A rear panel, disconnect BNC cable connected between INT and EXT Frequency Standard connectors, set INT/EXT switch to EXT, then connect cable from EXT connector to Spectrum Analyzer Frequency Reference (10 MHz) rear-panel connector. Allow instruments to warm up for one-half hour.

5-25. 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO), A30 (Cont'd)

2. Set Spectrum Analyzer controls as follows:

CENTER FREQ	100 MHz
REF LEVEL	3 dBm
ATTEN	+20 dB
LOG SCALE	1 dB/DIV
RES BW	300 Hz
VBW	300 Hz
FREQ SPAN	20 KHz
SWEEP TIME	1 SEC.
MARKER ENTRY	Press PEAK SEARCH
MARKER ENTRY	Press MKR→CF
MARKER MODE	Press SIGNAL TRACK

100 MHz OUTPUT ADJUSTMENT

3. Set LINE switch to ON and press **[INSTR PRESET]**.

4. At rear panel of 8340A, disconnect 10 MHz Frequency Standard cable at EXT FREQUENCY STANDARD connector.

5. Jumper −10 Vdc from A53TP5 (−10V) to A30TP1 TUNE test point. Refer to Figure 5-7 for location of A30 and adjustments.

8340A BOTTOM VIEW

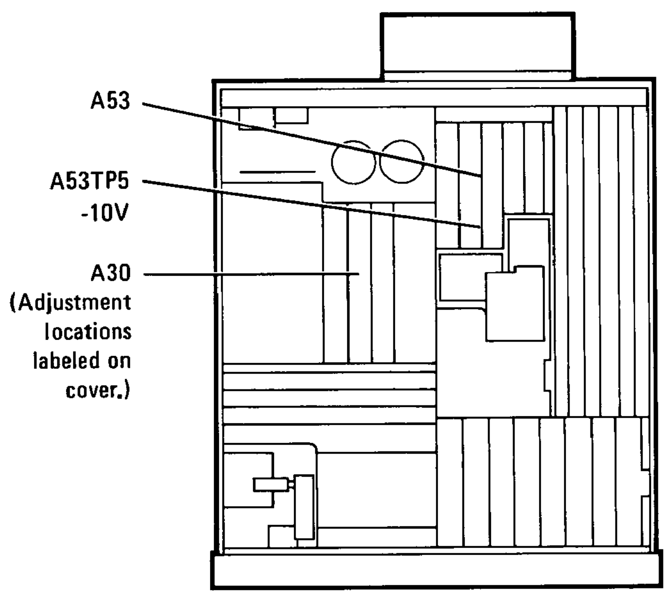


Figure 5-7. Location of A30 100 MHz VCXO Adjustments

5-25. 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO), A30 (Cont'd)

6. Disconnect cable W35 from A30J2 100 MHz OUT. Connect Spectrum Analyzer RF Input to A30J2.

7. Adjust A30C4 100 MHz ADJ through its full range while monitoring frequency indication on Spectrum Analyzer. Adjustment should provide a minimum adjustment range of plus and minus 300 Hz centered about 100 MHz. If adjustment does not provide sufficient range, select new values for factory selected components A30C8 and A30L4. A30L4 is used to center the adjustment about 100 MHz and A30C8 is used to adjust the range of A30C4. Refer to Table 5-3 for range of values. Refer to Table 5-5 for HP Part Numbers.

8. Adjust A30C4 100 MHz ADJ for Spectrum Analyzer indication of 100.0000 MHz ±0.0001 MHz.

9. Disconnect cable A30W1 at A31J1 400 MHz IN and connect the open end of this cable (A30W1) to the Spectrum Analyzer input using a BNC to SMB Snap-on test cable and SMB male-to-male adapter. Set Spectrum Analyzer controls to view a 400 MHz signal.

10. The 400 MHz output should be −10 dBm ±3 dB.

11. Disconnect jumper from −10 Vdc at A53TP5 and connect the jumper from A30TP1 TUNE test point to ground. Connect Spectrum Analyzer to A30J2. Adjust Spectrum Analyzer to view 100 MHz.

12. Frequency indication on Spectrum Analyzer should be less than 100 MHz. If not, repeat Steps 6 and 7.

13. Remove the jumper from A30TP1 to ground and connect A30TP1 TUNE to the output of an external low-voltage DC power supply. Set power supply for an output of −25 Vdc. Verify TUNE test point A30TP1 is at −25 Vdc.

14. Frequency indication on Spectrum Analyzer should be greater than 100 MHz. If not, repeat Steps 6 and 7 and verify that the oscillator range is 100 MHz ±300 Hz. Disconnect power supply from A30TP1. Reconnect 10 MHz signal cable from Spectrum Analyzer to 8340A rear-panel EXT FREQUENCY STANDARD.

400 MHz OUTPUT ADJUSTMENT

15. Set Spectrum Analyzer to 500 MHz center frequency and 100 MHz frequency span per division.

16. Connect Spectrum Analyzer to A30W1 cable. Adjust A30C3, A30C2, and A30C1 400 MHz adjustments, in that order, to maximize the 400 MHz signal and minimize all harmonics of 100 MHz. Harmonics at 100, 300, 500, 600, 700, and 900 MHz must be greater than 40 dB down from the 400 MHz signal. Harmonics at 200 MHz must be greater than 25 dB down from the 400 MHz signal. Harmonics at 800 MHz must be greater than 15 dB down from the 400 MHz signal. It may be necessary to perform the adjustments more than once. This should be done in the order stated each time through the adjustments.

5-25. 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO), A30 (Cont'd)

17. The amplitude of the 400 MHz signal should be −10 dBm ±3 dB. This amplitude is set by selecting attenuator network resistors A30R67, A30R68, and A30R69.

Table 5-6. Selection Chart for Attenuator Resistors

Attenuation (dB)		Resistors (Ohms)	
	R67	R68	R69
0	Open	Short	Open
1	825	6.8	825
2	422	12.1	422
3	261	17.8	261
4	215	23.7	215
5	178	31.6	178
6	162	38.3	162
7	133	46.4	133
8	121	51.1	121
9	110	61.9	110

NOTE

HP Part Numbers for resistors may be found in Table 5-5.

18. If the amplitude of the 400 MHz signal is not within 3 dB of −10 dBm, note the amplitude and change the values of A30R67, A30R68, and A30R69 as necessary to adjust the amplitude to −10 dBm ±3 dB. Table 5-6 contains a list of attenuations in 1 dB steps and the corresponding values for the attenuator network resistors to adjust the level to −10 dBm. Refer to A30 service section for location of resistors.

19. Check the level of the 100 MHz harmonics as displayed on the Spectrum Analyzer. Harmonics at 100, 300, 500, 600, 700, and 900 MHz must be greater than 40 dB down from the 400 MHz signal. Harmonics at 200 MHz must be greater than 25 dB down from the 400 MHz signal. Harmonics at 800 MHz must be greater than 15 dB down from the 400 MHz signal. If not, repeat step 15.

20. Set the 8340A LINE switch to STANDBY. Disconnect equipment from 8340A and reconnect the two cables. Disconnect the 10 MHz Frequency Standard cable at the rear of the 8340A, reconnect jumper cable between INT and EXT, and set switch to INT. Set 8340A LINE switch to ON.

5-26. M/N LOOP, A32, A33, AND A32A1

Reference:

Performance Test: Frequency Range and CW Mode Accuracy
Service Section: Reference - M/N Loops

Description:

The M/N VCO tuning range is centered and the output level is set and checked to ensure an adequate RF output level across the band of the M/N output.

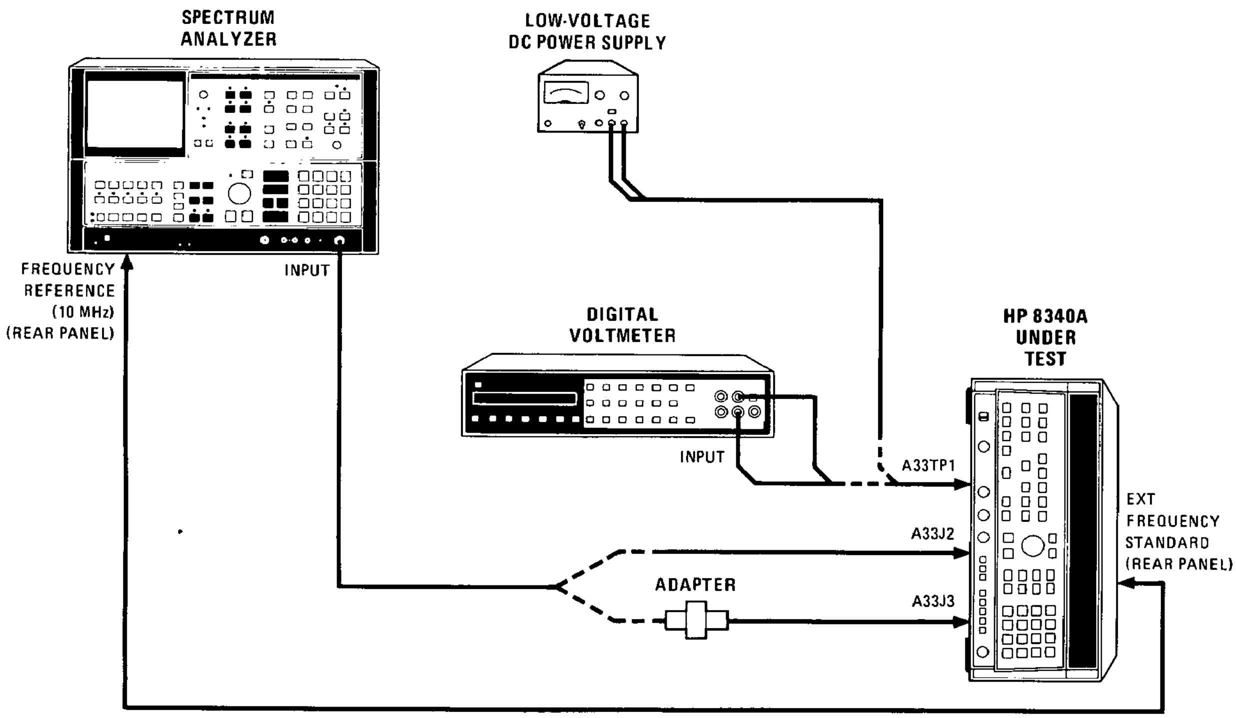


Figure 5-8. M/N Loop Adjustment Setup

Equipment Required:

Spectrum Analyzer	HP 8566A
Digital Voltmeter (DVM)	HP 3455A
Low-Voltage DC Power Supply	HP 6294A
BNC to SMB Snap-On Test Cable	HP P/N 85680-60093
Adapter, SMB Snap-On Male-to-Male	HP P/N 1250-0069

Procedure:

1. Position the 8340A in the test position as shown in Figure 5—8 with bottom cover removed. Connect equipment as shown in Figure 5-8. On the 8340A rear panel, disconnect BNC cable connected between INT and EXT Frequency Standard connectors, set INT/EXT switch to EXT, then connect cable from EXT connector to Spectrum Analyzer Frequency Reference (10 MHz) rear-panel connector. Allow one—half hour warm up time.

5-26. M/N LOOP, A32, A33, AND A32A1 (Cont'd)

2. Set LINE switch to ON and press **[INSTR PRESET]**. Connect jumper between A59TP4 DLI and A59TP5 +5V to disable the UNLK indicator circuit.

3. Disconnect cable from A33J2 M/N OUT and connect this output to Spectrum Analyzer RF INPUT. Set Spectrum Analyzer as follows:

CENTER FREQ	197.419
REF LEVEL	3 dBm
ATTEN	+20 dB
LOG SCALE	1 dB/DIV
RES BW	300 Hz
VBW	300 Hz
FREQ SPAN	5 KHz
SWEEP TIME	1 SEC.
MARKER ENTRY	Press PEAK SEARCH
MARKER ENTRY	Press MKR→CF
MARKER MODE	Press SIGNAL TRACK

4. Press 8340A **[CW]** then enter **[6] [0] [9] [0] [MHz]**.

5. The M/N output frequency indicated on Spectrum Analyzer should be 197.419 MHz ±1 count.

NOTE

To display the frequencies that the processor programs, press 8340A under Test [SHIFT][M1]. It will display from left to right: the M divide number, the N divide number, the M/N output frequency, and the 20/30 output frequency.

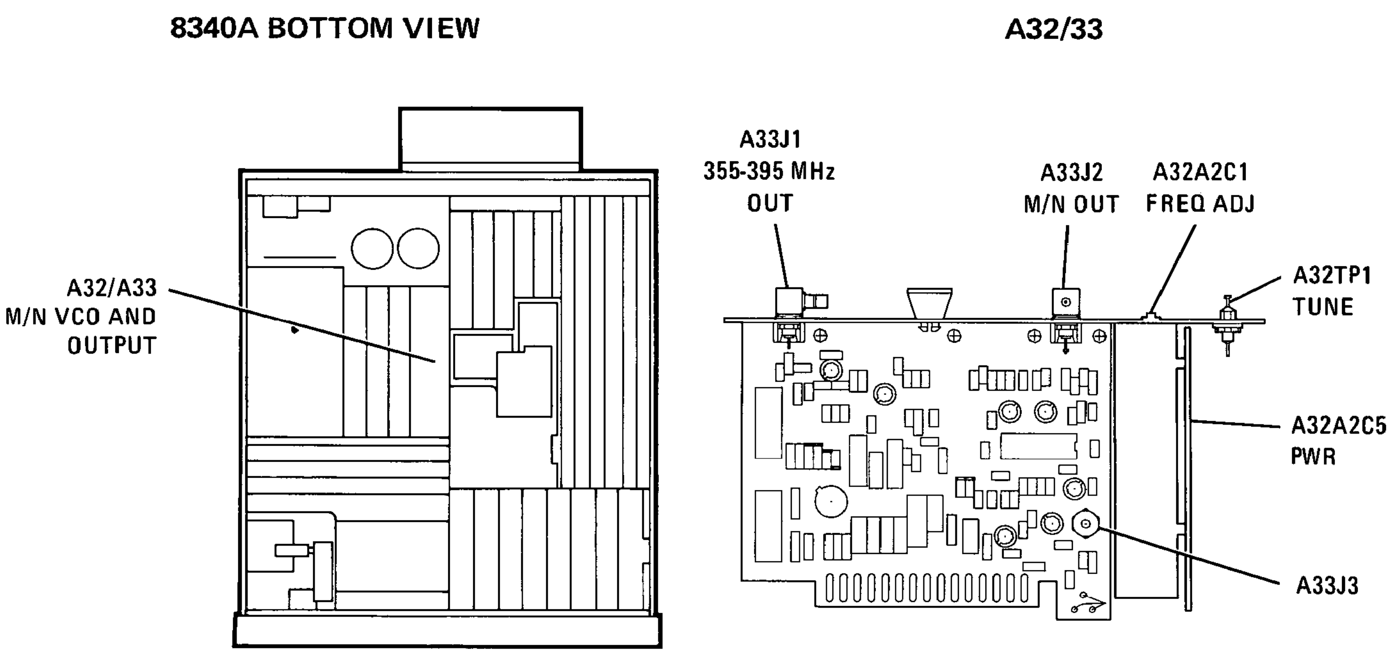


Figure 5-9. Location of M/N Loop Adjustments

5-26. M/N LOOP, A32, A33, AND A32A1 (Cont'd)

6. Connect DVM to A32TP1 TUNE test point. Refer to Figure 5-9 for location of A32 assembly.

7. Loosen locknut on A32A2C1 FREQ ADJ control and adjust A32A2C1 for DVM reading of −35.0 Vdc ±0.5 Vdc. Retighten A32A2C1 locknut. Verify that DVM reading is still within tolerance.

8. Press 8340A **[CW]** then enter **[2] [3] [0] [0] [MHz]**.

9. Set Spectrum Analyzer for Center Frequency of 179.230 MHz. Frequency indicated on Spectrum Analyzer should be 179.230 MHz ±1 count and the DVM should read −2.8 Vdc ±0.5 Vdc.

10. Set 8340A LINE switch to STANDBY.

11. Disconnect DVM from A32 assembly. Remove A32/A33 assembly from instrument and place on extender board.

12. Disconnect A32 output cable A32A1W1 from A33J3 (Figure 5-9) and connect this cable using SMB male-to-male adapter to the input of the Spectrum Analyzer. Set 8340A LINE switch to ON and press **[INSTR PRESET]** pushbutton.

13. Set Spectrum Analyzer Center Frequency to 375 MHz, Frequency Span to 10 MHz/Division, and Reference Level to +5 dBm.

CAUTION

Do not apply a positive voltage to A32TP1 or damage may occur to the VCO tuning diodes.

14. Connect the low-voltage power supply to the 8340A as follows: Positive lead to ground (do this first). Negative lead to A32TP1 TUNE test point. Set the output of the supply for −35.0 Vdc ±0.5 Vdc.

15. Adjust A32A2C5 PWR for a VCO output level of 0 dBm ±2 dB as indicated on Spectrum Analyzer. Refer to Figure 5-9 for location of adjustment.

16. Slowly reduce the dc voltage output of the external low-voltage power supply connected to A32TP1 TUNE test point while monitoring the VCO output level on the Spectrum Analyzer and voltage level on DVM.

17. The VCO output level should be greater than −2 dBm between 395 MHz (−35 Vdc) and 355 MHz (−2.8 Vdc).

18. Repeat Steps 2 through 9 to check frequency accuracy.

19. Set 8340A LINE switch to STANDBY. Disconnect all test equipment from A32/A33 assembly. Reconnect cable A32A1W1 to A33J3.

20. Reinstall A32/A33 M/N Output Assembly in instrument and remove jumper from A59TP4 to A59TP5 (UNLK indicator disable).

21. Disconnect cable from 8340A rear-panel EXT FREQUENCY STANDARD, reconnect BNC cable between INT and EXT connectors, and set adjacent switch to INT.

5-27. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43

Reference:

Performance Test: Frequency Range and CW Mode Accuracy
Service Section: 20/30 Loops

Description:

Phase Lock Loop 2 is adjusted by selecting a very narrow span width and adjusting A40 and A43 for proper voltages at designated test points. If PLL2 will not phase lock (UNLK indicator is lit and **[SHIFT] [EXT]** diagnostic indicates N2 is at fault), the A41 PLL2 Phase Detector must be disabled and a slightly different procedure used to initially set the A40 and A43 adjustments.

Phase Lock Loop 3 is adjusted for maximum multiplier output level at 160 MHz. The VCO is adjusted by setting up proper voltage levels at A39TP3.

Phase Lock Loop 1 40 kHz LPF is properly adjusted using a function generator and spectrum analyzer with an active probe. The response of PLL1 is adjusted for maximum rejection of signals between 160 and 166 MHz using a signal generator and spectrum analyzer.

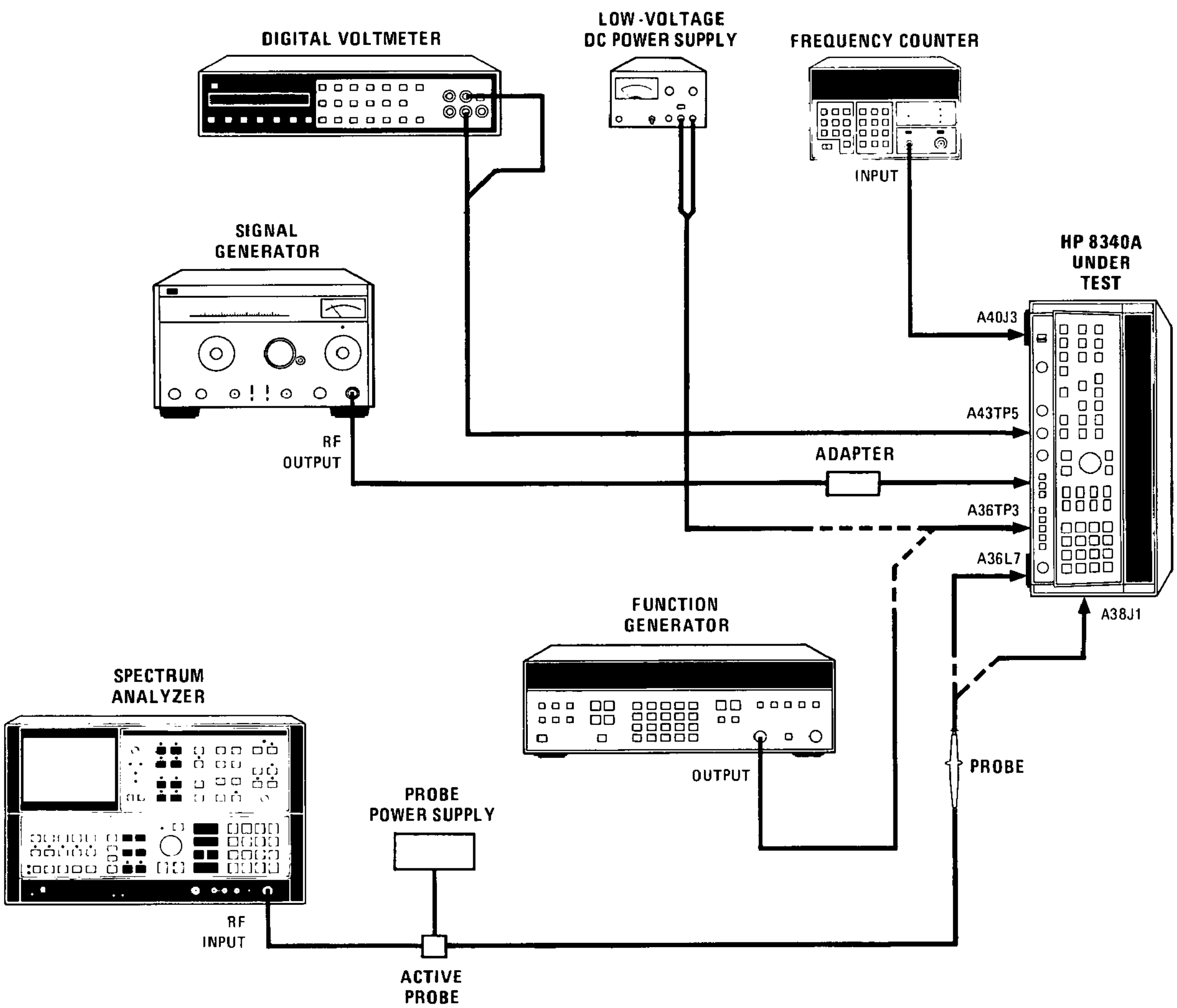


Figure 5-10. 20/30 Loop Phase Lock Adjustments Setup

5-27. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

Equipment Required:

Spectrum Analyzer	HP 8566A
Active Probe	HP 1121A
Probe Power Supply	HP 1122A
Signal Generator	HP 8654A
Low-Voltage DC Power Supply	HP 6294A
Digital Voltmeter (DVM)	HP 3455A
Function Generator	HP 3325A
BNC to SMB Snap-On Test Cable	HP 85680-60093
Adapter, SMB Snap-On Male-to-Male	HP 1250-0069

Procedure:

PHASE LOCK LOOP 2

NOTE

If PLL2 is phase locked (UNLK annunciator not lit), proceed to step 12. If the UNLK annunciator is lit, determine if PLL2 (N2) is phase locked as follows: (a) Press [SHIFT] then [EXT], (b) Observe ENTRY display and if N2 is blinking, PLL2 is unlocked. With PLL2 unlocked, proceed to step 1. If some other oscillator circuit caused the UNLK indication, proceed to step 12.

1. Position 8340A in test position as shown in Figure 5-10 with bottom cover removed. Connect equipment as shown in Figure 5-10 and allow one-half hour warm up time. Set LINE switch to STANDBY. Remove A41 PLL2 Phase Detector from its connector on the motherboard. (It is not necessary to completely remove the A41 assembly from the instrument.)

2. Set LINE switch to ON and press **[INSTR PRESET]**.

3. Remove cable from A40J3 .15−6MHz OUT FOR ΔF ≤.1 MHZ and connect Frequency Counter to A40J3 using BNC to SMB snap-on test cable.

4. Press **[CW]** then enter **[3] [0] [MHz]** to set the N2 oscillator to 150 MHz.

5. Connect DVM to A43TP5 VCO TUNE located on top cover of A43.

6. Adjust A40R2 150 MHz adjustment for a DVM indication of +3.0 Vdc ±0.5 Vdc. Refer to Figure 5-11 for location of adjustments.

7. Adjust A43R9 .3 MHz adjustment for a Frequency Counter indication of 0.300 MHz ±0.001 MHz (N2 frequency divided by 500).

8. Press **[CW]** then enter **[1] [9] [.] [9] [9] [9] [9] [9] [9] [MHz]** to set the N2 oscillator to 100 MHz.

9. Adjust A40R4 100 MHz adjustment for a DVM indication of +15.0 Vdc ±0.5 Vdc.

10. Adjust A43R41 .2 MHz adjustment for a Frequency Counter indication of 0.200 MHz ±0.001 MHz (N2 frequency divided by 500).

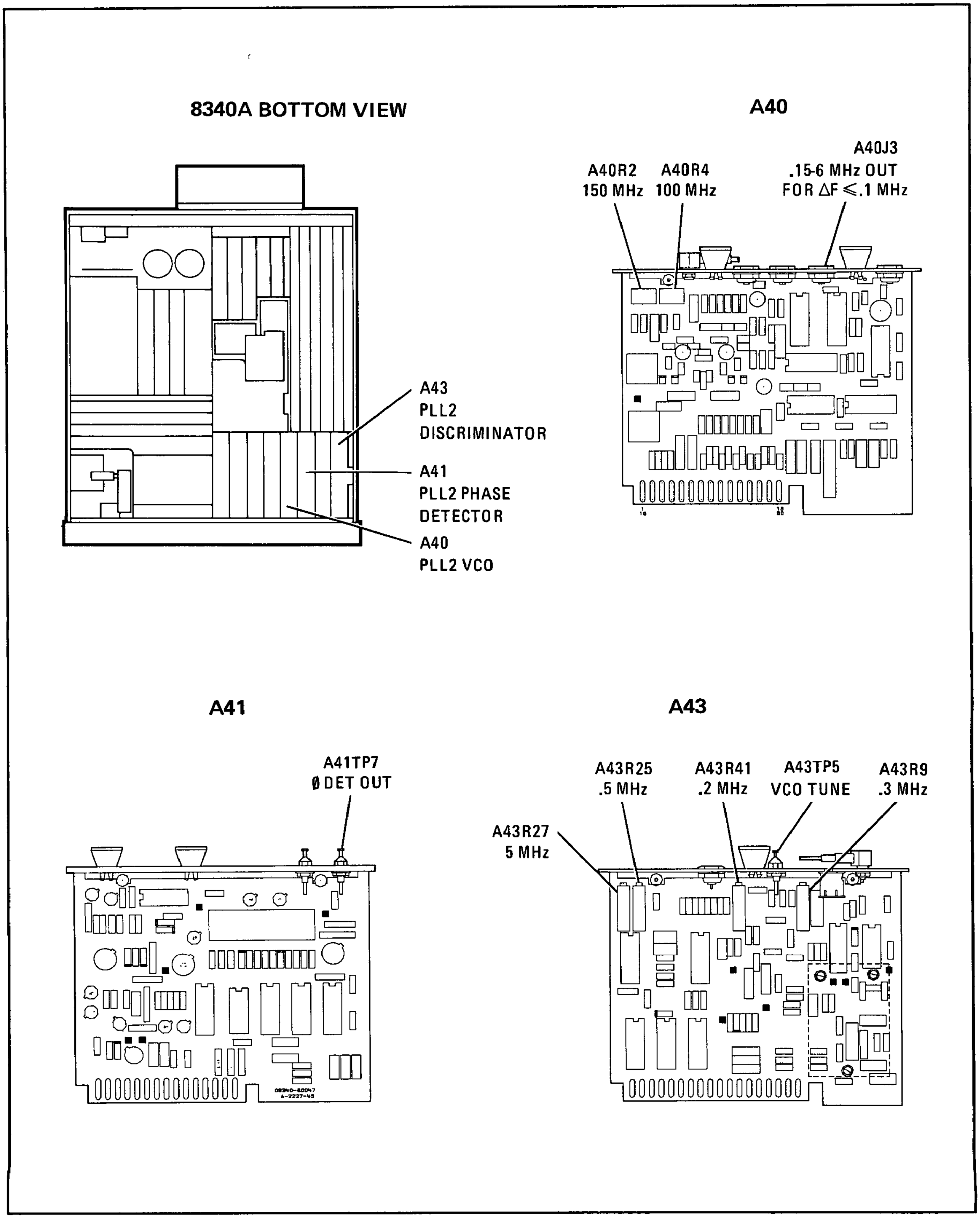


Figure 5-11. Location of PLL2 Adjustments

5-27. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

11. Set LINE switch to STANDBY. Reinstall A41 PLL2 Phase Detector. Disconnect Frequency Counter from A40J3 and reconnect A39W1 cable to A40J3 (.15−6MHz OUT FOR ΔF ≤.1 MHz) connector.

12. Set LINE switch to ON. Press **[INSTR PRESET]**.

13. Press **[CW]** then enter **[3] [0] [MHz]** to set the N2 oscillator to 150 MHz.

14. Connect DVM to A43TP5 VCO TUNE located on top cover of A43.

15. Adjust A40R2 150 MHz adjustment for a DVM indication of +3.00 Vdc ±0.05 Vdc.

16. Connect DVM to A41TP7 φ DET OUT on top cover of A41.

17. Adjust A43R9 .3 MHz adjustment for a DVM indication of +3.50 Vdc ±0.05 Vdc.

18. Press **[CW]** then enter **[1] [9] [.] [9] [9] [9] [9] [9] [9] [MHz]** to set the N2 oscillator to 100 MHz.

19. Connect DVM to A43TP5 VCO TUNE located on top cover of A43.

20. Adjust A40R4 100 MHz adjustment for a DVM indication of +15.00 Vdc ±0.05 Vdc.

21. Connect DVM to A41TP7 φ DET OUT located on top cover of A41.

22. Adjust A43R41 .2 MHz adjustment for a DVM indication of 3.50 Vdc ±0.05 Vdc.

23. Repeat Steps 12 through 22 until no further adjustment is required.

24. Set 8566A Spectrum Analyzer as follows:

    a. Press **[INSTR PRESET]**
    b. Set CENTER FREQ to 29.5 MHz
    c. Set SPAN to 200 kHz

25. Connect jumper between A59TP4 DL1 and A59TP5 +5V to disable the UNLK indicator circuit.

26. Set 8340A as follows:

    a. Press **[INSTR PRESET]**
    b. Press **[START FREQ]** then enter **[2] [0] [MHz]**
    c. Press **[STOP FREQ]** then enter **[2] [0] [.] [5] [MHz]**
    d. Press **[SHIFT]**, then **[XTAL]** (This stops frequency at end of sweep without retrace.)
    e. Press **[SINGLE]** Sweep

27. Disconnect cable W39 from A36J1 OUT 20−30 MHz and connect Spectrum Analyzer RF INPUT to A36J1 through an SMB snap-on to BNC cable. Adjust A43R25 0.5 MHz ΔF to center the signal on the Spectrum Analyzer screen.

5-27. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

28. Set 8566A Spectrum Analyzer as follows:

    a. Set CENTER FREQ to 25 MHz
    b. Set SPAN to 500 kHz

29. Set 8340A as follows:

    a. Press **[INSTR PRESET]**
    b. Press **[START FREQ]** then enter **[2] [0] [MHz]**
    c. Press **[STOP FREQ]** then enter **[2] [5] [MHz]**
    d. Press **[SHIFT]**, then **[XTAL]**
    e. Press **[SINGLE]** Sweep

30. Adjust A43R27 5 MHz ΔF to center the signal on the Spectrum Analyzer screen.

31. Disconnect Spectrum Analyzer from A36J1 and reconnect W39 to A36J1 OUT 20–30 MHz.

PHASE LOCK LOOP 3

32. Set LINE switch to STANDBY. Remove A39 PLL3 Up Converter and install it on extender board.

33. Set LINE switch to ON. Press **[INSTR PRESET]**. Press **[CW]** then enter **[5] [GHz]**. Press **[SHIFT] [M3]** to display the PLL2 and PLL3 frequencies.

34. Connect Spectrum Analyzer to Test Connector A39J3 on P.C. board. Tune Spectrum Analyzer center frequency to 160 MHz. Set reference level to −20 dBm and set scale to 1 dB per division.

35. Adjust A39L16, A39L17, and A39C50 160 MHz PEAK for maximum signal level at 160 MHz. Iteration of L16 and L17 adjustment may be necessary. Refer to Figure 5-12 for location of adjustments.

    If A39C50 does not have sufficient range, select the value of A39C49 for proper range. (Refer to Table 5-3.)

36. At the 8340A, select the following:

    a. Press **[CF]** then enter **[6] [.] [6] [2] [7] [2] [5] [0] [GHz]**.
    b. Press **[ΔF]** then enter **[1] [0] [0] [kHz]**.
    c. Press **[SINGLE]** SWEEP.

37. Tune Spectrum Analyzer to a center frequency of 6 MHz. Set scale to 10 dB per division.

38. The 6 MHz signal displayed should be at least −42 dBm. If not, repeat Steps 33 through 37.

39. Connect DVM to A39TP3.

40. Adjust A39L11 PLL3 VCO ADJ for DVM indication of −7.0 Vdc ±0.1 Vdc. The voltage may not change with initial adjustment but will change once the phase lock loop locks.

5-27. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

41. Press 8340A **[CF]** then enter **[5] [GHz]**. Press **[SINGLE]** SWEEP pushbutton to initiate a sweep.

42. DVM indication should be −3.0 Vdc ±0.5 Vdc.

43. Set LINE switch to STANDBY. Disconnect test equipment and reinstall A39 PLL3 Up Converter in instrument.

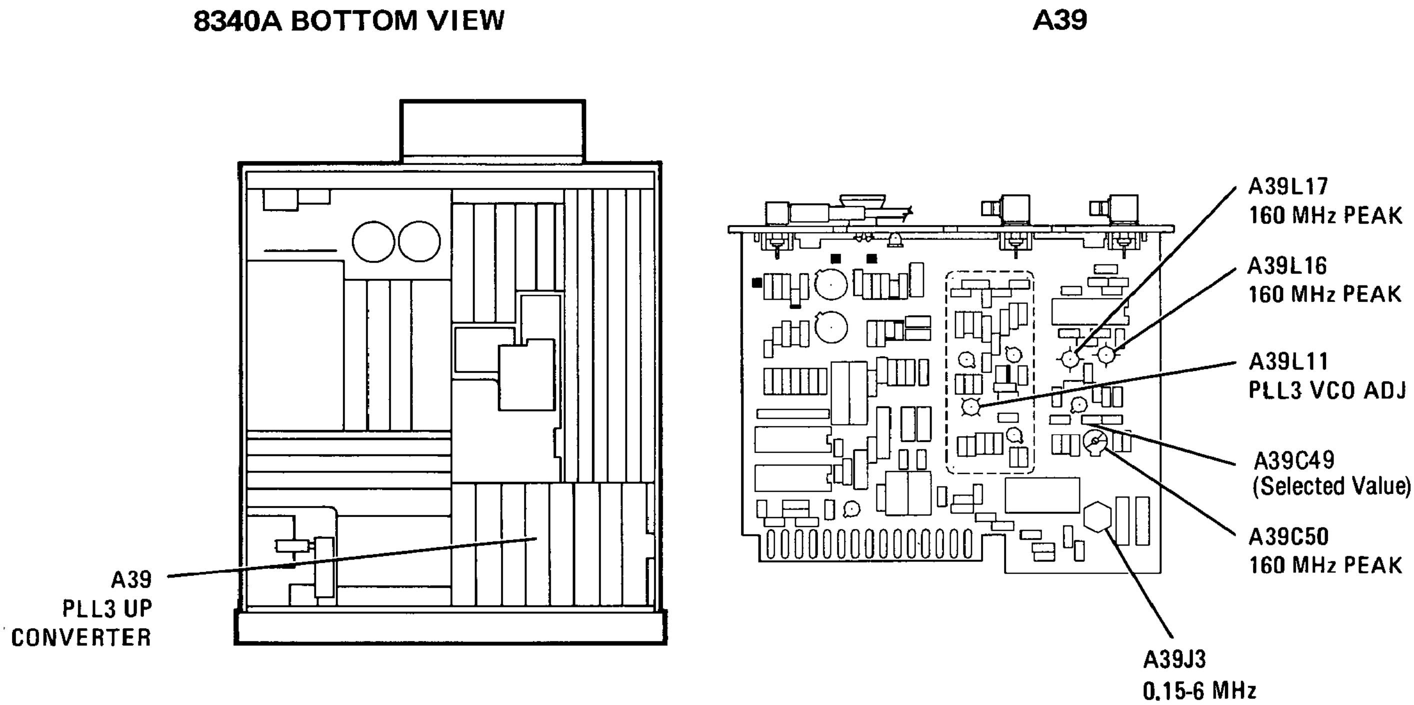


Figure 5-12. Location of PLL3 Adjustments

PHASE LOCK LOOP 1

44. Set LINE switch to STANDBY. Place A36 PLL1 VCO on an extender board. Remove all cables connected to A36.

45. Set Function Generator controls as follows:

FUNCTION	Sine Wave
FREQ	20 kHz
AMPL	−7.7 dBm

5-27. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

46. Set Spectrum Analyzer controls as follows:

INSTR PRESET	Press
START FREQ	10 kHz
STOP FREQ	60 kHz
REFERENCE LINE	0 dBm
RES BW	300 Hz
VIDEO BW	1 kHz
SWEEP TIME	1.2 SEC
SCALE	10 dB/DIV
MARKER MODE	NORMAL

47. Set Spectrum Analyzer Marker to 20 kHz.

48. Connect active probe to Spectrum Analyzer input and connect probe to output of 40 kHz LPF on A36 (see Figure 5-13). (This is the terminal on A36L7 next to A36C24.)

49. Adjust Function Generator amplitude to place the 20 kHz signal displayed on the Spectrum Analyzer at the 0 dBm reference line.

50. Set Function Generator to 50 kHz.

51. Set Spectrum Analyzer Marker to 50 kHz.

52. Adjust A36L7 and A36L8 50 kHz NULL adjustments to null the 50 kHz signal displayed on the Spectrum Analyzer. Refer to Figure 5-13 for location of adjustments.

53. Note the level of the 50 kHz signal. This level should be at least 65 dB down from the level of the 20 kHz response. Disconnect test equipment from A36 assembly.

54. Disconnect active probe from Spectrum Analyzer and connect Spectrum Analyzer input to A36J2 OUT 200−300 MHz using a BNC to SMB snap-on test cable. Set LINE switch to ON.

55. Set Spectrum Analyzer as follows:

INSTR PRESET	Press
START FREQ	150 MHz
STOP FREQ	470 MHz
REF LINE	+10 dBm
MARKER	PEAK SEARCH

56. Connect an external low-voltage dc power supply positive lead to A36TP3 and the negative lead to any convenient chassis ground. Set external power supply for +16.0 Vdc ±0.1 Vdc.

57. Oscillator frequency should be 310 MHz ±10 MHz as indicated on the Spectrum Analyzer. If not, remove metal shield from A36 assembly and increase or decrease spacing between turns of A36L4 and increase or decrease the area of the single turn of A36L5 to properly tune the oscillator.

58. Change power supply voltage to +4.0 Vdc ±0.1 Vdc.

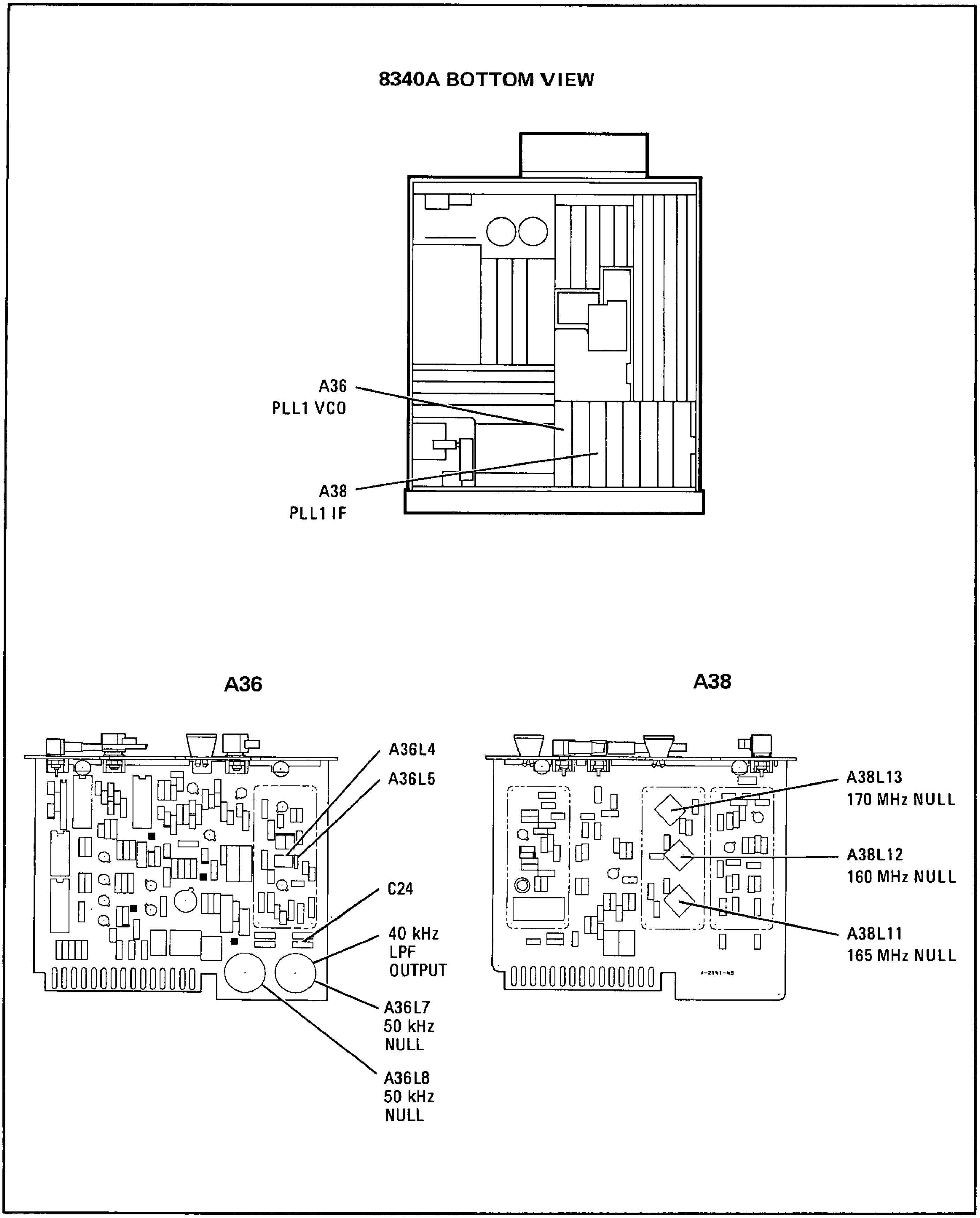


Figure 5-13. Location of PLL1 Adjustments

5-27. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

59. Oscillator frequency should drop below 200 MHz with an amplitude greater than −7 dBm.

60. Repeat Steps 56 through 59 if necessary to meet requirements.

61. Set LINE switch to STANDBY. Reinstall metal shield on A36 if removed, reinstall A36 PLL1 VCO assembly in instrument, and reconnect all cables.

62. Remove A38 PLL1 IF assembly from instrument and install it on an extender board. Connect all cables to A38.

63. Set LINE switch to ON and press **[INSTR PRESET]**. Press **[CW]** then enter **[1] [3] [.] [9] [7] [MHz]**.

64. Connect Spectrum Analyzer to A38J1 OUT PLL1 IF. Set Spectrum Analyzer controls as follows:

INSTR PRESET	Press
CENTER FREQ	170 MHz
FREQ SPAN	200 kHz
RES BW	3 kHz
VBW	3 kHz
SWP	100 ms
REF LEVEL	−10 dBm
ATT	0 dB
SCALE/DIV	10 dB/DIV
MARKER	NORMAL

65. Disconnect cable from A36J2 OUT 200−300 MHZ and connect the cable to Signal Generator using BNC to SMB snap-on test cable and adapter.

66. Adjust A38L11 165 MHz NULL, A38L12 160 MHz NULL, and A38L13 170 MHz NULL fully clockwise.

67. Set Signal Generator for an output of 330.3 MHz ±0.2 MHz at 0 dBm.

68. Adjust A38L13 170 MHz NULL to null the 170 MHz signal on the Spectrum Analyzer.

69. Change Signal Generator frequency to 325.3 MHz ±0.2 MHz. Set Spectrum Analyzer CENTER FREQ to 165 MHz.

70. Adjust A38L11 165 MHz NULL to null the 165 MHz signal on the Spectrum Analyzer.

71. Change Signal Generator frequency to 320.3 MHz ±0.2 MHz. Set Spectrum Analyzer CENTER FREQ to 160 MHz.

72. Adjust A38L12 160 MHz NULL to null the 160 MHz signal on the Spectrum Analyzer.

73. Set the Spectrum Analyzer CENTER FREQ to 140 MHz. Tune the Signal Generator to 300.3 MHz ±0.2 MHz. Note the amplitude of the 140 MHz response on the Spectrum Analyzer.

5-27. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

74. Set the Spectrum Analyzer as follows:

INSTR PRESET	Press
START FREQ.	130 MHz
STOP FREQ	170 MHz
MARKER	NORMAL
MARKER frequency	140 MHz

Slowly tune the Signal Generator from 320.3 to 326.3 MHz while monitoring the display on the Spectrum Analyzer.

75. The amplitude of the signal response between 160 and 166 (Signal Generator frequency of 320.3 to 326.3 MHz) should be at least 60 dB below the response at 140 MHz (Signal Generator frequency of 300.3 MHz) noted in Step 73.

76. Set LINE switch to STANDBY. Reinstall A38 PLL1 IF assembly in instrument and reconnect all cables.

5-28. YO PRETUNE DAC, A54

Reference:

Performance Test: None
Service Section: Sweep Generator - YO Loop

Description:

This procedure makes gain and offset adjustments to the pretune voltage such that the lowest output voltage from the DAC will tune the YO to its lowest frequency (2.3 GHz), and the highest voltage out of the DAC (full scale) will tune the YO to its highest frequency (7 GHz).

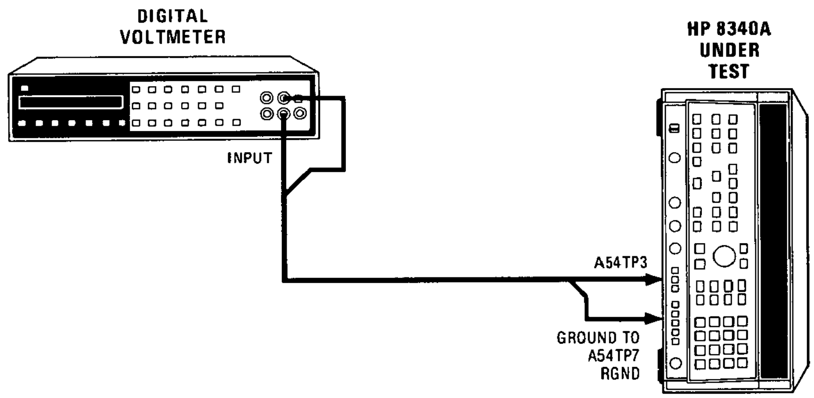


Figure 5-14. YO Pretune DAC Gain Test Setup

Equipment Required:

Digital Voltmeter (DVM) .... HP 3455A

Procedure:

1. Position the 8340A in the Test Position as shown in Figure 5-14 with bottom cover removed. Connect equipment as shown in Figure 5-14 and allow one-half hour warm up time. Be sure to connect DVM ground to A54TP7 REF. Ground.

2. Set the 8340A Under test as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[CW]** then enter **[2] [.] [3] [GHz]** to tune the YO to 2.3 GHz (minimum DAC output).

3. Adjust A54R22 POFF control (Figure 5-15) for −5.75 ±0.001 Vdc.

4. Press 8340A Under Test **[CW]** then enter **[6] [9] [9] [9] [.] [9] [9] [9] [9] [9] [MHz]** to set the YO close to 7 GHz (maximum DAC output).

5. Adjust A54R14 PGN control (Figure 5-15) for −17.5 ±0.001 Vdc.

5-28. YO PRETUNE DAC, A54 (Cont'd)

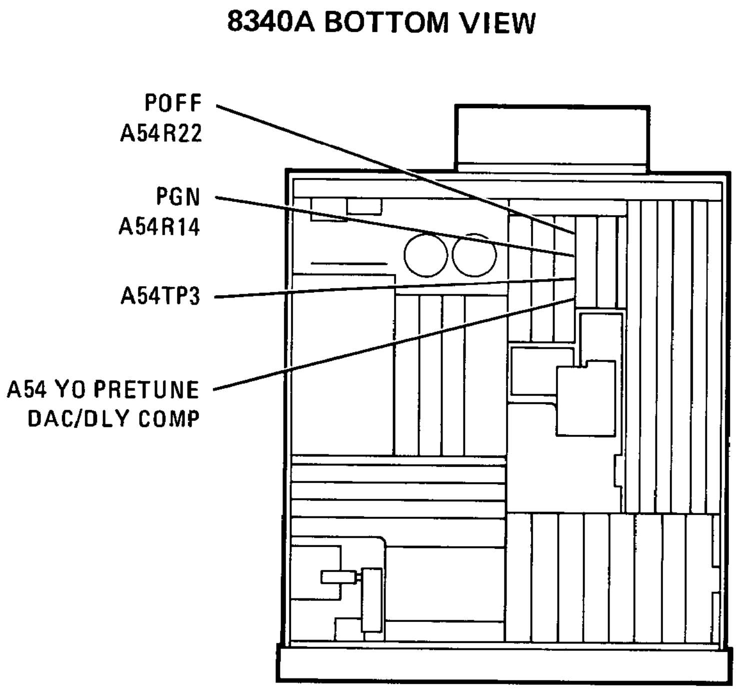


Figure 5-15. YO Pretune DAC Gain Adjustments Location

5-29. YO MAIN DRIVER, A55

Reference:

Performance Test: None
Service Section: Sweep Generator — YO Loop

Description:

The FM coil in the YO is disabled. The Main Coil Driver circuit gain and offset are then adjusted for the correct output frequency.

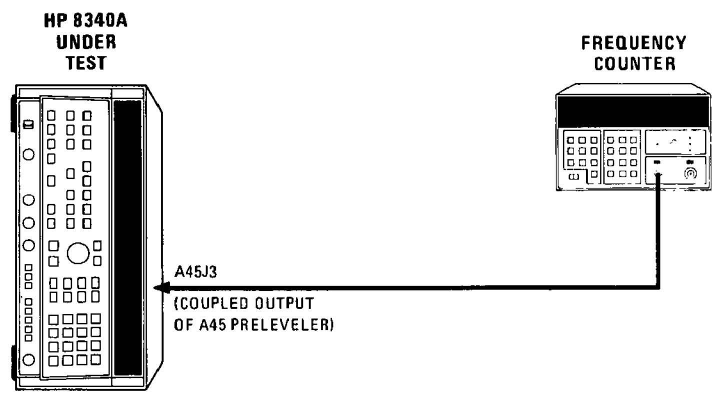


Figure 5-16. YO Main Driver A55 Test Setup

Equipment Required:

Frequency Counter. . . . . HP 5343A

Procedure:

1. Position 8340A in the Test Position as shown in Figure 5-16 with bottom cover removed. Connect equipment as shown in Figure 5-16 and allow one-half hour warm up time.

2. Remove cable W38 from A49J2 and connect a 50 Ohm load to the end of the cable.

3. Set the 8340A Under Test as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[CW]** then enter **[2] [.] [3] [GHz]**.

4. Adjust A55R47 OFFSET (Figure 5-17) for an indication at the Frequency Counter of 2.3 GHz ±1 MHz.

5. Press 8340A **[CW]** then enter **[6] [.] [9] [9] [9] [GHz]**.

5-29. YO MAIN DRIVER, A55 (Cont'd)

6. Adjust A55R4 GAIN (Figure 5-17) for an indication on the Frequency Counter of 6.999 GHz ±1 MHz.

7. Repeat steps 3 through 6 until no further adjustments are necessary.

8. Disconnect Frequency Counter and reconnect cable to A45J3 Preleveler Output. Remove 50 Ohm load from cable W37 and reconnect the cable to A49J2.

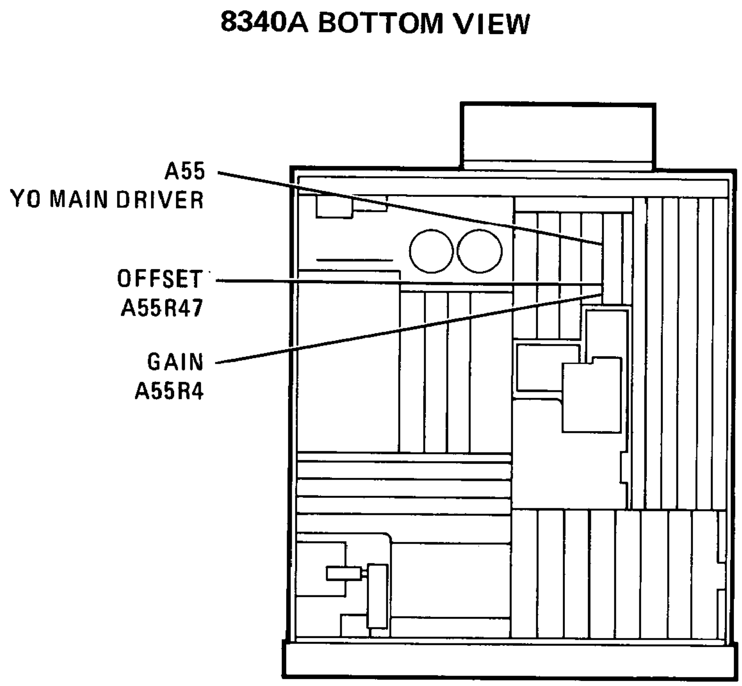


Figure 5-17. YO Main Driver A55 Adjustments Location

5-30. YO LOOP ADJUSTMENTS

Reference:

Performance Test: None
Service Section: Sweep Generator – YO Loop

Description:

This procedure adjusts the sampler drive circuitry and the IF gain.

NOTE

The YO frequency adjustment in Paragraph 5-29 must be completed before these adjustments are made.

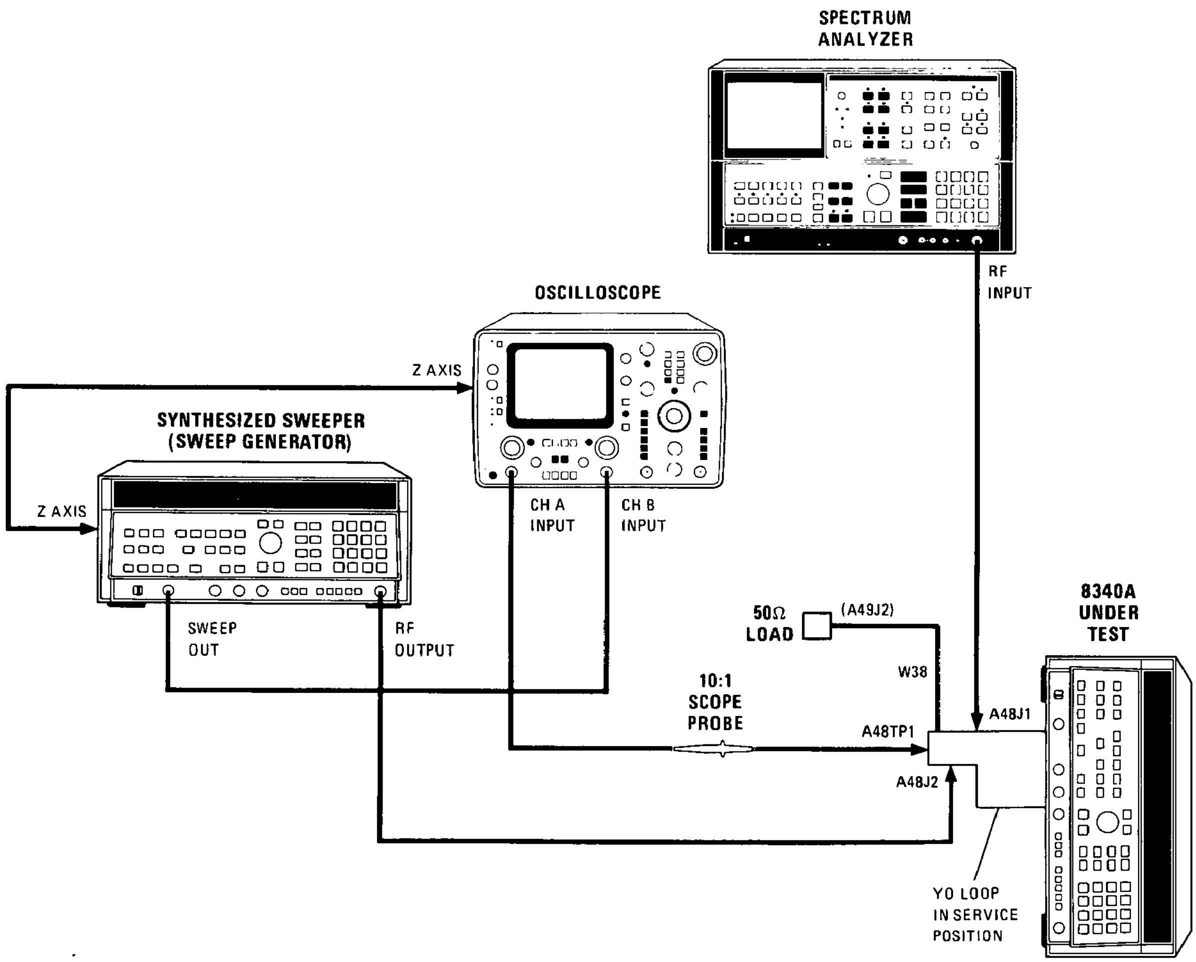


Figure 5-18. YO Loop Adjustment Setup

5-30. YO LOOP ADJUSTMENTS (Cont'd)

Equipment Required:

Spectrum Analyzer	HP 8566A
Synthesized Sweeper	HP 8340A
Oscilloscope	HP 1741A
10:1 Divider Probe	HP 10004D
BNC to SMB Snap-On Test Cable (2 required)	85680-60093

Procedures:

YO LOOP RESPONSE ADJUSTMENT

1. Put 8340A under test in the Test Position. Disconnect rigid cable going into A45 Preleveler RF Output through the mother board. Put the YO Loop section in the Service Position. Disconnect all cables that connect to A48 and A49 PC boards. Remove A48 YO Loop Sampler assembly cover. Connect a 50 Ohm load to W38 at the end that connects to A49J2.

2. Connect equipment as shown in Figure 5-18 except do not connect the Spectrum Analyzer. Set LINE to ON and allow 1/2 hour warmup.

3. Set the Sweep Generator 8340A as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[CF]** (center frequency) then enter **[1] [8] [7] [MHz]**
   c. Press **[ΔF]** then enter **[2] [0] [0] [MHz]**
   d. Press **[POWER LEVEL]** then enter **[3] [dBm]**
   e. Press **[SWEEP TIME]** then enter **[1] [0] [msec]**.

4. At the oscilloscope, set the controls as follows:

   a. Select A vs. B mode
   b. Set Channel A to 0.05 VOLTS/DIV (with 10:1 Probe)
   c. Set Channel B to 1 VOLT/DIV (typically)
   d. Select DC coupled on both channels.

5. On the oscilloscope, adjust channel B VOLTS/DIV (used as horizontal gain in A vs. B mode) for a trace of 10 horizontal divisions on the screen. Adjust oscilloscope POSITION control to center display trace.

6. Press Sweep Generator 8340A **[M1]** and enter **[1] [6] [0] [MHz]**. Press **[M2]** and enter **[2] [1] [0] [MHz]**.

7. Adjust A48C1 and A48C2 response adjustments (Figure 5-19) for a trace on the oscilloscope similar to Figure 5-20. Adjust for flattest response from 160 MHz to 210 MHz. The amplitude of the response should be at least 0.4 Volts peak-to-peak.

5-30. YO LOOP ADJUSTMENTS (Cont'd)

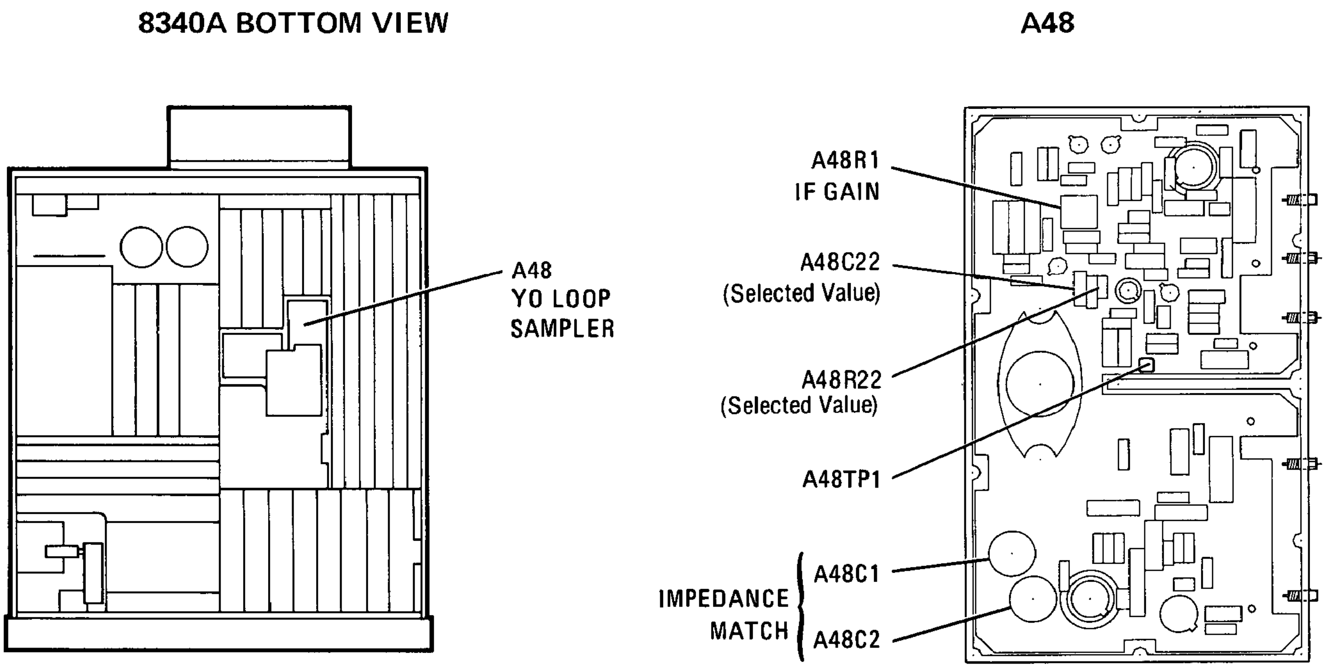


Figure 5-19. Location of YO Loop Adjustments

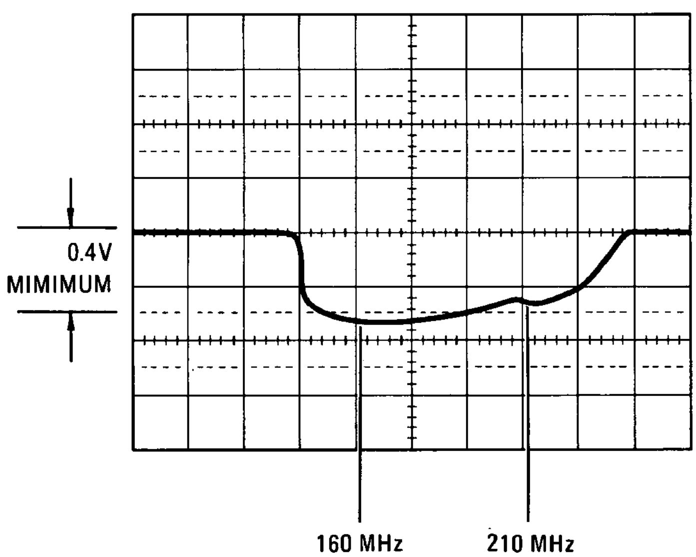


Figure 5-20. Typical Swept Frequency Response at A48TP1

5-30. YO LOOP ADJUSTMENTS (Cont'd)

IF GAIN ADJUSTMENT

8. Verify that the 50 Ohm load is still connected to W38 at the end that was connected to A49J2. Disconnect oscilloscope probe from A48TP1.

9. Connect the Spectrum Analyzer to A48J1.

10. Set the 8340A under Test as follows:

    a. Press **[INSTR PRESET]**
    b. Press **[CW]** then enter **[4] [.] [5] [GHz]**
    c. Connect a jumper between A59TP4 and A59TP5. (This disables the UNLK annunciator circuit.)

11. Set the Sweep Generator 8340A as follows:

    a. Press **[INSTR PRESET]**
    b. Press **[POWER LEVEL]** then enter **[3] [dBm]**
    c. Press **[CW]** then enter **[1] [8] [6] [MHz]**
    d. Press **[SHIFT]** then **[CW]**; press **[STEP]** keys to select 1 kHz resolution.

12. On the Spectrum Analyzer, make the following settings:

    a. Press **[INSTR PRESET]**
    b. Set CENTER FREQ to 30 MHz
    c. Set FREQUENCY SPAN to 60 MHz
    d. Press Marker **[PEAK SEARCH]** then **[SIGNAL TRACK]**.
    e. Set REF LEVEL to +10dBm.

13. Press Sweep Generator 8340A **[CW]** then adjust rotary knob to set a frequency that will produce a center frequency readout on the Spectrum Analyzer of 25.0 MHz. (See Figure 5-21.) Turn off **[SIGNAL TRACK]** on Spectrum Analyzer.

14. On the 8340A under test, adjust A48R1 IF GAIN control for a 25 MHz signal displayed on the Spectrum Analyzer of approximately 4 dBm.

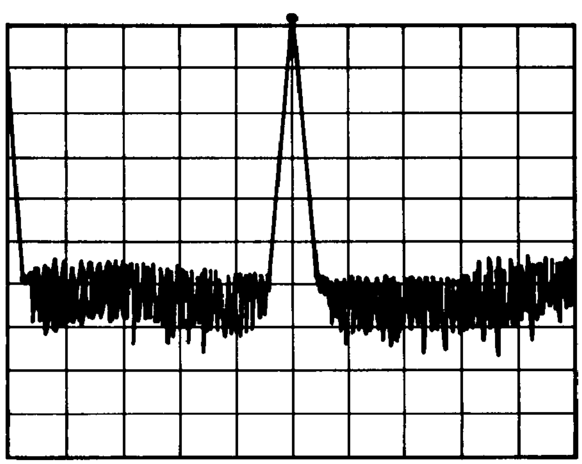


Figure 5-21. YO Loop Gain at A48J1

5-30. YO LOOP ADJUSTMENTS (Cont'd)

15. On the Spectrum Analyzer, make the following settings:

    a. Press **[INSTR PRESET]**
    b. Set CENTER FREQUENCY to 50 MHz
    c. Set FREQUENCY SPAN to 100 MHz
    d. Set REFERENCE LEVEL to +10 dBm
    e. Select 5 dB/DIV
    f. Select MAX HOLD on Trace B

NOTE

If Sweep Generator 8340A frequency is changed too quickly in Step 15, drop outs will occur on the Spectrum Analyzer display. If this happens, slowly adjust the Sweep Generator frequency so that the IF response passes over the drop outs and eliminates them.

16. Slowly tune the Sweep Generator 8340A using the rotary knob while monitoring the display on the Spectrum Analyzer. (Maximum hold may be used on the 8566A Spectrum Analyzer to trace out the IF response as frequency is changed.) Verify that the IF frequency response falls within the limits shown in Figure 5-22. If it does not, select new values for A48C22 and A48R22 to adjust the shape of the response (particularly in the 20 to 30 MHz region). Readjust A48R1 IF GAIN control if necessary.

17. Set 8340A under Test LINE to STANDBY. Disconnect all test cables going into 8340A under test.

18. Remove jumper between A59TP4 and A59TP5.

19. Reinstall A48 cover and reinstall YO Assembly into instrument; reconnect all cables.

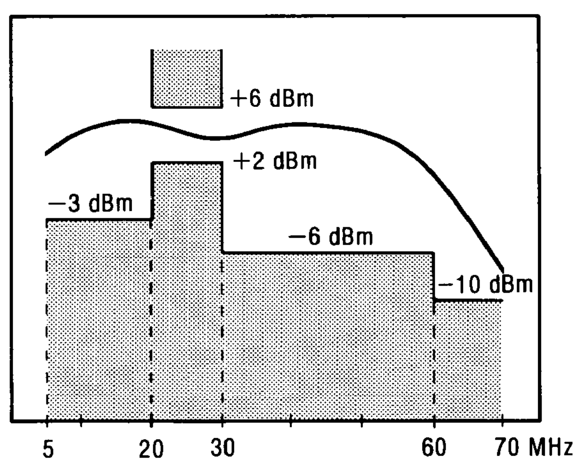


Figure 5-22. IF Frequency Response Limits

5-31. YO DELAY COMPENSATION, A54

Reference:

Performance Test: Swept Frequency Accuracy
Service Section: Sweep Generator - YO Loop

Description:

In this procedure, the programmable width of the YO kick pulse is calibrated. Then the YO delay is adjusted so the marker position tracks from the slowest to the fastest sweep speeds.

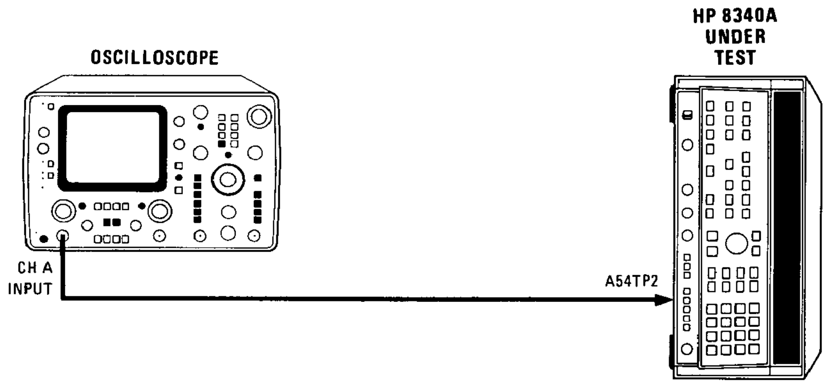


Figure 5-23. YO Kick Pulse Test Setup

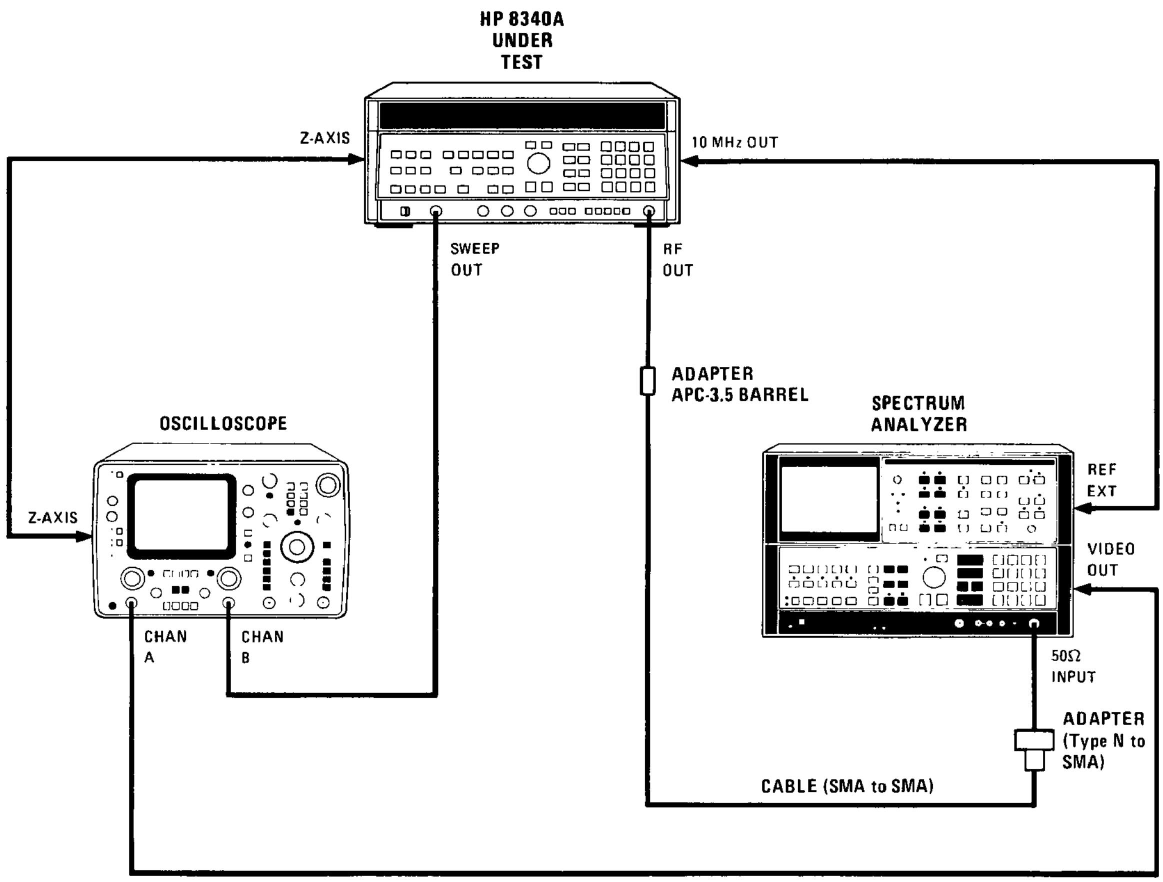


Figure 5-24. YO Delay Compensation Test Setup

5-31. YO DELAY COMPENSATION, A54 (Cont'd)

Equipment Required:

Spectrum Analyzer .... HP 8566A
Oscilloscope .... HP 1741A
Adapter, APC-3.5 female to female barrel .... HP P/N 5061-5311
Cable, SMA male to SMA male .... HP P/N 08340-20124

8340A BOTTOM VIEW

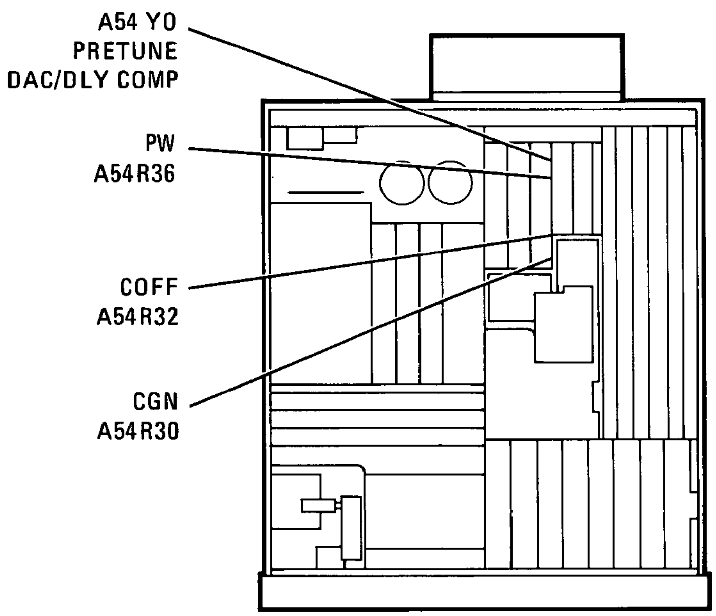


Figure 5-25. YO Delay Compensation Adjustments Location

Procedure:

1. Position the 8340A in the Test Position as shown in Figure 5-23 with bottom cover removed. Connect equipment as shown in Figure 5-23 and allow one-half hour warm up time.

YO KICK PULSE ADJUSTMENT

2. On the 8340A, make the following settings:

   a. Press **[INSTR PRESET]**
   b. Press **[START FREQ]** then enter **[2] [.] [3] [GHz]**
   c. Press **[STOP FREQ]** then enter **[6] [.] [9] [9] [9] [GHz]**.

3. Adjust A54R36 PW control (Figure 5-25) for a 12.5 msec pulse on the oscilloscope.

YO DELAY ADJUSTMENT

4. Connect equipment as shown in Figure 5-24.

5-31. YO DELAY COMPENSATION, A54 (Cont'd)

5. Set the 8340A Under Test as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[START FREQ]** then enter **[6] [.] [9] [GHz]**
   c. Press **[STOP FREQ]** then enter **[1] [3] [.] [5] [GHz]**
   d. Press **[M1]** then enter **[7] [.] [2] [GHz]**
   e. Press **[AMTD MKR]** on.
   f. Press **[SAVE]** then enter **[2]**
   g. Press **[SWEEP TIME]** then enter **[2] [0] [0] [msec]**
   h. Press **[SAVE]** then enter **[1]**
   i. Press Frequency Marker **[OFF]**
   j. Press **[M2]** then enter **[1] [3] [.] [2] [GHz]**
   k. Press **[SAVE]** then enter **[3]**
   l. At ENTRY pad, press **[AUTO]** (sweep time)
   m. Press **[SAVE]** then enter **[4]**
   n. Press **[RECALL]** then enter **[1]**

6. At the Spectrum Analyzer, make the following settings:

   a. Press **[INSTR PRESET]**
   b. Press **[CENTER FREQUENCY]** then enter 7.2 GHz
   c. Press **[FREQUENCY SPAN]** then enter 0 Hz
   d. Press **[SINGLE]** Sweep

7. At the 1741A Oscilloscope, make the following settings:

   a. Select A vs. B Mode
   b. Set Channel A Volts/Division to 0.5 V/DIV
   c. Set Channel B Volts/Division to 0.1 V/DIV

8. Press 8340A Under Test **[RF]** to turn RF power off.

9. On oscilloscope, position marker to center screen with horizontal position control. Press oscilloscope MAG X 10. Reposition the beginning of the marker at center line of screen with horizontal position control. (See Figure 5-26.)

10. Press 8340A **[RF]** to turn RF power on.

11. Press Spectrum Analyzer CENTER FREQUENCY key then use rotary knob to set Center Frequency so the peak of the blip is at the center line of the oscilloscope screen. (See Figure 5-27.)

12. Press 8340A **[RECALL]** then enter **[2]**. Press **[RF]** to turn RF power off.

13. Adjust oscilloscope horizontal position to place the beginning of the marker at the center line of the screen.

14. Press 8340A **[RF]** key to turn RF power on. Adjust A54R32 COFF to set the peak of the blip at the center line of the oscilloscope screen.

15. Press 8340A **[RECALL]** then enter **[3]**.

16. Press Spectrum Analyzer CENTER FREQUENCY then enter 13.2 GHz.

5-31. YO DELAY COMPENSATION, A54 (Cont'd)

17. Set oscilloscope Channel B Volts/Division switch to 2 V/DIV.

18. Press 8340A **[RF]** to turn RF power off.

19. Adjust the oscilloscope horizontal position control so the beginning of the marker is at the center line of the screen.

20. Press 8340A **[RF]** to turn RF power on.

21. Press Spectrum Analyzer CENTER FREQUENCY and adjust frequency using rotary knob so the peak of the blip is at the center line of the oscilloscope screen.

22. Press 8340A **[RECALL]** then enter **[4]**. Press **[RF]** to turn RF power off.

23. Adjust oscilloscope horizontal position to place beginning of the marker at the center line of the screen.

24. Press 8340A **[RF]** key to turn RF power on. Adjust A54R30 CGN to set the peak of the blip at the center line of the oscilloscope screen.

25. Press **[RECALL]**, then enter **[1]**. Repeat steps 7 through 24 until no further adjustment of A54R30 CGN and A54R32 COFF is necessary.

26. Disconnect all test equipment and reconnect cables.

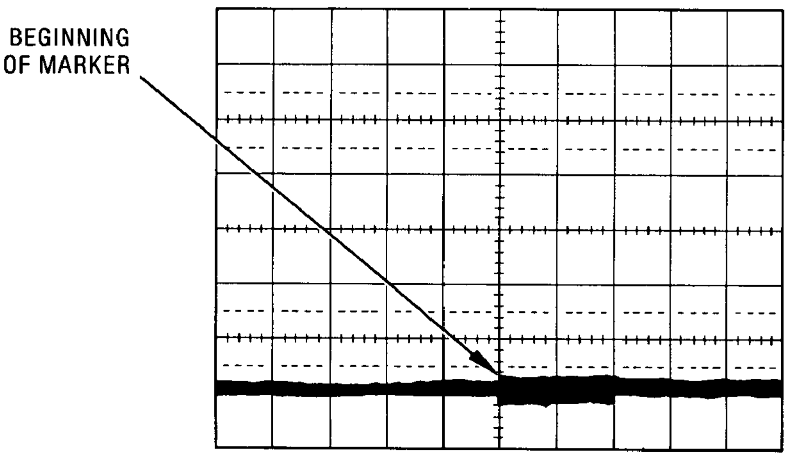


Figure 5-26. Z-Axis Marker Waveform

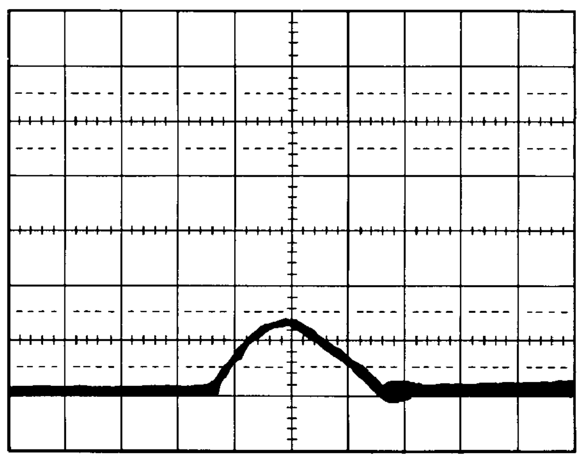


Figure 5-27. Amplitude Marker Waveform

5-32. 3.7 GHz OSCILLATOR, A8

NOTE

This procedure is provided primarily for those cases when the A8A1 circuit board has been repaired or replaced.

Reference:

Performance Test: None
Service Section: RF Section (Power Level Control)

Description:

This procedure monitors the output current of the 100 MHz RF Amplifier that provides the LO signal for the sampler and adjusts for maximum output. The oscillator phase—lock loop is then opened by removing jumper A8E3 and the balance is adjusted at the output of the sampler to obtain a symetrical square wave of approximately 35 Volts peak—to—peak to drive the phase—lock amplifier.

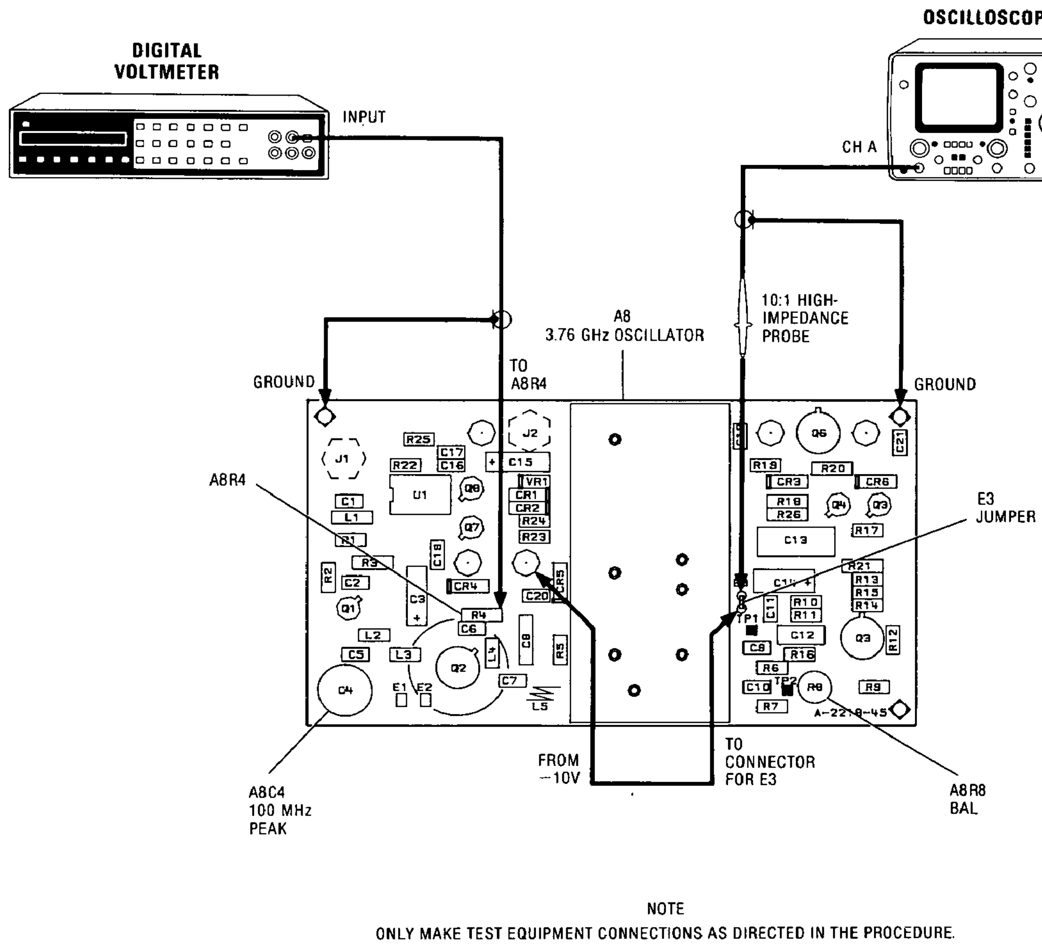


Figure 5-28. A8 3.7 GHz Oscillator Test Setup

5-32. 3.7 GHz OSCILLATOR, A8 (Cont'd)

Equipment Required:

Digital Voltmeter .... HP 3455A
Oscilloscope.......... HP 1741A
10:1 Divider Probe.......... HP 10004D

Procedure:

1. Connect DVM to A8R4 as shown in Figure 5-28.
2. Adjust A8C4 100 MHz Peak for minimum indication on DVM. (This is maximum current through A8R4 and A8Q2.)
3. Turn off 8340A and remove DVM connections from A8R4.
4. Remove jumper A8E3. Connect a jumper from the −10 Volt terminal to the lower connection point for E3 as shown in Figure 5-28. (This applies −10 Volts to the Oscillator.)
5. Connect the Oscilloscope 10:1 high−impedance probe to the upper connection point for E3 as shown in Figure 5-28.
6. Adjust A8R8 BAL control for a 50% duty cycle square wave with approximately 35 Volts peak−to−peak signal.
7. Turn off 8340A, remove the −10 Volt jumper and oscilloscope probe connections, and reinstall jumper A8E3 in its original position.

5-33. MARKER/BANDCROSS, A57

Reference:

Performance Test: None
Service Section: Controller

Description:

This procedure adjusts the manual sweep for a range of 0 to 10 Volts and sets the end of sweep at 10 Volts.

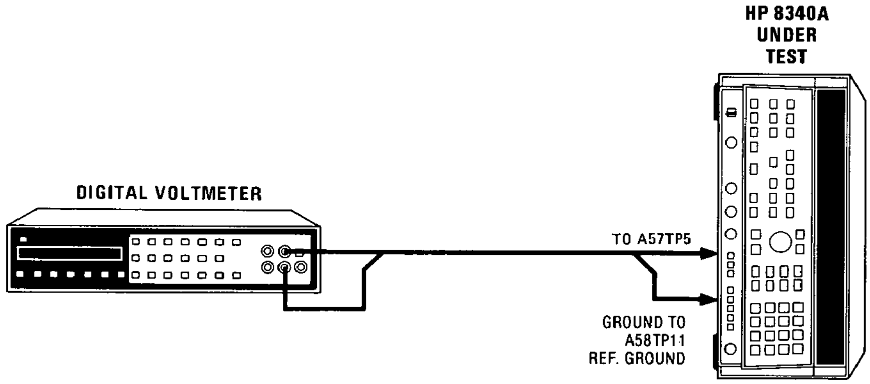


Figure 5-29. Marker Band Crossing Test Setup

Equipment Required:

Digital Voltmeter .... HP 3455A

Procedure:

MANUAL SWEEP GAIN

1. Position the 8340A in the Test Position and connect equipment as shown in Figure 5-29. Allow one–half hour for warmup.

2. Set the 8340A Under Test as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[START]** then enter **[4] [GHz]**
   c. Press **[STOP]** then enter **[5] [GHz]**
   d. Press **[MANUAL]** Sweep.
   e. Press **[SHIFT] [GHz]** then enter **[1] [3] [Hz]**, **[SHIFT] [MHz]** then enter **[2] [Hz]**, and **[SHIFT] [KHz]** then enter **[1] [0] [0] [0] [Hz]**. (This writes decimal 1,000 to IO address 13, R2.)

3. Adjust A57R33 MAN GAIN control (Figure 5-29) for 10.0000 ±0.0005Vdc at A57TP5 as indicated on DVM.

5-33. MARKER/BANDCROSS, A57 (Cont'd)

END OF SWEEP ADJUSTMENT

4. Set the 8340A Under Test as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[START FREQ]** then enter **[4] [GHz]**
   c. Press **[STOP FREQ]** then enter **[5] [GHz]**
   d. Press **[SHIFT]** then **[XTAL]** to stop the sweep at the end of band (5 GHz).

5. Connect DVM to A57TP5 SWEEP OUT.

6. Adjust A57R32 EOS control (Figure 5-30) for an indication on the DVM of 10.000 ±0.0008 Vdc.

7. Press **[CONT]** Sweep key after each adjustment is made for an update of end of sweep indication.

8. Repeat steps 6 and 7 until no further adjustment is needed.

8340A BOTTOM VIEW

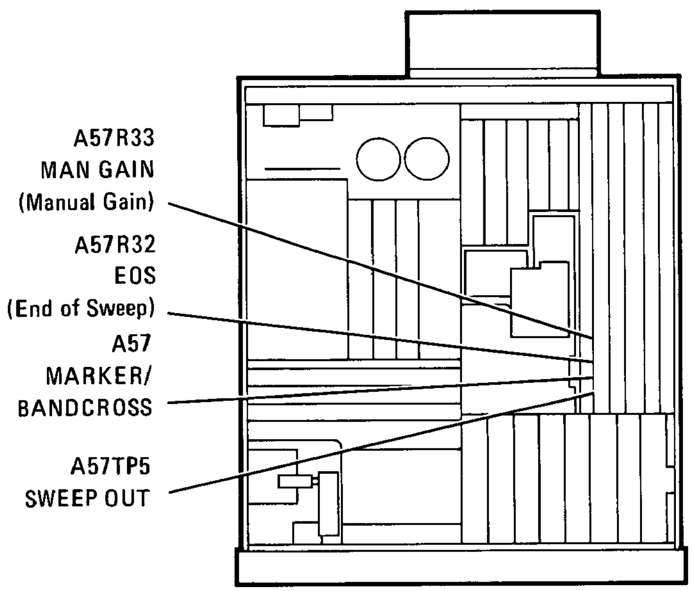


Figure 5-30. Marker Band Crossing Adjustments Location

5-34. SWEEP GENERATOR, A58

Reference:

Performance Test: Swept Frequency Accuracy
Service Section: Sweep Generator - YO Loop

Description:

The first section adjusts the gain of the sweep ramp amplifier. The next section adjusts the reset error. The last section adjusts the relationship between the VSWP ramp signal and the marker ramp.

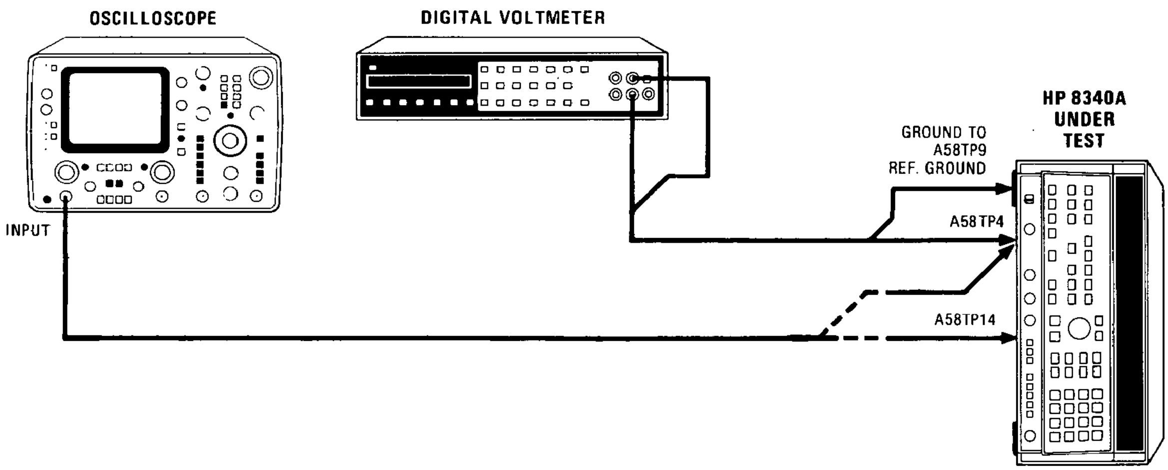


Figure 5-31. Sweep Generator Test Setup

Equipment Required:

Oscilloscope .... HP 1741A
Digital Voltmeter (DVM) .... HP 3455A

Procedure:

1. Position the 8340A in the Test Position as shown in Figure 5-31 with bottom cover removed. Connect oscilloscope to A58TP4. Allow one-half hour warm up time.

SWEEP RAMP GAIN ADJUSTMENT

2. Press 8340A **[INSTR PRESET]** then **[START FREQ]**. Enter **[2] [.] [3] [GHz]**.
3. Press 8340A **[STOP FREQ]** then enter **[7] [GHz]**.
4. Press **[SWEEP TIME]** then enter **[1] [0] [msec]**.
5. Adjust A58R4 SWP TIME control (Figure 5-32) for a 10 mSec ramp on oscilloscope (Figure 5-33).

5-34. SWEEP GENERATOR, A58 (Cont'd)

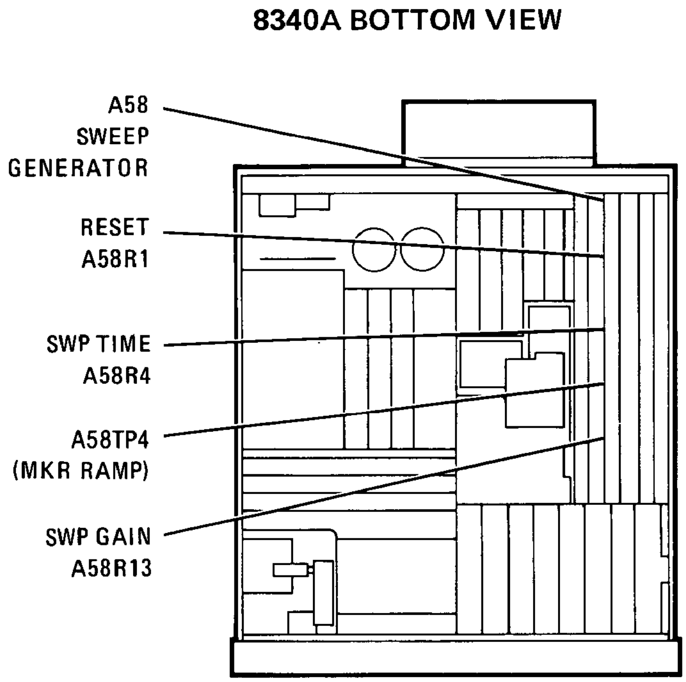


Figure 5-32. Sweep Generator Adjustments Location

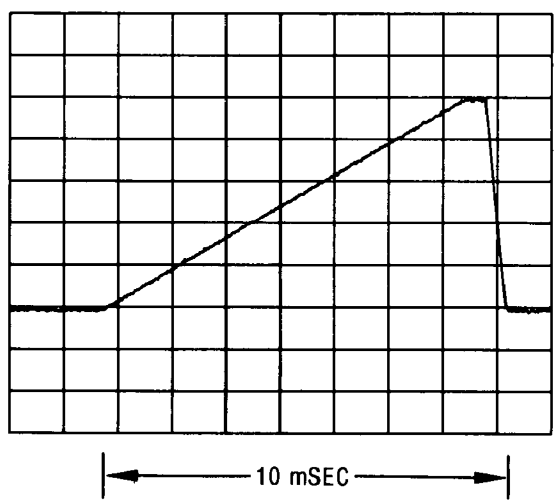


Figure 5-33. Sweep Ramp at A58TP4

5-34. SWEEP GENERATOR, A58 (Cont'd)

RESET ERROR ADJUSTMENT

6. Connect oscilloscope to A58TP14.
7. Press 8340A **[INSTR PRESET]**.
8. Adjust A58R1 RESET control (Figure 5-32) for as close as possible to zero Volt average on the oscilloscope. (See Figure 5-34.)

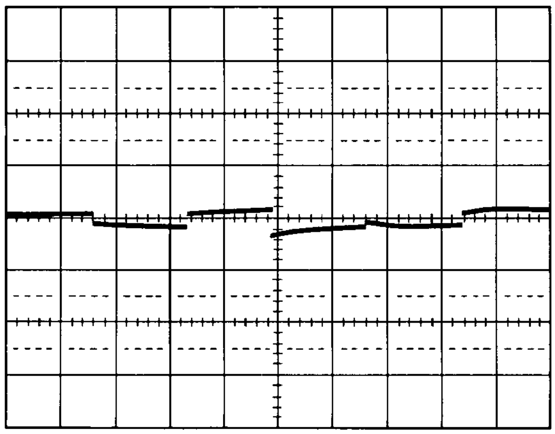


Figure 5-34. Reset Pulse Adjusted to Zero Volt Average

SWEEP GAIN ADJUSTMENT

9. Connect DVM to A58TP4 MKR RMP and connect DVM ground to A58TP9 REF. Ground.
10. Set the 8340A controls as follows:

    a. Press **[INSTR PRESET]**
    b. Press **[START FREQ]** then enter **[2] [.] [3] [GHz]**
    c. Press **[STOP FREQ]** then enter **[7] [GHz]**
    d. Press **[SHIFT]** then **[XTAL]** to stop the sweep at the end of sweep (7 GHz).

11. Record reading at DVM.
12. Connect DVM to A58TP10 VSWP.
13. Adjust A58R13 SWP GAIN control so that the DVM reading at A58TP10 = 94% of Reading at A58TP4 taken in step 11.
    EXAMPLE:

    a. DVM reading in step 11 at A58TP4 = 9.9884 Volts
    b. (0.94) (9.9884V) = 9.38909 Volts
    c. Adjust A58R13 for DVM reading at A58TP10 of 9.38909 Volts.

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS

NOTE

If equipment and the program are available to do the automated Unleveled Power Test and Adjustment described in manual supplement titled "Automated Test Procedures", it should be used instead of these procedures in Paragraph 5-35.

Reference:

Performance Test: Maximum Leveled Output Power and Accuracy

Service Section: RF Section

Description:

The A28 SYTM Driver Assembly is adjusted to cause the SYTM frequency response to track the YO frequency. When the YO frequency is in the center of the SYTM passband, the power loss through the SYTM is minimum; therefore, SYTM tracking is adjusted while viewing power out versus frequency and adjusting the SYTM tracking for maximum power out. The SRD bias is also adjusted for maximum power out. Since either adjustment may cause squegging (a power drop-out at the peak of the bandpass caused by an undesired oscillation of the SYTM's bias circuit), the tracking and SRD bias adjustments are made at the same time.

Sometimes you cannot tell by just the unleveled trace that the instrument is squegging. Sometimes, as the SRD bias is adjusted, the unleveled power will start to rise and then it will fall off. When it starts to fall off, it is an indication of possible squegging (usually in Band 2).

In Bands 2, 3, and 4, squegging occurs in the SRD diode circuit and is a function of SRD bias, power output, and tracking. In Band 1, squegging occurs in the SYTM YIG sphere and is a function of input power to SYTM.

Kick pulses are generated at retrace for the SYTM. These kick pulses are used so that the magnetics of the SYTM will always start from the same condition. The pulses have the effect of temporarily tuning the SYTM above the stop frequency and then below the start frequency. Since the kick pulses also affect delay, the kick pulse amplitudes are adjusted in this procedure.

NOTE

The following adjustments should be checked or adjusted before making the adjustments in this procedure: Power Supplies, 20/30 Loop, M/N Loop, Pretune, YO Loop, and Sweep Time.

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

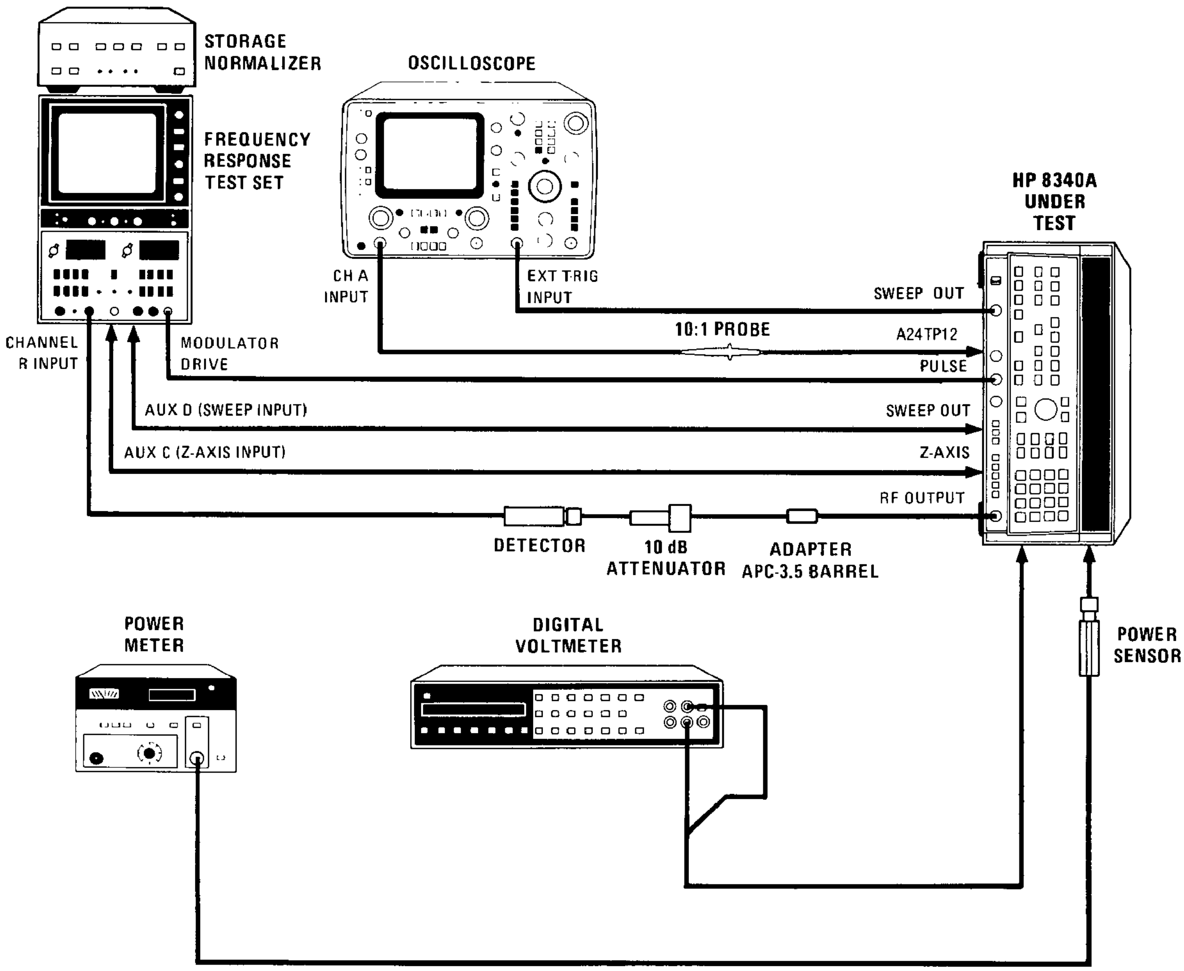


Figure 5-35. SYTM Tracking and Delay, and Unleveled SRD Bias Adjustment Test Setup

Equipment Required:

Frequency Response Test Set	HP 8755C
Detector	HP 11664B
Storage Normalizer	HP 8750A
Oscilloscope	HP 1741A
10:1 Divider Probe	HP 10004D
Digital Voltmeter	HP 3455A
Power Meter	HP 436A
Power Sensor	HP 8485A
10 dB Attenuator	HP 8493C Option 010

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

Procedure:

1. Place the 8340A in the Test Position and connect equipment as shown in Figure 5-35. Connect Digital Voltmeter (DVM) to 8340A rear-panel 1 V/GHz output connector. Allow one-half hour warmup time.

2. Press 8340A **[CW]** then enter **[1] [0] [MHz]**.

3. Adjust A28R85 +10 ADJ control for an indication on the DVM of 10 mV ±1 mV.

INITIAL SETTINGS

NOTE

Once these initial settings have been made it will be necessary to complete this procedure and the SRD Bias adjustments.

If the A24 Assembly or the SYTM has been replaced, set A24R5 X2C, A24R8 X3C, and A24R11 X4C controls fully counterclockwise and center A24R12 MIN control.

4. Set A24R1 (OFF A) (Figure 5-36) and A24R2 (OFF B) controls fully clockwise.

5. Set A26R88 (MO) fully clockwise.

6. The A26 Assembly contains an ALC Loop gain control for each band. These conrols may not require adjustment at this point; however, if the A26 Assembly has been replaced, these controls should be centered initially to ensure that a reasonable power level is obtained before making SYTM tracking adjustments. Center loop gain controls HET, X1, X2, X3, and X4 on the A26 Linear Modulator board **only if the ALC circuits require adjustment.**

SYTM TRACKING AND UNLEVELED SRD BIAS ADJUSTMENTS

7. Connect oscilloscope 10:1 probe to SRD BIAS test point, A24TP12. Press 8340A **[INSTR PRESET]**. Power level should be 0 dBm. Press **[START FREQ]** and enter **[6] [.] [9] [GHz]**. Press **[STOP FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[SWEEP TIME]** and enter **[2] [0] [0] [msec]**. Press **[XTAL]** leveling key to obtain non-leveled operation. The 8755C Modulation output must be connected to the 8340A PULSE INPUT. Press **[PULSE]** MODULATION key.

   The 8755A display of output power versus frequency should be similar to Figure 5-37 and the oscilloscope SRD bias display should be similar to Figure 5-38.

   Turning the X2A/B, X3A/B, or X4A/B controls clockwise when in the appropriate band will increase the SRD bias and be closer to the squegging region. If squegging occurs, turn the above controls CCW.

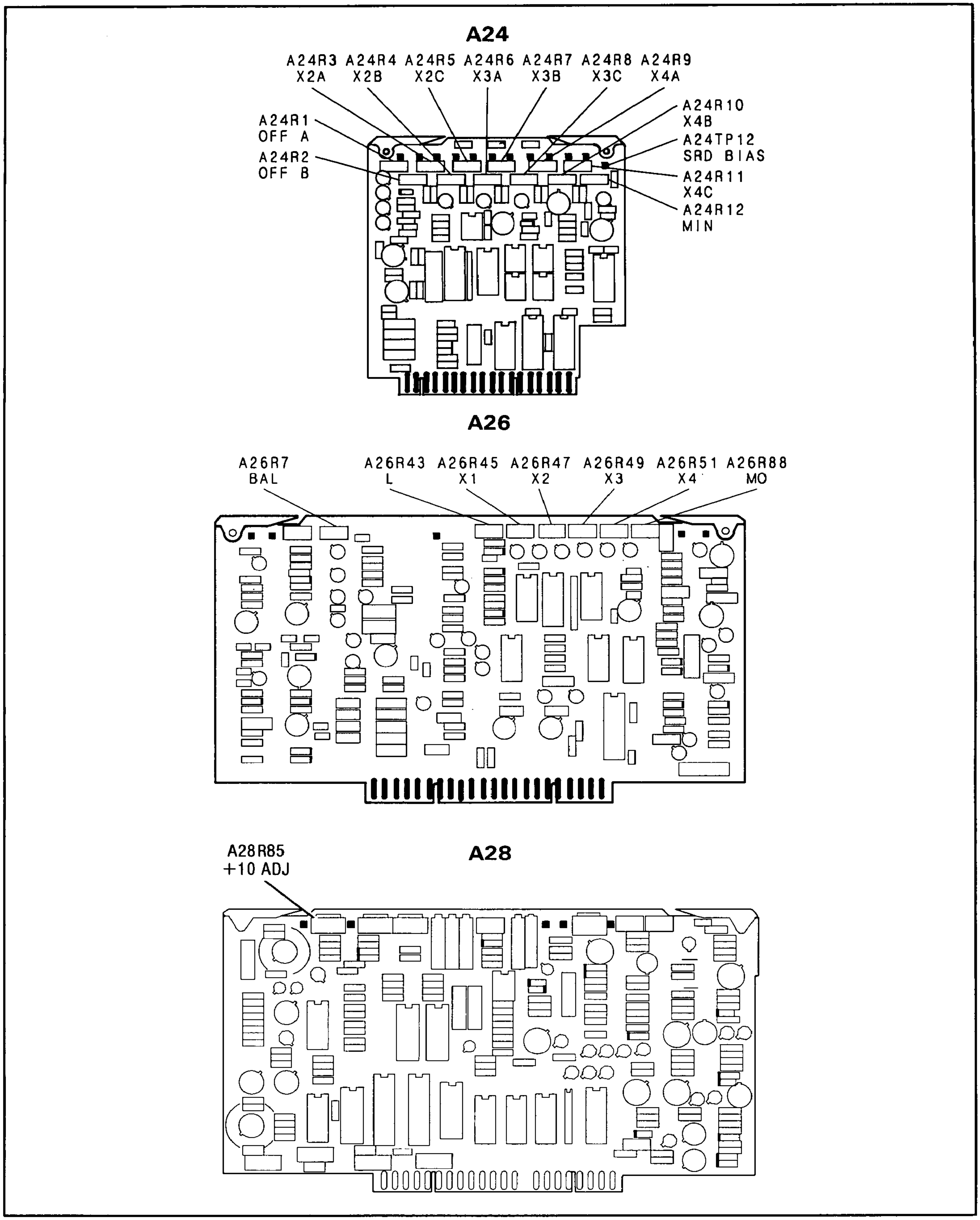


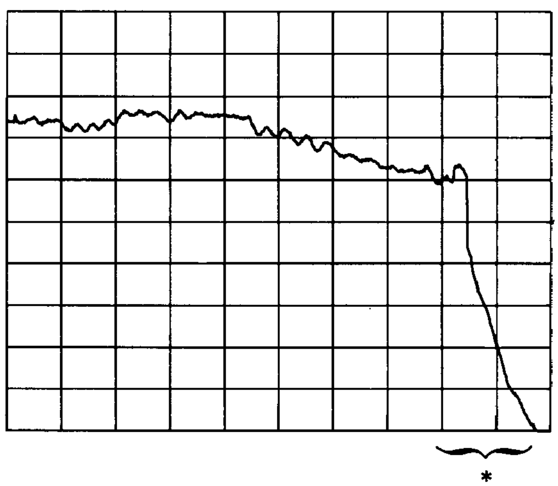
Figure 5-36. SRD Bias Adjustments Location

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

NOTE

If the oscilloscope trace is flat or slopes down, the following adjustments will be more difficult to optimize. Therefore, adjust A24R3 (X2A) and A24R4 (X2B) in Band 2 only for maximum output power, but also for a slight upward slope with no squegging (a power drop-out at the peak of the bandpass caused by an undesired oscillation of the SYTM bias circuit). A slight adjustment of either control (X2A or X2B) will affect the slope considerably and should have little affect on the output power. Detailed instructions for these adjustments are given in the following steps.

WAVEFORM A
(NO SQUEGGING)



WAVEFORM B
*(TYPICAL SQUEGGING AREAS)

Figure 5-37. 8755C Display of Power Out Versus Frequency

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

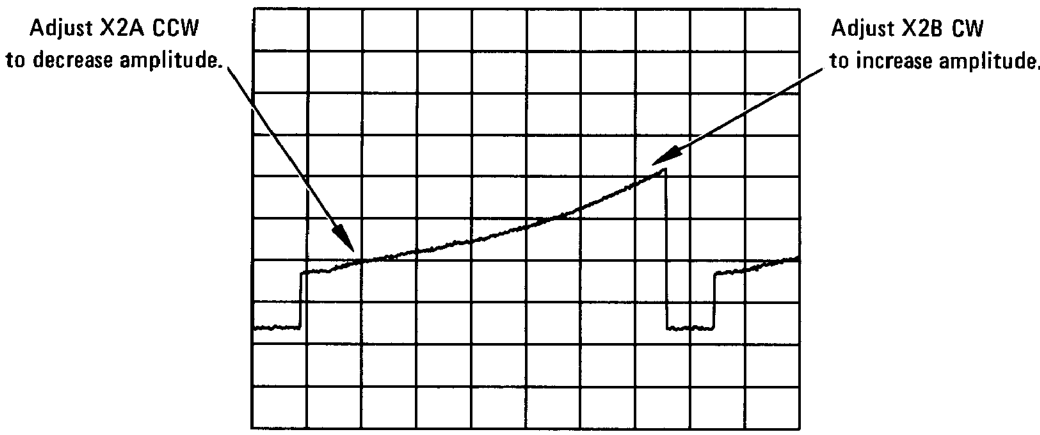


Figure 5-38. Oscilloscope Display of SRD Bias Waveform.

NOTE

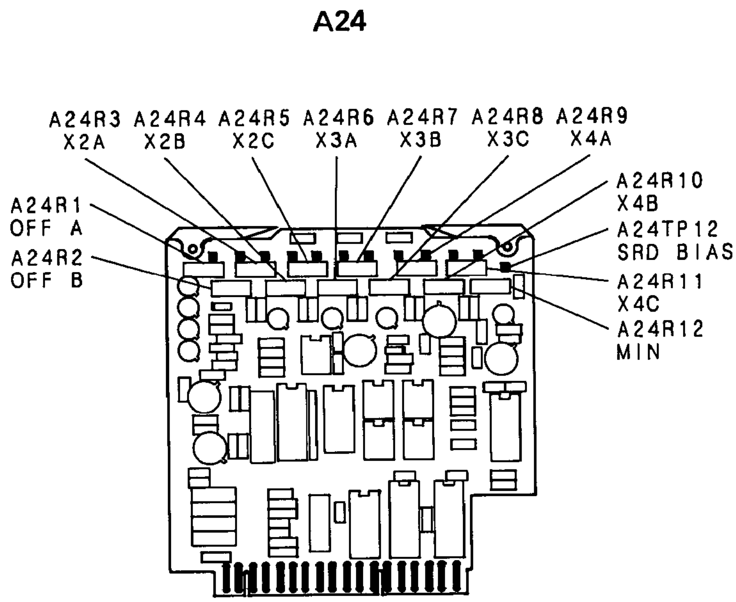
The following steps assume that pressing [INSTR PRESET] will set the power level to 0 dBm. If the 8340A Under Test programs the power to other than 0 dBm during INSTR PRESET, change calibration constant Number 56 to 0. Record the original Power value so that you can restore it after all adjustments are made.

NOTE

In the following steps, adjust for maximum power in each band with no squegging.

8. Set 8755C to 1 dB/DIV. Access 8340A Calibration Constant Number 10 by entering the following: **[SHIFT] [GHz] [1] [0] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. (Refer to Paragraph 5-15.) Use the rotary knob or the ENTRY keyboard and set Calibration Constant Number 10 to 1024.

9. For Band 2 (6.9 to 13.5 GHz), adjust A28R1 (OFF) (Figure 5-39) and A24R3 (X2A) for maximum power at the low frequency end. Adjust A28R8 (GAIN) and A24R4 (X2B) for maximum power at the high frequency end. These adjustments will interact so iterate for optimum settings. Observe the oscilloscope SRD Bias display for a slightly upward slope. Re-adjust X2A and/or X2B slightly if necessary to obtain the correct slope. Once the tracking has been optimized, store the trace in the 8750A Storage Normalizer by setting both 8755C inputs to R, setting the dB/DIV and offset of both 8755C channels the same. Press 8750A CH 1 INPUT, STORE INPUT, and RECALL. Activate the Auto Track function by pressing **[SHIFT] [PEAK]**. Iterate using A28R1 (OFF) and **[SHIFT] [PEAK]** to get the best overall results. When adjusting A28R1 (OFF), be sure to try both directions from the original optimized setting.



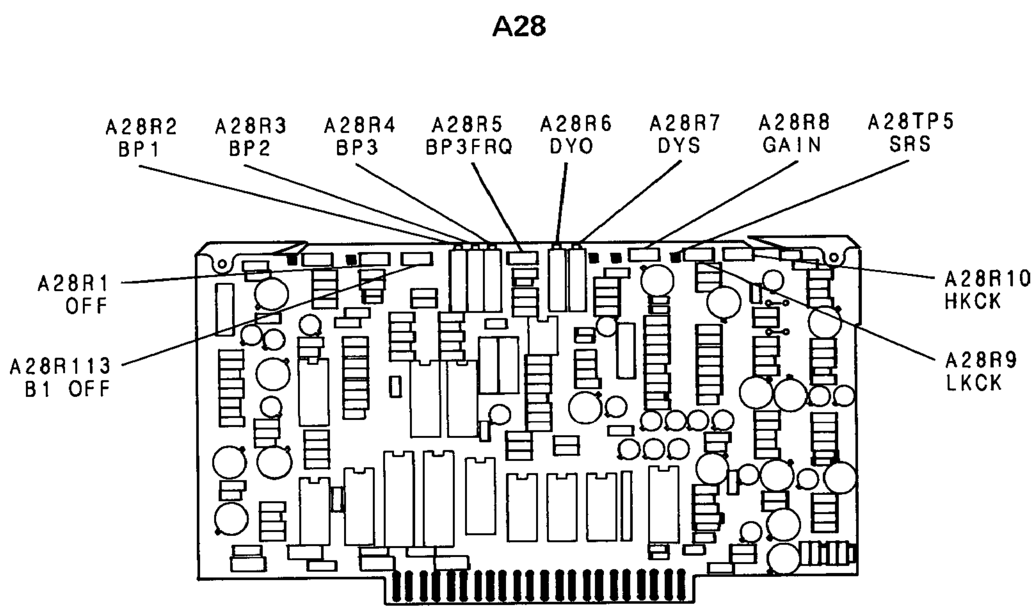


Figure 5-39. Bias, A24, and Tracking and Delay Compensation, A28 Adjustments Location

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

10. For Band 1, press **[START FREQ]** and enter **[2] [.] [3] [GHz]**. Press **[STOP FREQ]** and enter **[7] [.] [0] [GHz]**. Adjust A28R113 (B1 OFF) for maximum power at the low frequency end. Access Calibration Constant Number 9 by entering the following: **[SHIFT] [GHz] [9] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 9 for maximum power at the high frequency end.

    Fundamental band sphere squegging may occur with these adjustments. The cause is different from the squegging in other bands. It is a function of input power to the SYTM and cannot be adjusted out. Normal operation of the instrument is below the power level where this occurs so it can be overlooked when making adjustments.

11. For Band 3, press **[START FREQ]** and enter **[1] [3] [.] [3] [5] [GHz]**. Press **[STOP FREQ]** and enter **[2] [0] [GHz]**. Adjust A24R6 (X3A) and Calibration Constant Number 11 for maximum power at the low frequency end. Access Calibration Constant Number 11 by entering the following: **[SHIFT] [GHz] [1] [1] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust A28R2 (BP1) and A24R7 (X3B) for maximum power at the high frequency end. Once the tracking has been optimized, store the trace in the 8750A Storage Normalizer by setting both 8755C inputs to R, setting the dB/DIV and offset of both 8755C channels the same. Press 8750A CH 1 INPUT, STORE INPUT, and RECALL. Activate the Auto Track function by pressing **[SHIFT] [PEAK]**. Iterate using the Auto Track function and A28R2 (BP1) to match the stored trace as closely as possible. The adjustment of A28R2 should be tried in both directions from the original optimized settings.

12. For Band 4, press **[START FREQ]** and enter **[1] [9] [.] [8] [GHz]**. Press **[STOP FREQ]** and enter **[2] [6] [.] [5] [GHz]**. Access Calibration Constant Number 12 by entering the following: **[SHIFT] [GHz] [1] [2] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust A24R9 (X4A) and Calibration Constant Number 12 for maximum power at the low frequency end, A28R3 (BP2) for maximum power at the center, and A28R4 (BP3), A28R5 (BP3FRQ), and A24R10 (X4B) for maximum power at the high frequency end. Once the tracking in Band 4 has been optimized, store the trace in the 8750A Storage Normalizer by setting both 8755C inputs to R, setting the dB/DIV and offset of both 8755C channels the same. Press 8755C CH 1 INPUT, STORE INPUT, and RECALL. Activate the Auto Track function by pressing **[SHIFT] [PEAK]**. Compare the resulting trace to the stored trace and readjust A28R3 (BP2), A28R4 (BP3), and A28R5 (BP2FRQ) as before. Substitute **[SHIFT] [PEAK]** for the adjustment of Calibration Constant Number 12.

    The adjustments of A28R3, A28R4, and A28R5 should be tried in both directions during the iteration process with auto tracking. In some cases, better results are obtained by adjusting a control away from the optimum position then pressing **[SHIFT] [PEAK]** for Auto Tracking code.

SYTM DELAY COMPENSATION ADJUSTMENTS BY BAND

Description:

Delay compensation is adjusted for minimum change in SYTM frequency tracking between a slow sweep and a fast sweep. Since the kick pulses affect delay, the kick pulse amplitude is adjusted as well.

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

NOTE

SYTM kick pulses are generated at a SYTM retrace to reset SYTM magnetic state. The kick pulse has the effect of temporarily tuning the SYTM above the stop frequency and then below the start frequency. The following adjustments ensure that the pulse amplitude is sufficient to kick the SYTM frequency above and below the stop and start frequencies. The positive going voltage of the SRS waveform corresponds to the low frequency kick and the negative going voltage of the SRS waveform corresponds to the high frequency kick.

13. Connect the oscilloscope 10:1 probe to A28TP5 (SRS). Set oscilloscope to trigger at the end of the sweep ramp (i.e., NEG TRIGGER on 8340A SWEEP OUT signal). Set oscilloscope Channel A V/DIV switch to 0.1 (with 10:1 probe).

14. Press **[SAVE]** and enter **[1]** to save the instrument state set up in step 12. Temporarily set the 8340A to CW at 2.3 GHz (Press **[CW]** and enter **[2] [.] [3] [GHz]**). Press **[CONT]** Sweep key to give a sweep ramp for oscilloscope trigger. The oscilloscope should display a horizontal trace. Use the vertical position control to position the trace one division down from the top graticule line. This position represents the start frequency. Enter **[2] [6] [.] [5] [GHz]** and note the position of the oscilloscope trace. This represents the stop frequency. Press **[RECALL] [1]** to return to the previous instrument state.

NOTE

The range for the delay compensation calibration constants is 0 through 131. If the calibration constants do not provide enough range for the delay compensation, Calibration Constant Number 8 may be lowered, A28R6 and A28R7 readjusted in Band 4, and all of the delay compensation calibration constants will require readjustment. If the SYTM has been replaced, set Calibration Constant Number 8 to 120 initially.

15. Store the Band 4 trace of the 200 msec sweep in the 8750A Storage Normalizer by setting both 8755C inputs to channel R, setting the dB/Div and offset of both 8755C channels the same, press 8750A CH1 INPUT, STORE INPUT, and RECALL.

16. Press 8340A **[SWEEP TIME]** and **[AUTO]** to obtain the fastest sweep time for that frequency range.

17. Adjust A28R10 (HKCK) until the high frequency kick is about 300mV lower than the 26.5 GHz calibration line (Figure 5-40). Press **[SINGLE]** SWEEP key repetitively while adjusting A28R6 (DYO) and A28R7 (DYS) to match current 8755C trace with the stored trace to within 0.5 dB. Press **[CONT]** SWEEP and adjust A28R9 (LKCK) until the continuous sweep trace matches the stored trace to within 0.5 dB. Iterate between continuous sweep adjustments and single sweep adjustments to obtain the best match between the two 8755C traces. If the low frequency kick pulse cannot be made to fall above the 2.3 GHz calibration line and match the continuous sweep and single sweep traces, readjust A28R10 (HKCK) and repeat the procedure. The peaks of the oscilloscope kick pulse trace should be below the high frequency point (negative peak) and above the low frequency point (positive peak). Refer to the kick pulse waveform shown in Figure 5-40.

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

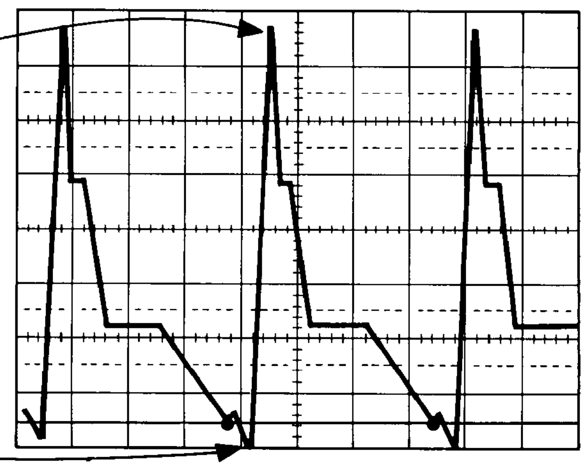


Figure 5-40. SYTM Kick Pulse Waveform.

18. Press **[START FREQ]** and enter **[1] [3] [.] [3] [5] [GHz]**. Press **[STOP FREQ]** and enter **[2] [0] [GHz]**. Press **[SWEEP TIME]** and enter **[2] [0] [0] [msec]**. Store this response using the storage normalizer as described in step 16 above. Press **[SWEEP TIME]** and **[AUTO]**. Access Calibration Constant Number 7 by entering the following: **[SHIFT] [GHz] [7] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 7 to obtain the best match between the current trace and the stored trace. (Calibration Constant Number 7 must be within the range of zero to 131.)

19. Press **[START FREQ]** and enter **[6] [.] [9] [GHz]**. Press **[STOP FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[SWEEP TIME]** and enter **[2] [0] [0] [msec]**. Store this response using the storage normalizer as described in step 15 above. Press **[SWEEP TIME]** and **[AUTO]**. Access Calibration Constant Number 6 by entering the following: **[SHIFT] [GHz] [6] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 6 to obtain the best match between the current trace and the stored trace. (Calibration Constant Number 6 must be within the range of zero to 131.)

20. Press **[START FREQ]** and enter **[2] [.] [3] [GHz]**. Press **[STOP FREQ]** and enter **[7] [GHz]**. Press **[SWEEP TIME]** and enter **[2] [0] [0] [msec]**. Store this response using the storage normalizer as described in step 15 above. Press **[SWEEP TIME]** and **[AUTO]**. Access Calibration Constant Number 5 by entering the following: **[SHIFT] [GHz] [5] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 5 to match the current trace with the stored trace at the high frequency end. Typically the low frequency will not match within 0.5 dB. The traces are typically different because the fundamental band squegging may occur on the slow sweep and not on the fast sweep. (Calibration Constant Number 5 must be within the range of zero to 131.)

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

SYTM DELAY COMPENSATION ADJUSTMENTS AT FULL SWEEP MULTIBAND

21. Press **[INSTR PRESET]**. Press **[START FREQ]** and enter **[2] [.] [3] [GHz]**. Press **[SWEEP TIME]** and enter **[1] [sec]**. Press **[XTAL]** LEVELING. Press the **[PULSE]** modulation key.

NOTE

The complete unleveled multiband response cannot be viewed on the 8755C at 1 dB/Div resolution. In the following steps it will be necessary to adjust the 8755C offset to position a portion of the trace on the display before storing the trace using the storage normalizer.

22. Press **[SAVE] [1]** to store the 8340A 1 sec. instrument state. Press **[SWEEP TIME]** and **[AUTO]** to obtain the fastest sweep time for that range. Press **[SAVE] [2]** to store the 8340A fast sweep instrument state. Press **[RECALL [1]** to return to the 1 sec. instrument state.

    The response of Band 2 is about from the second to the fifth horizontal division. Adjust both 8755C reference levels to view the swept trace from the second to the fifth horizontal division. Store this trace using the storage normalizer as described in step 15 above. Press **[RECALL] [2]**. Access Calibration Constant Number 2 by entering the following: **[SHIFT] [GHz] [2] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 2 for the best match between the current trace and the stored trace of Band 2. (Calibration Constant Number 2 must be within the range of zero to 131.)

23. Press **[RECALL] [1]**. The response of Band 3 is about from the fifth to the seventh horizontal division. Adjust both 8755C reference levels to view the swept trace from the fifth to the seventh horizontal division. Store this trace using the storage normalizer as described in step 15 above. Press **[RECALL] [2]**. Access Calibration Constant Number 3 by entering the following: **[SHIFT] [GHz] [3] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 3 for the best match between the current trace and the stored trace of Band 3. (Calibration Constant Number 3 must be within the range of zero to 131.)

24. Press **[RECALL] [1]**. The response of Band 4 is about from the seventh to the tenth horizontal division. Adjust both 8755C reference levels to view the swept trace from the seventh to the tenth horizontal division. Store this trace using the storage normalizer as described in step 15 above. Press **[RECALL] [2]**. Access Calibration Constant Number 4 by entering the following: **[SHIFT] [GHz] [4] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 4 for the best match between the current trace and the stored trace of Band 4. (Calibration Constant Number 4 must be within the range of zero to 131.)

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

UNLEVELED SQUEGGING TEST USING THE 8566A SPECTRUM ANALYZER

Description:

The 8340A Under Test RF output signal is down converted using a Local Oscillator 8340A and a mixer. The IF output of the mixer is fed to a spectrum analyzer. Any squegging of the 8340A under test will appear as a spurious response on the IF signal.

This test should be performed after adjusting the SYTM tracking and delay, and the SRD unleveled bias. Since unleveled squegging can be difficult to see using the 8755C, this test is performed to determine if additional adjustments are required.

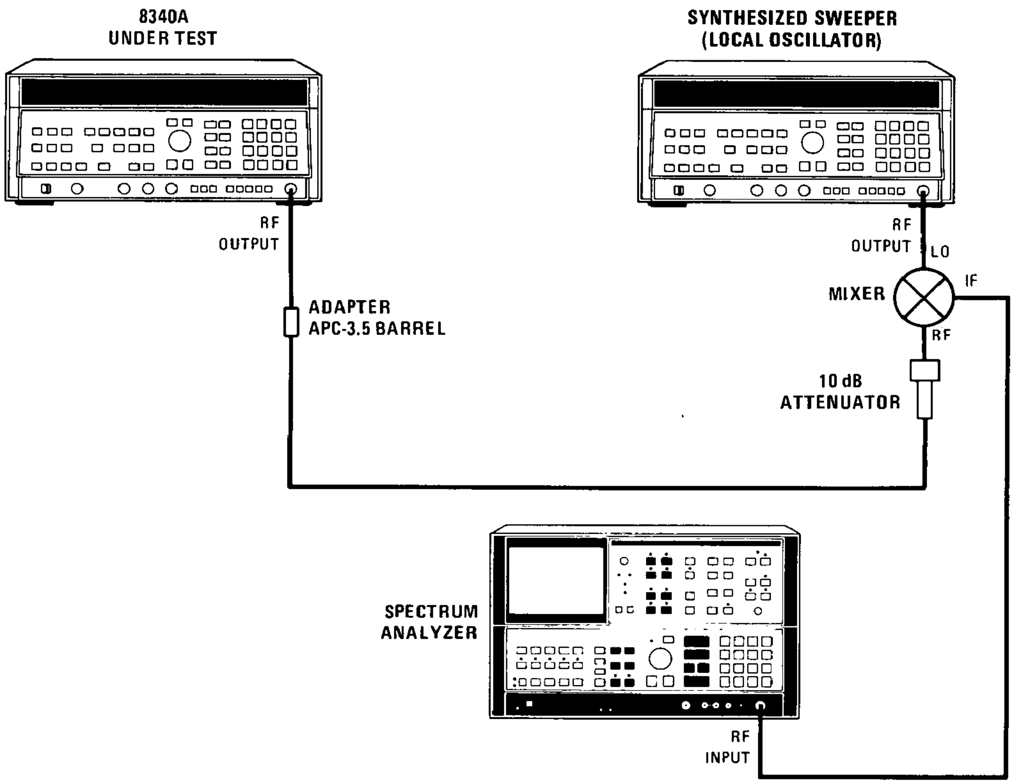


Figure 5-41. Unleveled Squegging Test Setup.

Equipment Required:

Synthesized Sweeper	HP 8340A (Opt 001)
10 dB Attenuator	HP 8493C Option 010
Mixer	RHG DMS 1–26
Spectrum Analyzer	HP 8566A

25. Connect equipment as shown in Figure 5-41. Connect the mixer at the Local Oscillator (LO) 8340A RF output connector to obtain maximum mixer LO input level. Allow at least 30 minutes warm up time.

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

26. Press the Local Oscillator 8340A **[INSTR PRESET]**. Press **[START FREQ]** and enter **[6] [.] [4] [GHz]**. Press **[STOP FREQ]** and enter **[1] [2] [.] [9] [GHz]**. Press **[POWER LEVEL]** and enter **[1] [0] [dBm]**. Press **[SHIFT] [CF]** and enter **[1] [0] [0] [MHz]** for a step size of 100 MHz. Press **[MANUAL]** SWEEP and enter **[6] [.] [4] [GHz]** to set the Local Oscillator to CW at 6.4 GHz. Press **[PEAK]** to turn on peaking.

27. Press the 8340A Under Test **[INSTR PRESET]**. Press **[START FREQ]** and enter **[7] [GHz]**. Press **[STOP FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[POWER LEVEL]** and enter **[2] [0] [dBm]**. UNLEVELED indicator should be on. Press **[SHIFT] [CF]** and enter **[1] [0] [0] [MHz]** for a step size of 100 MHz. Press **[MANUAL]** SWEEP and enter **[7] [GHz]**. The mixer IF frequency is now 600 MHz.

28. Set the Spectrum Analyzer for a FULL SPAN of 0–2.5 GHz. Set RES BW for 300 kHz. Set VIDEO BW for 100 kHz. Set START FREQ to 590 MHz. Set STOP FREQ to 800 MHz. Set REFERENCE LEVEL to −10 dBm. Set ATTEN to 0 dB. Press HOLD to retain these settings. The 600 MHz IF signal should be near the left side of the Spectrum Analyzer CRT.

29. Using the STEP UP key on both the 8340A Under Test and the Local Oscillator 8340A, step through Band 2, observing the Spectrum Analyzer display at each step. There may be responses due to mixing products. These will appear as low level signals. A squegging response will appear as a higher amplitude signal as shown in Figure 5-42. If squegging occurs at 8340A frequencies below 10 GHz, adjust A24R3 (X2A) slightly CCW to eliminate the squegging. If squegging occurs at frequencies above 10 GHz, adjust A24R4 (X2B) to eliminate the squegging. Note, if the control is adjusted and there is no effect on the response, the response is probably a mixing product.

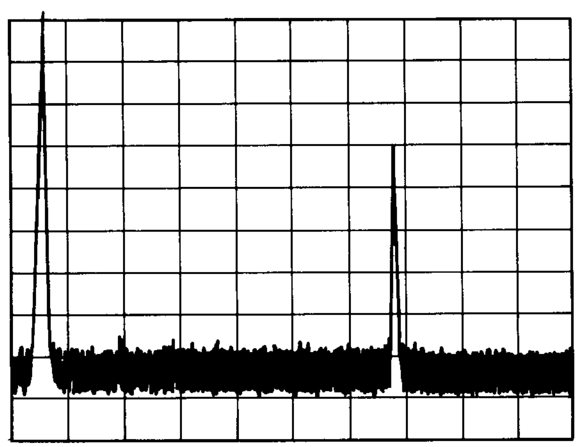


Figure 5-42. Unleveled Squegging Displayed on Spectrum Analyzer

30. For Band 3, press the Local Oscillator 8340A **[START FREQ]** and enter **[1] [2] [.] [9] [GHz]**. Press **[STOP FREQ]** and enter **[1] [9] [.] [4] [GHz]**. Press **[MANUAL]** and enter **[1] [2] [.] [9] [GHz]**.

31. Press the 8340A Under Test **[POWER LEVEL]** and enter **[2] [0] [dBm]**. Press **[START FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[STOP FREQ]** and enter **[2] [0] [GHz]**. Press **[MANUAL]** and enter **[1] [3] [.] [5] [GHz]**.

5-35. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

32. Using the step keys as described in step 30, step through Band 3. If squegging occurs below 15 GHz, adjust A24R6 (X3A) slightly CCW to eliminate the squegging. If squegging occurs above 15 GHz, adjust A24R7 (X3B).

33. For Band 4, press the Local Oscillator 8340A **[START FREQ]** and enter **[1] [9] [.] [4] [GHz]**. Press **[STOP FREQ]** and enter **[2] [5] [.] [9]**. Press **[MANUAL]** and enter **[1] [9] [.] [4] [GHz]**.

34. Press the 8340A Under Test **[START FREQ]** and enter **[2] [0] [GHz]**. Press **[STOP FREQ]** and enter **[2] [6] [.] [5] [GHz]**. Press **[POWER LEVEL]** and enter **[2] [0] [dBm]**. Press **[MANUAL]** and enter **[2] [0] [GHz]**.

35. Using the step keys as described in step 29, step through Band 4. If squegging occurs below 23 GHz, adjust A24R9 (X4A) slightly CCW to eliminate the squegging. If squegging occurs above 23 GHz, adjust A24R10 (X4B).

NOTE

If adjustments of the calibration constants were made in this procedure, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence: [SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz] [INSTR PRESET].

5-36. ALC ADJUSTMENTS

Reference:

Performance Test: Maximum Leveled Output Power and Accuracy
Service Section: RF Section

LOGGER TEMPERATURE COMPENSATION

Description:

NOTE

The following logger temperature compensation procedure should only be done if either A11 or A12 Detector is replaced.

The logger in A25 has temperature compensation in both high and low bands. This procedure calculates the values for the four factory-selected resistors in the temperature compensation circuit.

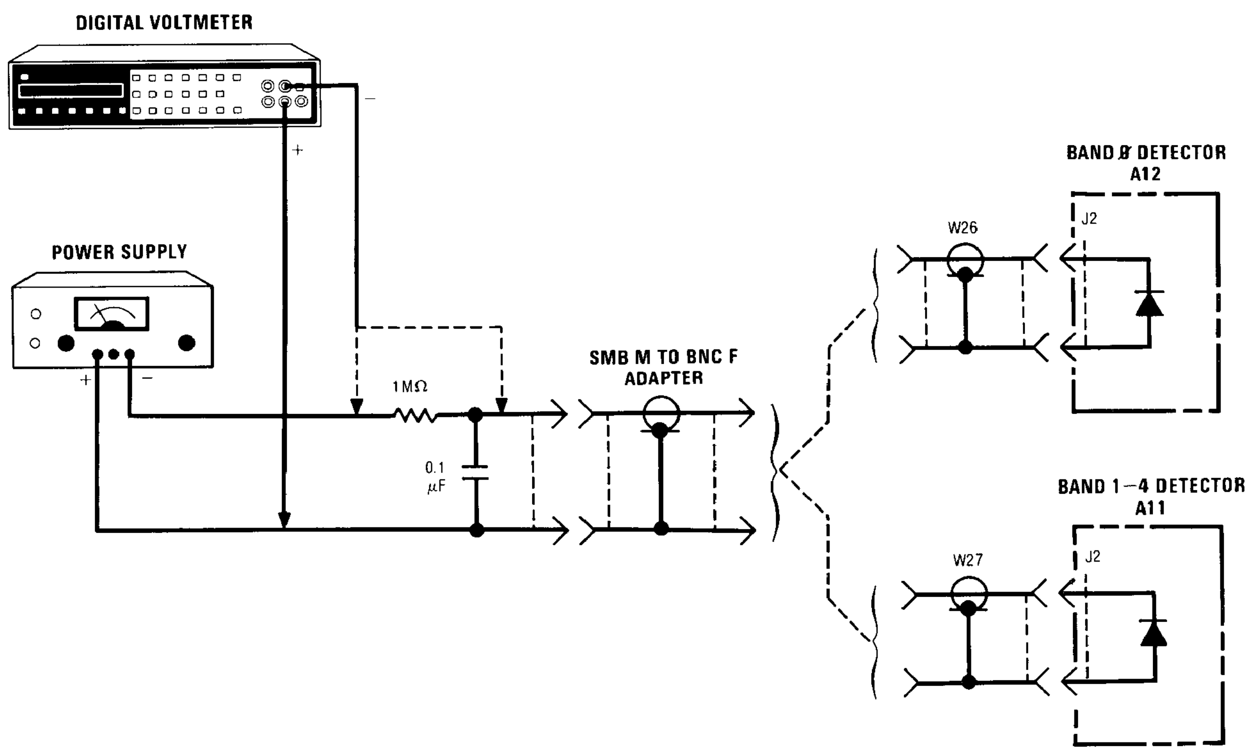


Figure 5-43. Logger Temperature Compensation Test Setup

5-36. ALC ADJUSTMENTS (Cont'd)

Equipment Required:

Power Supply	HP 6294A
Digital Voltmeter (DVM)	HP 3455A
1 Megohm Resistor	HP Part Number 0757-0059
0.1 UF Capacitor	HP Part Number 0160-0168
Extender Board	HP Part Number 08350-60031

Procedure:

1. Disconnect AC power cable from the 8340A Under Test and allow it to cool for at least two hours.

2. Disconnect cables W26 and W27 from A25J2 and A25J1 respectively (Figure 5-44), and remove A25 PC board from the instrument.

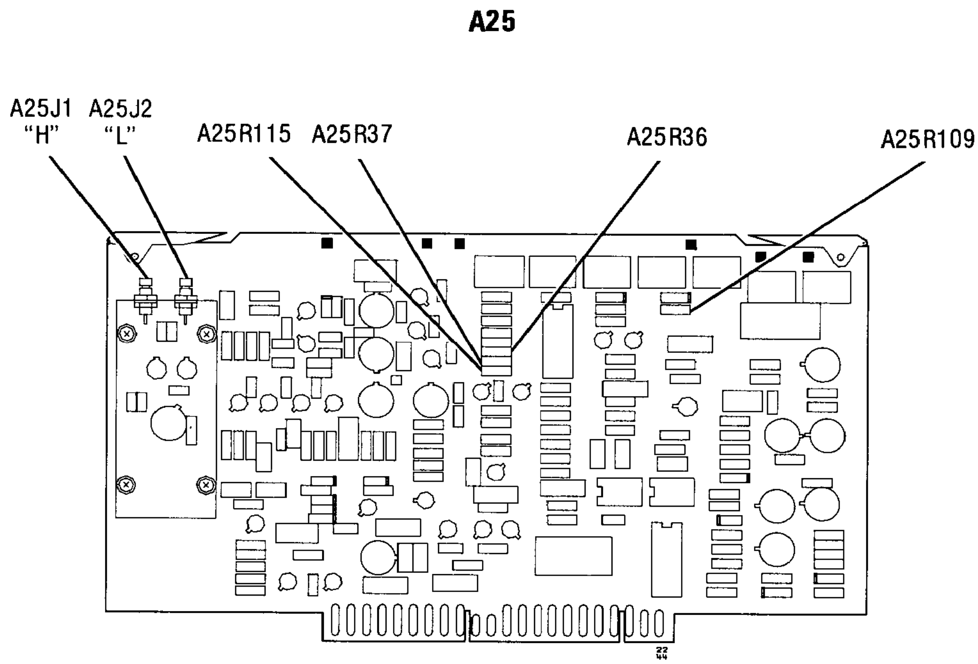


Figure 5-44. ALC Detector A25 Temperature Compensation Adjustments Location

3. Install Extender Board in place of A25.

4. Set DVM for Ohms measurement and connect the input between pins 4 and 26 of the extender board. Note the resistance measured. This value is thermistor resistance, R_T, and will be used for calculations in later steps.

5-36. ALC ADJUSTMENTS (Cont'd)

5. Connect equipment as shown in Figure 5-43 with cable W27 connector connected to SMB-to-BNC adapter.

6. Connect the DVM across the output terminals of the Power Supply and adjust the power supply output for 5.00 ±0.01 Vdc. Move the DVM connections back to the SMB-to-BNC adapter as shown in Figure 5-43.

7. Note indication on DVM. This value is V_{VM} for high band and will be used for calculations in step 8.

8. Calculate "Corrected Video Resistance in Hi Band", R_{VH}, as follows:

$$R_{VH} = (R_{VM} - 100) \times 24000/(R_T + 4000)$$

where:

R_{VH} = Corrected Video Resistance in High Band

R_{VM} = V_{VM} x 200 Ohms/mV

V_{VM} = Value measured in step 7 above.

R_T = Thermistor Resistance measured in step 4 above.

9. Use the value of R_{VH} found in step 8 above and select resistance values for A25R36 and A25R37 from Table 5-7.

10. Disconnect high band detector A11 cable W27 from SMB-to-BNC adapter and connect low band detector A12 cable W26 to adapter as shown in Figure 5-43.

11. Connect DVM at output of Power Supply and check that the output is still at 5.00 ±0.01 Vdc. Move the DVM connections back to the SMB-to-BNC adapter as shown in Figure 5-43.

12. Note indication on DVM. This value is V_{VM} for low band and will be used for calculations in step 13.

13. Calculate "Corrected Video Resistance in Low Band", R_{VL}, as follows:

$$R_{VL} = (R_{VM} - 680) \times 24000/(R_T + 4000)$$

where:

R_{VL} = Corrected Video Resistance in Low Band

R_{VM} = V_{VM} x 200 Ohms/mV

V_{VM} = Value measured in step 12 above.

R_T = Thermistor Resistance measured in step 4 above.

14. Use the value of R_{VL} found in step 13 above and select resistance values for A25R109 and A25R115 from Table 5-8.

5-36. ALC ADJUSTMENTS (Cont'd)

Table 5-7. Selected Values of High Band Temperature Compensation Resistors in A25

R_{VH} (Ohms)	A25R36 (Ohms)	A25R37 (Ohms)
800-870	9090	6190
870-950	8250	5620
950-1050	7500	5620
1050-1160	6810	5110
1160-1270	6190	4640
1270-1380	5620	4220
1380-1490	5110	4220
1490-1600	4640	3830

Table 5-8. Selected Values of Low Band Temperature Compensation Resistors in A25

R_{VL} (Ohms)	A25R109 (Ohms)	A25R115 (Ohms)
800-870	3830	9090
870-950	3480	8250
950-1050	3160	7500
1050-1160	2870	6810
1160-1270	2370	6190
1270-1380	2150	5620
1380-1490	1960	5110
1490-1600	1620	4640

5-36. ALC ADJUSTMENTS (Cont'd)

ALC ADJUSTMENTS

Description:

The ALC detectors have a linear region. Below the linear region the detector response is non-linear. The ALC circuit attempts to compensate for the non-linear regions such that the overall response of the ALC loop is linear over a 40 dB range from −20 dBm to +20 dBm. Since there is a separate detector and modulator for high band (Bands 1−4) and low band (Band 0), there are separate adjustments for high band and low band.

The 8340A is set to a CW frequency within the band to be adjusted. The RF attenuator and ALC is set for de-coupled operation (controlled separatly). The RF output level is set using the ENTRY keys. The power is measured with a power meter and if necessary adjustments are made until the power meter indication is correct at each 8340A power level.

Equipment Required:

Power Meter. . . . . HP 436A
Power Sensor. . . . . HP 8485A

Procedure:

NOTE

The ALC circuit contains several adjustment controls and the adjustment includes changing calibration constants stored in memory. All of the adjustments in each band interact with each other. In addition, the high band 0 dBm adjustment affects the low band, and the high band +18 dBm adjustment affects the low band. Before making any adjustments, check the operation of the ALC circuit as described below and make adjustments only if necessary.

NOTE

ALC accuracy problems for levels above +10 dBm may be due to parasitic oscillations in the log converter. If so, these may usually be cured by removing capacitor A25C11. This capacitor should be left in place if no oscillations occur to give best log amplifier rise time.

NOTE

In the following procedures, do not put P.C. boards on extender boards.

15. Connect equipment as shown in Figure 5-45. Calibrate and zero the power meter. Allow one hour warmup time. Connect the power sensor to the 8340A RF output. Press 8340A **[INSTR PRESET]**. Press **[CW]** and enter **[4] [.] [5] [GHz]**. Press 8340A **[RF]** key to turn the RF OFF and zero the power meter. To ensure that the power meter is properly zeroed, select "WATT" mode, and press the ZERO button two or three times. After the power meter is zeroed, the power meter should indicate ≤ 0.02 on the most sensitive range. Press **[RF]** to turn the RF ON. Press **[PEAK]** to center the SYTM frequency response to the YO signal. Press **[SHIFT] [PWR SWP]** to decouple the RF

5-36. ALC ADJUSTMENTS (Cont'd)

attenuator and ALC. Enter **[0] [dBm]**. If the display does not indicate ATTEN=0 dB, press STEP keys as necessary to select 0 dB attenuation.

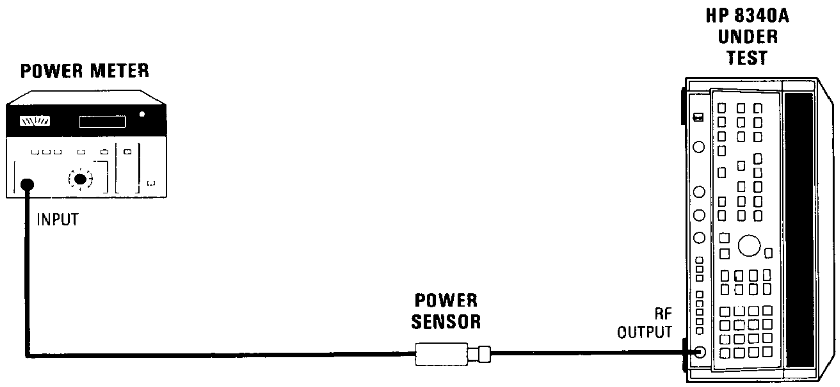


Figure 5-45. ALC Adjustment Test Setup

NOTE

When the power level is changed significantly, it may take as long as one minute for the power meter indication to be accurate. After making a power level change, wait until the power meter indication stabilizes before making any adjustments.

16. Refer to Table 5-9 below, enter the appropriate 8340A power level and check the power meter indication. Check the indication at each power level and note the amount of error before making any adjustments. If necessary, adjust the appropriate controls shown in the table to adjust the power level to be within the test limit shown.

    Adjustments are iterative. Adjust in the following order:

    0 dBm, −10 dBm, −20 dBm, −10 dBm, 0 dBm, +10 dBm, +18 dBm, and +10 dBm.

    See Figure 5-46 for more information that may help to reduce the number of iterations required. For example, if the +18 dBm indication is 0.1 dB low (+17.9 dBm), adjust for 0.05 dB high (+18.05 dBm). Then when the +10 is adjusted to +10 dBm, the +18 will move close to the correct level.

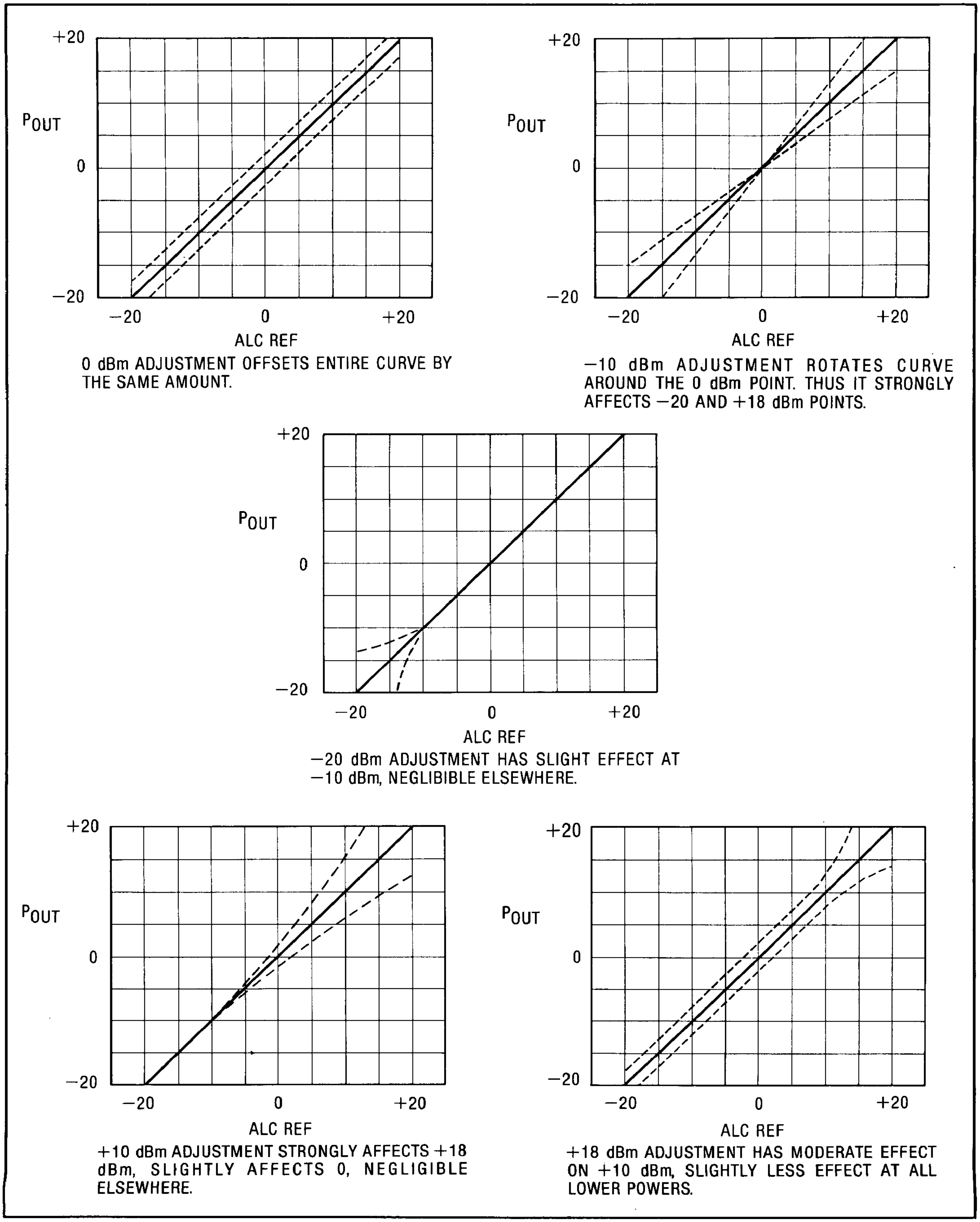


Figure 5-46. Typical ALC Adjustment Response Curves

5-36. ALC ADJUSTMENTS (Cont'd)

Table 5-9. High Band ALC Adjustment

8340A Power Level	Associated Adjustment	Check Limit	Adjustment Limit
−20 dBm	A25R34 (H-20)	0.3 dB	0.2 dB
−10 dBm	Calibration Constant #47*	0.1 dB	0.02 dB
0 dBm	Calibration Constant #44*	0.1 dB	0.02 dB
10 dBm	A25R39 (H+10)	0.1 dB	0.02 dB
18 dBm	A25R24 (+18)**	0.2 dB	0.05 dB

* Access Calibration Constant Number 47 by entering the following: **[SHIFT] [GHz] [4] [7] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Use **[STEP]** key to change Cal. Constant Number to 44.

** On some boards, this adjustment is labeled "+20."

5-36. ALC ADJUSTMENTS (Cont'd)

17. If all power meter indications are within the test limits, check at power levels from −20 dBm to +20 dBm in 5 dB steps.

18. Press **[CW]** and enter **[1] [.] [5] [GHz]**. Press **[SHIFT] [PWR SWP]** to decouple the RF attenuator and ALC. Enter **[0] [dBm]**. Press **[RF]** to turn the RF OFF. Zero the power meter as described in step 1. The low band (Band 0) contains broadband noise. If the power meter is properly zeroed, the broadband noise will be compensated and power measurements will be more accurate. Press **[RF]** to turn the RF ON.

19. Refer to Table 5-10 below, enter the appropriate 8340A power level and check the power meter indication. Check the indication at each power level and note the amount of error before making any adjustments. If necessary adjust the appropriate controls shown in the table to adjust the power level to be within the test limits.

    Adjustments are iterative. Adjust in the following order:

    0 dBm, −10 dBm, −20 dBm, −10 dBm, 0 dBm, and +10 dBm.

Table 5-10. Low Band ALC Adjustment

8340A Power Level	Associated Adjustment	Check Limit	Adjustment Limit
−20 dBm	A25R33 (L-20)	0.3 dB	0.2 dB
−10 dBm	Calibration Constant #46*	0.1 dB	0.02 dB
0 dBm	A25R108 (LOFS)	0.1 dB	0.02 dB
10 dBm	A25R38 (L+10)	0.1 dB	0.02 dB
There is no low band +20 dBm adjustment.			
* Access Calibration Constant Number 46 by entering the following: **[SHIFT] [GHz] [4] [6] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**.			

20. If all power meter indications are within the test limit, check at power levels from −20 dBm to +10 dBm in 5 dB steps.

NOTE

If adjustments of the calibration constants were made in this procedure, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence: [SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz] [INSTR PRESET].

5-36. ALC ADJUSTMENTS (Cont'd)

EXTERNAL LEVELING ADJUSTMENTS

NOTE

The negative external Xtal leveling adjustments include two variable resistor adjustments (+6 dBV and −60 dBV) and two calibration constant adjustments (−30 dBV and 0 dBV). These adjustments interact similar to the ALC adjustments. See Figure 5−47 for more information that may help to reduce the number of iterations required. Note that the curve rotates about the −30 dBV level.

21. Connect a negative Xtal detector to the 8340A RF output. Connect a BNC Tee at the detector output. Connect a BNC cable from one output of the Tee to the 8340A LEVELING EXT INPUT. Connect another BNC cable from the BNC Tee to a DVM. Set the DVM for a floating input. If using an HP 3455A or 3456A DVM, put a 0.1 UF capacitor across its terminals.

    Make adjustments in the following order:

    −30 dBV, 0 dBV, +6 dBV, 0 dBV, −30 dBV, and −60 dBV.

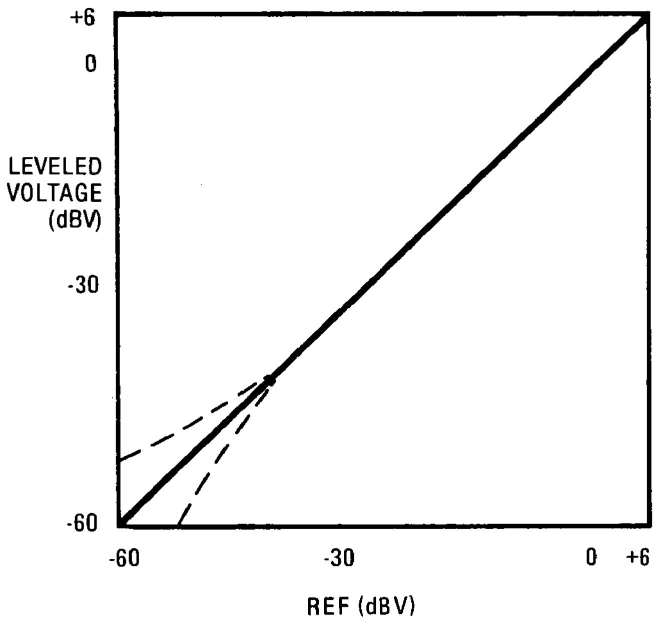
22. Press **[INSTR PRESET]**. Press **[CW]** and enter **[4] [.] [5] [GHz]**. Press **[XTAL]** LEVELING. The ENTRY DISPLAY should indicate ATN: 0 dB, REF −30.00 dBV. Adjust calibration constant Number 45 for a DVM indication of −31.6 mV ± 0.3 mV. Access Calibration Constant Number 45 by entering the following: **[SHIFT] [GHz] [4] [5] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**.

23. Press **[POWER LEVEL]** and enter **[0] [dBm]**. Adjust calibration constant Number 48 for a DVM indication of −1.00 volts ± 0.01 volts. Access Calibration Constant Number 48 by entering the following: **[SHIFT] [GHz] [4] [8] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**.

24. Press **[POWER LEVEL]** and enter **[6] [dBm]**. The ENTRY DISPLAY REF level should be +6 dBV. Adjust A25R88 (EXHI) for a DVM indication of −2.00 volts ±0.02 volts. The +6 dB adjustment will affect the 0 dBV level as well. To minimize the number of iterations, over adjust the +6 dBV level, then when the 0 dBV level is adjusted, the +6 dBV level will be close. For example, if the +6 dBV indication is 0.1V low, adjust for 0.15V high.

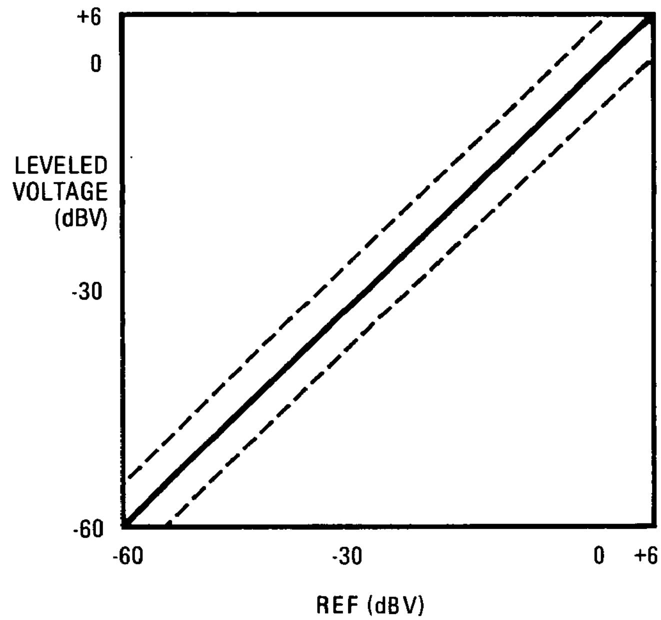
25. Press **[XTAL]** and enter **[−] [6] [0] [dBm]**. Use the down **[STEP]** key to set the RF attenuator to 20 dB. If the 8340A does not include an RF attenuator, connect a 20 dB pad between the RF output and the Xtal detector. Adjust A25R80 (EX−) for a DVM indication of −1.000 mV ±0.01 mV. Repeat all negative external leveling adjustments, in the order given, until all DVM indications are within ±1%. Note: Return the RF attenuator to zero except for the −60 dBV adjustment.

26. Connect a positive Xtal detector in place of the negative Xtal detector. With the RF attenuator set to 20 dB and the REF set to −60 dBV, adjust A25R84 (EX+) for +1.000 mV ±0.01 mV.



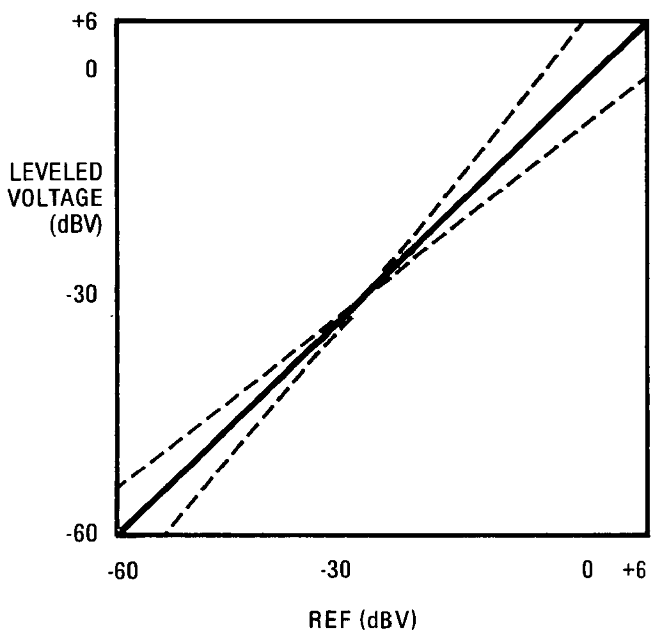
—60 dBV ADJUSTMENT HAS NEGLIGIBLE EFFECT ELSEWHERE.

(EX-/EX+)



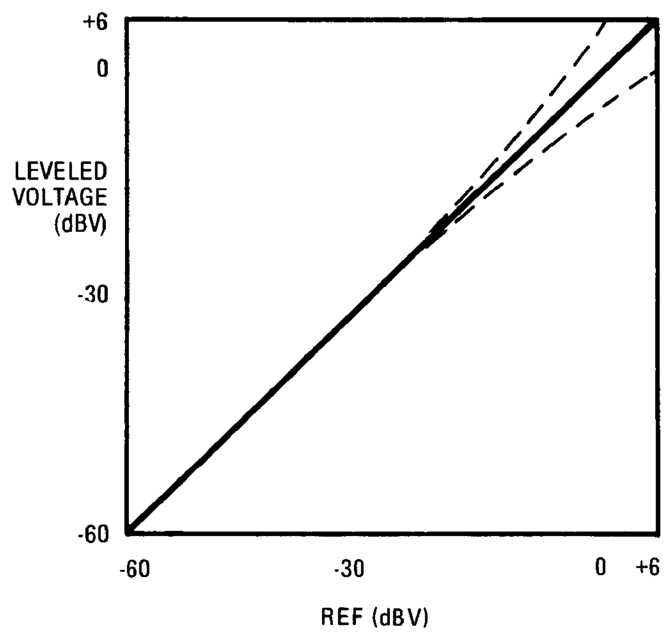
—30 dBV ADJUSTMENT OFFSETS ENTIRE CURVE BY THE SAME AMOUNT.

(CAL No. 45)



0 dBv ADJUSTMENT ROTATES CURVE ABOUT THE —30 dBV POINT. THUS IT AFFECTS —60 AND +6 dBV STRONGLY.

(CAL No. 48)



+6 dBV ADJUSTMENT HAS STRONG EFFECT ON 0 dBV, NEGLIGIBLE ELSEWHERE.

(A25R88)

Figure 5-47. Typical External Leveling Response Curves

5-36. ALC ADJUSTMENTS (Cont'd)

ADJUST AM OFFSET

27. Connect Power Sensor to 8340A RF OUTPUT. Press **[INSTR PRESET]**. Press **[CW]** and enter **[1] [GHz]**.Power level should be 0 dBm. Disconnect any AM inputs. Access Calibration Constant Number 43 by entering the following: **[SHIFT] [GHz] [4] [3] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 43 for no more than 0.05 dB change in power meter indication when turning AM on then off.

NOTE

If adjustments of the calibration constants were made in this procedure, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence: [SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz] [INSTR PRESET].

AM GAIN ADJUSTMENT

28. Set up the following equipment as shown in Figure 5-48a with the power supply set to 0.0 Vdc. Allow the equipment to warm up for at least 30 minutes.

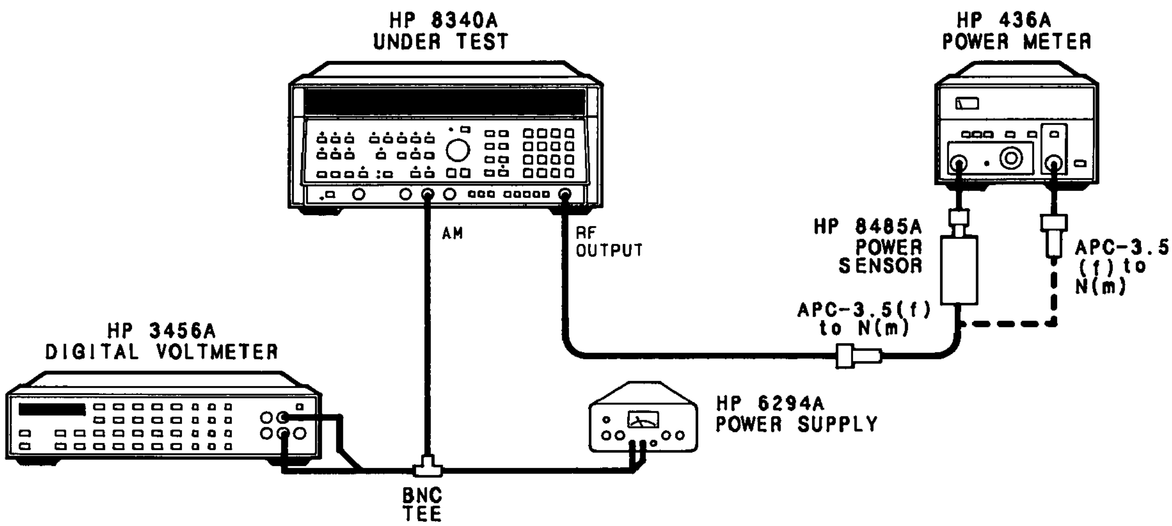


Figure 5-48a. AM GAIN Adjustment Test Setup

29. Calibrate the power meter and then set the calibration factor switch for a 1.5 GHz measurement. Connect the power sensor to the HP 8340A RF output.

30. Press the following key sequence on the HP 8340A:

[INSTR PRESET]
[CW] [1] [.] [5] [GHz]
[POWER LEVEL] [−] [5] [dBm]
[AM].

31. Adjust the power supply for 0.0 Vdc. press **dB[REF]** on the power meter (the power meter will now indicate the power level changes from this reference).

32. Adjust power supply for +0.3 Vdc. Power meter indication should be between 2.18 to 2.38 dB. If the indication is not in this range, adjust A26R91 (AM GAIN) for a power meter indication within the given range.

5-36. ALC ADJUSTMENTS (Cont'd)

33. Adjust power supply for −0.3 Vdc. Power meter indication should be between −2.91 and −3.29 dB. If the indication not in this range, adjust A26R91 (AM GAIN) for a power meter indication within the given range.

34. Repeat steps 32 and 33 until the power level requirements are met for each step.

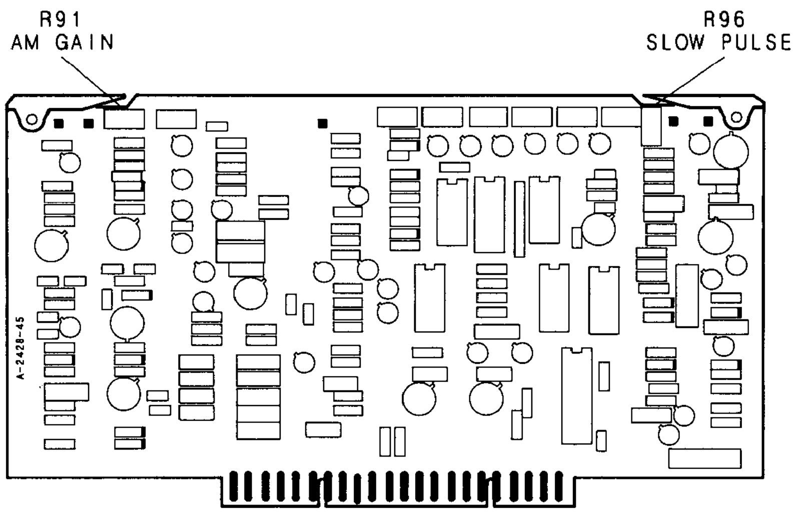


Figure 5-48b. AM Gain and Slow Pulse Adjustment Locations

5-36a. SLOW PULSE MODULATION ADJUSTMENT

Specification

Table 5-10b. Pulse Modulation Rise and Fall Time Adjustment Tolerances

Overshoot: <20%
Rise (T_R) and Fall (T_F) Times: 1 to 6 microseconds

Description

This adjustment optimizes pulse overshoot and Rise/Fall time in the instrument's "Slow Pulse" circuitry (located on the A26 linear modulator assembly). Slow pulse allows the HP 8340A to modulate its RF output at a 27.8 kHz rate. The 27.8 kHz signal is provided by connecting the modulation drive from an HP 8755C or 8756A network analyzer to the DUT's AM input.

The slow pulse circuitry is activated by pressing **[SHIFT] [PULSE]** on the front panel.

The HP 8340A under test RF output frequency is down converted to 50 MHz using a mixer and a second HP 8340A as a local oscillator. The 50 MHz IF signal is amplified and applied to an oscilloscope. The HP 8340A under test is pulsed using a 27.8 modulator drive from an HP 8755C. The modulator drive is also applied to the oscilloscope. the oscilloscope is used to measure the pulse envelope rise and fall times. Refer to Figure 5-49a Pulse Definitions.

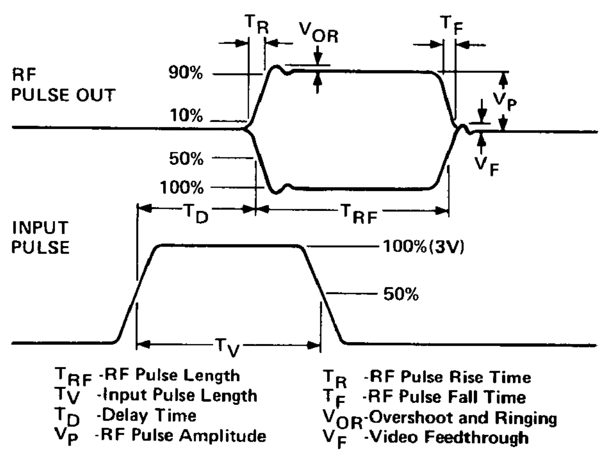


Figure 5-49a. Pulse Definitions

Equipment

Local Oscillator .... HP 8340A Opt. 001
Network Analyzer .... HP 8755C
Display .... HP 182T
Amplifier .... HP 8447F
Oscilloscope .... HP 1741A
Adapter .... HP P/N 5061-5311
10 dB Attenuator .... HP 8493C Opt. 010
Mixer .... RHG DMS 1-26
Low Pass Filter (LPF) .... HP P/N 08340-60176

5-36a. SLOW PULSE MODULATION ADJUSTMENT (Cont'd)

Procedure

1. Connect equipment as shown in Figure 5-49b. Connect the mixer directly to the local oscillator RF output to obtain maximum LO drive to the mixer. connect the BNC tee directly to the HP 8340A AM connector. Allow at least 30 minutes warm up time.

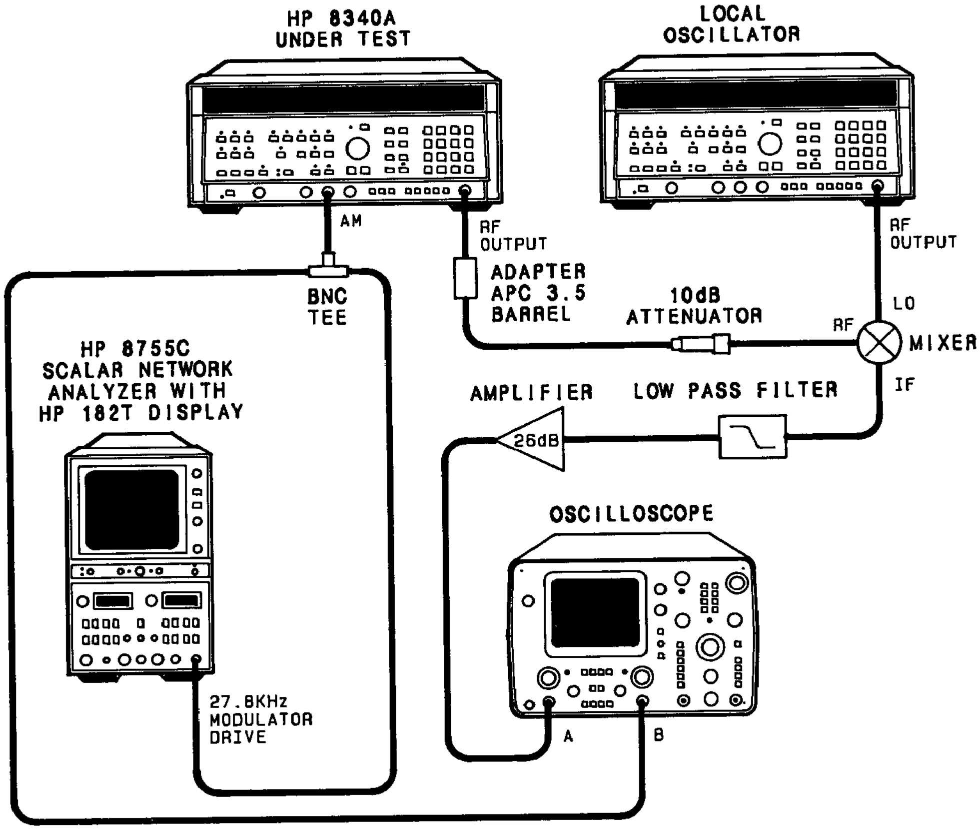


Figure 5-49b. Pulse Modulation Rise and Fall Time Test Setup

2. Set the oscilloscope up as follows:

   Channel A — 50 Ohm input. when the signal is present on the oscillocope, adjust vertical position and gain so the lower portion of the signal is at the 0% graticule, and the top of the pulse is at the 100% graticule. Use the averaged amplitude of the signal when setting up the 100% point, not the peak value.

   Channel B — DC input, 5V/div.

   Horizontal Controls — Chop Mode, trigger on Channel B, 2 usec/div.

5-36a. SLOW PULSE MODULATION ADJUSTMENT (Cont'd)

3. Press **[INSTR PRESET]** on both the HP 8340A under test and the local oscillator HP 8340A. Press the HP 8340A under test **[CW]** key and enter **[2] [GHz]** and press **[SHIFT] [PULSE]**. Press the local oscillator HP 8340A **[CW]** key and enter **[1] [.] [9] [5] [GHz]**. The IF frequency is then 50 MHz. Set the local oscillator HP 8340A for +10 dBm or maximum leveled output. The HP 8340A under test RF power should be 0 dBm.

NOTE

For best accuracy in this test, the Local Oscillator drive to the mixer should be ≥ +6 dBm. The HP 8340A Option 001 used as the LO will typically produce +6 dBm at any frequency, although it is only guaranteed to produce +4 dBm above 23 GHz. If +6 dBm is not available at a test frequency, try a slightly different frequency and be sure to have PEAK on.

4. Select oscilloscope channel A input only. Adjust the horizontal sweep period so the entire pulse width is visible on the oscillosope display. Adjust the vertical gain and position so that the pulse OFF is at the 0% graticule line and the pulse ON is a 100% graticule line. The ON portion of the pulse that is nearer to the trailing edge of the pulse should be used as the 100% reference point. The overshoot component of the pulse will then be clearly seen exceeding the 100% graticule.

5. Overshoot should not exceed 20%. Note the actual Overshoot value for later reference.

6. Repeat steps 4 and 5 at DUT frequencies of 3 through 26.0 GHz at 1 GHz steps, noting the overshoot at each frequency point. Make a last measurement at 26.5 GHz. At each frequency point, set the local oscillator HP 8340A CW frequency to be 50 MHz below that of the DUT.

7. Review the worst case Overshoot value; if it is within 20%, proceed to step 9. If the worst case Overshoot is out of tolerance, set the DUT and LO to the worst case frequencies and adjust A26R96 until the Overshoot meets tolerance.

8. Repeat steps 4 through 7 until overshoot is within tolerance at all frequency points.

9. Adjust the oscilloscope as in step 4 except the horizontal period should be adjusted so only the rising edge of the pulse is viewed. Refer to Figure 5-49c. Set the 10% point of the modulation envelope at the center vertical graticule line.

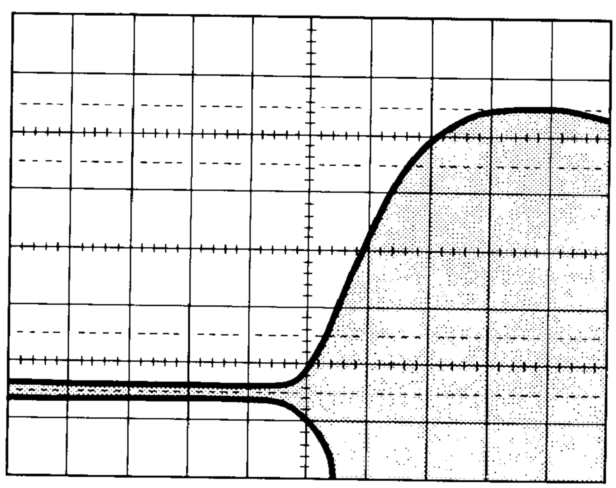


Figure 5-49c. Pulse Modulation Rise Time Waveform

5-36a. SLOW PULSE MODULATION ADJUSTMENT (Cont'd)

10. Set the DUT CW frequency to 2 GHz and the LO CW frequency to 1.95 GHz. Take note of the rise time for future reference. Rise time should be within 1 to 6 microseconds (10% to 90% points).

11. Repeat steps 9 and 10 at DUT frequencies of 3 through 26.0 GHz at 1 GHz steps, noting the rise time at each frequency point. Make a last measurement at 26.5 GHz. At each frequency point, set the local oscillator HP 8340A CW freequency to be 50 MHz below that of the DUT.

12. Take note of the worst case rise time, if this point is within 1 to 6 microseconds, proceed to step 14. If this point is out of tolerance, adjust A26R96 until tolerance is met.

13. Repeat steps 4 through 12 until overshoot and rise time at all listed frequencies are within tolerance. (Tolerances given for rise and fall time, as well as overshoot, are not warranted specifications.)

14. Adjust the oscilloscope horizontal position control to view the modulation envelope fall time. Position the waveform so that the 90% point of the modification envelope crosses a convenient vertical graticule. Refer to Figure 5-49d.

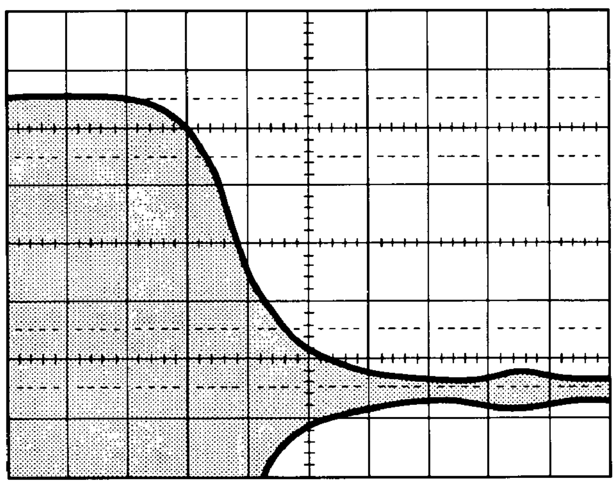


Figure 5-49d. Pulse Modulation Fall Time Waveform.

15. Set the DUT CW frequency to 2 GHz and the LO CW frequency to 1.95 GHz. Take note of the fall time for future reference. Fall time should be within 1 to 6 microseconds (10% to 90% points).

16. Repeat steps 14 and 15 at DUT frequencies of 3 through 26.0 GHz at 1 GHz steps, noting the fall time at each frequency point. Make a last measurement at 26.5 GHz. At each frequency point, set the local oscillator HP 8340A CW frequency to be 50 MHz below that of the DUT.

17. Take note of the worst case fall time, if this point is within 1 to 6 microseconds, this test has been completed. If this point is out of tolerance, adjust A26R96 until tolerance is met.

18. Repeat steps 4 through 17 until overshoot, rise time, and fall time at all listed frequencies are within tolerance.

5-37. LEVELED RF OUTPUT ADJUSTMENTS

Reference:

Performance Test: Maximum Leveled Output Power and Accuracy
Service Section: RF Section

Description:

In this procedure, the RF Output signal is checked in leveled mode. A Frequency Response Test Set (8755C) is used to check for signal flatness and for the possible occurence of "squegging". Squegging is an undesireable parasitic oscillation in the RF output signal.

In the next procedure, the ALC loop gain in each band is adjusted for optimum operation.

Next, a section is given using an 8340A internal program called "Auto Track". This program automatically sets the SYTM tracking.

A final section checks the RF Output signal with a Spectrum Analyzer (8566A) for the appearance of squegging in any of the bands and allows a final tweek of adjustments to eliminate any squegging that is observed.

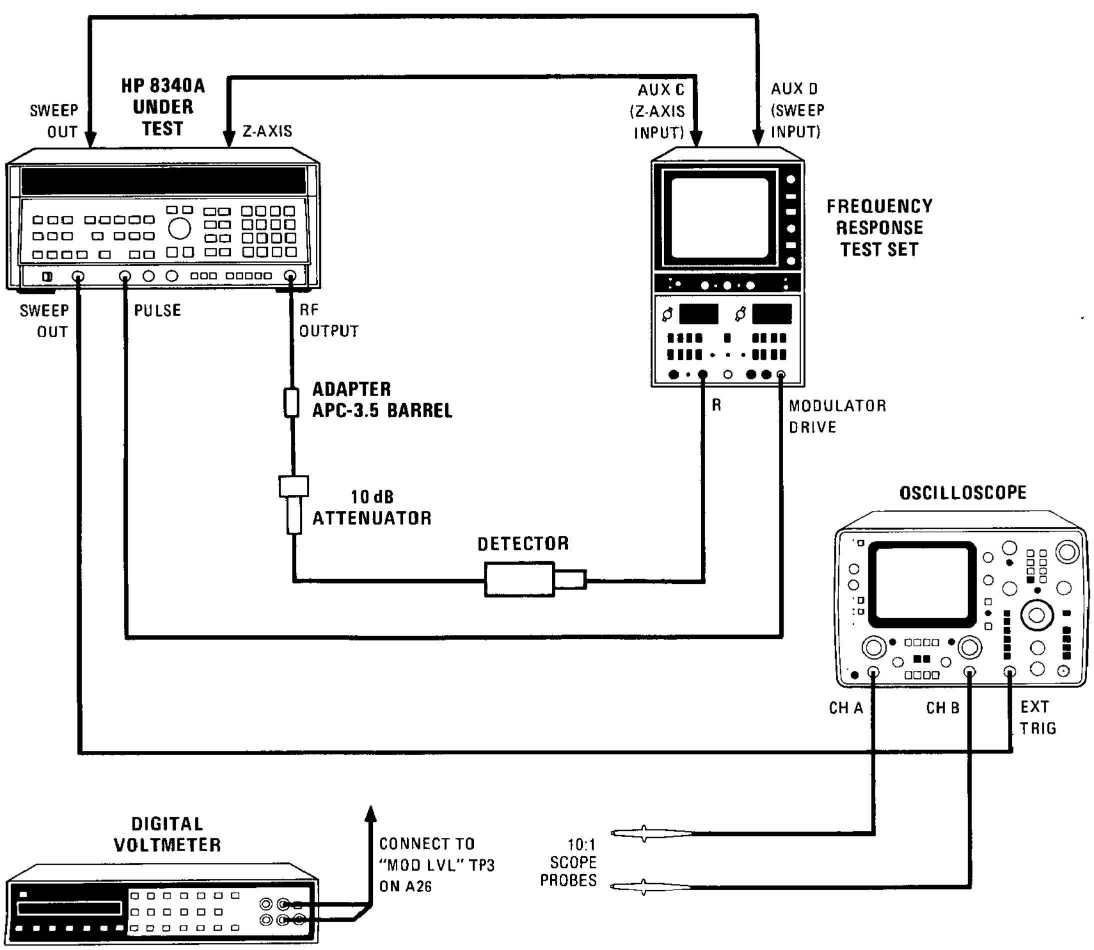


Figure 5-49. Leveled Power SRD Bias Adjustment Test Setup

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

Equipment Required:

Frequency Response Test Set	HP 8755C
Detector	HP 11664B
Oscilloscope	HP 1741A
10:1 Divider Probe (2 Required)	HP 10004D
Digital Voltmeter	HP 3455A
10 dB Attenuator	HP 8493C Option 010

Procedures:

MODULATOR OFFSET

1. Connect equipment as shown in Figure 5-49. Connect the DVM to A26TP3 (MOD LVL). Preset A26R88 (MO) fully clockwise (Figure 5-50). Allow at least 30 minutes warm up.

2. Press the 8340A **[INSTR PRESET]**. Press **[CW]** and enter **[8] [GHz]**. Press **[SHIFT] [METER]** to bypass the ALC circuit and allow direct control of the linear modulator circuit.

3. Adjust the front panel rotary knob for a DVM indication of 0.00 volts, then note the POWER dBm display indication. Adjust A26R88 (MO) CCW to decrease the POWER dBm indication by 0.2 dB.

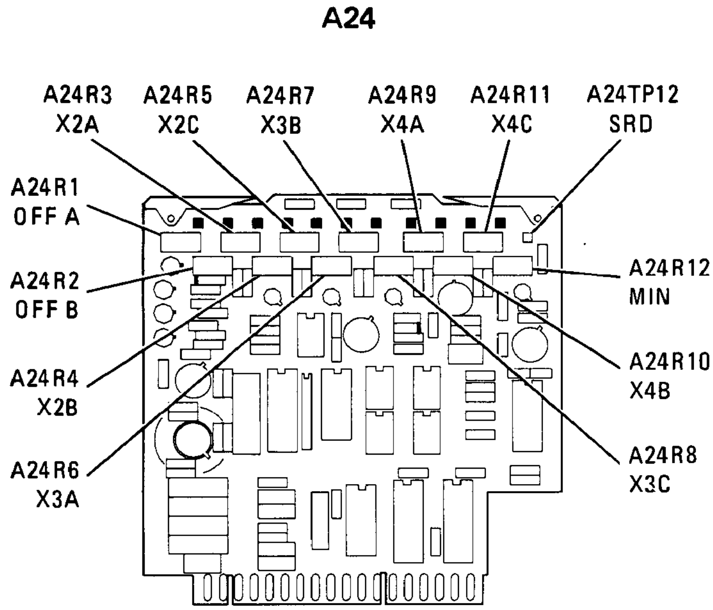
LEVELED BIAS

4. Disconnect the DVM and connect oscilloscope CHAN A probe to A26TP3 (MOD LVL). Connect CHAN B probe to A24TP12 (SRD).

5. Press 8340A **[INSTR PRESET]**. Press **[SHIFT] [CF]** and enter **[2] [0] [0] [MHz]** for a step size of 200 MHz. Press **[SWEEP TIME]** and enter **[5] [0] [msec]**. Press **[SHIFT] [PWR SWP]** to decouple the RF attenuator and ALC, and enter **[−] [2] [0] [dBM]**. Press **[PWR SWP]** and enter **[4] [0] [dB]**. Press **[AM]** ON. Press **[CW]** and enter **[8] [GHz]**. This puts the 8340A in power sweep from −20 to +20 dB at any frequency selected.

   Save this instrument state by pressing **[SAVE] [1]**.

   Set A24R1 (OFF A) (Figure 5-50) and A24R2 (OFF B) controls fully counter clockwise.



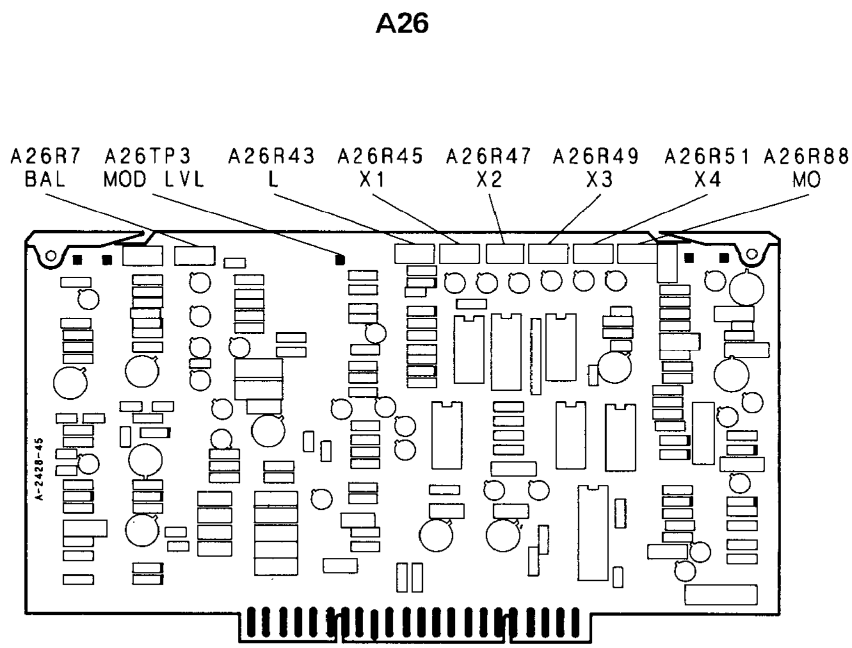


Figure 5-50. SRD Bias Adjustments on A24 and A26

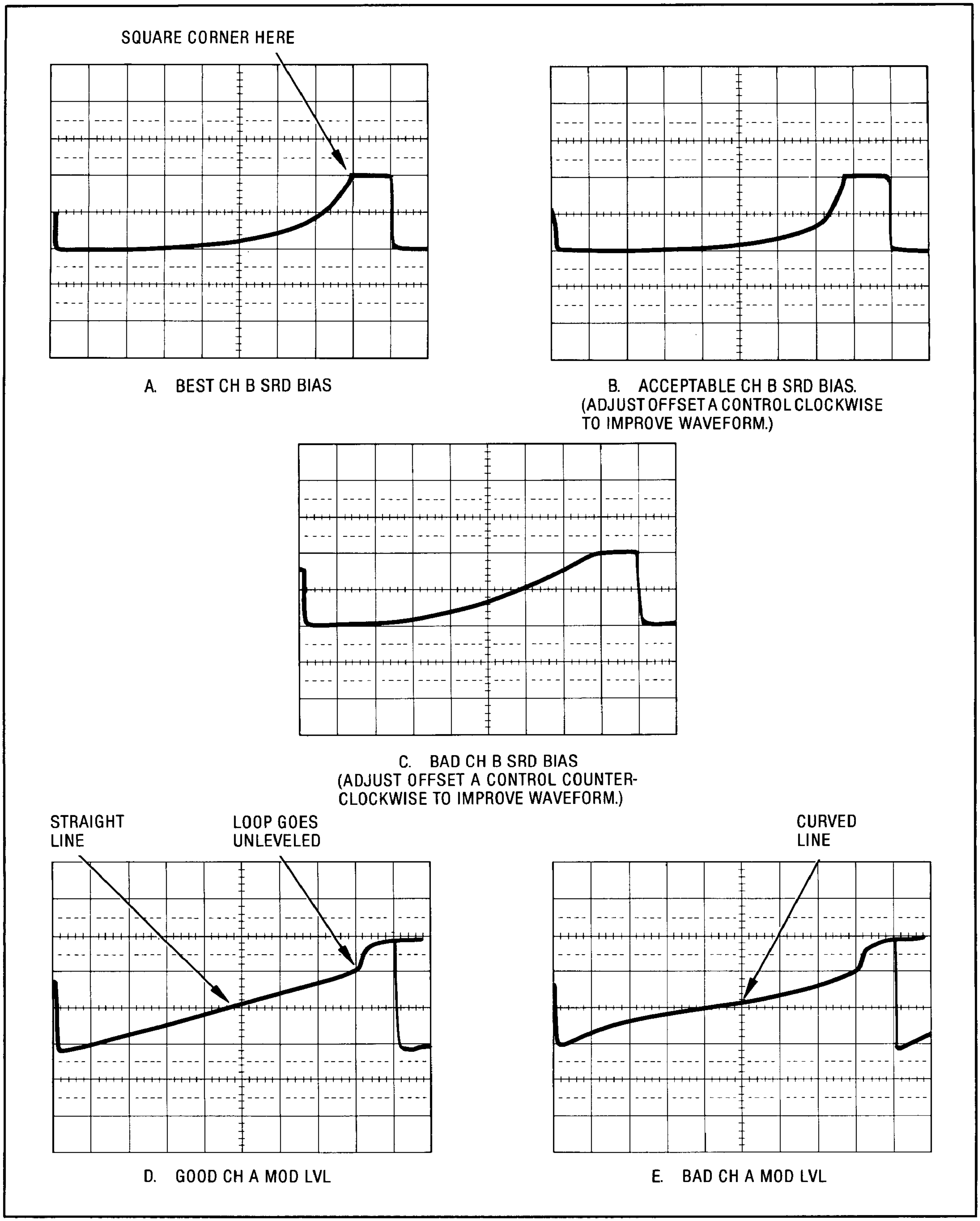


Figure 5-51. Typical MOD LVL and SRD BIAS Waveforms

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

6. Set the oscillosope as follows:

DISPLAY	CHOP, TRIGGER ON A
CH A	0.05V/Div DC COUPLED
CH B	0.1V/Div DC COUPLED
TRIGGER	EXT. NEG.
TIME/Div.	5 ms

The oscillosope display should look similar to Figure 5-52.

NOTE

It may be necessary to adjust the oscilloscope sweep vernier to view the entire sweep on the CRT.

LEVELED POWER SRD BIAS ADJUSTMENT

7. Center A24R12 MIN control and A24R5 X2C control. Adjust A24R1 OFF A for optimum display as shown in Figure 5-51, Waveform A, B, and C.

8. Press 8340A **[CW]** and enter **[1] [0] [.] [6] [GHz]**. Adjust A24R2 OFF B for optimum trace as shown in Figure 5-51, Waveforms A, B, and C. Using the **[STEP]** keys, step through Band 2 from 7 to 13.4 GHz and check for an optimum SRD Bias trace (Figure 5-51, Waveforms D and E) at each step. If not optimum, adjust A24R2 OFF B if the 8340A frequency is closer to 13.5 GHz, or adjust A24R1 OFF A if the frequency is closer to 7 GHz. If an adjustment is made, step through the entire band again, making sure every step is optimized or acceptable if all steps cannot be optimized.

9. Set oscilloscope EXT TRIGGER to POS. TRIGGER, DISPLAY A, and set CH A to .02 V/DIV.

10. Press 8340A **[INSTR PRESET]**. Press **[START FREQ]** and enter **[7] [GHz]**. Press **[STOP FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[SHIFT] [PWR SWP]** and enter **[−] [2] [0] [dBm]**. Press **[SWEEP TIME]** and enter **[5] [0] [msec]**.

    Save this instrument state by pressing **[SAVE] [2]**.

11. The oscilloscope display should be similar to Figure 5-52. Adjust A24R12 MIN control so that the highest peak on the oscilloscope display is minimum.

12. Press **[RECALL] [1]** then press **[CW]** and enter **[1] [0] [.] [6] [GHz]**. Change oscilloscope EXT TRIGGER to NEG. TRIGGER, DISPLAY CHOP; CH A to .05 V/DIV, and CH B to 0.1 V/DIV. Adjust A24R5 X2C to minimize the MOD LEVEL voltage at the start of the power sweep and keep the MOD LEVEL power sweep trace straight with no steps or "bows" as it sweeps up. Using the **[STEP]** keys, step through band 2 from 7 to 13.4 GHz and readjust A24R5 X2C if necessary to improve the MOD LEVEL trace. Also, adjust A24R1 OFF A and A24R2 OFF B if necessary to optimize the SRD Bias as in step 8 above. If any adjustments are made, step through band 2 again until the SRD bias and the MOD LEVEL trace is optimized. It will not be possible to adjust the MOD LEVEL trace for optimum at each step, so adjust for best compromise trace all across Band 2. (See Figure 5-51.)

13. A24R8 X3C and A24R11 X4C are adjusted in Bands 3 and 4 respectively. They are adjusted the same as in Band 2 to minimize the MOD LEVEL voltage at the start of the

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

power sweep and keep the MOD LEVEL trace straight with no "bows" as it sweeps up. (Refer to Figure 5-51.) Press **[RECALL] [1]** then **[CW]** and enter **[1] [7] [.] [5] [GHz]**. Adjust A24R8 X3C for a MOD LEVEL trace as described above. Using the **[STEP]** keys, step through Band 3 from 13.5 to 19.9 GHz and readjust if necessary to achieve the best MOD LEVEL trace across Band 3.

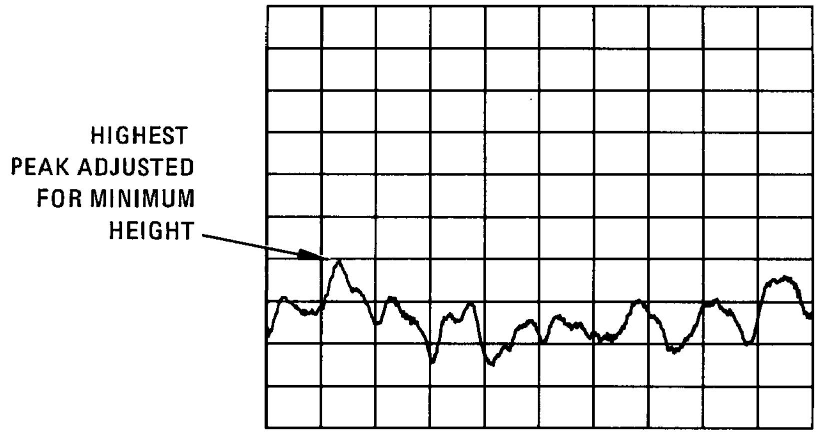


Figure 5-52. Oscilloscope Display at A26TP3 MOD LVL with No Squegging

NOTE

The SRD bias trace is adjusted in Band 2 with A24R1 OFF A and A24R2 OFF B for optimum. It should not require any other adjustments in Bands 3 or 4, unless the SRD bias trace is bad as shown in Figure 5—51. If either the OFF A or OFF B controls are adjusted in Bands 3 or 4, then each band will have to be rechecked, starting with Band 2 at 7 GHz and stepping through each band.

14. Press **[RECALL] [1]**, **[CW] [2] [3] [.] [3] [GHz]** and adjust A24R11 X4C for a MOD LEVEL trace as described above. Using the **[STEP]** keys, step through Band 4 from 20.1 to 26.5 GHz and readjust if necessary for best MOD LEVEL trace all across Band 4.

15. Remove oscilloscope probes from the 8340A. Connect the 8340A to the 8755C as shown in Figure 5-49. Press 8340A **[INSTR PRESET]** and **[RECALL] [2]**. Press **[SHIFT] [PWR SWP]** and enter **[2] [0] [dBm]**. Press **[PULSE]** modulation to turn it on. Press **[SWEEP TIME] [AUTO]**.

    Adjust 8755C reference level to view the Band 2 response at 1 dB/DIV. Using the front panel rotary knob and the 8755C reference level controls, vary the ALC level from +20 dBm to −20 dBm. Look for squegging as shown in Figure 5-53. If any squegging occurs, adjust A24R5 X2C counterclockwise to eliminate the squegging.

16. Press **[START FREQ] [1] [3] [.] [5] [GHz]**, **[STOP FREQ] [2] [0] [GHz]**, **[SHIFT] [PWR SWP] [2] [0] [dBm]**. Vary the ALC level as in step 15 and check for squegging. If squegging occurs, adjust A24R8 X3C counterclockwise to eliminate the squegging.

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

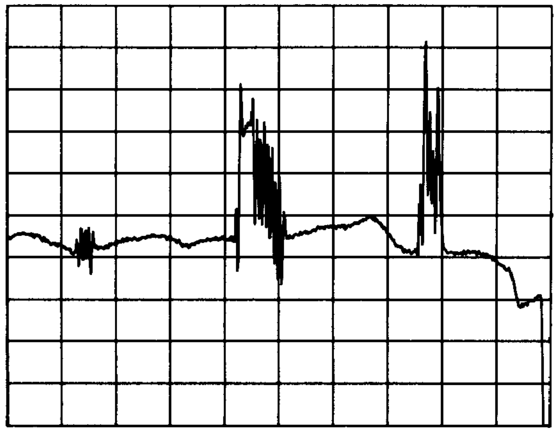


Figure 5-53. 8755C Display with Squegging Present

17. Press **[START FREQ] [2] [0] [GHz]**, **[STOP FREQ] [2] [6] [.] [5] [GHz]**, **[SHIFT] [PWR SWP] [2] [0] [dBm]**. Vary the ALC level as in step 15. If any squegging occurs, adjust A24R11 X4C counterclockwise to eliminate the squegging.

18. Press **[SHIFT] [PWR SWP] [0] [dBm]** and adjust the 8755C REF LEVEL to view Band 4 at 1 dB/DIV. Press **[START FREQ]** and using the front panel rotary knob, move the START FREQ up to 26 GHz and down to 14 GHz while watching the 8755C display for squegging. If any squegging is seen, stop at the START FREQ where it occurs. If the squegging occurs in Band 3 (13.5 to 20 GHz), adjust A24R8 X3C counterclockwise until squegging is gone. If squegging occurs in Band 4 (20 to 26.5 GHz), adjust A24R11 X4C counterclockwise until the squegging is gone. Press **[SHIFT] [PWR SWP] [−] [5] [dBm]** and change the start frequency as above; adjust out squegging if any occurs. Press **[SHIFT] [PWR SWP] [−] [1] [0] [dBm]** and change the start frequency as above; adjust out sqegging if any occurs. Press **[SHIFT] [PWR SWP] [−] [1] [5] [dBm]** and change the start frequency as above; adjust out squegging if it occurs.

LINEAR MODULATOR ALC LOOP GAIN ADJUSTMENTS

Description:

The following adjustments are performed to set the ALC Loop Gain for each band. The adjustment is done in the power sweep (PWR SWP) mode, while sweeping the ALC Loop from −20 dBm to maximum power (or +20 dBm).

NOTE

If the A26 Assembly has not been replaced, adjustments may not be necessary.

19. Connect the 8340A SWEEP OUT to the oscilloscope EXT TRIGGER. Connect CH A probe to A26TP3 (MOD LVL). Connect CH B probe to A25TP2 (DET). Set up the oscillosope as follows:

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

DISPLAY	CHOP
CH A	0.05V/Div DC COUPLED
CH B	0.05V/Div DC COUPLED
TRIGGER	EXT NEG
TIME/Div.	5 ms
SWEEP VERNIER	ON

20. Press the 8340A **[INSTR PRESET]**. Press **[SWEEP TIME]** and enter **[5] [0] [msec]**. Press **[SHIFT] [PWR SWP]** and enter **[−] [2] [0] [dBm]**. Press **[PWR SWP]** and enter **[4] [0] [dBm]**. Press **[SHIFT] [CF] [2] [0] [0] [MHz]**. Press **[AM]** to turn it ON. Press **[CW]** and enter **[1] [0] [MHz]**.

    The oscilloscope display should be similar to Figure 5-54, Waveforms A and B. It may be necessary to adjust the SWEEP VERNIER to view the entire power sweep.

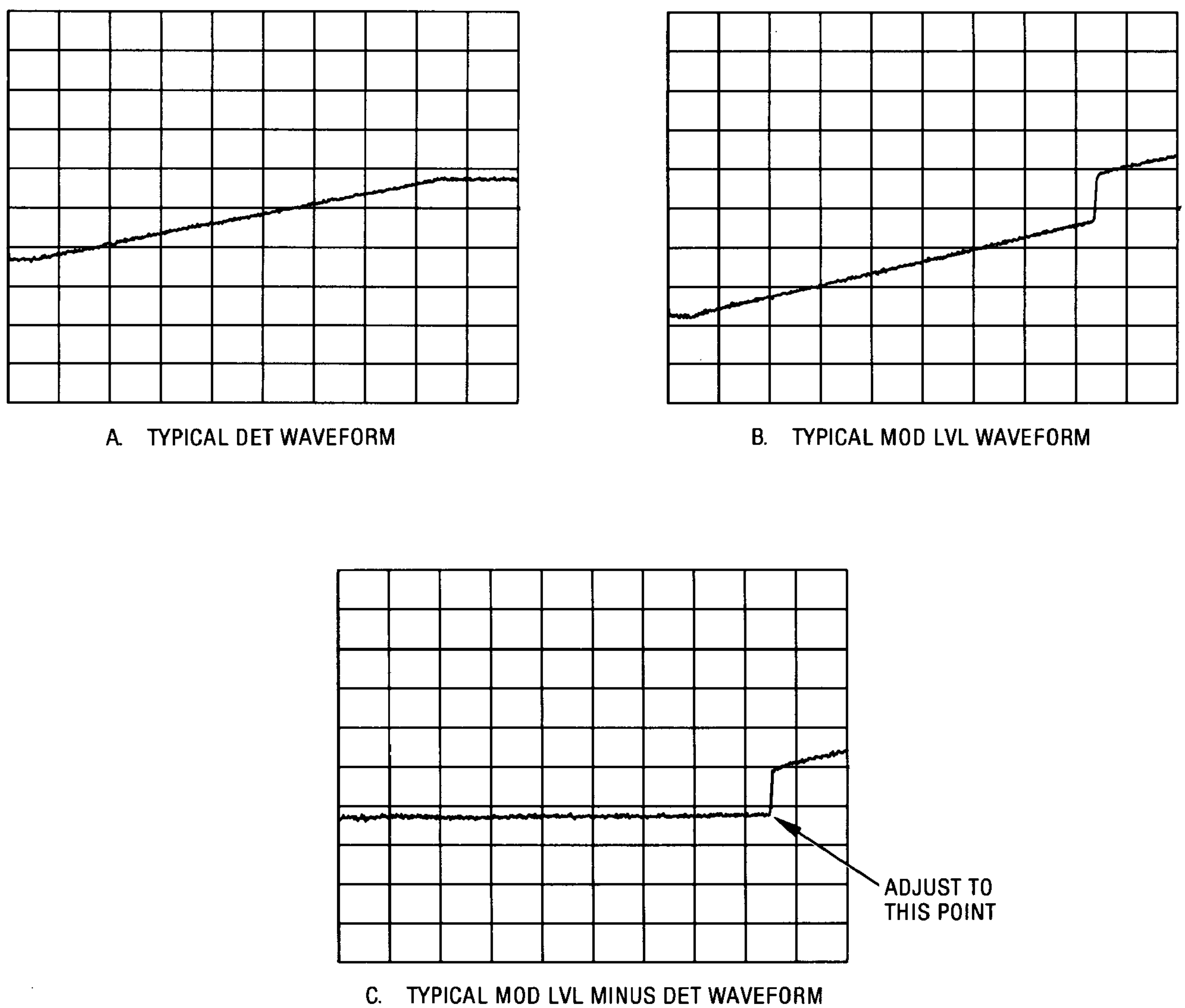


Figure 5-54. Typical MOD LVL and DET Waveforms for ALC Loop Gain Adjustment

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

NOTE

In step 21 through 25, the oscilloscope display will be adjusted for the most horizontal line. This adjustment is only concerned with the trace up to where it deviates from a flat line. (See Figure 5-54, waveform C.) This point on the display will change position with frequency.

21. On the oscilloscope, invert Channel B and select DISPLAY A+B mode. Using the 8340A **[STEP]** keys, step the CW frequency through Band 0 from 10 MHz to 2.21 GHz and adjust A26R43 HET for the most horizontal line across Band 0.

22. Press **[CW]** and enter **[2] [.] [3] [GHz]**. Using the **[STEP]** keys, step the CW frequency through Band 1 from 2.3 to 6.9 GHz and adjust A26R45 X1 for the most horizontal line across Band 1.

23. Press **[CW]** and enter **[7] [GHz]**. Using the **[STEP]** keys, step the CW frequency through Band 2 from 7.0 to 13.4 GHz and adjust A26R47 X2 for the most horizontal line across Band 2.

24. Press **[CW]** and enter **[1] [3] [.] [5] [GHz]**. Using the **[STEP]** keys, step the CW frequency through Band 3 from 13.5 to 19.9 GHz and adjust A26R49 X3 for the most horizontal line across Band 3.

25. Press **[CW]** and enter **[2] [0] [GHz]**. Using the **[STEP]** keys, step the CW frequency through Band 4 and adjust A26R51 X4 for the most horizontal line across Band 4.

NOTE

A26R7 BAL is adjusted in the Pulse Adjustment procedure and A26R88 MO is adjusted in the Leveled Power SRD Bias Adjustment procedure.

SYTM TRACKING USING AUTO TRACK

Description:

Auto Tracking is an internal program that sets Calibration Constants 9 through 12 to optimize the tracking. The program takes about 5 to 10 seconds to run and is invoked using **[SHIFT] [PEAK]**.

When **[SHIFT] [PEAK]** is pressed, the 8340A adjusts the Calibration Constants to give tracked performance. The tracking adjustments made to the A28 SYTM Driver should be adjusted in connection with the auto-tracking routine to give optimum tracking performance.

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

Equipment Required:

Frequency Response Test Set	HP 8755C
Detector	HP 11664B
Storage Normalizer	HP 8750A
Oscilloscope	HP 1741A
10:1 Divider Probe	HP 10004D
Digital Voltmeter	HP 3455A
Power Meter	HP 436A
Power Sensor	HP 8485A
10 dB Attenuator	HP 8493C Option 010

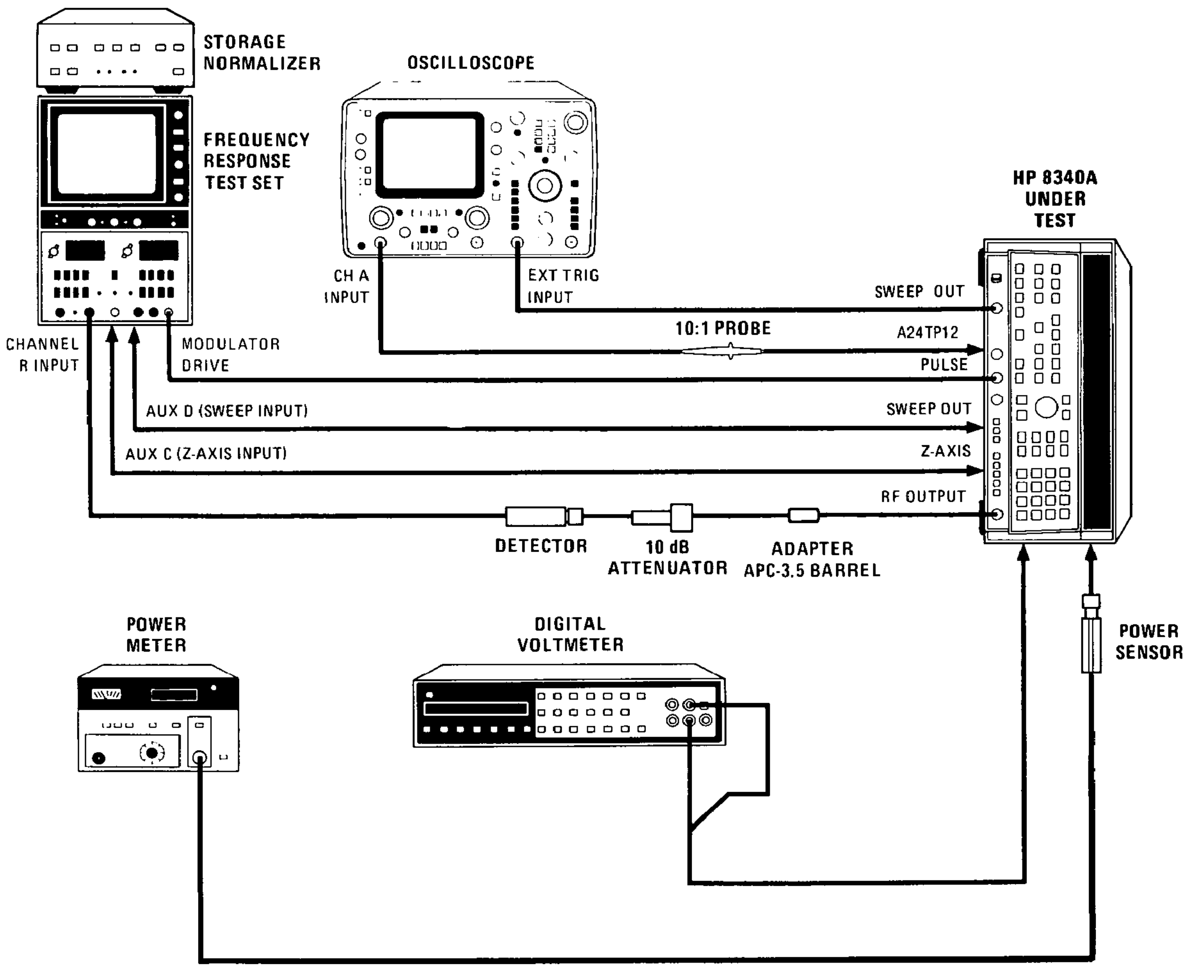


Figure 5-55. SYTM Tracking and Delay, and Leveled SRD Bias Adjustment Setup

26. Connect equipment for SYTM Tracking as shown in Figure 5-55. Allow at least 30 minutes warm up.

27. Press 8340A **[INSTR PRESET]** then press **[PULSE]** to turn on pulse modulation. Press **[START FREQ]** and enter **[6] [.] [9] [GHz]**. Press **[STOP FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[SWEEP TIME]** and enter **[2] [0] [0] [msec]**. Press **[XTAL]** leveling key to obtain non-leveled operation. Display CH R on both channels at 1 dB/Div so that one channel can be stored and then compared to the other channel. Store the Band 2 response using the storage normalizer by pressing 8750A CH1 INPUT, STORE INPUT, and RECALL.

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

28. Press **[SHIFT] [PEAK]**. After about 10 seconds, the CH 2 trace should match the stored CH 1 trace within approximatly 0.5 dB. If the difference is less than 1 dB, proceed to step 33, otherwise continue with step 29.

29. Adjust the low end of Band 2 with A28R1 OFF and the high end with the auto track routine (**[SHIFT] [PEAK]**) until the unleveled power trace for Band 2 is optimized.

30. Store the optimized trace using the storage normalizer as described in step 27.

31. Set Calibration Constant Number 10 to 1024 as follows. Press **[SHIFT] [GHz] [1] [0] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]** and enter **[1] [0] [2] [4] [Hz]**.

32. Adjust A28R8 GAIN until the trace on the 8755C matches the stored trace. Go to step 28 and repeat auto-track routine until no further adjustments are necessary.

33. For Band 1, press **[START FREQ]** and enter **[2] [.] [3] [GHz]**. Press **[STOP FREQ]** and enter **[7] [GHz]**.

34. Adjust the low end of Band 1 with A28R113 B1 OFF and the high end of Band 1 with Calibration Constant Number 9. Calibration Constant Number 9 may be accessed as follows. Press **[SHIFT] [GHz] [9] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [KHz] [2] [2] [Hz]**. Use the rotary knob to optimize the high end. Adjust both A28R113 B1 OFF and Calibration Constant Number 9 until the optimum trace is present on the 8755C. Do not worry about sections that drop out due to squegging; they will not present a problem with leveled output power over the specified power range of the instrument.

35. Store the optimized trace using the storage normalizer as described in step 27. Press **[ENTRY OFF]** to disable the rotary knob.

36. Press **[SHIFT] [PEAK]** and wait until the auto tracking is complete. If the resulting trace is greater than 1 dB from the stored trace, adjust A28R113 B1 OFF and repeat this step until the trace is within 1 dB of the stored trace.

37. For Band 3, press **[START FREQ]** and enter **[1] [3] [.] [3] [5] [GHz]**. Press **[STOP FREQ]** and enter **[2] [0] [GHz]**.

38. Adjust the low end of Band 3 with Calibration Constant Number 11. Calibration Constant Number 11 may be accessed by pressing **[SHIFT] [GHz] [1] [1] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [KHz] [2] [2] [Hz]**. Adjust the high end of Band 3 with A28R2 BP1. Iterate adjusting the low end and the high end until the optimum trace is present on the 8755C.

39. Store the optimized trace using the storage normalizer as described in step 27. Press **[ENTRY OFF]** to disable the rotary knob.

40. Press **[SHIFT] [PEAK]** and wait until the auto tracking is complete. If the resulting trace is greater than 1 dB from the stored trace, adjust A28R2 BP1. Repeat this step until the trace is within 1 dB of the stored trace.

41. For Band 4, press **[START FREQ]** and enter **[1] [9] [.] [8] [GHz]**. Press **[STOP FREQ]** and enter **[2] [6] [.] [5] [GHz]**.

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

42. Adjust the low end of Band 4 with Calibration Constant Number 12. Calibration Constant Number 12 may be accessed as follows. Press **[SHIFT] [GHz] [1] [2] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [KHz] [2] [2] [Hz]**. Adjust the middle of Band 4 using A28R3 BP2. Adjust the high end of Band 4 using A28R4 BP3 and A28R5 BP3FRQ. Iterate all of these adjustments until the optimum trace is present on the 8755C.

43. Store the optimized trace using the storage normalizer as described in step 27. Press **[ENTRY OFF]** to disable the rotary knob.

44. Press **[SHIFT] [PEAK]** and wait until the auto tracking is complete. If the trace is greater than 1 dB from the stored trace, iterate the adjustments using autotracking (**[SHIFT] [PEAK]**), A28R3 BP2, A28R4 BP3, and A28R5 BP3FRQ until the trace is within 1 dB of the stored trace.

45. Press **[SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [KHz] [5] [3] [4] [9] [Hz] [INSTR PRESET]** to copy the new Calibration Constant values permanently in "protected memory area".

LEVELED SQUEGGING TEST USING THE 8566A SPECTRUM ANALYZER

Description:

The 8340A Under Test RF output signal is down converted using a Local Oscillator 8340A and a mixer. The IF output of the mixer is fed to a spectrum analyzer. Any squegging of the 8340A under test will appear as a spurious response on the IF signal.

This test should be performed after SYTM tracking and delay, and SRD unleveled bias adjustments.

Equipment Required:

Synthesized Sweeper	HP 8340A (Opt 001)
10 dB Attenuator	HP 8493C Option 010
Mixer	RHG DMS 1-26
Spectrum Analyzer	HP 8566A

46. Connect equipment as shown in Figure 5-56. Connect the mixer LO input port directly to the LO 8340A RF output connector to obtain maximum mixer LO input level. Allow at least 30 minutes warm up time.

47. Press the LO 8340A **[INSTR PRESET]**. Press **[START FREQ]** and enter **[6] [.] [4] [GHz]**. Press **[STOP FREQ]** and enter **[1] [2] [.] [9] [GHz]**. Press **[POWER LEVEL]** and enter **[1] [0] [dBm]**. Press **[SHIFT] [CF]** and enter **[1] [0] [0] [MHz]** for a step size of 100 MHz. Press **[MANUAL]** SWEEP and enter **[6] [.] [4] [GHz]** to set the LO to CW at 6.4 GHz.

48. Press the 8340A Under Test **[INSTR PRESET]**. Press **[START FREQ]** and enter **[7] [GHz]**. Press **[STOP FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[POWER LEVEL]** and using the front panel rotary knob, adjust for maximum leveled power (just before the UNLEVELED light comes on). Press **[SHIFT] [CF]** and enter **[1] [0] [0] [MHz]** for a step size of 100 MHz. Press **[MANUAL]** SWEEP and enter **[7] [GHz]**. The mixer IF frequency is now 600 MHz.

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

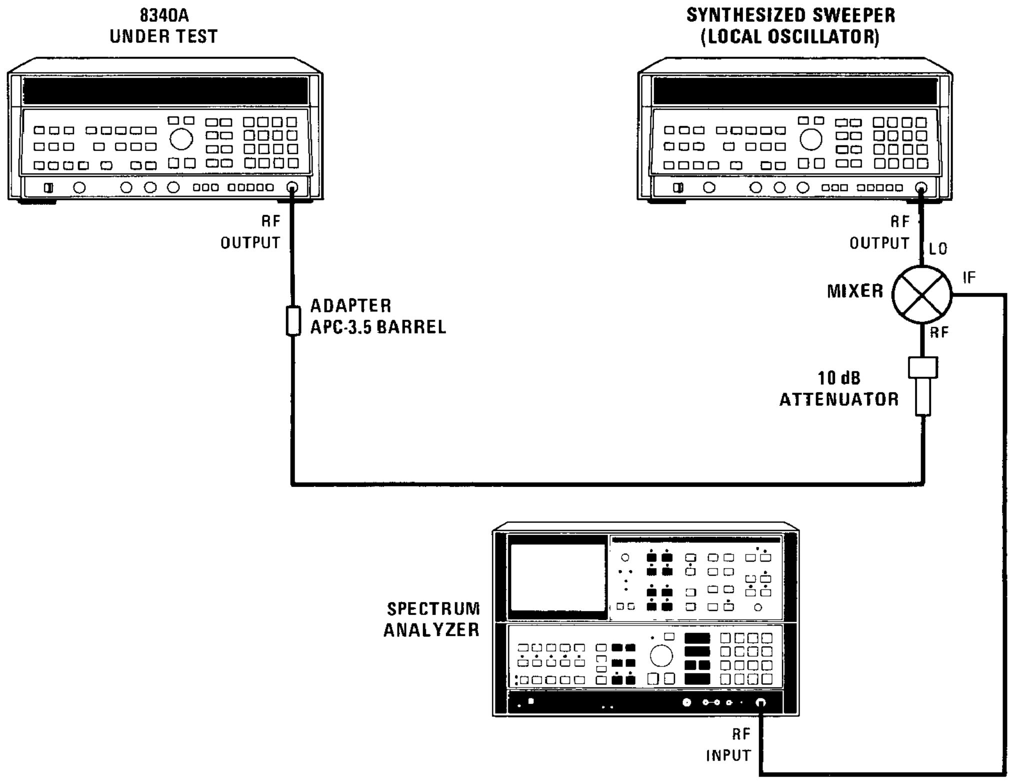


Figure 5-56. Leveled Squegging Test Setup.

49. Set the spectrum analyzer for FULL SPAN of 0-2.5 GHz. Set RES BW for 300 kHz. Set VIDEO BW for 100 kHz. Set START FREQ to 590 MHz. Set STOP FREQ to 800 MHz. Set REFERENCE LEVEL to −10 dBm. Set ATTEN to 0 dB. Press HOLD to retain these settings. The 600 MHz IF signal should be near the left side of the spectrum analyzer CRT.

50. Using the STEP UP key on both the 8340A Under Test and the LO 8340A, step through Band 2 observing the spectrum analyzer display at each step. There may be responses due to mixing products. These will appear as low level signals. A squegging response will appear as a higher amplitude signal as shown in Figure 5-57. If squegging occurs, adjust A24R5 (X2C) slightly CCW to eliminate the squegging. Note, if the control is adjusted and there is no effect on the response, the response is probably a mixing product.

NOTE

Test for squegging at power levels from maximum leveled power to −20 dBm in 5 dB increments.

51. Press 8340A Under Test **[SHIFT] [PWR SWP]** and enter the maximum ALC power level that will be a 5 dB increment below max leveled power (i.e., 15, 10, 5). Repeat step 50 at this power level. Enter the next 5 dB increment and repeat step 50 until the test for squegging has been performed from maximum leveled power to −20 dBm.

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

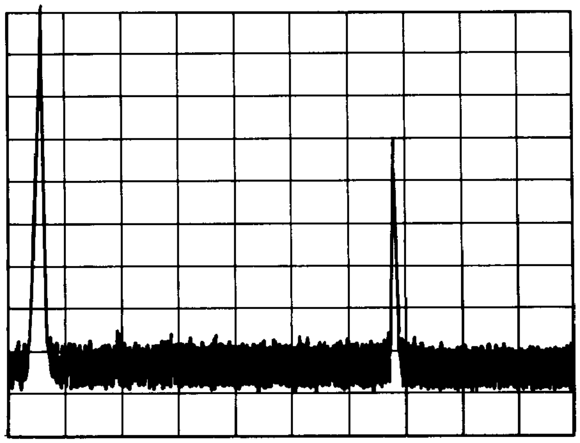


Figure 5-57. Squegging Displayed on Spectrum Analyzer

52. For Band 3, press the LO 8340A **[START FREQ]** and enter **[1] [2] [.] [9] [GHz]**. Press **[STOP FREQ]** and enter **[1] [9] [.] [4] [GHz]**. Press **[MANUAL]** and enter **[1] [2] [.] [9] [GHz]**.

53. Press the 8340A Under Test **[START FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[STOP FREQ]** and enter **[2] [0] [GHz]**. Press **[POWER LEVEL]** and using the front panel rotary knob, adjust for maximum leveled power. Press **[MANUAL]** and enter **[1] [3] [.] [5] [GHz]**.

54. Using the step keys as described in step 50, step through Band 3. If squegging occurs, adjust A24R8 (X3C) slightly CCW to eliminate the squegging.

NOTE

Test for squegging at power levels from maximum leveled power to −20 dBm in 5 dB increments.

55. Press 8340A Under Test **[SHIFT] [PWR SWP]** and enter the maximum ALC power level that will be a 5 dB increment below max leveled power (i.e., 10, 5). Repeat step 54 at this power level. Enter the next 5 dB increment and repeat step 54 until the test for squegging has been performed from maximum leveled power to −20 dBm.

56. For Band 4, press the LO **[START FREQ]** and enter **[1] [9] [.] [4] [GHz]**. Press **[STOP FREQ]** and enter **[2] [5] [.] [9] [GHz]**. Press **[MANUAL]** and enter **[1] [9] [.] [4] [GHz]**.

57. Press the 8340A Under Test **[START FREQ]** and enter **[2] [0] [GHz]**. Press **[STOP FREQ]** and enter **[2] [6] [.] [5] [GHz]**. Press **[CONT]** and **[POWER LEVEL]**. Adjust the 8340A front panel rotary knob for maximum leveled power. Press **[MANUAL]** and enter **[2] [0] [GHz]**.

58. Using the step keys as described in step 50, step through Band 4. If squegging occurs, adjust A24R11 (X4C) slightly CCW to eliminate the squegging.

5-37. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

NOTE

Test for squegging at power levels from maximum leveled power to −20 dBm in 5 dB increments.

59. Press 8340A Under Test **[SHIFT]** **[PWR SWP]** and enter the maximum ALC power level that will be a 5 dB increment below max leveled power (i.e., 5, 0, −5). Repeat step 58 at this power level. Enter the next 5 dB increment and repeat step 58 until the test for squegging has been performed from maximum leveled power to −20 dBm.

5-38. FLATNESS VERIFICATION AND ADJUSTMENT

Reference:

Performance Test: Maximum Leveled Output Power and Accuracy
Service Section: RF Section

Description:

This procedure tests the 8340A for leveled power flatness. If the 8340A meets the requirements in this procedure, flatness adjustments are not necessary. Flatness is checked in the 10 MHz to 2.4 GHz band by finding the minimum and maximum power points across the frequency band using an oscilloscope to view the power meter recorder output while sweeping. A marker is positioned at the minimum and maximum points. The 8340A is set to Manual Sweep at the marker frequencies and the power is measured. Flatness is the maximum deviation from the power level at 100 MHz for the 0.01 to 2.4 GHz range and at 2.4 GHz for the 2.4 to 26.5 GHz range. Flatness corrections are made by modifying the Calibration Constants data.

In the 2.4 to 26.5 GHz bands, an 8755C Frequency Response Test Set and directional coupler are used to display the swept frequency signal. Errors due to frequency response of the test equipment are subtracted from the measurement by the Storage Normalizer.

NOTE

If equipment and the program are available to run the automated test on flatness described in manual supplement titled "Automated Test Procedures", it may be used instead of these procedures in Paragraph 5-38.

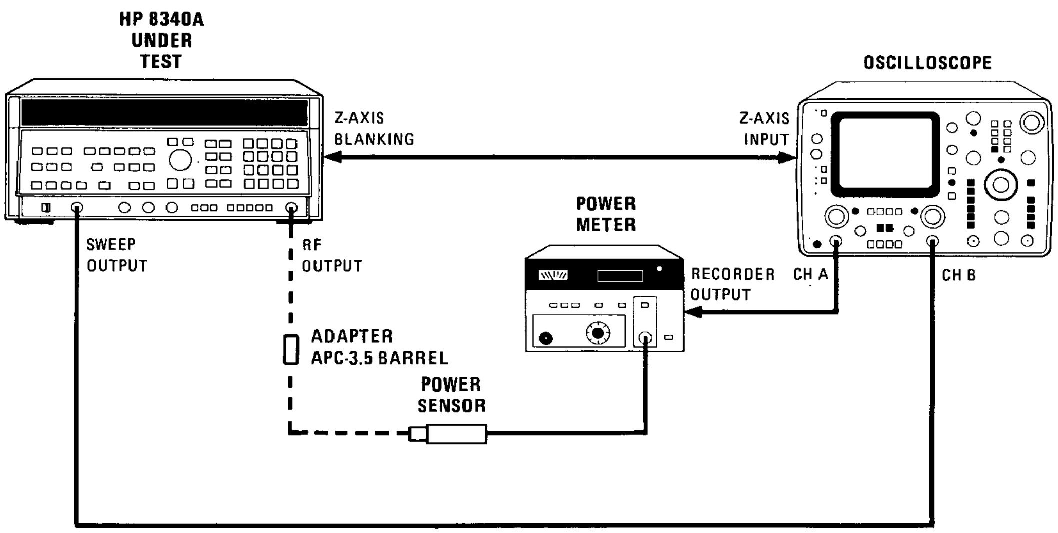


Figure 5-58. Flatness Verification Test Setup

Equipment Required:

Oscilloscope	HP 1741A
Power Meter	HP 436A
Power Sensor	HP 8481A
Power Sensor	HP 8485A
Adapter (APC-3.5 fem. to fem.)	HP Part Number 5061-5311

5-38. FLATNESS VERIFICATION AND ADJUSTMENT (Cont'd)

Procedure:

10 MHz TO 2.4 GHz FLATNESS VERIFICATION

1. Connect the equipment as shown in Figure 5-58. Connect the HP 8485A Power Sensor to the power meter. Allow at least 30 minutes warm up time. Set the power meter calibration factor switch for 2.4 GHz, then zero and calibrate the power meter before connecting the power sensor to the 8340A Under Test.

2. Press 8340A **[INSTR PRESET]**. Press the **[STOP FREQ]** key and enter **[2] [.] [4] [GHz]**. Adjust oscilloscope horizontal position and gain to obtain a full CRT horizontal trace.

3. Press the **[SWEEP TIME]** key and enter an appropriate sweep time (for an oscilloscope, enter 2 to 5 seconds dependent upon CRT illumination).

4. Adjust the oscilloscope controls to view the power meter RECORDER OUTPUT voltage versus the 8340A SWEEP OUTPUT voltage (A versus B). The oscilloscope vertical gain and position must be changed as a function of the power meter range and RECORDER OUTPUT voltage.

5. Press Frequency Marker key **[M2]** and, using the rotary knob, vary the marker frequency to position the (intensified) marker on the lowest point on the oscilloscope trace. It may be necessary to adjust the oscilloscope INTENSITY to view the marker dot.

6. Note the marker frequency. Press the **[MANUAL]** key and enter the frequency noted for M2. Set the power meter calibration factor switch for this frequency. The power meter indication is the minimum power point. Record this power meter indication.

NOTE

If the minimum or maximum power occured below 50 MHz, use the 8481A Power Sensor to measure the power level.

7. Press the **[CONT]** key to return to the sweep mode. Press **[M1]** and, using the rotary knob, vary the marker frequency to position the marker on the highest point on the oscilloscope trace. Note the marker frequency. Press the **[MANUAL]** key and enter the frequency noted for M1. Set the power meter calibration factor switch for this frequency. The power meter indication is the maximum power point. Record the power meter indication.

8. Press **[M3]** and enter **[1] [0] [0] [MHz]**. Set the power meter calibration factor for 100 MHz. The power meter indication is the power level at 100 MHz used for reference in the remainder of this test. Record the indication.

9. Calculate the power flatness by comparing the minimum power point (step 6) and the maximum power point (step 7) against the 100 MHz reference (step 8). To meet the specification in the 10 MHz to 2.4 GHz band (Band 0), the power meter indications relative to the 100 MHz reference power level should be within ±0.5 dB in a standard instrument and within ±0.6 dB in an Option 004 or 006 instrument. If the flatness specification is not met, proceed to step 24 and make power flatness adjustments.

5-38. FLATNESS VERIFICATION AND ADJUSTMENT (Cont'd)

2.4 TO 26.5 GHz FLATNESS

Calculate Total Coupler Slope and Sensor Slope

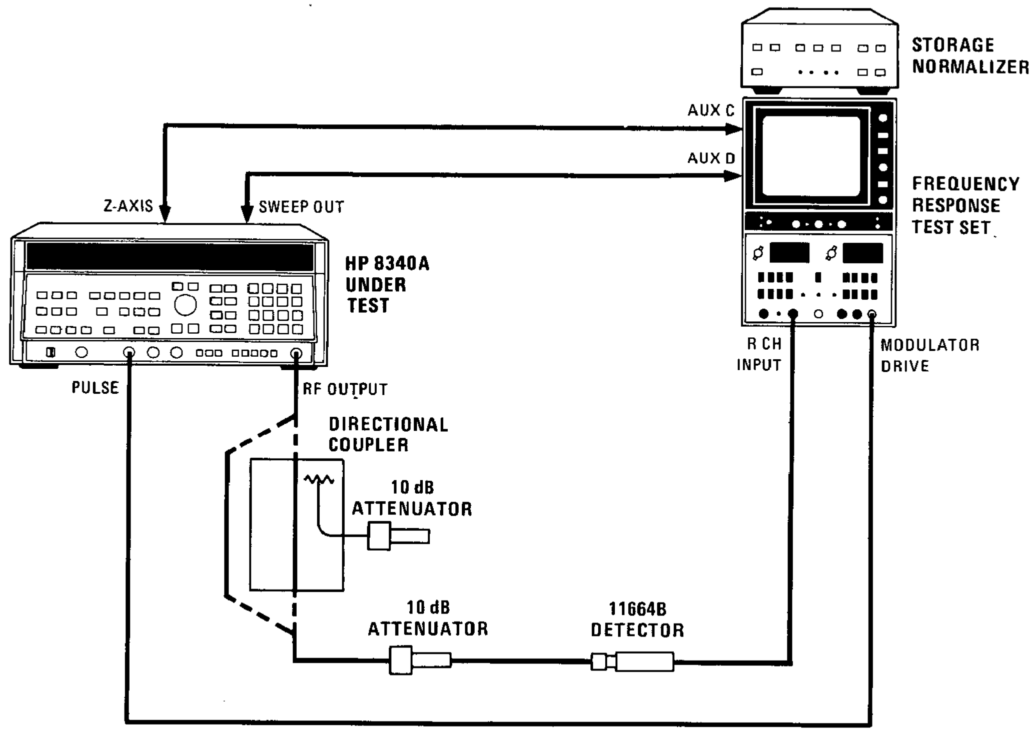


Figure 5-59. Coupler Slope Characterization Test Setup

Equipment Required:

Frequency Response Test Set	HP 8755C
Detector	HP 11664B
Storage Normalizer	HP 8750A
10 dB Attenuator (2 required)	HP 8493C Opt. 010
Directional Coupler	HP Part Number 0955-0125

10. Connect equipment as shown in Figure 5-59. Connect 10 dB Attenuator and 11664B Detector directly to 8340A RF Output. Allow at least 30 minutes warm up. Press 8340A **[INSTR PRESET]**. Press **[START FREQ]** and enter **[2] [.] [4] [GHz]**. Stop frequency should be 26.5 GHz. Press **[PULSE]** ON.

11. Set the 8755C input to channel R, center the trace at 1 dB/Div. Store this trace in the HP 8750A Storage Normalizer by pressing 8750A [CH1] [INPUT], [STORE INPUT].

12. Insert the directional coupler and the second 10 dB attenuator as shown in Figure 5-59. Press 8750A [INPUT−MEMORY]. Press 8340A **[SLOPE]** ON. Adjust the 8340A front panel rotary knob for the best straight line on the 8755C trace. Note the 8340A ENTRY DISPLAY value for slope. This is the correction factor for the coupler which will be used in subsequent steps.

5-38. FLATNESS VERIFICATION AND ADJUSTMENT (Cont'd)

13. Calculate a correction factor for the power sensor as follows:

    Use a calculator to find the best straight line approximation to the CAL FACTOR curve in percent, or find the end points (0.05 and 26.5 GHz) using a straight edge for the best straight line approproximation on the CAL FACTOR curve located on the body of the power sensor.

    Convert both end points to dB using the following equation:

    Endpoint (dB) = −10 log (endpoint (%)/100)

    Calculate the slope as follows:

    Slope (dB/GHz) = [26.5 GHz endpoint (dB) − 0.05 GHz endpoint (dB)]/26.45

14. Calculate the total correction value by adding the coupler correction factor from step 12 and the power sensor correction factor from step 13. Note this value for later use.

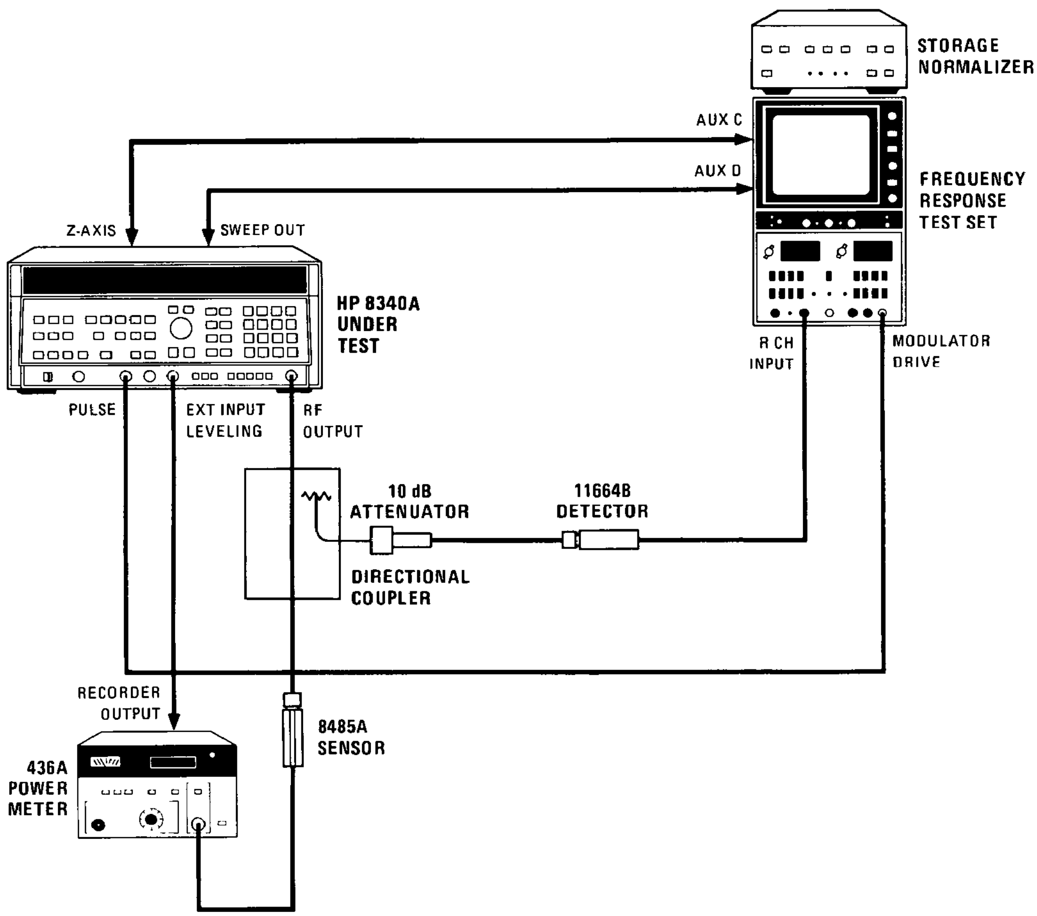


Figure 5-60. Flatness Adjustment Equipment Test Setup.

15. Connect the equipment as shown in Figure 5-60. Press 8340A **[CW]** and enter **[5] [GHz]**. Press **[RF]** to turn RF power off. Zero the power meter. Press **[RF]** to turn RF power on. The power level should be 0 dBm. Press the 436A [RANGE HOLD].

16. Press 8340A **[CONT]**. Set the 8755C to display R on channel 1 at 1 dB/DIV. Set reference level at about −27 dB to center the trace. Press 8340A **[METER]** leveling and enter **[−] [6] [dBm]** (dBV). Press **[SWEEP TIME]** and enter **[5] [0] [sec]**.

5-38. FLATNESS VERIFICATION AND ADJUSTMENT (Cont'd)

17. Press 8750A [CH1] [INPUT] and [STORE INPUT]. Press 8340A **[SINGLE]** SWEEP and verify that the 8340A is sweeping by watching the green SWEEP LED. At the end of the 50 second single sweep, the 8750A STORE LED should be ON. Press 8340A **[SINGLE]** SWEEP again and the 8750A STORE INPUT LED should go OFF. The reference trace is now stored in the 8750A.

18. Press 8340A **[SWEEP TIME]** and **[AUTO]**. Press **[INT]** LEVELING. Press **[SHIFT]** **[PWR SWP]** and enter **[0]** **[dBm]**. Press **[CONT]** SWEEP. Press **[SLOPE]** and enter the calculated correction value for the directional coupler and power sensor noted in step 14. Terminate the entry with **[dBm]**.

19. Press 8750A [INPUT—MEMORY]. The trace on the 8755C should be only the flatness of the 8340A in internal leveling mode.

20. Press Frequency Marker key **[M1]** and, using the rotary knob, vary the marker frequency to position the intensified marker to the following positions and note the frequency of each:

    a. Highest spot in 2.4 to 20 GHz range
    b. Second highest spot in 2.4 to 20 GHz range
    c. Lowest spot in 2.4 to 20 GHz range
    d. Second lowest spot in 2.4 to 20 GHz range
    e. Highest spot in 20 to 26.5 GHz range
    f. Second highest spot in 20 to 26.5 GHz range
    g. Lowest spot in 20 to 26.5 GHz range
    h. Second lowest spot in 20 to 26.5 GHz range.

21. Disconnect directional coupler from 8340A RF OUTPUT port and connect the HP 8485A Power Sensor directly to the RF OUTPUT port.

22. Press to release 8340A **[SLOPE]** to turn slope OFF. Verify that **[INT]** leveling switch is still on. Press **[MANUAL]** Sweep, set frequency, and make power meter measurements at 2.4 GHz then at each of the frequencies noted for peaks and valleys in step 20. Before making each measurement, be sure to set the calibration factor of the power meter to the value shown on the body of the power sensor for the frequency being measured. Record power meter reading at each frequency setting.

23. Calculate the power flatness to see if the specifications are met in the 2.4 to 26.5 GHz range as shown in Table 5-11.

    If the flatness is not met in either of these ranges, proceed to step 24 and make power flatness adjustments.

FLATNESS ADJUSTMENTS

NOTE

Flatness adjustments should be performed if the ALC circuit has been adjusted, or if any assembly in the RF path from the directional coupler to the output connector (including the output connector) has been replaced. If only the ALC has been readjusted, proceed with step 28. Before making the following adjustments, check flatness using the Flatness Verification procedure.

5-38. FLATNESS VERIFICATION AND ADJUSTMENT (Cont'd)

Table 5-11. Flatness in 2.4 to 26.5 GHz Range

Option	Flatness (dB) Relative to 2.4 GHz Reference	
	Band 1-3 (2.4 to 20 GHz)	**Band 4 (20 to 26.5 GHz)**
Standard	±1.1	±1.6
Option 001	±0.9	±1.3
Option 004	±1.3	±1.8
Option 005	±1.1	±1.5

24. The frequency response correction should still be in 8750A memory from the flatness verification procedures in the previous steps. If it is not, perform the previous steps 10 through 19.

25. Press 8340A **[INSTR PRESET]**, **[START]**, then enter **[2] [.] [4] [GHz]**. Press **[SWEEP TIME]** and **[AUTO]**. Press **[INT]** LEVELING. Press **[SHIFT] [PWR SWP]** and enter **[0] [dBm]**. Press **[CONT]** SWEEP. Press **[SLOPE]** and enter the calculated correction value for the directional coupler and power sensor found in step 14. Terminate the entry with **[dBm]**.

26. Press 8750A [INPUT−MEMORY]. Access the 8340A Calibration Constant Number 14 by entering the following:

    [SHIFT] [GHz] [1] [4] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]

    Use the **[STEP]** keys to select the Calibration Constant Number and use the front panel rotary knob to change the value.

27. Refer to Figure 5-61 and make adjustments as follows:

    Adjust Calibration Constant Number 14 for the flattest trace from 2.4 to 9 GHz.

    Adjust Calibration Constant Number 15 and A27R4 BKPT1 for the flattest trace from 9 to 20 GHz.

    Adjust Calibration Constant Number 16 and A27R8 BKPT2 for flattest trace from 20 to 26.5 GHz.

    Repeat these adjustments until the flattest trace is obtained from 2.4 to 26.5 GHz.

5-38. FLATNESS VERIFICATION AND ADJUSTMENT (Cont'd)

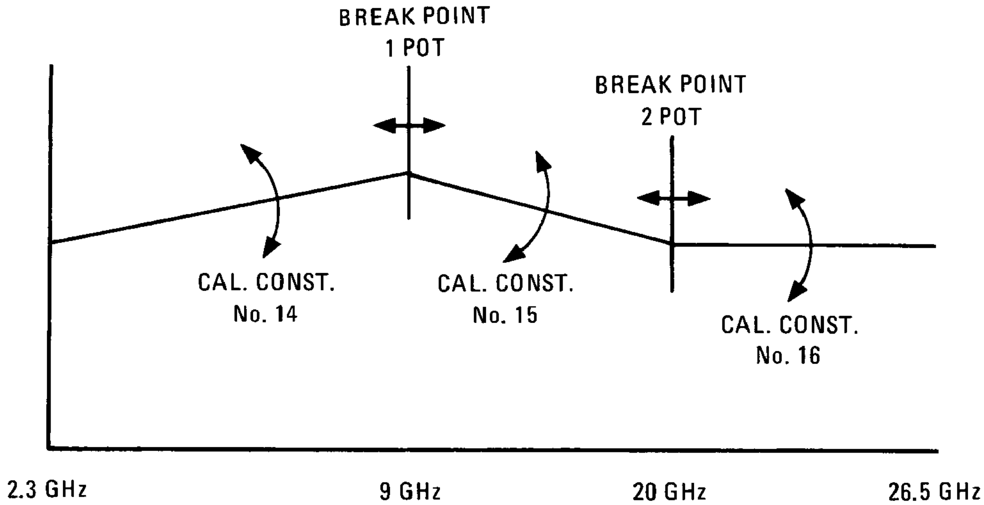


Figure 5-61. Relationship of Flatness Adjustments Diagram.

28. Disconnect the directional coupler from the 8340A and connect the power sensor to the 8340A RF output. Set the power meter CAL FACTOR switch for 2.4 GHz. Press 8340A **[CW]** and enter **[2] [.] [4] [GHz]**. Press **[SLOPE]** to turn it OFF and **[PULSE]** to turn it OFF. Adjust Calibration Constant Number 44 for 0 dBm on the power meter.

29. Press 8340A **[CW]** and enter **[1] [0] [0] [MHz]**. Set the power meter CAL FACTOR switch to 100%. Note the power meter indication. This power level will be P3 in the following equation.

    Press 8340A **[CW]** and enter **[2] [.] [3] [9] [GHz]**. Set the power meter CAL FACTOR switch to include 2.39 GHz. Note the power meter indication. This value will be used as P4 in the following equation.

    Calculate the value of P using the following equation:

    P=(1.044xP3)−(0.044xP4)

30. Access Calibration Constant Number 13 by entering the following: **[SHIFT] [GHz] [1] [3] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 13 for a power meter indication of P. Then adjust A25R108 LOFS (Figure 5-62) for a 0 dBm power meter indication.

31. Perform the Flatness Verification procedure to ensure that the 8340A meets its flatness specification.

5-38. FLATNESS VERIFICATION AND ADJUSTMENT (Cont'd)

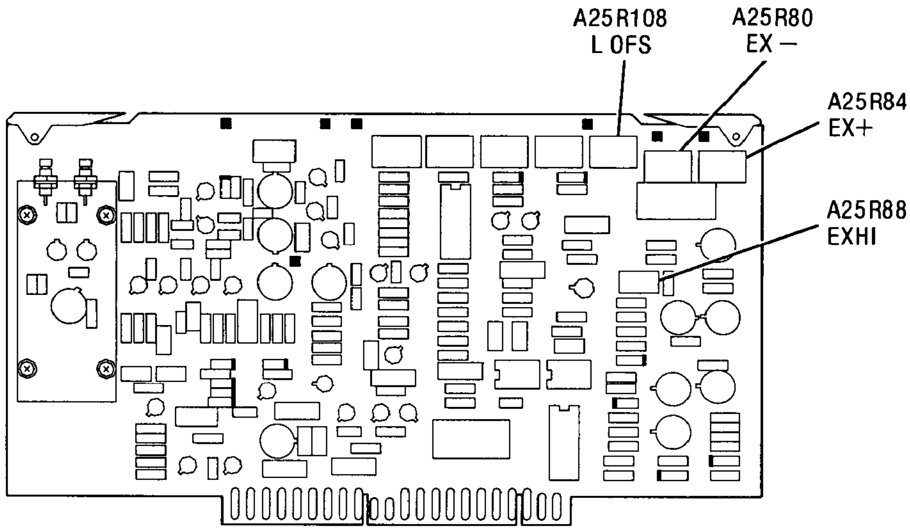


Figure 5-62. Flatness and External Leveling Adjustments Location

ADJUST AM OFFSET

32. Connect Power Meter Sensor to 8340A RF OUTPUT. Press **[INSTR PRESET]**. Press **[CW]** and enter **[4] [.] [5] [GHz]**. Power level should be 0 dBm. Access Calibration Constant Number 43 by entering the following: **[SHIFT] [GHz] [4] [3] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 43 for no more than 0.05 dB change in power meter indication when turning AM ON and OFF.

ADJUST ADC CALIBRATION CONSTANTS

33. Press **[SHIFT] [PWR SWP]** to decouple the RF attenuator and ALC. RF attenuator should be at 0 dB, ALC power should be at 0 dBm, and the CW frequency should be 4.5 GHz. Press **[AM]** ON.

34. With the **[ENTRY]** keys, select +5 dBm through −20 dBm in 1 dB increments and at each position check that the **[ENTRY DISPLAY]** ALC level and the **[POWER dBm]** indications are within 0.1 dB of each other.

35. If the indications are out of tolerance, adjust Calibration Constant Number 42 in the high power range and adjust Calibration Constant Number 40 in the low power range. Access Calibration Constant Number 42 by entering the following: **[SHIFT] [GHz] [4] [2] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Use the **[STEP]** key to change to Calibration Constant Number 40. After adjustments, recheck the +5 through −20 dBm range to verify that all points are within tolerance.

36. Press **[CW]** and enter **[1] [.] [5] [GHz]**. Press **[SHIFT] [PWR SWP]**. With **[ENTRY]** keys, select +5 dBm through −20 dBm in 1 dB increments and at each position check that the **[ENTRY DISPLAY]** ALC level and **[POWER dBm]** indications are within 0.1 dB of each other.

5-38. FLATNESS VERIFICATION AND ADJUSTMENT (Cont'd)

37. If the indications are out of tolerance, adjust Calibration Constant Number 39 primarily for low level power settings. Access Calibration constant Number 39 by entering the following: **[SHIFT] [GHz] [3] [9] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Again recheck the +5 dBm to −20 dBm range to verify that all points are within tolerance.

NOTE

If adjustments of the Calibration constants were made in this procedure, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence: [SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz] [INSTR PRESET].

5-39. PULSE ADJUSTMENTS

Reference:

Performance Test: Pulse Modulation Rise, Fall, and Delta Time; Pulse Modulation Accuracy; and Pulse Modulation Video Feedthrough

Service Section: RF Section

Description:

The detector sample-and-hold balance is adjusted for best continuity across the trailing edge of the pulse waveform. The timing is adjusted for maximum negative level.

The integrator gate balance is set for the flattest pulse envelope.

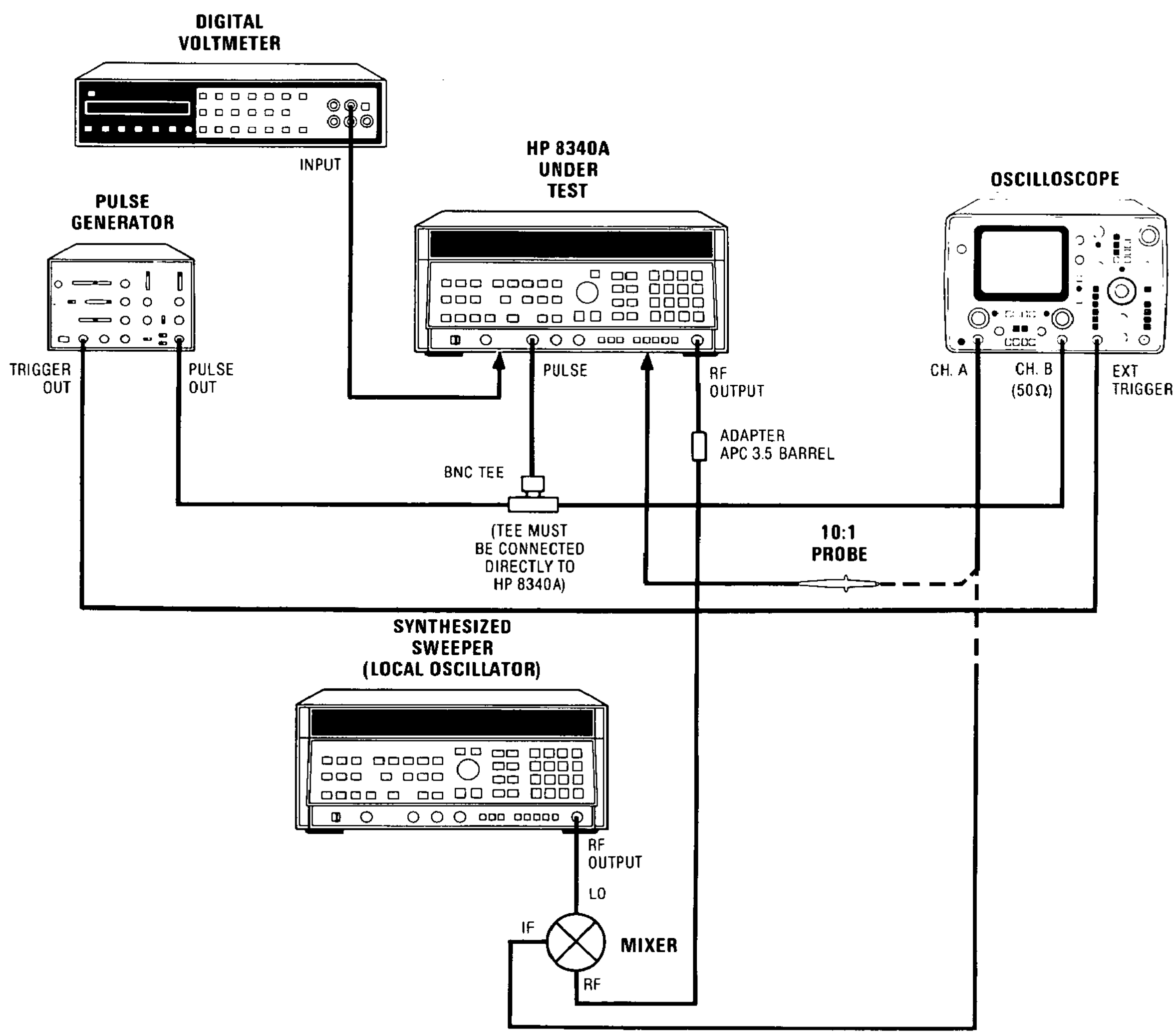


Figure 5-63. Pulse Adjustment Setup.

5-39. PULSE ADJUSTMENTS (Cont'd)

NOTE

The following adjustments are required if any of the following four assemblies have been replaced or if any of the controls listed after each assembly have been adjusted or replaced.

A11 High Band Detector (Bands 1−4)
A21 Pulse Modulator Assembly, A21R21 (ON DELAY), A21R23 (OFF DELAY)
A25 ALC Detector Assembly, A25R58 (BAL)
A26 Linear Modulator Assembly, A26R7 (BAL)

Equipment Required:

Synthesized Sweeper	HP 8340A Opt 001
Pulse Generator	HP 8012B
Oscilloscope	HP 1741A
10:1 Divider Probe	HP 10004D
Mixer	RHG DMS 1−26
Digital Voltmeter (DVM)	HP 3455A

Procedure:

DETECTOR SAMPLE AND HOLD BALANCE ADJUSTMENT

1. Connect equipment as shown in Figure 5-63. Allow at least 30 minutes warmup.

NOTE

The A21, A25, and A26 PC boards must not be placed on extender boards in this adjustment procedure. Also, the cables connected to detectors A11 and A12 are especially designed for low capacitance and only these cables may be used during adjustment procedures.

2. Set the oscilloscope as follows:

DISPLAY	CHOP
MODE	MAIN
MAG X5	ON
CH A	0.005 V/Div AC COUPLED
CH B	5 V/Div 50 Ohms
TIME/Div	2 usec

Connect CH A probe to A26TP2 (DET)

3. Set the pulse generator for a pulse width of 4 microseconds, a pulse period of 10 microseconds, and amplitude = +3 Volts high and 0 Volts low.

4. Press the 8340A Under Test **[INSTR PRESET]**. Press **[PULSE]** ON. Press **[CW]** and enter **[5] [GHz]**. Press **[SHIFT] [PWR SWP]** and enter **[0] [dBM]**. Use the step keys to step in 10 dB RF attenuation. If the 8340A does not include an RF attenuator, connect a 10 dB pad to the RF output. Set A21R21 (ON DELAY) and A21R23 (OFF DELAY) fully counterclockwise. (See Figure 5-64.)

Check that the 8340A Under Test is leveled (the UNLEVELED light is not lit).

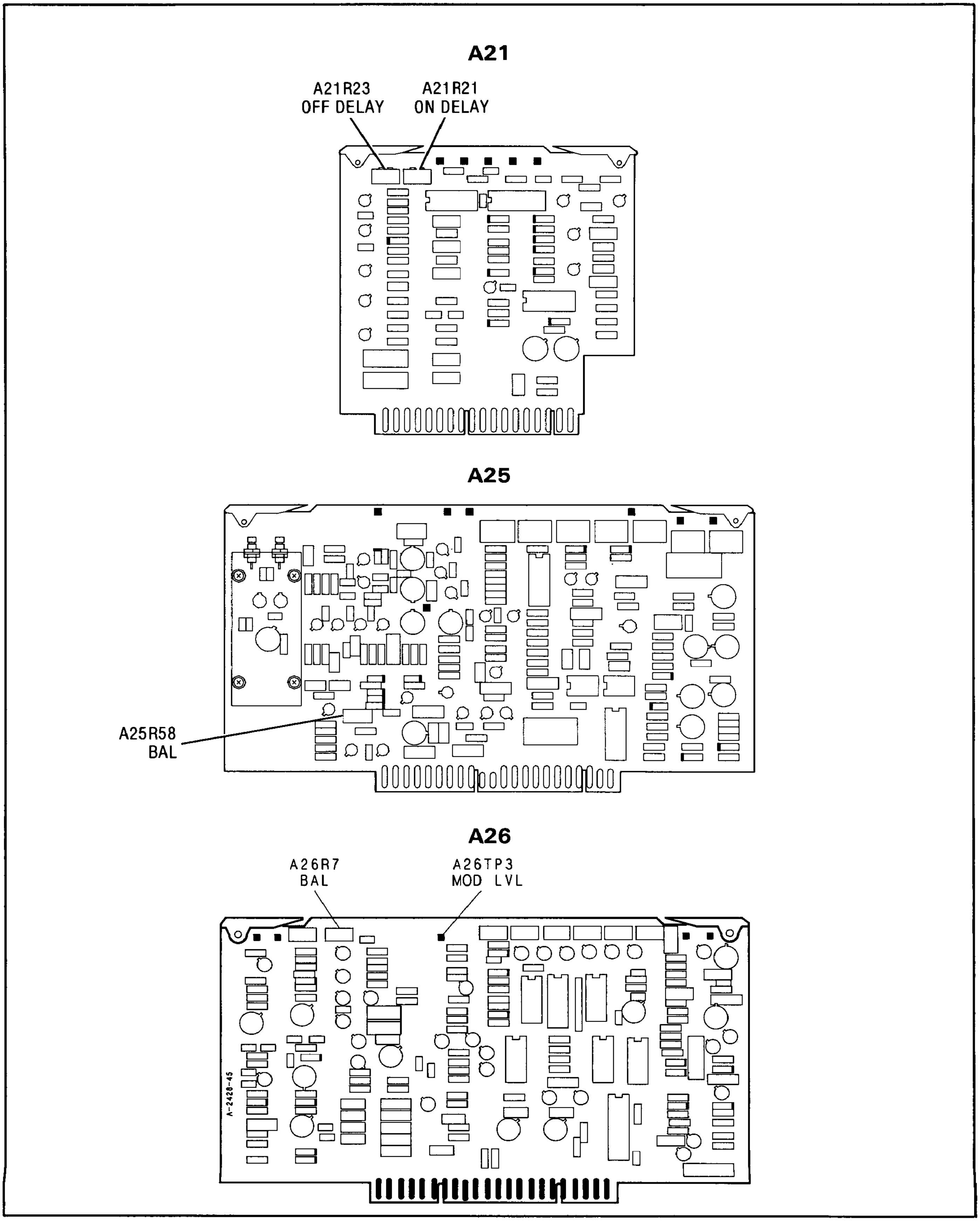


Figure 5-64. Pulse Adjustments Location

5-39. PULSE ADJUSTMENTS (Cont'd)

5. Set the oscilloscope to 1 usec/Div. The CH A trace should be similar to Figure 5-65.

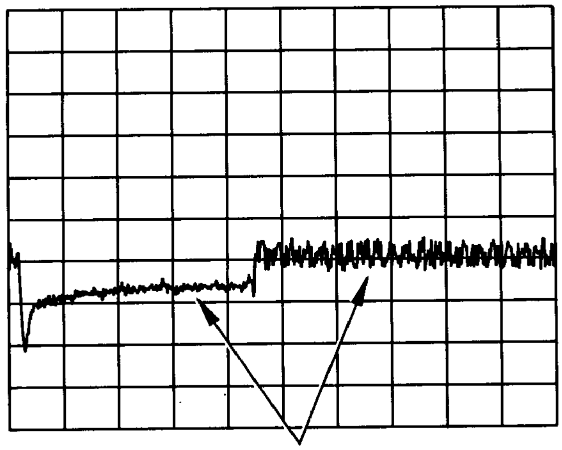


Figure 5-65. Typical A26TP2 (DET) Pulse Waveform.

6. Adjust A25R58 (BAL) control for best continuity across the pulse trailing edge. (NOTE: A25 must not be on an extender board when viewing trace.)

SAMPLE AND HOLD TIMING ADJUSTMENT

7. Set the pulse generator for a pulse width of 120 nanoseconds. Press the 8340A Under Test **[SHIFT] [PWR SWP]** and enter **[–] [1] [0] [dBm]**. Then press **[SHIFT] [SLOPE]** and use the **[STEP]** keys to set attenuator to –10 dB.

8. Connect DVM to A26TP3 MOD LVL. Adjust A21R21 ON DELAY and A21R23 OFF DELAY for the most negative reading.

9. At the 8340A Under Test, make settings as follows:

   a. Press **[SHIFT] [PWR SWP]** and use **[STEP]** keys to set attenuator to –10 dB.
   b. Use keys to enter **[0] [dBm]**.
   c. Press **[CW]** and enter **[5] [GHz]**.

10. Set the oscilloscope to 0.2 usec/DIV and adjust the Pulse Generator to a 1 usec pulse.

11. Connect the output IF port of the mixer to CH A of oscilloscope and set oscilloscope to 50 Ohm input and .005 V/DIV.

12. At the Local Oscillator, make settings as follows:

   a. Press **[CW]** and enter **[4] [.] [9] [5] [GHz]**.
   b. Press **[POWER LEVEL]** and enter **[1] [0] [dBm]**.

5-39. PULSE ADJUSTMENTS (Cont'd)

13. Turn pulse ON and then OFF alternately by pressing **[PULSE]** pushbutton. Adjust A25R58 BAL control so that the peak-to-peak amplitude of the envelope displayed on the oscilloscope is the same value with pulse on and pulse off.

INTEGRATOR GATE BALANCE ADJUSTMENT

14. Set the pulse generator for a pulse width of 5 microseconds and a pulse period of 20 microseconds. Set oscilloscope to 1 usec/Div.

15. Press 8340A Under Test **[SHIFT] [AM]** and adjust A26R7 BAL for the flattest pulse envelope on the CH A display.

    Press **[AM]** OFF and the pulse envelope should be flatter.

5-40. YO LOOP GAIN AND PHASE MARGIN TEST AND ADJUSTMENT

Reference:

Performance Test: None
Service Section: Sweep Generator — YO Loop

Description:

This procedure selects a value of resistor A49R18 to place the YO Loop gain and phase within specified limits to prevent the YO Loop from oscillating while still providing sufficient gain in the YO Loop.

NOTE

This procedure should be performed only after a YO failure or repair, or after replacing any assembly in the YO Loop.

NOTE

The YO Driver A55 should be aligned as described in Paragraph 5-29 prior to this procedure.

Equipment Required:

Spectrum Analyzer 3585A
Special Test Fixture .... Fabricated Locally

Procedure:

1. Fabricate special test fixture as shown in Figure 5-66.

2. Place the YO Loop in the Service Position and remove the cover from A49 Phase Detector board. Remove jumper A49W1 from Phase Detector board.

3. Connect Special Test Fixture and Spectrum Analyzer to YO Loop as shown in Figure 5-67.

4. On the Special Test Fixture, set S1 to position 1 and set S2 to J2 position. The YO Loop should now be locked as indicated by A50DS1 (green LED) being lit.

5. On the 8340A, press **[INSTR PRESET] [CW] [3] [GHz]**.

6. On the 3585A Spectrum Analyzer, make the following settings:

   INSTR PRESET .... Press
   TRACKING GENERATOR AMPLITUDE .... Fully Clockwise (0 dBm)
   INPUT IMPEDANCE .... 1 Megohm
   AUTO RANGE .... OFF
   REF. LVL. TRK. .... OFF
   START FREQ. .... 0 Hz
   STOP FREQ. .... 100 kHz
   dB/div. .... 1 dB/div.
   REF. LEVEL. .... −25 dBm
   RANGE (use STEP keys) .... −15 dBm

5-40. YO LOOP GAIN AND PHASE MARGIN TEST AND ADJUSTMENTS (Cont'd)

7. A trace similar to Figure 5-68, Waveform A should be displayed on the Spectrum Analyzer.

8. On the 3585A Spectrum Analyzer, press [STORE A→B] to store the trace from A into Trace B. On the Special Test Fixture, set switch S1 to position 2. The 3585A Spectrum Analyzer should display the two traces similar to Figure 5-68, Waveform B.

9. Using the rotary knob on the Spectrum Analyzer, move the marker to the point where the two traces cross. Observe the marker frequency on the Spectrum Analyzer. The marker (crossover frequency) should be between 45 and 55 kHz.

10. If the crossover frequency is below 45 kHz, then the value of A49R18 on the A49 YO Phase Detector board should be decreased in value to increase the crossover frequency. If the crossover frequency is above 55 kHz, then the value of A49R18 should be increased to lower the crossover frequency.

11. If the crossover frequency is good, then the phase margin is checked next. Make sure the marker is at the crossover frequency, then set switch S1 on the Special Test Fixture to position 1. On the Spectrum Analyzer, press Marker [OFFSET], then marker [ENTER OFFSET]. The offset should now display 0 dB. On the Special Test Fixture, set switch S2 to the [SHORT] position. (The A50DS1 green LED should be off.) Read the offset in dB and insert the dB measurement into the following formula to determine the phase margin in degrees:

    K=10 ((dB measurement)/20)

    Phase Margin=ACS((2−K^2)/2)

    NOTE: ACS is arccosine function; phase margin is in degrees.

    0 dB = 60 degree phase margin; −2.3 dB = 45 degree phase margin; +2 dB = 75 degrees phase margin.

    The phase margin should be between 45 degrees and 75 degrees.

GAIN AT 2 KHZ

12. On the Spectrum Analyzer, make the following settings:

INSTR PRESET	Press
INPUT IMPEDANCE	1 Megohm
AUTO RANGE	OFF
REF. LVL. TRK	OFF
REF. LEVEL	−15 dBm
RANGE (use STEP keys)	−15 dBm
RBW	3 Hz
VBW	1 Hz
MANUAL SWEEP	2 kHz

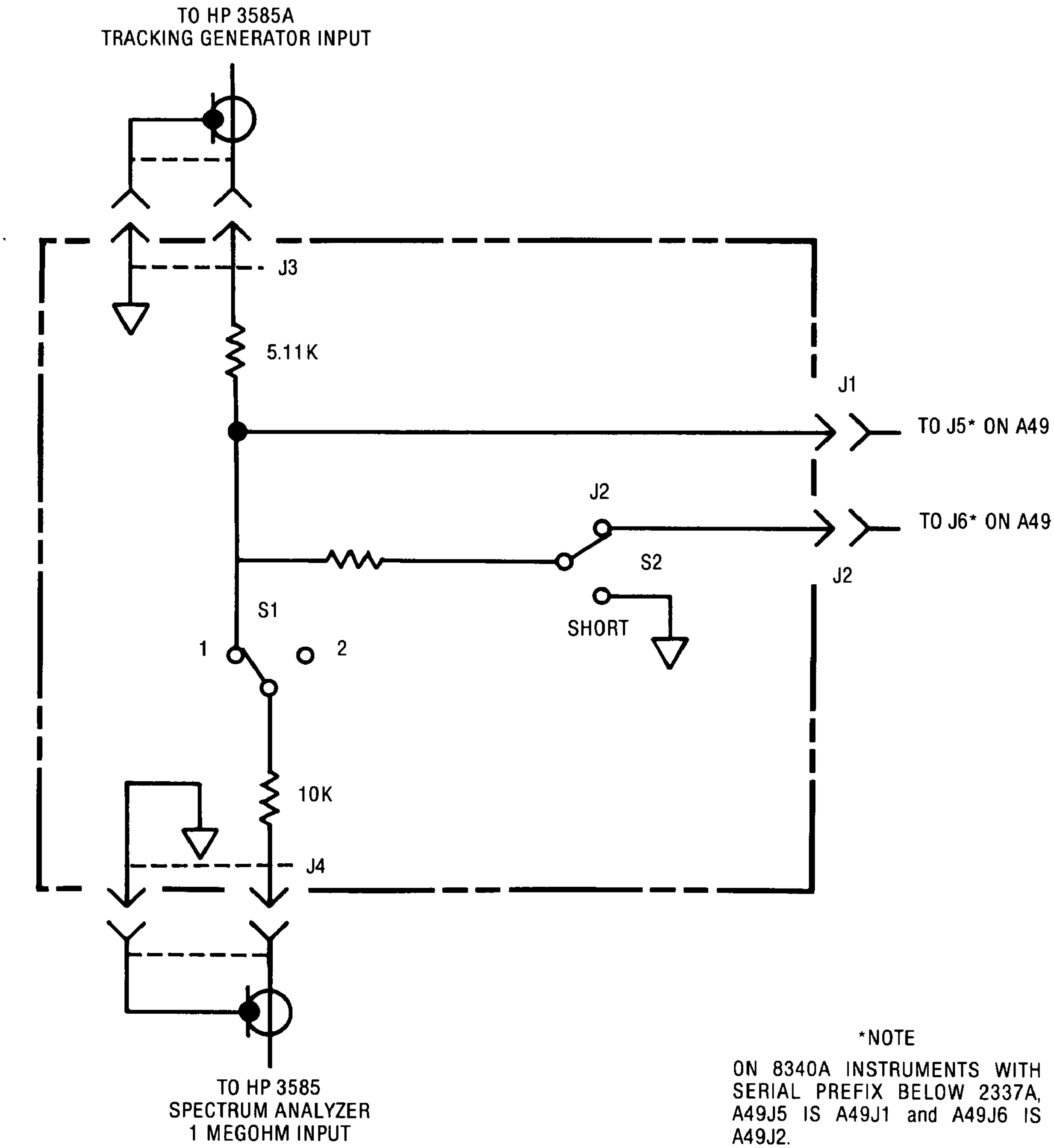
13. On the Special Test Fixture, set switch S2 to J2 and set switch S1 to position 1.

5-40. YO LOOP GAIN AND PHASE MARGIN TEST AND ADJUSTMENTS (Cont'd)

14. On the Spectrum Analyzer, press marker [OFFSET] then marker [ENTER OFFSET] and change switch S1 on the Special Test Fixture to position 2. Observe the offset measurement in dB on the Spectrum Analyzer. This is the gain at 2 kHz and should be >37 dB.

15. Disconnect all test equipment from the 8340A, reinstall jumper W1 on A49 Phase Detector board, and reinstall the YO Loop into the 8340A.

SCHEMATIC

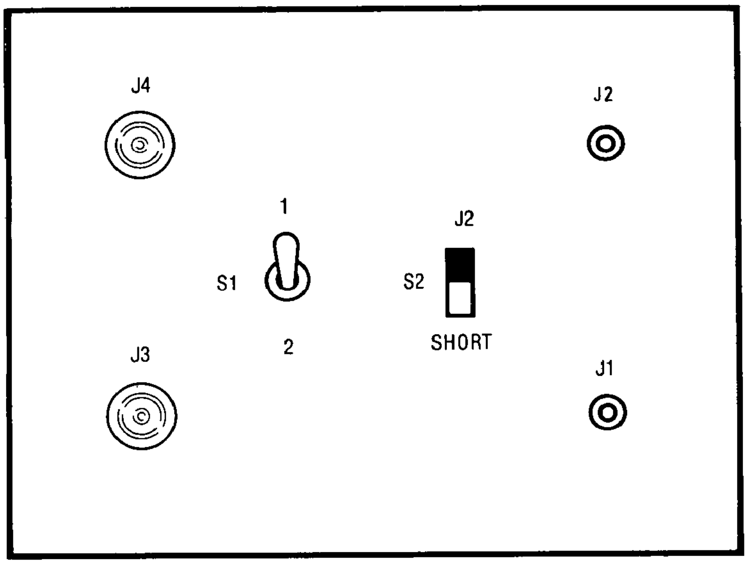


*NOTE

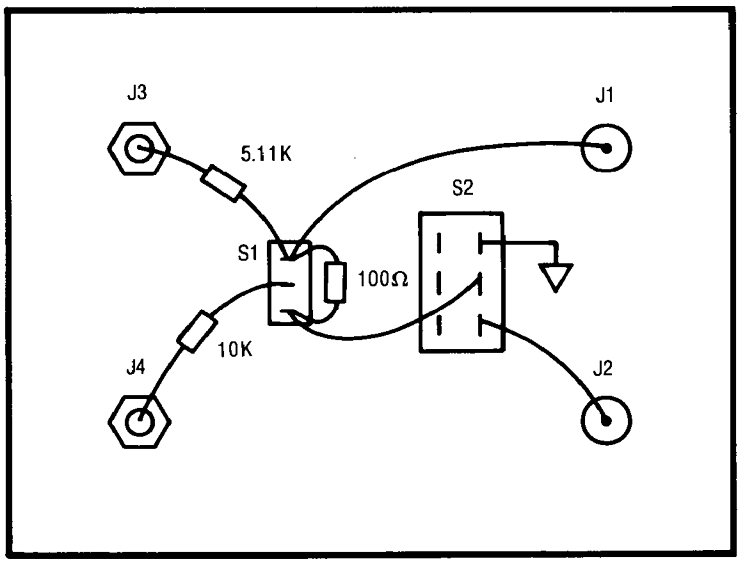
ON 8340A INSTRUMENTS WITH SERIAL PREFIX BELOW 2337A, A49J5 IS A49J1 and A49J6 IS A49J2.

Figure 5-66. Special Test Fixture Fabrication Instructions (1 of 2)

TOP VIEW



BOTTOM VIEW



YO Special Test Fixture Material List					
Qty	**Description**	**HP Part Number**	**Qty**	**Description**	**HP Part Number**
1	BUD BOX 2.75 X 2.1	7100-1207	2	CHASSIS MOUNT SNAP ON (M)	1250-0691
1	SWITCH SPDT (TOGGLE)	3101-0163	2	LOCK WASHER	2190-0124
1	SWITCH DPDT (SLIDE)	3101-0070 (only requires a SPDT)	2	NUT	2950-0078
2	CHASSIS MOUNT BNC (F)	1250-0212	1	10kΩ ¼W RESISTOR	0757-0442
2	LOCK WASHER	2190-0016	1	100Ω ¼W RESISTOR	0757-0401
2	NUT	2950-0001	1	5.11kΩ ¼W RESISTOR	0757-0438

Figure 5-66. Special Test Fixture Fabrication Instructions (2 of 2)

5-40. YO LOOP GAIN AND PHASE MARGIN TEST AND ADJUSTMENTS (Cont'd)

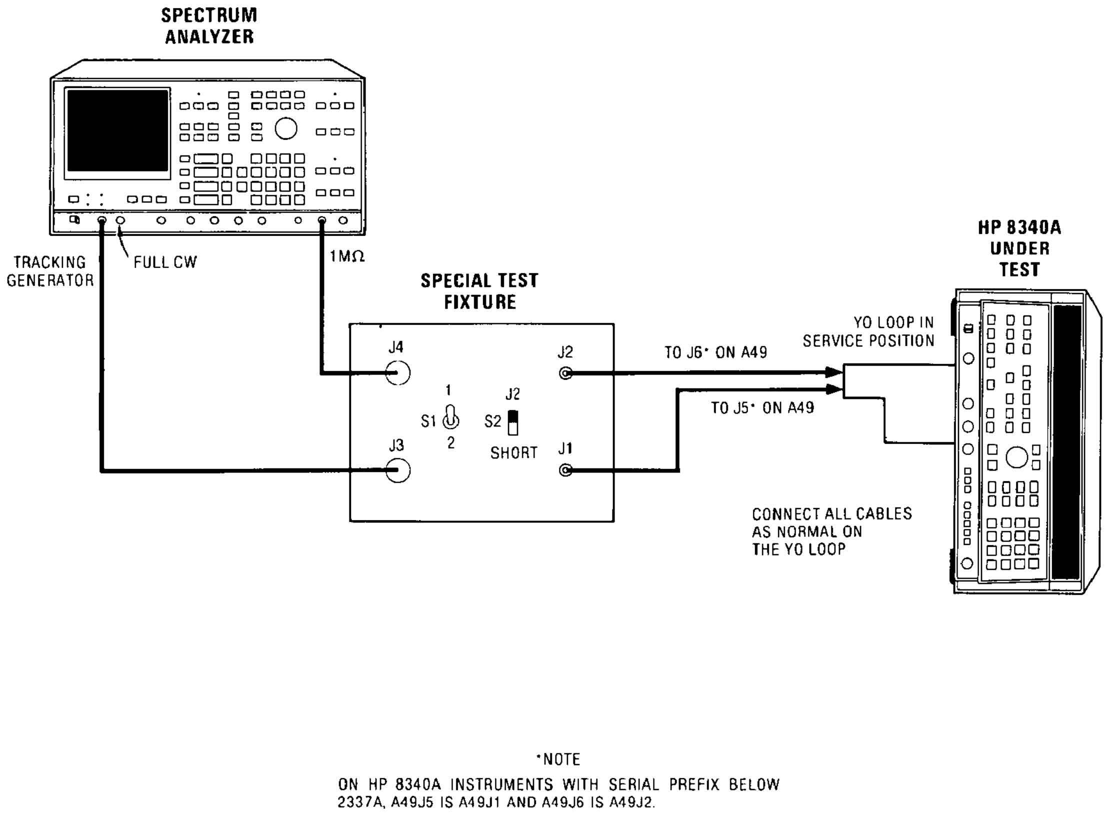


Figure 5-67. YO Loop Gain Test Setup

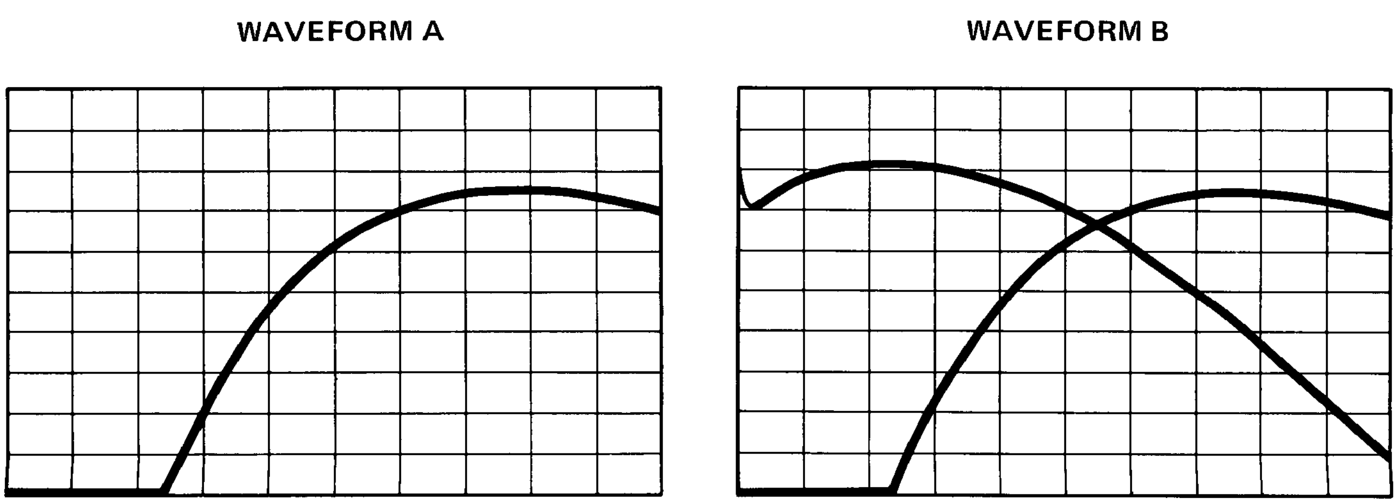


Figure 5-68. Spectrum Analyzer Waveforms of YO Loop Gain

VI Replaceable Parts

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-2 lists abbreviations used in the parts list and the names and addresses that correspond to the manufacturer's code numbers. Table 6-3 lists all replaceable parts in reference designator order.

WARNING

Any service or adjustments performed with the protective covers removed should only be done by qualified service personnel. A shock hazard exists with the covers removed.

6-3. EXCHANGE ASSEMBLIES

6-4. Table 6-1 lists assemblies within the instrument that may be replaced on an exchange basis, thus affording a considerable cost saving. Exchange, factory-repaired and tested assemblies are available only on a trade-in basis; therefore, the defective assemblies must be returned for credit. For this reason, assemblies required for spare parts stock must be ordered by the new assembly part number. Refer to Section VIII Service for additional information on the Rebuilt-Exchange program.

6-5. ABBREVIATIONS

6-6. Table 6-2 lists abbreviations used in the parts list and schematics. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always capitals. However, in the schematics, other abbreviation forms are used with both lower case and upper case letters.

6-7. REPLACEABLE PARTS LIST

6-8. Table 6-3 is the list of replaceable parts and is organized as follows:

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

b. Miscellaneous electrical and chassis-mounted parts in alpha-numerical order by reference designation.

c. Option configuration instruments.

d. Miscellaneous mechanical and chassis parts.

6-9. The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. Part number Check Digit (CD).

c. The total quantity (Qty.) in the major assembly (A1, A2, or A3, etc.).

d. The description of the part.

e. A typical manufacturer of the part in a five-digit code.

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

6-10. The total quantity for each part is given only once — at the first appearance of the part number in the list for each major assembly.

NOTE

Total quantities for optional assemblies are totaled by assembly and not integrated into the standard list.

6-11. ORDERING INFORMATION

6-12. To order a part listed in the replaceable parts table, quote the Hewlett-Packard Part Number (with Check Digit), indicate the quantity required, and address the order to the nearest Hewlett-Packard office. Including the Check Digit will ensure accurate and timely processing of your order.

6-13. To order a part that is not listed in the Replaceable Parts List, include the instrument model number, instrument serial number, description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

6-14. 2 YEAR WARRANTED MICROCIRCUITS

6-15. Table 6-1b lists assemblies within the instrument that are warranted for 2 years from date of sale. Refer to the warranty statement in the beginning of Volume 1, Operating Manual, for conditions and details of this warranty.

Table 6-1. Exchange Parts

Description	New Part Number	C D	Rebuilt-Exchange Part Number	C D
A8 Band 0 3.7 GHz Oscillator	5086-7309	3	5086-6309	1
A9 Band 0 Pulse Modulator	5086-7372	0	5086-6372	8
A13 Band 0-4 SYTM	08340-60241	0	08340-60242	1
A14 Band 1-4 Power Amplifier (2.3 to 7.0 GHz)	5086-7407	1	5086-6407	9
A16 Band 1-4 Modulator/Splitter	5086-7304	8	5086-6304	6
A17 Band 0 Mixer	5086-7374	2	5086-6374	0
A18 Band 0 Power Amplifier (0.01 to 2.4 GHz)	5086-7217	2	5086-6217	0
A44 YIG Oscillator	5086-7327	1	5086-6323	9
A63 90 dB Programmable Attenuator	08340-60175	9	08340-60223	8

Table 6-1b. 2 Year Warranted Microcircuits

Assembly Number	Part Number	Description
A8	5086-7309	3.7 GHz Oscillator
	5086-6309	Exchange 5086-7309
A9	5086-7372	Band 0 Pulse Modulator
	5086-6372	Exchange 5086-7372
A12	5086-7434	Band 0 Splitter/Detector
A13	5086-7308	SYTM (**Order new part replacement kit 08340-60241, CD0**)
	5086-6308	Exchange 5086-7308 (**Order exchange part replacement kit 08340-60242, CD1**)
A13	5086-7508	SYTM (**Order new part replacement kit 08340-60241, CD0**)
	5086-6508	Exchange 5086-7508 (**Order exchange part replacement kit 08340-60242, CD1**)
A14	5086-7407	Band 1-4 Power Amp, Standard
	5086-6407	Exchange 5086-7407
A16	5086-7304	Modulator/Splitter
	5086-6304	Exchange 5086-7304
A17	5086-7374	Band 0 Mixer
	5086-6374	Exchange 5086-7374
A18	5086-7217	Band 0 Power Amplifier
	5086-6217	Exchange 5086-7217
A44	5086-7323	YIG Oscillator
	5086-6323	Exchange 5086-7323
A48U1	5086-7292	YO Sampler

Table 6-2. Manufacturer's Code List, Reference Designations, and Abbreviations (1 of 4)

MANUFACTURER'S CODE LIST

Mfr. No.	Manufacturer Name	Address		Zip Code
00000	ANY SATISFACTORY SUPPLIER			
0003J	NIPPON ELECTRIC CO.	TOKYO	JA	
00046	UNITRODE COMPUTER PRODUCTS CORP.	METHUEN	MA	53204
01121	ALLEN-BRADLEY CO.	MILWAUKEE	WI	53204
01295	TEXAS INSTR. INC. SEMICOND CMPNT. DIV.	DALLAS	TX	75222
01921	RCA CORP SOLID STATE DIV.	SOMERVILLE	NJ	08876
02111	SPECTROL ELECTRONICS CORP.	CITY OF IND	CA	91745
03888	KDI PYROFILM CORP.	WHIPPANY	NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85062
06001	GE CO ELEK CAP & BAT PROD. DEPT.	IRMO	SC	29063
06665	PRECISION MONOLITHICS INC.	SANTA CLARA	CA	95050
07263	FAIRCHILD SEMICONDUCTOR DIV.	MOUNTAIN VIEW	CA	94042
11236	CTS OF BERNE INC.	BERNE	IN	46711
13606	SPRAGUE ELECT. CO. SEMICONDUCTOR DIV.	CONCORD	NH	03301
16179	OMNI SPECTRA INC.	FARMINGTON	MI	03504
17856	SILICONIX INC.	SANTA CLARA	CA	95054
18324	SIGNETICS CORP.	SUNNYVALE	CA	94086
19701	MEPCO/ELECTRA CORP.	MINERAL WELLS	TX	76067
20932	EMCON DIV. ITW	SAN DIEGO	CA	92129
24355	ANALOG DEVICES INC.	NORWOOD	MA	02062
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
25088	SIEMENS CORP.	ISELIN	NJ	08830
27014	NATIONAL SEMICONDUCTOR CORP.	SANTA CLARA	CA	95051
28480	HEWLETT-PACKARD CO. CORPORATE HQ.	PALO ALTO	CA	94304
30983	MEPCO/ELECTRA CORP.	SAN DIEGO	CA	92121
32997	BOURNS INC. TRIMPOT PROD. DIV.	RIVERSIDE	CA	92507
34371	HARRIS SEMICON DIV HARRIS-INTERTYPE	MELBOURNE	FL	32901
34649	INTEL CORP.	MOUNTAIN VIEW	CA	95051
51642	CENTRE ENGINEERING INC.	STATE COLLEGE	PA	16801
56289	SPRAGUE ELECTRIC CO.	NORTH ADAMS	MA	01247
72116	ELECTRO MOTIVE CORP. SUB IEC	WILLIMANTIC	CT	06226
73138	BECKMAN INSTRUMENTS INC. HELIPOT DIV.	FULLERTON	CA	92634
74970	JOHNSON E F CO.	WASECA	MN	56093

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (2 of 4)

REFERENCE DESIGNATIONS

A ... Assembly
AT ... Attenuator, Isolator, Limiter, Termination
B ... Fan, Motor
BT ... Battery
C ... Capacitor
CP ... Coupler
CR ... Diode, Diode Thyristor, Step Recovery Diode (SCR), Varactor
DC ... Directional Coupler
DL ... Delay Line
DS ... Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Audible or Visible)
E ... Miscellaneous Electrical Part
F ... Fuse
FL ... Filter
H ... Hardware
HY ... Circulator
J ... Electrical Connector (Stationary Portion), Jack
K ... Relay
L ... Coil, Inductor
M ... Meter
MP ... Miscellaneous Mechanical Part
P ... Electrical Connector (Movable Portion), Plug
Q ... Silicon Controlled Rectifier (SCR), Transistor, Triode Thrystor
R ... Resistor
RT ... Thermistor
S ... Switch
T ... Transformer
TB ... Terminal Board
TC ... Thermocouple
TP ... Test Point
U ... Integrated Circuit, Microcircuit
V ... Electron Tube
VR ... Breakdown Diode (Zener), Voltage Regulator
W ... Cable, Transmission Path, Wire
X ... Socket
Y ... Crystal Unit (Piezoelectric, Quartz)
Z ... Tuned Cavity, Tuned Circuit

ABBREVIATIONS

ADC ... Analog-to-Digital Converter
ADJ ... Adjust, Adjustment
AG ... Silver
AL ... Aluminum
AMP ... Amperage
ANDZ ... Anodized
ANLG ... Analog
ASTBL ... Astable
AWG ... American Wire Gage

B

BCD ... Binary Coded Decimal
BCKT ... Bracket
BD ... Board, Bundle
BE ... Baume, Beryllium
BFR ... Before, Buffer
BIN ... Bin Box (Container), Binary
BNC ... Type of Connector
BSC ... Basic
BSHG ... Bushing
BVR ... Reverse Breakdown Voltage

C

C ... Capacitance, Capacitor, Center Tapped, Centistoke, Ceramic, Cermet, Circular Mil Foot, Closed Cup, Cold, Compression
CAL ... Calibrate, Calibration
CBL ... Cable
CER ... Ceramic
CHAM ... Chamfer
CHAN ... Channel
CNTR ... Container, Counter
COM ... Commercial, Common
CONN ... Connect, Connection, Connector
CONT ... Contact, Continuous, Control, Controller
CRP ... Crepe, Crimp
CTR ... Center
CU ... Copper, Cubic
CURRNT ... Current

D

D ... Deep, Depletion, Depth, Diameter, Direct Current
DAC ... Dacron
DAP ... Diallyl Phthalate
DB ... Decibel, Double Break
DBL ... Double
DCDR ... Decoder
DECD ... Decade
DEG ... Degree
DIVR ... Divider
DO ... Package Type Designation
DRVR ... Driver
DUAL ... Two

E

ECL ... Emitter-Coupled Logic
EFF ... Effective
ENCDR ... Encoder
EXCL ... Excluding, Exclusive
EXT ... Extended, Extension, External, Extinguish
EXTR ... Extractor

F

F ... Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency
FDTHRU ... Feed Through
FET ... Field-Effect Transistor
FF ... Flange, Female Connection; Flip Flop
FL ... Flash, Flat, Fluid
FLEX ... Flexible
FLG ... Flange
FLTR ... Filter, Floater
FRTD ... Flame Retardant
FT ... Current Gain Bandwidth Product (Transition Frequency); Feet, Foot
FXD ... Fixed

G

GEN ... General, Generator

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (3 of 4)

GHZ ..... Gigahertz
GL ..... Glass
GP ..... General Purpose, Group
GRN ..... Green
GRV ..... Grooved

H

H ..... Henry, Hermaphrodite, High, Hole Diameter, Hot, Hub Inside Diameter, Hydrogen
HD ..... Hand, Hard, Head, Heavy Duty
HEX ..... Hexadecimal, Hexagon, Hexagonal
HGT ..... Height
HLCL ..... Helical
HS ..... Heat Sealed, Heat Shrink, High Speed

I

IC ..... Collector Current, Integrated Circuit
ID ..... Identification, Inside Diameter
IMPD ..... Impedance
IN ..... Inch, Indium
INP ..... Input
INS ..... Insert, Inside, Insulation, Insulator
INT ..... Integral, Intensity, Internal
INTL ..... Internal, International
INV ..... Invert, Inverter
IR ..... Insulation Resistance, Iridium

K

K ..... Kelvin, Key, Kilo, Potassium
KB ..... Knob

L

LCH ..... Latch
LED ..... Light Emitting Diode
LG ..... Length, Long
LKG ..... Leakage, Locking
LKWR ..... Lockwasher
LS ..... Loudspeaker, Low Power Schottky, Series Inductance
LUM ..... Luminous

M

M ..... Male, Maximum, Mega, Mil, Milli, Mode, Momentary, Mounting Hole Centers, Mounting Hole Diameter
MA ..... Milliampere
MAGTD ..... Magnitude
MCD ..... Millicandela
MIN ..... Miniature, Minimum, Minor, Minute
MIR ..... Mirror
MLD ..... Mold, Molded
MM ..... Magnetized Material (Restricted Articles Code); Millimeter
MNT ..... Minute (Angle)
MO ..... Metal Oxide, Milliounce, Molybdenum
MOM ..... Momentary, Motherboard
MONO ..... Monostable
MONOSTBL ..... Monostable
MTG ..... Mounting
MTLC ..... Metallic
MULTR ..... Multiplier
MW ..... Milliwatt

N

NB ..... Niobium
NCH ..... Notched
NEG ..... Negative
NH ..... Nanohenry
NM ..... Nanometer, Nonmetallic
NOR ..... Logic Not-OR
NPN ..... Negative Positive Negative (Transistor)
NS ..... Nanosecond, Non-Shorting, Nose
NTD ..... Non-Time-Delay
NYL ..... Nylon (Polyamide)

O

OCTL ..... Octal
OD ..... Olive Drab, Outside Diameter
OP AMP ..... Operational Amplifier

P

PC ..... Picocoulomb, Piece, Printed Circuit
P.C. ..... Printed Circuit
PCB ..... Printed Circuit Board
PD ..... Pad, Palladium, Pitch Diameter, Power Dissipation
PF ..... Picofarad; Pipe, Female Connection; Power Factor
PKG ..... Package
PL-MTG ..... Plate Mounting
PLSTC ..... Plastic
PN ..... Part Number
PNP ..... Positive Negative Positive (Transistor)
POLYC ..... Polycarbonate
POLYE ..... Polyester
POLYI ..... Polyimide
POS ..... Position, Positive
POZI ..... Pozidriv Recess
PRCN ..... Precision
PRESCR ..... Pre-Scaler
PRIM ..... Primary
PRL ..... Parallel
PRP ..... Purple, Purpose
P/S ..... Power Supply
PT ..... Part, Pint, Platinum, Point, Pulse Time
PVC ..... Polyvinyl Chloride

Q

QUAD ..... Set of Four

R

RBN ..... Ribbon
RCVR ..... Receiver
RECT ..... Rectangle, Rectangular, Rectifier
RES ..... Research, Resistance, Resistor, Resolution
RETRIG ..... Retriggerable
RFI ..... Radio Frequency Interference
RGLTR ..... Regulator
RGTR ..... Register
RND ..... Round
RVT ..... Rivet, Riveted

S

SCR ..... Screw, Scrub, Silicon Controlled Rectifier
SEC ..... Second, Secondary
SEN ..... Sense, Sensing

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (4 of 4)

SENS...... Sensitive, Sensitivity
SER.............. Serial, Series
SGL .... Single
SHF .... Shift, Super High Frequency
SHFT.................... Shaft
SHLDR.............. Shoulder
SI.......... Silicon, Square Inch
SIG .... Signal, Significant
SIP ..... Single In-Line Package
SKT.............. Skirt, Socket
SLDR.................. Solder
SM .... Samarium, Seam, Small, Square Meter, Sub Modular, Subminiature
SMB ..... Subminiature, B Type (Snap-On Connector)
SNP...................... Snap
SPCL .... Special
SQ..................... Square
SST............. Stainless Steel
STDF................. Standoff
STRP........... Strapped, Strip
SYNTH.............. Synthetic
SZ........................ Size

T

T ..... Tab Width, Taper, Teeth, Temperature, Tera, Tesla, Thermoplastic (Insulation), Thickness, Time, Timed, Tooth, Turns Ratio, Typical

TA ...... Ambient Temperature, Tantalum
TC .... Thermoplastic
TERMS............. Terminals
TFE... Polytetrafluro - ethylene, Teflon
THD .... Thread, Threaded
THK .... Thick
THKNS............. Thickness
TPL..................... Triple
TR .... Rise Time, Truss
TRIG...... Trigger, Triggerable, Triggering, Trigonometry
TRMR............... Trimmer
TRN.............. Turn, Turns
TTL.......... Tan Translucent, Transistor Transistor Logic

U

UCD............ Microcandela
UF................ Microfarad
UNCT............... Undercut
UVEROM..... Ultraviolet Erase Read Only Memory

V

VCO........ Voltage Controlled Oscillator
VCXO ...... Voltage Controlled Crystal Oscillator
VDC...... Volts, Direct Current
VVC .... Voltage Variable Capacitor

W

W........ Watt, Wattage, White, Wide, Width, Wire
WD.............. Width, Wood

X

XSTR............... Transistor

Y

YTM.... YIG-Tuned Modulator

Z

ZNR .... Zener

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	**08340-60007**	**6**	**1**	**ALPHA DISPLAY ASSEMBLY**	**28480**	**08340-60007**
				NOTE A1J1, HP Part Number 1251-6798, must be cut to length prior to replacement.		
A1J1	1251-6798	9	1	CONNECTOR PC 36-CONT M	03206	65647-136
A1U1-7	1990-0553	8	7	DISPLAY ANNUNCIATOR .15-IN-HIGH	01542	QDSP-2049, CAT C
A2	**08340-60182**	**8**	**1**	**DISPLAY DRIVER ASSEMBLY**	**28480**	**08340-60182**
A2C1	0160-2055	9	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C2	0160-4084	8	2	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A2C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A2C4	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A2C5	0160-4535	4	1	CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A2CR1	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2DS1	1990-0699	3	3	L.E.D. (RED) 7 MCD	01542	1LM1-2350
				NOTE A2DS2-6, 8, 9 and 12 are matched for luminous intensity at the factory. Any single LED may be ordered separately by the part number given for each but its luminous intensity may not match that of the others on the assembly. A complete matched set may be ordered as HP Part Number 1990-0887, CD1.		
A2DS2	1990-0700	7	3	L.E.D. (YELLOW) 5 MCD	01542	1LM1-2450
A2DS3	1990-0697	1	5	L.E.D. (YELLOW) 2 MCD	01542	1LM1-2400
A2DS4	1990-0697	1		L.E.D. (YELLOW) 2 MCD	01542	1LM1-2400
A2DS5	1990-0697	1		L.E.D. (YELLOW) 2 MCD	01542	1LM1-2400
A2DS6	1990-0697	1		L.E.D. (YELLOW) 2 MCD	01542	1LM1-2400
A2DS7	1990-0699	3		L.E.D. (RED) 7 MCD	01542	1LM1-2350
A2DS8	1990-0700	7		L.E.D. (YELLOW) 5 MCD	01542	1LM1-2450
A2DS9	1990-0697	1		L.E.D. (YELLOW) 2 MCD	01542	1LM1-2400
A2DS10	1990-0696	0	2	LED-LIGHT BAR MODULE LUM-INT=3MCD	01542	1LM1-2300
A2DS11	1990-0696	0		LED-LIGHT BAR MODULE LUM-INT=3MCD	01542	1LM1-2300
A2DS12	1990-0700	7		L.E.D. (YELLOW) 5 MCD	01542	1LM1-2450
A2DS13	1990-0699	3		L.E.D. (RED) 7 MCD	01542	1LM1-2350
A2J1	1251-6063	1	1	CONNECTOR-PC 10 FEMALE IR	28480	1251-6063
				NOTE HP Part Number 1251-6798 (A2J2-4, 6-10, 12 and 14-17) must be cut to length prior to replacement.		
A2J2	1200-0681	0	15	SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J3	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J4	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J5	1251-6787	6	3	SOCKET-STRIP 6 CONTACT	28480	1251-6787
A2J6	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J7	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J8	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J9	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J10	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J11	1251-6787	6		SOCKET-STRIP 6 CONTACT	28480	1251-6787
A2J12	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J13	1251-6788	7	1	SOCKET-STRIP 16 CONTACT	28480	1251-6788
A2J14	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J15	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J16	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J17	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2J18	1251-6787	6		SOCKET-STRIP 6 CONTACT	28480	1251-6787
A2MP1	08340-20060	7	10	STANDOFF PRIM	28480	08340-20060
A2MP2	08340-20060	7		STANDOFF PRIM	28480	08340-20060
A2MP3	08340-20060	7		STANDOFF PRIM	28480	08340-20060
A2MP4	08340-20060	7		STANDOFF PRIM	28480	08340-20060
A2MP5	08340-20060	7		STANDOFF PRIM	28480	08340-20060
A2MP6	08340-20060	7		STANDOFF PRIM	28480	08340-20060
A2MP7	08340-20060	7		STANDOFF PRIM	28480	08340-20060
A2MP8	08340-20060	7		STANDOFF PRIM	28480	08340-20060

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2MP9	08340-20060	7		STANDOFF PRIM	28480	08340-20060
A2MP10	08340-20060	7		STANDOFF PRIM	28480	08340-20060
A2MP11	08340-20061	8	8	STANDOFF-SEC	28480	08340-20061
A2MP12	08340-20061	8		STANDOFF-SEC	28480	08340-20061
A2MP13	08340-20061	8		STANDOFF-SEC	28480	08340-20061
A2MP14	08340-20061	8		STANDOFF-SEC	28480	08340-20061
A2MP15	08340-20061	8		STANDOFF-SEC	28480	08340-20061
A2MP16	08340-20061	8		STANDOFF-SEC	28480	08340-20061
A2MP17	08340-20061	8		STANDOFF-SEC	28480	08340-20061
A2MP18	08340-20061	8		STANDOFF-SEC	28480	08340-20061
A2MP19	08340-20063	0	2	STANDOFF-SHORT	28480	08340-20063
A2MP20	08340-20063	0		STANDOFF-SHORT	28480	08340-20063
A2MP21	08340-20066	3	6	SPACER POST	28480	08340-20066
A2MP22	08340-20066	3		SPACER POST	28480	08340-20066
A2MP23	08340-20066	3		SPACER POST	28480	08340-20066
A2MP24	08340-20066	3		SPACER POST	28480	08340-20066
A2MP25	08340-20066	3		SPACER POST	28480	08340-20066
A2MP26	08340-20066	3		SPACER POST	28480	08340-20066
A2MP27-43	1200-0172	4	17	INSULATOR-XSTR DAP-GL	28480	1200-0172
A2MP44	1200-0173	5	5	INSULATOR-XSTR DAP-GL	28480	1200-0173
A2MP45	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A2MP46	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A2MP47	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A2MP48	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
				NOTE HP Part Number 1200-0681 (A2P1,2) must be cut to length prior to replacement.		
A2P1	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2P2	1200-0681	0		SOCKET-STRP 20-CONT DIP-SLDR	28480	1200-0681
A2P3	1251-6786	5	1	CONNECTOR-SINGLE CONTACT .02	28480	1251-6786
A2Q1	1853-0442	4	5	TRANSISTOR PNP 2N3867 SI TO-5 PD=1W	04713	2N3867
A2Q2	1853-0442	4		TRANSISTOR PNP 2N3867 SI TO-5 PD=1W	04713	2N3867
A2Q3	1853-0442	4		TRANSISTOR PNP 2N3867 SI TO-5 PD=1W	04713	2N3867
A2Q4	1853-0442	4		TRANSISTOR PNP 2N3867 SI TO-5 PD=1W	04713	2N3867
A2Q5	1853-0442	4		TRANSISTOR PNP 2N3867 SI TO-5 PD=1W	04713	2N3867
A2Q6	1854-0477	7	17	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q7	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q8	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q10	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q11	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q12	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q13	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q14	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q15	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q16	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q17	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q18	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q19	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q20	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q21	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2Q22	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2R1	0757-0416	7	3	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A2R2	0757-0279	0	4	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A2R3	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A2R4	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A2R5	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A2R6	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A2R7	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+100	24546	C4-1/8-T0-2610-F
A2R8	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A2R9	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A2R10				NOT ASSIGNED		
A2R11	0698-3446	3	3	RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A2R12	0698-3441	8	3	RESISTOR 215 1% .125W F TC=0+100	24546	C4-1/8-T0-215R-F
A2R13	0698-3447	4	5	RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A2R14	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A2R15	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A2R16	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A2R17	0757-0419	0	2	RESISTOR 681 1% .125W F TC=0+100	24546	C4-1/8-T0-681R-F
A2R18	0698-3441	8		RESISTOR 215 1% .125W F TC=0+100	24546	C4-1/8-T0-215R-F
A2R19	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A2R20	0698-3446	3		RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R21	0757-0419	0		RESISTOR 681 1% .125W F TC=0+100	24546	C4-1/8-T0-681R-F
A2R22	0698-3441	8		RESISTOR 215 1% .125W F TC=0+100	24546	C4-1/8-T0-215R-F
A2R23	0698-3446	3		RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A2R24	0698-7193	5	8	RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A2R25	0698-7193	5		RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A2R26	0698-7193	5		RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A2R27	0698-7193	5		RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A2R28	0698-7193	5		RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A2R29	0698-7193	5		RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A2R30	0698-7193	5		RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A2R31	0698-7193	5		RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A2R32	0698-3274	5	1	RESISTOR 10K 1% .125W F TC=0+25	28480	0698-3274
A2R33	0698-7244	7	8	RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A2R34	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A2R35	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A2R36	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A2R37	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A2R38	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A2R39	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A2R40	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A2TP1	0360-2050	8	7	TERMINAL TEST POINT PCB	28480	0360-2050
A2TP2	0360-2050	8		TERMINAL TEST POINT PCB	28480	0360-2050
A2TP3	0360-2050	8		TERMINAL TEST POINT PCB	28480	0360-2050
A2TP4	0360-2050	8		TERMINAL TEST POINT PCB	28480	0360-2050
A2TP5	0360-2050	8		TERMINAL TEST POINT PCB	28480	0360-2050
A2TP6	0360-2050	8		TERMINAL TEST POINT PCB	28480	0360-2050
A2TP7	0360-2050	8		TERMINAL TEST POINT PCB	28480	0360-2050
A2U1	1810-0364	9	1	NETWORK-RES 6-SIP470.0 OHM X 5	01121	206A471
A2U2	1810-0340	1	1	NETWORK-RES 10-SIP24.0 OHM X 5	01121	210B240
A2U3	1820-2266	5	1	IC DRVR TTL	18324	NE590F
A2U4	1820-1226	5	3	IC SHF-RGTR TTL ASYNCHRO SERIAL-IN	28480	1820-1226
A2U5	1820-1226	5		IC SHF-RGTR TTL ASYNCHRO SERIAL-IN	28480	1820-1226
A2U6	1810-0374	1	2	NETWORK-RES 8-SIP1.0K OHM X 4	01121	208B102
A2U7	1810-0374	1		NETWORK-RES 8-SIP1.0K OHM X 4	01121	208B102
A2U8	1820-1226	5		IC SHF-RGTR TTL ASYNCHRO SERIAL-IN	28480	1820-1226
A2U9	1820-1729	3	1	IC LCH TTL LS COM CLEAR 8-BIT	01295	SN74LS259N
A2U10	08340-60017	8	3	MATCHED DISPLAY SET	28480	08340-60017
A2U11	08340-60017	8		MATCHED DISPLAY SET	28480	08340-60017
A2U12	08340-60017	8		MATCHED DISPLAY SET (MUST BE ORDERED AS A SET, MATCHED FOR LUMINOUS INTENSITY)	28480	08340-60017
A2VR1	1902-3036	3	3	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A2VR2	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A2VR3	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A2VR4	1902-0064	1	1	DIODE-ZNR 7.5V 5% DO-35 PD=.4W TC=+.05%	28480	1902-0064

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3	08340-60008	7	1	DISPLAY PROCESSOR ASSEMBLY	28480	08340-60008
A3C1	0160-3875	3	2	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A3C2	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A3C3	0180-0552	9	1	CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A3C4	0160-2055	9	3	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C6	0160-4841	5	1	CAPACITOR-FXD .1UF +80 -20% 50VDC CER	28480	0160-4841
A3C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C8	0160-4084	8	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3C9				NOT ASSIGNED		
A3C10	0180-0228	6	2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3C11	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A3C12	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3C13	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3C14	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3C15	0180-3240	8	5	CAPACITOR-AL 220 UF 10VDC	28480	0180-3240
A3C16	0180-3240	8		CAPACITOR-AL 220 UF 10VDC	28480	0180-3240
A3C17	0180-3240	8		CAPACITOR-AL 220 UF 10VDC	28480	0180-3240
A3C18	0180-3240	8		CAPACITOR-AL 220 UF 10VDC	28480	0180-3240
A3C19	0180-3240	8		CAPACITOR-AL 220 UF 10VDC	28480	0180-3240
A3C20	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A3C21	0160-3879	7	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A3C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A3C23	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3CR1	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A3J1	1251-6787	6	1	SOCKET STRIP-6 CONTACT	28480	1251-6787
A3J2	1251-5746	5	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5746
A3L1				NOT ASSIGNED		
A3L2	08340-80001	2	1	COIL-TOROID	28480	08340-80001
A3L3	9100-1788	6	2	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A3L4	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A3MP1	0340-0162	7	1	INSULATOR-XSTR ALUMINUM	28480	0340-0162
A3MP2	0590-0526	6	1	INSERT-NB 4-40	28480	0590-0526
A3MP3				NOT ASSIGNED		
A3MP4	1205-0085	8	1	HEAT SINK TO-66-CS	28480	1205-0085
A3MP5	2200-0105	4	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3MP6	2200-0105	4		SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
				NOTE HP Part Number 1251-6798 (A3P1-5) must be cut to length prior to replacement.		
A3P1	1251-6798	9	5	CONNECTOR-PC 36 MALE IR	28480	1251-6798
A3P2	1251-6798	9		CONNECTOR-PC 36 MALE IR	28480	1251-6798
A3P3	1251-6798	9		CONNECTOR-PC 36 MALE IR	28480	1251-6798
A3P4	1251-6798	9		CONNECTOR-PC 36 MALE IR	28480	1251-6798
A3P5	1251-6798	9		CONNECTOR-PC 36 MALE IR	28480	1251-6798
A3Q1	1853-0413	9	1	TRANSISTOR PNP 2N6049 SI TO-66 PD=75W	28480	1853-0413
A3Q2	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3R1	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R2	0698-7260	7	2	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A3R3	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A3R4	0698-3396	2	1	RESISTOR 38.3 1% .5W F TC=0+-100	28480	0698-3396
A3R5	0811-1553	1	1	RESISTOR .68 5% 2W PW TC=0+-800	75042	BWH2-11/16-J
A3R6	0811-1666	7	1	RESISTOR 1 5% 2W PW TC=0+-800	75042	BWH2-1R0-J
A3R7				NOT ASSIGNED		
A3R8	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R9	0757-0458	7	4	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3R10	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A3R11	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3R12	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A3R13	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R14	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3R15	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3R16	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A3TP1-8				NOT ASSIGNED		
A3TP9	0360-2050	8	8	TERMINAL TEST POINT, PCB	28480	0360-2050
A3TP10	0360-2050	8		TERMINAL TEST POINT, PCB	28480	0360-2050
A3TP11	0360-2050	8		TERMINAL TEST POINT, PCB	28480	0360-2050
A3TP12	0360-2050	8		TERMINAL TEST POINT, PCB	28480	0360-2050
A3TP13	0360-2050	8		TERMINAL TEST POINT, PCB	28480	0360-2050
A3TP14	0360-2050	8		TERMINAL TEST POINT, PCB	28480	0360-2050
A3TP15	0360-2050	8		TERMINAL TEST POINT, PCB	28480	0360-2050
A3TP16	0360-2050	8		TERMINAL TEST POINT, PCB	28480	0360-2050
A3U1	1820-2865	0	1	IC-8-BIT MICROCOMPUTER; 11MHZ OPERATION	28480	1820-2865

See introduction to this section for ordering information.

*Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3U2	1820-1975	1	1	IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165N
A3U3	1820-1287	8	1	IC BFR TTL LS NAND QUAD 2-INP	01295	SN74LS37N
A3U4	1820-0668	7	2	IC BFR TTL NON-INV HEX 1-INP	01295	SN7407N
A3U5	1820-1196	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3U6	1820-1997	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A3U7	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A3U8	1820-0668	7		IC BFR TTL NON-INV HEX 1-INP	01295	SN7407N
A3U9	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A3U10	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A3U11	1826-0161	7	1	IC OP AMP GP QUAD 14-DIP-P PKG	04713	MLM324P
A3U12	1810-0398	9	1	NETWORK-RES 10-SIP22.0K OHM X 9	11236	750-101-R22K
A3VR1	1902-1359	9	1	DIODE-ZNR 4.3V 2% PD=5W IR=10UA	28480	1902-1359
A3Y1	0410-1295	8	1	CRYSTAL-10.92 MHZ	28480	0410-1295

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4				NOT ASSIGNED		
A5	08340-60010	1	1	KEYBOARD	28480	08340-60010
A5DS1	1990-0858	6	18	L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS2	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS3	1990-0857	5	1	L.E.D. (GREEN) 150 UCD	28480	1990-0857
A5DS4	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS5	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS6	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS7	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990 0858
A5DS8	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS9	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS10	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990 0858
A5DS11	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS12	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS13	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS14	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS15	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS16	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS17	1990-0856	4	2	L.E.D. (RED) 150 UCD	28480	1990-0856
A5DS18	1990-0856	4		L.E.D. (RED) 150 UCD	28480	1990-0856
A5DS19				NOT ASSIGNED		
A5DS20	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS21	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5DS22	1990-0858	6		L.E.D. (YELLOW) 150 UCD	28480	1990-0858
A5J1	1251-6799	0	1	CONNECTOR HEADER 36 MIR	28480	1251-6799
A5J2	1251-6787	6	2	SOCKET STRIP-6 CONTACT	28480	1251-6787
A5J3	1251-6787	6		SOCKET STRIP-6 CONTACT	28480	1251-6787
A5MP1	0590-0526	6	1	THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0526
A5MP2	5041-2732	2	1	KEY CAP "CONT"	28480	5041-2732
A5MP3	5041-2735	5	1	KEY CAP "FREE RUN"	28480	5041-2735
A5MP4	5041-2738	8	1	KEY CAP "LOCAL"	28480	5041-2738
A5MP5	5041-2733	3	1	KEY CAP "SINGLE"	28480	5041-2733
A5MP6	5041-2736	6	1	KEY CAP "LINE"	28480	5041-2736
A5MP7	5041-2739	9	1	KEY CAP "SAVE"	28480	5041-2739
A5MP8	5041-2734	4	1	KEY CAP "MANUAL"	28480	5041-2734
A5MP9	5041-2737	7	1	KEY CAP "EXT"	28480	5041-2737
A5MP10	5041-2731	1	1	KEY CAP "ALT"	28480	5041-2731
A5MP11	5041-2740	2	1	KEY CAP "RECALL"	28480	5041-2740
A5MP12	5041-2712	8	1	KEY CAP "M1"	28480	5041-2712
A5MP13	5041-2713	9	1	KEY CAP "M2"	28480	5041-2713
A5MP14	5041-2725	3	1	KEY CAP "MKR SWP"	28480	5041-2725
A5MP15	5041-0720	4	1	KEY CAP "INST PREST"	28480	5041-0720
A5MP16	5041-2714	0	1	KEY CAP "M3"	28480	5041-2714
A5MP17	5041-0692	9	1	KEY CAP "OFF"	28480	5041-0692
A5MP18	5041-2715	1	1	KEY CAP "M4"	28480	5041-2715
A5MP19	5041-2718	4	1	KEY CAP "MKR DELTA"	28480	5041-2718
A5MP20	5041-2729	7	1	KEY CAP "PULSE"	28480	5041-2729
A5MP21	5041-2716	2	1	KEY CAP "M5"	28480	5041-2716
A5MP22	5041-2726	4	1	KEY CAP "MKR TO CF"	28480	5041-2726
A5MP23	5041-2748	0	1	KEY CAP "AM"	28480	5041-2748
A5MP24	5041-2748	0	1	KEY CAP "ENTRY OFF"	28480	5041-2748
A5MP25	5041-2748	0	2	KEY CAP "ARROW DOWN"	28480	5041-2747
A5MP26	5041-2748	0		KEY CAP "ARROW UP"	28480	5041-2747
A5MP27	5041-2719	5	1	KEY CAP "START FREQ"	28480	5041-2719
A5MP28	5041-2721	9	1	KEY CAP "CF"	28480	5041-2721
A5MP29	5041-2724	2	1	KEY CAP "CW"	28480	5041-2724
A5MP30	5041-2727	5	1	KEY CAP "SWEEP TIME"	28480	5041-2727
A5MP31	5041-2720	8	1	KEY CAP "STOP FREQ"	28480	5041-2720
A5MP32	5041-2722	0	1	KEY CAP "DELTA FREQ"	28480	5041-2722
A5MP33	5041-2723	1	1	KEY CAP "PWR LVL"	28480	5041-2723
A5MP34	5041-2745	7	1	KEY CAP "SHIFT"	28480	5041-2745
A5MP35	5041-0643	0	1	KEY CAP "7"	28480	5041-0643
A5MP36	5041-0640	7	1	KEY CAP "4"	28480	5041-0640
A5MP37	5041-0637	2	1	KEY CAP "1"	28480	5041-0637
A5MP38	5041-0646	3	1	KEY CAP "0"	28480	5041-0646
A5MP39	5041-0644	1	1	KEY CAP "8"	28480	5041-0644
A5MP40	5041-0641	8	1	KEY CAP "5"	28480	5041-0641
A5MP41	5041-0638	3	1	KEY CAP "2"	28480	5041-0638
A5MP42	5041-0647	4	1	KEY CAP "DECIMAL"	28480	5041-0647
A5MP43	5041-0645	2	1	KEY CAP "9"	28480	5041-0645
A5MP44	5041-2747	9	1	KEY CAP "6"	28480	5041-2747
A5MP45	5041-0639	4	1	KEY CAP "3"	28480	5041-0639

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5MP46	5041-2747	9	1	KEY CAP "BACK SPACE"	28480	5041-2748
A5MP47	5041-2741	3	1	KEY CAP "GHZ/DB(M)"	28480	5041-2741
A5MP48	5041-2742	4	1	KEY CAP "MHZ/SEC)"	28480	5041-2742
A5MP49	5041-2743	5	1	KEY CAP "KHZ/MSEC)"	28480	5041-2743
A5MP50	5041-2744	6	1	KEY CAP "HZ AUTO"	28480	5041-2744
A5MP51	5040-8858	3	21	LED STDF STRP, 2 PER	28480	5040-8858
A5R1	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A5R2	0757-0428	1	2	RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A5R3	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A5S1 - 39	5060-9436	7	49	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S40				NOT ASSIGNED		
A5S41	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S42	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S43	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S44	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S45	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S46	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S47	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S48	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S49	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5S50	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A5U1	1810-0203	5	3	NETWORK-RES 8-SIP 470.0 OHM X 7	01121	208A471
A5U2	1810-0203	5		NETWORK-RES 8-SIP 470.0 OHM X 7	01121	208A471
A5U3	1810-0203	5		NETWORK-RES 8-SIP 470.0 OHM X 7	01121	208A471

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	**08340-60011**	**2**	**1**	**KEYBOARD INTERFACE**	**28480**	**08340-60011**
A6C1	0180-0197	8	2	CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A6C2	0160-2055	9	10	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C5	0160-4084	8	7	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A6C6	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A6C7	0180-0116	1	1	CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A6C8	0160-0162	5	1	CAPACITOR-FXD .022UF +10% 200VDC POLYE	28480	0160-0162
A6C9	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A6C10	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A6C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C15	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A6C16	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A6C17	0180-0291	3	1	CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A6C18	0180-0228	6	1	CAPACITOR-FXD 22UF+10% 15VDC TA	56289	150D226X9015B2
A6C19	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A6C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C22	0180-0197	8		CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A6C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C24	0180-2731	0	1	CAPACITOR-FXD 2.2UF+10% 20VDC TA	28480	0180-2731
A6C25	0160-3879	7	4	CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A6C26	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A6C27	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A6C28	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A6CR1	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR2	1901-0518	8	2	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A6CR3	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A6J1	1251-4634	8	2	CONNECTOR HEADER 20 M2R	28480	1251-4634
A6J2	1251-6868	4	1	CONNECTOR HEADER 5 M IR	28480	1251-6868
A6J3	1251-5746	5	1	CONNECTOR HEADER 50 M2R	28480	1251-5746
A6J4	1251-6793	4	1	CONNECTOR HEADER 3 M IR	28480	1251-6793
A6L1	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A6MP1	0380-0043	7	6	SPACER-RVT-ON .375-IN-LG .14-IN-ID	28480	0380-0043
A6MP2	0380-0043	7		SPACER-RVT-ON .375-IN-LG .14-IN-ID	28480	0380-0043
A6MP3	0380-0043	7		SPACER-RVT-ON .375-IN-LG .14-IN-ID	28480	0380-0043
A6MP4				NOT ASSIGNED		
A6MP5	0380-0043	7		SPACER-RVT-ON .375-IN-LG .14-IN-ID	28480	0380-0043
A6MP6	0380-0043	7		SPACER-RVT-ON .375-IN-LG .14-IN-ID	28480	0380-0043
A6MP7	0380-0111	0	1	STANDOFF-RVT-ON .25-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
A6P1	1251-6787	6	5	SOCKET STRIP 6 CONTACT	28480	1251-6787
A6P2	1251-6799	0	2	CONNECTOR HEADER 36 M IR	28480	1251-6799
A6P3	1251-6799	0		CONNECTOR HEADER 36 M IR	28480	1251-6799
A6R1	0683-6855	3	1	RESISTOR 6.8M 5% .25W FC TC=-900/+1100	01121	CB6855
A6R2	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A6R3	0757-0464	5	1	RESISTOR 90.9K 1% .125W F TC=0+100	03292	C4-1/8-T0-9092-F
A6R4	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A6R5	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-2872-F
A6R6	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+100	24546	C4-1/8-T0-4642-F
A6R7	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+100	28480	0757-0123
A6R8	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A6R9	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A6R10	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A6R11	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A6R12	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A6TP1	0360-0535	0	15	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP13	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP14	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6TP15	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A6U1	1820-1851	2	2	IC ENCDR TTL LS	01295	SN74LS148N
A6U2	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A6U3	1820-1272	1	1	IC BFR TTL LS NOR QUAD 2-INP	01295	SN74LS33N
A6U4	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U5	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	01295	NE555P
A6U6	1820-1730	6	4	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U7	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U8	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A6U9	1820-1437	0	1	IC MV TTL LS MONOSTBL DUAL	01698	SN74LS221N
A6U10	1820-1851	2		IC ENCDR TTL LS	01295	SN74LS148N
A6U11	1820-1917	1	1	IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS240N
A6U12	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U13	1820-2270	1	2	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	34335	AM25LS2569DC
A6U14	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A6U15	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A6U16	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U17	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U18	1820-2270	1		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	34335	AM25LS2569DC
A6U19	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U20	1820-1437	0	1	IC MV TTL LS MONOSTBL DUAL	01295	SN74LS221N
A6U21	1810-0280	8	2	NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A6U22	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A6U23	1810-0206	8	1	NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7	**08340-60012**	**3**	**1**	**LOWER KEYBOARD**	**28480**	**08340-60012**
A7DS1	1990-0670	0	8	L.E.D. (YELLOW) 1 MCD	28480	1990-0670
A7DS2	1990-0670	0		L.E.D. (YELLOW) 1 MCD	28480	1990-0670
A7DS3	1990-0670	0		L.E.D. (YELLOW) 1 MCD	28480	1990-0670
A7DS4	1990-0670	0		L.E.D. (YELLOW) 1 MCD	28480	1990-0670
A7DS5	1990-0670	0		L.E.D. (YELLOW) 1 MCD	28480	1990-0670
A7DS6	1990-0670	0		L.E.D. (YELLOW) 1 MCD	28480	1990-0670
A7DS7	1990-0670	0		L.E.D. (YELLOW) 1 MCD	28480	1990-0670
A7DS8	1990-0670	0		L.E.D. (YELLOW) 1 MCD	28480	1990-0670
A7J1	1251-4634	8		CONNECTOR HEADER 20 M2R	28480	1251-4634
A7MP1	5041-0318	6	8	KEY CAP-QUARTER LT PIPE	28480	5041-0318
A7S1	5060-9436	7	8	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A7S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A7S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A7S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A7S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A7S6	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A7S7	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A7S8	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A7U1	1810-0272	8	1	NETWORK-RES 10-SIP330.0 OHM X 9	01121	210A331

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8	5086-7309	3	1	BAND O 3.7 GHZ OSCILLATOR 5086-7309 INCLUDES A8A1 PC BOARD AND A8A2 3.7 GHZ OSCILLATOR MICROCIRCUIT.)	28480	5086-7309
	5086-6309	1	1	EXCHANGE 5086-7309 OSCILLATOR	28480	5086-6309
A8A1	08340-60041	8	2	3.7 GHZ OSCILLATOR PC BOARD	28480	08340-60041
A8A1C1	0160-3874	2	1	CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A8A1C2	0160-3877	5	2	CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A8A1C3	0180-0291	3	1	CAPACITOR-FXD 1UF±10% 35VDC TA	56289	150D105X9035A2
A8A1C4	0121-0046	2	1	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304322 9/35PF N650
A8A1C5	0160-3877	5		CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A8A1C6	0160-3878	6	7	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8A1C7	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8A1C8	0160-2150	5	1	CAPACITOR-FXD 33PF ±5% 300VDC MICA	28480	0160-2150
A8A1C9	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8A1C10	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8A1C11	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8A1C12	0160-0134	1	1	CAPACITOR-FXD 220PF ±5% 300VDC MICA	28480	0160-0134
A8A1C13	0170-0040	9	1	CAPACITOR-FXD .047UF ±10% 200VDC POLYE	56289	292P47392
A8A1C14	0180-2904	9	1	CAPACITOR-FXD .1UF±10% 75VDC TA	28480	0180-2904
A8A1C15	0180-2205	3	1	CAPACITOR-FXD .33UF±10% 35VDC TA	56289	150D334X9035A2
A8A1C16	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8A1C17	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8A1C18	0160-0574	3	4	CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A8A1C19	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A8A1C20	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A8A1C21	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A8A1C22	0180-0630	4		CAPACITOR-FXD 4.7UF ±20% 50VDC TA	28480	0180-0630
A8A1CR1	1901-0033	2	6	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8A1CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8A1CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8A1CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8A1CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8A1CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8A1E1	1460-1489	8	1	JUMPER .022 LG	28480	1460-1489
A8A1E2	9170-0029	3	2	CORE-SHIELDING BEAD	28480	9170-0029
A8A1E3	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A8A1J1	1250-1611	3	2	CONNECTOR-RF M SMB-PC	28480	1250-1611
A8A1J2	1250-1611	3		CONNECTOR-RF M SMB-PC	28480	1250-1611
A8A1L1	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A8A1L2	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A8A1L3	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A8A1L4	9100-2247	4	1	INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A8A1L5	85660-80010	2	1	COIL-40 NH	28480	85660-80010
A8A1MP1				NOT ASSIGNED		
A8A1MP2	1205-0011	0	1	HEAT SINK- TO-5 (FOR Q2)	28480	1205-0011
A8A1MP3	1251-3172	7	7	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND (SOCKETS FOR MICROCIRCUITS)	28480	1251-3172
A8A1MP4	1200-0173	5	1	INSULATOR-TRANSISTOR TO-5 (FOR Q2)	28480	1200-0173
A8A1MP5	1251-2194	1	1	CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ (SOCKETS FOR JUMPER WIRE)	28480	1251-2194
A8A1MP6				NOT ASSIGNED		
A8A1MP7	8151-0014	5		WIRE 24AWG 1X24	28480	8151-0014
A8A1Q1	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A8A1Q2	1854-0378	7	1	TRANSISTOR NPN 2N5109 SI TO-39 PD=800MW	3L585	2N5109
A8A1Q3	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A8A1Q4	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A8A1Q5	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A8A1Q6	1854-0248	0	1	TRANSISTOR-DUAL NPN 2N4044 TO-77	22229	2N4044
A8A1Q7	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A8A1Q8	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A8A1R1	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0±100	24546	C3-1/8-TO-316R-F
A8A1R2	0698-7188	8	2	RESISTOR 10 1% .05W F TC=0±100	24546	C3-1/8-TO-10R-F
A8A1R3	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0±100	24546	C4-1/8-TO-751-F
A8A1R4	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0±100	03888	PME55-1/8-TO-19R6-F
A8A1R5	0698-7203	8	1	RESISTOR 42.2 1% .05W F TC=0±100	24546	C3-1/8-TO-42R2-F
A8A1R6	0698-7276	5	2	RESISTOR 46.4K 1% .05W F TC=0±100	24546	C3-1/8-TO-4642-F
A8A1R7	0698-7276	5		RESISTOR 46.4K 1% .05W F TC=0±100	24546	C3-1/8-TO-4642-F
A8A1R8	2100-2030	6	1	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A8A1R9	0698-7288	9	2	RESISTOR 147K 1% .05W F TC=0±100	24546	C3-1/8-TO-1473-F
A8A1R10	0698-7277	6	2	RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-TO-5112-F

See introduction to this section for ordering information
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Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8A1R11	0698-7219	6	1	RESISTOR 196 1% .05W F TC=0+100	24546	C3-1/8-TO-196R-F
A8A1R12	0698-7284	5	2	RESISTOR 100K 1% .05W F TC=0+100	24546	C3-1/8-T0-1003-F
A8A1R13	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A8A1R14	0698-7288	9		RESISTOR 147K 1% .05W F TC=0+100	24546	C3-1/8-T0-1473-F
A8A1R15	0698-7211	8	1	RESISTOR 90.9 1% .05W F TC=0+100	24546	C3-1/8-TO-90R9-F
A8A1R16	0698-7281	2	1	RESISTOR 75K 2% .05W F TC=0+100	24546	C3-1/8-T0-7502-G
A8A1R17	0698-7216	3	1	RESISTOR 147 1% .05W F TC=0+100	24546	C3-1/8-TO-147R-F
A8A1R18	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A8A1R19	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A8A1R20	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A8A1R21	0698-3161	9	1	RESISTOR 38.3K 1% .125W F TC=0+100	24546	C4-1/8-T0-3832-F
A8A1R22	0698-7284	5		RESISTOR 100K 1% .05W F TC=0+100	24546	C3-1/8-T0-1003-F
A8A1R23	0698-7244	7	1	RESISTOR 2.15K 1% .05W F TC=0+100	24546	C3-1/8-T0-2151-F
A8A1R24	0698-7188	8		RESISTOR 10 1% .05W F TC=0+100	24546	C3-1/8-TO-10R-F
A8A1R25	0698-7205	0	1	RESISTOR 51.1 1% .05W F TC=0+100	24546	C3-1/8-TO-51R1-F
A8A1R26	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+100	24546	C4-1/8-T0-121R-F
A8A1TP1	0360-0535	0	2	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A8A1TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A8A1U1	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	01295	NE555P
A8A1VR1	1902-3301	5	1	DIODE-ZNR 34.8V 5% DO-35 PD=.4W	28480	1902-3301
A8A2				3.7GHZ OSCILLATOR (NOT SEPARATELY REPLACEABLE; ORDER A8.)		
A8C1	9135-0002	8	5	FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A8C2	9135-0002	8		FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A8C3	9135-0002	8		FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A8C4	9135-0002	8		FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A8C5	9135-0002	8		FILTER-LOW PASS SOLDER-TERMS	33095	51-744-018
A8MP1	08340-20082	3	1	BOX 3.7 GHZ OSC.	28480	08340-20082
A8MP2	08340-00020	7	1	LID 3.7 GHZ OSC.	28480	08340-00020
A8MP3	08340-20055	0	1	DONUT RFI SHIELD	28480	08340-20055
A8MP4	2200-0103	2	14	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A8MP5	0520-0131	2	4	SCREW-MACH 2-56 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A8MP6	2190-0045	8	4	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0045
A8MP7	2580-0002	4	5	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
A8MP8	2190-0009	4	5	WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
A8MP9	1400-0510	8	1	CLAMP-CABLE .15-DIA .62-WD NYL	28480	1400-0510
A8MP10	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A8MP11	2190-0124	4	2	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A8W1	08340-60097	4	1	WIRE ASSEMBLY-A8 TO A20J3	28480	08340-60097

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9	5086-7372	0	1	BAND 0 PULSE MODULATOR	28480	5086-7372
	5086-6372	8	1	EXCHANGE 5086-7372 BAND O PULSE MOD.	28480	5086-6372
A10	0955-0125	5	1	DIRECTIONAL COUPLER	28480	0955-0125
A11	08340-60130	6	1	BAND 1-4 DETECTOR	28480	08340-60130
A12	5086-7434	5	1	BAND 0 SPLITTER/DETECTOR (DOES NOT INCLUDE A12W1)	28480	5086-7434
	08340-60240	9	1	BAND 0 SPLITTER/DETECTOR REPLACEMENT KIT (REQUIRED FOR INSTRUMENTS WITH SERIAL PREFIX 2430A AND BELOW. INCLUDES 5086-7434, REQ'D HARDWARE, AND SERVICE NOTE)	28480	08340-60240
A12W1	08340-60122	6	1	WIRE ASSEMBLY- A12 TO A62J34	28480	08340-60122
A13	5086-7508		1	BAND 1-4 SWITCHED YIG TUNED MULTIPLIER (FOR SYTM REPLACEMENT, ORDER ONE OF THE FOLLOWING SYTM REPLACEMENT KITS. THESE KITS PROVIDE THE A13 MICROCIRCUIT, THE A13A1 PC BOARD, AND REQUIRED HARDWARE.)	28480	5086-7508
	5086-6508			EXCHANGE 5086-7508 SYTM (FOR SYTM REPLACEMENT, ORDER ONE OF THE FOLLOWING SYTM REPLACEMENT KITS. THESE KITS PROVIDE THE A13 MICROCIRCUIT, THE A13A1 PC BOARD, AND REQUIRED HARDWARE.) NOTE: When ordering a replacement SYTM or SYTM Bias assy (not separately replaceable) order one of the following replacement kits. DO NOT ORDER THE INDIVIDUAL ASSY'S PART NUMBER. If ordering a replacement kit for an instrument with a serial prefix of 2506A or below, two potentiometers and one resistor must be changed on the A28 SYTM Driver Assembly. Refer to Service note 8340A-14 for details.	28480	5086-6508
	08340-60241	0		SYTM REPLACEMENT KIT, NEW	28480	08340-60241
	08340-60242	1		SYTM REPLACEMENT KIT, EXCHANGE	28480	08340-60242
A13A1	5061-1090		1	SYTM BIAS BOARD ASSEMBLY (NOT SEPARATELY REPLACEABLE, ORDER ONE OF THE SYTM REPLACEMENT KITS SHOWN ABOVE.)	28480	5061-1090
A13A1C1	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A13A1CR1	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A13A1J1	1200-0482	9	1	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A13A1J2	1251-3172	7	4	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A13A1J3	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A13A1J4	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A13A1J5	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A13A1MP1	0380-1272	6	2	SPACER-RVT-ON .125-IN-LG .098-IN-ID	00000	ORDER BY DESCRIPTION
A13A1R1	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13A1TP1	0360-0535	0	1	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A13A1VR1	1902-0175	5	1	DIODE-ZNR 100V 5% PD=1W IR=5UA	28480	1902-0175
A13MP1	5021-5361	7	1	SYTM SPACER	28480	5021-5361
A13MP2	5086-3460	9	1	CENTER BODY ASSEMBLY	28480	5086-3460
A13MP3	0520-0129	8	2	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A13MP4	2190-0890	1	2	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890

See introduction to this section for ordering information   Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A14	**5086-7407**	**2**	**1**	**BAND 1-4 POWER AMPLIFIER** (5086-7407 INCLUDES A14A1 PC BOARD AND A14 MICROCIRCUIT.)	**28480**	**5086-7407**
				NOTE		
				Order power amp replacement kit, HP Part Number 08340-60204, CD5.		
	5086-6407	0	1	EXCHANGE 5086-7407 BAND 1-4 PWR AMP	28480	5086-6407
				NOTE		
				Order exchange 5086-7407 power amp replacement kit, HP Part Number 08340-60196 CD4		
A14A1	5061-5326	8	1	BAND 1-4 POWER AMP BIAS BOARD	28480	5061-5326
A14A1C1	0160-0174	9	2	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A14A1C2	0180-1704	5	4	CAPACITOR-FXD 47UF±10% 6VDC TA	56289	150D476X9006B2
A14A1C3	0180-1704	5		CAPACITOR-FXD 47UF±10% 6VDC TA	56289	150D476X9006B2
A14A1C4	0180-0228	6	1	CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A14A1C5	0180-0291	3	1	CAPACITOR-FXD 1UF±10% 35VDC TA	56289	150D105X9035A2
A14A1C6	0180-1704	5		CAPACITOR-FXD 47UF±10% 6VDC TA	56289	150D476X9006B2
A14A1C7	0180-1704	5		CAPACITOR-FXD 47UF±10% 6VDC TA	56289	150D476X9006B2
A14A1C8	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A14A1C9	0160-4084	8	1	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A14A1C10	0160-3879	7	1	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A14A1E1-E12	1251-3172	7	12	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1J1	1200-0507	9	1	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A14A1MP1	0380-0322	5	8	SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1MP2	1200-0173	5	1	INSULATOR-XSTR DAP-GL	28480	1200-0173
A14A1MP3	0340-0614	4	1	INSULATOR-XSTR POLYI HD-ANDZ	28480	0340-0614
A14A1MP4	0590-0106	8	1	NUT-HEX-PLSTC LKG 2-56-THD .143-IN-THK	00000	ORDER BY DESCRIPTION
A14A1MP5	5001-1600	7	1	HEAT SINK/BRACKET	28480	5001-1600
A14A1MP6	5021-0950	0	1	BOARD INSULATOR	28480	5021-0950
A14A1MP7	5021-2519	1	1	INSULATOR	28480	5021-2519
A14A1Q1	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A14A1Q2	1853-0213	7	1	TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A14A1Q3	1853-0281	9	1	TRANSISTOR NPN 2N2194 SI TO-5 PD=800MW	01698	2N2194
A14A1R1	0698-3443	0	2	RESISTOR 287 1% .125W F TC=0±100	24546	C4-1/8-T0-287R-F
A14A1R2	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0±100	24546	C4-1/8-T0-751-F
A14A1R3	0698-3441	8	3	RESISTOR 215 1% .125W F TC=0±100	24546	C4-1/8-T0-215R-F
A14A1R4	0698-3441	8		RESISTOR 215 1% .125W F TC=0±100	24546	C4-1/8-T0-215R-F
A14A1R5	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A14A1R6	0757-0198	2	1	RESISTOR 100 1% .5W F TC=0±100	28480	0757-0198
A14A1R7	0757-0417	8	2	RESISTOR 562 1% .125W F TC=0±100	24546	C4-1/8-T0-562R-F
A14A1R8	0757-0400	9	2	RESISTOR 90.9 1% .125W F TC=0±100	24546	C4-1/8-T0-90R9-F
A14A1R9	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0±100	24546	C4-1/8-T0-90R9-F
A14A1R10	0698-3441	8		RESISTOR 215 1% .125W F TC=0±100	24546	C4-1/8-T0-215R-F
A14A1R11	2100-1738	9	6	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A14A1R12				NOT ASSIGNED		
A14A1R13	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A14A1R14	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A14A1R15	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A14A1R16	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A14A1R17				NOT ASSIGNED		
A14A1R18	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A14A1R19	0757-0442	9	6	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R20				NOT ASSIGNED		
A14A1R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R25				NOT ASSIGNED		
A14A1R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R27	0757-0417	8		RESISTOR 562 1% .125W F TC=0±100	24546	C4-1/8-T0-562R-F
A14A1R28	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0±100	24546	C4-1/8-T0-121R-F
A14A1R29				NOT ASSIGNED		
A14A1R30	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A14A1R31	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A14A1R32	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-TO-1003-F
A14A1R33	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-TO-101-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A14A1R34	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-TO-5111-F
A14A1R35	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-TO-3161-F
A14A1U1	1826-0527	9	1	IC V RGLTR-ADJ-NEG 1.2/37V TO-220 PKG	28480	1826-0527
A14A1VR1	1902-0551	1	1	DIODE-ZNR 6.2V 5% PD=1W IR=10UA	28480	1902-0551
A14A1VR2	1902-0029	8	1	DIODE-ZNR 12V 5% PD=1W IR=5UA	28480	1902-0029

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15	9135-0191	6	1	BAND 0 LOW PASS FILTER	28480	9135-0191
A16	5086-7304	0	1	BAND 1-4 MODULATOR/SPLITTER	28480	5086-7304
	5086-6304	8	1	EXCHANGE 5086-7304 BAND 1-4 MOD/SPL	28480	5086-6304
A16A1	5061-5323	5	1	BAND 1-4 MODULATOR/SPLITTER BIAS BOARD	28480	5061-5323
A16A1C1	0160-0174	9	1	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A16A1C2	0180-1704	5	2	CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A16A16C3	0180-1704	5		CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A16A1J1	1200-0482	9	1	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A16A1J2	1250-1849	9	1	CONNECTOR-RF FEEDTHRU CAPACITOR; 50 OHMS	28480	1250-1849
A16A1MP1	2200-0107	6	4	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A16A1MP2	0380-0321	4	5	SPACER-RVT-ON .125-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A16A1MP3				NOT ASSIGNED		
A16A1MP4				NOT ASSIGNED		
A16A1MP5	1251-3172	7	1	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A16A1Q1	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A16A1R1	0698-3441	8	2	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A16A1R2	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A16A1R3	0698-3443	0	2	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16A1R4	2100-1738	9	2	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A16A1R5	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16A1R6	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A16A1R7	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16A1R8	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A16A1R9	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A16A1VR1	1902-0551	1	1	DIODE-ZNR 6.2V 5% PD=1W IR=10UA	28480	1902-0551
A17	5086-7374	2	1	BAND 0 MIXER	28480	5086-7374
	5086-6374	0		EXCHANGE 5086-7374 BAND 0 MIXER	28480	5086-6374
A18	5086-7217	2	1	BAND 0 POWER AMPLIFIER (5086-7217 INCLUDES A18 MICROCIRCUIT AND A18A1 PC BOARD BUT DOES NOT INCLUDE A18A2 BAND 0 SPLITTER.)	28480	5086-7217
	5086-6217	0		EXCHANGE 5086-7217 BAND 0 PWR AMPLIFIER	28480	5086-6217
A18A1	5060-0325	5	1	BAND 0 POWER AMP BIAS BOARD	28480	5060-0325
A18A1R1	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A18A1R2	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A18A1R3	0698-3437	2	1	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A18A1R4	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A18A1R5	0757-0417	8	1	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A18A1R6	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A18A1R7	0757-1090	5		RESISTOR 261 1% .5W F TC=0+-100	28480	0757-1090
A18A1R8*	0698-3102	8	1	RESISTOR 237 1% .5W F TC=0+-100	28480	0698-3102
A18A1R8*	0698-3334	8	1	RESISTOR 178 1% .5W F TC=0+-100	28480	0698-3334
A18A1R8*	0698-3401	0	1	RESISTOR 215 1% .5W F TC=0+-100	28480	0698-3401
A18A1R8*	0757-1060	9	1	RESISTOR 196 1% .5W F TC=0+-100	28480	0757-1060
A18A1R8*	0757-1090	5	2	RESISTOR 261 1% .5W F TC=0+-100	28480	0757-1090
A18A1R8*	0757-1092	7	1	RESISTOR 287 1% .5W F TC=0+-100	28480	0757-1092
A18A1R9	0757-0794	4	1	RESISTOR 68.1 1% .5W F TC=0+-100	28480	0757-0794
A18A1R10				R10 IS FACTORY SELECTED FROM THE FOLLOWING VALUES:		
	0757-0795	5		RESISTOR 75 1% .5W F TC=0+-100	19701	MF-1/2-T0-75R0-F
	0757-0796	6		RESISTOR 82.5 1% .5W F TC=0+-100	28480	0757-0796
	0757-0797	7		RESISTOR 90.9 1% .5W F TC=0+-100	28480	0757-0797
	0757-1000	7		RESISTOR 51.1 1% .5W F TC=0+-100	28480	0757-1000
	0757-1001	8		RESISTOR 56.2 1% .5W F TC=0+-100	28480	0757-1001
	0757-1002	9		RESISTOR 61.9 1% .5W F TC=0+-100	28480	0757-1002
A18A1W1	08340-60099	6	1	WIRE ASSEMBLY A18A1 TO A20J4 (NOT INCLUDED WITH A18 OR A18A1)	28480	08340-60099

See introduction to this section for ordering information   *Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A18MP1	5020-8550	0	1	DIELECTRIC SPACER	28480	5020-8550

See introduction to this section for ordering information *Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A19	**08340-60003**	**2**	**1**	**CAPACITOR ASSEMBLY**	**28480**	**08340-60003**
A19C1	0160-2055	9	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C3	0160-3638	6	2	CAPACITOR-FXD .22UF +80-20% 200VDC CER	28480	0160-3638
A19C4	0160-5647	1	1		28480	0160-5647
A19C5	0180-2603	5	2	CAPACITOR-FXD 7200UF+75-10% 50VDC AL	28480	0180-2603
A19C6	0180-2603	5		CAPACITOR-FXD 7200UF+75-10% 50VDC AL	28480	0180-2603
A19C7	0180-2671	7	3	CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	500123U030AC2A
A19C8	0180-2671	7		CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	500123U030AC2A
A19C9	0180-2671	7		CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	500123U030AC2A
A19C10	0160-3638	6		CAPACITOR-FXD .22UF +80-20% 200VDC CER	28480	0160-3638
A19CR1	1901-0662	3	4	DIODE-PWR RECT 100V 6A	04713	MR751
A19CR2	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A19CR3	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A19CR4	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A19CR5	1901-0935	3	4	DIODE-PWR RECT 45V 8A	28480	1901-0935
A19CR6	1901-0935	3		DIODE-PWR RECT 45V 8A	28480	1901-0935
A19CR7	1901-0935	3		DIODE-PWR RECT 45V 8A	28480	1901-0935
A19CR8	1901-0935	3		DIODE-PWR RECT 45V 8A	28480	1901-0935
A19DS1	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A19MP1	2190-0011	8	10	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0011
A19MP2	2680-0129	8	10	SCREW-MACH 10-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A19MP3	2360-0113	2	3	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A19MP4	08340-00019	4	1	CAP SHIELD	28480	08340-00019
A19R1	0764-0016	8	2	RESISTOR 1K 5% 2W MO TC=0+200	28480	0764-0016
A19R2	0698-3407	6	1	RESISTOR 1.96K 1% .5W F TC=0+100	28480	0698-3407
A19R3	0757-1078	9	1	RESISTOR 1.47K 1% .5W F TC=0+100	28480	0757-1078
A19R4	0764-0016	8		RESISTOR 1K 5% 2W MO TC=0+200	28480	0764-0016
A19TP1	0360-0535	0	1	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20	**08340-60203**	**4**	**1**	**RF SECTION FILTER**	**28480**	**08340-60203**
A20C1	0180-2614	8	2	CAPACITOR-FXD 100UF+10% 30VDC TA	56289	150D107X9030S2
A20C2	0160-4835	7	2	CAPACITOR-FXD .1UF +10% 50VDC CER	28480	0160-4835
A20C3	0180-2614	8		CAPACITOR-FXD 100UF+10% 30VDC TA	56289	150D107X9030S2
A20C4	0180-0094	4	2	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A20C5	0160-4835	7		CAPACITOR-FXD .1UF +10% 50VDC CER	28480	0160-4835
A20C6	0180-0094	4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A20C7	0180-0116	1	1	CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A20J1	1200-0482	9	2	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A20J2	1200-0482	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A20J3	1251-6794	5	1	CONNECTOR HEADER 5 M IR	28480	1251-6794
A20J4	1251-6795	6	1	CONNECTOR HEADER 3 M IR	28480	1251-6795
A20L1	08340-80001	2	4	COIL-TOROID	28480	08340-80001
A20L2	08340-80001	2		COIL-TOROID	28480	08340-80001
A20L3	08340-80001	2		COIL-TOROID	28480	08340-80001
A20L4	08340-80001	2		COIL-TOROID	28480	08340-80001
A20L5	9100-0539	3	1	INDUCTOR (MISC ITEM)	28480	9100-0539
A20MP1	0380-0773	0	4	SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A20Q1	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A20Q2	1854-0361	8	1	TRANSISTOR NPN 2N4239 SI TO-5 PD=6W	04713	2N4239
A20R1	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A20R2	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A20R3	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+100	19701	MF4C1/8-T0-6191-F
A20R4	0757-1090	5	1	RESISTOR 261 1% .5W F TC=0+100	28480	0757-1090
A20R5	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21	**08340-60160**	**2**	**1**	**PULSE MODULATOR DRIVER**	**28480**	**08340-60160**
A21C1*	0160-4492	2	1	CAPACITOR-FXD 18PF ±5% 200VDC CER 0±30	28480	0160-4492
A21C2	0160-4084	8	4	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A21C3	0160-0127	2	2	CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A21C4	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A21C5	0160-0574	3	1	CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A21C6	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A21C7	0160-4822	2	1	CAPACITOR-FXD 1000PF ±5% 100VDC CER	28480	0160-4822
A21C8	0160-4823	3	1	CAPACITOR-FXD 820PF ±5% 100VDC CER	28480	0160-4823
A21C9	0160-4808	4	1	CAPACITOR-FXD 470PF ±5% 100VDC CER	02798	0160-4808
A21C10	0160-0573	2	1	CAPACITOR-FXD 4700PF ±20% 100VDC CER	28480	0160-0573
A21C11	0160-4809	5	1	CAPACITOR-FXD 390PF ±5% 100VDC CER	28480	0160-4809
A21C12	0160-4386	3	1	CAPACITOR-FXD 33PF ±5% 200VDC CER 0±30	28480	0160-4386
A21C13	0160-4387	4	1	CAPACITOR-FXD 47PF ±5% 200VDC CER 0±30	28480	0160-4387
A21C14	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A21C15	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A21C16	0180-0229	7	1	CAPACITOR-FXD 33UF+10% 10VDC TA	56289	150D336X9010B2
A21C17	0180-0116	1	1	CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A21CR1	1901-0050	3	9	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR7	1901-0539	3	1	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A21CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A21L1	9100-3562	8	2	COIL-4.7 UH 5%	28480	9100-3562
A21L2	9100-3562	8		COIL-4.7 UH 5%	28480	9100-3562
A21L3	9140-0138	2	1	INDUCTOR RF-CH-MLD 180UH 5% .166DX.385LG	28480	9140-0138
A21L4	9140-0129	1	2	INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A21L5	9100-3912	2	1	INDUCTOR RF-CH-MLD 15UH 5% .166DX.385LG	28480	9100-3912
A21L6	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A21L7	9140-0237	2	1	INDUCTOR RF-CH-MLD 200UH 5% .166DX.385LG	28480	9140-0237
A21MP1	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
A21MP2	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-BD-THKNS	28480	4040-0749
A21MP3, 4	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A21Q1	1854-0809	9	7	TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A21Q2	1853-0018	0	2	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A21Q3	1853-0018	0		TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	28480	1853-0018
A21Q4	1854-0809	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A21Q5	1854-0809	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A21Q6	1854-0809	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A21Q7	1854-0809	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A21Q8	1853-0405	9	1	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A21Q9	1854-0809	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A21Q10	1854-0809	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A21Q11	1855-0251	7	2	TRANSISTOR MOSFET N-CHAN E-MODE TO-39 SI	28480	1855-0251
A21Q12	1855-0251	7		TRANSISTOR MOSFET N-CHAN E-MODE TO-39 SI	28480	1855-0251
A21R1	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-T0-3161-F
A21R2	0757-0416	7	3	RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A21R3	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A21R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A21R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A21R6	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-T0-196R-F
A21R7	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A21R8	0698-3444	1	2	RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-T0-316R-F
A21R9	0698-3440	7		RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-T0-196R-F
A21R10	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A21R11	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A21R12	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A21R13	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A21R14	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A21R15	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0±100	24546	C4-1/8-T0-1331-F
A21R16	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0±100	24546	C4-1/8-T0-3481-F
A21R17	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A21R18	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0±100	24546	C4-1/8-T0-2610-F
A21R19	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0±100	24546	C4-1/8-T0-681R-F
A21R20	0698-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21R21	2100-3353	8	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A21R22	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A21R23	2100-3273	1	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	28480	2100-3273
A21R24	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+100	24546	C4-1/8-T0-215R-F
A21R25	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A21R26	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A21R27	0757-0402	1	2	RESISTOR 110 1% .125W F TC=0+100	24546	C4-1/8-T0-111-F
A21R28	0757-0402	1		RESISTOR 110 1% .125W F TC=0+100	24546	C4-1/8-T0-111-F
A21R29	0757-0418	9	2	RESISTOR 619 1% .125W F TC=0+100	24546	C4-1/8-T0-619R-F
A21R30	0698-3444	1		RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A21R31	0757-0422	5	2	RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-T0-909R-F
A21R32	0757-0422	5		RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-T0-909R-F
A21R33-36				NOT ASSIGNED		
A21R37	0757-0418	9		RESISTOR 619 1% .125W F TC=0+100	24546	C4-1/8-T0-619R-F
A21R38	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+100	24546	C4-1/8-T0-1781-F
A21R39				NOT ASSIGNED		
A21R40	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+100	24546	C4-1/8-T0-1782-F
A21R41	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A21R42	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A21R43	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A21R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A21R45	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A21TP1	0360-0535	0	5	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A21TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A21TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A21TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A21TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A21U1	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A21U2	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A21U3	1826-0161	7	1	IC OP AMP GP QUAD 14-DIP-P PKG	04713	MLM324P

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22				NOT ASSIGNED		
A23				NOT ASSIGNED		
A24	08340-60158	8	1	ATTENUATOR DRIVER/SRD BIAS	28480	08340-60158
A24C1	0180-0116	1	4	CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A24C2	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A24C3	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A24C4	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A24C5	0160-4835	7	6	CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A24C6	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A24C7	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A24C8	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A24C9	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A24C10	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A24C11	0180-0228	6	1	CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A24C12	0160-4832	4	1	CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A24C13	0180-0049	9	1	CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A24C14	0160-3335	0	1	CAPACITOR-FXD 470PF ±10% 100VDC CER	28480	0160-3335
A24C15	0160-4787	8	1	CAPACITOR-FXD 22PF ±5% 100VDC CER 0±30	28480	0160-4787
A24C16	0160-4812	0	1	CAPACITOR-FXD 220PF ±5% 100VDC CER	28480	0160-4812
A24C17, 18				NOT ASSIGNED		
A24C19	0160-0575	4	5	CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A24C20	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A24C21	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A24C22	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A24C23	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A24C24	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 100VDC CER	28480	0160-4389
A24CR1	1901-0050	3	2	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A24CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A24L1	9140-0129	1	4	INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A24L2	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A24L3	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A24L4	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A24L5	9100-0539	3	1	INDUCTOR (MISC ITEM)	28480	9100-0539
A24MP1				NOT ASSIGNED		
A24MP2	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
A24MP3	4040-0752	9	1	EXTR-PC BD YEL POLYC .062-BD-THKNS	28480	4040-0752
A24MP4	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A24MP5, 6				NOT ASSIGNED		
A24MP7	1205-0033	6	1	HEAT SINK TO-5/TO-39-CS	28480	1205-0033
A24Q1	1853-0281	9	4	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q2	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q3	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q4	1855-0386	9	3	TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A24Q5	1855-0386	9		TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A24Q6	1855-0386	9		TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A24Q7	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A24Q8	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A24Q9	1853-0213	4	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0213
A24Q10	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	28480	1853-0281
A24R1	2100-3274	2	2	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A24R2	2100-3274	2		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A24R3	2100-3353	8	9	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R4	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R5	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R6	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R7	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R8	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R9	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R10	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R11	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A24R12	2100-3351	6	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A24R13	0698-3453	2	6	RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A24R14	0698-3453	2		RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A24R15	0698-3453	2		RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A24R16	0698-3453	2		RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A24R17	0698-3453	2		RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A24R18	0698-3453	2		RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A24R19	0698-3449	6	3	RESISTOR 28.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2872-F
A24R20	0698-3449	6		RESISTOR 28.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2872-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A24R21	0698-3449	6		RESISTOR 28.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2872-F
A24R22				NOT ASSIGNED		
A24R23	0757-0442	9	9	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R27	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R28	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R30	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R31	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A24R32	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0±100	24546	C4-1/8-T0-1102-F
A24R33	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0±100	24546	C4-1/8-T0-2871-F
A24R34	0698-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-TO-1961-F
A24R35	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-TO-1961-F
A24R36	0698-3156	2	2	RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A24R37	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A24R38	0698-7278	7	1	RESISTOR 56.2K 1% .05W F TC=0±100	28480	0698-7278
A24R39	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A24R40	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-3162-F
A24R41	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A24R42	0698-6624	5	1	RESISTOR 2K .1% .125W F TC=0±25	28480	0698-6624
A24R43	0811-3575	1	1	RESISTOR- 3K OHM 2% .12W	28480	0811-3575
A24R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A24R45	0698-8827	4	1	RESISTOR 1M 1% .125W F TC=0±100	28480	0698-8827
A24R46	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A24R47	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0±100	24546	C4-1/8-T0-2611-F
A24R48	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0±100	24546	C4-1/8-T0-4642-F
A24R49	0699-0068	1	1	RESISTOR- 1.47 MEGOHM 1% .12W	28480	0699-0068
A24R50	0757-0465	6	5	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A24R51	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A24R52	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A24R53	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A24R54	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A24R55	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-T0-3161-F
A24R56	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-5110-F
A24R57	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0±100	24546	C4-1/8-T0-8251-F
A24R58	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1212-F
A24R59	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0±100	24546	C4-1/8-T0-1781-F
A24R60	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A24R61	0698-7205	0	1	RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-TO-51R1-F
A24TP1	0360-0535	0	12	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A24U1	1826-0785	1	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	01295	TL072ACJG
A24U2	1826-0828	3	2	IC-15G M1 OP AMP	06665	OP-15GJ
A24U3	1826-0828	3		IC-15G M1 OP AMP	06665	OP-15GJ
A24U4	1826-0261	8	1	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A24U5	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A24U6	1810-0395	6	1	NETWORK-RES 8-SIP47.0K OHM X 7	11236	750-81-R47K
A24U7	1826-0138	8	2	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A24U8	1820-0535	7	4	IC DRVR TTL AND DUAL 2-INP	01295	SN75451BP
A24U9	1820-0535	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75451BP
A24U10	1820-0535	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75451BP
A24U11	1820-0535	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75451BP
A24U12	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A24U13	1906-0074	1	1	DIODE-ARRAY 50V 400MA	28480	1906-0074
A24U14	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A24U15	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A25	08340-60020	3	1	ALC DETECTOR	28480	08340-60020
A25C1	0160-4535	4	8	CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A25C2	0160-0575	4	5	CAPACITOR-FXD .047UF +20% 50VDC CER	28480	0160-0575
A25C3	0160-4385	2	1	CAPACITOR-FXD 15PF +5% 200VDC CER 0+30	28480	0160-4385
A25C4	0160-0575	4		CAPACITOR-FXD .047UF +20% 50VDC CER	28480	0160-0575
A25C5	0160-4535	4		CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A25C6	0160-4535	4		CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A25C7	0160-0575	4		CAPACITOR-FXD .047UF +20% 50VDC CER	28480	0160-0575
A25C8	0160-4387	4	1	CAPACITOR-FXD 47PF +5% 200VDC CER 0+30	28480	0160-4387
A25C9	0160-3879	7	4	CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A25C10	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A25C11*	0160-3878	6	5	CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A25C12	0160-4389	6	1	CAPACITOR-FXD 100PF +5PF 200VDC CER	28480	0160-4389
A25C13	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A25C14	0160-0575	4		CAPACITOR-FXD .047UF +20% 50VDC CER	28480	0160-0575
A25C15	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A25C16	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A25C17	0160-4084	8	4	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A25C18	0160-3874	2	1	CAPACITOR-FXD 10PF +.5PF 200VDC CER	28480	0160-3874
A25C19	0160-3873	1	3	CAPACITOR-FXD 4.7PF +.5PF 200VDC CER	28480	0160-3873
A25C20	0160-3873	1		CAPACITOR-FXD 4.7PF +.5PF 200VDC CER	28480	0160-3873
A25C21	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A25C22	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A25C23	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A25C24	0160-4789	0	1	CAPACITOR-FXD 15PF 100VDC	28480	0160-4789
A25C25	0160-0153	4	1	CAPACITOR-FXD 1000PF +10% 200VDC POLYE	28480	0160-0153
A25C26	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A25C27	0160-3875	3	1	CAPACITOR-FXD 22PF +5% 200VDC CER 0+30	28480	0160-3875
A25C28	0180-2208	6	1	CAPACITOR-FXD 220UF+10% 10VDC TA	56289	150D227X9010S2
A25C29	0160-4535	4		CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A25C30	0160-4535	4		CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A25C31	0180-0116	1	1	CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A25C32	0160-4535	4		CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A25C33-35				NOT ASSIGNED		
A25C36	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A25C37	0160-3405	5	1	CAPACITOR-FXD 2UF +10% 50VDC MET-POLYC	28480	0160-3405
A25C38	0160-3873	1		CAPACITOR-FXD 4.7PF +.5PF 200VDC CER	28480	0160-3873
A25C39	0160-0575	4		CAPACITOR-FXD .047UF +20% 50VDC CER	28480	0160-0575
A25C40	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A25C41	0160-4535	4		CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A25C42	0160-4535	4		CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A25CR1	1901-0539	3	5	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A25CR2	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A25CR3	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A25CR4	1901-0050	3	2	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A25CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A25CR6	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A25CR7	1901-0376	6	1	DIODE-GEN PRP 35V 50MA DO-35 (RECOMMENDED REPLACEMENT)	28480	1901-0376
A25CR8	1901-0376	6	4	DIODE-GEN PRP 35V 50MA DO-35 (RECOMMENDED REPLACEMENT)	28480	1901-0376
A25CR9	1901-0033	2	3	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A25CR10	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A25CR11	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A25CR12	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A25J1	1250-0691	7	2	CONNECTOR-RF M SMB	28480	1250-0691
A25J2	1250-0691	7		CONNECTOR-RF M SMB	28480	1250-0691
A25L1	9100-3562	8	2	COIL-4.7 UH 5%	28480	9100-3562
A25L2	9100-3562	8		COIL-4.7 UH 5%	28480	9100-3562
A25MP1				NOT ASSIGNED		
A25MP2	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
A25MP3	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A25MP4	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A25MP5	08340-20184	6	1	COMPARTMENT FILTER	28480	08340-20184
A25MP6	08340-20054	9	1	COVER-FILTER	28480	08340-20054
A25MP7	08340-00054	7	1	COVER-FILTER	28480	08340-00054
A25MP8-15	2200-0103	2	8	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A25MP16, 17	2190-0124	4	2	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A25MP18, 19	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A25Q1	1855-0276	6	2	TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	01295	2N4416A
A25Q2	1855-0276	6		TRANSISTOR J-FET 2N4416A N-CHAN D-MODE	01295	2N4416A
A25Q3	1854-0477	7	3	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A25Q4	1853-0405	9	3	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A25Q5	1854-0295	7	2	TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A25Q6	1853-0075	9	1	TRANSISTOR-DUAL PNP PD=400MW	28480	1853-0075
A25Q7	1854-0345	8	4	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A25Q8	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A25Q9	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A25Q10	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A25Q11	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A25Q12	1855-0235	7	2	TRANSISTOR J-FET N-CHAN D-MODE TO-52 SI	28480	1855-0235
A25Q13	1854-0546	1	2	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A25Q14	1854-0546	1		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A25Q15	1855-0235	7		TRANSISTOR J-FET N-CHAN D-MODE TO-52 SI	28480	1855-0235
A25Q16	1854-0295	7		TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A25Q17	1854-0475	5	2	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A25Q18	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A25Q19	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A25Q20	1854-0688	2	1	TRANSISTOR-DUAL NPN TO-71	28480	1854-0688
A25Q21	1854-0475	5		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A25Q22	1853-0269	3	1	TRANSISTOR-DUAL PNP 2N3809 PD=600MW	01295	2N3809
A25Q23	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A25Q24	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A25Q25	1855-0414	4	1	TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A25Q26	1853-0316	1	1	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A25Q27	1855-0386	9	3	TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A25Q28	1855-0386	9		TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A25Q29	1855-0386	9		TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A25Q30	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A25Q31	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A25R1	0698-7284	5	3	RESISTOR 100K 1% .05W F TC=0+100	24546	C3-1/8-T0-1003-F
A25R2	0698-7284	5		RESISTOR 100K 1% .05W F TC=0+100	24546	C3-1/8-T0-1003-F
A25R3	0698-7212	9	3	RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-TO-100R-F
A25R4	0698-8827	4	2	RESISTOR 1M 1% .125W F TC=0+100	28480	0698-8827
A25R5	0698-7264	1	1	RESISTOR 14.7K 1% .05W F TC=0+100	24546	C3-1/8-T0-1472-F
A25R6	0698-7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-TO-100R-F
A25R7	0698-3429	2	2	RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A25R8	0698-0082	7	3	RESISTOR 464 1% .125W F TC=0+100	24546	C4-1/8-T0-4640-F
A25R9	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A25R10	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A25R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A25R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A25R13	0757-0424	7	2	RESISTOR 1.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1101-F
A25R14	0698-3154	0	4	RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A25R15	0698-7209	4	3	RESISTOR 75 1% .05W F TC=0+100	24546	C3-1/8-TO-75R0-F
A25R16	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A25R17	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1101-F
A25R18	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A25R19	0698-7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-TO-100R-F
A25R20	0698-7209	4		RESISTOR 75 1% .05W F TC=0+100	24546	C3-1/8-TO-75R0-F
A25R21	0698-7209	4		RESISTOR 75 1% .05W F TC=0+100	24546	C3-1/8-TO-75R0-F
A25R22	0698-0083	8	3	RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A25R23	0698-8821	8	1	RESISTOR 5.62 1% .125W F TC=0+100	28480	0698-8821
A25R24	2100-0589	6	1	RESISTOR-TRMR 10 10% C SIDE-ADJ 1-TRN	28480	2100-0589
A25R25	0698-7188	8	1	RESISTOR 10 1% .05W F TC=0+100	24546	C3-1/8-TO-10R-F
A25R26	0757-0459	8	1	RESISTOR 56.2K 1% .125W F TC=0+100	24546	C4-1/8-T0-5622-F
A25R27	0757-0419	0	2	RESISTOR 681 1% .125W F TC=0+100	24546	C4-1/8-T0-681R-F
A25R28	0698-3161	9	1	RESISTOR 38.3K 1% .125W F TC=0+100	24546	C4-1/8-T0-3832-F
A25R29	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A25R30	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+100	24546	C4-1/8-T0-6192-F
A25R31	0698-3157	3	4	RESISTOR 19.6K 1% .125W F TC=0+100	24546	C4-1/8-T0-1962-F
A25R32	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+100	24546	C4-1/8-T0-1962-F
A25R33	2100-1762	9	4	RESISTOR-TRMR 20K 5% WW SIDE-ADJ 1-TRN	28480	2100-1762
A25R34	2100-1762	9		RESISTOR-TRMR 20K 5% WW SIDE-ADJ 1-TRN	28480	2100-1762
A25R35	0811-3596	6	1	RESISTOR- 320 OHM 2% .12W	28480	0811-3596
A25R36*	0757-0438	3	4	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A25R37*	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A25R38	2100-1759	4	2	RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TRN	28480	2100-1759
A25R39	2100-1759	4		RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TRN	28480	2100-1759
A25R40	0757-0418	9	2	RESISTOR 619 1% .125W F TC=0+100	24546	C4-1/8-T0-619R-F
A25R41	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+100	19701	MF4C1/8-T0-6191-F
A25R42	0698-6320	8	3	RESISTOR 5K .1% .125W F TC=0+25	03888	PME55-1/8-T9-5001-B
A25R43	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+100	24546	C4-1/8-T0-1331-F
A25R44	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+25	03888	PME55-1/8-T9-5001-B
A25R45	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0+100	24546	C4-1/8-T0-3481-F
A25R46	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A25R47	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+100	24546	C4-1/8-T0-147R-F
A25R48	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A25R49	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A25R50	0698-6377	5	1	RESISTOR 200 .1% .125W F TC=0+25	28480	0698-6377
A25R51	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-2152-F
A25R52	0699-1056	9	1	RESISTOR- 825 OHM .1% .12W	28480	0699-1056
A25R53	0757-0274	5	2	RESISTOR 1.21K 1% .125W F TC=0+100	24546	C4-1/8-TO-1211-F
A25R54	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A25R55	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A25R56	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A25R57	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+100	24546	C4-1/8-T0-178R-F
A25R58	2100-3351	6	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A25R59	0757-0418	9		RESISTOR 619 1% .125W F TC=0+100	24546	C4-1/8-T0-619R-F
A25R60	0698-0082	7		RESISTOR 464 1% .125W F TC=0+100	24546	C4-1/8-T0-4640-F
A25R61	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+100	24546	C4-1/8-T0-1962-F
A25R62	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-5621-F
A25R63	0698-0082	7		RESISTOR 464 1% .125W F TC=0+100	24546	C4-1/8-T0-4640-F
A25R64	0811-3575	1	2	RESISTOR- 3K OHM 2% .12W	28480	0811-3575
A25R65	0698-6624	5	2	RESISTOR 2K .1% .125W F TC=0+25	28480	0698-6624
A25R66	0811-3576	2	1	RESISTOR- 533 OHM 2% .12W	28480	0811-3576
A25R67	0699-0793	9	1	RESISTOR- 33.2K OHM .1% .12W	28480	0699-0793
A25R68	0757-0464	5	1	RESISTOR 90.9K 1% .125W F TC=0+100	24546	C4-1/8-T0-9092-F
A25R69	0698-6376	4	2	RESISTOR 200K .1% .125W F TC=0+25	19701	MF4C1/8-T9-2003-B
A25R70	0698-6376	4		RESISTOR 200K .1% .125W F TC=0+25	19701	MF4C1/8-T9-2003-B
A25R71	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+100	24546	C4-1/8-T0-2871-F
A25R72	0698-3160	8	1	RESISTOR 31.6K .1% .125W F TC=0+25	28480	0698-3160
A25R73	0757-0346	2	3	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A25R74	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A25R75	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+100	28480	0698-8827
A25R76	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A25R77	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+100	24546	C4-1/8-T0-3831-F
A25R78	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A25R79	0698-3453	2	2	RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A25R80	2100-1762	9		RESISTOR-TRMR 20K 5% WW SIDE-ADJ 1-TRN	28480	2100-1762
A25R81	0757-0419	0		RESISTOR 681 1% .125W F TC=0+100	24546	C4-1/8-T0-681R-F
A25R82	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A25R83	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A25R84	2100-1762	9		RESISTOR-TRMR 20K 5% WW SIDE-ADJ 1-TRN	28480	2100-1762
A25R85	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A25R86	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A25R87	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+100	24546	C4-1/8-T0-1962-F
A25R88	2100-0552	3	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 1-TRN	28480	2100-0552
A25R89	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A25R90	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+100	24546	C4-1/8-T0-3481-F
A25R91	0757-0465	6	5	RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A25R92	0698-3458	7	1	RESISTOR 348K 1% .125W F TC=0+100	28480	0698-3458
A25R93	0699-0794	0	1	RESISTOR- 1.07K OHM .1% .12W	28480	0699-0794
A25R94	0698-6360	6	1	RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A25R95	0698-6362	8	1	RESISTOR 1K .1% .125W F TC=0+25	28480	0698-6362
A25R96	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A25R97	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A25R98	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A25R99	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+25	03888	PME55-1/8-T9-5001-B
A25R100	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+25	28480	0698-6624
A25R101	0811-3575	1		RESISTOR- 3K OHM 2% .12W	28480	0811-3575
A25R102	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+100	24546	C4-1/8-T0-1782-F
A25R103	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A25R104	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+100	24546	C4-1/8-TO-1211-F
A25R105	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A25R106	0698-3158	4	1	RESISTOR 23.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-2372-F
A25R107	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A25R108	2100-1760	7	1	RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TRN	28480	2100-1760
A25R109*	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A25R110	0698-7284	5		RESISTOR 100K 1% .05W F TC=0+100	24546	C3-1/8-T0-1003-F
A25R111	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A25R112	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A25R113	0757-0420	3		RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A25R114				NOT ASSIGNED		
A25R115*	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A25R116	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-2152-F
A25R117	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A25TP1	0360-0535	0	7	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A25TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A25TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A25TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A25TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A25TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A25TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A25U1	1826-0845	4	1	IC OP AMP PRCN TO-99 PKG	06665	OP-07EJ
A25U2	1826-0306	2	2	IC COMPARATOR GP QUAD 14-DIP-C PKG	27014	LM339AJ
A25U3	1826-0471	2	4	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A25U4	1826-0785	1	2	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	01295	TL072ACJG
A25U5	1826-0785	1		IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	01295	TL072ACJG
A25U6	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A25U7	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A25U8	1826-0601	0	1	IC OP AMP PRCN TO-99 PKG	06665	OP-16FJ
A25U9	1826-0306	2		IC COMPARATOR GP QUAD 14-DIP-C PKG	27014	LM339AJ
A25U10	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A26	08340-60212	5	1	LINEAR MODULATOR	28480	08340-60212
A26C1	0160-4811	9	1	CAPACITOR-FXD 270PF +-5% 100VDC CER	28480	0160-4811
A26C2	0160-4385	2	1	CAPACITOR-FXD 15PF +-5% 200VDC CER 0+-30	28480	0160-4385
A26C3	0160-0575	4	10	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C4	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C5	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A26C6	0160-0153	4	1	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A26C7	0160-0162	5	1	CAPACITOR-FXD .022UF +-10% 200VDC POLYE	28480	0160-0162
A26C8	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C9	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C10	0160-4389	6	2	CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A26C11	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C12	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C13	0160-4386	3	1	CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A26C14	0160-4389	6		CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A26C15	0160-0156	7	1	CAPACITOR-FXD 3900PF +-10% 200VDC POLYE	28480	0160-0156
A26C16	0160-3878	6	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A26C17	0160-4535	4	8	CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A26C18	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A26C19	0160-4835	7	2	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A26C20	0160-5098	6	2	CAPACITOR-CER .22UF 50VDC	16299	CAC05X7R224J050A
A26C21	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A26C22	0160-5098	6		CAPACITOR-CER .22UF 50VDC	16299	CAC05X7R224J050A
A26C23	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A26C24	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A26C25	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A26C26	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A26C27	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A26C28	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A26C29	0160-4825	5	1	CAPACITOR-FXD 560PF +-5% 100VDC CER	28480	0160-4825
A26C30	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A26C31	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C32	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C33	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C34	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A26C35				NOT ASSIGNED		
A26C36	0160-4825	5	1	CAPACITOR-FXD 560PF +-5% 100VDC CER	28480	0160-4825
A26CR1	1901-0033	2	9	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A26CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A26CR3	1901-0050	3	5	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A26CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A26CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A26CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A26CR7	1901-0539	3	2	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A26CR8	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A26CR9				NOT ASSIGNED		
A26CR10	1901-0050	3		DIODE-SWITCHING 180V 200MA 2NS DO-35	28480	1901-0050
A26CR11	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A26CR12	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A26CR13	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A26CR14	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A26L1	9100-1643	2	1	INDUCTOR RF-CH-MLD 300UH 5% .2DX.45LG	28480	9100-1643
A26L2	9140-0112	2	5	INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0112
A26L3	9140-0112	2		INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0112
A26L4	9140-0112	2		INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0112
A26L5	9140-0112	2		INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0112
A26L6	9140-0112	2		INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0112
A26L7	9100-1666	9	1	INDUCTOR RF-CH-MLD 3.6MH 5%	28480	9100-1666
A26MP1	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
A26MP2	4040-0754	1	1	EXTR-PC BD BLU POLYC .062-BD-THKNS	28480	4040-0754
A26MP3, 4	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A26Q1	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A26Q2	1855-0414	4	10	TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q3	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q4	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q5	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q6	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q7	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A26Q8	1853-0388	7	1	TRANSISTOR-DUAL PNP PD=600MW	28480	1853-0388
A26Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A26Q10	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q11	1853-0405	9	3	TRANSISTOR NPN SI TO-39 PD=1W FT=25 MHZ	02037	2N4209
A26Q12	1853-0405	9		TRANSISTOR NPN SI TO-39 PD=1W FT=25 MHZ	02037	2N4209
A26Q13	1853-0405	9		TRANSISTOR NPN SI TO-39 PD=1W FT=25 MHZ	02037	2N4209
A26Q14	1855-0421	3	4	TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A26Q15	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A26Q16	1855-0386	9	2	TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A26Q17	1854-0477	7	5	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A26Q18	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A26Q19	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q20	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q21	1855-0421	3		TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A26Q22	1855-0421	3		TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A26Q23	1855-0386	9		TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A26Q24	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A26Q25	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A26Q26	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A26Q27	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A26Q28	1855-0278	8	1	TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	17856	2N5116
A26Q29	1855-0421	3		TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A26Q30	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A26Q31	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A26Q32	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A26R1	0698-6362	8	2	RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A26R2	0698-3450	9	2	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A26R3	0698-8861	6	2	RESISTOR 6.66K .1% .125W F TC=0+-25	28480	0698-8861
A26R4	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A26R5	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A26R6	0757-0442	9	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R7	2100-3274	2	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A26R8	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A26R9	0757-0280	3	10	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R11	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A26R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R13	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A26R14	0698-3458	7	2	RESISTOR 348K 1% .125W F TC=0+-100	28480	0698-3458
A26R15	0757-0465	6	6	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A26R16	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A26R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R18	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A26R19	0698-6323	1	1	RESISTOR 100 .1% .125W F TC=0+-25	28480	0698-6323
A26R20	0698-6317	3	2	RESISTOR 500 .1% .125W F TC=0+-25	03888	PME55-1/8-T9-500R-B
A26R21	0698-6360	6	1	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A26R22	0698-4433	0	1	RESISTOR 2.26K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2261-F
A26R23	0698-6624	5	1	RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A26R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R25	0757-0428	1	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A26R26	0698-6363	9	2	RESISTOR 40K .1% .125W F TC=0+-25	28480	0698-6363
A26R27	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A26R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R29	0698-6363	9		RESISTOR 40K .1% .125W F TC=0+-25	28480	0698-6363
A26R30	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A26R31	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R32	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A26R33	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R34	0698-8827	4	6	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A26R35	0698-3458	7		RESISTOR 348K 1% .125W F TC=0+-100	28480	0698-3458
A26R36	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A26R37	0698-6364	0	1	RESISTOR 50 OHM .1% .125W	28480	0698-6364
A26R38	0698-6317	3		RESISTOR 500 .1% .125W F TC=0+-25	03888	PME55-1/8-T9-500R-B
A26R39	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R40	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A26R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R42	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A26R43	2100-3353	8	3	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A26R44	0757-0462	3	2	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A26R45	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A26R46	0698-0084	9	3	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A26R47	2100-3354	9	2	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	28480	2100-3354
A26R48	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A26R49	2100-3355	0		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	28480	2100-3355
A26R50	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A26R51	2100-3355	0		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	28480	2100-3355
A26R52	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R53	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A26R54	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A26R55	0811-3619	4	1	RESISTOR- 260 OHM 2% .12W	28480	0811-3619
A26R56	0757-0816	1	1	RESISTOR 681 OHM 1% .5W F TC=0+-100	28480	0757-0816
A26R57	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A26R58	0698-8861	6		RESISTOR 6.66K .1% .125W F TC=0+-25	28480	0698-8861
A26R59	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A26R60	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A26R61	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A26R62	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A26R63	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A26R64	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R65	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R66	0757-0440	7	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A26R67	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A26R68	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A26R69	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A26R70	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R71	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R72	0698-8959	3	1	RESISTOR 619K 1% .125W F TC=0+-100	28480	0698-8959
A26R73	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A26R74	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A26R75	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A26R76	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A26R77	0757-0460	1		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A26R78	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A26R79	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A26R80	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A26R81	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A26R82	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R83	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R84	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R85	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A26R86	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A26R87	0811-3575	1	1	RESISTOR- 3K OHM 2% .12W	28480	0811-3575
A26R88	2100-3353	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A26R89	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A26R90	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A26R91	2100-3350	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
A26R92	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2151-F
A26R93	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A26R94	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	03292	C4-1/8-TO-1003-F
A26R95	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	03292	C4-1/8-TO-2611-F
A26R96	2100-3757	6	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17 TRN	04568	67XR100
A26R97	0698-3443	0	1	RESISTOR 287 OHM 1% .125W F TC=0+-100	03292	C4-1/8-TO-287R-F
A26R98	0698-0082	7	1	RESISTOR 464 OHM 1% .125W F TC=0+-100	03292	C4-1/8-TO-4640-F
A26R99	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A26R100	0698-0084	9		RESISTOR 2.15K 1% .125w F TC=0+-100	24546	C4-1/8-TO-2151-F
A26TP1-5	0360-0535	0	5	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A26U1	1826-0601	0	3	IC OP AMP PRCN TO-99 PKG	06665	OP-16FJ
A26U2	1826-1007	2	1	IC- 27G M1 OP AMP	28480	1826-1007
A26U3	1826-0306	2	3	IC COMPARATOR GP QUAD 14-DIP-C PKG	27014	LM339AJ
A26U4	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A26U5	1810-0371	8	1	RESISTIVE NETWORK-100K OHM 8 PINS	01121	208A104
A26U6	1826-0306	2		IC COMPARATOR GP QUAD 14-DIP-C PKG	27014	LM339AJ
A26U7	1826-0828	3	1	IC- 15G M1 OP AMP	06665	OP-15GJ
A26U8	1826-0601	0		IC OP AMP PRCN TO-99 PKG	06665	OP-16FJ
A26U9	1826-0306	2		IC COMPARATOR GP QUAD 14-DIP-C PKG	27014	LM339AJ
A26U10	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A26U11	1826-0161	7	1	IC OP AMP GP QUAD 14-DIP-P PKG	04713	MLM324P
A26U12	1826-0601	0		IC OP AMP PRCN TO-99 PKG	06665	OP-16FJ
A26U13	1826-0026	3	2	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A26U14	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A26U15	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A26W1	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A27	**08340-60022**	**5**	**1**	**LEVEL CONTROL**	**28480**	**08340-60022**
A27C1	0160-4084	8	16	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C2	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C3	0160-3878	6	3	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A27C4	0160-3876	4	3	CAPACITOR-FXD 47PF ±20% 200VDC CER	28480	0160-3876
A27C5	G160-3879	7	18	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C6	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C7	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C8	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C9	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A27C10	0160-3876	4		CAPACITOR-FXD 47PF ±20% 200VDC CER	28480	0160-3876
A27C11	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C12	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C13	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A27C14	0160-3876	4		CAPACITOR-FXD 47PF ±20% 200VDC CER	28480	0160-3876
A27C15	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C16	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C17	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C18	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C19	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C20	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C21	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C22				NOT ASSIGNED		
A27C23	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C24	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C25				NOT ASSIGNED		
A27C26	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C27	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C28	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C29				NOT ASSIGNED		
A27C30	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C31	0180-2661	5	2	CAPACITOR-FXD 1UF+10% 50VDC TA	25088	D1R0GS1A50K
A27C32	0160-4846	0	1	CAPACITOR-FXD 1500PF ±5% 100VDC CER	28480	0160-4846
A27C33	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C34	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C35	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C36				NOT ASSIGNED		
A27C37	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A27C38	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C39	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C40	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C41	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C42	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C43	0180-0630	4	2	CAPACITOR-FXD 4.7UF±20% 50VDC TA	28480	0180-0630
A27C44	0180-2661	5		CAPACITOR-FXD 1UF+10% 50VDC TA	25088	D1R0GS1A50K
A27C45	0180-0630	4		CAPACITOR-FXD 4.7UF±20% 50VDC TA	28480	0180-0630
A27C46	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C47	0180-2617	1	2	CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A27C48	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C49	0180-2697	7	1	CAPACITOR-FXD 10UF±10% 25VDC TA	28480	0180-2697
A27C50	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C51	0180-2617	1		CAPACITOR-FXD 6.8UF+10% 35VDC TA	25088	D6R8GS1B35K
A27C52	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A27C53	0180-0500	7	1	CAPACITOR-FXD 47UF±20% 20VDC TA	28480	0180-0500
A27C54	0160-3875	3	2	CAPACITOR-FXD 22PF ±5% 200VDC CER 0±30	28480	0160-3875
A27C55	0160-3875	3		CAPACITOR-FXD 22PF ±5% 200VDC CER 0±30	28480	0160-3875
A27CR1	1901-0050	3	8	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A27CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A27CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A27CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A27CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A27CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A27CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A27CR8	1901-0518	8	5	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A27CR9	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A27CR10	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A27CR11	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A27CR12	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A27CR13	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A27DS1	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A27L1	9140-0210	1	4	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A27L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A27L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A27L4	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A27L5	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A27MP1	1200-0173	5	2	INSULATOR-XSTR DAP-GL	28480	1200-0173
A27MP2	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A27MP3	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
A27MP4, 5	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A27MP6	4040-0755	2	1	EXTR-PC BD VIO POLYC .062-BD-THKNS	28480	4040-0755
A27Q1	1826-0730	6	1	IC V RGLTR-V-REF-FXD 10V TO-5 PKG	28480	1826-0730
A27Q2	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A27Q3	1826-0512	2	1	IC 78M15C V RGLTR TO-39	04713	MC78M15CG
A27R1	0698-6360	6	7	RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A27R2	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A27R3	0698-6977	1	1	RESISTOR 30K .1% .125W F TC=0+25 (RECOMMENDED REPLACEMENT)	28480	0698-6977
A27R4	2100-3353	8	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN (RECOMMENDED REPLACEMENT)	28480	2100-3353
A27R5	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A27R6	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A27R7	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+100	24546	C4-1/8-T0-1782-F
A27R8	2100-3207	1	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
A27R9	0698-6630	3	1	RESISTOR 20K .1% .125W F TC=0+25	28480	0698-6630
A27R10	0698-6320	8	2	RESISTOR 5K .1% .125W F TC=0+25	03888	PME55-1/8-T9-5001-B
A27R11	0698-6347	9	1	RESISTOR 1.5K .1% .125W F TC=0+25	28480	0698-6347
A27R12	0698-6631	4	2	RESISTOR 2.5K .1% .125W F TC=0+25	28480	0698-6631
A27R13	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+25	28480	0698-6624
A27R14				NOT ASSIGNED		
A27R15	0757-0442	9	6	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A27R16	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A27R17	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A27R18	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+25	03888	PME55-1/8-T9-5001-B
A27R19	0698-6362	8	1	RESISTOR 1K .1% .125W F TC=0+25	28480	0698-6362
A27R20	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0+100	24546	C4-1/8-T0-619R-F
A27R21	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A27R22	0698-3446	3	3	RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A27R23	0699-0118	2	1	RESISTOR- 20K OHM .1% .1W	28480	0699-0118
A27R24	0699-0144	4	2	RESISTOR- 10K OHM .1% .1W	28480	0699-0144
A27R25	0699-0144	4		RESISTOR- 10K OHM .1% .1W	28480	0699-0144
A27R26	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A27R27				NOT ASSIGNED		
A27R28	0698-6353	7	8	RESISTOR 50K .1% .125W F TC=0+25	28480	0698-6353
A27R29	0698-6353	7		RESISTOR 50K .1% .125W F TC=0+25	28480	0698-6353
A27R30	0698-6353	7		RESISTOR 50K .1% .125W F TC=0+25	28480	0698-6353
A27R31	0698-6353	7		RESISTOR 50K .1% .125W F TC=0+25	28480	0698-6353
A27R32	0698-8191	5	1	RESISTOR 12.5K .1% .125W F TC=0+25	19701	MF4C1/8-T9-1252-B
A27R33	0698-6353	7		RESISTOR 50K .1% .125W F TC=0+25	28480	0698-6353
A27R34	0698-6977	1	1	RESISTOR 30K .1% .125W F TC=0+25	28480	0698-6977
A27R35	0698-6353	7		RESISTOR 50K .1% .125W F TC=0+25	28480	0698-6353
A27R36	0698-6353	7		RESISTOR 50K .1% .125W F TC=0+25	28480	0698-6353
A27R37				NOT ASSIGNED		
A27R38	0698-6353	7		RESISTOR 50K .1% .125W F TC=0+25	28480	0698-6353
A27R39	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A27R40	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A27R41	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A27R42	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-5112-F
A27R43	0698-6631	4		RESISTOR 2.5K .1% .125W F TC=0+25	28480	0698-6631
A27R44	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A27R45	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A27R46	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A27R47	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A27R48	0757-0398	4	2	RESISTOR 75 1% .125W F TC=0+100	24546	C4-1/8-T0-75R0-F
A27R49	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A27R50	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A27R51	0757-0422	5	2	RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-T0-909R-F
A27R52	0698-3446	3		RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A27R53	0757-0422	5		RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-T0-909R-F
A27R54	0698-3446	3		RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A27R55	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A27R56	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A27R57	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A27R58	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1212-F
A27R59	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A27R60	0757-0398	4		RESISTOR 75 1% .125W F TC=0+100	24546	C4-1/8-T0-75R0-F
A27R61	0698-6358	2	3	RESISTOR 100K .1% .125W F TC=0+25	28480	0698-6358
A27R62	0698-6358	2		RESISTOR 100K .1% .125W F TC=0+25	28480	0698-6358

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A27R63	0698-6358	2		RESISTOR 100K .1% .125W F TC=0+25	28480	0698-6358
A27R64				NOT ASSIGNED		
A27R65	0811-3575	1	1	RESISTOR- 3K OHM 2% .12W	28480	0811-3575
A27R66	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A27R67	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A27R68	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A27R69	0698-8824	1	1	RESISTOR 562K 1% .125W F TC=0+100	28480	0698-8824
A27R70	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-T0-2371-F
				STANDARD INSTRUMENT		
				OPTION 004 AND 005, R.P. RF OUT,		
				REPLACE A27R70 WITH A SHORT CIRCUIT		
A27R71	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
				STANDARD INSTRUMENT		
				OPTION 004 AND 005 INSTRUMENTS		
				DELETE A27R71		
A27RT1	0837-0105	1	1	THERMISTOR BEAD 200K-OHM TC=-4.9%/C-DEG	28480	0837-0105
A27TP1-21	0360-0535	0	21	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A27U1	1820-1435	8	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS669N
A27U2	1826-0026	3	2	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A27U3	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A27U4	1826-0092	3	3	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A27U5	1826-0092	3		IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A27U6	1820-1415	4	1	IC SCHMITT-TRIG TTL LS NAND DUAL 4-INP	01295	SN74LS13N
A27U7	1826-0471	2	3	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A27U8	1826-0798	6	3	IC-5018 C1 DAC	18324	NE5018F
A27U9	1826-0798	6		IC-5018 C1 DAC	18324	NE5018F
A27U10	1826-0798	6		IC-5018 C1 DAC	18324	NE5018F
A27U11	1826-0881	8	1	IC-8560 C1 ADC	28480	1826-0881
A27U12	1820-1491	6	3	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A27U13	1820-1196	8	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A27U14	1826-0921	7	2	D/A 10-BIT 16 CBRZ/SDR CMOS	07050	MP7533MP
				(RECOMMENDED REPLACEMENT)		
A27U15	1820-1491	6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A27U16	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A27U17	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A27U18	1826-0092	3		IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A27U19	1820-1297	0	1	IC GATE TTL LS EXCL-NOR QUAD 2-INP	01295	SN74LS266N
A27U20	1820-1216	3	2	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A27U21	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A27U22	1820-1491	6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A27U23	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A27U24	1826-0921	7		D/A 10-BIT 16 CBRZ/SDR CMOS	07050	MP7533MP
				(RECOMMENDED REPLACEMENT)		
A27U25	1826-0609	8	1	IC MULTIPLXR ANLG 16-DIP-C PKG	06665	MUX08FQ
A27U26	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A27U27	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A27U28	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A27U29	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A27U30	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A27U31	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A27U32	1810-0318	3	4	RESISTIVE NETWORK- 6 PINS	01121	206A102
A27U33	1810-0318	3		RESISTIVE NETWORK- 6 PINS	01121	206A102
A27U34	1810-0318	3		RESISTIVE NETWORK- 6 PINS	01121	206A102
A27U35	1810-0318	3		RESISTIVE NETWORK- 6 PINS	01121	206A102
A27VR1	1902-3171	7	1	DIODE-ZNR 11V 5% DO-35 PD=.4W TC=+.062%	28480	1902-3171

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A28	08340-60159	8	1	SYTM DRIVER	28480	08340-60159
A28C1				NOT ASSIGNED		
A28C2	0160-4841	5	25	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C3	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C4	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C5	0160-4801	7	3	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A28C6	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	02798	CAC325U1042050A
A28C7	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C8	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C9	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A28C10, 11	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	02798	CAC325U1042050A
A28C12				NOT ASSIGNED		
A28C13	0160-0163	6	2	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A28C14	0160-0163	6		CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A28C15	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C16	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A28C17	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C18	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C19	0160-4805	1	1	CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30	28480	0160-4805
A28C20	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C21	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C22	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C23	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C24	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C25	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C26	0160-4833	5	1	CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
A28C27				NOT ASSIGNED		
A28C28	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C29	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C30	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C31	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C32	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C33	0180-0269	5	4	CAPACITOR-FXD 1UF+50-10% 150VDC AL	56289	30D105G150BA2
A28C34	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C35	0180-0269	5		CAPACITOR-FXD 1UF+50-10% 150VDC AL	56289	30D105G150BA2
A28C36	0180-0269	5		CAPACITOR-FXD 1UF+50-10% 150VDC AL	56289	30D105G150BA2
A28C37	0180-0269	5		CAPACITOR-FXD 1UF+50-10% 150VDC AL	56289	30D105G150BA2
A28C38	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A28C39	0160-0300	3	1	CAPACITOR-FXD 2700PF +-10% 200VDC POLYE	28480	0160-0300
A28C40	0160-3572	7	1	CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
A28C41	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A28CR1	1901-0033	2	3	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A28CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A28CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A28CR4	1901-0518	8	4	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A28CR5	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A28CR6	1901-0028	5	2	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A28CR7	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A28CR8	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A28CR9	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A28CR10-14	1901-0050	3	4	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A28CR15				NOT ASSIGNED		
A28CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A28CR17				NOT ASSIGNED		
A28CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A28L1	9140-0144	0	4	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A28L2	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A28L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A28L4	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A28MP1	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
A28MP2	1205-0011	0	2	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A28MP3-8				NOT ASSIGNED		
A28MP9, 10	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A28MP11	4040-0747	2	1	EXTR-PC BD GRA POLYC .062-BD-THKNS	28480	4040-0747
A28Q1	1854-0361	8	1	TRANSISTOR NPN 2N4239 SI TO-5 PD=6W	04713	2N4239
A28Q2	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A28Q3	1855-0421	3	1	TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A28Q4	1855-0414	4	13	TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q5	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q6	1853-0038	4	3	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A28Q7	1854-0475	5	3	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A28Q8	1853-0316	1	1	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A28Q9	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q10	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q11	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q12	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q13	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q14	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q15	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A28Q16	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q17	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q18	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q19	1854-0475	5		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A28Q20	1854-0809	9	3	TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A28Q21	1855-0278	8	2	TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	17856	2N5116
A28Q22	1855-0278	8		TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	03714	2N5116
A28Q23	1854-0809	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A28Q24	1854-0475	5		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A28Q25	1855-0414	4		TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A28Q26	1853-0038	4		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A28Q27	1853-0038	4		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A28R1	2100-4004	8	4	RESISTOR-TRMR 10K 5% WW SIDE-ADJ 1-TRN	28480	2100-4004
A28R2	2100-3094	4	3	RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	02111	43P104
A28R3	2100-3094	4		RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	02111	43P104
A28R4	2100-3161	6	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A28R5	2100-3352	7	2	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	28480	2100-3352
A28R6	2100-3094	4		RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	02111	43P104
A28R7	2100-3161	6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A28R8	2100-4004	8		RESISTOR-TRMR 10k 5% WW SIDE-ADJ 1-TRN	28480	2100-4004
A28R9	2100-3352	7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	28480	2100-3352
A28R10	2100-3274	2	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A28R11	0698-3637	4	1	RESISTOR 820 5% 2W MO TC=0+-200	28480	0698-3637
A28R12	0698-6353	7	2	RESISTOR 50K .1% .125W F TC=0+-25	28480	0698-6353
A28R13	0698-6624	5	6	RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A28R14	0757-0440	7	3	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A28R15	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A28R16	0757-0346	2	22	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R17	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A28R18	0698-3487	2	1	RESISTOR 255 1% .125W F TC=0+-100	24546	C4-1/8-T0-255R-F
A28R19	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A28R20	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A28R21	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A28R22	0757-0405	4	2	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A28R23	0698-6360	6	10	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R24	0698-3162	0	6	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A28R25	0698-3156	2	3	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A28R26	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A28R27	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A28R28	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A28R29	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R30	0698-3442	9	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A28R31	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A28R32	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A28R33	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A28R34	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A28R35	0698-3268	7	1	RESISTOR 11.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1152-F
A28R36	0698-8038	9	1	RESISTOR 5.9K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-5901-C
A28R37	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A28R38	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A28R39	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R40	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R41	0698-3153	9	2	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A28R42	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R43	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R44	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R45	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R46	0698-3157	3	4	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A28R47	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A28R48	0757-0440	7		RESISTOR 7.5K .1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A28R49	0698-6320	8	2	RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A28R50	0757-0280	3	7	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A28R51	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A28R52	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A28R53	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R54	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R55	0698-6631	4	4	RESISTOR 2.5K .1% .125W F TC=0+-25	28480	0698-6631
A28R56	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A28R57	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A28R58	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A28R59	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A28R60	0698-6631	4		RESISTOR 2.5K .1% .125W F TC=0+-25	28480	0698-6631
A28R61	0698-6631	4		RESISTOR 2.5K .1% .125W F TC=0+-25	28480	0698-6631
A28R62	0698-6631	4		RESISTOR 2.5K .1% .125W F TC=0+-25	28480	0698-6631
A28R63	0698-6353	7		RESISTOR 50K .1% .125W F TC=0+-25	28480	0698-6353
A28R64	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A28R65	0757-0802	5	1	RESISTOR 162 1% .5W F TC=0+-100	28480	0757-0802
A28R66	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F

See introduction to this section for ordering information. *Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A28R67	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R68	0698-8039	0	1	RESISTOR 8.87K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-8871-B
A28R69	0698-8498	5	1	RESISTOR 1.02K .1% .125W F TC=0+-25	28480	0698-8498
A28R70	0698-8061	8	1	RESISTOR 8.25K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-8251-B
A28R71	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A28R72	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A28R73	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A28R74	0698-6363	9	2	RESISTOR 40K .1% .125W F TC=0+-25	28480	0698-6363
A28R75	0698-6363	9		RESISTOR 40K .1% .125W F TC=0+-25	28480	0698-6363
A28R76	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R77	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A28R78	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A28R79	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R80	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R81	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A28R82	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A28R83	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A28R84	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A28R85	2100-4004	8		RESISTOR-TRMR 10k 5% WW SID-ADJ 1-TRN	28480	2100-4004
A28R86	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R87	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A28R88	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A28R89	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A28R90	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R91	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R92	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A28R93	0698-3160	8	5	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A28R94	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A28R95	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A28R96	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A28R97	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R98	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R99	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R100	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A28R101	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A28R102	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R103	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A28R104	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A28R105	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A28R106	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A28R107	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A28R108	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A28R109	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A28R110	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A28R111	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A28R112	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A28R113	2100-4004	8		RESISTOR-TRMR 10K 5% WW SIDE-ADJ 1-TRN	28480	2100-4004
A28R114	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A28R115	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A28R116	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A28R117	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A28R118-122	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A28R123	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	03292	CT4-1/8-TO-2611-F
A28R124, 125	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A28R126	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A28R127	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A28R128	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	02995	5033R-1/8-TO-6191-F
A28R129	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	03292	CT4-1/8-TO-1003-F
A28R130	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1962-F
A28R131	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A28R132	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3162-F
A28R133	0698-3159	5		RESISTOR 26.1K 1% .125W TC=0+-100	24546	C4-1/8-TO-2612-F
A28R134	0698-4037	0	1	RESISTOR 46.4 1% .125W F TC=0+-100	03292	LO4D
A28R135	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A28TP1	0360-0535	0	5	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A28TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A28TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A28TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A28TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A28U1	1826-0471	2	5	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A28U2	1826-0616	7	1	IC OP AMP PRCN QUAD 14-DIP-C PKG	06665	OP-11EY
A28U3	1820-1934	2	2	IC CONV 8-B-D/A 16-DIP-C PKG	06665	DAC-08EQ
A28U4	1820-1934	2		IC CONV 8-B-D/A 16-DIP-C PKG	06665	DAC-08EQ
A28U5	1826-0785	1	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	01295	TL072ACJG
A28U6	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A28U7	1826-0026	3	2	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A28U8	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A28U9	1826-0853	4	1		28480	1826-0853
A28U10	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471

See introduction to this section for ordering information. †Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A28U11	1826-0512	2	1	IC 78M15C V RGLTR TO-39	04713	MC78M15CG
A28U12	1820-1203	8	1	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A28U13	1820-2056	1	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS378N
A28U14	1820-1997	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A28U15	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A28U16	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A28U17	1826-0759	9	3	IC COMPARATOR GP QUAD 14-DIP-C PKG	04713	LM339J
A28U18	1826-0759	9		IC COMPARATOR GP QUAD 14-DIP-C PKG	04713	LM339J
A28U19	1826-0759	9		IC COMPARATOR GP QUAD 14-DIP-C PKG	04713	LM339J
A28U20	1810-0395	6	1	NETWORK-RES 8-SIP47.0K OHM X 7	11236	750-81-R47K
A28U21	1810-0535	6	1	NETWORK-RES 16-DIP2.5K OHM X 8	28480	1810-0535
A28U22	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A28U23	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A28VR1	1902-3171	7	1	DIODE-ZNR 11V 5% DO-35 PD=.4W TC=+.062%	28480	1902-3171
A28VR2	1902-0175	5	1	DIODE-ZNR 100V 5% PD=1W IR=5UA	28480	1902-0175
A28W1	1460-1489	8	2	WIREFORM BE CU AG	28480	1460-1489
A28W2	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A29	08340-60034	9	1	REFERENCE PHASE DETECTOR	28480	08340-60034
A29C1	0180-2141	6	2	CAPACITOR-FXD 3.3UF+-10% 50VDC TA	04200	150D335X905082
A29C2	0180-0197	8	5	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A29C3	0180-1746	5	4	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A29C4	0160-3879	7	6	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A29C5	0140-0190	7	1	CAPACITOR-FXD 39PF +-5% 300VDC MICA	72136	DM15E390J0300WV1CR
A29C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A29C7	0160-2055	9	24	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C8	0180-2141	6		CAPACITOR-FXD 3.3UF+-10% 50VDC TA	04200	150D335X905082
A29C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A29C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C11	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A29C12	0160-2199	2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A29C13	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A29C14	0160-2204	0	3	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A29C15	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A29C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C23	0180-0553	0	2	CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	0180-0553
A29C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C26	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A29C27	0140-0193	0	4	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A29C28	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	0180-0553
A29C29	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C30	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A29C31	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A29C32	0170-0066	9	1	CAPACITOR-FXD .027UF +-10% 200VDC POLYE	28480	0170-0066
A29C33	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C35	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A29C36	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C37	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C38	0140-0193	0		CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A29C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A29C40	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A29C41	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C42	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C43	0160-2206	2	1	CAPACITOR-FXD 160PF +-5% 300VDC MICA	28480	0160-2206
A29C44	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C45	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C46	0140-0210	2	3	CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A29C47	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C48	0140-0210	2		CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A29C49	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A29C50	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C51	0140-0210	2		CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A29C52	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C53	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A29C54	0180-0183	2	1	CAPACITOR-FXD 10UF+75-10% 50VDC AL	56289	30D106G050CB2
A29C55	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A29C56	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A29C57	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A29C58	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A29C59	0160-3878	6	2	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A29C60	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A29C61	0160-3454	4	1	CAPACITOR-FXD 220PF +-10% 1KVDC CER	28480	0160-3454
A29C62	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A29CR1	1901-0518	8	6	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A29CR2	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A29CR3	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A29CR4	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A29CR5	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A29CR6	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A29J1	1250-0544	9	5	CONNECTOR- RF MALE SMB	28480	1250-0544
A29J2	1250-0544	9		CONNECTOR- RF MALE SMB	28480	1250-0544
A29J3	1250-0544	9		CONNECTOR- RF MALE SMB	28480	1250-0544

See introduction to this section for ordering information.

*Indicates factory selected value.

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A29J4	1250-0544	9		CONNECTOR- RF MALE SMB	28480	1250-0544
A29J5	1250-0544	9		CONNECTOR- RF MALE SMB	28480	1250-0544
A29L1	9140-0238	3	2	INDUCTOR RF-CH-MLD 82UH 5% .166DX.385LG	28480	9140-0238
A29L2	9140-0238	3		INDUCTOR RF-CH-MLD 82UH 5% .166DX.385LG	28480	9140-0238
A29L3	9140-0143	9	2	INDUCTOR RF-CH-MLD 3.3UH 10% .105DX.26LG	28480	9140-0143
A29L4	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10% .105DX.26LG	28480	9140-0143
A29L5	9100-2261	2	1	INDUCTOR RF-CH-MLD 2.7UH 10% .105DX.26LG	28480	9100-2261
A29L6	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A29L7	9100-2255	4	4	INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A29L8	9100-0368	6	1	INDUCTOR RF-CH-MLD 330NH 10% .105DX.26LG	28480	9100-0368
A29L9	9100-2257	6	3	INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A29L10	9100-2255	4		INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A29L11	9100-2257	6		INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A29L12	9100-2255	4		INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A29L13	9100-2257	6		INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A29L14	9100-2255	4		INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A29L15	9100-2256	5	1	INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A29L16	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A29MP1	1205-0250	9	1	THERMISTOR LINK TO-5/TO-39	28480	1205-0250
A29MP2	2190-0124	4	1	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A29MP3	2200-0101	0	3	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A29MP4	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A29MP5	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A29MP6	2950-0078	9	1	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A29MP7	08340-20090	3	1	COVER-PC REF. PHASE DETECTOR	28480	08340-20090
A29MP8	86701-40001	9	2	EXTRACTOR-PC BOARD	28480	86701-40001
A29MP9	86701-40001	9		EXTRACTOR-PC BOARD	28480	86701-40001
A29Q1	1854-0019	3	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A29Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A29Q3	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A29Q4	1855-0049	1	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A29Q5	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A29Q6	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A29Q7	1853-0034	0	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A29R1	0757-0399	5	2	RESISTOR 82.5 1% .125W F TC=0+100	24546	C4-1/8-T0-82R5-F
A29R2	0757-0417	8	1	RESISTOR 562 1% .125W F TC=0+100	24546	C4-1/8-T0-562R-F
A29R3	0757-0416	7	4	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A29R4	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A29R5	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A29R6	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A29R7	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A29R8	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A29R9	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+100	24546	C4-1/8-T0-82R5-F
A29R10	0698-7222	1	1	RESISTOR 261 1% .05W F TC=0+100	24546	C3-1/8-TO-261R-F
A29R11	0698-7219	6	1	RESISTOR 196 1% .05W F TC=0+100	24546	C3-1/8-TO-196R-F
A29R12	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A29R13	0698-3453	2	3	RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A29R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A29R15	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A29R16	0757-0441	8	2	RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-T0-8251-F
A29R17	0698-3438	3	2	RESISTOR 147 1% .125W F TC=0+100	24546	C4-1/8-T0-147R-F
A29R18	0757-0346	2	6	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A29R19	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A29R20	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-T0-8251-F
A29R21	0698-3438	3		RESISTOR 147 1% .125W F TC=0+100	24546	C4-1/8-T0-147R-F
A29R22	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+100	24546	C4-1/8-T0-1782-F
A29R23	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A29R24	0698-3154	0	5	RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A29R25	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A29R26	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A29R27	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A29R28	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+100	24546	C4-1/8-T0-4222-F
A29R29	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-2872-F
A29R30	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1212-F
A29R31	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A29R32	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A29R33	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A29R34	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A29R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A29R36	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1212-F
A29R37	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-5621-F
A29R38	0757-0421	4	2	RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A29R39	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A29R40	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A29R41	0698-3446	3	2	RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A29R42	0698-0085	0	3	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A29R43	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A29R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A29R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A29R46	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A29R47	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A29R48	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A29R49	0698-7285	6	1	RESISTOR 110K 1% .05W F TC=0+100	24546	C3-1/8-T0-1103-F
A29R50	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0+100	24546	C4-1/8-T0-1962-F
A29R51	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+100	24546	C4-1/8-T0-1962-F
A29R52	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A29R53	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A29R54	0698-7234	5	1	RESISTOR 825 1% .05W F TC=0+100	24546	C3-1/8-T0-825R-F
A29R55	0698-7257	2	1	RESISTOR 7.5K 1% .05W F TC=0+100	24546	C3-1/8-T0-7501-F
A29R56	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A29R57	0698-3446	3		RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A29R58	0698-7246	9	1	RESISTOR 2.61K 1% .05W F TC=0+100	24546	C3-1/8-T0-2611-F
A29R59	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A29R60				NOT ASSIGNED		
A29R61	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A29R62	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+100	24546	C4-1/8-T0-1781-F
A29R63	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A29R64	0698-3132	4	2	RESISTOR 261 1% .125W F TC=0+100	24546	C4-1/8-T0-2610-F
A29R65	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A29R66	0757-0421	4		RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A29R67	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A29R68	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A29R69	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A29R70	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A29R71	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+100	24546	C4-1/8-T0-1211-F
A29R72	0698-3132	4		RESISTOR 261 1% .125W F TC=0+100	24546	C4-1/8-T0-2610-F
A29R73	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+100	24546	C4-1/8-T0-1331-F
A29R74	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A29R75	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A29T1	08552-6044	1	2	TRANSFORMER-RF 5 PIN	28480	08552-6044
A29T2	08552-6044	1		TRANSFORMER-RF 5 PIN	28480	08552-6044
A29TP1	0360-0535	0	1	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A29U1	1858-0032	8	1	TRANSISTOR ARRAY 14-PIN PLSTC DIP	3L585	CA3146E
A29U2	1820-0328	6	1	IC GATE TTL NOR QUAD 2-INP	01295	SN7402N
A29U3	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A29U4	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A29U5	1820-0223	0	1	IC OP AMP GP TO-99 PKG	3L585	CA301AT
A29U6	1820-0429	8	1	IC V RGLTR TO-39	18324	LM309H
A29VR1	1902-3082	9	1	DIODE-ZNR 4.64V 5% DO-35 PD=.4W	28480	1902-3082
A29VR2	1902-3256	9	1	DIODE-ZNR 23.7V 5% DO-35 PD=.4W	28480	1902-3256
A29W1	08340-60101	1	1	CABLE ASSEMBLY- A29	28480	08340-60101

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A30	08340-60035	0	1	100 MHZ VCXO	28480	08340-60035
A30C1	0121-0495	5	3	CAPACITOR-V TRMR-AIR 1.9-15.7PF 175V	74970	187-0309-125
A30C2	0121-0495	5		CAPACITOR-V TRMR-AIR 1.9-15.7PF 175V	74970	187-0309-125
A30C3	0121-0495	5		CAPACITOR-V TRMR-AIR 1.9-15.7PF 175V	74970	187-0309-125
A30C4	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A30C5	0180-0049	9	1	CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A30C6	0160-3456	6	5	CAPACITOR-FXD 1000PF ±10% 1KVDC CER	28480	0160-3456
A30C7	0160-3454	4	19	CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C8*	0160-2253	9	1	CAPACITOR-FXD 6.8PF ±.5PF 100VDC CER	28480	0160-2253
A30C9	0160-4084	8	1	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A30C10	0140-0191	8	1	CAPACITOR-FXD 56PF ±5% 300VDC MICA	72136	DM15E560J0300WV1CR
A30C11	0160-2204	0	1	CAPACITOR-FXD 100PF ±5% 300VDC MICA	28480	0160-2204
A30C12	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C13	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C14	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C15	0160-2261	9	8	CAPACITOR-FXD 15PF ±5% 500VDC CER 0±30	28480	0160-2261
A30C16	0160-2261	9		CAPACITOR-FXD 15PF ±5% 500VDC CER 0±30	28480	0160-2261
A30C17	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C18	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C19	0160-2261	9		CAPACITOR-FXD 15PF ±5% 500VDC CER 0±30	28480	0160-2261
A30C20	0160-2261	9		CAPACITOR-FXD 15PF ±5% 500VDC CER 0±30	28480	0160-2261
A30C21	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C22	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C23	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C24	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C25	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C26	0160-2261	9		CAPACITOR-FXD 15PF ±5% 500VDC CER 0±30	28480	0160-2261
A30C27	0160-2261	9		CAPACITOR-FXD 15PF ±5% 500VDC CER 0±30	28480	0160-2261
A30C28	0160-3872	0	2	CAPACITOR-FXD 2.2PF ±.25PF 200VDC CER	28480	0160-3872
A30C29	0160-3872	0		CAPACITOR-FXD 2.2PF ±.25PF 200VDC CER	28480	0160-3872
A30C30	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C31	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C32	0160-2261	9		CAPACITOR-FXD 15PF ±5% 500VDC CER 0±30	28480	0160-2261
A30C33	0160-2261	9		CAPACITOR-FXD 15PF ±5% 500VDC CER 0±30	28480	0160-2261
A30C34	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C35	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C36	0160-3878	6	7	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A30C37	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A30C38	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A30C39	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C40	0160-2238	0	1	CAPACITOR-FXD 1.5PF ±.25PF 500VDC CER	28480	0160-2238
A30C41	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A30C42	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A30C43	0180-0116	1	2	CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A30C44	0160-2253	9	1	CAPACITOR-FXD 6.8PF ±.25PF 500VDC CER	28480	0160-2253
A30C45	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A30C46	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A30C47	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C48	0160-3456	6		CAPACITOR-FXD 1000PF ±10% 1KVDC CER	28480	0160-3456
A30C49	0160-3456	6		CAPACITOR-FXD 1000PF ±10% 1KVDC CER	28480	0160-3456
A30C50	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A30C51	0160-4299	7	1	CAPACITOR-FXD 2200PF ±20% 250VDC CER	56289	C067F251F222MS22-CDH
A30C52	0160-3456	6		CAPACITOR-FXD 1000PF ±10% 1KVDC CER	28480	0160-3456
A30C53	0160-3456	6		CAPACITOR-FXD 1000PF ±10% 1KVDC CER	28480	0160-3456
A30C54	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C55	0160-3454	4		CAPACITOR-FXD 220PF ±10% 1KVDC CER	28480	0160-3454
A30C56	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A30CR1	0122-0245	5	1	DIODE-VVC 1N5139 6.8PF 10%	01281	1N5139
A30CR2				NOT ASSIGNED		
A30CR3	1901-0539	3	2	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A30CR4	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A30E1	9170-0029	3	1	CORE-SHIELDING BEAD	28480	9170-0029
A30J1	1250-0544	9	3	CONNECTOR-RF MALE SMB	28480	1250-0544
A30J2	1250-0544	9		CONNECTOR-RF MALE SMB	28480	1250-0544
A30J3	1250-0544	9		CONNECTOR-RF MALE SMB	28480	1250-0544
A30L1				NOT ASSIGNED		
A30L2	9100-2250	7	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A30L3	9140-0158	6	3	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A30L4*	9100-0368	6	1	INDUCTOR RF-CH-MLD 330NH 10% .105DX.26LG	28480	9100-0368
A30L5	9100-2538	6	1	INDUCTOR RF-CH-MLD 1UH 10% .161DX.385LG	28480	9100-2538
A30L6	9100-2251	0	4	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A30L7	9100-2251	0		INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A30L8	9100-2251	0		INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A30L9	9100-2251	0		INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A30L10-13				NOT ASSIGNED		
A30L14	9100-2247	4	2	INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A30L15	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A30L16	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A30L17	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A30L18	9140-0144	0	2	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A30L19	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A30MP1				NOT ASSIGNED		
A30MP2				NOT ASSIGNED		
A30MP3	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
A30MP4	2190-0124	4	1	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A30MP5	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A30MP6	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A30MP7	2200-0103	2	3	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A30MP8	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A30MP9	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A30MP10	2580-0002	4	1	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
A30MP11	2950-0078	9	1	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A30MP12	4330-0145	9	1	INS. BEAD GL.062L	28480	4330-0145
A30MP13	08340-20091	4	1	COVER-PC VCXO	28480	08340-20091
A30MP14	86701-40001	9	2	EXTRACTOR-PC BOARD	28480	86701-40001
A30MP15	86701-40001	9		EXTRACTOR-PC BOARD	28480	86701-40001
A30MP16	86701-00045	7	1	SHIELD	28480	86701-00045
A30MP17	0460-0683	1	1	TAPE-FILM 1.5	28480	0460-0683
A30MP18	0460-1303	4	1	TAPE-SILICON SPONGE	28480	0460-1303
A30MP19	6960-0059	1	1	PLUG-HOLE RND-HD FOR .187-D-HOLE NYL	28480	6960-0059
A30Q1	1854-0345	8	9	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30Q5	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A30Q6	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30Q8	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30Q9	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30Q10	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A30Q11	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A30R1	0757-0279	0	3	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A30R2	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+100	24546	C4-1/8-T0-681R-F
A30R3	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A30R4	0757-0422	5	6	RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-T0-909R-F
A30R5	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A30R6	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0+100	24546	C3-1/8-T0-316R-F
A30R7	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A30R8	0757-0422	5		RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-T0-909R-F
A30R9	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A30R10	0757-0401	0	7	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A30R11	0757-0394	0	5	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A30R12	0757-0416	7	6	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A30R13	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A30R14	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A30R15	0757-0422	5		RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-T0-909R-F
A30R16	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A30R17	0698-3150	6	8	RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-T0-2371-F
A30R18	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-T0-2371-F
A30R19	0698-7198	0	2	RESISTOR 26.1 1% .05W F TC=0+100	24546	C3-1/8-TO-26R1-F
A30R20	0698-3443	0	5	RESISTOR 287 1% .125W F TC=0+100	24546	C4-1/8-T0-287R-F
A30R21	0698-3429	2	3	RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A30R22	0698-3443	0		RESISTOR 287 1% .125W F TC=0+100	24546	C4-1/8-T0-287R-F
A30R23	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-T0-2371-F
A30R24	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A30R25	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-T0-2371-F
A30R26	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A30R27	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A30R28	0757-0422	5		RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-T0-909R-F
A30R29	0698-7198	0		RESISTOR 26.1 1% .05W F TC=0+100	24546	C3-1/8-TO-26R1-F
A30R30	0698-3443	0		RESISTOR 287 1% .125W F TC=0+100	24546	C4-1/8-T0-287R-F
A30R31	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A30R32	0698-3443	0		RESISTOR 287 1% .125W F TC=0+100	24546	C4-1/8-T0-287R-F
A30R33	0698-3443	0		RESISTOR 287 1% .125W F TC=0+100	24546	C4-1/8-T0-287R-F
A30R34	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A30R35	0698-7223	2	1	RESISTOR 287 1% .05W F TC=0+100	24546	C3-1/8-TO-287R-F
A30R36	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-TO-2371-F
A30R37	0757-0422	5		RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-TO-909R-F
A30R38	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A30R39	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-TO-2371-F
A30R40	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-TO-511R-F
A30R41	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-TO-51R1-F
A30R42	0698-0084	9	3	RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-TO-2151-F
A30R43	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-TO-4641-F
A30R44	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-TO-2151-F
A30R45	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-TO-2151-F
A30R46	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-TO-3161-F
A30R47	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0+100	24546	C4-1/8-TO-6811-F
A30R48	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-TO-511R-F
A30R49	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-TO-3161-F
A30R50	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+100	24546	C4-1/8-TO-6811-F
A30R51	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-TO-511R-F
A30R52	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-TO-1001-F
A30R53	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-TO-51R1-F
A30R54	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-TO-51R1-F
A30R55	0757-0422	5		RESISTOR 909 1% .125W F TC=0+100	24546	C4-1/8-TO-909R-F
A30R56	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-TO-2371-F
A30R57	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A30R58	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A30R59	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-TO-2371-F
A30R60	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-TO-1001-F
A30R61	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+100	24546	C4-1/8-TO-68R1-F
A30R62	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A30R63-66				NOT ASSIGNED		
A30R67*	0698-3437	2	2	RESISTOR 133 1% .125W F TC=0+100	24546	C4-1/8-TO-133R-F
A30R68*	0698-4037	0	1	RESISTOR 46.4 1% .125W F TC=0+100	24546	C4-1/8-TO-46R4-F
A30R69*	0698-3437	2		RESISTOR 133 1% .125W F TC=0+100	24546	C4-1/8-TO-133R-F
A30T1	08553-6012	5	3	TRANSFORMER-RF (BLUE)	28480	08553-6012
A30T2	08553-6012	5		TRANSFORMER-RF (BLUE)	28480	08553-6012
A30T3	08553-6012	5		TRANSFORMER-RF (BLUE)	28480	08553-6012
A30TP1				NOT ASSIGNED		
A30TP2	0360-0535	0	3	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A30TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A30TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A30W1	08340-60102	2	1	CABLE ASSEMBLY- A30	28480	08340-60102
A30Y1	0410-1086	5	1	CRYSTAL- 100.0 MHZ	28480	0410-1086

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31	08340-60036	1	1	**M/N PHASE DETECTOR**	28480	08340-60036
A31C1	0160-4299	7	4	CAPACITOR-FXD 2200PF ±20% 250VDC CER	56289	C067F251F222MS22-CDH
A31C2	0160-0574	3	6	CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A31C3	0160-4299	7		CAPACITOR-FXD 2200PF ±20% 250VDC CER	56289	C067F251F222MS22-CDH
A31C4	0180-0100	3	1	CAPACITOR-FXD 4.7UF±10% 35VDC TA	56289	150D475X9035B2
A31C5	0160-0572	1	2	CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A31C6	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A31C7	0160-3876	4	2	CAPACITOR-FXD 47PF ±20% 200VDC CER	28480	0160-3876
A31C8	0160-3877	5	1	CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A31C9	0160-3876	4		CAPACITOR-FXD 47PF ±20% 200VDC CER	28480	0160-3876
A31C10	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A31C11	0160-3873	1	1	CAPACITOR-FXD 4.7PF ±.5PF 200VDC CER	28480	0160-3873
A31C12	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A31C13	0160-3878	6	3	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A31C14	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A31C15	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A31C16	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A31C17	0180-0197	8	1	CAPACITOR-FXD 2.2UF±10% 20VDC TA	56289	150D225X9020A2
A31C18	0160-4299	7		CAPACITOR-FXD 2200PF ±20% 250VDC CER	56289	C067F251F222MS22-CDH
A31C19	0180-0291	3	1	CAPACITOR-FXD 1UF±10% 35VDC TA	56289	150D105X9035A2
A31C20	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A31C21	0160-4299	7		CAPACITOR-FXD 2200PF ±20% 250VDC CER	56289	C067F251F222MS22-CDH
A31C22	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A31J1	1250-0690	6	1	CONNECTOR-RF MALE SMB	28480	1250-0690
A31L1	9100-1641	0	2	INDUCTOR RF-CH-MLD 240UH 5% .166DX.385LG	28480	9100-1641
A31L2	9100-2259	8	1	INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259
A31L3	9100-1641	0		INDUCTOR RF-CH-MLD 240UH 5% .166DX.385LG	28480	9100-1641
A31L4	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A31L5				NOT ASSIGNED		
A31L6	9100-2248	5	3	INDUCTOR RF-CH-MLD 120NH 10% .105DX.26LG	28480	9100-2248
A31L7	9100-2248	5		INDUCTOR RF-CH-MLD 120NH 10% .105DX.26LG	28480	9100-2248
A31L8	9100-2248	5		INDUCTOR RF-CH-MLD 120NH 10% .105DX.26LG	28480	9100-2248
A31MP1, 2				NOT ASSIGNED		
A31MP3	0520-0129	8	13	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP4	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP5	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP6	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP7	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP8	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP9	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP10	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP11	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP12	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP13	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP14	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP15	0520-0129	8		SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP16	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP17	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP18	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP19	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP20	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP21	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP22	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP23	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP24	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP25	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP26	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP27	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP28	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A31MP29	1205-0285	0	5	HEAT SINK SGL DIP	28480	1205-0285
A31MP30	1205-0285	0		HEAT SINK SGL DIP	28480	1205-0285
A31MP31	1205-0285	0		HEAT SINK SGL DIP	28480	1205-0285
A31MP32	1205-0285	0		HEAT SINK SGL DIP	28480	1205-0285
A31MP33	1205-0285	0		HEAT SINK SGL DIP	28480	1205-0285
A31MP34	2190-0014	1	3	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A31MP35	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A31MP36	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A31MP37	2190-0124	4	6	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A31MP38	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A31MP39	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A31MP40	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A31MP41	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31MP42	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A31MP43	2190-0890	1	10	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP44	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP45	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP46	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP47	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP48	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP49	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP50	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP51	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP52	2190-0890	1		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
A31MP53	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP54	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP55	2200-0103	2	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP56	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A31MP57	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A31MP58	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A31MP59	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A31MP60	08340-20092	5	1	COVER-PC M/N PHASE DETECTOR	28480	08340-20092
A31MP61	85660-20068	4	2	GROUND LUG	28480	85660-20068
A31MP62	85660-20068	4		GROUND LUG	28480	85660-20068
A31MP63	86701-00032	2	1	HEAT SINK-IC	28480	86701-00032
A31MP64	86701-00033	3	1	BRACKET-HEAT SINK	28480	86701-00033
A31MP65	86701-40001	9	1	EXTRACTOR-PC BOARD	28480	86701-40001
A31MP66	1200-0172	4	1	INSULATOR-XSTR DAP-GL	28480	1200-0172
A31Q1	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A31Q2	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A31Q3	1854-0345	8	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31R1	0698-3154	0	5	RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A31R2	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A31R3	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A31R4	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A31R5	0698-7267	4	1	RESISTOR 19.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-1962-F
A31R6	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A31R7	0698-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-TO-1961-F
A31R8	0698-7192	4	2	RESISTOR 14.7 1% .05W F TC=0±100	24546	C3-1/8-TO-14R7-F
A31R9	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A31R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A31R11	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A31R12	0698-7212	9	1	RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-TO-100R-F
A31R13	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
A31R14	0757-0416	7	4	RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A31R15	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A31R16	0698-7248	1	3	RESISTOR 3.16K 1% .05W F TC=0±100	24546	C3-1/8-T0-3161-F
A31R17	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0±100	24546	C3-1/8-T0-3161-F
A31R18	0698-7223	2	1	RESISTOR 287 1% .05W F TC=0±100	24546	C3-1/8-TO-287R-F
A31R19	0698-7256	1	1	RESISTOR 6.81K 1% .05W F TC=0±100	24546	C3-1/8-T0-6811-F
A31R20	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0±100	24546	C3-1/8-T0-3161-F
A31R21	0698-7220	9	2	RESISTOR 215 1% .05W F TC=0±100	24546	C3-1/8-TO-215R-F
A31R22	0698-7220	9		RESISTOR 215 1% .05W F TC=0±100	24546	C3-1/8-TO-215R-F
A31R23	0698-7192	4		RESISTOR 14.7 1% .05W F TC=0±100	24546	C3-1/8-TO-14R7-F
A31R24	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A31R25	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A31R26	0757-0441	8	2	RESISTOR 8.25K 1% .125W F TC=0±100	24546	C4-1/8-T0-8251-F
A31R27	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0±100	24546	C4-1/8-T0-8251-F
A31R28	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
A31R29	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0±100	24546	C4-1/8-T0-4642-F
A31R30	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A31TP1	0360-0535	0	7	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A31TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A31TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A31TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A31TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A31TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A31TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A31U1	1820-1344	8	1	IC PL LOOP 14-DIP-C PKG	04713	MC12040L
A31U2	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A31U3	1810-0251	3	3	NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0251
A31U4	1820-1225	4	2	IC FF ECL D-M/S DUAL	04713	MC10231P
A31U5	1810-0204	6	6	NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A31U6	1820-0821	4	2	IC CNTR ECL BIN UP/DOWN SYNCHRO	28480	1820-0821
A31U7	1820-0802	1	4	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A31U8	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31U9	1820-0806	5	2	IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A31U10	1820-0820	3	2	IC FF ECL J-BAR K-BAR COM CLOCK DUAL	04713	MC10135L
A31U11	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A31U12	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A31U13	1810-0251	3		NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0251
A31U14	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A31U15	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A31U16	1820-0821	4		IC CNTR ECL BIN UP/DOWN SYNCHRO	28480	1820-0821
A31U17	1810-0251	3		NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0251
A31U18	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A31U19	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A31U20	1820-0806	5		IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A31U21	1820-0820	3		IC FF ECL J-BAR K-BAR COM CLOCK DUAL	04713	MC10135L
A31U22	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A31U23	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A31U24	0955-0063	0	1	MIXER-DOUBLER 5-500 MH	28480	0955-0063
A31VR1	1902-3082	9	1	DIODE-ZNR 4.64V 5% DO-35 PD=.4W	28480	1902-3082
A31W1	08340-60103	3	1	CABLE ASSEMBLY- A31	28480	08340-60103
A31W2	08340-60104	4	1	CABLE ASSEMBLY- A31	28480	08340-60104

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A32	**08340-60091**	**8**	**1**	**M/N VCO ASSEMBLY**	**28480**	**08340-60091**
				(08340-60091 INCLUDES A32A1 M/N VCO PC BD AND A32A2 VCO)		
A32/A33	08340-60092	9	1	M/N-VCO/OUTPUT ASSEMBLY (INCLUDES A32 M/N VCO ASSY. AND A33 M/N OUTPUT ASSY)	28480	08340-60092
A32A1				M/N VCO PC BOARD ASSEMBLY (NSR)		
A32A1C1	0160-3878	6	21	CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A32A1C2	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A32A1C3	0160-3879	7	2	CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A32A1C4	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A32A1C5	0180-0116	1	1	CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A32A1C6	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A32A1C7	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A32A1C8	0160-3873	1	3	CAPACITOR-FXD 4.7PF +.5PF 200VDC CER	28480	0160-3873
A32A1C9	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A32A1C10	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A32A1C11	0180-2161	0	1	CAPACITOR-FXD .75UF+10% 50VDC TA	56289	150D754X9050A2
A32A1J1	1251-0600	0	3	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A32A1J2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A32A1J3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A32A1L1	9100-0346	0	2	INDUCTOR RF-CH-MLD 50NH 20% .105DX.26LG	28480	9100-0346
A32A1L2	9100-0346	0		INDUCTOR RF-CH-MLD 50NH 20% .105DX.26LG	28480	9100-0346
A32A1L3	86701-20051	7	1	INDUCTOR	28480	86701-20051
A32A1L4	9140-0158	6	3	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A32A1MP1	0590-0526	6	1	THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0526
A32A1Q1	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A32A1Q2	1854-0610	0	1	TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A32A1R1	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A32A1R2	0698-7219	6	1	RESISTOR 196 1% .05W F TC=0+100	24546	C3-1/8-TO-196R-F
A32A1R3	0698-7193	5	1	RESISTOR 16.2 1% .05W F TC=0+100	24546	C3-1/8-TO-16R2-F
A32A1R4	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A32A1R5	0757-0428	1	2	RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A32A1R6	0698-7262	9	1	RESISTOR 12.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1212-F
A32A1R7	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A32A1R8	0698-7254	9	1	RESISTOR 5.62K 1% .05W F TC=0+100	24546	C3-1/8-T0-5621-F
A32A1R9	0698-7205	0	2	RESISTOR 51.1 1% .05W F TC=0+100	24546	C3-1/8-TO-51R1-F
A32A1R10	0698-7265	2	1	RESISTOR 16.2K 1% .05W F TC=0+100	24546	C3-1/8-T0-1622-F
A32A1R11	0698-7250	5	1	RESISTOR 3.83K 1% .05W F TC=0+100	24546	C3-1/8-T0-3831-F
A32A1R12	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A32A1R13	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0+100	24546	C4-1/8-T0-90R9-F
A32A1W1	08340-60105	5	1	CABLE ASSEMBLY-COAX A32	28480	08340-60105
A32A1W2				NOT ASSIGNED		
A32A1W3	86701-20050	6	1	CABLE-JUMPER	28480	86701-20050
	1251-2313	6	2	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A32A2				M/N VCO (NSR)		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A33	08340-60038	3	1	M/N OUTPUT	28480	08340-60038
A33C1	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C2	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C3	0160-3874	2	3	CAPACITOR-FXD 10PF +.5PF 200VDC CER	28480	0160-3874
A33C4	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C5	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C6	0160-3873	1		CAPACITOR-FXD 4.7PF +.5PF 200VDC CER	28480	0160-3873
A33C7	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C8	0160-3873	1		CAPACITOR-FXD 4.7PF +.5PF 200VDC CER	28480	0160-3873
A33C9	0160-4491	1		CAPACITOR-FXD 8.2PF +.5PF 200VDC CER	28480	0160-4491
A33C10	0160-4490	0	1	CAPACITOR-FXD 1.8PF +.25PF 200VDC CER	28480	0160-4490
A33C11				NOT ASSIGNED		
A33C12	0160-2261	9	1	CAPACITOR-FXD 15PF +5% 500VDC CER 0+30	28480	0160-2261
A33C13	0160-2290	4	2	CAPACITOR-FXD .15UF +10% 80VDC POLYE	28480	0160-2290
A33C14	0160-2290	4		CAPACITOR-FXD .15UF +10% 80VDC POLYE	28480	0160-2290
A33C15	0140-0196	3	1	CAPACITOR-FXD 150PF +5% 300VDC MICA	72136	DM15F151J0300WV1CR
A33C16	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C17	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C18	0160-3874	2		CAPACITOR-FXD 10PF +.5PF 200VDC CER	28480	0160-3874
A33C19	0160-3876	4	1	CAPACITOR-FXD 47PF +20% 200VDC CER	28480	0160-3876
A33C20	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C21	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C22	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C23	0160-4351	2	1	CAPACITOR-FDTHRU 1000PF 20% 200V CER	28480	0160-4351
A33C24	0160-0161	4	2	CAPACITOR-FXD .01UF +10% 200VDC POLYE	28480	0160-0161
A33C25	0160-0153	4	1	CAPACITOR-FXD 1000PF +10% 200VDC POLYE	28480	0160-0153
A33C26	0160-0161	4		CAPACITOR-FXD .01UF +10% 200VDC POLYE	28480	0160-0161
A33C27	0160-3534	1	1	CAPACITOR-FXD 510PF +5% 100VDC MICA	28480	0160-3534
A33C28	0160-0298	8	1	CAPACITOR-FXD 1500PF +10% 200VDC POLYE	28480	0160-0298
A33C29	0180-0197	8	2	CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A33C30	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C31	0180-0197	8		CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A33C32	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C33	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C34	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33C35	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A33CR1	1901-0040	1	4	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33J1	1250-0690	6	2	CONNECTOR-RF MALE SMB	28480	1250-0690
A33J2	1250-0690	6		CONNECTOR-RF MALE SMB	28480	1250-0690
A33J3	1250-1889	7	1	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A33L1	9135-0073	3	8	INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A33L2	9135-0073	3		INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A33L3	9135-0073	3		INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A33L4	9135-0073	3		INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A33L5				NOT ASSIGNED		
A33L6	9100-1634	1	1	INDUCTOR RF-CH-MLD 75UH 5% .166DX.385LG	28480	9100-1634
A33L7	9100-1635	2	1	INDUCTOR RF-CH-MLD 91UH 5% .166DX.385LG	28480	9100-1635
A33L8	9100-1620	5	1	INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A33L9	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A33L10	9135-0073	3		INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A33L11	9135-0073	3		INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A33L12	9135-0079	9		INDUCTOR RF-CH-MLD 100NH 5.5% .102DX.26LG	28480	9135-0079
A33L13	9135-0073	3		INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A33L14	9140-0144	0	1	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A33MP1	1200-0172	4	7	INSULATOR-XSTR DAP-GL	28480	1200-0172
A33MP2	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A33MP3	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A33MP4	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A33MP5	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A33MP6	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A33MP7	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A33MP8	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
A33MP9	2190-0124	4	4	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A33MP10	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A33MP11	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A33MP12	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A33MP13	2200-0101	0	4	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A33MP14	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A33MP15	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A33MP16	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A33MP17	2580-0002	4	1	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
A33MP18	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A33MP19	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A33MP20	3050-0082	8	1	WASHER-FL NM NO. 4 .116-IN-ID .188-IN-OD	28480	3050-0082
A33MP21	4330-0145	9	2	INSULATOR-BEAD GLASS	28480	4330-0145
A33MP22	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A33MP23	08340-20093	6	1	COVER-PC M/N OUTPUT	28480	08340-20093
A33MP24	85660-20068	4	2	GROUND LUG	28480	85660-20068
A33MP25	85660-20068	4		GROUND LUG	28480	85660-20068
A33MP26	86701-40001	9	1	EXTRACTOR-PC	28480	86701-40001
A33Q1	1854-0345	8	7	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A33Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A33Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A33Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A33Q5	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A33Q6	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A33Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A33R1	0698-7212	9	4	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-TO-100R-F
A33R2	0698-7248	1	5	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A33R3	0698-7243	6	4	RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1961-F
A33R4	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A33R5	0698-7223	2	3	RESISTOR 287 1% .05W F TC=0+-100	24546	C3-1/8-TO-287R-F
A33R6	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A33R7	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1961-F
A33R8	0757-0316	6	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A33R9	0698-7221	0	1	RESISTOR 237 1% .05W F TC=0+-100	24546	C3-1/8-TO-237R-F
A33R10	0698-7188	8	3	RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-TO-10R-F
A33R11	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-TO-100R-F
A33R12	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A33R13	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-TO-100R-F
A33R14	0757-1094	9	4	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A33R15	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A33R16	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A33R17	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A33R18	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A33R19	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A33R20	0698-7222	1	1	RESISTOR 261 1% .05W F TC=0+-100	24546	C3-1/8-TO-261R-F
A33R21	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	C3-1/8-TO-287R-F
A33R22	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-TO-10R-F
A33R23	0698-7229	8	2	RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A33R24	0698-7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-TO-100R-F
A33R25	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A33R26	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1961-F
A33R27	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A33R28	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A33R29	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1961-F
A33R30	0698-7195	7	1	RESISTOR 19.6 1% .05W F TC=0+-100	24546	C3-1/8-TO-19R6-F
A33R31	0698-7227	6	1	RESISTOR 422 1% .05W F TC=0+-100	24546	C3-1/8-TO-422R-F
A33R32	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-TO-10R-F
A33R33	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A33R34	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A33R35	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	C3-1/8-TO-287R-F
A33R36	0698-7210	7	1	RESISTOR 82.5 1% .05W F TC=0+-100	24546	C3-1/8-TO-82R5-F
A33R37	0698-3442	9	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C3-1/8-TO-257R-F
A33U1	1826-0059	2	1	IC OP AMP GP TO-99 PKG	01295	LM201AL
A33U2	1820-2642	1	1	IC CNTR ECL BIN DUAL	28480	1820-2642
A33VR1	1902-3070	5	2	DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1902-3070
A33VR2	1902-3070	5		DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1902-3070
A33W1	08340-60123	7	1	JUMPER WIRE ASSEMBLY	28480	08340-60123

See introduction to this section for ordering information *Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A34	**08340-60039**	**4**	**1**	**REFERENCE M/N MOTHERBOARD**	**28480**	**08340-60039**
A34C1	0160-2437	1	12	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C2	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C3	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C4	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C5	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C6	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C7	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C8	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C9	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C10	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C11	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C12	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A34C13	0160-4083	7	2	CAPACITOR-FDTHRU 10PF 10% 200V CER	28480	0160-4083
A34C14	0160-4083	7		CAPACITOR-FDTHRU 10PF 10% 200V CER	28480	0160-4083
A34E1-9	9170-0029	3	12	CORE-SHIELDING BEAD	28480	9170-0029
A34E10-12				NOT ASSIGNED		
A34E13-26	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A34MP1	8150-0014	3	1	WIRE-24 AWG 1 X 24	28480	8150-0014
A34MP2	2190-0007	2	2	WASHER-LK INTL T NO. 6 .141-IN-ID	28480	2190-0007
A34MP3	2420-0003	7	2	NUT-HEX-DBL-CHAM 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A34MP4	2190-0843	4	12	WASHER-LK INTL T NO. 8 .165-IN-ID	28480	2190-0843
A34MP5	2580-0002	4	12	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
A34MP6	8150-0447	6	1	WIRE-24 AWG 300V 0	28480	8150-0447
A34MP7	85660-00037	5	1	INSULATOR- 15 PIN (FOR XA33)	28480	85660-00037
A34MP8	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A34MP9	0890-0983	5		TUBING-HEAT SINK .125ID	28480	0890-0983
A34MP10	8150-0464	7	3	WIRE-24 AWG 300V 97	28480	8150-0464
A34MP11	8150-0454	5	3	WIRE-24 AWG 300V 7	28480	8150-0454
A34MP12	8150-0449	8	2	WIRE-24 AWG 300V 2	28480	8150-0449
A34MP13	8150-0451	2	3	WIRE-24 AWG 300V 4	28480	8150-0451
A34MP14	8150-0472	7	2	WIRE-24 AWG 300V 907	28480	8150-0472
A34MP15	8150-0464	7		WIRE-24 AWG 300V 97	28480	8150-0464
A34MP16	8150-0454	5		WIRE-24 AWG 300V 7	28480	8150-0454
A34MP17	8150-0449	8		WIRE-24 AWG 300V 2	28480	8150-0449
A34MP18	8150-0451	2		WIRE-24 AWG 300V 4	28480	8150-0451
A34MP19	8150-0451	2		WIRE-24 AWG 300V 4	28480	8150-0451
A34MP20	8150-0464	7		WIRE-24 AWG 300V 97	28480	8150-0464
A34MP21	8150-0472	7		WIRE-24 AWG 300V 907	28480	8150-0472
A34MP22	8150-0454	5		WIRE-24 AWG 300V 7	28480	8150-0454
A34MP23	8150-0461	4	1	WIRE-24 AWG 300V 94	28480	8150-0461
A34XA29	1251-4423	3	1	CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-4423
	85660-00051	3	1	INSULATOR- 15 PIN (FOR XA29	28480	85660-00051
A34XA30	1251-4174	1	1	CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-4174
	85660-00050	2	1	INSULATOR- 15 PIN (FOR XA30)	28480	85660-00050
A34XA31	1251-2035	9	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A34XA32				NOT ASSIGNED		
A34XA33	1251-5020	8	1	CONNECTOR-PC 15 IR	28480	1251-5020
A34XA34A	5060-0112	8	1	CONNECTOR- 15 CONTACT DIP	28480	5060-0112
A34XA34B	5060-0112	8		CONNECTOR- 15 CONTACT DIP	28480	5060-0112

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A35	**08340-60002**	1	1	**RECTIFIER**	**28480**	**08340-60002**
A35C1	0160-3638	6	1	CAPACITOR-FXD .22UF +80-20% 200VDC CER	28480	0160-3638
	0360-0535	0	5	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A35C2	0160-4005	3	3	CAPACITOR-FXD 1UF +20% 100VDC CER	28480	0160-4005
	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A35C3	0160-4005	3		CAPACITOR-FXD 1UF +20% 100VDC CER	28480	0160-4005
	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A35C4	0160-4005	3		CAPACITOR-FXD 1UF +20% 100VDC CER	28480	0160-4005
	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A35C5	0160-2055	9	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A35C6	0160-0128	3	1	CAPACITOR-FXD 2.2UF +20% 50VDC CER	28480	0160-0128
A35C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A35C8	0160-3094	8	2	CAPACITOR-FXD .1UF +10% 100VDC CER	28480	0160-3094
A35C9	0160-3094	8		CAPACITOR-FXD .1UF +10% 100VDC CER	28480	0160-3094
A35C10	0180-2129	0	1	CAPACITOR-FXD 10UF+10% 50VDC TA	56289	150D106X9050R2
A35CR1	1901-0662	3	6	DIODE-PWR RECT 100V 6A	04713	MR751
A35CR2	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A35CR3	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A35CR4	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A35CR5	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A35CR6	1901-0028	5	1	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A35CR7	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A35DS1	1990-0487	7	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A35F1	2110-0425	0	1	FUSE 2A 125V .25X.27	28480	2110-0425
A35MP1, 2				NOT ASSIGNED		
A35MP3	0590-0526	6	1	THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0526
A35MP4	1200-0081	4	1	INSULATOR-FLG-BSHG NYLON	28480	1200-0081
A35MP5	2200-0107	6	4	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A35MP6	6040-0454	0		THERMAL COMPOUND SYNTH	28480	6040-0454
A35MP7	08340-00009	2	1	HEAT SINK RECTIFIER	28480	08340-00009
A35P1	1251-2313	6	2	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A35P2	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A35Q1	1884-0018	5	2	THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A35Q2	1884-0018	5		THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A35R1	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A35R2	0698-3406	5	1	RESISTOR 1.33K 1% .5W F TC=0+100	28480	0698-3406
A35R3	2100-3123	0	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A35R4	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+100	24546	C4-1/8-T0-4640-F
A35R5	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A35R6	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A35R7	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A35U1	1906-0239	0	1	DIODE-CT-RECT 45V 30A	01281	SD-241
A35U2	1826-0423	4	1	IC V RGLTR TO-3	27014	LM317K
A35VR1	1902-0197	1	1	DIODE-ZNR 82V 5% PD=1W IR=5UA	28480	1902-0197
A35VR2	1902-1249	6	1	DIODE-ZNR 24.9V 5% DO-15 PD=1W TC=+.081%	28480	1902-1249
A35VR3	1902-0202	9	1	DIODE-ZNR 15V 5% PD=1W IR=5UA	28480	1902-0202

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A36	08340-60042	9	1	PLL1 VCO	28480	08340-60042
A36C1	0160-0574	3	8	CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A36C2	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A36C3	0160-3875	3	3	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A36C4	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A36C5	0160-3877	5	1	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A36C6	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A36C7	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A36C8	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A36C9	0160-3878	6	3	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A36C10	0160-3874	2	5	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A36C11	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A36C12	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A36C13	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A36C14	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A36C15	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A36C16	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A36C17	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A36C18	0160-4084	8	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A36C19	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A36C20	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A36C21	0160-4953	0	4	CAPACITOR-CER .027 UF 50VDC	28480	0160-4953
A36C22	0160-4953	0		CAPACITOR-CER .027 UF 50VDC	28480	0160-4953
A36C23	0160-4953	0		CAPACITOR-CER .027 UF 50VDC	28480	0160-4953
A36C24	0160-4951	8	3	CAPACITOR-FXD .033UF +-5% 50VDC CER	28480	0160-4951
A36C25	0160-4952	9	1	CAPACITOR-FXD .039UF +-5% 50VDC CER	28480	0160-4952
A36C26	0160-0158	9	1	CAPACITOR-FXD 5600PF +-10% 200VDC POLYE	28480	0160-0158
A36C27	0180-0116	1	2	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A36C28	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A36C29	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A36C30	0180-0197	8	2	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A36C31	0160-4953	0		CAPACITOR-CER .027 UF 50VDC	28480	0160-4953
A36C32	0160-4298	6	1	CAPACITOR-FXD 4700PF +-20% 250VDC CER	56289	C067F251H472MS22-CDH
A36C33	0160-4951	8		CAPACITOR-FXD .033UF +-5% 50VDC CER	28480	0160-4951
A36C34	0160-4951	8		CAPACITOR-FXD .033UF +-5% 50VDC CER	28480	0160-4951
A36C35	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A36C36	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A36CR1	1901-0040	1	5	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A36CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A36CR3	0122-0085	1	2	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	02032	SMV1288
A36CR4	0122-0085	1		DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	02032	SMV1288
A36CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A36CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A36CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A36J1	1250-0690	6	2	CONNECTOR-RF MALE SMB	28480	1250-0690
A36J2	1250-0690	6		CONNECTOR-RF MALE SMB	28480	1250-0690
A36L1	9100-2257	6	2	INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A36L2	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A36L3	9100-2257	6		INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A36L4	85660-80004	4	1	INDUCTOR- 30 NH	28480	85660-80004
A36L5	85660-80005	5	1	INDUCTOR- 4 NH	28480	85660-80005
A36L6	9100-2258	7	2	INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A36L7	85660-80008	8	2	INDUCTOR-ADJ .4 MH	28480	85660-80008
A36L8	85660-80008	8		INDUCTOR-ADJ .4 MH	28480	85660-80008
A36L9	9100-1647	6	1	INDUCTOR RF-CH-MLD 470UH 5% .2DX.45LG	28480	9100-1647
A36L10	9100-1788	6	3	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A36L11	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A36L12	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A36L13	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A36L14	9100-2254	3	2	INDUCTOR RF-CH-MLD 390NH 10% .105DX.26LG	28480	9100-2254
A36L15	9100-2254	3		INDUCTOR RF-CH-MLD 390NH 10% .105DX.26LG	28480	9100-2254
A36L16	9100-2247	4	1	INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A36MP1	2190-0124	4	6	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A36MP2	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A36MP3	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A36MP4	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A36MP5	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A36MP6	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A36MP7	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A36MP8	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A36MP9	86701-40001	9	1	EXTRACTOR PC BOARD	28480	86701-40001

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A36MP10	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A36MP11	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A36MP12	08340-20094	7	1	COVER-PC PLL1 VCO	28480	08340-20094
A36MP13	85660-00038	6	1	SHIELDING CAN	28480	85660-00038
A36MP14	85660-20068	4	3	GROUND LUG	28480	85660-20068
A36MP15	85660-20068	4		GROUND LUG	28480	85660-20068
A36MP16	85660-20068	4		GROUND LUG	28480	85660-20068
A36Q1	1855-0420	2	4	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A36Q2	1854-0023	9	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A36Q3	1854-0345	8	4	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A36Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A36Q5	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A36Q6	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A36Q7	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A36Q8	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A36Q9	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A36Q10	1854-0023	9		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A36Q11	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A36R1	0757-0395	1	2	RESISTOR 56.2 1% .125W F TC=0+100	24546	C4-1/8-T0-56R2-F
A36R2	0757-0280	3	11	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R3	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+100	24546	C4-1/8-T0-1331-F
A36R4	0757-0441	8	2	RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-T0-8251-F
A36R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R6	0757-0123	3	4	RESISTOR 34.8K 1% .125W F TC=0+100	28480	0757-0123
A36R7	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-T0-8251-F
A36R8	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R9	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A36R10	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+100	24546	C4-1/8-T0-6192-F
A36R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R12	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+100	24546	C4-1/8-T0-4640-F
A36R13	0757-0428	1	2	RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A36R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R15	0757-0402	1	2	RESISTOR 110 1% .125W F TC=0+100	24546	C4-1/8-T0-111-F
A36R16	0698-7195	7	1	RESISTOR 19.6 1% .05W F TC=0+100	24546	C3-1/8-T0-19R6-F
A36R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R18	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A36R19	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A36R20	0757-0395	1		RESISTOR 56.2 1% .125W F TC=0+100	24546	C4-1/8-T0-56R2-F
A36R21	0698-3438	3	2	RESISTOR 147 1% .125W F TC=0+100	24546	C4-1/8-T0-147R-F
A36R22	0698-3438	3		RESISTOR 147 1% .125W F TC=0+100	24546	C4-1/8-T0-147R-F
A36R23	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-5112-F
A36R24	0757-0289	2	3	RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A36R25	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A36R26	0757-0416	7	4	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A36R27	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+100	28480	0757-0123
A36R28	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+100	28480	0757-0123
A36R29	0757-0440	7	2	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A36R30	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A36R31	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A36R32	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A36R33	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-2612-F
A36R34	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+100	19701	MF4C1/8-T0-6191-F
A36R35	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-5112-F
A36R36	0757-0402	1		RESISTOR 110 1% .125W F TC=0+100	24546	C4-1/8-T0-111-F
A36R37	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A36R38	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+100	28480	0757-0123
A36R39	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A36R40	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A36R41	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A36R42	0698-7188	8	1	RESISTOR 10 1% .05W F TC=0+100	24546	C3-1/8-T0-10R-F
A36R43	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R46	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R47	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A36R48	0757-0462	3	4	RESISTOR 75K 1% .125W F TC=0+100	24546	C4-1/8-T0-7502-F
A36R49	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+100	24546	C4-1/8-T0-7502-F
A36R50	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+100	24546	C4-1/8-T0-7502-F
A36R51	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+100	24546	C4-1/8-T0-7502-F
A36TP1	0360-0535	0	4	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A36TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A36TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A36TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A36U1	1810-0204	6	1	NETWORK-RES 8-SIP 1.0K OHM X 7	01121	208A102
A36U2	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A36U3	1820-1888	5	1	IC PRESCR ECL	04713	MC12013L
A36U4	1826-0161	7	1	IC OP AMP GP QUAD 14-DIP-P PKG	04713	MLM324P
A36U5	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A36U6	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A36VR1	1902-3048	7	1	DIODE-ZNR 3.48V 5% DO-35 PD=.4W	28480	1902-3048
A36W1	08340-60106	6	1	CABLE ASSEMBLY- A36	28480	08340-60106

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A37	08340-60043	0	1	PLL1 DIVIDER	28480	08340-60043
A37C1	0160-0574	3	8	CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A37C2	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A37C3	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A37C4	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A37C5	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A37C6	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A37C7	0160-0570	9	2	CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A37C8	0160-0570	9		CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A37C9	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A37C10	0160-4084	8	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A37C11	0160-3875	3	1	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A37C12	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A37C13	0180-2207	5	1	CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A37CR1	1901-0040	1	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A37CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A37DS1	1990-0485	5	1	LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A37J1	1250-0690	6	1	CONNECTOR-RF MALE SMB	28480	1250-0690
A37L1	9100-2255	4	1	INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A37L2	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A37MP1	0520-0128	7	2	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A37MP2	0520-0128	7		SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A37MP3	0590-0533	5	2	THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A37MP4	0590-0533	5		THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A37MP5	1205-0285	0	1	HEAT SINK SGL DIP	28480	1205-0285
A37MP6	2190-0014	1	2	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A37MP7	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A37MP8	2190-0124	4	4	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A37MP9	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A37MP10	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A37MP11	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A37MP12	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A37MP13	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A37MP14	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A37MP15	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A37MP16	08340-20083	4	1	COVER-PC PLL1 DIVIDER	28480	08340-20083
A37MP17	85660-00012	6	1	HEAT SINK- BOTTOM	28480	85660-00012
A37MP18	85660-20068	4	2	GROUND LUG	28480	85660-20068
A37MP19	85660-20068	4		GROUND LUG	28480	85660-20068
A37MP20	86701-40001	9	2	EXTRACTOR-PC BOARD	28480	86701-40001
A37MP21	86701-40001	9		EXTRACTOR-PC BOARD	28480	86701-40001
A37Q1	1853-0405	9	1	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A37Q2	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A37Q3	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A37R1	0757-0280	3	19	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R2	0698-3431	6	1	RESISTOR 23.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-23R7-F
A37R3	0757-0403	2	2	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A37R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R6	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A37R7	0757-0416	7	5	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A37R8	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A37R9	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A37R10	0698-3440	7	4	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A37R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R12	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A37R13	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A37R14	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A37R15	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A37R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R17	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A37R18	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R21	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R22	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R24	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A37R25	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A37R26	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A37R27	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A37R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A37R29	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A37R30	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A37R31	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A37R32	0757-0403	2		RESISTOR 121 1% .125W F TC=0+100	24546	C4-1/8-T0-121R-F
A37R33	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+100	24546	C4-1/8-T0-681R-F
A37R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A37R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A37TP1	0360-0535	0	14	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP13	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37TP14	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A37U1	1820-0909	9	2	IC MULTR TTL	01295	SN74167N
A37U2	1820-0909	9		IC MULTR TTL	01295	SN74167N
A37U3	1820-0808	7	1	IC GATE ECL NOR DUAL 3-INP	04713	MC10111P
A37U4	1820-1225	4	1	IC FF ECL D-M/S DUAL	04713	MC10231P
A37U5	1820-1320	0	1	IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10216L
A37U6	1810-0204	6	4	NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A37U7	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A37U8	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A37U9	1820-1196	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A37U10	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A37U11	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A37U12	1820-0821	4	1	IC CNTR ECL BIN UP/DOWN SYNCHRO	04713	MC10136L
A37U13	1810-0204	6		NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A37U14	1820-0817	8	3	IC FF ECL D-M/S DUAL	04713	MC10131P
A37U15	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A37U16	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A37VR1	1902-3059	0	1	DIODE-ZNR 3.83V 5% DO-35 PD=.4W	28480	1902-3059
A37W1	08340-60107	7	1	CABLE ASSEMBLY- A37	28480	08340-60107

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A38	08340-60044	1	1	PLL1 IF	28480	08340-60044
A38C1	0160-3878	6	5	CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A38C2	0160-0574	3	12	CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C3	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A38C4	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A38C5	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C6	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A38C7	0160-3875	3	4	CAPACITOR-FXD 22PF +5% 200VDC CER 0+30	28480	0160-3875
A38C8	0160-3875	3		CAPACITOR-FXD 22PF +5% 200VDC CER 0+30	28480	0160-3875
A38C9	0160-3875	3		CAPACITOR-FXD 22PF +5% 200VDC CER 0+30	28480	0160-3875
A38C10	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C11	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C12	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C13	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C14	0160-3876	4	1	CAPACITOR-FXD 47PF +20% 200VDC CER	28480	0160-3876
A38C15	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C16	0160-3653	5	1	CAPACITOR-FXD 33PF +5% 200VDC CER 0+30	28480	0160-3653
A38C17	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A38C18	0160-3874	2		CAPACITOR-FXD 10PF +.5PF 200VDC CER	28480	0160-3874
A38C19	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C20	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C21	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C22	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C23	0160-3874	2		CAPACITOR-FXD 10PF +.5PF 200VDC CER	28480	0160-3874
A38C24	0160-3875	3		CAPACITOR-FXD 22PF +5% 200VDC CER 0+30	28480	0160-3875
A38C25	0160-3565	8	3	CAPACITOR-FXD 6.8PF +.5PF 100VDC CER	28480	0160-3565
A38C26*	0160-3874	2	4	CAPACITOR-FXD 10PF +.5PF 200VDC CER	28480	0160-3874
A38C27	0160-3565	8		CAPACITOR-FXD 6.8PF +.5PF 100VDC CER	28480	0160-3565
A38C28	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A38C29	0160-3874	2		CAPACITOR-FXD 10PF +.5PF 200VDC CER	28480	0160-3874
A38C30	0160-3565	8		CAPACITOR-FXD 6.8PF +.5PF 100VDC CER	28480	0160-3565
A38C31	0160-3873	1	1	CAPACITOR-FXD 4.7PF +.5PF 200VDC CER	28480	0160-3873
A38C32	0160-4289	5	1	CAPACITOR-FXD 15PF +5% 100VDC CER 0+30	51642	150100C0G150J
A38CR1	1901-0535	9	2	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A38CR2	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A38J1	1250-0690	6	1	CONNECTOR-RF MALE SMB	28480	1250-0690
A38L1	9100-2256	5	3	INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A38L2	9100-2247	4	5	INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A38L3	9100-2248	5	3	INDUCTOR RF-CH-MLD 120NH 10% .105DX.26LG	28480	9100-2248
A38L4	9100-2248	5		INDUCTOR RF-CH-MLD 120NH 10% .105DX.26LG	28480	9100-2248
A38L5	9100-2891	4	3	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A38L6	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A38L7	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A38L8	9100-1788	6	2	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A38L9	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A38L10	9100-0368	6	1	INDUCTOR RF-CH-MLD 330NH 10% .105DX.26LG	28480	9100-0368
A38L11	85660-80006	6	2	INDUCTOR- 120 NH	28480	85660-80006
A38L12	85660-80009	9	1	INDUCTOR- 100 NH	28480	85660-80009
A38L13	85660-80006	6		INDUCTOR- 120 NH	28480	85660-80006
A38L14	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A38L15	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A38L16	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A38L17	9100-2248	5		INDUCTOR RF-CH-MLD 120NH 10% .105DX.26LG	28480	9100-2248
A38L18	9100-2256	5		INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A38L19	9100-2256	5		INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A38L20	9100-2891	4		INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A38L21	9100-2891	4		INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A38MP1				NOT ASSIGNED		
A38MP2	2190-0124	4	6	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A38MP3	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A38MP4	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A38MP5	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A38MP6	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A38MP7	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A38MP8	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A38MP9	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A38MP10	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A38MP11	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A38MP12	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A38MP13	08340-20084	5	1	COVER-PC PLL1 IF	28480	08340-20084
A38MP14	85660-00038	6	2	SHIELDING CAN	28480	85660-00038

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A38MP15	85660-00038	6		SHIELDING CAN	28480	85660-00038
A38MP16	85660-00040	0	1	SHIELDING CAN	28480	85660-00040
A38MP17	85660-20068	4	3	GROUND LUG	28480	85660-20068
A38MP18	85660-20068	4		GROUND LUG	28480	85660-20068
A38MP19	85660-20068	4		GROUND LUG	28480	85660-20068
A38MP20	86701-40001	9	2	EXTRACTOR-PC BOARD	28480	86701-40001
A38MP21	86701-40001	9		EXTRACTOR-PC BOARD	28480	86701-40001
A38Q1	1854-0345	8	4	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A38Q2	1854-0378	7	1	TRANSISTOR NPN 2N5109 SI TO-39 PD=800MW	3L585	2N5109
A38Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A38Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A38Q5	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A38R1	0757-0394	0	3	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A38R2	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0+100	24546	C4-1/8-T0-3481-F
A38R3	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A38R4	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A38R5	0698-3429	2	3	RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A38R6	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+100	24546	C4-1/8-T0-147R-F
A38R7	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A38R8	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A38R9	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A38R10	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A38R11	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+100	24546	C4-1/8-T0-68R1-F
A38R12	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A38R13	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A38R14	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+100	24546	C4-1/8-T0-3481-F
A38R15	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A38R16	0698-3444	1	2	RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A38R17	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A38R18	0698-3444	1		RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A38R19	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A38R20	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A38R21	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A38R22	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A38R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A38R24	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A38R25	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A38R26	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A38R27	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A38U1	0955-0063	0	1	MIXER-DOUBLER 5-500 MH	28480	0955-0063
A38W1	08340-60108	8	1	CABLE ASSEMBLY- A38	28480	08340-60108
A38W2	08340-60113	5	1	CABLE ASSEMBLY- A38	28480	08340-60113

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A39	08340-60045	2	1	PLL3 UPCONVERTER	28480	08340-60045
A39C1	0160-0574	3	16	CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C2	0160-0572	1	2	CAPACITOR-FXD 2200PF +-20% 100VDC CER	28480	0160-0572
A39C3	0160-0572	1		CAPACITOR-FXD 2200PF +-20% 100VDC CER	28480	0160-0572
A39C4	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C5	0160-4084	8	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A39C6	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A39C7	0180-0291	3	2	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A39C8	0160-0161	4	2	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A39C9	0160-0161	4		CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A39C10	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C11	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C12	0180-0228	6	3	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A39C13	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A39C14	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C15	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C16	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C17	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A39C18	0160-3749	0	2	CAPACITOR-FXD 330PF +-10% 50VDC CER	28480	0160-3749
A39C19	0160-3877	5	3	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A39C20	0160-3749	0		CAPACITOR-FXD 330PF +-10% 50VDC CER	28480	0160-3749
A39C21	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A39C22	0160-3876	4	1	CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A39C23	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A39C24	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A39C25	0160-0571	0	2	CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A39C26	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A39C27	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C28	0160-0571	0		CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A39C29	0160-3878	6	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A39C30	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C31	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C32	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C33	0160-3875	3	3	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A39C34	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C35	0160-3872	0	2	CAPACITOR-FXD 2.2PF +-.25PF 200VDC CER	28480	0160-3872
A39C36	0160-3872	0		CAPACITOR-FXD 2.2PF +-.25PF 200VDC CER	28480	0160-3872
A39C37	0160-3565	8	1	CAPACITOR-FXD 6.8PF +-.5PF 100VDC CER	28480	0160-3565
A39C38	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C39	0160-3874	2	3	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A39C40	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C41	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C42	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A39C43	0160-3873	1	2	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER	28480	0160-3873
A39C44	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A39C45	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A39C46	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A39C47	0160-3873	1		CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER	28480	0160-3873
A39C48	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A39C49*	0160-4521	8	1	CAPACITOR-FXD 12PF +-5% 200VDC CER 0+-30	28480	0160-4521
A39C50	0121-0452	4	1	CAPACITOR-V TRMR-AIR 1.3-5.4PF 175V	74970	187-0103-028
A39CR1	1901-0050	3	4	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A39CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A39CR3	0122-0085	1	1	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	02032	SMV1288
A39CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A39CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A39DS1	1990-0485	5	1	LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A39J1	1250-0690	6	2	CONNECTOR-RF MALE SMB	28480	1250-0690
A39J2	1250-0690	6		CONNECTOR-RF MALE SMB	28480	1250-0690
A39J3	1250-1889	7	1	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A39L1	9140-0179	1	2	INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A39L2	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A39L3	9100-1788	6	2	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A39L4	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A39L5	9100-2258	7	7	INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A39L6	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A39L7	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A39L8	9100-2257	6	1	INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A39L9	9100-2254	3	1	INDUCTOR RF-CH-MLD 390NH 10% .105DX.26LG	28480	9100-2254
A39L10	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A39L11	85660-80006	6	3	INDUCTOR- 120 NH	28480	85660-80006
A39L12	9100-2255	4	1	INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A39L13	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A39L14	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A39L15	9135-0073	3	2	INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A39L16	85660-80006	6		INDUCTOR- 120 NH	28480	85660-80006
A39L17	85660-80006	6		INDUCTOR- 120 NH	28480	85660-80006
A39L18	9135-0073	3		INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG	28480	9135-0073
A39L19	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A39L20	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A39L21	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A39L22	9140-0144	0	1	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A39MP1	1200-0172	4	5	INSULATOR-XSTR DAP-GL	28480	1200-0172
A39MP2	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A39MP3	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A39MP4	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A39MP5	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A39MP6	2190-0124	4	6	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A39MP7	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A39MP8	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A39MP9	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A39MP10	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A39MP11	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A39MP12	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A39MP13	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A39MP14	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A39MP15	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A39MP16	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A39MP17	08340-20085	6	1	COVER-PC PLL1 UPCONVERTER	28480	08340-20085
A39MP18	85660-00042	2	1	SHIELDING CAN	28480	85660-00042
A39MP19	85660-20068	4	3	GROUND LUG	28480	85660-20068
A39MP20	85660-20068	4		GROUND LUG	28480	85660-20068
A39MP21	85660-20068	4		GROUND LUG	28480	85660-20068
A39MP22	86701-40001	9	1	EXTRACTOR-PC BOARD	28480	86701-40001
A39MP23	3050-0082	8	1	WASHER-FL NM NO. 4 .116-IN-ID .188-IN-OD	28480	3050-0082
A39Q1	1854-0345	8	4	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A39Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A39Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A39Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A39Q5	1855-0327	8	1	TRANSISTOR J-FET 2N4416 N-CHAN D-MODE	01295	2N4416
A39R1	0698-3440	7	3	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A39R2	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A39R3	0698-0083	8	3	RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A39R4	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0+100	24546	C4-1/8-T0-619R-F
A39R5	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A39R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A39R7	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-2612-F
A39R8	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-2612-F
A39R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A39R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A39R11	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A39R12	0757-0441	8	3	RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-T0-8251-F
A39R13	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A39R14	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+100	24546	C4-1/8-T0-3162-F
A39R15	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A39R16	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-T0-8251-F
A39R17	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-T0-8251-F
A39R18	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A39R19	0757-0346	2	4	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A39R20	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A39R21	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A39R22	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A39R23	0757-0466	7	1	RESISTOR 110K 1% .125W F TC=0+100	24546	C4-1/8-T0-1103-F
A39R24	0698-3156	2	2	RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A39R25	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A39R26	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A39R27	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A39R28	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A39R29	0757-0397	3	2	RESISTOR 68.1 1% .125W F TC=0+100	24546	C4-1/8-T0-68R1-F
A39R30	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A39R31	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A39R32	0698-7219	6	1	RESISTOR 196 1% .05W F TC=0+100	24546	C3-1/8-TO-196R-F
A39R33	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+100	24546	C4-1/8-T0-68R1-F
A39R34	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A39R35	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A39R36	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A39R37	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A39R38	0698-7192	4	1	RESISTOR 14.7 1% .05W F TC=0+100	24546	C3-1/8-TO-14R7-F
A39R39	0698-7230	1	2	RESISTOR 562 1% .05W F TC=0+100	24546	C3-1/8-TO-562R-F
A39R40	0698-7188	8	1	RESISTOR 10 1% .05W F TC=0+100	24546	C3-1/8-TO-10R-F
A39R41	0698-7200	5	2	RESISTOR 31.6 1% .05W F TC=0+100	24546	C3-1/8-TO-31R6-F
A39R42	0698-7236	7	2	RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A39R43	0698-7248	1	1	RESISTOR 3.16K 1% .05W F TC=0+100	24546	C3-1/8-T0-3161-F
A39R44	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A39R45	0698-7230	1		RESISTOR 562 1% .05W F TC=0+100	24546	C3-1/8-TO-562R-F
A39R46	0698-7218	5	2	RESISTOR 178 1% .05W F TC=0+100	24546	C3-1/8-TO-178R-F
A39R47	0698-7200	5		RESISTOR 31.6 1% .05W F TC=0+100	24546	C3-1/8-TO-31R6-F
A39R48	0698-7218	5		RESISTOR 178 1% .05W F TC=0+100	24546	C3-1/8-TO-178R-F
A39R49	0698-7207	2	1	RESISTOR 61.9 1% .05W F TC=0+100	24546	C3-1/8-TO-61R9-F
A39TP1	0360-0535	0	3	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A39TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A39TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A39U1	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A39U2	1826-0261	8	1	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A39U3	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A39U4	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A39U5	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A39U6	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A39U7	0955-0063	0	1		28480	0955-0063
A39W1	08340-60109	9	1	CABLE ASSEMBLY- A39	28480	08340-60109

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A40	08340-60046	3	1	PLL2 VCO	28480	08340-60046
A40C1	0160-0300	3	1	CAPACITOR-FXD 2700PF +-10% 200VDC POLYE	28480	0160-0300
A40C2	0160-0155	6	1	CAPACITOR-FXD 3300PF +-10% 200VDC POLYE	28480	0160-0155
A40C3	0160-0154	5	1	CAPACITOR-FXD 2200PF +-10% 200VDC POLYE	28480	0160-0154
A40C4	0160-3879	7	4	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C5	0160-4084	8	14	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C8	0160-3878	6	6	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A40C9	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C10	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A40C11	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A40C12	0160-4525	2	1	CAPACITOR-FXD 29PF +-5% 200VDC CER 0+-30	28480	0160-4525
A40C13	0160-4524	1	1	CAPACITOR-FXD 24PF +-5% 200VDC CER 0+-30	51642	200-200-NP0-240J
A40C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C15	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A40C16	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A40C17	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A40C18	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C19	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A40C20	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C21	0160-0571	0	1	CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A40C22	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C23	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C24	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C25	0160-3877	5	1	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A40C26	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C27	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C28	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C29	0180-2141	6	2	CAPACITOR-FXD 3.3UF+-10% 50VDC TA	56289	150D335X9050B2
A40C30	0180-2141	6		CAPACITOR-FXD 3.3UF+-10% 50VDC TA	56289	150D335X9050B2
A40C31	0180-1715	8	1	CAPACITOR-FXD 150UF+-10% 6VDC TA	56289	150D157X9006R2
A40C32	0180-1746	5	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A40C33	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C34	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A40C35	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C36	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A40C37	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40C38	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A40CR1	0122-0085	1	4	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	02032	SMV1288
A40CR2	0122-0085	1		DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	02032	SMV1288
A40CR3	0122-0085	1		DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	02032	SMV1288
A40CR4	0122-0085	1		DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	02032	SMV1288
A40J1	1250-0544	9	5	CONNECTOR-RF MALE SMB	28480	1250-0544
A40J2	1250-0544	9		CONNECTOR-RF MALE SMB	28480	1250-0544
A40J3	1250-0544	9		CONNECTOR-RF MALE SMB	28480	1250-0544
A40J4	1250-0544	9		CONNECTOR-RF MALE SMB	28480	1250-0544
A40J5	1250-0544	9		CONNECTOR-RF MALE SMB	28480	1250-0544
A40L1	85660-80031	7	2	INDUCTOR	28480	85660-80031
A40L2	85660-80031	7		INDUCTOR	28480	85660-80031
A40L3	9140-0144	0	1	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L4	9100-3358	0	2	INDUCTOR RF-CH-MLD 162NH 5% .2DX.385LG	28480	9100-3358
A40L5	9100-3358	0		INDUCTOR RF-CH-MLD 162NH 5% .2DX.385LG	28480	9100-3358
A40L6	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A40L7	9140-0158	6	2	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A40L8	9100-2247	4	8	INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A40L9	9100-2891	4	2	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A40L10	9100-2891	4		INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	28480	9100-2891
A40L11	9140-0158	6		INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A40L12	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A40L13	9100-2258	7	1	INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A40L14	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A40L15	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A40L16	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A40L17	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A40L18	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A40L19	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A40L20	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A40L21	9100-1618	1	3	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A40L22	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A40L23	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A40MP1	1200-0172	4	4	INSULATOR-XSTR DAP-GL	28480	1200-0172

See introduction to this section for ordering information *Indicates factory selected value.

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A40MP2	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A40MP3	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A40MP4	1200-0172	4		INSULATOR-XSTR DAP-GL	28480	1200-0172
A40MP5	2190-0124	4	1	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A40MP6	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A40MP7	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A40MP8	2950-0078	9	1	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A40MP9	08340-20086	7	1	COVER-PC PLL2 VCO	28480	08340-20086
A40MP10	86701-40001	9	2	EXTRACTOR-PC BOARD	28480	86701-40001
A40MP11	86701-40001	9		EXTRACTOR-PC BOARD	28480	86701-40001
A40Q1	1854-0610	0	2	TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A40Q2	1854-0610	0		TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A40Q3	1854-0345	8	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A40Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A40Q5	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A40Q6	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A40R1	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0±100	24546	C4-1/8-TO-2611-F
A40R2	2100-3273	1	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	28480	2100-3273
A40R3	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0±100	24546	C4-1/8-TO-1621-F
A40R4	2100-3273	1		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	28480	2100-3273
A40R5	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0±100	24546	C4-1/8-TO-1622-F
A40R6	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-TO-101-F
A40R7	0698-7205	0	2	RESISTOR 51.1 1% .05W F TC=0±100	24546	C3-1/8-TO-51R1-F
A40R8	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0±100	24546	C3-1/8-TO-51R1-F
A40R9	0757-0346	2	4	RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-TO-10R0-F
A40R10	0698-7228	7	2	RESISTOR 464 1% .05W F TC=0±100	24546	C3-1/8-TO-464R-F
A40R11	0698-7228	7		RESISTOR 464 1% .05W F TC=0±100	24546	C3-1/8-TO-464R-F
A40R12	0698-7188	8	1	RESISTOR 10 1% .05W F TC=0±100	24546	C3-1/8-TO-10R-F
A40R13	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-TO-10R0-F
A40R14	0757-0398	4	4	RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-TO-75R0-F
A40R15	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-TO-75R0-F
A40R16	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0±100	24546	C4-1/8-TO-619R-F
A40R17	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-TO-10R0-F
A40R18	0757-0419	0	3	RESISTOR 681 1% .125W F TC=0±100	24546	C4-1/8-TO-681R-F
A40R19	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-TO-10R0-F
A40R20	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0±100	24546	C4-1/8-TO-90R9-F
A40R21	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-TO-75R0-F
A40R22	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-TO-75R0-F
A40R23	0757-0401	0		RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-TO-101-F
A40R24	0698-4037	0	1	RESISTOR 46.4 1% .125W F TC=0±100	24546	C4-1/8-TO-46R4-F
A40R25	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-TO-1961-F
A40R26	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1001-F
A40R27	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-TO-196R-F
A40R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1001-F
A40R29	0757-0316	6	1	RESISTOR 42.2 1% .125W F TC=0±100	24546	C4-1/8-TO-42R2-F
A40R30	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1001-F
A40R31	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1001-F
A40R32	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-TO-383R-F
A40R33	0698-3444	1	2	RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-TO-316R-F
A40R34	0757-0419	0		RESISTOR 681 1% .125W F TC=0±100	24546	C4-1/8-TO-681R-F
A40R35	0698-3444	1		RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-TO-316R-F
A40R36	0757-0419	0		RESISTOR 681 1% .125W F TC=0±100	24546	C4-1/8-TO-681R-F
A40R37	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-TO-1002-F
A40R38	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-TO-1002-F
A40R39	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-TO-1003-F
A40R40	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1001-F
A40R41	0757-0401	0		RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-TO-101-F
A40R42	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0±100	24546	C4-1/8-TO-68R1-F
A40R43	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0±100	24546	C4-1/8-TO-2610-F
A40R44	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-TO-511R-F
A40T1	08553-6012	5	1	TRANSFORMER-RF (BLUE)	28480	08553-6012
A40TP1	0360-0535	0	1	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A40U1	1820-1383	5	2	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A40U2	1820-1383	5		IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A40U3	1820-2047	0	1	IC DIVR ECL QUINARY	52648	SP8622BDG
A40U4	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A40U5	1820-0802	1	3	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A40U6	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A40U7	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A40W1	08340-60110	2	1	CABLE ASSEMBLY- A40	28480	08340-60110

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A41	**08340-60162**	**4**	**1**	**PLL2 PHASE DETECTOR**	**28480**	**08340-60162**
A41C1	0180-0197	8	4	CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A41C2	0160-0574	3	1	CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A41C3	0160-3879	7	3	CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A41C4	0160-0127	2	2	CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A41C5	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A41C6				NOT ASSIGNED		
A41C7	0160-5609	5	1	CAPACITOR- MPC 10.0 UF 50VDC	28480	0160-5609
A41C8	0160-4084	8	4	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A41C9	0160-0573	2	1	CAPACITOR-FXD 4700PF +20% 100VDC CER	28480	0160-0573
A41C10	0160-2199	2	1	CAPACITOR-FXD 30PF +5% 300VDC MICA	28480	0160-2199
A41C11	0180-0291	3	3	CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A41C12	0180-0291	3		CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A41C13	0160-4535	4	1	CAPACITOR-FXD 1UF +10% 50VDC CER	28480	0160-4535
A41C14	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A41C15	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A41C16	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A41C17	0180-0291	3		CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A41C18	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A41C19	0180-0197	8		CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A41C20	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A41C21	0180-0197	8		CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A41C22	0180-0197	8		CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A41C23	0160-2437	1	2	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A41C24	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A41CR1	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A41CR2	1901-0376	6	2	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A41CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A41CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A41CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A41CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A41L1	9100-1651	2	1	INDUCTOR RF-CH-MLD 750UH 5% .2DX.45LG	28480	9100-1651
A41L2	9140-0144	0	3	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A41L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A41L4	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A41MP1	2190-0009	4	2	WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
A41MP2	2190-0009	4		WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
A41MP3	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A41MP4	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A41MP5	2580-0002	4	2	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
A41MP6	2580-0002	4		NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
A41MP7	08340-20087	8	1	COVER-PC 2 PHASE DETECTOR	28480	08340-20087
A41MP8	86701-40001	9	2	EXTRACTOR-PC BOARD	28480	86701-40001
A41MP9	86701-40001	9		EXTRACTOR-PC BOARD	28480	86701-40001
A41Q1	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A41Q2	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A41Q3	1855-0386	9	1	TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A41Q4	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	02037	2N2907A
A41Q5	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	02037	2N2222A
A41Q6	1854-0404	0	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A41Q7	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A41Q8	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A41Q9	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A41Q10	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A41R1	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A41R2	0757-0317	7	2	RESISTOR 1.33K 1% .125W F TC=0+100	24546	C4-1/8-T0-1331-F
A41R3	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A41R4	0757-0317	7		RESISTOR 1.33K 1% .125W F TC=0+100	24546	C4-1/8-T0-1331-F
A41R5	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A41R6	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A41R7	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+100	28480	0757-0123
A41R8	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+100	24546	C4-1/8-T0-4640-F
A41R9	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A41R10	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+100	28480	0698-3260
A41R11	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+100	19701	MF4C1/8-T0-6191-F
A41R12	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A41R13	0698-0084	9	3	RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A41R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A41R15	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A41R16	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A41R17	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1212-F
A41R18	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A41R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A41R20	0698-3445	2	3	RESISTOR 348 1% .125W F TC=0+100	24546	C4-1/8-T0-348R-F
A41R21	0698-3445	2		RESISTOR 348 1% .125W F TC=0+100	24546	C4-1/8-T0-348R-F
A41R22	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A41R23	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A41R24	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+100	24546	C4-1/8-T0-4222-F
A41R25	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+100	24546	C4-1/8-T0-7502-F
A41R26	0757-0467	8	1	RESISTOR 121K 1% .125W F TC=0+100	24546	C4-1/8-T0-1213-F
A41R27	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+100	24546	C4-1/8-T0-2373-F
A41R28	0698-3460	1	1	RESISTOR 422K 1% .125W F TC=0+100	28480	0698-3460
A41R29	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A41R30	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A41R31	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A41R32	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A41R33	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A41R34	0698-3445	2		RESISTOR 348 1% .125W F TC=0+100	24546	C4-1/8-T0-348R-F
A41R35	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A41R36	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A41TP1	0360-0535	0	5	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A41TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A41TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A41TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A41TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A41U1	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A41U2	1826-0459	6	1	IC OP AMP 14-DIP-C PKG	27014	LH0042CD
A41U3	1826-0471	2	1	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A41U4	1826-0059	2	1	IC OP AMP GP TO-99 PKG	01295	LM201AL
A41U5	1820-0429	8	1	IC V RGLTR TO-39	18324	LM309H
A41U6	1820-1212	9	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112AN
A41U7	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A41U8	1820-1194	6	2	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS193N
A41U9	1820-1194	6		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS193N
A41U10	1826-0448	3	1	IC- 7533C P1 DAC	24355	AD7520LN(SEL)
A41VR1				NOT ASSIGNED		
A41VR2	1902-0041	4	2	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A41VR3	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A41VR4	1902-3002	3	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A42	**08340-60048**	**5**	**1**	**PPL2 DIVIDER**	**28480**	**08340-60048**
A42C1	0160-3877	5	2	CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A42C2	0160-3879	7	2	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A42C3	0160-4084	8	12	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C4	0160-3877	5		CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A42C5	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C6	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C7	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C8	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A42C9	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C10	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C11	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C12	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C13	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C14	0160-0570	9	1	CAPACITOR-FXD 220PF ±20% 100VDC CER	20932	5024EM100RD221M
A42C15	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C16	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C17	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A42C18	0180-1746	5	2	CAPACITOR-FXD 15UF±10% 20VDC TA	56289	150D156X9020B2
A42C19	0180-1746	5		CAPACITOR-FXD 15UF±10% 20VDC TA	56289	150D156X9020B2
A42CR1	1901-0743	1	2	DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A42CR2	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A42J1	1250-0544	9	1	CONNECTOR-RF MALE SMB	28480	1250-0544
A42L1	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A42L2	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A42L3	9100-1618	1	2	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A42L4	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A42MP1	2190-0124	4	1	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A42MP2	2200-0101	0	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A42MP3	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A42MP4	2950-0078	9	1	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A42MP5	08340-20088	9	1	COVER-PC PLL2 DRIVER	28480	08340-20088
A42MP6	86701-40001	9	2	EXTRACTOR-PC BOARD	28480	86701-40001
A42MP7	86701-40001	9		EXTRACTOR-PC BOARD	28480	86701-40001
A42Q1	1854-0546	1	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A42Q2	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A42R1	0757-0276	7	1	RESISTOR 61.9 1% .125W F TC=0±100	24546	C4-1/8-T0-6192-F
A42R2	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-T0-3161-F
A42R3	0757-0280	3	7	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A42R4	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0±100	24546	C4-1/8-T0-56R2-F
A42R5	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A42R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A42R7	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-T0-316R-F
A42R8	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
A42R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A42R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A42R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A42R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A42R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A42R14	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A42TP1	0360-0535	0	5	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A42TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A42TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A42TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A42TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A42U1	1820-1888	5	1	IC PRESCR ECL	04713	MC12013L
A42U2	1820-0681	4	1	IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
A42U3	1820-0629	0	2	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A42U4	1820-1251	6	5	IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A42U5	1820-0909	9	2	IC MULTR TTL	01295	SN74167N
A42U6	1820-0909	9		IC MULTR TTL	01295	SN74167N
A42U7	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A42U8	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A42U9	1820-0686	9	1	IC GATE TTL S AND TPL 3-INP	01295	SN74S11N
A42U10	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A42U11	1820-0261	6	1	IC MV TTL MONOSTBL	01295	SN74121N
A42U12	1820-1196	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A42U13	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A42U14	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A42U15	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N

See introduction to this section for ordering information
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Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A42U16	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A42W1	08340-60111	3	1	CABLE ASSEMBLY- A42	28480	08340-60111

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A43	**08340-60049**	**6**	**1**	**PLL2 DISCRIMINATOR**	**28480**	**08340-60049**
A43C1	0160-4084	8	10	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C2	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C3	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C4	0180-0291	3	1	CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A43C5	0180-0197	8	2	CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A43C6	0180-0197	8		CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A43C7	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C8	0180-0229	7	1	CAPACITOR-FXD 33UF+10% 10VDC TA	56289	150D336X9010B2
A43C9	0160-3879	7	3	CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A43C10	0160-2199	2	2	CAPACITOR-FXD 30PF +5% 300VDC MICA	28480	0160-2199
A43C11	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C12	0160-0571	0	1	CAPACITOR-FXD 470PF +20% 100VDC CER	28480	0160-0571
A43C13	0160-0127	2	2	CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A43C14	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C15	0160-4605	9	1	CAPACITOR-CER 36 PF 500VDC	28480	0160-4605
A43C16	0160-2252	8	1	CAPACITOR-FXD 6.2PF +.25PF 500VDC CER	28480	0160-2252
A43C17	0160-3877	5	2	CAPACITOR-FXD 100PF +20% 200VDC CER	28480	0160-3877
A43C18	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C19	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C20	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A43C21	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C22	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A43C23	0160-0161	4	1	CAPACITOR-FXD .01UF +10% 200VDC POLYE	28480	0160-0161
A43C24	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A43C25	0160-3456	6	1	CAPACITOR-FXD 1000PF +10% 1KVDC CER	28480	0160-3456
A43C26	0160-2199	2		CAPACITOR-FXD 30PF +5% 300VDC MICA	28480	0160-2199
A43C27	0160-3877	5		CAPACITOR-FXD 100PF +20% 200VDC CER	28480	0160-3877
A43C28	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A43C29	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A43CR1	1901-0539	3	2	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A43CR2	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A43J1	1250-0544	9	1	CONNECTOR-RF MALE SMB	28480	1250-0544
A43L1	9140-0144	0	4	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A43L2	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A43L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A43L4	9140-0392	0	1	INDUCTOR RF-CH-MLD 22UH 3% .166DX.385LG	28480	9140-0392
A43L5	9100-1629	4	1	INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A43L6	9100-1666	9	1	INDUCTOR RF-CH-MLD 3.6MH 5% .23DX.57LG	28480	9100-1666
A43L7	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A43MP1				NOT ASSIGNED		
A43MP2				NOT ASSIGNED		
A43MP3	1205-0250	9	1	THERMAL LINK SGL TO-5/TO-39-CS	28480	1205-0250
A43MP4	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
A43MP5	2190-0124	4	1	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A43MP6	2200-0101	0	5	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A43MP7	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A43MP8	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A43MP9	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A43MP10	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A43MP11	2200-0164	5	1	SCREW-MACH 4-40 .188-IN-LG UNCT 82 DEG	00000	ORDER BY DESCRIPTION
A43MP12	2580-0002	4	1	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
A43MP13	2950-0078	9	1	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A43MP14	08340-00037	6	1	SHIELD-PLL2 DISCRIMINATOR	28480	08340-00037
A43MP15	08340-20089	0	1	COVER-PC 2 DISCRIMINATOR	28480	08340-20089
A43MP16	86701-40001	9	1	EXTRACTOR-PC BOARD	28480	86701-40001
A43Q1	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A43Q2	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A43Q3	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A43Q4	1855-0413	3	1	TRANSISTOR J-FET P-CHAN D-MODE TO-18 SI	27014	2N5116
A43Q5	1853-0269	3	1	TRANSISTOR-DUAL PNP 2N3809 PD=600MW	01295	2N3809
A43Q6	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A43Q7	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A43Q8	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A43Q9	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A43Q10	1853-0388	7	1	TRANSISTOR-DUAL PNP PD=600MW	28480	1853-0388
A43Q11	1853-0034	0	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A43R1	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A43R2	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-2152-F
A43R3	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+100	28480	0757-0123

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A43R4	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A43R5	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A43R6	0699-0078	3	3	RESISTOR-FXD 2.1K OHM .1% .1W	28480	0699-0078
A43R7	0699-0078	3		RESISTOR-FXD 2.1K OHM .1% .1W	28480	0699-0078
A43R8	0699-0078	3		RESISTOR-FXD 2.1K OHM .1% .1W	28480	0699-0078
A43R9	2100-1739	0	1	RESISTOR-TRMR 5K 10% WW SIDE-ADJ 20-TRN	02660	3810P-502
A43R10	0699-0082	9	1	RESISTOR-FXD 215 OHM .1% .1W	28480	0699-0082
A43R11	0757-0280	3	9	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R14	0698-3153	9	2	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A43R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R16	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A43R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R18	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A43R19	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A43R20	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A43R21	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A43R22	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R23	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A43R24	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A43R25	2100-1972	3	1	RESISTOR-TRMR 20K 10% WW SIDE-ADJ 20-TRN	02660	3810P-203
A43R26	0699-0081	8	1	RESISTOR-FXD 390.1K OHM .1% .12W	28480	0699-0081
A43R27	2100-2851	9	1	RESISTOR-TRMR 2K 10% WW SIDE-ADJ 20-TRN	02660	3810P-202
A43R28	0699-0080	7	1	RESISTOR-FXD 39K OHM .1% .12W	28480	0699-0080
A43R29	0698-3499	6	3	RESISTOR 40.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4022-F
A43R30	0698-3499	6		RESISTOR 40.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4022-F
A43R31	0698-3499	6		RESISTOR 40.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4022-F
A43R32	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A43R33	0699-0084	1	1	RESISTOR-FXD 6.19K OHM .1% .1W	28480	0699-0084
A43R34	0699-0083	0	1	RESISTOR-FXD 681 OHM .1% .1W	28480	0699-0083
A43R35	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A43R36	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A43R37	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A43R38	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R39	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R40	0699-0079	4	1	RESISTOR-FXD 4.667K OHM .1% .1W	28480	0699-0079
A43R41	2100-1799	2	1	RESISTOR-TRMR 500 10% WW SIDE-ADJ 20-TRN	02660	3810P-501
A43R42	0698-8831	0	1	RESISTOR 13.4K .1% .125W F TC=0+-10	28480	0698-8831
A43R43	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1211-F
A43R44	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A43R45	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A43R46	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A43R47	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A43R48	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A43R49	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A43R50	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A43TP1	0360-0535	0	6	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A43TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A43TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A43TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A43TP5				See A43C29		
A43TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A43TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A43U1	1826-0811	4	2	ANALOG SWITCH 4 SPST 16 CERDIP	02180	SW-01FQ
A43U2	1826-0811	4		ANALOG SWITCH 4 SPST 16 CERDIP	02180	SW-01FQ
A43U3	1826-0471	2	1	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A43U4	1820-0223	0	2	IC OP AMP GP TO-99 PKG	3L585	CA301AT
A43U5	1820-0429	8	1	IC V RGLTR TO-39	18324	LM309H
A43U6	1820-1194	6	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS193N
A43U7	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A43U8	1826-0353	9	1	IC 78L15 V RGLTR TO-39	07263	UA78L15ACH
A43U9	1820-1196	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A43U10	1826-0059	2	1	IC OP AMP GP TO-99 PKG	01295	LM201AL
A43U11	1826-0448	3	1	IC CONV 10-B-D/A 16-DIP-P PKG	24355	AD7520LN(SEL)
A43U12	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A43U13	1820-0223	0		IC OP AMP GP TO-99 PKG	3L585	CA301AT
A43VR1	1902-0692	1	1	DIODE-ZNR 6.3V 1% DO-7 PD=.4W TC=+.001%	28480	1902-0692
A43W1	08340-60112	4	1	CABLE ASSEMBLY- A43	28480	08340-60112

See introduction to this section for ordering information. *Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A44	**5086-7323**	1	1	**YIG OSCILLATOR 2.3 60 7.0 GHZ** (5086-7323 INCLUDES A44 YIG OSCILLATOR AND A44A1 BIAS BOARD.)	**28480**	**5086-7323**
	5086-6323	9	1	EXCHANGE 5086-7323 YIG OSCILLATOR	28480	5086-6323
A44A1	5061-1089	2	1	YIG OSCILLATOR BIAS BOARD	28480	5061-1089
A44A1C1	0160-0127	2	2	CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A44A1C2	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A44A1C3	0160-0299	9	1	CAPACITOR-FXD 1800PF +10% 200VDC POLYE	28480	0160-0299
A44A1C4	0170-0040	9	1	CAPACITOR-FXD .047UF +10% 200VDC POLYE	56289	292P47392
A44A1C5	0160-0161	4	1	CAPACITOR-FXD .01UF +10% 200VDC POLYE	28480	0160-0161
A44A1CR1	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A44A1J1	1200-0482	9	2	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A44A1J2	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A44A1MP1	1251-2194	1	2	CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	28480	1251-2194
A44A1MP2	1251-3172	7	2	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A44A1MP3	0380-1104	3	2	SPACER- .094 L .152 ID	00000	ORDER BY DESCRIPTION
A44A1Q1	1853-0038	4	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A44A1Q2	1884-0009	4	1	THYRISTOR-SCR TO-5 VRRM=200	03508	C6B
A44A1R1	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+100	24546	C4-1/8-T0-4222-F
A44A1R2	0698-3452	1	1	RESISTOR 147K 1% .125W F TC=0+100	24546	C4-1/8-T0-1473-F
A44A1R3	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A44A1R4	2100-1986	9	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	82PR1K
A44A1R5	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+100	24546	C4-1/8-T0-3831-F
A44A1R6	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-2152-F
A44A1R7	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A44A1R8	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A44A1R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A44A1TP1	0360-0535	0	6	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A44A1TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A44A1TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A44A1TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A44A1TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A44A1TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A44A1VR1	1902-0579	3	2	DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579
A44A1VR2	1902-0579	3		DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579
A44A1VR3	1902-3404	9	1	DIODE-ZNR 82.5V 5% DO-7 PD=.4W TC=+.082%	28480	1902-3404
A44A1W1	1460-1489	8	1	WIREFORM BE CU AG	28480	1460-1489
A44MP1	5001-1559	5	1	INSULATOR	28480	5001-1559
A44MP2	2360-0115	4	2	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A45	0955-0098		1	DIRECTIONAL COUPLER (ORDER THE REPLACEMENT KIT BELOW IF INSTRUMENT IS EQUIPPED WITH A 5086-7305 OR 5086-6305 PRE-LEVELER. INSTRUMENTS WITH A SERIAL PREFIX OF 2405A OR BELOW WERE ORIGINALLY EQUIPPED WITH A PRELEVELER	28480	0955-0098
	08340-60207	8	1	REPLACEMENT KIT FOR 5086-7305 (AND 5086-6305) PRELEVELER. (INCLUDES DIRECTIONAL COUPLER, 15 DB ATTENUATOR, AND REQUIRED CABLES)	28480	08340-60207

See introduction to this section for ordering information.

*Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A46	9135-0165	4	1	**7.0 GHZ LOW PASS FILTER**	28480	9135-0165
A47	08340-60094	1	1	**SENSE RESISTOR ASSEMBLY**	28480	08340-60094
				NOTE See Figure 6-1 for mechanical parts location.		
A47C1	0160-4835	7	1	CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A47MP1	0340-0162	7	1	INSULATOR-XSTR ALUMINUM	28480	0340-0162
A47MP2	08340-60128	2	1	CBL AY SEN RES S	28480	08340-60128
A47MP3	0360-0268	6	1	TERMINAL-SLDR LUG LK-MTG FOR-#6-SCR	28480	0360-0268
A47MP4	08340-60129	3	1	CBL AY SEN RES L	28480	08340-60129
A47MP5	0400-0009	9	1	GROMMET-RND .125-IN-ID .25-IN-GRV-OD	28480	0400-0009
A47MP6	0400-0011	3	2	GROMMET-RND .375-IN-ID .5-IN-GRV-OD	28480	0400-0011
A47MP7	0400-0011	3		GROMMET-RND .375-IN-ID .5-IN-GRV-OD	28480	0400-0011
A47MP8	0520-0127	6	10	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP9	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP10	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP11	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP12	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP13	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP14	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP15	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP16	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP17	0520-0127	6		SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP18	0624-0305	2	4	SCREW-TPG 6-20 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP19	0624-0305	2		SCREW-TPG 6-20 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP20	0624-0305	2		SCREW-TPG 6-20 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP21	0624-0305	2		SCREW-TPG 6-20 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP22	0890-0094	9	1	TUBING-FLEX .051-ID TFE .016-WALL	00000	ORDER BY DESCRIPTION
A47MP23	1200-0043	8	1	INSULATOR-XSTR ALUMINUM	28480	1200-0043
A47MP24	1200-0456	7	1	SOCKET-XSTR 2-CONT TO-3	28480	1200-0456
A47MP25	1200-0457	8	1	SOCKET-XSTR 2-CONT TO-66	28480	1200-0457
A47MP26-28	2190-0006	1	3	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
A47MP29	2190-0014	1	10	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP30	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP31	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP32	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP33	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP34	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP35	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP36	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP37	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP38	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A47MP39	2200-0103	2	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP40	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP41	2360-0113	2	2	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP42	2360-0113	2		SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP43	2360-0203	1	4	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP44	2360-0203	1		SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP45	2360-0203	1		SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP46	2360-0203	1		SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A47MP47	3050-0003	3	4	WASHER-FL NM NO. 6 .141-IN-ID .375-IN-OD	28480	3050-0003
A47MP48	3050-0003	3		WASHER-FL NM NO. 6 .141-IN-ID .375-IN-OD	28480	3050-0003
A47MP49	3050-0003	3		WASHER-FL NM NO. 6 .141-IN-ID .375-IN-OD	28480	3050-0003
A47MP50	3050-0003	3		WASHER-FL NM NO. 6 .141-IN-ID .375-IN-OD	28480	3050-0003
A47MP51	3050-0005	5	4	WASHER-SHLDR NO. 6 .14-IN-ID .375-IN-OD	28480	3050-0005
A47MP52	3050-0005	5		WASHER-SHLDR NO. 6 .14-IN-ID .375-IN-OD	28480	3050-0005
A47MP53	3050-0005	5		WASHER-SHLDR NO. 6 .14-IN-ID .375-IN-OD	28480	3050-0005
A47MP54	3050-0005	5		WASHER-SHLDR NO. 6 .14-IN-ID .375-IN-OD	28480	3050-0005
A47MP55	3050-0227	3	4	WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
A47MP56	3050-0227	3		WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
A47MP57	3050-0227	3		WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
A47MP58	3050-0227	3		WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
A47MP59	6960-0016	0	4	PLUG-HOLE TR-HD FOR .125-D-HOLE NYL	28480	6960-0016
A47MP60	6960-0016	0		PLUG-HOLE TR-HD FOR .125-D-HOLE NYL	28480	6960-0016
A47MP61	6960-0016	0		PLUG-HOLE TR-HD FOR .125-D-HOLE NYL	28480	6960-0016
A47MP62	6960-0016	0		PLUG-HOLE TR-HD FOR .125-D-HOLE NYL	28480	6960-0016
A47MP63	08340-00033	2	1	BCKT CURRNT SENS	28480	08340-00033
A47MP64	08340-00046	7	1	BOX-CURRNT SENS	28480	08340-00046
A47MP65	08340-00048	9	1	MTG PLATE	28480	08340-00048
A47Q1	1854-0237	7	1	TRANSISTOR NPN SI TO-66 PD=20W FT=10MHZ	28480	1854-0237
A47Q2	1854-0080	8	1	TRANSISTOR NPN SI TO-3 PD=100MW FT=300 MHZ	02037	SJ1515

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A47R1	0811-3571	7	4	RESISTOR 60 1% 12W PW TC=0±2	28480	0811-3571
A47R2	0811-3571	7		RESISTOR 60 1% 12W PW TC=0±2	28480	0811-3571
A47R3	0811-3571	7		RESISTOR 60 1% 12W PW TC=0±2	28480	0811-3571
A47R4	0811-3571	7		RESISTOR 60 1% 12W PW TC=0±2	28480	0811-3571
A47R5	0811-1100	4	1	RESISTOR 3 1% 12W PW TC=0±5	28480	0811-1100
A47R6	0811-3597	7	1	RESISTOR 97.5 .25% 25W PW TC = 0 ±2	28480	0811-3597
A47W1	08340-60128	2	1	CBL AY SEN RES S	28480	08340-60128
A47W2	08340-60129	3	1	CBL AY SEN RES L	28480	08340-60129
A47W3	8151-0010	1	1	WIRE 16AWG 1X16	28480	8151-0010

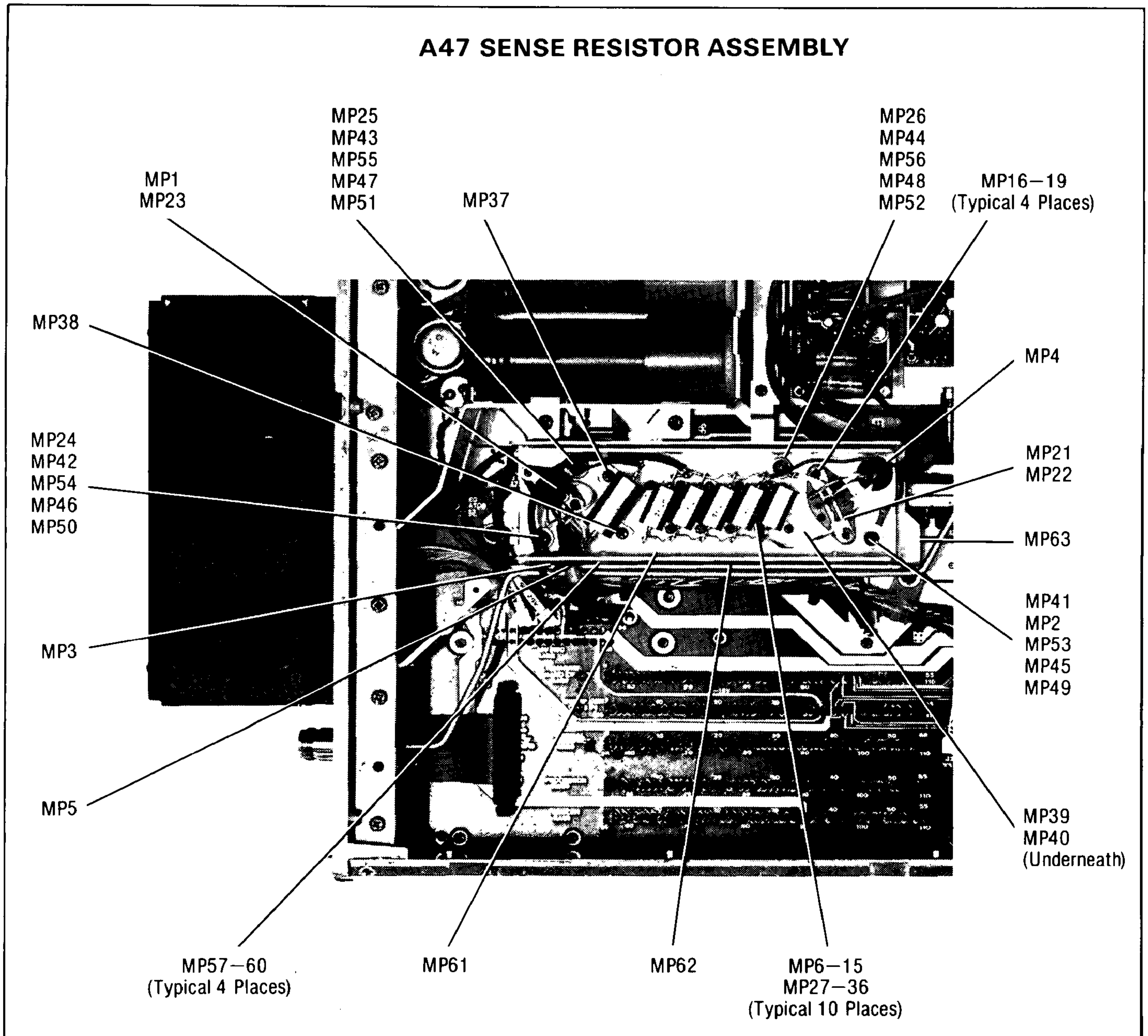

Figure 6-1. A47 Sense Resistor Assembly Mechanical Parts Location

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A48	08340-60028	1	1	SAMPLER AMPIFIER, NOT SEPERATELY REPLACEABLE, ORDER 08340-60177 (INCLUDES A48, A49, AND HOUSING)		
A48C1	0121-0046	2	2	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304322 9/35PF N650
A48C2	0121-0046	2		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304322 9/35PF N650
A48C3	0180-0197	8	2	CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A48C4	0180-0116	1	1	CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A48C5	0160-2055	9	11	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C6	0160-2150	5	1	CAPACITOR-FXD 33PF +5% 300VDC MICA	28480	0160-2150
A48C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C8	0160-3878	6	3	CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A48C9	0180-0197	8		CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A48C10	0160-2264	2	1	CAPACITOR-FXD 20PF +5% 500VDC CER 0+30	28480	0160-2264
A48C11	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A48C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C13	0180-0228	6	1	CAPACITOR-FXD 22UF+10% 15VDC TA	56289	150D226X9015B2
A48C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C16				NOT ASSIGNED		
A48C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C18	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A48C19	0160-3879	7	4	CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A48C20	0160-0939	4	1	CAPACITOR-FXD 430PF +5% 300VDC MICA	28480	0160-0939
A48C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C22	0140-0195	2	1	CAPACITOR-FXD 130PF +5% 300VDC MICA	72136	DM15F131J0300WV1CR
A48C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C24	0140-0193	0	2	CAPACITOR-FXD 82PF +5% 300VDC MICA	72136	DM15E820J0300WV1CR
A48C25	0140-0193	0		CAPACITOR-FXD 82PF +5% 300VDC MICA	72136	DM15E820J0300WV1CR
A48C26	0160-2308	5	1	CAPACITOR-FXD 36PF +5% 300VDC MICA	28480	0160-2308
A48C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C29	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A48C30	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A48C31	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A48C32	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A48E1	1251-3172	7	3	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A48E2	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A48E3	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A48J1				SEE "MISCELLANEOUS YO LOOP PARTS" AT THE END OF TABLE 6-3.		
A48J2				SEE "MISCELLANEOUS YO LOOP PARTS" AT THE END OF TABLE 6-3.		
A48L1				STRIP LINE ON P.C. BOARD		
A48L2	9140-0144	0	1	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A48L3	9100-1623	8	1	INDUCTOR RF-CH-MLD 27UH 5% .166DX.385LG	28480	9100-1623
A48L4	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A48L5	9100-2258	7	2	INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A48L6	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A48L7	9135-0073	3	1	INDUCTOR RF-CH-MLD 51NH 6% .102DX.26LG (RECOMMENDED REPLACEMENT)	28480	9135-0073
A48L8, 9				STRIP LINE ON P. C. BOARD		
A48L10	9140-0539	7	1	INDUCTOR RF-CH-MLD 3UH 5% .105DX.26LG	28480	9140-0539
A48L11	9100-0368	6	1	INDUCTOR RF-CH-MLD 330NH 10% .105DX.26LG	28480	9100-0368
A48L12	9100-2249	6	2	INDUCTOR RF-CH-MLD 150NH 10% .105DX.26LG	28480	9100-2249
A48L13	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A48L14	9100-2249	6		INDUCTOR RF-CH-MLD 150NH 10% .105DX.26LG	28480	9100-2249
A48MP1				NOT ASSIGNED		
A48MP2	1205-0011	0	2	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A48MP3				NOT ASSIGNED		
A48MP4				NOT ASSIGNED		
A48MP5	1205-0011	0		HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A48MP6, 7	4330-0145	9	2	INSULATOR-BEAD GLASS	28480	4330-0145
A48Q1	1854-0247	9	3	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A48Q2	1854-0345	8	3	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A48Q3	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A48Q4	1855-0235	7	1	TRANSISTOR J-FET N-CHAN D-MODE TO-52 SI	28480	1855-0235
A48Q5	1853-0015	7	1	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A48Q6	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A48Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A48Q8	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				NOTE **A48R1, R28, AND R29 MUST BE REPLACED AT THE SAME TIME**		
A48R1	2100-3212	8	1	RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN (RECOMMENDED REPLACEMENT)	28480	2100-3212
A48R2	0757-0394	0	5	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A48R3	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A48R4	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A48R5	0757-0424	7	3	RESISTOR 1.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1101-F
A48R6	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A48R7	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+100	24546	C4-1/8-T0-1781-F
A48R8	0757-0796	6	1	RESISTOR 82.5 1% .5W F TC=0+100	28480	0757-0796
A48R9	0757-0399	5	1	RESISTOR 82.5 1% .125W F TC=0+100	24546	C4-1/8-T0-82R5-F
A48R10	0698-3457	6	1	RESISTOR 316K 1% .125W F TC=0+100	28480	0698-3457
A48R11	0757-0470	3	1	RESISTOR 162K 1% .125W F TC=0+100	24546	C4-1/8-T0-1623-F
A48R12				NOT ASSIGNED		
A48R13	0698-7216	3	1	RESISTOR 147 1% .05W F TC=0+100	24546	C3-1/8-TO-147R-F
A48R14				NOT ASSIGNED		
A48R15	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1101-F
A48R16	0757-0398	4	1	RESISTOR 75 1% .125W F TC=0+100	24546	C4-1/8-T0-75R0-F
A48R17	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1101-F
A48R18	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+100	24546	C4-1/8-T0-681R-F
A48R19	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A48R20	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0+100	24546	C3-1/8-TO-316R-F
A48R21	0698-7212	9	1	RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-TO-100R-F
A48R22	0698-7195	7	1	RESISTOR 19.6 1% .05W F TC=0+100	24546	C3-1/8-TO-19R6-F
A48R23	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A48R24	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-TO-2151-F
A48R25	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+100	24546	C4-1/8-T0-4640-F
A48R26	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A48R27	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A48R28	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+100 (RECOMMENDED REPLACEMENT)	24546	C4-1/8-T0-147R-F
A48R29	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+100 (RECOMMENDED REPLACEMENT)	24546	C3-1/8-TO-422R-F
A48R30	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A48R31	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A48R32	0698-3439	4	2	RESISTOR 178 1% .125W F TC=0+100	24546	C4-1/8-T0-178R-F
A48R33	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A48R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A48R35	0698-3439	4		RESISTOR 178 1% .125W F TC=0+100	24546	C4-1/8-T0-178R-F
A48R36	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A48R37	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A48R38	0757-0276	7	2	RESISTOR 61.9 1% .125W F TC=0+100	24546	C4-1/8-T0-6192-F
A48R39	0757-0276	7		RESISTOR 61.9 1% .125W F TC=0+100	24546	C4-1/8-T0-6192-F
A48R40	0757-0189	2		RESISTOR 31.6 1% .125W F TC=0+100	24546	C4-1/8-T0-31R6-F
A48R41	0698-7196	8	1	RESISTOR 21.5 1% .05W F TC=0+100	24546	C3-1/8-TO-21R5-F
A48R42	0757-0294	9	1	RESISTOR 17.8 1% .125W F TC=0+100	24546	C4-1/8-TO-17R8-F
A48TP1	0360-0535	0	1	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A48U1	5086-7292	3	1	SAMPLER	28480	5086-7292

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A49	08340-60180	6	1	YO LOOP PHASE DETECTOR, NOT SEPERATELY REPLACEABLE, ORDER 08340-60177 (INCLUDES A48, A49, AND HOUSING)	28480	08340-60180
A49C1	0160-4805	1	2	CAPACITOR-FXD 47PF ±5% 100VDC CER 0±30	28480	0160-4805
A49C2	0160-4805	1		CAPACITOR-FXD 47PF ±5% 100VDC CER 0±30	28480	0160-4805
A49C3	0160-4526	3	1	CAPACITOR-FXD 42PF ±5% 200VDC CER 0±30	28480	0160-4526
A49C4	0160-4767	4	1	CAPACITOR-FXD 20PF ±5% 200VDC CER 0±30	28480	0160-4767
A49C5	0160-4918	7		CAPACITOR-FXD .022UF ±10% 50VDC CER	28480	0160-4918
A49C6	0160-4832	4	8	CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A49C7	0160-4918	7		CAPACITOR-FXD .022UF ±10% 50VDC CER	28480	0160-4918
A49C8	0160-4832	4		CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A49C9	0180-0116	1	1	CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A49C10	0180-0197	8	2	CAPACITOR-FXD 2.2UF±10% 20VDC TA	56289	150D225X9020A2
A49C11	0160-4918	7	4	CAPACITOR-FXD .022UF ±10% 50VDC CER	28480	0160-4918
A49C12	0160-4918	7		CAPACITOR-FXD .022UF ±10% 50VDC CER	28480	0160-4918
A49C13	0180-0197	8		CAPACITOR-FXD 2.2UF±10% 20VDC TA	56289	150D225X9020A2
A49C14	0160-4835	7	1	CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A49C15	0160-4932	5	2	CAPACITOR-FXD 750PF ±5% 100VDC CER	28480	0160-4932
A49C16	0160-4932	5		CAPACITOR-FXD 750PF ±5% 100VDC CER	28480	0160-4932
A49C17	0160-4832	4		CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A49C18	0160-4832	4		CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A49C19	0160-0162	5	1	CAPACITOR-FXD .022UF ±10% 200VDC POLYE	28480	0160-0162
A49C20	0160-4787	8	3	CAPACITOR-FXD 22PF ±5% 100VDC CER 0±30	28480	0160-4787
A49C21	0160-2290	4	1	CAPACITOR-FXD .15UF ±10% 80VDC POLYE	28480	0160-2290
A49C22	0160-4787	8		CAPACITOR-FXD 22PF ±5% 100VDC CER 0±30	28480	0160-4787
A49C23	0160-0164	7	1	CAPACITOR-FXD .039UF ±10% 200VDC POLYE	28480	0160-0164
A49C24	0160-3405	5	1	CAPACITOR-FXD 2UF ±10% 50VDC MET-POLYC	28480	0160-3405
A49C25	0160-4535	4	2	CAPACITOR-FXD 1UF ±10% 50VDC CER	28480	0160-4535
A49C26	0160-4535	4		CAPACITOR-FXD 1UF ±10% 50VDC CER	28480	0160-4535
A49C27	0160-4787	8		CAPACITOR-FXD 22PF ±5% 100VDC CER 0±30	28480	0160-4787
A49C28	0160-4832	4		CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A49C29	0160-4832	4		CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A49C30	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A49C31	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A49C32	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A49C33	0160-4832	4		CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A49C34	0160-4832	4		CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A49CR1	1901-0033	2	6	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A49CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A49CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A49CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A49CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A49CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A49CR7	1901-1098	1	2	DIODE-SWITCHING 1N4150 50V 200MA 4NS	28480	1901-1098
A49CR8	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	28480	1901-1098
A49E1	1251-4932	9	2	CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	91506	LSG-1AG14-1
A49E2	1251-4932	9		CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	91506	LSG-1AG14-1
A49J1	1250-0258	2	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0258
A49J2	1250-0258	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0258
A49J3	1250-0691	7	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0691
A49J4	1250-0691	7		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0691
A49J5	1250-1889	7	2	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A49J6	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A49L1	9100-0368	6	2	INDUCTOR RF-CH-MLD 330NH 10% .105DX.26LG	28480	9100-0368
A49L2	9100-2254	3	2	INDUCTOR RF-CH-MLD 390NH 10% .105DX.26LG	28480	9100-2254
A49L3	9100-2254	3		INDUCTOR RF-CH-MLD 390NH 10% .105DX.26LG	28480	9100-2254
A49L4	9100-0368	6		INDUCTOR RF-CH-MLD 330NH 10% .105DX.26LG	28480	9100-0368
A49L5	9100-1641	0	2	INDUCTOR RF-CH-MLD 240UH 5% .166DX.385LG	28480	9100-1641
A49L6	9100-1620	5	3	INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A49L7	9100-1641	0		INDUCTOR RF-CH-MLD 240UH 5% .166DX.385LG	28480	9100-1641
A49L8	9100-1620	5		INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A49L9	9100-1620	5		INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A49Q1	1854-0404	0	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A49Q2	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A49Q3	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A49R1	0698-7212	9	4	RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-TO-100R-F
A49R2	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-TO-100R-F
A49R3	0698-7219	6	2	RESISTOR 196 1% .05W F TC=0±100	24546	C3-1/8-TO-196R-F
A49R4	0757-0401	0	8	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-TO-101-F
A49R5	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-TO-100R-F
A49R6	0698-7219	6		RESISTOR 196 1% .05W F TC=0±100	24546	C3-1/8-TO-196R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A49R7	0698-3122	2	2	RESISTOR 412 1% .125W F TC=0+100	03888	PME55-1/8-T0-4120-F
A49R8	0698-3122	2		RESISTOR 412 1% .125W F TC=0+100	03888	PME55-1/8-T0-4120-F
A49R9	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A49R10	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A49R11	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A49R12	0698-3445	2	2	RESISTOR 348 1% .125W F TC=0+100	24546	C4-1/8-T0-348R-F
A49R13	0698-3445	2		RESISTOR 348 1% .125W F TC=0+100	24546	C4-1/8-T0-348R-F
A49R14	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A49R15	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A49R16	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A49R17	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+100	24546	C4-1/8-T0-1781-F
A49R18	0757-0317	7	2	RESISTOR 1.33K 1% .125W F TC=0+100	24546	C4-1/8-T0-1331-F
A49R19	0698-0085	0	2	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A49R20	0757-0288	1	2	RESISTOR 9.09K 1% .125W F TC=0+100	19701	MF4C1/8-T0-9091-F
A49R21	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A49R22	0698-7277	6	1	RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A49R23	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A49R24	0698-7267	4	1	RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F
A49R25	0757-0416	7	4	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A49R26	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A49R27	0698-4020	1	1	RESISTOR 9.53K 1% .125W F TC=0+100	24546	C4-1/8-T0-9531-F
A49R28	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A49R29	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A49R30	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A49R31	0757-0317	7		RESISTOR 1.33K 1% .125W F TC=0+100	24546	C3-1/8-T0-1331-F
A49R32	0698-7241	4	2	RESISTOR 1.62K 1% .05W F TC=0+100	24546	C3-1/8-T0-1621-F
A49R33	0698-7241	4		RESISTOR 1.62K 1% .05W F TC=0+100	24546	C3-1/8-TO-1621-F
A49R34	0757-0288	1		RESISTOR 9.09K 1% .125W F TC=0+100	19701	MF4C1/8-T0-9091-F
A49R35	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+100	24546	C4-1/8-T0-121R-F
A49R36	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A49R37	0757-0346	2	3	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A49R38	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A49R39	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A49R40	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A49R41	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A49R42	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A49R43	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A49R44	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A49R45	0698-7273	2	2	RESISTOR 34.8K 1% .05W F TC=0+100	28480	0698-7273
A49R46	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+100	24546	C4-1/8-TO-8251-F
A49R47	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+100	28480	0698-3150
A49R48	0698-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-TO-5111-F
A49R49	0698-7273	2		RESISTOR 34.8K 1% .05W F TC=0+100	28480	0698-7273
A49R50	0698-3452	1	1	RESISTOR 147K 1% .125W F TC=0+100	28480	0698-3452
A49A51	0698-7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C4-1/8-TO-100R-F
A49R52	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-TO-511R-F
A49R53	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-TO-10R0-F
A49R54	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-TO-10R0-F
A49TP1	0360-0535	0	5	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A49TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A49TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A49TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A49TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A49U1	1826-0783	9	3	IC OP AMP LOW-NOISE 8-DIP-C PKG	52063	XR5534ACN
A49U2	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	02037	SC76551GK
A49U3	1826-1145	9	1	IC AMP LOW-DROOP 14-DIP-C PKG	28480	1826-1145
A49U4	1826-0783	9		IC OP AMP LOW-NOISE 8-DIP-C PKG	52063	XR5534ACN
A49U5	1826-0783	9		IC OP AMP LOW-NOISE 8-DIP-C PKG	52063	XR5534ACN
A49U6	1820-1344	8	1	IC PL LOOP 14-DIP-C PKG	04713	MC12040L
A49U7	1810-0204	6	1	NETWORK-RES 8-SIP1.0K OHM X 7	01121	208A102
A49U8	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A49VR1	1902-1260	1	2	DIODE-ZNR 1N5525C 6.2V 2% DO-7 PD=.4W	04713	1N5525C
A49VR2	1902-1260	1		DIODE-ZNR 1N5525C 6.2V 2% DO-7 PD=.4W	04713	1N5525C
A49VR3	1902-3082	9	1	DIODE-ZNR 4.64V 5% DO-35 PD=.4W	28480	1902-3082
A49VR4	1902-3036	3	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A49VR5	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A49W1	1258-0124	7	1	PIN-PROGRAMING DUMPER .30 CONTACT	91506	8136-475G1

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A50	**08340-60030**	5	1	**YO LOOP INTERCONNECT**	**28480**	**08340-60030**
A50C1	0180-2614	8	3	CAPACITOR-FXD 100UF±10% 30VDC TA	56289	150D107X9030S2
A50C2	0160-4835	7	2	CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A50C3	0160-4835	7		CAPACITOR-FXD .1UF ±10% 50VDC CER	28480	0160-4835
A50C4	0180-2614	8		CAPACITOR-FXD 100UF±10% 30VDC TA	56289	150D107X9030S2
A50C5	0180-2614	8		CAPACITOR-FXD 100UF±10% 30VDC TA	56289	150D107X9030S2
A50C6, 7				NOT ASSIGNED		
A50C8	0160-3036	8	8	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A50C9	0160-3036	8		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A50C10	0160-3036	8		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A50C11	0160-3036	8		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A50C12	0160-3036	8		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A50C13	0160-3036	8		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A50C14	0160-3036	8		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A50C15	0160-3036	8		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-3036
A50DS1	1990-0485	5	1	LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A50L1	9100-2262	3	1	INDUCTOR RF-CH-MLD 3.9UH 10% .105DX.26LG	28480	9100-2262
A50L2	9100-1618	1	4	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A50L3	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A50L4	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A50L5	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A50R1	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A50R2	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A50R3	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A50R4	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A50R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A50R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A50TP1	0360-2050	8	10	TEST POINT	28480	0360-2050
A50TP2	0360-2050	8		TEST POINT	28480	0360-2050
A50TP3	0360-2050	8		TEST POINT	28480	0360-2050
A50TP4	0360-2050	8		TEST POINT	28480	0360-2050
A50TP5	0360-2050	8		TEST POINT	28480	0360-2050
A50TP6	0360-2050	8		TEST POINT	28480	0360-2050
A50TP7	0360-2050	8		TEST POINT	28480	0360-2050
A50TP8	0360-2050	8		TEST POINT	28480	0360-2050
A50TP9	0360-2050	8		TEST POINT	28480	0360-2050
A50TP10	0360-2050	8		TEST POINT	28480	0360-2050
A50U1	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A50W1	8120-3120	5	1	CABLE	28480	8120-3120
A50W2	08340-60209	0	1	CABLE RBN 16 PIN (INCLUDES W2P1,P2)	28480	08340-60209
A50X1	1251-2313	6	8	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A50X2	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A50X3	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A50X4	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A50X5	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A50X6	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A50X7	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A50X8	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A51	08340-60183	9	1	10 MHZ REFERENCE OSCILLATOR	28480	08340-60183
	0960-0477	1	1	CRYSTAL OSCILLATOR FREQ. = 10.00 MHZ	28480	0960-0477
	08340-60246	5	1	CABLE 10MHz FREQ STD	28480	08340-60246

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A52	08340-60179	3	1	**POSITIVE REGULATOR**	28480	08340-60179
A52C1	0160-5338	7	1	CAPACITOR-FXD .33UF +10% 50VDC CER	28480	0160-5338
A52C2	0180-0116	1	4	CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A52C3	0160-4807	3	1	CAPACITOR-FXD 33PF +5% 100VDC CER 0+30	28480	0160-4807
A52C4	0180-1746	5	2	CAPACITOR-FXD 15UF+10% 20VDC TA	56289	150D156X9020B2
A52C5	0180-0228	6	3	CAPACITOR-FXD 22UF+10% 15VDC TA	56289	150D226X9015B2
A52C6	0180-0116	1		CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A52C7	0180-1746	5		CAPACITOR-FXD 15UF+10% 20VDC TA	56289	150D156X9020B2
A52C8	0160-4005	3		CAPACITOR-FXD 1UF+20% 100VDC CER	28480	0160-4005
A52C9	0160-4835	7	1	CAPACITOR-FXD .1UF +10% 50VDC CER	28480	0160-4835
A52C10	0180-2811	7		CAPACITOR-FXD 10UF+20% 35VDC TA	28480	0180-2811
A52C11	0160-4834	6	1	CAPACITOR-FXD .047UF +10% 100VDC CER	28480	0160-4834
A52C12	0160-4005	3	1	CAPACITOR-FXD 1UF +20% 100VDC CER	28480	0160-4005
A52C13	0180-2617	1	1	CAPACITOR-FXD 6.8UF +10% 35VDC TA	28480	0180-2617
A52C14	0180-0228	6		CAPACITOR-FXD 22UF+10% 15VDC TA	56289	150D226X9015B2
A52C15	0180-0228	6		CAPACITOR-FXD 22UF+10% 15VDC TA	56289	150D226X9015B2
A52C16	0160-4386	3	1	CAPACITOR-FXD 33PF +5% 200VDC CER 0+30	28480	0160-4386
A52C17	0180-0116	1		CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A52C18	0180-0116	1		CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A52C19	0160-4832	4	1	CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A52C20-22	0160-4084	8	3	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A52CR1-3				NOT ASSIGNED		
A52CR4	1901-0033	2	9	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR9	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR10	1901-0662	3	4	DIODE-PWR RECT 100V 6A	04713	MR751
A52CR11	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A52CR12	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A52CR13	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR14	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR15	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A52CR16	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A52DS1-3	1990-0487	7	3	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A52DS4	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A52F1	2110-0618	3	1	FUSE 5A 125V NTD .25X.27	28480	2110-0618
A52F2	2110-0332	8	1	FUSE 3A 125V .25X.27	28480	2110-0332
A52F3	2110-0249	6	1	FUSE 12A 250V NTD 1.25X.25 UL	28480	2110-0249
A52MP1	08340-20073	2	1	MTG BLOCK DIODE	28480	08340-20073
A52MP2	0520-0129	8	1	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A52MP3	2190-0014	1	1	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A52MP4	2950-0014	3	1	NUT-HEX-DBL-CHAM 1/4-28-THD .219-IN-THK	00000	ORDER BY DESCRIPTION
A52MP5	5040-6847	6	1	EXTRACTOR, RED	28480	5040-6847
A52MP6,7	1251-2313	6	4	CONN. SGL CONN.	28480	1251-2313
A52MP8				NOT ASSIGNED		
A52MP9	1251-2313	6		CONN.SGL CONN.	28480	1251-2313
A52MP10	5000-9043	6	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A52MP11	2110-0643	4	1	FUSEHOLDER-CLIP TYPE 15A 250 V	28480	2110-0643
A52MP12				NOT ASSIGNED		
A52MP13	8150-0014	3	1	WIRE 22AWG BL 300V PVC 7X30 105C	28480	8150-0014
A52MP14	2190-0027	6	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0027
A52Q1	1884-0018	5	2	THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A52Q2	1884-0018	5		THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A52Q3	1854-0477	7	4	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A52Q4	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A52Q5	1853-0213	7	1	TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A52Q6	1854-0404	0	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A52Q7	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A52Q8	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A52Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A52Q10	1854-0441	5	1	TRANSISTOR NPN SI PD=5.8W FT=800KHZ	28480	1854-0441
A52Q11	1884-0046	9	1	THYRISTOR-SCR VRRM=50	03508	C230F
A52Q12	1854-0637	1	1	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A52Q13	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A52Q14	1853-0314	9	1	TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
A52Q15	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A52Q16	1853-0034	0	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A52R1	0812-0021	8	1	RESISTOR .47 5% 3W PW TC = 0+90	91637	CW2B1-3-T2-47/100-J
A52R2	0811-4507	1	1	RESISTOR .56 5% 3W PW TC = 0+90	28480	0811-4507

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A52R3	0811-4506	0	3	RESISTOR .27 5% 3W PW TC = 0 +90	28480	0811-4506
A52R4	0811-4506	0		RESISTOR .27 5% 3W PW TC = 0 +90	28480	0811-4506
A52R5	0811-4506	0		RESISTOR .27 5% 3W PW TC = 0 +90	28480	0811-4506
A52R6	0757-0401	0	7	RESISTOR 100 1% .125W F TC = 0 +100	24546	C4-1/8-T0-101-F
A52R7	0757-0401	0		RESISTOR 100 1% .125W F TC = 0 +100	24546	C4-1/8-T0-101-F
A52R8	0757-0416	7	3	RESISTOR 511 1% .125W F TC = 0 +100	24546	C4-1/8-T0-511R-F
A52R9	0757-0442	9	7	RESISTOR 10K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1002-F
A52R10	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC = 0 +100	24546	C4-1/8-T0-51R1-F
A52R11	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-2371-F
A52R12	0698-3442	9	2	RESISTOR 237 1% .125W F TC = 0 +100	24546	C4-1/8-T0-237R-F
A52R13	0757-0438	3	5	RESISTOR 5.11K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-5111-F
A52R14	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1621-F
A52R15	0757-0438	3		RESISTOR 5.11K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-5111-F
A52R16	0757-0280	3	5	RESISTOR 1K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1001-F
A52R17	0757-0438	3		RESISTOR 5.11K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-5111-F
A52R18	0698-8817	2	3	RESISTOR 2.61 1% .125W F TC = 0 +100	28480	0698-8817
A52R19	0757-0346	2	3	RESISTOR 10 1% .125W F TC = 0 +100	24546	C4-1/8-T0-10R0-F
A52R20	0698-3444	1	3	RESISTOR 316 1% .125W F TC = 0 +100	24546	C4-1/8-T0-316R-F
A52R21	0698-3447	4	1	RESISTOR 422 1% .125W F TC = 0 +100	24546	C4-1/8-T0-422R-F
A52R22	0757-0440	7	2	RESISTOR 7.5K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-7501-F
A52R23	0757-0442	9		RESISTOR 10K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1002-F
A52R24	0698-3407	6	2	RESISTOR 1.96K 1% .5W F TC = 0 +100	28480	0698-3407
A52R25	0757-0442	9		RESISTOR 10K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1002-F
A52R26	0698-3407	6		RESISTOR 1.96K 1% .5W F TC = 0 +100	28480	0698-3407
A52R27	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-2872-F
A52R28	0757-0461	2	1	RESISTOR 68.1K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-6812-F
A52R29*	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-3831-F
A52R30	0698-3442	9		RESISTOR 237 1% .125W F TC = 0 +100	24546	C4-1/8-T0-237R-F
A52R31	0698-8817	2		RESISTOR 2.61 1% .125W F TC = 0 +100	28480	0698-8817
A52R32	0698-3444	1		RESISTOR 316 1% .125W F TC = 0 +100	24546	C4-1/8-T0-316R-F
A52R33	0757-0346	2		RESISTOR 10 1% .125W F TC = 0 +100	24546	C4-1/8-T0-10R0-F
A52R34	0698-3445	2	1	RESISTOR 348 1% .125W F TC = 0 +100	24546	C4-1/8-T0-348R-F
A52R35	0757-0440	7		RESISTOR 7.5K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-7501-F
A52R36	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-2611-F
A52R37	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC = 0 +100	19701	MF4C1/8-T0-6191-F
A52R38	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-4641-F
A52R39	0757-0279	0	4	RESISTOR 3.16K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-3161-F
A52R40	0698-6348	0	1	RESISTOR 3K .1% .125W F TC = 0 +25	28480	0698-6348
A52R41	0698-0084	9	5	RESISTOR 2.15K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-2151-F
A52R42	0698-0084	9		RESISTOR 2.15K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-2151-F
A52R43	0698-0084	9		RESISTOR 2.15K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-2151-F
A52R44	0698-0084	9		RESISTOR 2.15K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-2151-F
A52R45	0698-8827	4	5	RESISTOR 1M 1% .125W F TC = 0 +100	28480	0698-8827
A52R46	0698-8827	4		RESISTOR 1M 1% .125W F TC = 0 +100	28480	0698-8827
A52R47	0698-8827	4		RESISTOR 1M 1% .125W F TC = 0 +100	28480	0698-8827
A52R48	0698-8827	4		RESISTOR 1M 1% .125W F TC = 0 +100	28480	0698-8827
A52R49	0757-0465	6		RESISTOR 100K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1003-F
A52R50	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1961-F
A52R51	0757-0416	7		RESISTOR 511 1% .125W F TC = 0 +100	24546	C4-1/8-T0-511R-F
A52R52	0757-0416	7		RESISTOR 511 1% .125W F TC = 0 +100	24546	C4-1/8-T0-511R-F
A52R53	0757-0465	6	1	RESISTOR 100K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1003-F
A52R54	0757-0442	9		RESISTOR 10K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1002-F
A52R55	0757-0442	9		RESISTOR 10K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1002-F
A52R56	0698-8827	4		RESISTOR 1M 1% .125W F TC = 0 +100	28480	0698-8827
A52R57	0698-0084	9		RESISTOR 2.15K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-2151-F
A52R58	0757-0442	9		RESISTOR 10K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1002-F
A52R59	0757-0438	3		RESISTOR 5.11K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-5111-F
A52R60	0757-0438	3		RESISTOR 5.11K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-5111-F
A52R61	0757-0420	3	1	RESISTOR 750 1% .125W F TC = 0 +100	24546	C4-1/8-T0-751-F
A52R62	0757-0279	0		RESISTOR 3.16K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-3161-F
A52R63	0757-0401	0		RESISTOR 100 1% .125W F TC = 0 +100	24546	C4-1/8-T0-101-F
A52R64	0757-0159	5	1	RESISTOR 1K 1% .5W F TC = 0 +100	28480	0757-0159
A52R65	0698-8466	7	1	RESISTOR 942 .5% .125W F TC = 0 +50	28480	0698-8466
A52R66	0757-0279	0		RESISTOR 3.16K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-3161-F
A52R67	0757-0279	0		RESISTOR 3.16K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-3161-F
A52R68	0698-8464	5	1	RESISTOR 12.6K .5% .125W F TC = 0 +50	28480	0698-8464
A52R69	0698-8817	2		RESISTOR 2.61 1% .125W F TC = 0 +100	28480	0698-8817
A52R70	0698-3444	1		RESISTOR 316 1% .125W F TC = 0 +100	24546	C4-1/8-T0-316R-F
A52R71	0757-0346	2		RESISTOR 10 1% .125W F TC = 0 +100	24546	C4-1/8-T0-10R0-F
A52R72	0698-3443	0	1	RESISTOR 287 1% .125W F TC = 0 +100	24546	C4-1/8-T0-287R-F
A52R73	0698-0090	7	1	RESISTOR 464 1% .5W F TC = 0 +100	28480	0698-0090
A52R74	0757-0401	0		RESISTOR 100 1% .125W F TC = 0 +100	24546	C4-1/8-T0-101-F
A52R75	0757-0401	0		RESISTOR 100 1% .125W F TC = 0 +100	24546	C4-1/8-T0-101-F
A52R76	0757-0401	0		RESISTOR 100 1% .125W F TC = 0 +100	24546	C4-1/8-T0-101-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A52R77	0757-0401	0		RESISTOR 100 1% .125W F TC = 0 +100	24546	C4-1/8-T0-101-F
A52R78	0757-0280	3		RESISTOR 1K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1001-F
A52R79	0757-0280	3		RESISTOR 1K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1001-F
A52R80	0757-0280	3		RESISTOR 1K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1001-F
A52R81	0757-0280	3		RESISTOR 1K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1001-F
A52R82	0698-7220	9	1	RESISTOR 215 1% .05W F TC=0+100	28480	0698-7220
A52R83	0698-3437	2	1	RESISTOR 133 1% .125W F TC=0+100	28480	0698-3437
A52TP1	0360-0535	0	7	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A52TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A52TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A52TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A52TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A52TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A52TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A52U1	1820-0223	0	2	IC OP AMP GP TO-99 PKG	3L585	CA301AT
A52U2	1826-0742	0	1	IC V RGLTR-V-REF-FXD 10V TO5 PKG	28480	1826-0742
A52U3	1820-0223	0		IC OP AMP GP TO-99 PKG	3L585	CA301AT
A52U4	1826-0138	8	2	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A52U5	1820-1531	5	1	IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	3L585	CD4013AF
A52U6	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A52VR1	1902-3252	5	1	DIODE-ZNR 22.6V 2% DO-35 PD=.4W	28480	1902-3252
A52VR2	1902-3193	3	2	DIODE-ZNR 13.3V 5% DO-35 PD=.4W	28480	1902-3193
A52VR3	1902-0049	2	2	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A52VR4	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A52VR5	1902-3160	4	1	DIODE-ZNR 10V 2% DO-35 PD=.4W TC=+.06%	28480	1902-3160
A52VR6	1902-3193	3		DIODE-ZNR 13.3V 5% DO-35 PD=.4W	28480	1902-3193
A52VR7	1902-0049	2		DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A53	08340-60161	4	1	NEGATIVE REGULATOR	28480	08340-60161
A53C1	0160-4807	3	1	CAPACITOR-FXD 33PF ±5% 100VDC CER 0±30	28480	0160-4807
A53C2	0160-4804	0		CAPACITOR-FXD 56PF ±5% 100VDC CER 0±30	28480	0160-4804
A53C3	0160-4535	4	2	CAPACITOR-FXD 1UF ±10% 50VDC CER	28480	0160-4535
A53C4	0160-4834	6	2	CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A53C5	0180-0228	6	2	CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A53C6	0180-1746	5	1	CAPACITOR-FXD 15UF±10% 20VDC TA	56289	150D156X9020B2
A53C7	0180-0291	3	2	CAPACITOR-FXD 1UF±10% 35VDC TA	56289	150D105X9035A2
A53C8	0180-0291	3		CAPACITOR-FXD 1UF±10% 35VDC TA	56289	150D105X9035A2
A53C9				NOT ASSIGNED		
A53C10	0160-4535	4		CAPACITOR-FXD 1UF ±10% 50VDC CER	28480	0160-4535
A53C11	0160-4834	6		CAPACITOR-FXD .047UF ±10% 100VDC CER	28480	0160-4834
A53C12	0180-0228	6		CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A53C13	0180-2610	4	1	CAPACITOR-FXD 10UF±10% 75VDC TA	00904	T110A106K075AS
A53C14	0180-0374	3	1	CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A53C15, 16	0160-4835	7	2	CAPACITOR-FXD .1UF±10% 50VDC CER	02798	CAC04X7R104K050A
A53CR1	1901-0033	2	9	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR4	1901-1068	5	2	DIODE-SCHOTTKY SM SIG	28480	1901-1068
A53CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR7	1901-0662	3	4	DIODE-PWR RECT 100V 6A	04713	MR751
A53CR8	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A53CR9	1901-0028	5	1	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A53CR10	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR11	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR12	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A53CR13	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR14	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A53CR15	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A53CR16	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A53CR17	1901-1068	5		DIODE-SCHOTTKY SM SIG	28482	1901-1068
A53DS1	1990-0487	7	3	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A53DS2	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A53DS3	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A53E1	1251-2313	6	4	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A53E2	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A53E3	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A53E4	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A53F1	2110-0425	0	1	FUSE 2A 125V .25X.27	28480	2110-0425
A53F2	2110-0332	8	1	FUSE 3A 125V .25X.27	28480	2110-0332
A53F3	2110-0056	3	1	FUSE 6A 250V NTD 1.25X.25 UL IEC	75915	312006
A53MP1	2110-0643	4	1	FUSEHOLDER-CLIP TYPE 15A 250 V	28480	2110-0643
A53MP2	0590-0526	6	1	THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0526
A53MP3	2200-0105	4	1	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A53MP4	5040-6852	3	1	EXTRACTOR, ORANGE	28480	5040-6852
A53MP5	5000-9043	6	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A53MP6	85662-00029	7	1	HEAT SINK	28480	85662-00029
A53MP7				NOT ASSIGNED		
A53MP8	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A53MP9	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A53Q1	1884-0244	9	1	THYRISTOR-SCR VRRM=400	3L585	S2600D
A53Q2	1854-0404	0	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A53Q3	1854-0271	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0271
A53Q4	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A53Q5	1884-0018	5	2	THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A53Q6	1884-0018	5		THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A53Q7	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A53R1	0811-1079	6	3	RESISTOR .68 5% 3W PW TC=0±90	91637	CW2B1-3-T2-68/100-J
A53R2	0811-1079	6		RESISTOR .68 5% 3W PW TC=0±90	91637	CW2B1-3-T2-68/100-J
A53R3	0811-1220	9	1	RESISTOR 1.5 5% 3W PW TC=0±50	05524	CW-2B-39
A53R4	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0±100	03292	C4-1/8-TO-511R-F
A53R5	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0±100	03292	C4-1/8-TO-4641-F
A53R6	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-TO-101-F
A53R7	0757-0159	5	2	RESISTOR 1K 1% .5W F TC=0±100	28480	0757-0159
A53R8	0757-0279	0	5	RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-TO-3161-F
A53R9	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-TO-3161-F
A53R10	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-TO-3161-F
A53R11	0698-8817	2	2	RESISTOR 2.61 1% .125W F TC=0±100	28480	0698-8817
A53R12	0698-3444	1	5	RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-TO-316R-F
A53R13	0757-0346	2	3	RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-TO-10R0-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A53R14	0698-3442	9	1	RESISTOR 237 1% .125W F TC=0+100	24546	C4-1/8-T0-237R-F
A53R15	0811-1080	9	2	RESISTOR 2.2 5% 3W PW TC=0+50	28480	0811-1080
A53R16	0698-3444	1		RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A53R17	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A53R18	0811-1080	9		RESISTOR 2.2 5% 3W PW TC=0+50	28480	0811-1080
A53R19	0698-3444	1		RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A53R20	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A53R21	0698-3444	1		RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A53R22	0811-1079	6	1	RESISTOR .68 5% 3W PW TC=0+90	28480	0811-1079
A53R23	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	03292	C4-1/8-T0-511R-F
A53R24	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+100	03292	C4-1/8-T0-2152-F
A53R25	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A53R26	0757-0159	5		RESISTOR 1K 1% .5W F TC=0+100	28480	0757-0159
A53R27	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A53R28	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A53R29	0698-8464	5	1	RESISTOR 12.6K .5% .125W F TC=0+50	28480	0698-8464
A53R30	0698-3410	1	1	RESISTOR 3.16K 1% .5W F TC=0+100	28480	0698-3410
A53R31	0698-8817	2		RESISTOR 2.61 1% .125W F TC=0+100	28480	0698-8817
A53R32	0698-3444	1		RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A53R33	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A53R34	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A53R35	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+100	24546	C4-1/8-T0-2610-F
A53R36	0757-0442	9	9	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A53R37	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A53R38	0698-0084	9	4	RESISTOR 2.15K 1% .125W F TC=0+100	03292	C4-1/8-T0-2151-F
A53R39	0698-8827	4	4	RESISTOR 1M 1% .125W F TC=0+100	03292	CT4
A53R40	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	03292	C4-1/8-T0-2151-F
A53R41	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+100	03292	CT4
A53R42	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	03292	C4-1/8-T0-2151-F
A53R43	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+100	03292	CT4
A53R44	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	03292	C4-1/8-T0-2151-F
A53R45	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+100	03292	CT4
A53R46	0757-0442	9		RESISTOR 10K 1% .125W F TC = 0 +100	24546	C4-1/8-T0-1002-F
A53R47	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A53R48	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A53R49	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A53R50	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A53R51	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A53R52	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A53R53	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A53R54	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A53R55, 56	0757-0274	5	2	RESISTOR 1.21K 1% .125W F TC=0+100	03292	CT4-1/8-TO-1211-F
A53TP1	0360-0535	0	6	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A53TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A53TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A53TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A53TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A53TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A53U1	1826-0523	5	1	IC 337 V RGLTR TO-3	27014	LM337K
A53U2	1826-0138	8	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A53U3	1820-0223	0	2	IC OP AMP GP TO-99 PKG	3L585	CA301AT
A53U4	1820-0223	0		IC OP AMP GP TO-99 PKG	3L585	CA301AT
A53VR1	1902-3171	7	1	DIODE-ZNR 11V 5% DO-35 PD=.4W TC=+.062%	28480	1902-3171
A53VR2	1902-0049	2	1	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A53VR3	1902-3330	0	1	DIODE-ZNR 44.2V 2% DO-35 PD=.4W	28480	1902-3330
A53VR4	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
A53VR5	1902-3083	0	1	DIODE-ZNR 4.64V 2% DO-35 PD=.4W	28480	1902-3083
A53VR6	1902-3291	2	1	DIODE-ZNR 31.6V 2% DO-35 PD=.4W	28480	1902-3291
A53VR7	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A53VR8	1902-0244	9	1	DIODE-ZNR 30V 5% PD=1W IR=5UA	28480	1902-0244

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A54	08340-60016	7	1	YO PRETUNE DAC/DELAY COMPENSATION	28480	08340-60016
A54C1	0160-4535	4	9	CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C2	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C3	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C4	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C5	0160-3670	6	1	CAPACITOR-FXD .1UF +-20% 200VDC CER	28480	0160-3670
A54C6	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C7	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C8	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C9	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C10	0160-4835	7	15	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C11	0160-3402	2	1	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A54C12	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C13	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C14				NOT ASSIGNED		
A54C15	0160-4261	3	1	CAPACITOR-FXD .22UF +-10% 50VDC	84411	HEW 249
A54C16	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C17	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C18, 19				NOT ASSIGNED		
A54C20	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C21	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C22	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C23	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A54C24	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C25	0160-4805	1	1	CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30	28480	0160-4805
A54C26	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A54C27	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C28	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C29	0160-5098	6	1	CAPACITOR-FXD .22UF +-10% 50VDC CER	16299	CAC05X7R224J050A
A54C30	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C31	0160-4787	8	1	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A54C32	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C33	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54C34	0160-3829	7	1	CAPACITOR-FXD .47UF +-10% 50VDC	28480	0160-3829
A54C35	0160-4535	4		CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4535
A54C36	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A54CR1	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A54CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A54CR3				NOT ASSIGNED		
A54CR4	1901-0518	8	3	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A54CR5	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A54CR6	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A54L1	9140-0144	0	5	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A54L2	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A54L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A54L4	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A54L5	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A54MP1	5040-6848	7	1	EXTRACTOR	28480	5040-6848
A54MP2				NOT ASSIGNED		
A54MP3				NOT ASSIGNED		
A54MP4				NOT ASSIGNED		
A54MP5	1205-0011	0	3	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A54MP6	1205-0011	0		HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A54MP7	1205-0011	0		HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A54MP8	5000-9043	6	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A54Q1	1855-0278	8	4	TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	17856	2N5116
A54Q2	1853-0038	4	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A54Q3	1855-0278	8		TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	17856	2N5116
A54Q4	1855-0278	8		TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	17856	2N5116
A54R1	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A54R2	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A54R3	0757-0442	9	10	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R4	0698-3156	2	2	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A54R5	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A54R6	0698-3446	3	2	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A54R7	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A54R8	0699-0059	0	1	RESISTOR 5K .1% .1W F TC=0+-5	28480	0699-0059
A54R9	0698-6406	1	1	RESISTOR 8.54K .1% .1W F TC=0+4	28480	0698-6406
A54R10	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A54R11	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A54R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R14	2100-3123	0	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A54R15	0757-0346	2	4	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A54R16	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A54R17	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A54R18	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A54R19	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A54R20	0699-0797	3	1	RESISTOR 7.65K .1% .1W F TC=0+4	28480	0699-0797
A54R21	0699-0642	7	1	RESISTOR 10K .1% .1W F TC=0+-5	28480	0699-0642
A54R22	2100-3154	7	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A54R23	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A54R24	0698-8500	0	1	RESISTOR 16.58K .1% .1W F TC=0+4	28480	0698-8500
A54R25	0699-0747	3	2	RESISTOR 4K .05% .1W F TC=0+-10	28480	0699-0747
A54R26	0699-0747	3		RESISTOR 4K .05% .1W F TC=0+-10	28480	0699-0747
A54R27	0698-3430	5	5	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A54R28	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A54R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R30	2100-3161	6	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A54R31	0698-3136	8	2	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A54R32	2100-3054	6	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	02111	43P503
A54R33	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A54R34	0698-3158	4	1	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A54R35	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A54R36	2100-3161	6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A54R37	0757-0461	2	2	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A54R38	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A54R39	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R40	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R41	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A54R42	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R43	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R44				NOT ASSIGNED		
A54R45	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R46	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A54R47	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R48	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A54R49	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A54R50	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A54R51	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A54R52	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A54R53	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A54TP1	0360-0535	0	7	TEST POINT	28480	0360-0535
A54TP2	0360-0535	0		TEST POINT	28480	0360-0535
A54TP3	0360-0535	0		TEST POINT	28480	0360-0535
A54TP4	0360-0535	0		TEST POINT	28480	0360-0535
A54TP5	0360-0535	0		TEST POINT	28480	0360-0535
A54TP6	0360-0535	0		TEST POINT	28480	0360-0535
A54TP7	0360-0535	0		TEST POINT	28480	0360-0535
A54U1	1826-0367	5	1	IC 78M05C V RGLTR TO-39	04713	MC78M05CG
A54U2	1826-0471	2	3	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A54U3	1826-0512	2	1	IC 78M15C V RGLTR TO-39	04713	MC78M15CG
A54U4	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A54U5	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A54U6	1826-0308	4	1	IC CONV 12-B-D/A 24-DIP-C PKG	24355	AD562KD/BIN
A54U7	1820-0138	6	1	IC OP AMP GP 14-DIP-C PKG	29832	S52
A54U8	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A54U9	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A54U10	1810-0206	8	2	NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A54U11	1820-1196	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A54U12	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A54U13	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A54U14	1826-0785	1	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	01295	TL072ACJG
A54U15	1826-0798	6	1	IC CONV 8-B-D/A	18324	NE5018F
A54U16	1826-0928	4	1	D/A 8-BIT 22-CERDIP BPLR	02910	NE5118F
A54VR1	1902-0692	1	1	DIODE-ZNR 6.3V 1% DO-7 PD=.4W TC=+.001%	28480	1902-0692

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A55	08340-60202	6	1	YO DRIVER	28480	08340-60202
A55C1	0180-2140	5	2	CAPACITOR-FXD 5.6UF+-10% 50VDC TA	56289	150D565X9050R2
A55C2	0160-4833	5	1	CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
A55C3	0180-2139	2	1	CAPACITOR-FXD 10UF+-20% 60VDC TA	06001	69F177G7
A55C4	0160-3877	5	1	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A55C5				NOT ASSIGNED		
A55C6	0160-4834	6	4	CAPACITOR-FXD .047UF +-10% 100VDC CER	28480	0160-4834
A55C7	0160-4834	6		CAPACITOR-FXD .047UF +-10% 100VDC CER	28480	0160-4834
A55C8	0160-0302	5	1	CAPACITOR-FXD .018UF +-10% 200VDC POLYE	28480	0160-0302
A55C9-11				NOT ASSIGNED		
A55C12	0160-4834	6		CAPACITOR-FXD .047UF +-10% 100VDC CER	28480	0160-4834
A55C13	0160-4834	6		CAPACITOR-FXD .047UF +-10% 100VDC CER	28480	0160-4834
A55C14	0160-4261	3	2	CAPACITOR-FXD .22UF +-10% 50VDC	84411	HEW 249
A55C15	0160-4261	3		CAPACITOR-FXD .22UF +-10% 50VDC	84411	HEW 249
A55C16	0160-3879	7	7	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A55C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A55C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A55C19	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A55C20	0180-2140	5		CAPACITOR-FXD 5.6UF+-10% 50VDC TA	56289	150D565X9050R2
A55C21	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A55C22	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A55C23	0180-2505	6	2	CAPACITOR-FXD 1UF+-10% 75VDC TA	56289	150D105X9075B2
A55C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A55C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A55C26	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A55C27-29				NOT ASSIGNED		
A55C30	0180-2505	6		CAPACITOR-FXD 1UF+-10% 75VDC TA	56289	150D105X9075B2
A55C31	0180-0230	0	1	CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A55C32				NOT ASSIGNED		
A55C33	0180-2148	3	1	CAPACITOR-FXD .47UF+-20% 50VDC TA	56289	150D474X0050A2
A55CR1	1901-0033	2	6	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A55CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A55CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A55CR4, 5				NOT ASSIGNED		
A55CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A55CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A55CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A55CR9	1901-0050	3	2	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A55CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A55MP1	5040-6851	2	1	EXTRACTOR	28480	5040-6851
A55MP2	5000-9043	6	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A55Q1	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A55Q2	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A55Q3	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A55Q4	1855-0278	8	2	TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	17856	2N5116
A55Q5	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A55Q6	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A55Q7	1854-0022	8	1	TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A55Q8	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A55Q9	1853-0012	4	1	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A55Q10	1853-0038	4	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A55Q11	1855-0278	8		TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	17856	2N5116
A55Q12	1854-0232	2	1	TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A55R1	0757-0276	7	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A55R2	0699-0961	3	1	RESISTOR 720 .1% .1W F TC=0+-4	28480	0699-0961
A55R3	0699-0059	0	1	RESISTOR 5K .1% .1W F TC=0+-5	28480	0699-0059
A55R4	2100-3056	8	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A55R5	0757-0440	7	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A55R6	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A55R7	0757-0467	8	1	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A55R8	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A55R9	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A55R10	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A55R11	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A55R12				NOT ASSIGNED		
A55R13	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A55R14	0757-0442	9	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A55R15	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A55R16-19				NOT ASSIGNED		
A55R20	0757-0294	9	1	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A55R21	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A55R22	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A55R23	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A55R24	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A55R25, 26				NOT ASSIGNED		
A55R27	0757-0346	2	6	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A55R28	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A55R29	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A55R30, 31				NOT ASSIGNED		
A55R32	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A55R33	0757-0443	0	3	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A55R34-37				NOT ASSIGNED		
A55R38	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A55R39				NOT ASSIGNED		
A55R40	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A55R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A55R42	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A55R43	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A55R44	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A55R45	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A55R46	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A55R47	2100-3103	6	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A55R48	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A55R49	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A55R50	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A55R51	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A55R52	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A55R53	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A55R54				NOT ASSIGNED		
A55R55	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A55R56-59				NOT ASSIGNED		
A55R60	0757-0814	9	1	RESISTOR 511 1% .5W F TC=0+-100	28480	0757-0814
A55R61	0698-3442	9	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A55R62	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A55R63	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A55TP1	0360-0535	0	5	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A55TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A55TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A55TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A55TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A55U1	1826-0783	9	2	IC OP AMP LOW-NOISE 8-DIP-C PKG	52063	XR5534ACN
A55U2	1826-0783	9		IC OP AMP LOW-NOISE 8-DIP-C PKG	52063	XR5534ACN
A55U3	1826-0226	5	1	IC V RGLTR TO-39	07263	78M12HC
A55U4	1826-0558	6	1	IC 337 V RGLTR TO-39	27014	LM337H
A55U5	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A55VR1	1902-0197	1	1	DIODE-ZNR 82V 5% PD=1W IR=5UA	28480	1902-0197
A55VR2	1902-0625	0	1	DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829

See introduction to this section for ordering information. *Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A56	**08340-60029**	**2**	**1**	**-15V REGULATOR**	**28480**	**08340-60029**
A56C1	0180-2505	6	1	CAPACITOR-FXD 1UF+10% 75VDC TA	56289	150D105X9075B2
A56C2	0180-2129	0	1	CAPACITOR-FXD 10UF+10% 50VDC TA	56289	150D106X9050R2
A56C3	0180-0291	3	1	CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A56CR1	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A56CR2	1901-0662	3	2	DIODE-PWR RECT 100V 6A	04713	MR751
A56CR3	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A56DS1	1990-0487	7	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A56E1	1251-2313	6	2	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A56E2	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A56F1	2110-0047	2	1	FUSE 1A 125V .25X.27	71400	GMW-1
A56MP1	5040-6849	8	1	EXTRACTOR, P.C. BOARD	28480	5040-6849
A56MP2	5000-9043	6	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A56MP3	08340-00030	9	1	HEAT SINK	28480	08340-00030
A56MP4	0590-0526	6	1	THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0526
A56MP5	2200-0105	4	1	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A56Q1	1884-0244	9	1	THYRISTOR-SCR VRRM=400	3L585	S2600D
A56Q2	1855-0414	4	1	TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A56R1	0811-1084	3	2	RESISTOR 22 5% 3W PW TC=0+30	28480	0811-1084
A56R2	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-T0-316R-F
A56R3	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A56R4	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+100	24546	C4-1/8-T0-2610-F
A56R5	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A56R6	0811-1084	3		RESISTOR 22 5% 3W PW TC=0+30	28480	0811-1084
A56R7	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+100	24546	C4-1/8-T0-121R-F
A56TP1	0360-0535	0	2	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A56TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A56U1	1826-0523	5	1	IC 337 V RGLTR TO-3	27014	LM337K
A56VR1	1902-3224	1	1	DIODE-ZNR 17.8V 5% DO-35 PD=.4W	28480	1902-3224
A56VR2	1902-3182	0	1	DIODE-ZNR 12.1V 5% DO-35 PD=.4W	28480	1902-3182
A56VR3	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
A56VR4	1902-3197	7	1	DIODE-ZNR 13.7V 2% DO-35 PD=.4W	28480	1902-3197

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A57	08340-60014	5	1	MARKER/BANDCROSS	28480	08340-60014
A57C1	0180-0291	3	2	CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A57C2	0180-0291	3		CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A57C3	0180-0197	8	1	CAPACITOR-FXD 2.2UF+10% 20VDC TA	56289	150D225X9020A2
A57C4	0160-4832	4	18	CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C5	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C6	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C7	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C8	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C9	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C10	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C11	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C12	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C13	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C14	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C15	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C16	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C17	0160-4823	3	1	CAPACITOR-FXD 820PF +5% 100VDC CER	28480	0160-4823
A57C18	0160-4801	7	1	CAPACITOR-FXD 100PF +5% 100VDC CER	28480	0160-4801
A57C19	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C20	0160-4807	3	3	CAPACITOR-FXD 33PF +5% 100VDC CER 0+30	28480	0160-4807
A57C21	0160-4819	7	2	CAPACITOR-FXD 2200PF +5% 100VDC CER	28480	0160-4819
A57C22	0160-4819	7		CAPACITOR-FXD 2200PF +5% 100VDC CER	28480	0160-4819
A57C23	0160-4807	3		CAPACITOR-FXD 33PF +5% 100VDC CER 0+30	28480	0160-4807
A57C24	0160-4807	3		CAPACITOR-FXD 33PF +5% 100VDC CER 0+30	28480	0160-4807
A57C25	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C26	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C27	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57C28	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A57CR1	1901-0535	9	4	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A57CR2	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A57CR3	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A57CR4	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A57CR5	1901-0033	2	6	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A57CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A57CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A57CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A57CR9	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A57CR10	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A57L1	9100-3562	8	2	INDUCTOR RF-CH-MLD 4.7UH 5% .166DX.385LG	28480	9100-3562
A57L2	9100-3562	8		INDUCTOR RF-CH-MLD 4.7UH 5% .166DX.385LG	28480	9100-3562
A57L3	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/48
A57MP1, 2	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A57MP3	4040-0755	2	1	EXTR-PC BD VIO POLYC .062-BD-THKNS	28480	4040-0755
A57P1	1251-7469	3	1	CONN - POST TYPE	28480	1251-7469
A57Q1	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A57Q2	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A57Q3	1854-0361	8	1	TRANSISTOR NPN 2N4239 SI TO-5 PD=6W	04713	2N4239
A57R1	0757-0280	3	8	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A57R2	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A57R3	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A57R4	0757-0442	9	4	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A57R5	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+100	24546	C4-1/8-T0-215R-F
A57R6	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A57R7	0757-0402	1	1	RESISTOR 110 1% .125W F TC=0+100 (Recommended Replacement)	24546	C4-1/8-T0-110R-F
A57R8				NOT ASSIGNED		
A57R9	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+100	24546	C4-1/8-T0-121R-F
A57R10	0690-1021	0	2	RESISTOR 1K 10% 1W CC TC=0+647	01121	GB1021
A57R11	0690-1021	0		RESISTOR 1K 10% 1W CC TC=0+647	01121	GB1021
A57R12	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A57R13	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A57R14-16				NOT ASSIGNED		
A57R17	0698-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A57R18	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A57R19	0757-0288	1	3	RESISTOR 9.09K 1% .125W F TC=0+100	19701	MF4C1/8-T0-9091-F
A57R20	0757-0443	0	3	RESISTOR 11K 1% .125W F TC=0+100	24546	C4-1/8-T0-1102-F
A57R21	0757-0288	1		RESISTOR 9.09K 1% .125W F TC=0+100	19701	MF4C1/8-T0-9091-F
A57R22	0757-0288	1		RESISTOR 9.09K 1% .125W F TC=0+100	19701	MF4C1/8-T0-9091-F
A57R23	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+100	24546	C4-1/8-T0-1102-F
A57R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Model 8340A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A57R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A57R26	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A57R27	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A57R28	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A57R29	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A57R30	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+100	24546	C4-1/8-T0-1102-F
A57R31	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-TO-1961-F
A57R32	2100-3757	6	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A57R33	2100-3757	6	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN (Recommended Replacement)	28480	2100-3757
A57R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A57R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A57R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A57R37	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A57R38	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A57R39	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A57R40	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A57R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A57TP1	0360-2050	8	5	TEST POINT	28480	0360-2050
A57TP2	0360-2050	8		TEST POINT	28480	0360-2050
A57TP3	0360-2050	8		TEST POINT	28480	0360-2050
A57TP4	0360-2050	8		TEST POINT	28480	0360-2050
A57TP5	0360-2050	8		TEST POINT	28480	0360-2050
A57U1	1820-1194	6	2	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS193N
A57U2	1818-0135	8	2	IC NMOS 1024 (1K) STAT RAM 360-NS 3-S	04713	MCM68A10L
A57U3	1820-1984	2	2	IC CONV 10-B-D/A 16-DIP-C PKG	24355	AD561KD
A57U4	1820-1984	2		IC CONV 10-B-D/A 16-DIP-C PKG	24355	AD561KD
A57U5	1820-1437	0	1	IC MV TTL LS MONOSTBL DUAL	01295	SN74LS221N
A57U6	1826-0098	9	1	IC COMPARATOR PRCN TO-99 PKG	27014	LM211H
A57U7	1826-0471	2	3	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A57U8	1820-2075	4	2	IC MISC TTL LS	01295	SN74LS245N
A57U9	1820-1196	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A57U10	1820-1194	6		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS193N
A57U11	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A57U12	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A57U13	1820-1272	1	1	IC BFR TTL LS NOR QUAD 2-INP	01295	SN74LS33N
A57U14	1826-0081	0	2	IC OP AMP WB TO-99 PKG	27014	LM318H
A57U15	1818-0135	8		IC NMOS 1024 (1K) STAT RAM 360-NS 3-S	04713	MCM68A10L
A57U16	1820-2075	4		IC MISC TTL LS	01295	SN74LS245N
A57U17	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A57U18	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A57U19	1820-1298	1	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS251N
A57U20	1820-1144	6	2	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A57U21	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A57U22	1826-0081	0		IC OP AMP WB TO-99 PKG	27014	LM318H
A57U23	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A57U24	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A57U25	1820-1216	3	2	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A57U26	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A57U27	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A57U28	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A57U29	1820-1201	6	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A57U30	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A57U31	1810-0583	4	1	NETWORK-RES 16-DIP10.0K OHM X 8	28480	1810-0583
A57VR1	1902-3104	6	3	DIODE-ZNR 5.62V 5% DO-35 PD=.4W	28480	1902-3104
A57VR2	1902-3104	6		DIODE-ZNR 5.62V 5% DO-35 PD=.4W	28480	1902-3104
A57VR3	1902-3104	6		DIODE-ZNR 5.62V 5% DO-35 PD=.4W	28480	1902-3104
A57VR4	1902-0579	3	2	DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579
A57VR5	1902-3357	1	1	DIODE-ZNR 56.2V 5% DO-7 PD=.4W TC=+.081%	28480	1902-3357
A57VR6	1902-0579	3		DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A58	08340-60154	4	1	SWEEP GENERATOR	28480	08340-60154
A58C1	0180-0291	1	1	CAPACITOR-FXD 1UF +10% 35VDC TA	28480	0180-0291
A58C2	0160-4841	5	38	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C3				NOT ASSIGNED		
A58C4	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C5	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C6, 7				NOT ASSIGNED		
A58C8	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C9	0160-4832	4	8	CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A58C10	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A58C11	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C12	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C13	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C14	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C15	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C16	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C17	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C18	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C19	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A58C20	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C21	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C22	0160-4810	8	1	CAPACITOR-FXD 330PF +5% 100VDC CER	28480	0160-4810
A58C23	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C24	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C25	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C26	0160-4825	5	1	CAPACITOR-FXD 560PF +5% 100VDC CER	28480	0160-4825
A58C27				NOT ASSIGNED		
A58C28	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C29	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C30	0160-5662	0	1	CAPACITOR-FXD 5UF +10% 50VDC NET-POLYC	28480	0160-5662
A58C31	0160-4265	7	1	CAPACITOR-FXD .47UF +20% 50VDC	84411	HEW 386
A58C32	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A58C33	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C34	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C35	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C36	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C37	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C38	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C39	0160-4807	3	1	CAPACITOR-FXD 33PF +5% 100VDC CER 0+30	28480	0160-4807
A58C40	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C41	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C42	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C43	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A58C44	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A58C45	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A58C46	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C47	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C48	0180-1731	8	1	CAPACITOR-FXD 4.7UF +10% 50VDC TA	28480	0180-1731
A58C49	0180-0374	3	1	CAPACITOR-FXD 10UF +10% 20VDC TA	56289	150D106X9020B2
A58C50	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C51	0180-0116	1	3	CAPACITOR-FXD 6.8UF +10% 35VDC TA	28480	0180-0116
A58C52	0180-0116	1		CAPACITOR-FXD 6.8UF +10% 35VDC TA	28480	0180-0116
A58C53	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C54	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C55	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C56	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C57	0160-4832	4		CAPACITOR-FXD .01UF +10% 100VDC CER	28480	0160-4832
A58C58	0180-0116	1		CAPACITOR-FXD 6.8UF +10% 35VDC TA	28480	0180-0116
A58C59	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C60	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58C61	0160-4841	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4841
A58CR1	1901-1098	1	2	DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A58CR2	1901-0586	0	9	DIODE-GEN PRP 30V 25MA TO-72	28480	1901-0586
A58CR3	1901-0586	0		DIODE-GEN PRP 30V 25MA TO-72	28480	1901-0586
A58CR4	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A58CR5	1901-0518	8	2	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A58CR6	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A58CR7	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A58CR8				NOT ASSIGNED		
A58CR9	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A58L1	9140-0210	1	4	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A58L2	9100-0539	3	1	INDUCTOR RF-CH-MLD 10UH 5% .156DX.375LG	28480	9100-0539
A58L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210

See introduction to this section for ordering information
*Indicates factory selected value

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Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A58L4	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A58L5	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A58MP1	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A58MP2	4040-0747	2	1	EXTR-PC BD GRA POLYC .062-BD-THKNS	28480	4040-0747
A58MP3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A58MP4,5				NOT ASSIGNED		
A58MP6	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A58MP7	1200-0172	4	2	INSULATOR-XSTR DAP-GL	28480	1200-0172
A58MP8	0380-1221	5	1	STANDOFF-RUT-ON .25-IN-LG 2-56 THD	28480	0380-1221
A58MP9	08340-00068	3	1	DAC SHIELD	28480	08340-00068
A58MP10	0520-0126	5	1	SCREW-MACH 2-56 .125-IN-LG 100DEG	28480	0520-0126
A58MP11	2190-0112	0	1	WASHER LK .088-IN-DIA	28480	2190-0112
A58P1	1251-7469	3	1	CONN - POST TYPE	28480	1251-7469
A58Q1	1855-0420	2	10	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q2	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q3	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q4	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q5	1855-0278	8	1	TRANSISTOR J-FET 2N5116 P-CHAN D-MODE	17856	2N5116
A58Q6	1855-0386	2		TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A58Q7	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q8	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q9	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q10	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q11	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q12	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A58Q13	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A58Q14	1854-0361	8	1	TRANSISTOR NPN 2N4239 SI TO-5 PD=6W	02037	2N4239
A58R1	2100-3154	7	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A58R2	0757-0280	3	9	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A58R3	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A58R4	2100-3123	0	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	02111	43P501
A58R5	0757-0465	6	3	RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A58R6	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-1621-F
A58R7	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A58R8	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0 +100	24546	C4-1/8-TO-101F
A58R9	0699-0747	3	2	RESISTOR 4K .05% .1W F TC=0+10	28480	0699-0747
A58R10	0757-0442	9	14	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R11	0698-8960	6	1	RESISTOR 750K 1% .125W F TC=0+100	28480	0698-8960
A58R12	0699-0747	3		RESISTOR 4K .05% .1W F TC=0+10	28480	0699-0747
A58R13	2100-3095	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	02111	43P201
A58R14	0757-0346	2	9	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R15	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R16	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R17	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A58R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R19	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+100	24546	C4-1/8-T0-5621-F
A58R20	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A58R21	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R22	0757-1101	9	1	RESISTOR 360 1% .125W F TC=0+100	24546	C4-1/8-T0-361-F
A58R23	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+100	28480	0698-3260
A58R24	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-5112-F
A58R25	0698-3484	9	1	RESISTOR 6.65K 1% .125W F TC=0+100	24546	C4-1/8-T0-6651-F
A58R26	0698-4503	5	1	RESISTOR 66.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-6652-F
A58R27	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A58R28	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A58R29	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+100	19701	MF4C1/8-T0-6191-F
A58R30	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+100	24546	C4-1/8-T0-2871-F
A58R31	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-5112-F
A58R32	0698-5093	0	1	RESISTOR 390K 1% .125W F TC=0+100	28480	0698-5093
A58R33				NOT ASSIGNED		
A58R34	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A58R35				NOT ASSIGNED		
A58R36	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-2152-F
A58R37	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R38	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R39	0698-3432	7	1	RESISTOR 26.1 1% .125W F TC=0+100	03888	PME55-1/8-T0-26R1-F
A58R40				NOT ASSIGNED		
A58R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R42	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R43	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+100	24546	C4-1/8-T0-1782-F
A58R44	0757-0459	8	1	RESISTOR 56.2K 1% .125W F TC=0+100	24546	C4-1/8-T0-5622-F
A58R45	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A58R46	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R47	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R48	0698-3430	5	1	RESISTOR 21.5 1% .125W F TC=0+100	03888	PME55-1/8-T0-21R5-F
A58R49	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A58R50	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A58R51				NOT ASSIGNED		
A58R52	0699-0683	6	3	RESISTOR 10K .01% .1W F TC=0+15	28480	0699-0683
A58R53	0699-0683	6		RESISTOR 10K .01% .1W F TC=0+15	28480	0699-0683
A58R54	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R55	0699-0683	6		RESISTOR 10K .01% .1W F TC=0+15	28480	0699-0683
A58R56	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R57	0699-0685	8	1	RESISTOR 2K .01% .1W F TC=0+15	28480	0699-0685
A58R58	0699-0684	7	2	RESISTOR 8.1K .01% .1W F TC=0+15	28480	0699-0684
A58R59	0699-0275	2	1	RESISTOR 1K .01% .1W F TC=0+15	28480	0699-0275
A58R60	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A58R61	0699-0684	7		RESISTOR 8.1K .01% .1W F TC=0+15	28480	0699-0684
A58R62	0699-0682	5	1	RESISTOR 900 .01% .1W F TC=0+15	28480	0699-0682
A58R63	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A58R64	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A58R65	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R67	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R68	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R69	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R70	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R71	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R72	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A58R73	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A58R74	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A58R75	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A58R76	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A58R77	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A58R78	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A58R79	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-TO-511R-F
A58R80	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+100	24546	C4-1/8-TO-1781-F
A58R81	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-TO-5111-F
A58R82				NOT ASSIGNED		
A58R83	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-TO-101-F
A58R84	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-TO-1001-F
A58TP1	0360-0535	0	14	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP13	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58TP14	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A58U1	1826-0471	2	9	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U2	1820-1984	2	1	IC CONV 10-B-D/A 16-DIP-C PKG	24355	AD561KD
A58U3	1810-0206	8	7	NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A58U4	1826-0138	8	3	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A58U5	1826-0938	6	1	D/A 10-bit 18-CERDIP BPLR	28480	1826-0938
A58U6	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U7	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U8	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U9	1813-0041	5	1	IC OP AMP TO-99 PKG	27014	LH0042CH
A58U10	1826-0785	1	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	01295	TL072ACJG
A58U11	1826-0684	9	1	IC CONV 12-B-D/A 18 DIP-C PKG	28480	1826-0684
A58U12	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U13	1826-1140	4	1	IC SMPL/HOLD 14 CERDIP	02180	SMP-10FT
A58U14	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U15	1826-0783	9	1	IC OP AMP LOW-NOIS 8-DIP-C PKG	52063	XR5534ACN
A58U16	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U17	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U18	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A58U19	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A58U20	1820-1196	8	6	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A58U21	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A58U22	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A58U23	1820-2550	0	2	IC DCDR TTL LS 3-TO-8-LINE	01295	SN74LS137N
A58U24	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A58U25	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A58U26	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A58U27	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A58U28	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A58U29	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A58U30	1810-0206	8		NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A58U31	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A58U32	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A58U33	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A58U34	1820-2550	0		IC DCDR TTL LS 3-TO-8-LINE	01295	SN74LS137N
A58U35	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A58U36	1810-0371	8	1	NETWORK-RES 8-SIP100.0K OHM X7	01121	208A104
A58U37	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A58VR1	1902-0625	0	1	DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829

See introduction to this section for ordering information
*Indicates factory selected value

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Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A59	08340-60226	1	1	DIGITAL INTERFACE	28480	08340-60226
A59C1	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A59C2	0160-4557	0	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A59C3	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A59C4	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A59C5				NOT ASSIGNED		
A59C6	0160-4832	4	11	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C7	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C8	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C9	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C10	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C11	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C12	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C13	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C14				NOT ASSIGNED		
A59C15				NOT ASSIGNED		
A59C16	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C17	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59C18	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A59CR1	1901-0033	2	3	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A59CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A59CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A59L1	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A59MP1	4040-0756	3	1	EXTR-PC BD WHT POLYC .062-BD-THKNS	28480	4040-0756
A59MP2, 3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A59MP4	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A59P1	1251-7469	3	1		28480	1251-7469
A59R1	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A59R2	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A59R3	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A59R4	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A59R5	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A59R6	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A59R7	0698-3446	3	3	RESISTOR 383 1% .125W F TC=0+-100	03292	C4-1/8-T0-383R-F
A59R8	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	03292	C4-1/8-T0-383R-F
A59R9	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	03292	C4-1/8-T0-383R-F
A59R10	0698-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A59R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A59R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A59R13				NOT ASSIGNED		
A59R14	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A59R15-21				NOT ASSIGNED		
A59R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A59R23-24				NOT ASSIGNED		
A59R26-28				NOT ASSIGNED		
A59R29	0757-0422	5	3	RESISTOR 909 1% .125W F TC=0+-100	03292	CT4-1/8-TO-909R-F
A59R30	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	03292	CT4-1/8-TO-909R-F
A59R31	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	03292	CT4-1/8-TO-909R-F
A59R32				NOT ASSIGNED		
A59R33	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	03292	CT4-1/8-TO-5111-F
A59TP1	0360-0535	0	10	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A59U1				NOT ASSIGNED		
A59U2	1820-0577	7	2	IC INV TTL HEX 1-INP	01295	SN7416N
A59U3	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A59U4	1820-1440	5	2	IC LCH TTL LS QUAD	01295	SN74LS279N
A59U5	1820-1905	7	1	IC GATE TTL LS NOR DUAL 5-INP	07263	74LS260PC
A59U6	1820-1297	0	1	IC GATE TTL LS EXCL-NOR QUAD 2-INP	01295	SN74LS266N
A59U7	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A59U8				NOT ASSIGNED		
A59U9	1820-0577	7		IC INV TTL HEX 1-INP	01295	SN7416N
A59U10	1820-1196	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A59U11	1820-1210	7	2	IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A59U12	1820-1216	3	3	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A59U13	1826-0138	8	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A59U14-17				NOT ASSIGNED		
A59U17	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A59U18	1820-1917	1	1	IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS240N

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A59U19	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A59U20				NOT ASSIGNED		
A59U21				NOT ASSIGNED		
A59U22	1820-1440	5		IC LCH TTL LS QUAD	01295	SN74LS279N
A59U23	1820-1858	9	2	IC FF TTL LS D-TYPE OCTL	01295	SN74LS377N
A59U24	1820-1858	9		IC FF TTL LS D-TYPE OCTL	01295	SN74LS377N
A59U25	1820-1210	7		IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A59U26	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A59U27	1810-0280	8	1	NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A59W1	1460-1489	8	3	WIREFORM BE CU AG	28480	1460-1489
A59W2	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A59W3	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A60	08340-60193	1	1	PROCESSOR BOARD ASSEMBLY	28480	08340-60193
A60BT1	1420-0331	3	1	BATTERY 3.4V 1.75A-HR LITHIUM THIONYL	28480	1420-0331
A60C1	0180-0374	3	3	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A60C2	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A60C3	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A60C4	0160-4835	7	19	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C5	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C6	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A60C7	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C8	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C9	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C10	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C11	0160-4832	4	11	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C12	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C13	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C14	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C15	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C16	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C17	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C18	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C19	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C20	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C21	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C22	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C23	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C24	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A60C25	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C26	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C27	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C28	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C29	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C30	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C31	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C32	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C33	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60C34	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A60C35	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A60CR1	1901-0376	6	2	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A60CR2	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A60CR3	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A60CR4	1901-0050	3	2	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A60CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A60CR6	1901-1098	1	2	DIODE-SWITCHING 50V 200MA 4NS	02682	1N4150
A60CR7	1901-1098	1		DIODE-SWITCHING 50V 200MA 4NS	02682	1N4150
A60DS1	1990-0958	7	16	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS2	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS3	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS4	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS5	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS6	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS7	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS8	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS9	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS10	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS11	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS12	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS13	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS14	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS15	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS16	1990-0958	7		LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A60DS17	1990-0487	7	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A60L1	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A60MP1	4040-0754	1	1	EXTR PC BD BLU	28480	4040-0754
A60MP2	4040-0748	3	1	EXTR PC BD BLK	28480	4040-0748
A60MP3,4	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A60MP5	1400-1267	4	1	CLIP BTRY AA	28480	1400-1267
A60P1	1251-7469	3	1	CONN-POST TYPE .100-PIN-SPCG 110-CONT	28480	1251-7469
A60Q1	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A60Q2	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A60Q3	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A60R1	0757-0873	0	1	RESISTOR 1.62K 1% .5W F TC=0+-100	28480	0757-0873
A60R2	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A60R3	0757-0442	9	10	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R4	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A60R5	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R6	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A60R7	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A60R8	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A60R9	0698-3260	9	3	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A60R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A60R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R14	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A60R15	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A60R16	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A60R17	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A60R18	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A60R19	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A60R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R22				NOT ASSIGNED		
A60R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R26	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A60R27	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A60R28	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A60R29	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A60R30	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A60TP1-TP26	0360-0535	0	26	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A60U1	1826-0759	9	1	IC COMPARATOR GP QUAD 14-DIP-C PKG	04713	LM339J
A60U2	1810-0206	8	1	NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A60U3	1813-0196	1	1	XTAL-CLOCK-OSCILLATOR 14.7456-MHZ	28480	1813-0196
A60U4	1820-3449	8	1	IC-PARALLEL INTERFACE/TIMER/8MHZ/MC68000	28480	1820-3449
A60U5	1820-3172	4	1	IC FF CMOS/74HC J-K BAR POS-EDGE-TRIG	28480	1820-3172
A60U6	1820-2483	8	1	IC RCVR TTL LS BUS OCTL	01295	SN75161N
A60U7	1820-2485	0	1	IC RCVR TTL LS BUS OCTL	01295	SN75160N
A60U8	1820-3401	2	1	IC BFR TTL ALS OR QUAD 2-INP	28480	1820-3401
A60U9	1810-0276	2	2	NETWORK-RES 10-SIP1.5K OHM X 9	01121	210A152
A60U10	08340-80005	6	1	IO DECODER	28480	08340-80005
A60U11	1820-2548	6	1	IC GENERAL PURPOSE INTERFACE BUS ADAPTER	28480	1820-2548
A60U12	1810-0276	2		NETWORK-RES 10-SIP1.5K OHM X 9	01121	210A152
A60U13	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A60U14	1820-1997	7	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A60U15	1810-0279	5	4	NETWORK-RES 10-SIP4.7K OHM X 9	01121	210A472
A60U16	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A60U17	1810-0279	5		NETWORK-RES 10-SIP4.7K OHM X 9	01121	210A472
A60U18	1820-2675	0	2	IC RCVR TTL LS BUS OCTL	01295	SN74LS646N
A60U19	1820-2675	0		IC RCVR TTL LS BUS OCTL	01295	SN74LS646N
A60U20	1820-1203	8	1	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A60U21	1820-2102	8	1	IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A60U22	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A60U23	08340-80007	8	1	DECODER	28480	08340-80007
A60U24	1820-1851	2	1	IC ENCDR TTL LS	01295	SN74LS148N
A60U25	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN74ALS00N
A60U26	1810-0279	5		NETWORK-RES 10-SIP4.7K OHM X 9	01121	210A472
A60U27	1820-2505	5	1	IC -MPU; CLK FREQ=8MHZ, INSTRUCTION	28480	1820-2505
A60U28	1820-1492	7	1	IC BFR TTL LS INV HEX 1-INP	01698	SN74LS368AN
A60U29	08340-80006	7	1	MEMORY DECODER	28480	08340-80006
A60U30	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A60U31	1810-0279	5		NETWORK-RES 10-SIP4.7K OHM X 9	01121	210A472
A60U32	1818-3464	2	2	IC EPROM 2KX8	28480	1818-3464
A60U33	1818-3464	2		IC EPROM 2KX8	28480	1818-3464
A60U34				NOT ASSIGNED		
A60U35				NOT ASSIGNED		
A60U36	1818-3329	8	2	IC NMOS 262144(256K) EPROM 200-NS 3-S	28480	1818-3329
A60U37	1818-3329	8		IC NMOS 262144(256K) EPROM 200-NS 3-S	28480	1818-3329
A60U38	1818-3183	2	2	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A60U39	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A60U40	1251-4787	2	1	SHUNT-DIP 8-POSITION	28480	1251-4787
A60VR1	1902-3107	9	1	DIODE-ZNR 5.76V 2% DO-35 PD=.4W	28480	1902-3107
A60X1	1200-0607	0	1	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607

See introduction to this section for ordering information

*Indicates factory selected value.

PAGES 6-127 THROUGH 6-130 HAVE BEEN INTENTIONALLY OMITTED

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A62	08340-60163		1	MOTHERBOARD	28480	08340-60163
				NOTE		
				THIS ASSEMBLY IS NOT FIELD REPLACEABLE. FAULTY MOTHERBOARDS MUST BE REPLACED AT THE FACTORY.		
A62C1	0180-3205	5	1	CAPACITOR-FXD 4200uF +75-10% 75VDC AL	28480	0180-3205
A62C2	0180-3017	7	2	CAPACITOR-FXD .045F+75-10% 25VDC AL	28480	0180-3017
A62C3	0180-3017	7		CAPACITOR-FXD .045F+75-10% 25VDC AL	28480	0180-3017
A62C4				NOT ASSIGNED		
A62C5	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A62C6	0180-0374	3	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A62C7	0180-2661	5	1	CAPACITOR-FXD 1UF+-10% 50VDC TA	25088	D1R0GS1A50K
A62CR1	1901-0028	5	2	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A62CR2	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A62CR3	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A62DS1	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A62J1				(NOT REPLACEABLE P/O MB)		
A62J2	1251-5799	8	1	CONNECTOR 20-PIN M POST TYPE	28480	1251-5799
A62J3	1251-6868	4	2	CONNECTOR 5-PIN M POST TYPE	28480	1251-6868
A62J4	1250-0543	8	1	CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A62J5	1250-1889	7	13	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J6	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J7	1251-7482	0	1		28480	1251-7482
A62J8	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J9	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J10	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J11	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J12				NOT ASSIGNED		
A62J13	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J14	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J15	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J16	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J17				NOT ASSIGNED		
A62J18	1200-0482	9	2	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A62J19	1200-0482	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A62J20	1200-0483	0	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0483
A62J21-24				NOT ASSIGNED		
A62J25	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J26	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J27	1250-1889	7		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1889
A62J28				NOT ASSIGNED		
A62J29	1251-6868	4		CONNECTOR 5-PIN M POST TYPE	28480	1251-6868
A62J30	1251-6795	6	2	CONNECTOR 3-PIN M POST TYPE	28480	1251-6795
A62J31	1251-8458	2	1	CONNECTOR 36-PIN M POST TYPE	28480	1251-8458
A62J32	1251-6794	5	1	CONNECTOR 5-PIN M POST TYPE	28480	1251-6794
A62J33				NOT ASSIGNED		
A62J34	1251-6795	6		CONNECTOR 3-PIN M POST TYPE	28480	1251-6795
A62K1	0490-0618	5	1	RELAY 2C 24VDC-COIL 5A 115VAC	28480	0490-0618
A62L1	85660-80007	7	8	INDUCT P/S FLTR	28480	85660-80007
A62L2	85660-80007	7		INDUCT P/S FLTR	28480	85660-80007
A62L3	85660-80007	7		INDUCT P/S FLTR	28480	85660-80007
A62L4	85660-80007	7		INDUCT P/S FLTR	28480	85660-80007
A62L5	85660-80007	7		INDUCT P/S FLTR	28480	85660-80007
A62L6	85660-80007	7		INDUCT P/S FLTR	28480	85660-80007
A62L7	85660-80007	7		INDUCT P/S FLTR	28480	85660-80007
A62L8	85660-80007	7		INDUCT P/S FLTR	28480	85660-80007
A62MP1	1251-2313	6	1	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A62MP2	08340-20052	7	1	HEAT SINK	28480	08340-20052
A62MP3	1251-1115	4	20	POLARIZING KEY-PC EDGE CONN	28480	1251-1115
A62MP4	1251-5595	2	2	POLARIZING KEY-POST CONN (AL2J2)	28480	1251-5595
A62MP5	85660-00026	2	1	SHOCK MNT BOTTOM	28480	85660-00026
A62MP6	1520-0205	2	2	SHOCK MOUNT .47-EFF-HGT	28480	1520-0205
A62MP7	2200-0105	4	1	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A62MP8				NOT ASSIGNED		
A62MP9				NOT ASSIGNED		
A62MP10				NOT ASSIGNED		
A62MP11	0890-0048	3	1	TUBING-FLEX .02-ID TFE .01-WALL	00000	ORDER BY DESCRIPTION
A62P1	1251-0600	0	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A62P2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A62Q1	1854-0618	8	2	TRANSISTOR NPN SI DARL TO-3 PD=150W	04713	MJ3000
A62Q2	1854-0294	6	1	TRANSISTOR NPN SI TO-3 PD=115W FT=500KHZ	28480	1854-0294
A62Q3	1854-0618	8		TRANSISTOR NPN SI DARL TO-3 PD=150W	04713	MJ3000
A62Q4	1854-0679	1	1	TRANSISTOR NPN 2N5885 SI TO-3 PD=200W	04713	2N5885

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A62R1	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A62R2	0757-0836	5	1	RESISTOR 7.5K 1% .5W F TC=0+-100	28480	0757-0836
A62R3	0698-3404	3	1	RESISTOR 383 1% .5W F TC=0+-100	28480	0698-3404
A62R4	0757-0436	1	1	RESISTOR 4.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4321-F
A62R5, 6				NOT ASSIGNED		
A62R7	0698-7229	8	7	RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A62R8	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A62R9	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A62R10	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A62R11	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A62R12	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A62R13	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-F
A62S1	3103-0108	2	1	SWITCH-THRM FXD +212F 2.5A CL-ON-RISE	28480	3103-0108
A62U1	1826-0423	4	1	IC V RGLTR TO-3	27014	LM317K
A62W1	08340-60057	6	1	CBL RBN 50 PN	28480	08340-60057
A62XA19	1251-1626	2	1	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-1626
A62XA21	1251-2134	9	3	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2134
A62XA24	1251-2134	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2134
A62XA25	1251-1887	7	3	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1887
A62XA26	1251-1887	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1887
A62XA27	1251-7187	2	1	CONNECTOR-PC EDGE 31-CONT/ROW 2-ROWS	28480	1251-7187
A62XA28	1251-1887	7		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1887
A62XA35	1251-2026	8	5	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A62XA36	1251-2035	9	6	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A62XA37	1251-2026	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A62XA38	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A62XA39	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A62XA40	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A62XA41	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A62XA42	1251-2026	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A62XA43	1251-2026	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A62XA52	1251-2582	1	1	CONNECTOR-PC EDGE 24-CONT/ROW 2-ROWS	28480	1251-2582
A62XA53	1251-2134	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2134
A62XA54	1251-2026	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A62XA55	1251-1886	6	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-1886
A62XA56	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A62XA57	1251-7472	8	5	CONNECTOR - POST TYPE	28480	1251-7472
A62XA58	1251-7472	8		CONNECTOR - POST TYPE	28480	1251-7472
A62XA59	1251-7472	8		CONNECTOR - POST TYPE	28480	1251-7472
A62XA60	1251-7472	8		CONNECTOR - POST TYPE	28480	1251-7472
A62XA61	1251-7472	8		CONNECTOR - POST TYPE	28480	1251-7472

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A63	08340-60175	9	1	90 DB PROGRAMMABLE ATTENUATOR	28480	08340-60175
				MISCELLANEOUS ELECTRICAL PARTS		
AT1	0960-0638	8	1	PERIPHERAL MODE ISOLATOR	28480	0960-0638
AT2	0955-0090	3	1	ATTENUATOR 15 DB	28480	0955-0090
B1	08340-60055	4	1	FAN ASSEMBLY (STANDARD) (INCL B1W1)	28480	08340-60055
				08340-60055 INCLUDES THE FOLLOWING PARTS:		
	0360-0535	0	2	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
	0890-0029	0	1	TUBING-HS .187-D/.093-RCVD .02-WALL	28480	0890-0029
	0890-0983	5		TUBING-HS .125-D/.062-RCVD .02-WALL	28480	0890-0983
	1251-4223	1	2	CONNECTOR- CONT F .025	28480	1251-4223
	1251-6796	7	1	CONNECTOR HOUSING- 3 FEMALE IR	28480	1251-6796
	1400-0249	0	1	CABLE TIE .062-.625-DIA .091-WD NYL	06383	PLT1M-8
	1520-0230	3	4		28480	1520-0230
	2190-0017	4	2	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
	2200-0770	9	10	SCREW-MACH 4-40 .188-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
	2360-0119	8	4	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0196	1	4	SCREW-MACH 6-32 .375-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
	2510-0135	7	2	SCREW-MACH 8-32 2.25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2680-0137	8	1	SCREW-MACH 10-32 .188-IN-LG PAN-HD-SLT	00000	ORDER BY DESCRIPTION
	3160-0371	1	1	FAN-TBAX 180-CFM 115V 50/60-HZ	28480	3160-0371
	8150-0011	0	1	WIRE 22AWG G 300V PVC 7X30 105C	28480	8150-0011
	8150-0447	6	1	WIRE 24AWG BK 300V PVC 7X32 80C	28480	8150-0447
	08340-00012	7	1	HOUSING FAN (TOP)	28480	08340-00012
	08340-00013	8	1	HOUSING FAN (BOTTOM)	28480	08340-00013
	08340-00014	9	1	HOUSING FAN (GRILLE)	28480	08340-00014
	08340-00016	1	1	BASE PLATE	28480	08340-00016
	08340-00017	2	1	GRILL AIR FILTER	28480	08340-00017
	08340-00018	3	1	FILTER-AIR	28480	08340-00018
	85660-20092	4	4	SNUBBER-SHOCK MOUNT	28480	85660-20092
C1	0160-4065	5	1	CAPACITOR-FXD .1UF +-20% 250VAC(RMS)	28480	0160-4065
C2	0160-4819	7	1	CAPACITOR-FXD 2200PF +-5% 100VDC CER	28480	0160-4819
C3	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C4	0160-4063	3	1	CAPACITOR-FXD 0.39 UF 21.0 VDC	28480	0160-4063
CR1	1901-0179	7	2	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
CR2	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
DS1	1990-0858	6	1	LED-LAMP LUM-INT=150UCD IF=25MA MAX	28480	1990-0858
	1450-0615	9	1	LAMPHOLDER	28480	1450-0615
	08340-40002	9	1	L.E.D. MOUNT	28480	08340-40002
F1	2110-0002	9	1	FUSE 2A 250V NTD 1.25X.25 UL (REQUIRED FOR 240V OPERATION)	75915	312002
F1	2110-0003	0	1	FUSE 3A 250V NTD 1.25X.25 UL (REQUIRED FOR 200V OPERATION)	75915	312003
F1	2110-0010	9	1	FUSE 5A 250V NTD 1.25X.25 UL (REQUIRED FOR 100V OPERATION)	75915	312005
F1	2110-0055	2	1	FUSE 4A 250V NTD 1.25X.25 UL (REQUIRED FOR 120V OPERATION)	75915	312004
FL1	0960-0443	1	1	LINE MODULE-FILTERED	28480	0960-0443
J1				SEE J1W1		
J1W1	08340-60071	4	1	CABLE ASSY-COAX (SWP OUT)	28480	08340-60071
	0590-1251	6	4	NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	00000	ORDER BY DESCRIPTION
	1250-0870	4	3	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0870
J2				SEE J2W1		
J2W1	08340-60066	7	1	CABLE ASSY-COAX (PULSE)	28480	08340-60066
	0590-1251	6		NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	00000	ORDER BY DESCRIPTION
	1250-0870	4		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0870
J3				SEE J3W1		
J3W1	08340-60069	0	1	CABLE ASSY-COAX (AM)	28480	08340-60069
	0590-1251	6		NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	00000	ORDER BY DESCRIPTION
	1250-0870	4		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0870
J4				SEE J4W1		
J4W1	08340-60068	9	1	CABLE ASSY-COAX (EXT INPUT)	28480	08340-60068
	00310-48801	0	2	WASHER-SHOULDERED	28480	00310-48801
	0590-1251	6		NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	00000	ORDER BY DESCRIPTION
	0360-1158	5	1	LUG	28480	0360-1158
	1250-1091	3	1	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1091
J5	5061-5316	6	1	RF OUTPUT CONNECTOR ASSEMBLY	28480	5061-1100
	5061-5311	1	1	3.5 MM F/F ADAPTER	28480	5061-5311
	1250-1745	4		TYPE N(F) TO APC-3.5(F) ADAPTER	28480	1250-1745
J6	1250-0083	1	8	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	0360-1632	0	4	TERMINAL-SLDR LUG LK-MTG FOR-#3/8-SCR	28480	0360-1632
	2950-0001	8	2	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J7	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	0360-1632	0		TERMINAL-SLDR LUG LK-MTG FOR-#3/8-SCR	28480	0360-1632
	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
J7W1	08340-60070	3	1	CABLE ASSY-COAX (A62J8 TO R.P. J7)	28480	08340-60070
J8	1250-0102	5	3	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0102
	2190-0068	5	3	WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	2950-0054	1	3	NUT-HEX-DBL-CHAM 1/2-28-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
J8W1	08340-60086	1	1	CABLE ASSY-COAX (A29J5 TO R.P. J8)	28480	08340-60086
J9	1250-0102	5		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0102
	2190-0068	5		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	2950-0054	1		NUT-HEX-DBL-CHAM 1/2-28-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
J9W1	08340-60089	4	1	CABLE ASSY-COAX (A51J1 TO R.P. J9)	28480	08340-60089
J10	1250-0102	5		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0102
	2190-0068	5		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	2950-0054	1		NUT-HEX-DBL-CHAM 1/2-28-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
J10W1	08340-60085	0	1	CABLE ASSY-COAX (A29J1 TO R.P. J10)	28480	08340-60085
J11	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	2190-0016	3	4	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
J12	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
J13	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	0360-1632	0		TERMINAL-SLDR LUG LK-MTG FOR-#3/8-SCR	28480	0360-1632
J14	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
J15	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
J16	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	0360-1632	0		TERMINAL-SLDR LUG LK-MTG FOR-#3/8-SCR	28480	0360-1632
J17	1251-6781	0	1	CONNECTOR 3-PIN M CIRC AUDIO (INCLUDES MOUNTING HARDWARE)	28480	1251-6781
J18	1251-0064	0	1	CONNECTOR 25-PIN F D SERIES	28480	1251-0064
	1251-2942	7	2	MOUNTING HARDWARE KIT	28480	1251-2942
J19	08340-60127	1	1	CONNECTOR-TYPE N (R.P. AUX OUT)	28480	08340-60127
	2190-0104	0	1	WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
	2950-0132	6	1	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
J20				(REFER TO OPTION 004 AND 005 LISTINGS)		
J21				SEE J21W1		
J21W1	8120-3653	9	1	CABLE ASSY-RIBBON (HP-IB) (INCLUDES J21 & MOUNTING HARDWARE)	28480	8120-3653
RPG1	08340-60197	5	1	ROTARY PULSE GENERATOR REPLACEMENT KIT (INCLUDES LOCKING TANGS, CONNECTOR HOUSING, NUT AND WASHER)	28480	08340-60197
S1	3101-2193	5	1	SWITCH-TGL SUBMIN SPDT 2A 250VAC	28480	3101-2193
S2	3101-0163	5	1	FREQUENCY STANDARD SWITCH KIT (INCLUDES MOUNTING HARDWARE)	28480	3101-0163
T1	9100-4133	1	1	TRANSFORMER	28480	9100-4133
				NOTE		
				The complete transformer assembly (including the wiring harness and all attached lugs) may be ordered as 08340-60124 CD8. Individual lugs for the transformer wiring harness may be ordered separately as indicated below.		
				TRANSFORMER WIRE SOLDER LUGS:		
	0360-0037	7	6	TERMINAL-SLDR LUG PL-MTG FOR-#6-SCR	28480	0360-0037
	0360-0042	4	2	TERMINAL-SLDR LUG PL-MTG FOR-#6-SCR	28480	0360-0042
	0360-0043	5	1	TERMINAL-SLDR LUG PL-MTG FOR-#6-SCR	28480	0360-0043
W1	08340-60062	3	1	CABLE ASSY-RIBBON A7J1 TO A6J1	28480	08340-60062
W2	NONE		1	WIRE ASSY-RF MODULE(GND) TO FRONT PANEL		
W3	08340-20198	2	1	CABLE ASSY-RIGID COAX W51 TO A16J2	28480	08340-20198
W4	08340-20116	4	1	CABLE ASSY-RIGID COAX A16J1 TO J19	28480	08340-20116
W5	08340-20104	0	1	CABLE ASSY-RIGID COAX A17J2 TO A16J7	28480	08340-20104
W6	08340-20108	4	1	CABLE ASSY-RIGID COAX A16J6 TO A14J1	28480	08340-20108
W7	08340-20110	8	1	CABLE ASSY-RIGID COAX A14J1 TO AT1J1	28480	08340-20110
W8	08340-20111	9	1	CABLE ASSY-RIGID COAX AT1J2 TO A13J1	28480	08340-20111
W9	08340-20114	2	1	CABLE ASSY-RIGID COAX A8A2J1 TO A9J1	28480	08340-20114
W10	08340-20115	3	1	CABLE ASSY-RIGID COAX A9J2 TO A15J1	28480	08340-20115
W11	08340-20109	5	1	CABLE ASSY-RIGID COAX A15J2 TO A17J1	28480	08340-20109
W12	08340-20107	3	1	CABLE ASSY-RIGID COAX A17J3 TO A18J1	28480	08340-20107
W13	08340-20223	4	1	CABLE ASSY-RIGID COAX A18J2 TO A12J1	28480	08340-20223
W14	08340-20224	5	1	CABLE ASSY-RIGID COAX A12J2 TO A13J2	28480	08340-20224
W15				NOT ASSIGNED		
W16	08340-20221	2	1	CABLE ASSY-RIGID COAX A13J3 TO A10J1	28480	08340-20221
W17				NOT ASSIGNED		

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W18	08340-20119	7	1	CABLE ASSY-RIGID COAX A10J3 TO A63J1(STD	28480	08340-20119
W19	08340-20117	5	1	CABLE ASSY-RIGID COAX A63J2 TO J5 (STD.)	28480	08340-20117
W20	08340-20122	2	1	CABLE ASSY-RIGID COAX A63J2 TO J20 (004)	28480	08340-20122
W21	08340-20121	1	1	CABLE ASSY-RIGID COAX A10J3 TO J5 (001)	28480	08340-20121
W22	08340-20120	0	1	CABLE ASSY-RIGID COAX A10J3 TO J20 (005)	28480	08340-20120
W23	08340-60118	0	1	CABLE ASSY-COAX A30J3 TO A8A1J1	28480	08340-60118
W24	08340-60117	9	1	CABLE ASSY-COAX A62J14 TO A8A1J2	28480	08340-60117
W25	08340-60119	1	1	CABLE ASSY-COAX A62J10 TO A9J3	28480	08340-60119
W26	08340-60115	7	1	CABLE ASSY-COAX A12J3 TO A25J2	28480	08340-60115
W27	08340-60114	6	1	CABLE ASSY-COAX A11J2 TO A25J1	28480	08340-60114
W28	08340-60126	0	1	CABLE ASSY-COAX A62J13 TO A16J3	28480	08340-60126
W29	08340-60125	9	1	CABLE ASSY-COAX A62J25 TO A16J4	28480	08340-60125
W30	08340-60080	5	1	CABLE ASSY-COAX A16A1J2 TO A16J5	28480	08340-60080
W31	08340-60060	1	1	CABLE ASSY-RIBBON A62J19 TO A20J1/A16A1	28480	08340-60060
W32	08340-60058	7	1	CABLE ASSY-RIBBON A20J2 TO A14A1J1	28480	08340-60058
W33	08340-60061	2	1	CABLE ASSY-RIBBON A62J18 TO A13A1J1	28480	08340-60061
W34	08340-60116	8	1	CABLE ASSY-COAX A29J4 TO A37J1	28480	08340-60116
W35	08340-60081	6	1	CABLE ASSY-COAX A39J2 TO A30J2	28480	08340-60081
W36	08340-60073	6	1	CABLE ASSY-COAX A29J3 TO A42J1	28480	08340-60073
W37	08340-60075	8	1	CABLE ASSY-COAX A49J1 TO A44J1	28480	08340-60075
W38	08340-60074	7	1	CABLE ASSY-COAX A49J2 TO A62J6	28480	08340-60074
W39	08340-60078	1	1	CABLE ASSY-COAX A36J1 TO A49J3	28480	08340-60078
W40	08340-60072	5	1	CABLE ASSY-COAX A48J1 TO A49J4	28480	08340-60072
W41	08340-60084	9	1	CABLE ASSY-COAX A33J2 TO A48J2	28480	08340-60084
W42	08340-20197	1	1	CABLE ASSY-RIGID COAX A44J2 TO A45J1	28480	08340-20197
W43	08340-20196	0	1	CABLE ASSY-RIGID COAX AT2J2 TO A46J1	28480	08340-20196
W44	08340-20101	7	1	CABLE ASSY-RIGID COAX A46J2 TO A48U1J1	28480	08340-20101
W45	NONE		1	WIRE ASSY-STAR GND TO LUG BY A62J29		
W46	08340-60184	0	1	WIRE ASSY (ALSO INCLUDES W47 AND J7W1)	28480	08340-60184
W47	08340-60082	7	1	CABLE ASSY-COAX A62J27 TO A62J4	28480	08340-60082
W48	08340-60079	2	1	CABLE ASSY-COAX A62J5 TO A62J11	28480	08340-60079
W49	08340-60088	3	1	CABLE ASSY-COAX J9 TO J10	28480	08340-60088
W50	08340-60065	6	1	WIRE ASSY- A6J4 TO POWER SWITCH	28480	08340-60065
W51	08340-20195	9	1	CABLE ASSY-RIGID COAX A45J3 TO W3	28480	08340-20195

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				OPTION CONFIGURATIONS		
				OPTION 001: FRONT PANEL RF OUTPUT-NO ATTENUATOR		
				DELETE THE FOLLOWING:		
	08340-00028	5	1	ATTENUATOR MOUNTING PLATE	28480	08340-00028
A63	08340-60175	9	1	90 DB PROGRAMMABLE ATTENUATOR	28480	08340-60175
W18	08340-20119	7	1	CABLE ASSY-RIGID COAX A10J3 TO A63J1	28480	08340-20119
W19	08340-20117	5	1	CABLE ASSY-RIGID COAX A63J2 TO J5	28480	08340-20117
				ADD THE FOLLOWING:		
				CABLE ASSY-RIGID COAX A10J3 TO J5		
				OPTION 004: REAR PANEL RF OUTPUT WITH ATTENUATOR		
				DELETE THE FOLLOWING:		
	08340-20076	5	1	RF CONNECTOR BRACKET	28480	08340-20076
W19	08340-20117	5	1	CABLE ASSY-RIGID COAX A63J2 TO J5	28480	08340-20117
	08340-20078	7	1	BEZEL-KEYBOARD FINISH	28480	08340-20078
				ADD THE FOLLOWING:		
W20	08340-20122	2	1	CABLE ASSY-RIGID COAX A63J2 TO J20	28480	08340-20122
	83592-20063	2	1	PLUG BUTTON-FRONT PANEL	28480	83592-20063
	83595-20004	4	1	FRONT PANEL CONNECTOR SPACER	28480	83595-20004
	08340-20080	1	1	BEZEL-KEYBOARD FINISH	28480	08340-20080
	1400-0053	4	1	CLAMP-CABLE .172-DIA .375-WD NYL		
	2200-0145	2	1	SCREW-MACH 4-40 .438-IN-LG PAN-HD-POZI		
	2190-0019	6	1	WASHER-LK HLCL NO. 4 .115-IN-ID		
	3050-0105	6	1	WASHER-FL MTLC NO. 4 .125-IN-ID		
				OPTION 005: REAR PANEL RF OUTPUT-NO ATTENUATOR		
				DELETE THE FOLLOWING:		
	08340-00028	5	1	ATTENUATOR MOUNTING PLATE	28480	08340-00028
	08340-20076	5	1	RF CONNECTOR BRACKET	28480	08340-20076
W18	08340-20119	7	1	CABLE ASSY-RIGID COAX A10J3 TO A63J1	28480	08340-20119
W19	08340-20117	5	1	CABLE ASSY-RIGID COAX A63J2 TO J5	28480	08340-20117
A63	08340-60175	9	1	90 DB PROGRAMMABLE ATTENUATOR	28480	08340-60175
	08340-20078	7	1	BEZEL-KEYBOARD FINISH	28480	08340-20078
				ADD THE FOLLOWING:		
W22	08340-20120	0	1	CABLE ASSY-RIGID COAX	28480	08340-20120
	83595-20004	4	1	FRONT PANEL CONNECTOR SPACER	28480	83595-20004
	83592-20063	2	1	PLUG BUTTON-FRONT PANEL	28480	83592-20063
	08340-20080	1	1	BEZEL-KEYBOARD FINISH	28480	08340-20080
	1400-0053	4	1	CLAMP-CABLE .172-DIA .375-WD NYL		
	2200-0145	2	1	SCREW-MACH 4-40 .438-IN-LG PAN-HD-POZI		
	2190-0019	6	1	WASHER-LK HLCL NO. 4 .115-IN-ID		
	3050-0105	6	1	WASHER-FL MTLC NO. 4 .125-IN-ID		
				OPTION 006: DELETE PULSE MODULATION		
				DELETE THE FOLLOWING:		
A21 (STD)	08340-60160	2	1	PULSE MODULATOR DRIVER (STD)	28480	08340-60160
				ADD THE FOLLOWING:		
A21 (OPT 006)	08341-60002	2	1	PULSE MODULATION DRIVER (OPTION 006)	28480	08341-60002
				OPTION 806: CHASSIS SLIDE KIT		
				DELETE THE FOLLOWING:		
	5061-9517	7	1	CHASSIS COVER (SIDE) PERFORATED	28480	5061-9517
	5061-9462	1	1	CHASSIS COVER (SIDE)	28480	5061-9462
				ADD THE FOLLOWING:		
	08340-60136	2	1	SLIDE RACK MOUNT KIT	28480	08340-60136
				OPTION 850: INTERFACE CABLE FOR OPERATION WITH HP 8410B/C		
				ADD THE FOLLOWING:		
	08410-60146	9	1	INTERCONNECT CABLE	28480	08410-60146
				OPTION 908: RACK FLANGES WITHOUT HANDLES		
				ADD THE FOLLOWING:		
	5061-9678	1	1	RACK FLANGES WITHOUT HANDLES KIT	28480	5061-9678
				OPTION 913: RACK FLANGES WITH HANDLES		
				ADD THE FOLLOWING:		
	5061-9772	6	1	RACK FLANGES WITH HANDLES KIT	28480	5061-9772

See introduction to this section for ordering information. *Indicates factory selected value

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				MISCELLANEOUS MECHANICAL & CHASSIS PARTS		
1	0340-0923	8	10	INSULATOR-BSHG NYLON	28480	0340-0923
2	0360-0037	7	10	TERMINAL-SLDR LUG PL-MTG FOR-#6-SCR	28480	0360-0037
3	0360-0042	4	3	TERMINAL-SLDR LUG PL-MTG FOR-#6-SCR	28480	0360-0042
4	0400-0082	8	2	GROMMET-CHAN NCH .09-IN-GRV-WD	28480	0400-0082
5	0400-0219	3	3	GROMMET-RND .5-IN-ID .093-IN-GRV-WD	28480	0400-0219
6	0520-0127	6	4	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
7	0570-0632	3	10	SCREW-SPCL 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	0590-1251	6	4	NUT-HEX 15/32-32	00000	ORDER BY DESCRIPTION
9	1200-0043	8	5	INSULATOR-XSTR ALUMINUM	28480	1200-0043
10	1400-0031	8	3	CLAMP-CABLE .375-DIA .5-WD NYL	28480	1400-0031
11	1400-0249	0	9	CABLE TIE .062-.625-DIA .091-WD NYL	06383	PLT1M-8
12	1400-0510	8	4	CLAMP-CABLE .15-DIA .62-WD NYL	28480	1400-0510
13	1400-0907	7	2	CLAMP-CABLE .187-DIA .5-WD FRTD-NYLON	95987	3/16-HFR
14	1520-0205	2	3	SHOCK MOUNT .31 HGT.	28480	1520-0205
15	2190-0003	8	14	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0003
16	2190-0006	1	15	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
17	2190-0008	3	1	WASHER-LK EXT T NO. 6 .141-IN-ID	28480	2190-0008
18	2190-0011	8	6	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0011
19	2190-0045	8	4	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0045
20	2200-0103	2	4	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
21	2200-0105	4	99	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
22	2200-0107	6	1	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
23	2200-0141	8	1	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
24	2200-0149	6	10	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
25	2200-0153	2	4	SCREW-MACH 4-40 .875-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
26	2200-0166	7	3	SCREW-MACH 4-40 .312-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
27	2360-0111	0	5	SCREW-MACH 6-32 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
28	2360-0113	2	13	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
29	2360-0114	3	5	SCREW-MACH 6-32 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
30	2360-0115	4	37	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
31	2360-0116	5	4	SCREW-MACH 6-32 .312-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
32	2360-0117	6	10	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
33	2360-0119	8	10	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
34	2360-0122	3	1	SCREW-MACH 6-32 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
35	2360-0197	2	11	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
35A	2360-0193	8	4	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
36	2360-0331	6	9	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	28480	2360-0331
37	2360-0333	8	26	SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
38	2360-0334	9	9	SCREW-MACH 6-32 .312-IN-LG 100 DEG	28480	2360-0334
39	2360-0360	1	2	SCREW-MACH 6-32 .438-IN-LG 100 DEG	28480	2360-0360
40	2420-0002	6	2	NUT-HEX-DBL-CHAM 6-32-THD .109-IN-THK	28480	2420-0002
41	0515-1331	5	16	SCREW-MACH M4x0.7x6mm FH 90	28480	0515-1331
42	0515-0896	5	8	SCREW-MACH M4x0.7x10mm FH 90	28480	0515-0896
43	2680-0129	8	6	SCREW-MACH 10-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
44	3050-0066	8	2	WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0066
45	3050-0105	6	4	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
46	3050-0227	3	7	WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
47	1250-0915	8	1	CONTACT-RF CONN SER APC-N FEMALE	9D949	131-149
48	1250-1577	0	1	CONNECTOR-RF FEMALE TYPE N	28480	1250-1577
49	2190-0104	0	1	WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
50	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
51	2950-0132	6	1	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
52	5040-0306	0	1	INSULATOR	28480	5040-0306
53	08340-00011	6	1	PANEL-REAR (AUX OUTPUT)	28480	08340-00011
54	08340-00056	9	1	DEFLECTOR-AIR	28480	08340-00056
55	08555-20093	5	1	CONTACT JACK	28480	08555-20093
56	08555-20094	6	1	BODY-BULKHEAD	28480	08555-20094
57	08761-2027	4	1	INSULATOR	28480	08761-2027
58	5021-5805	4	1	FRAME-FRONT (METRIC)	28480	5021-5805
59	08340-00001	4	1	CENTER DIVIDER	28480	08340-00001
60	08340-00002	5	1	CHASSIS-RF MOD (REAR)	28480	08340-00002
61	08340-00003	6	1	BRACKET- 20-30 MOUNT	28480	08340-00003
62	08340-00004	7	1	BRACKET-MOUNT TRANS	28480	08340-00004
63	08340-00005	8	1	SUPPORT-MOM BOARD	28480	08340-00005
64	08340-00020	7	1	DIVIDER PROCESSOR	28480	08340-00020
65	08340-00029	6	1	GUIDE PLATE-PC BOARDS	28480	08340-00029
66	08340-00031	0	1	SUPPORT-PC PROCESSOR	28480	08340-00031
67	08340-20051	6	1	SUPPORT-REAR CENTER	28480	08340-20051
68	08340-20234	7	1	FRAME (REAR) MOD (METRIC)	28480	08340-20234
69	08340-20054	9	1	SUPPORT-FRONT CENTER DIVIDER	28480	08340-20054
70	08340-20056	1	1	GUIDE-POWER SUPPLY	28480	08340-20056
71	08340-20236	9	1	STRUT-CORNER (TOP) (METRIC)	28480	08340-20236
72	08340-20238	1	3	STRUT-CORNER MOD (METRIC)	28480	08340-20238
73	85660-00004	6	1	BRACKET-PIVOT PROCESSOR	28480	85660-00004
74	85660-20190	3	1	HOUSING-20-30 MHZ	28480	85660-20190
75	86701-20006	2	1	GUIDE-FRONT PC	28480	86701-20006
76	0360-0037	7	6	TERMINAL-SLDR LUG PL-MTG FOR-#6-SCR	28480	0360-0037

See introduction to this section for ordering information. *Indicates factory selected value.

Figure 6-2. Miscellaneous Mechanical & Chassis Parts (1 of 9)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
77	1251-4223	1	10	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-4223
78	1251-6594	3	1	CONNECTOR HOUSING- 5 FEMALE IR	28480	1251-6594
79	8120-0579	2	1	CABLE-SHLD 22AWG 5-CNDCT JGK-JKT	28480	8120-0579
80	8150-0005	2		WIRE 22AWG BK 300V PVC 7X30 105C	28480	8150-0005
81	5001-0440	1	2	TRIM-SIDE F.F	28480	5001-0440
82	5040-7201	8	4	FOOT-BOTTOM	28480	5040-7201
83	5040-7202	9	1	TRIM STRIP (TOP)	28480	5040-7202
84	5061-9435	8	1	COVER FM TOP (METRIC)	28480	5061-9435
85	5061-9447	2	1	COVER FM BOTTOM (METRIC)	28480	5061-9447
86	5061-9462	1	1	COVER SIDE (METRIC)	28480	5061-9462
87	5061-9517	7	1	COVER FM PERFORATED (METRIC)	28480	5061-9517
88	5061-2033	8	1	INFO TRAY ASSY KIT	28480	5061-2033
89	08340-00023	0	1	DRESS PANEL-KEYBOARD	28480	08340-00023
90	08340-00074	1	1	HOLDER-PC COVER	28480	08340-00074
91	08340-00040	1	1	HOLDER-POWER SUPPLY BOARDS	28480	08340-00040
92	08340-00060	5	1	PLATE-CAP HOLDER	28480	08340-00060
93	08340-00061	6	1	HOLDER-CAP HOLDER	28480	08340-00061
94	08340-90201	6	1	INFO CARD #1	28480	08340-90201
95	08340-90202	7	1	INFO CARD #2	28480	08340-90203
96	85660-00025	1	1	SHOCK MOUNT (TOP)	28480	85660-00025
97	85660-00027	3	1	INSULATOR-HEAT SINK	28480	85660-00027
98	86701-00028	6	1	SPRING-FLAT	28480	86701-00028
99	1990-0720	1	1	DISPLAY-SPECIAL .1 HI	28480	1990-0720
100	8160-0226	0	12	RFI RND STR .050D	28480	8160-0226
101	08340-00006	9	1	SUPPORT-PC RECT.	28480	08340-00006
102	08340-00008	1	1	CHASSIS RF MOD (FRONT)	28480	08340-00008
103	08340-00064	9	1	POCKET (Holds Cal. Constant Data)	28480	08340-00064
104	6960-0009	1	1	Hole Plug .531-D-HOLE	28480	6960-0009
105	0380-0644	4	2	Standoff-Hex .400-IN-LG 6-32 THD	28480	0380-0644
106	2200-0164	5	10	SCREW-MACH 4-40 .188-IN-LG	28480	2200-0164
107	5021-3208	7	1	Housing-machined	28480	5021-3208
108	86701-00029	7	1	Baffle-Air Top	28480	86701-00029
109	86701-00024	2	1	Skoop Air	28480	86701-00024
110	86701-00030	0	1	Baffle-Air Bottom	28480	86701-00030
111	08340-00067	2		COVER-RECT. BOARD	28480	08340-00067
112	08340-00018	3		Fan Filter	28480	08340-00018
113	08340-00017	2		Grill Air	28480	08340-00017
114	3030-0152	1	2	SCREW-SET 4-40 .312-IN-LG SMALL CUP PT	28480	3030-0152
115	08340-00016	1	1	Fan Housing-Bottom	28480	08340-00016
116	08340-00012	7	1	Fan Housing-Top	28480	08340-00012
117	08340-00014	9		Fan Grill Housing	28480	08340-00014
118	1520-0230	3	4	Shock Mount	28480	1520-0230
119	08340-00016	1	1	Base Plate-Fan	28480	08340-00016
120	85660-20092	4	4	Snubber-Shock Mount	28480	85660-20092
121	2360-0196	1	4	Screw-Mach 6-32 .375-IN-LG 100 DEG	28480	2360-0196
122	2190-0009	4	2	WASHER-LK INT T NO. 8 .168-IN-ID	28480	2190-0009
123	2510-0051	6	2	SCREW-MACH 8-32 .625-IN-LG PAN-HD-POZI	28480	2510-0051
124	0360-0043	5		TERMINAL-SLDR LUG PL-MTG FOR-NO. 6-SCR	28480	0360-0043
125	1251-6796	7		CONN-POST TYPE	28480	1251-6796
126	0360-1632	0	4	TERMINAL-SLDR LUG LK-MTG FOR-#3/8-SCR	28480	0360-1632
127	0362-0227	1	2	CONNECTOR-SGL CONT SKT 1.14-MM-BSC-SZ	28480	0362-0227
128	1250-0083	1	8	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
129	1250-0102	5	3	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0102
130	1251-0064	0	1	CONNECTOR 25-PIN F D SERIES	28480	1251-0064
131	1251-2942	7	2	CONNECTOR-RACK & PANEL LOCK	28480	1251-2942
132	1251-3653	9	26	CONNECTOR CONTACT FEMALE .025	28480	1251-3653
133	1251-6781	0	1	CONNECTOR RECEPTACLE 3 MALE CONTACT	28480	1251-6781
134	1251-7374	9	1	CONNECTOR HOUSING-28 FEMALE 2R	28480	1251-7374
135	2190-0016	3	4	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
136	2190-0068	5	3	WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
137	2190-0104	0	1	WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
138	2950-0001	8	8	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
139	2950-0054	1	3	NUT-HEX-DBL-CHAM 1/2-28-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
140	08340-00010	5	1	REAR PANEL	28480	08340-00010

See introduction to this section for ordering information. *Indicates factory selected value

Figure 6-2. Miscellaneous Mechanical & Chassis Parts (2 of 9)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
141	3101-0163	5	1	SWITCH KIT	28480	3101-0163
142	9222-0090	9	1	Plastic Jacket (Holds Cal. Constant Data)	28480	9222-0090
143	08340-00070	7	1	BRACKET	28480	08340-00070

See introduction to this section for ordering information
*Indicates factory selected value

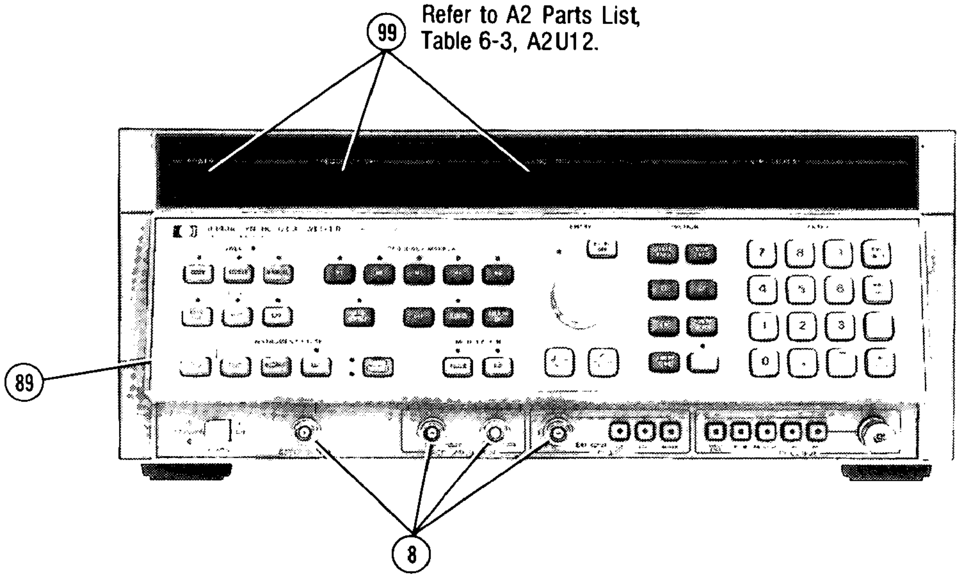


Figure 6-2. Miscellaneous Mechanical & Chassis Parts (3 of 9)

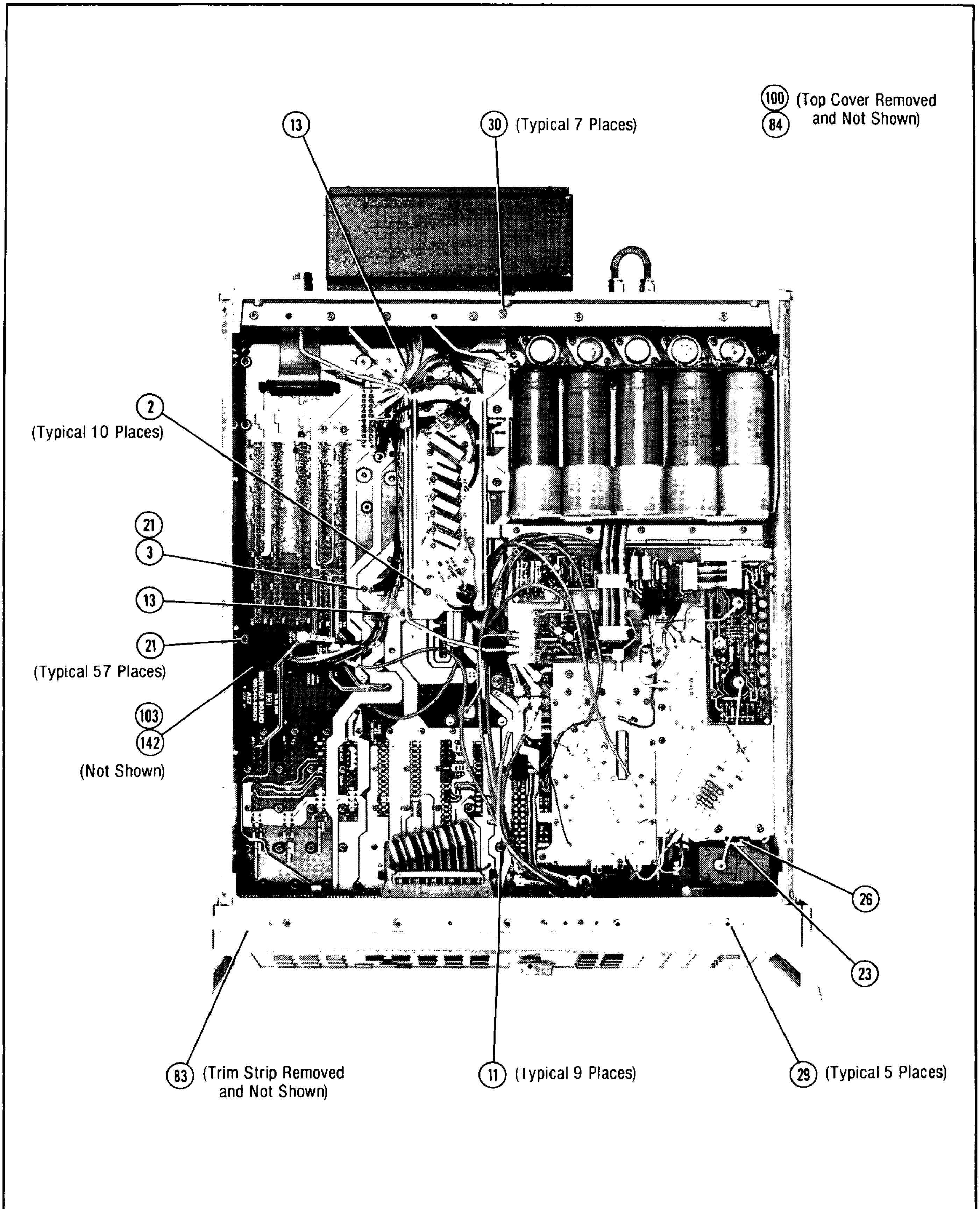


Figure 6-2. Miscellaneous Mechanical & Chassis Parts (4 of 9)

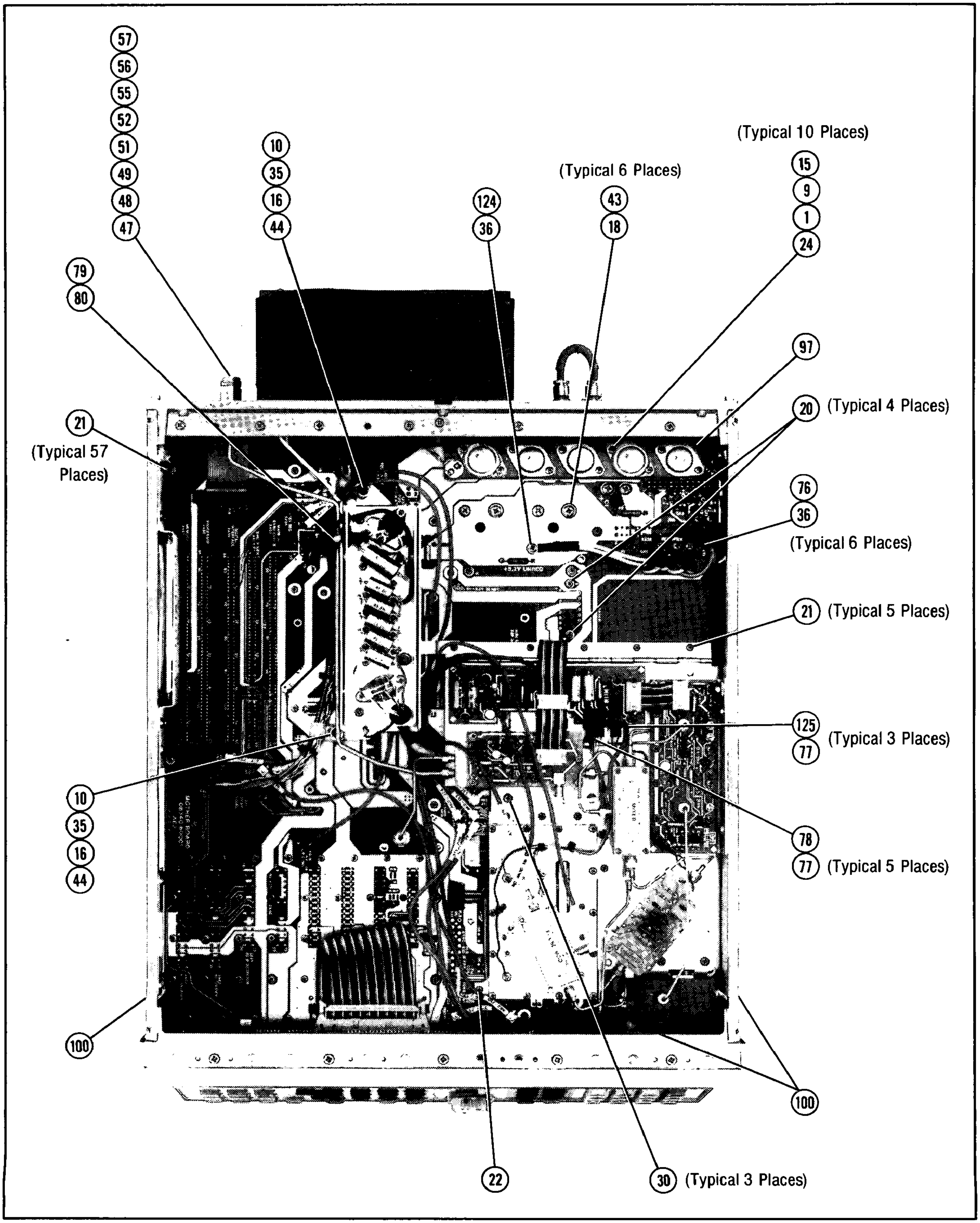


Figure 6-2. Miscellaneous Mechanical & Chassis Parts (5 of 9)

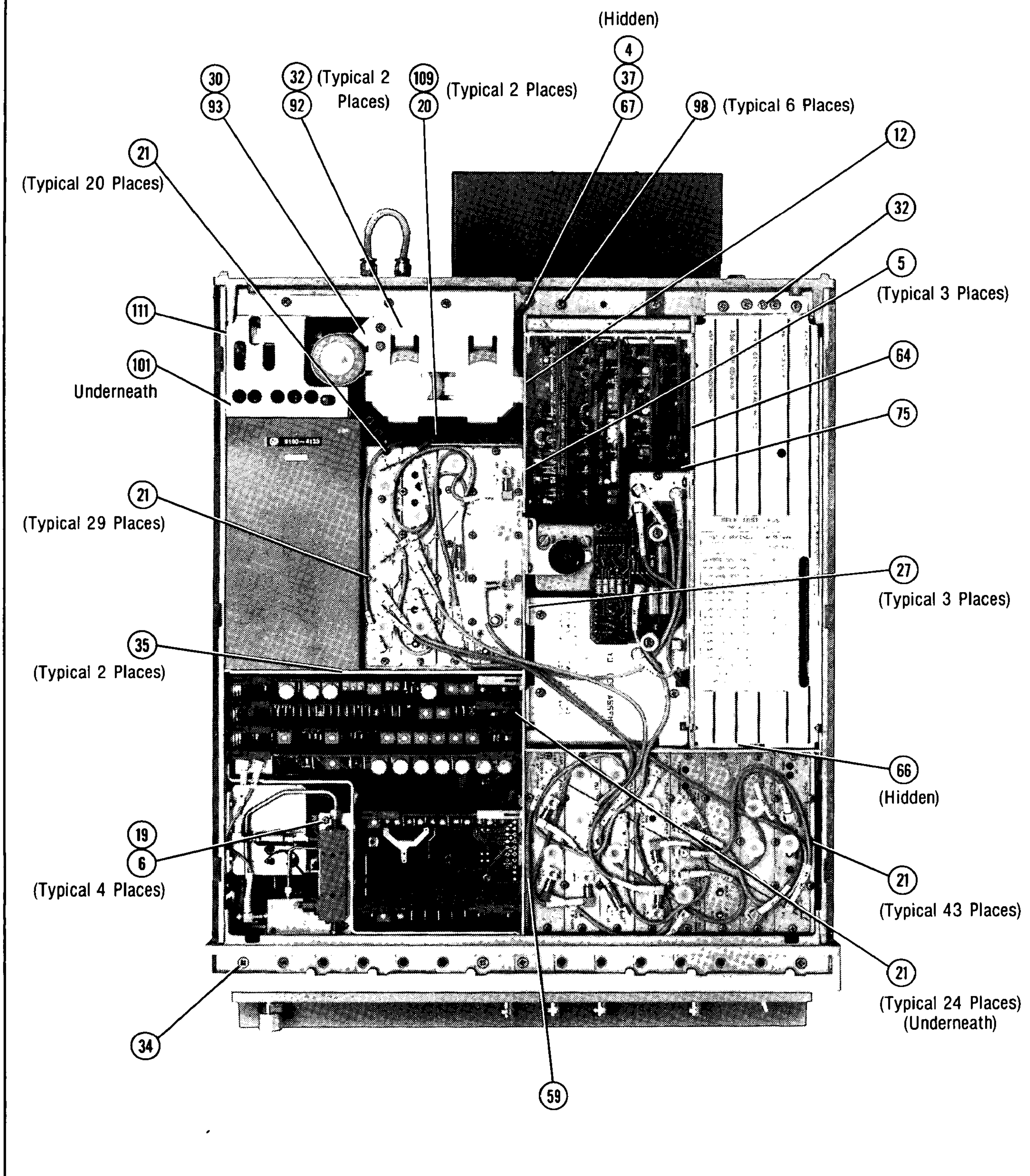


Figure 6-2. Miscellaneous Mechanical & Chassis Parts (6 of 9)

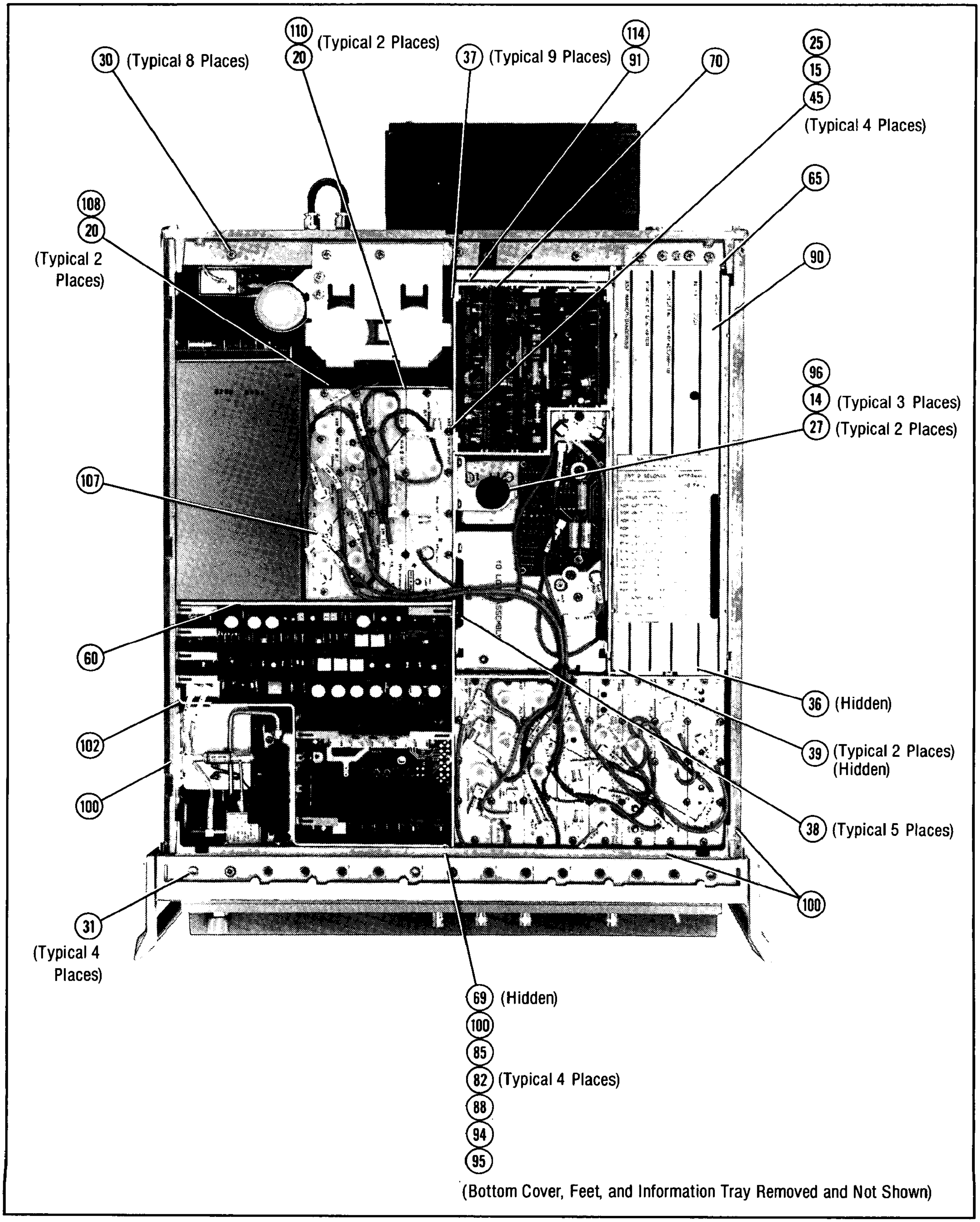


Figure 6-2. Miscellaneous Mechanical & Chassis Parts (7 of 9)

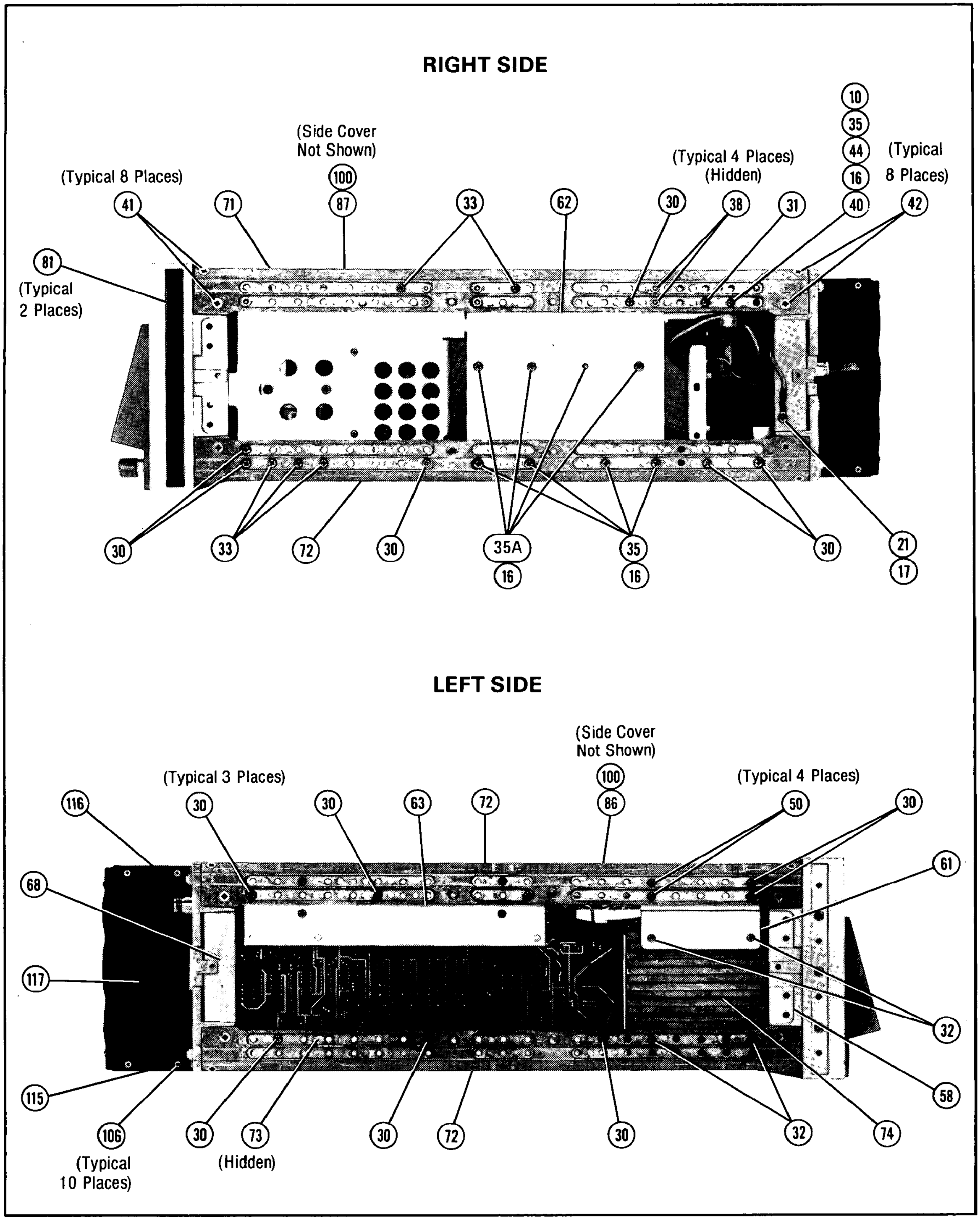


Figure 6-2. Miscellaneous Mechanical & Chassis Parts (8 of 9)

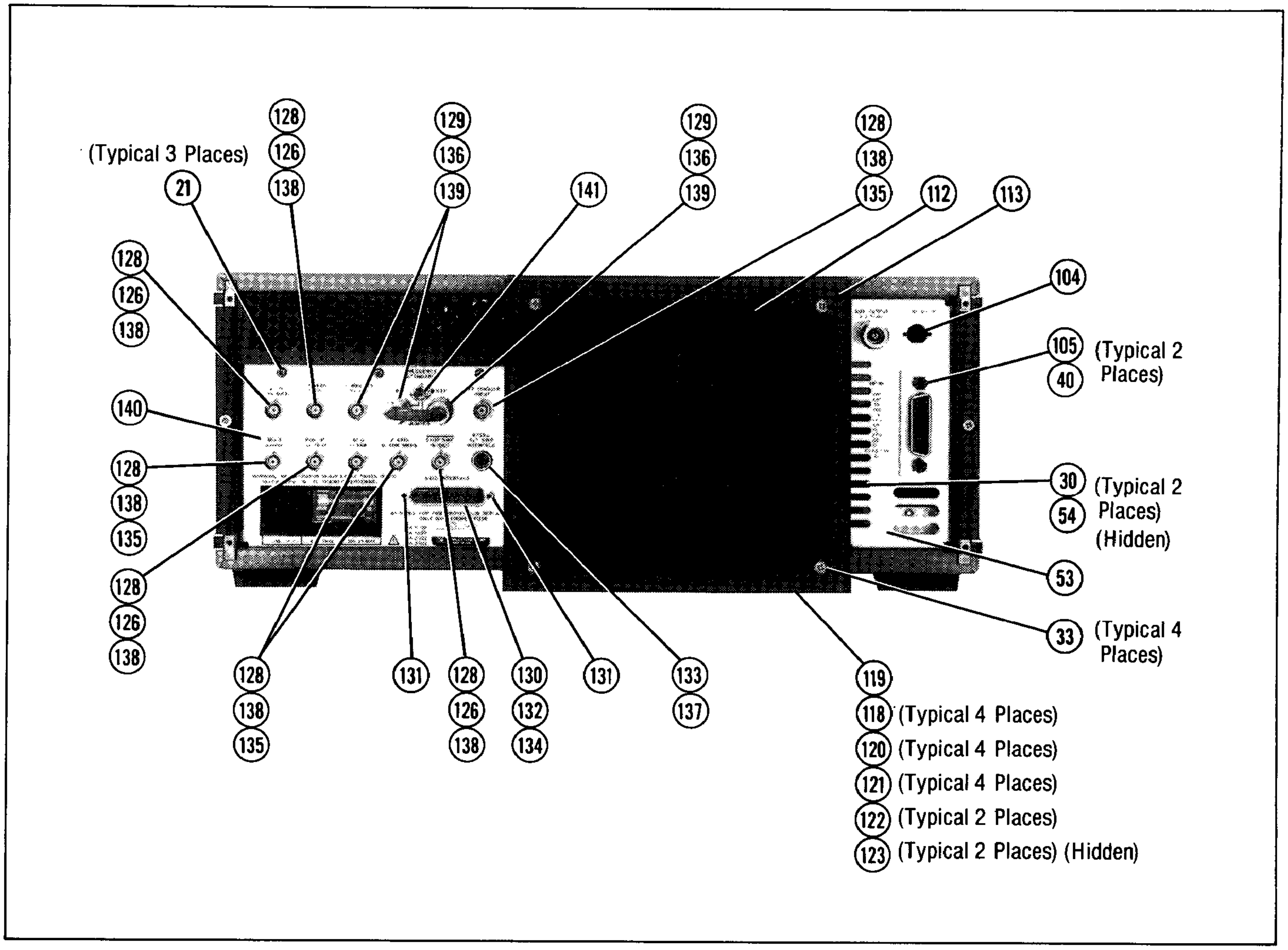


Figure 6-2. Miscellaneous Mechanical & Chassis Parts (9 of 9)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				FRONT PANEL ATTACHING HARDWARE		
1	0360-0005	9	1	TERMINAL-SLDR LUG PL-MTG FOR-#8-SCR	28480	0360-0005
2	0510-1148	2	2	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
3	0624-0264	2	16	SCREW-TPG 4-40 .312-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
4	1400-0249	0	2	CABLE TIE .062-.625-DIA .091-WD NYL	06383	PLT1M-8
5	2190-0016	3	2	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
6	2200-0105	4	7	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
7	2200-0113	4	5	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	2200-0115	6	6	SCREW-MACH 4-40 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
9	2260-0009	3	2	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
10	2950-0043	8	2	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
11	08340-00024	1	1	SUB-PANEL KEYBOARD	28480	08340-00024
12	08340-00025	2	1	DRESS PANEL (LOWER)	28480	08340-00025
13	08340-00026	3	1	SUB-PANEL (LOWER) KEYBOARD	28480	08340-00026
14	08340-20078	7	1	BEZEL-KEYBOARD FIN	28480	08340-20078
15	1450-0615	9	1	Retainer	28480	1450-0615
16	08340-40002	9	1	LED Mount	28480	08340-40002
17	0370-2992	8	1	KNOB-BASE 1-1/8 JGK .252-IN-ID	28480	0370-2992
18	0590-1251	6	4	NUT-SPCLY 15/32-32-THD .1-IN-THK .562-W	28480	0590-1251
19	00310-48801	0	2	WASHER SHOULDER	28480	00310-48801
20	0360-1158	5	1	LUG	28480	0360-1158

See introduction to this section for ordering information
*Indicates factory selected value

Figure 6-3. Front Panel Attaching Hardware (1 of 2)

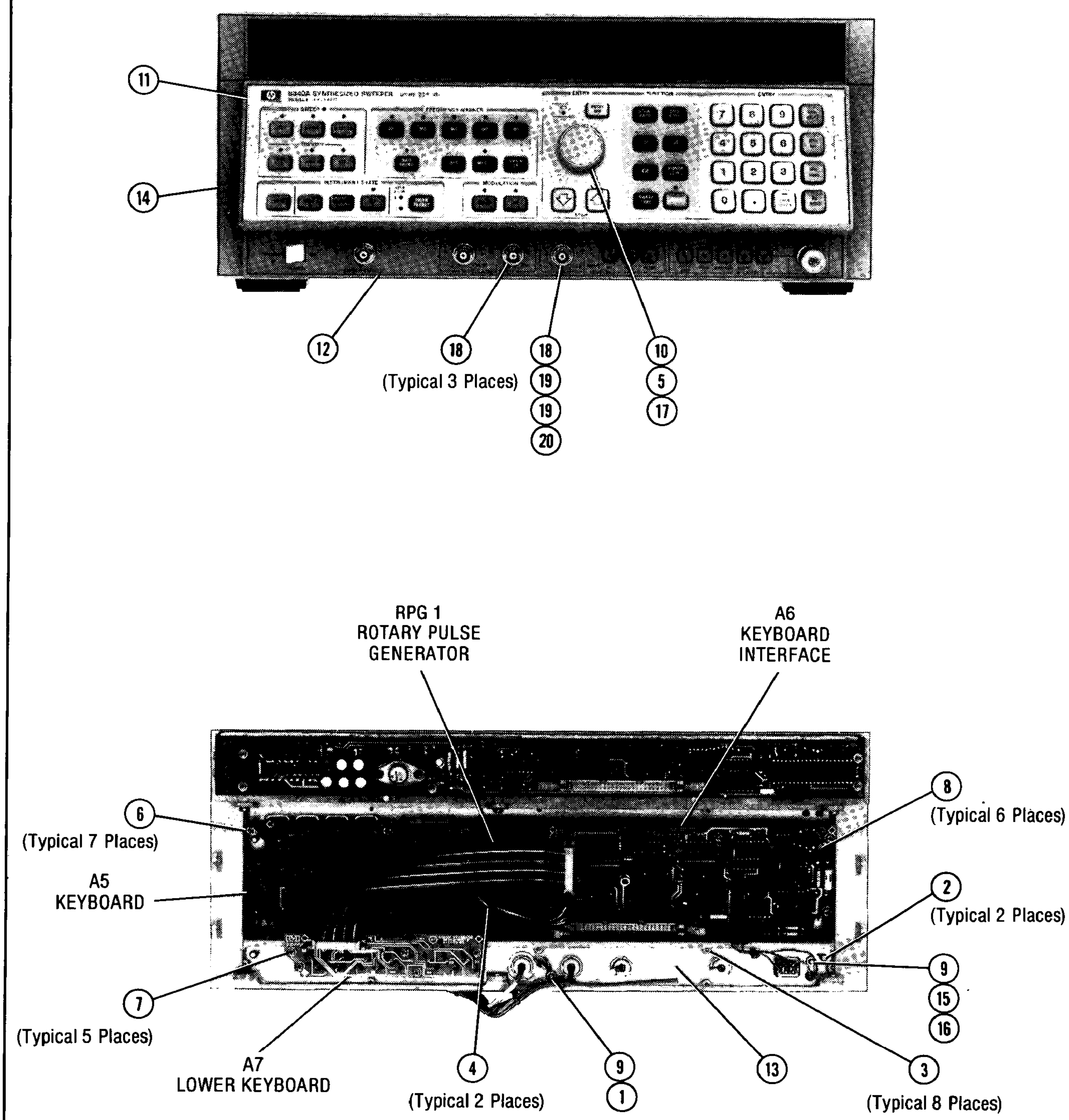


Figure 6-3. Front Panel Attaching Hardware (2 of 2)

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
				DISPLAY ASSEMBLY ATTACHING HARDWARE		
1	0050-2141	1	1	CASTING-AL CTR DISPLAY	28480	0050-2141
				NOTE Replace with service kit 08340-60195.		
2	0520-0127	6	5	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
3	0520-0136	7	2	SCREW-MACH 2-56 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
4	0520-0139	0	8	SCREW-MACH 2-56 .875-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
5	0520-0174	3	8	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
6	0570-0189	5	6	SCREW-MACH 0-80 .125-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
7	2190-0014	1	7	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
8	2190-0045	8	8	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0045
9	3050-0098	6	8	WASHER-FL MTLC NO. 2 .094-IN-ID	28480	3050-0098
10	4040-1912	5	1	WINDOW-DISPLAY	28480	4040-1912
11	08340-00036	5	1	INSULATOR-HEAT CONDUCTIVE	28480	08340-00036
12	08340-20057	2	1	FRAME-DISPLAY/MACH	28480	08340-20057
				NOTE Replace with service kit 08340-60195.		
13	2360-0115	4	3	SCREW	28480	2360-0115

See introduction to this section for ordering information
*Indicates factory selected value

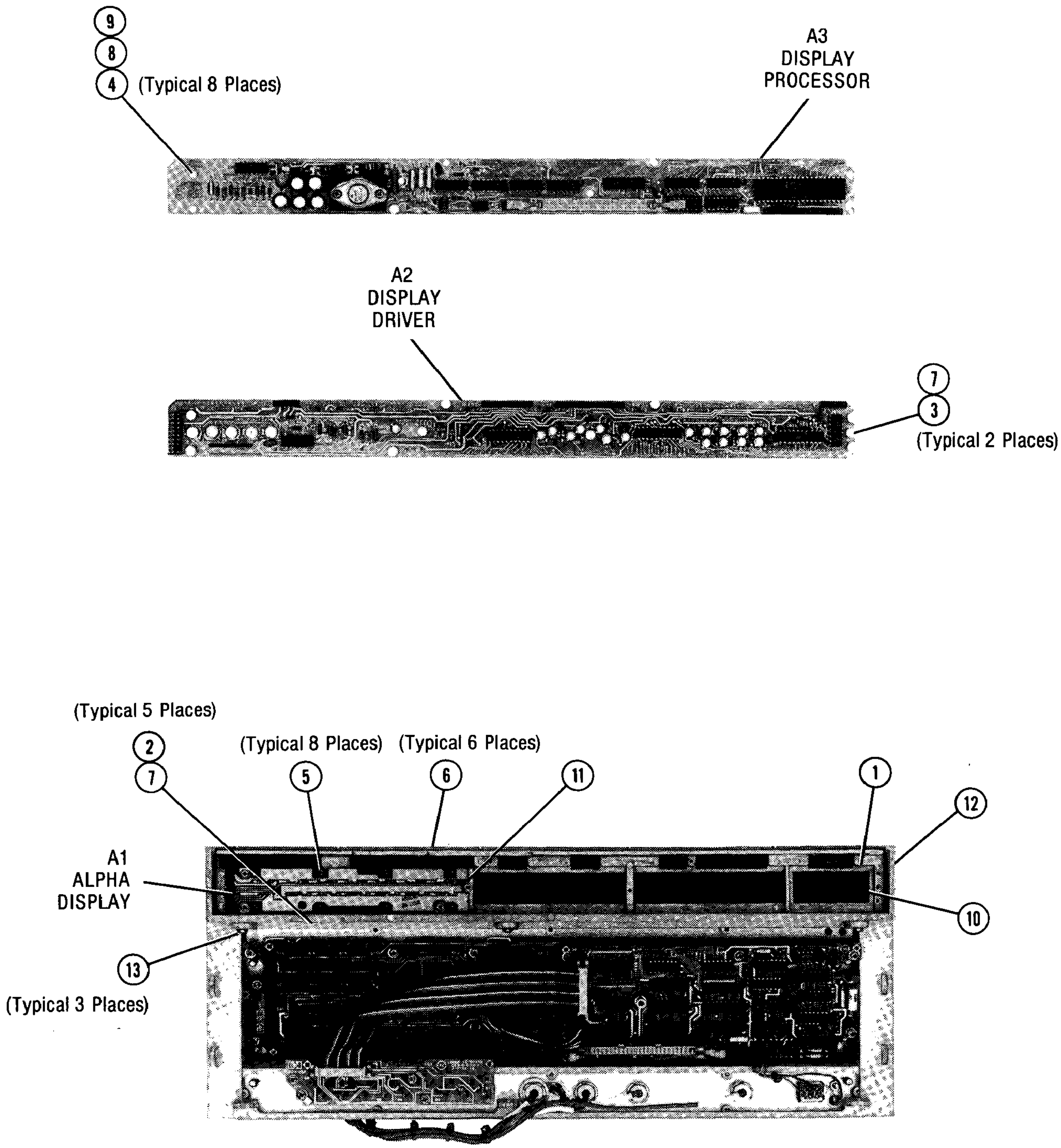


Figure 6-4. Display Assembly Attaching Hardware (2 of 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				YO LOOP SECTION ATTACHING HARDWARE		
1	0360-0452	0	2	TERMINAL-SLDR LUG PL-MTG FOR-#10-SCR	28480	0360-0452
2	0520-0164	1	2	SCREW-MACH 2-56 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
3	1250-0258	2	2	A49J1,J2 CONNECTOR-RF MALE SMB	28480	1250-0258
4	1250-0691	7	4	A49J3,J4 A48J1,2- CONNECTOR-RF MALE SMB	28480	1250-0691
5	2190-0124	4	2	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
6	2200-0103	2	13	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
7	2200-0147	4	2	SCREW-MACH 4-40 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	2200-0165	6	23	SCREW-MACH 4-40 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
9	2360-0331	6	4	SCREW-MACH 6-32 .25-IN-LG PANHD POZI	28480	2360-0331
10	2360-0333	8	2	SCREW-MACH-6-32 .25-IN-LG 100 DEG	28480	2360-0333
11	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
12	3050-0105	6	2	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
13	3050-0907	6	4	WASHER-SHLDR NO. 10 .194-IN-ID	28480	3050-0907
14	08340-00032	1	1	DECK-YO LOOP	28480	08340-00032
15	08340-00049	0	1	COVER-SAMPLER	28480	08340-00049
16	08340-00050	3	1	COVER-PHASE LOCK	28480	08340-00050
17	08340-20072	1	1	HOUSING-YT P/L	28480	08340-20072
18	85660-20088	8	2	STUD-YTO LOOP	28480	85660-20088
19	85660-20100	5	2	EXTRACTOR	28480	85660-20100
20	86701-00054	8	1	SPACER-SAMPLER	28480	86701-00054
21	2190-0003	8	2	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0003
22	1250-1142	5	1	WASHER-LK INTL T 1/2 IN .26-IN-ID	28480	1250-1142
23	1250-1143	6	1	NUT-RF CONNECTOR-SERIES SM A	28480	1250-1143

Figure 6-5. YO Loop Section Attaching Hardware (1 of 4)

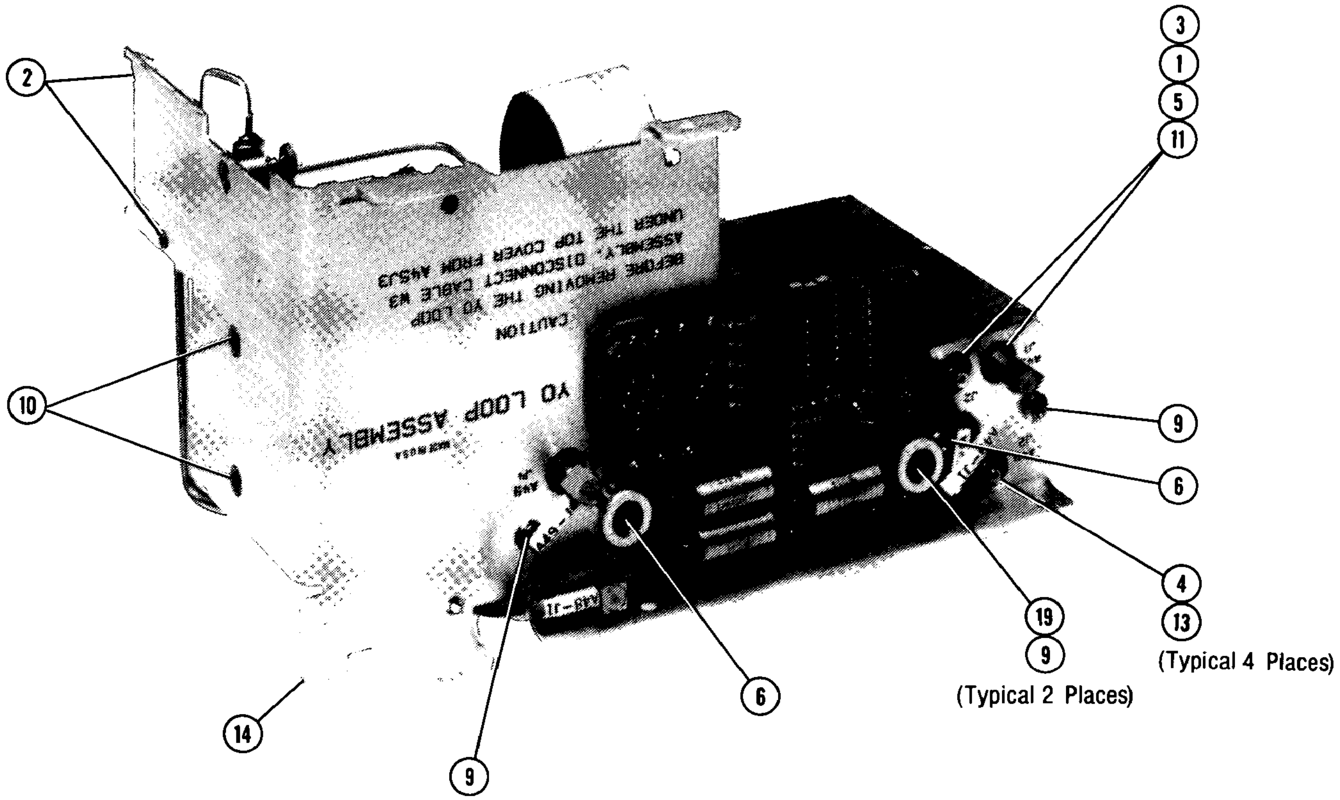


Figure 6-5. YO Loop Section Attaching Hardware (2 of 4)

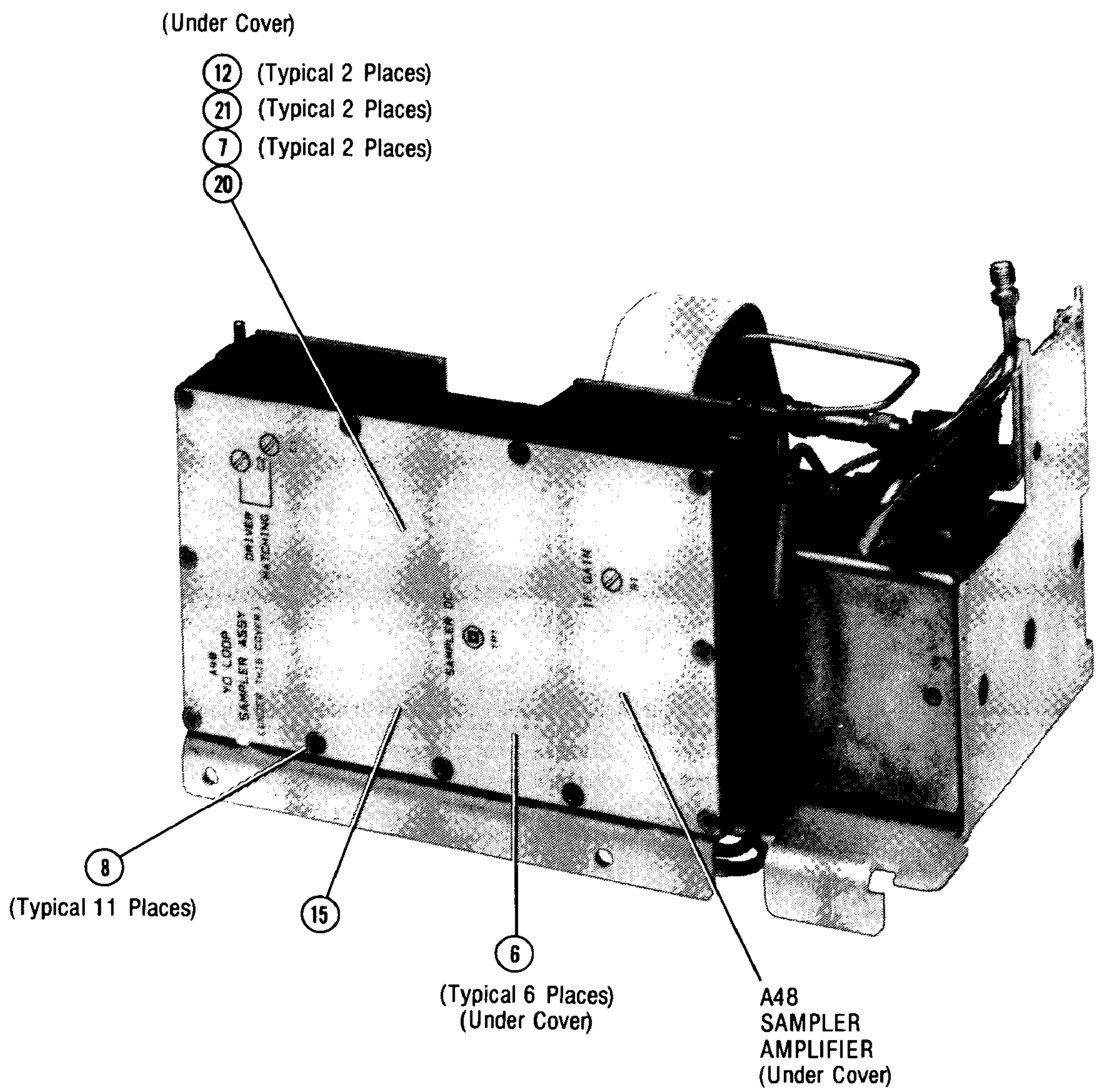
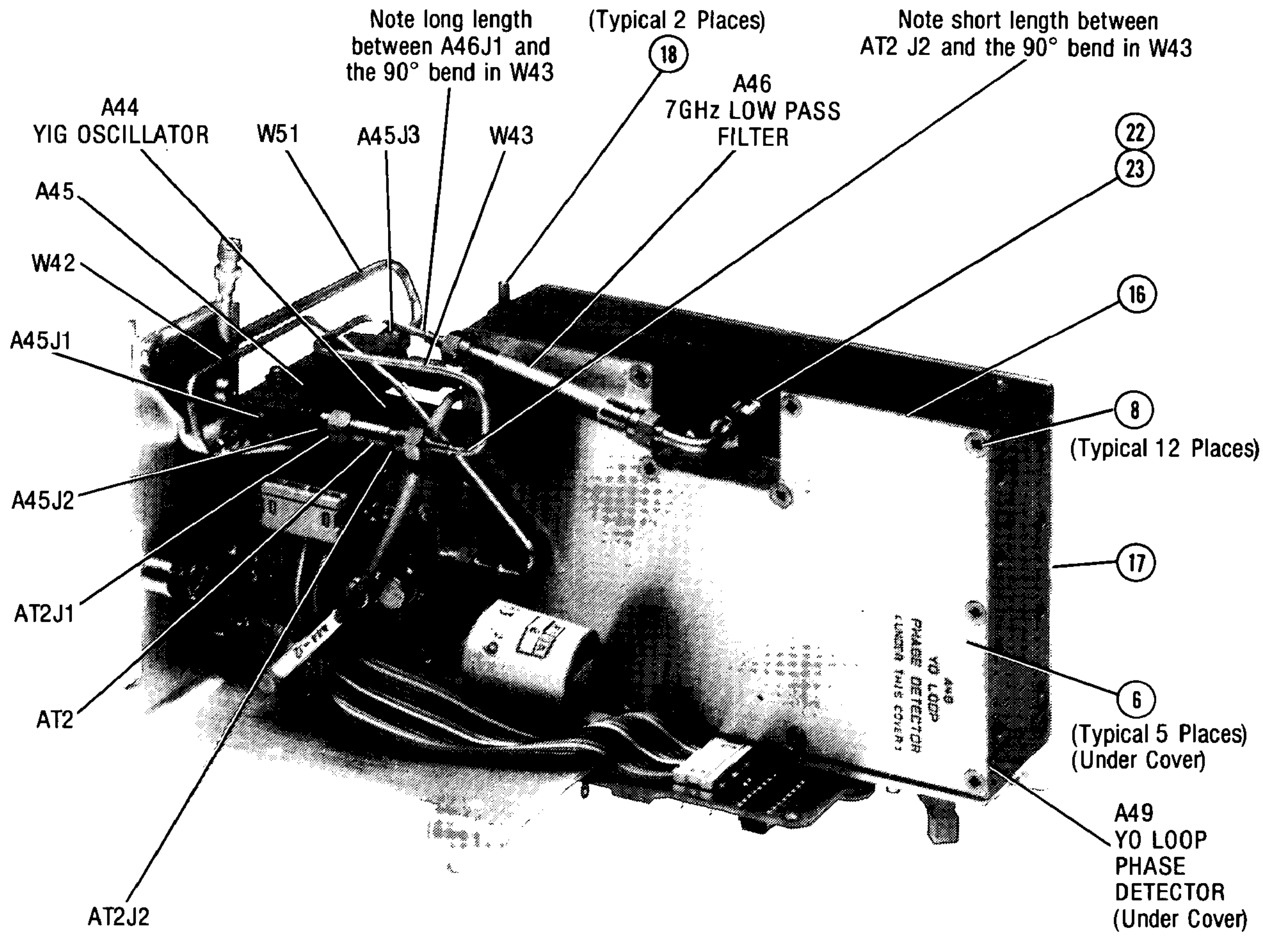


Figure 6-5. YO Loop Section Attaching Hardware (3 of 4)



CAUTION: W51 Must be disengaged from W3 before removing the YO Loop from the instrument or damage to these cables will result. Refer to Figure 8I-8, View C, in the RF Section (Volume 4).

Figure 6-5. YO Loop Section Attaching Hardware (4 of 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				RF SECTION ATTACHING HARDWARE		
				(REFER TO FIGURE 6-3.)		
1	0520-0128	7	2	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
2	0520-0136	7	4	SCREW-MACH 2-56 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
3	2190-0003	8	20	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0003
4	2190-0006	1	4	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
5	2190-0045	8	6	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0045
6	2200-0091	7	8	SCREW-MACH 4-40 .562-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
7	2200-0105	4	5	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	2200-0141	8	1	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
9	2200-0143	0	7	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
10	2200-0166	7	1	SCREW-MACH 4-40 .312-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
11	2260-0001	5	4	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	28480	2260-0001
12	2360-0115	4	2	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
13	2360-0207	5	8	SCREW-MACH 6-32 .875-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
14	2360-0334	9	6	SCREW-MACH 6-32 .312-IN-LG 100 DEG	28480	2360-0334
15	08340-00007	0	1	DECK-MICROCIRCUIT MOUNT	28480	08340-00007
16	08340-00045	6	1	BRACKET-PMI MOUNT	28480	08340-00045

Figure 6-6. RF Section Attaching Hardware (1 of 2)

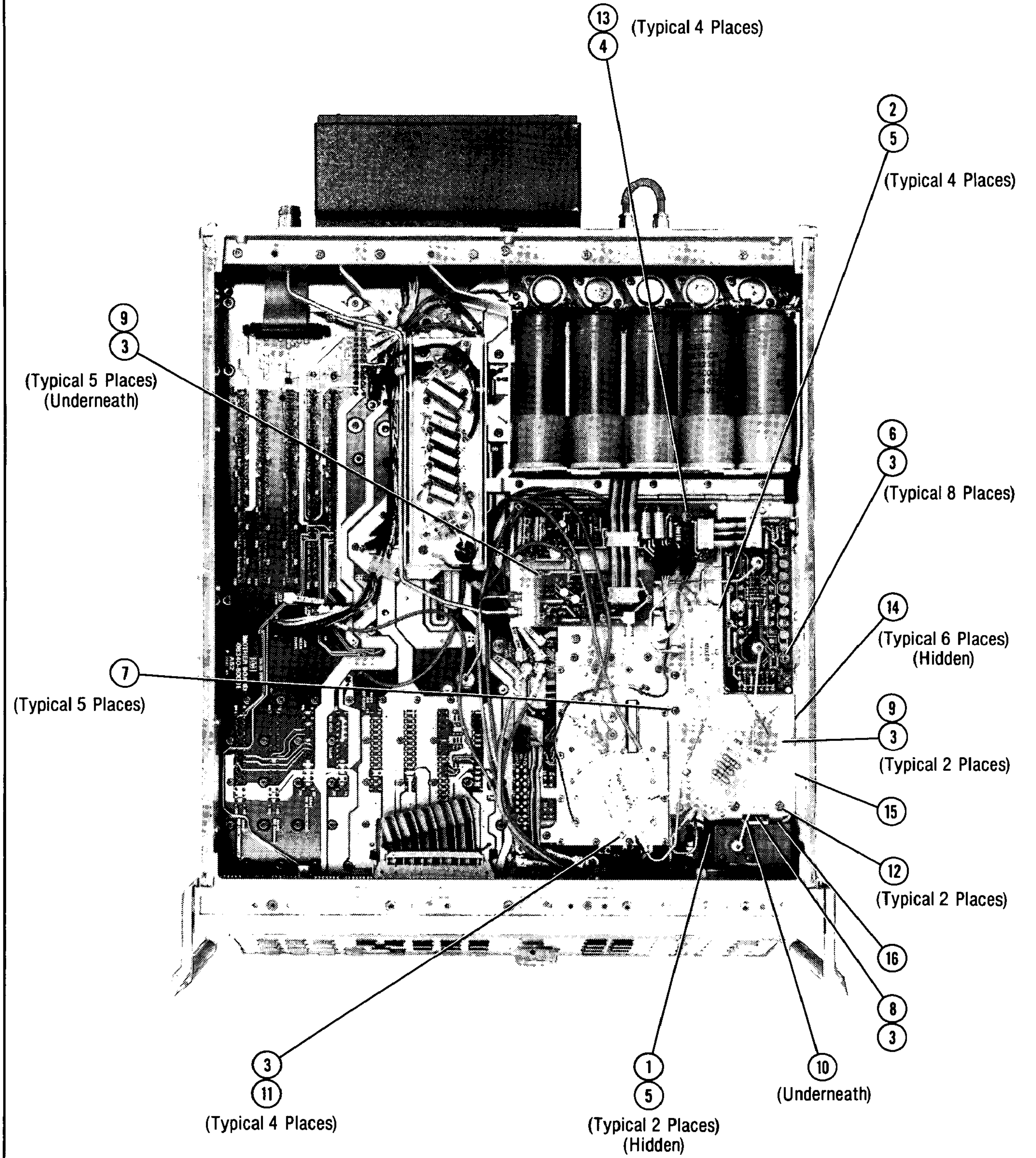


Figure 6-6. RF Section Attaching Hardware (2 of 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				REFERENCE-M/N SECTION ATTACHING HARDWARE		
1	2200-0103	2	6	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
2	2200-0105	4	24	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
3	5021-3208	7	1	HOUSING-MACH	28480	5021-3208
4	08340-60039	4	1	BOARD ASSY-REF ASSY MO	28480	08340-60039
5	86701-00024	2	1	SCOOP-AIR	28480	86701-00024
6	86701-00029	7	1	BAFFLE-AIR (TOP)	28480	86701-00029
7	86701-00030	0	1	BAFFLE-AIR (BOTTOM)	28480	86701-00030

Figure 6-7. Reference — M/N Section Attaching Hardware (1 of 2)

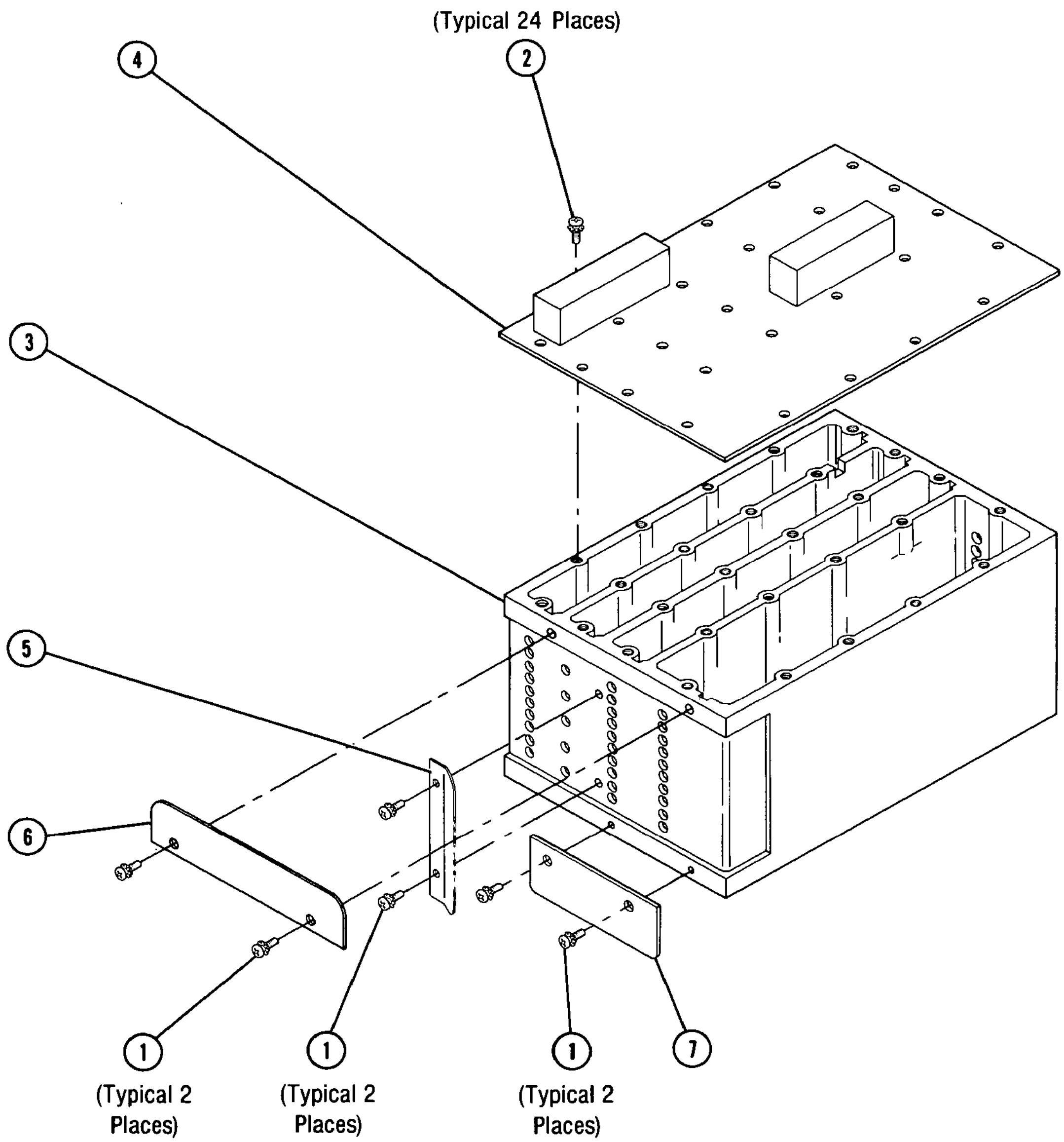
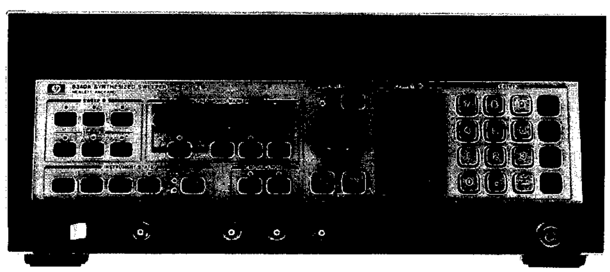


Figure 6-7. Reference — M/N Section Attaching Hardware (2 of 2)

SERVICE MANUAL

HP 8340A SYNTHESIZED SWEEPER

10 MHz to 26.5 GHz



HEWLETT PACKARD

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

⚠ Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SAFETY EARTH GROUND

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an autotransformer, make sure the common terminal is connected to the neutral (grounded) side of mains supply.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

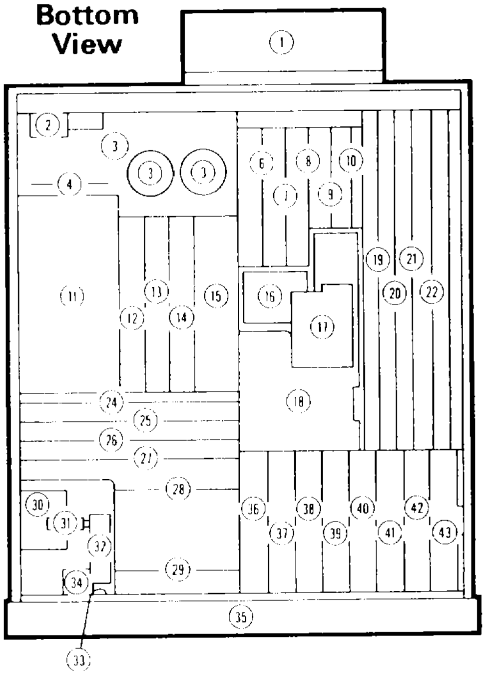
To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

VOLUME 3 CONTENTS

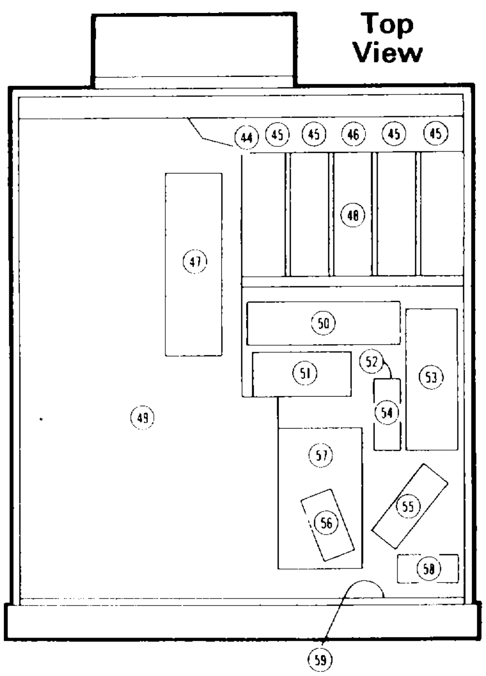
TABLES

REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



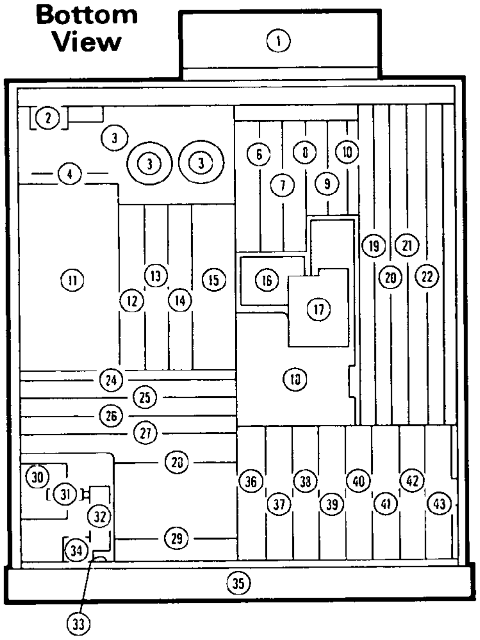
Top View



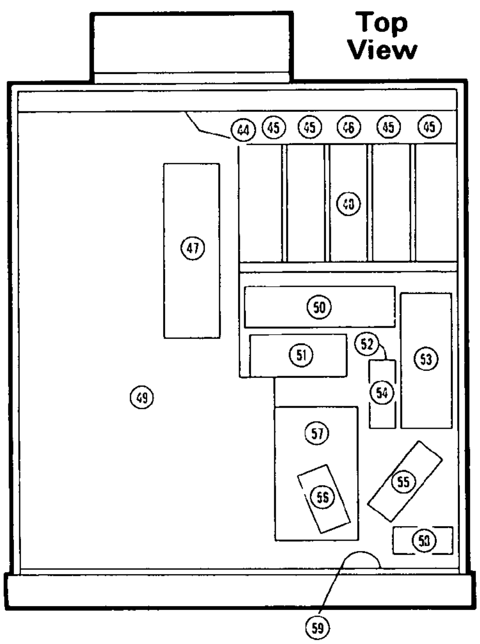
			Volume 3				Volume 4			
Assy./Ref. Des.	Description	Location	Ref.-M/N Loops	20-30 Loops	Swp. Gen.-YO Loop	Motherboard	Controller	Front/Rear Panel	RF Section	Power Supplies
A1	Alpha Display	33						●		
A2	Display Driver	33						●		
A3	Display Processor	33						●		
A4	Not Assigned	-								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	56							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	31							●	
A12	Band 0 Splitter/Detector	34							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	54							●	
A18	Band 0 Power Amplifier	55							●	
		60							●	
A19	Capacitor Assembly	48								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	28							●	
A25	ALC Detector	27							●	
A26	Linear Modulator	26							●	
A27	Level Control	25							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	15	●							
A33	M/N Output	15	●							
A34	Reference-M/N Motherboard	5	●							
A35	Rectifier	4								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	40		●						
A41	PLL2 Phase Detector	41		●						
A42	PLL2 Divider	42		●						
A43	PLL2 Discriminator	43		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	18			●					
A49	YO Loop Phase/Detector	18			●					
A50	YO Loop Interconnect	17			●					
A51	Reference Oscillator	16	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	10								●
A57	Marker/Bandcross	19					●			
A58	Sweep Generator	20			●					
A59	Digital Interface	21					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	58							●	
AT2	15 dB Attenuator	18			●					
B1	Fan Assembly	1								●
A62C1-3	Power Supply Filter Capacitors	3								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



Top View



Assy./Ref. Des.	Description	Location	Volume 3: Ref.-M/N Loops	Volume 3: 20-30 Loops	Volume 3: Swp. Gen.-YO Loop	Volume 3: Motherboard	Volume 3: Controller	Volume 3: Front/Rear Panel	Volume 4: RF Section	Volume 4: Power Supplies
A1	Alpha Display	[illegible]						●		
A2	Display Driver	[illegible]						●		
A3	Display Processor	[illegible]						●		
A4	Not Assigned									
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	[illegible]							●	
A10	Directional Coupler	[illegible]							●	
A11	Band 1-4 Detector	[illegible]							●	
A12	Band 0 Splitter/Detector	[illegible]							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	[illegible]							●	
A18	Band 0 Power Amplifier	[illegible]							●	
		[illegible]							●	
A19	Capacitor Assembly	[illegible]								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	[illegible]							●	
A25	ALC Detector	[illegible]							●	
A26	Linear Modulator	26							●	
A27	Level Control	[illegible]							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	[illegible]	●							
A33	M/N Output	[illegible]	●							
A34	Reference-M/N Motherboard	[illegible]	●							
A35	Rectifier	[illegible]								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	[illegible]		●						
A41	PLL2 Phase Detector	[illegible]		●						
A42	PLL2 Divider	[illegible]		●						
A43	PLL2 Discriminator	43		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	[illegible]			●					
A49	YO Loop Phase/Detector	[illegible]			●					
A50	YO Loop Interconnect	[illegible]			●					
A51	Reference Oscillator	[illegible]	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	[illegible]								●
A57	Marker/Bandcross	[illegible]					●			
A58	Sweep Generator	[illegible]			●					
A59	Digital Interface	21					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	[illegible]							●	
AT2	15 dB Attenuator	[illegible]			●					
B1	Fan Assembly	[illegible]								●
A62C1-3	Power Supply Filter Capacitors	[illegible]								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

SERVICE INTRODUCTION A

SERVICE INTRODUCTION

This Service Introduction provides the troubleshooter with a structured procedure by which an instrument fault may be localized to the appropriate **functional group** (see below). The functional group provides the information required to troubleshoot to the component level. This section contains an "OVERALL THEORY OF OPERATION" and simplified block diagram. These are used in conjunction with the "OVERALL INSTRUMENT TROUBLESHOOTING," and "TROUBLESHOOTING AIDS" to determine the cause of the instrument failure. Information on safety and repair procedures is also included in this Service Introduction. Refer to the "SERVICE SECTION FORMAT" description, below.

The HP 8340A Service Section is divided into eight sub-sections called functional groups. Four of these are listed on the front of each Service section tab along with a chart that shows which individual assemblies they contain and where these assemblies are located.

The tab for each of the eight functional groups provides an outline of the functional group's contents. Typically this includes an introduction, overall theory of operation, simplified block diagram, and a troubleshooting block diagram.

This is followed by a description of each assembly in the functional group. Each assembly description contains an overall theory of operation, simplified block diagram, component layout, pin I/O table and schematic diagram.

A Major Assembly and Component Locations diagram is provided at the end of each volume.

ATTENTION

In order to avoid unnecessary troubleshooting, verify the instruments internally stored calibration constants. If these constants have been incorrectly modified, the instrument may activate an error annunciator. To do this, first remove the hard copy of the calibration constants from the metal bracket inside the instrument on the left hand side panel (as viewed from the front). Compare these to the constants stored in memory per the instructions in the "CALIBRATION CONSTANTS" section, "Instrument User Access," step 1.

SERVICE SECTION FORMAT

INTRODUCTION

The HP 8340A Service Section is structured to minimize the time it takes to troubleshoot a problem. The following text describes the format of the Service Section and provides important information concerning its use.

SECTION FORMAT

General Information

The beginning of Section VIII contains general information concerning safety, required tools, and the location of instrument interconnects and mnemonics.

Overall Theory of Operation

An Overall Instrument Theory of Operation is supplied that includes an overall block diagram of the instrument. A description of the instrument's stored Calibration Constants is also provided.

Troubleshooting Aids

This part of Section VIII contains descriptions of the troubleshooting aids that are built into the instrument. These aids are: the instrument Self-Test, Digital Signature Analysis (DSA), Direct I/O Addressing, and front panel Diagnostics.

Overall Instrument Troubleshooting

This is the single most important part of the Service Section. This troubleshooting guide will allow the repair person to begin troubleshooting with a symptom and lead him or her to one of the eight major functional areas of the instrument (see below). In many cases this guide leads the troubleshooter directly to the faulty assembly.

Repair

This section contains warnings and cautions concerning the repair of the HP 8340A. It is extremely important that these precautions are implemented when repairing the instrument. A description of the microcircuit field exchange program and after-service safety checks is also included.

Major Functional Group Service Sections

A functional group is a group of assemblies that work in conjunction with one another to perform a certain task. There are eight such groups in the HP 8340A. These are:

- Reference Loop - M/N Loop
- 20-30 Loops
- Sweep Generator - YO Loop
- Motherboard - Wiring List
- Controller Section
- Front Panel - Rear Panel
- RF Section (Power Level Control)
- Power Supplies - Fan

These sections are further divided into overall troubleshooting guides, one for each of the above functional groups. Each of these guides contains the theory of operation and block diagrams for the functional group as a whole. This is followed by a service guide for each asssembly that makes up that functional group. These assembly level service guides contain; theory of operation, troubleshooting information, block diagrams, a component location diagram, a pin I/O table, and a schematic diagram.

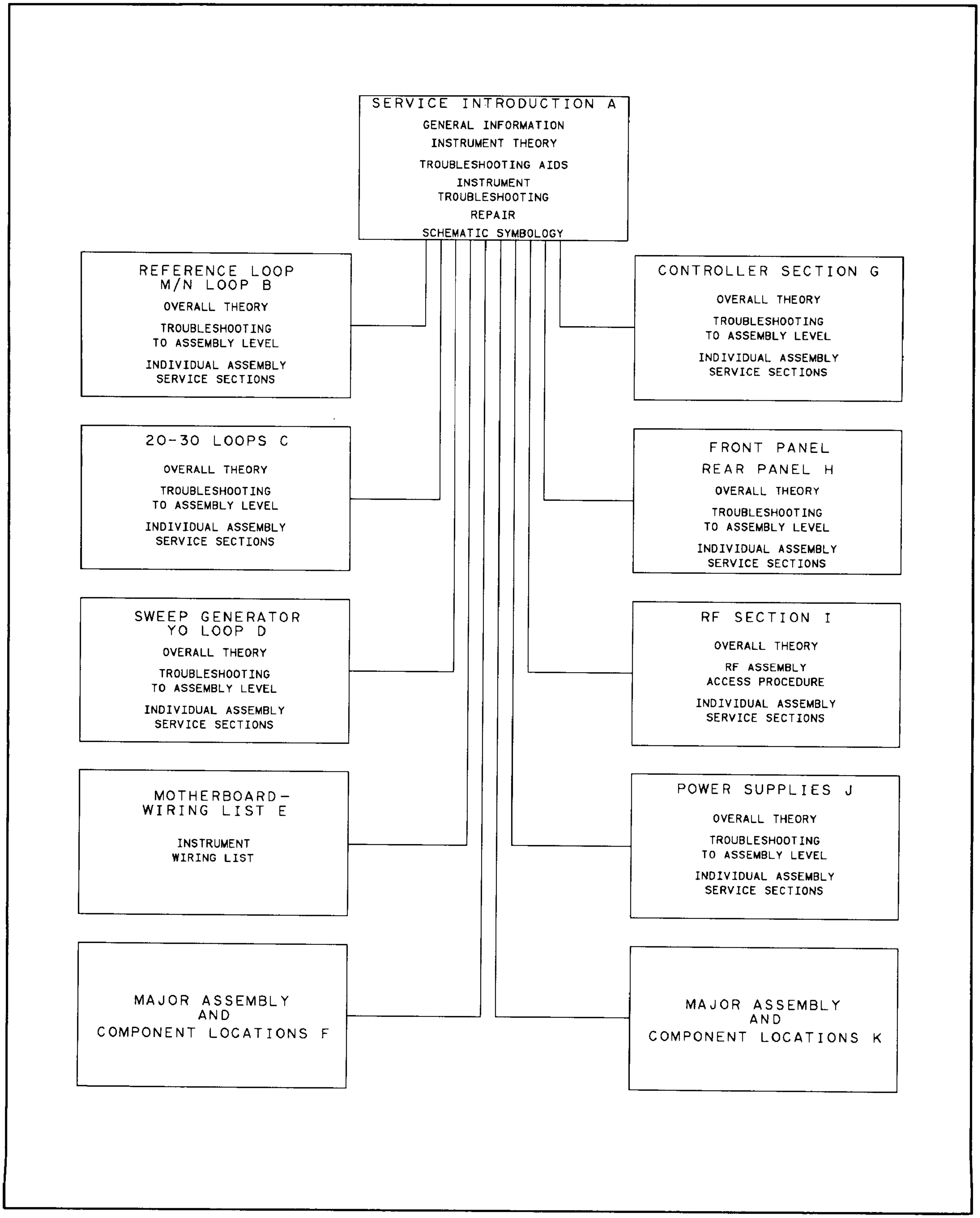


Figure 8A-1. Service Section Format

WARNING

When connected to ac mains, there are voltages at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

If the A19 POWER-ON SAFETY INDICATOR LED is on, there are voltages present inside the instrument (the A62 Motherboard, the A35 and A19 Rectifier Assemblies, line filter module/transformer wiring, etc.) that can cause injury or even death.

Whenever the instrument is connected to ac mains, the A19 and A35 rectifiers, as well as the A35 +22V REGULATOR, are fully operational. All filter capacitors are charged to full potential. This is true regardless of the position of the POWER switch. Only the A52, A53, and A56 regulators are turned off when the POWER switch is set to STANDBY.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from ac mains. The A19 POWER-ON SAFETY INDICATOR indicates that the filter capacitors on the A19 assembly are sufficiently charged to constitute a shock hazard. Wait until this LED is out before touching any internal components. The filter capacitors on the A35 RECTIFIER assembly bleed-off faster than the A19 capacitors. Therefore, by the time the A19 POWER-ON SAFETY INDICATOR LED is dark, (and the A35 assembly is connected to all of its normal loads) the A35 capacitors have had time to discharge.

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury or even death. (Grounding one conductor of a two conductor outlet is not sufficient protection). Whenever it is likely that this protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer, make sure the common terminal is connected to the earth terminal of ac mains.

For continued protection against fire hazards, replace the LINE fuse only with 250V normal blow fuses with the proper current rating. Do not use repaired fuses or short circuited fuseholders.

CAUTION

Never short a capacitor with a screwdriver or similar direct short. Instead, either wait for the capacitor to bleed off via normal instrument loads or, if this is not convenient, provide a discharge path by applying a 0.5 watt, 100 ohm resistor (via shielded clip leads) across the capacitor terminals.

GENERAL INFORMATION

TOOLS REQUIRED

As mentioned above, a soldering station equipped with a grounded tip as well as a low static solder removal tool are required. The Ungar HOT VAC or equivalent is recommended for removing motherboard connectors. Other than these items, no special equipment is needed that isn't provided in the Service Kit (HP Part Number 08340-60134). Table 8A-1 is a list of the tools included in this kit:

Table 8A-1. Tools Supplied in Service Kit

Item	Description	HP Part Number
Adapters	APC-3.5 Female to Female APC-3.5 Female to Type N Male	5061-5311 1250-1744
Adapter Tee	SMB Male-Male-Male	1250-0670
PC Board Extenders	24-pin 30-pin 36-pin 44-pin 48-pin 62-pin 110-pin	08340-60095 08505-60041 08505-60042 08350-60031 08340-60050 08340-60096 08340-60033
IC Test Clip	16-pin 20-pin	1400-0734 1400-0979
Adjustment Tool	Fits adjustment slot on components	8830-0024
Service Cables	BNC (Male) to SMB (Female) (2 required) 61 mm (2 ft), 0.85 in., semi-rigid, SMA Male to SMA Male (2 required) 30 mm (12 in) SMB (Female) to SMB (Female)	85680-60093 08340-20124 5061-1022
Nut Driver	9/16 inch, to replace front panel BNC nuts	08340-20099
Wrench	5/16-inch slotted box/open end	08555-20097

Table 8A-2. Equipment Not Supplied in Service Kit

Item	Description	HP Part Number
RMA Solder	Rosin Mildly Activated	8090-0587
EDSYN SILVERSTAT	Low static solder removal tool	8690-0227
Replacement Tip	For low-static solder removal tool	8690-0253
Wrist Strap	Anti-static wrist strap, 4 ft cord and alligator clip	9300-0791

INTERCONNECT CABLES AND MNEMONICS

All interconnect cables and their associated connectors are listed in Table 8E-1, located within the A62 Motherboard Functional Group.

Table 8E-1 alphabetically lists and defines all HP 8340A signal mnemonics, references the point-to-point distribution of each signal to and from the PC board sockets and the cable connectors on the A62 Motherboard assembly, and identifies the signal source. This table is located in the A62 Motherboard Functional Group.

HP 8340A OVERALL INSTRUMENT THEORY

INTRODUCTION

Refer to Figure 8A-2, HP 8340A Block Diagram.

The HP Model 8340A is a synthesized sweeper that covers the frequency range from 10 MHz to 26.5 GHz in five bands. These bands are:

- Band 0 (10 MHz to 2.3 GHz)
- Band 1 (2.3 to 7.0 GHz)
- Band 2 (7.0 to 13.5 GHz)
- Band 3 (13.5 to 20.0 GHz)
- Band 4 (20.0 to 26.5 GHz)

Internal to the HP 8340A are 7 phase-lock loops, 16 high frequency microcircuits, and a 16 bit microprocessor. these provide the capability of broadband sweeps and the frequency accuracy of a high-performance synthesizer.

REFERENCE LOOPS

The HP 8340A's frequency accuracy and stability are tied to either the 10 MHz internal frequency standard or an external 10 MHz source. The Reference Loop uses this 10 MHz source to generate all of the translation and reference signals that are used by other phase-lock loops inside the instrument. These signals are:

- 400 MHz and 20 MHz signals used in the M/N Loop to produce the M/N output frequency.
- 10 MHz and 100 MHz signals used as reference signals in the 20-30 Loops.
- A separate, lower power 100 MHz output sent to the RF Section for phase locking the 3.7 GHz Oscillator to the 10 MHz Reference.

M/N LOOP

The M/N Loop produces an output between 177-197 MHz. This M/N output drives a Sampler in the YO Loop. The variables "M" and "N" are integers generated by the processor and control the output frequency of the M/N Loop. The output from the Sampler in the YO Loop must always be between 20-30 MHz for the instrument to phase-lock. With the YO at a specific frequency between 2.3 and 7.0 GHz there will be an M/N output frequency between 177 and 197 MHz. When a harmonic of this frequency is mixed with the YO frequency in the Sampler, an IF output between 20-30 Mhz will result. the Sampler output is then compared to the 20-30 Loop output by the YO Loop Phase/Frequency detector in the YO Loop.

20-30 LOOPS

The 20-30 Loops contain 3 phase-locked loops that are used in conjunction with one another to provide the HP 8340A YO Loop with 1 Hz CW resolution, and with analog sweep widths from 100 Hz to 5 MHz. For sweep widths $\leq$5 MHz the YO Loop remains phase-locked during the sweep, and the 20-30 Loop is swept the desired amount. For sweep widths $\geq$5 MHz, all phase-lock loops lock at the beginning of sweep, the 20-30 Loop remains fixed, and the YO is swept. This is called Lock and Roll and will be discussed later.

The 20-30 Loop generates an output between 20-30 MHz in CW mode and 15-30 MHz when the 20-30 Loop is swept. This loop has an output resolution of 1 Hz. Comparing and locking the down-converted YO frequency to the 20-30 output produces a 1 Hz resolution in the YO frequency.

YO LOOP

The YO Loop contains the YIG Oscillator (YO) that is the tunable local oscillator source for all frequency bands. When the HP 8340A is set to a specific CW frequency, the processor sets the frequency of the M/N and 20-30 Loops accordingly. It also sets the YO pretune voltage which tunes the YO to the approximate frequency.

The output of the YO is fed through the directional coupler to the RF Section. The directional coupler splits off part of the YO signal which goes to the Sampler. The M/N output frequency and its harmonics are mixed with the YO frequency in the Sampler to produce an IF signal between 20-30 MHz. The 20-30 MHz IF from the Sampler is compared to the 20-30 Loop output in the Phase/Frequency Detector. The error-induced voltage from the Phase/Frequency Detector is fed through a sample/hold and is summed with the pretune voltage that drives the YO tuning coils. The YO Frequency changes until the output voltage from the Phase/Frequency Detector goes to zero and phase-lock is achieved. For sweep widths greater than 5 MHz, the YO is phase-locked at the start of the sweep. The sample/hold is then set to hold, breaking the loop, and allowing the YO to sweep. The Sweep Generator initiates a Voltage-Sweep (VSWP) ramp that is summed with the YO pretune voltage. This voltage causes the YO to sweep to the STOP frequency. This action is referred to as Lock and Roll. During multi-band sweeps, the YO will again phase-lock at the start of each band before continuing on with the sweep, thus ensuring frequency accuracy across the full range of the HP 8340A.

CONTROLLER SECTION

The Controller Section performs all of the data transfer and coordinates the control signals that operate the HP 8340A. It contains a 16 bit microprocessor, a total of 34K x 16 ROM and 8K x 16 RAM. This section also contains interface circuitry for communicating with the rest of the instrument.

Digital information is exchanged between the microprocessor and other sections of the instrument on a bidirectional bus. In the power-on condition or at Instrument Preset, the controller runs through an instrument self-test. The microprocessor will also set the front panel controls to preset conditions if Instrument Preset was pressed.

The rear panel interface signals, such as the HP-IB bus, SWEEP OUTPUT, Z-AXIS, and others are also routed through or generated in the Controller functional group. The sweep control signal from the controller stops and starts the Sweep Generator. As previously mentioned, during bandcrossings, the sweep must be stopped to phased lock the YO before the sweep can continue. The controller monitors sweep events such as bandcrossings, end of sweep, and markers. It then executes specific instructions according to each type of sweep event.

FRONT PANEL

The front panel contains both the displays and the keyboard as well as some interface connectors. The display has a dedicated microprocessor that keeps the display refreshed and updated. When the instrument processor places display data into the display interface latch, it signals the display processor that some information is ready. The display processor immediately takes the data from the latch and stores it in internal memory. The data will be handled when the display processor has time. The keyboard communicates directly with the instrument processor. When a key is pressed, the instrument processor will either execute that key (if it is a single key operation), or wait for completion of the key sequence. Different key sequences not only allow the operator to set up the HP 8340A for normal operation but also allow access to internal registers, latches, D to A converters, and calibration constants for troubleshooting.

RF SECTION

The RF Section contains the microcircuits and control circuits that produce the 10 MHz to 26.5 GHz RF OUTPUT from the 2.3 to 7.0 GHz YO loop output.

RF output from the directional coupler in the YO loop is fed to the Modulator/Splitter (Mod/Splitter) in the RF Section. Band 0 (10 MHz to 2.3 GHz) is the heterodyne band and is produced by mixing a swept LO Drive from the Mod/Splitter with the phase-locked 3.7 GHz Oscillator output. The IF signal from the Band 0 Splitter/Detector is routed through the Switched-YIG-Tuned Multiplier (SYTM), the Band 1-4 Coupler, and the 90 dB Step Attenuator before reaching the RF OUTPUT connector. The SYTM and Band 1-4 Coupler perform no function in this band. Option 001 and 005 instruments do not have a Step Attenuator.

Band 1 (2.3 to 7.0 GHz) is the same as the YO frequency range. The RF from the Band 1-4 output on the Mod/Splitter is amplified by the Band 1-4 Power Amplifier and passes through the SYTM to the Band 1-4 Coupler. Here, part of the RF is coupled to the Band 1-4 Detector for leveling through the ALC Loop. After the coupler, the RF passes through the 90 dB Step Attenuator (on instruments so equipped) to the RF OUTPUT.

Bands 2-4 (7.0 to 26.5 GHz) are generated by multiplying the YO frequency in the SYTM. A Step Recovery Diode (SRD) in the SYTM, when biased properly, generates harmonics of the input signal. A YIG-Tuned filter tracks the desired harmonic allowing it to pass through to the Band 1-4 Coupler and Step Attenuator (if equipped with Step Attenuator) to the RF OUTPUT. The SYTM Driver provides the necessary circuitry so the YIG-Tuned filter in the SYTM can track the YO properly. Leveling in Bands 2-4 is the same as in Band 1.

Pulse modulation in the HP 8340A is produced by the Pulse Modulator Driver and two fast response time pulse modulators. The Band 0 Pulse Modulator, located just before the Band 0 Mixer, is used when the HP 8340A is operating below 2.3 GHz. Operation above 2.3 GHz uses the Band 1-4 Pulse Modulator inside the Mod/Splitter.

POWER SUPPLIES

The power supply in the HP 8340A produces eight regulated voltage levels, four positive supplies and four negative supplies. These voltages are +22, +20, +12, +5.2, −5.2, −10, −15, and −40 volts. The +22 volt supply powers the 10 MHz Reference Oscillator heater coil. This is the only supply that actually produces an output when the HP 8340A is switched to **STANDBY**. All supplies except for the +22 volt supply are referenced either directly or indirectly to the +20 volt supply. In **STANDBY** mode, the +20 volt supply shuts down. This in turn shuts down the regulators for all other supplies (except the +22 volt supply). However, it is important to note that even though these supplies are "shut down," all of the unregulated supply circuits are fully operational. Therefore, hazardous voltages exist in these sections of the instrument even when the front panel **POWER** switch is set to **STANDBY**. The +20, −15, −10, and −40 volt supplies deliver current to the low noise analog circuits and the microcircuits. The +12, +5.2, −5.2, and −15 volt supplies deliver power to the digital and non-critical analog circuits. Over temperature protection, current limit, and over voltage protection are built into each supply. The output voltage of each supply (excluding the +22 volt supply) is monitored. If any of these supplies drop out of regulation, the instrument microprocessor is flagged.

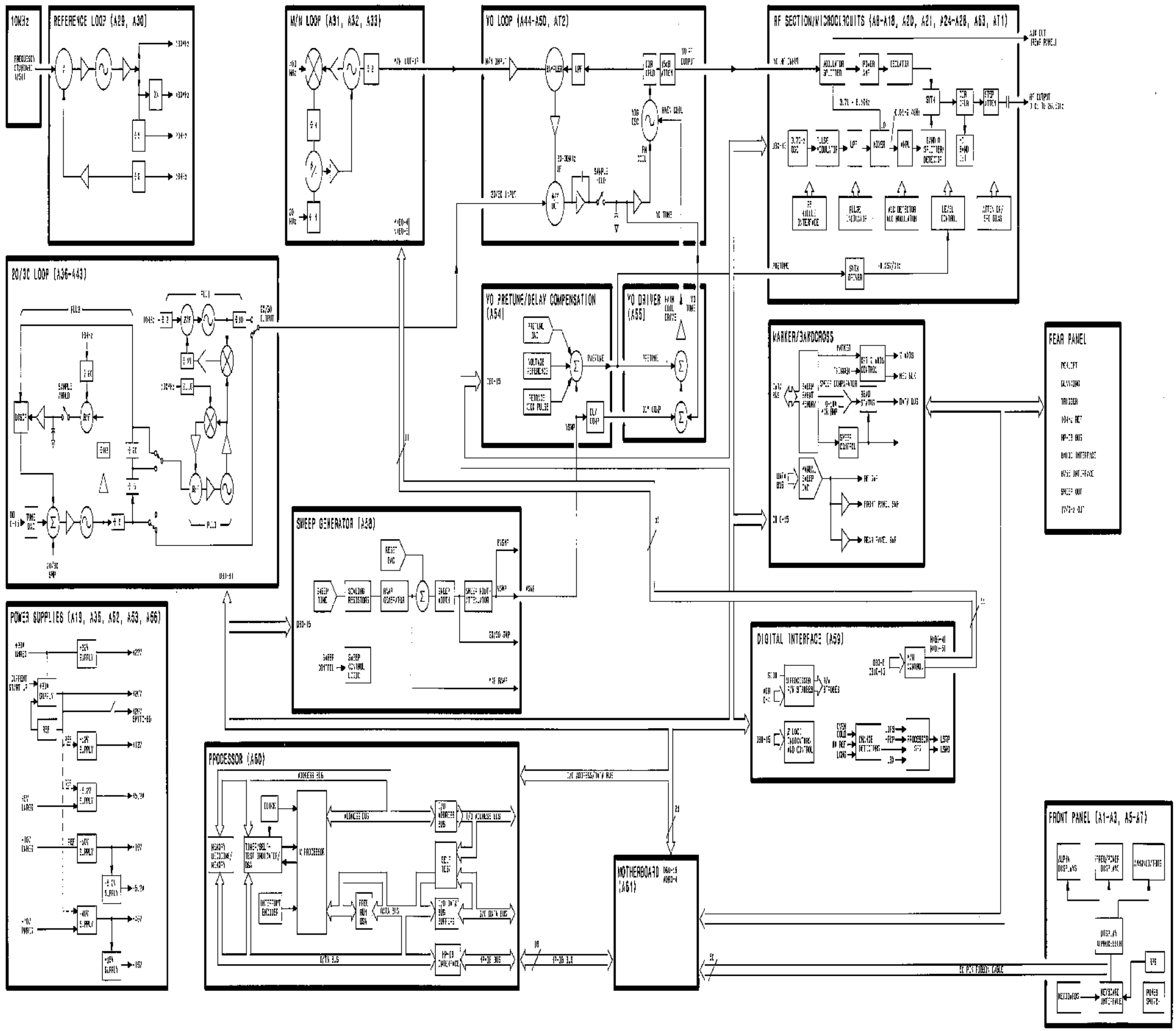


Figure 8A-2. Model 6340A Block Diagram

8-13/8-14

CALIBRATION CONSTANTS

Introduction

There are three sets of Calibration Constants maintained by the HP 8340A which contain the calibration data, serial number, option, HP-IB Address, and CHECKSUM information. The three sets of Calibration Constants are:

* Working Data
* Protected Data
* Default Data

Working Data contains the calibration information that is required for optimum performance of the HP 8340A. This is the only set of Calibration Constants that is accessed during normal operation of the HP 8340A. It is stored in RAM on the A60 Processor Assembly and maintained by battery A60BT1.

Protected Data contains calibration information which is accessed by the instrument if there is a problem with the Working Data or accessed by the user to update the data. The Protected Data is typically an exact duplicate of the Working Data and acts as a backup in the event an error occurs in the Working Data. Protected data is stored in EE-PROM on the A60 Processor Assembly.

Default Data differs from the Working and Protected Data in that its calibration data is the average calibration data of several HP 8340As. This is done to ensure that if any HP 8340A goes to Default Data, it will still be fairly close to its required calibration data for normal operation. This data is stored in UV-EPROM on the A60 Processor Assembly. The only instance where the instrument would select Default Data would be if a problem existed with both the Working and Protected Data.

Instrument and User Access

During normal operation, the HP 8340A will access the Working Data to obtain the calibration information required for optimum operation of the instrument. In addition to this, the HP 8340A will access the Working Data after an **[INSTR PRESET]** is initiated, and only to verify that the CHECKSUM (Cal Constant #99) is accurate (see Figure 8A-3, Instrument Preset Calibration Constant Verification Sequence).

When **[INSTR PRESET]** is pressed, the Working Data Cal Constants 1 through 98 are summed and then complemented. The result is then compared with the CHECKSUM. If the two numbers agree, the instrument continues normal operation. If not, the Protected Data is written into the Working Data's memory location and the CHECKSUM test is repeated. If the checksum test passes, the data that was in Protected Data is now stored as Working and Protected Data and displayed in the ENTRY DISPLAY will be "CALIBRATION RESTORED." If the CHECKSUMs do not agree, the Default Data is then written to the Working Data. The Working Data now contains the Default values, the FAULT light on the HP 8340A front panel is lit, and "CAL DEFAULTED" is displayed. Pressing **[SHIFT] [MANUAL]** will display the FAULT diagnostics in the ENTRY DISPLAY and the CAL light will be flashing. (Note that the Protected Data was not changed. For troubleshooting, this data may be written into the Working Data (per procedure #5 below) and viewed (per procedure #1 below)).

CAUTION

The following describes methods for intentionally changing the values of the Cal Constants. When a Cal Constant is changed, the CHECKSUM is automatically updated. If a CAL FAULT occurs and a Cal Constant is updated, on the next [INSTR PRESEST] (unless otherwise stated), the CAL FAULT indicator will turn off. This means that if only a few of the Cal Constants were updated, the balance will still be using Default Data.

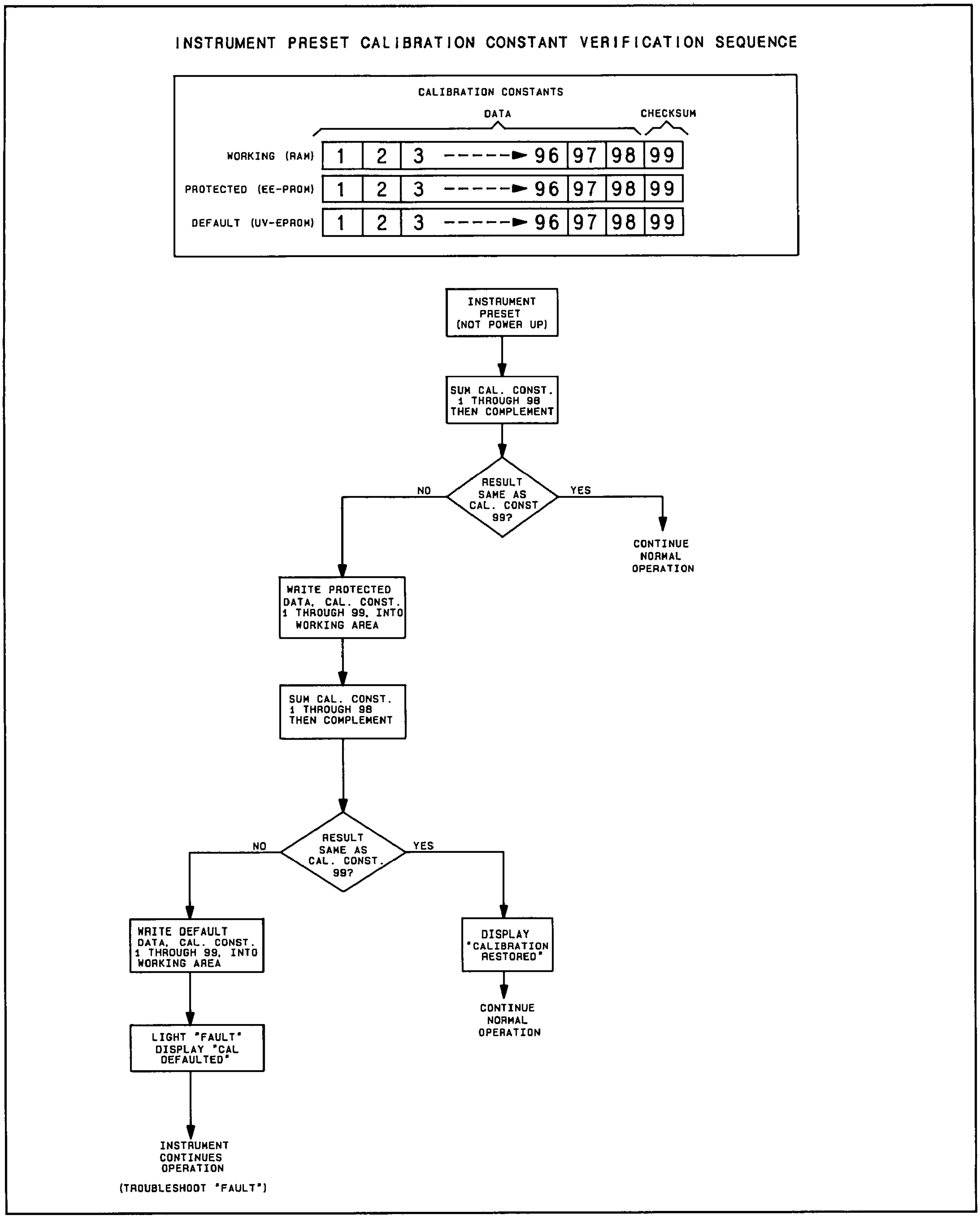


Figure 8A-3. Instrument Preset Calibration Constant Verification Sequence

A number of methods exist for user access of the Cal Constants. A description of each follows:

1. CALIBRATION CONSTANT ACCESS

   [SHIFT] [MHz] [1] [2] [Hz]
   (I/O SUBCHANNEL: 12 displayed in ENTRY DISPLAY)

   [SHIFT] [kHz] [2] [2] [Hz]
   (I/O WRITE: 22 displayed in ENTRY DISPLAY)

   Performing this key sequence allows the user direct access to the Working Data. At this point the data may either be viewed or changed. Immediately after entering the final [Hz], a Cal Constant number and value for that specific Cal Constant will be displayed on the HP 8340A ENTRY DISPLAY. Using the up and down [STEP] keys allows the rest of the Cal Constants to be viewed. For immediate access to a specific Cal Constant, press **[SHIFT] [GHz]** (I/O CHANNEL: XX displayed in ENTRY DISPLAY), enter the number of the desired Cal Constant, and then press **[Hz]** prior to beginning the above key sequence. To change a Cal Constant, use the **[STEP]** keys to move to the desired Cal Constant. Then use either the RPG or the ENTRY keyboard to enter a new value. After the desired value is reached, press **[Hz]**. At this point the Cal Constant value is changed and the CHECKSUM is updated. Note that using this method only changes the Working Data. To permanently change the Protected Data, the procedure described in #4 must be followed.

2. HP-IB ADDRESS ACCESS

   [SHIFT] [LOCAL]

   Performing this key sequency allows the HP-IB address to be viewed in the ENTRY DISPLAY. By rotating the RPG or by keyboard entry, the HP-IB address may be changed from 00 to 30. When the desired address is set, press the **[Hz]** key and the HP-IB address will be changed and the CHECKSUM updated (note that only the Working Data is updated). To prevent the HP-IB address from being changed in this manner, bit 5 of Cal Constant #57 may be set and this function is disallowed. The procedure for doing this is:

   a. Access the Working Data Cal Constant #57 as described in #1.
   b. Set bit 5 by adding 32 to the HP-IB address. Enter this value.
   c. Press **[Hz]**.

3. AUTOMATIC SYTM TO YTO TRACKING (POWER OPTIMIZATION)

   [SHIFT] [PEAK]

   Performing this key sequence causes an automatic SYTM Tracking to be performed. This function automatically adjusts and updates the YTM GAIN Cal Constants (#9 through #12 and #50 through #53) for peak RF output power and then updates the CHECKSUM. This function will also automatically turn off the CAL FAULT indicator without performing an **[INSTR PRESET]** as described in the above note.

4. WORKING DATA TO PROTECTED DATA TRANSFER

   [SHIFT] [MHz] [1] [4] [Hz]
   [SHIFT] [kHz] [5] [3] [4] [9] [Hz]

   Performing this key sequence causes the CHECKSUM of the Working Data to be recalculated and stored. The Working Data is then written over the Protected Data and stored as Protected Data. This is the only method for updating the Protected Data. If this transfer of data fails, the message "EEROM FAILURE, CAL NOT STORED" will be displayed in the ENTRY DISPLAY.

5. PROTECTED DATA TO WORKING DATA TRANSFER

   [SHIFT] [MHz] [1] [4] [Hz]
   [SHIFT] [kHz] [1] [9] [4] [6] [Hz]

   Performing this key sequence causes the HP 8340A to recall the Protected Data and store it in the Working Data memory location.

6. SAVE/RECALL REGISTER INITIALIZATION

   [SHIFT] [MHz] [1] [8]
   [SHIFT] [kHz] [0] [Hz]

   Performing this key sequence, switching the HP 8340A off then on, and then pressing **[INSTR PRESET]** forces the HP 8340A to reinitialize the Save/Recall Registers in RAM (this function does not effect the Cal Constants).

7. CAL CONSTANTS PASSWORD ENABLE

   [SHIFT] [GHz] [8] [2] [Hz]
   [SHIFT] [MHz] [1] [2] [Hz]
   [SHIFT] [kHz] [2] [2] [Hz]
   [−] [2] [3] [8] [7] [5] [Hz]

   The above key sequence accesses Cal Constant number 82 (LOCKWORD ENABLE) and sets it to −23,875. This enables the lockword function and sets Cal Constant number 81 (LOCKWORD) to 0. To change the LOCKWORD (password), access Cal Constant number 81 by pressing the down arrow STEP key. Enter a number between −32,768 and 32,767 via the ENTRY keyboard and terminate the entry with **[Hz]**. The number entered will be the password required to access the calibration constants. After this, remove number A59W1 on the A59 Digital Interface assembly. This is the final step in enabling the Cal Constants' lockword function. In the event that the password is forgotten, re-installing jumper A59W1 will disable the lockword function.

8. CALIBRATION CONSTANT ACCESS WHEN LOCKWORD FUNCTION IS ENABLED

   [SHIFT] [MHz] [2] [0] [Hz]

   This key sequence allows access to the location (sub-channel) where the password for access to the Cal Constants will need to be entered. After pressing the above key sequence, enter the password via the ENTRY keyboard and press **[Hz]**. Upon entry of the correct password, the Cal Constants may be accessed per procedure #1 described previously.

Description

A listing and description of the Cal Constants is given in Table 8A-3. The values that are given in the "Range" column represent the amount of adjustment that is possible with the Cal Constant. The numbers that are shown are the only ones that should be entered by the user. It is possible to enter values out of the given range, but they will not represent the value being used by the HP 8340A. The column labeled "Significance" gives the units associated with the Cal Constant. For example, the value entered for DWELL TIME represents the number of milliseconds that the HP 8340A will wait, after phase lock at the beginning of a sweep or at bandcross, before it will continue its sweep. Another example is the 9GZ SLOPE. For each count, a power compensation of 0.0025 dB/GHz will be added to the RF output. In other words, if 10 were entered for the Cal Constant, a 0.025 dB/GHz slopoe (10 times 0.0025 dB/GHz) would be added for a sweep within the 9 to 20 GHz range.

Five of the Cal Constants, PRESET OPTION (#56), HPIB ADDRESS (#57), RETRACE DWELL (#58), ATTEN CONFIG (#59), and CONFIGURATION (#60) use their bit configuration to store more than one piece of information for the HP 8340A. For example, the HPIB ADDRESS sets up the HP 8340A's HP-IB address and allows or disallows the **[SHIFT] [LOCAL]**, **[SHIFT] [SAVE]**, and **[SHIFT] [RECALL]** functions. If a user wished to set up an HP-IB address of 19, disallow the **[SHIFT] [LOCAL]** and **[RECALL]** functions, and allow the **[SHIFT] [SAVE]** function, the user would enter 179 for Cal Constant #57. The 179 was arrived at by adding 19 (HP-IB address), 32 (disallows **[SHIFT] [LOCAL]**), 0 (allows **[SHIFT] [SAVE]**), and 128 (disallows **[SHIFT] [RECALL]**). The other four Cal Constants work in the same manner.

A hard copy of the HP 8340A's Protected Data is included in a plastic envelope with each instrument. It is stored in a bracket which is located underneath the top cover, on the side of the instrument. If the Working and Protected Data are ever lost, the information on this sheet should be used to restore the Cal Constants. Also, when the HP 8340A is recalibrated, the hard copy of the Protected Data should be updated and placed back into the instrument (remember to update the Protected Data). A sample of the hard copy that is included with the instrument is shown in Figure 8A-4.

8340A CALIBRATION CONSTANTS

SERIAL NUMBER; 9999 **8340AREV 08 JAN 85**

1. DWELL TIME	50	34. AT90 SLOPE	−12	67. AT60 SLP 20GZ	10
2. YTM BX DLY 2	112	35. unused	0	68. AT70 SLP 20GZ	13
3. YTM BX DLY 3	131	36. unused	0	69. AT80 SLP 20GZ	13
4. YTM BX DLY 4	125	37. unused	0	70. AT90 SLP 20GZ	18
5. YTM DLY 1	89	38. unused	0	71. YTM OFFSET 1	1024
6. YTM DLY 2	100	39. ADC GAIN LO	−33	72. YTM OFFSET 2	1024
7. YTM DLY 3	117	40. ADC GAIN HI	−28	73. YTM OFFSET 3	1024
8. YTM DLY 4	104	41. MAX SWEEP RATE	600	74. YTM OFFSET 4	1024
9. YTM GAIN 1	755	42. ADC OFFSET	−36	75. YTM TC GAIN	25
10. YTM GAIN 2	859	43. AM OFFSET	0	76. YTM TC OFFSET	1000
11. YTM GAIN 3	772	44. LVL DAC OFF; INT	33	77. YTM TC BKP GAIN	175
12. YTM GAIN 4	990	45. LVL DAC OFF; EXT	2	78. YTM TC BKP FREQ	50
13. LO SLOPE	40	46. LVL DAC GAIN; LO	8	79. OI MODEL	1
14. HI SLOPE	119	47. LVL DAC GAIN; HI	3	80. unused	0
15. 9GZ SLOPE	100	48. LVL DAC GAIN; EXT	26	81. LOCKWORD	0
16. 20GZ SLOPE	215	49. PWR SWP GAIN	1	82. LOCKWORD ENABLE	0
17. AT10 OFFSET	−2	50. YTM BX GAIN 1	890	83. unused	0
18. AT20 OFFSET	−5	51. YTM BX GAIN 2	791	84. unused	0
19. AT30 OFFSET	−1	52. YTM BX GAIN 3	1030	85. unused	0
20. AT40 OFFSET	−4	53. YTM BX GAIN 4	990	86. unused	0
21. AT50 OFFSET	−7	54. STOP LIMIT	20000	87. unused	0
22. AT60 OFFSET	−2	55. START LIMIT	10	88. unused	0
23. AT70 OFFSET	−5	56. PRESET OPTION	0	89. unused	0
24. AT80 OFFSET	−7	57. HPIB ADDRESS	531	90. unused	0
25. AT90 OFFSET	−10	58. RETRACE DWELL	0	91. unused	0
26. AT10 SLOPE	−2	59. ATTEN CONFIG	20980	92. unused	0
27. AT20 SLOPE	−4	60. CONFIGURATION	23	93. unused	0
28. AT30 SLOPE	−3	61. SERIAL #	9999	94. unused	0
29. AT40 SLOPE	−5	62. AT10 SLP 20GZ	4	95. unused	0
30. AT50 SLOPE	−7	63. AT20 SLP 20GZ	5	96. unused	0
31. AT60 SLOPE	−60	64. AT30 SLP 20GZ	5	97. unused	0
32. AT70 SLOPE	−8	65. AT40 SLP 20GZ	8	98. MODEL #	0
33. AT80 SLOPE	−10	66. AT50 SLP 20GZ	9	99. CHECKSUM	9557

Procedure for manually entering calibration data into the HP 8340A:

1. Push the following sequence of KEYS:
   Instrument Preset SHIFT MHz 1 2 Hz SHIFT KHz 2 2 Hz
2. Note the Entry Display will indicate the Calibration Constant number and value.
3. Enter via the KEY BOARD or DATA KNOB the correct value for the first Calibration Constant indicated in the display.
   ≪ Terminate KEYBOARD entries with the Hz key ≫
4. Go to the next Calibration Constant by pushing the UP step key. The next constant can then be entered. Do not enter the "CHECKSUM" Constant. (This is computed automatically)
5. The Step Keys can be used to move from one Calibration Constant to another to either check them or to correct them.
6. After all entries have been made, check that all numbers are correct by using the step keys to review and verify them.
7. Allow instrument to warm up for 1/2 hour and make sure that nothing is connected to the Stop Sweep connector on the rear panel. Push SHIFT PEAK to perform an Automatic Tracking Calibration. This step may modify the "YTM GAIN n" & "YTM BX GAIN n" consts.
8. The CALIBRATION data should be permanently stored in the Non Volatile Protected Memory by pushing the following key sequence: SHIFT MHz 14 Hz SHIFT KHz 5349 Hz PRESET.

Figure 8A-4. Sample Calibration Constants Hard Copy (Found Inside Instrument)

Table 8A-3. Calibration Constants (1 of 7)

No.	Name	Function	Range (Counts)	Significance
1	DWELL TIME	Defines time to wait after phase lock at beginning of sweep and at bandcross.	0-500	0.2 ms/count
2	YTM BX DLY 2	Compensates for YTM Delay in Band 2 after bandcross from Band 1 to Band 2.	0-131	2.4 MHz/ms/count
3	YTM BX DLY 3	Compensates for YTM Delay in Band 3 after bandcross from Band 2 to Band 3.	0-131	2.4 MHz/ms/count
4	YTM BX DLY 4	Compensates for YTM Delay in Band 4 after bandcross from Band 3 to Band 4.	0-131	2.4 MHz/ms/count
5	YTM DLY 1	Compensates for YTM Delay in Band 1.	0-131	2.4 MHz/ms/count
6	YTM DLY 2	Compensates for YTM Delay in Band 2 for single band sweeps or multi-band sweeps that begin in Band 2.	0-131	2.4 MHz/ms/count
7	YTM DLY 3	Compensates for YTM Delay in Band 3 for single band sweeps or multi-band sweeps that begin in Band 3.	0-131	2.4 MHz/ms/count
8	YTM DLY 4	Compensates for YTM Delay in Band 4 for single band sweep.	0-131	2.4 MHz/ms/count
9	YTM GAIN 1	Adjusts Band 1 in YTM slow speed tracking.	0-2040	−4% - +4% of YTM Frequency
10	YTM GAIN 2	Adjusts Band 2 YTM slow speed tracking.	0-2040	−2% - +2% of YTM Frequency
11	YTM GAIN 3	Adjusts Band 3 YTM slow speed tracking.	0-2040	−1.33% - +1.33% of YTM Frequency
12	YTM GAIN 4	Adjusts Band 4 YTM slow speed tracking	0-2040	−1% - +1% of YTM Frequency
13	LO SLOPE	Slope compensation for RF power in Band 0.	0-255	0.005 dB/GHz/count
14	HI SLOPE	Slope compensation for RF power from 2.3 to 9.0 GHz.	0-255	0.005 dB/GHz/count
15	9 GZ SLOPE	Slope compensation for RF power from 9.0 to 20.0 GHz.	0-255	0.0025 dB/GHz/count
16	20 GZ SLOPE	Slope compensation for RF power from 20.0 to 26.5 GHz.	0-255	0.01 dB/GHz/count
17	AT10 OFFSET	Offset compensation for RF power at 10 dB attenuator setting from 0.01 to 26.5 GHz.	−200 - +200	0.05 dB/count

Table 8A-3. Calibration Constants (2 of 7)

No.	Name	Function	Range (Counts)	Significance
18	AT20 OFFSET	Offset compensation for RF power at 20 dB attenuator setting from 0.01 to 26.5 GHz.	−200 - +200	0.05 dB/count
19	AT30 OFFSET	Offset compensation for RF power at 30 dB attenuator setting from 0.01 to 26.5 GHz.	−200 - +200	0.05 dB/count
20	AT40 OFFSET	Offset compensation for RF power at 40 dB attenuator setting from 0.01 to 26.5 GHz.	−200 - +200	0.05 dB/count
21	AT50 OFFSET	Offset compensation for RF power at 50 dB attenuator setting from 0.01 to 26.5 GHz.	−200 - +200	0.05 dB/count
22	AT60 OFFSET	Offset compensation for RF power at 60 dB attenuator setting from 0.01 to 26.5 GHz.	−200 - +200	0.05 dB/count
23	AT70 OFFSET	Offset compensation for RF power at 70 dB attenuator setting from 0.01 to 26.5 GHz.	−200 - +200	0.05 dB/count
24	AT80 OFFSET	Offset compensation for RF power at 80 dB attenuator setting from 0.01 to 26.5 GHz.	−200 +200	0.05 dB/count
25	AT90 OFFSET	Offset compensation for RF power at 90 dB attenuator setting from 0.01 to 26.5 GHz.	−200 +200	0.05 dB/count
26	AT10 SLOPE	Slope compensation for RF power at 10 dB attenuator setting from 2.3 to 20.0 GHz.	−255 - +255	0.005 dB/GHz/count
27	AT20 SLOPE	Slope compensation for RF power at 20 dB attenuator setting from 2.3 to 20.0 GHz.	−255 - +255	0.005 dB/GHz/count
28	AT30 SLOPE	Slope compensation for RF power at 30 dB attenuator setting from 2.3 to 20.0 GHz.	−255 - +255	0.005 dB/GHz/count
29	AT40 SLOPE	Slope compensation for RF power at 40 dB attenuator setting from 2.3 to 20.0 GHz.	−255 - +255	0.005 dB/GHz/count
30	AT50 SLOPE	Slope compensation for RF POWER at 50 dB attenuator setting from 2.3 to 20.0 GHz.	−255 - +255	0.005 dB/GHz/count

Table 8A-3. Calibration Constants (3 of 7)

No.	Name	Function	Range (Counts)	Significance
31	AT60 SLOPE	Slope compensation for RF power at 60 dB attenuator setting from 2.3 to 20.0 GHz.	−255 - +255	0.005 dB/GHz/count
32	AT70 SLOPE	Slope compensation for RF power at 70 dB attenuator setting from 2.3 to 20.0 GHz.	−255 - +255	0.005 dB/GHz/count
33	AT80 SLOPE	Slope compensation for RF power at 80 dB attenuator setting from 2.3 to 20 GHz.	−255 - +255	0.005 dB/GHz/count
34	AT90 SLOPE	Slope compensation for RF power at 90 dB attenuator setting from 2.3 to 20 GHz.	−255 - +255	0.005 dB/GHz/count
35		UNUSED		
36		UNUSED		
37		UNUSED		
38		UNUSED		
39	ADC GAIN LO	Adjusts front panel dBm display accuracy from .01 to 2.3 GHz.	−100 - +100	−10% - +10%
40	ADC GAIN HI	Adjusts front panel dBm display accuracy from 2.3 to 26.5 GHz.	−100 - +100	−10% - +10%
41	MAX SWEEP RATE	Sets the maximum sweep rate in the AUTO sweeptime mode.	1-1000	1 MHz/ms/count
42	ADC OFFSET	Adjusts front panel dBm display.	−100 - +100	0.05 dB/count
43	AM OFFSET	Modulation level offset for output power accuracy in AM mode.	−100 - +100	0.05 dB/count
44	LVL DAC OFF; INT	Offsets level DAC A27U14 for internal leveling operation.	−100 - +100	0.05 dB/count
45	LVL DAC OFF; EXT	Offsets level DAC A27U14 for external leveling operation.	−100 - +100	0.05 dB/count
46	LVL DAC GAIN; LO	Adjusts gain of level DAC for internal leveling operation in Band 0.	−100 - +100	1% of ALC power (in dBm)/count
47	LVL DAC GAIN; HI	Adjust gain of level DAC for internal leveling operation in Bands 1-4.	−100 - +100	−10.0% - +10.0%

Table 8A-3. Calibration Constants (4 of 7)

No.	Name	Function	Range (Counts)	Significance
48	LVL DAC GAIN; EXT	Adjusts gain of level DAC for external leveling operation.	−100 - +100	−10.0% - +10.0%
49	PWR SWP	Adjust gain of power sweep DAC A27U24 during power sweep operation.	−100 - +100	−10.0% - +10.0%
50	YTM BX GAIN 1	Adjusts YTM slow speed tracking for sweeps which cross from Band 0 to Band 1.	0-2040	−4% - +4% YTM Frequency
51	YTM BX GAIN 2	Adjusts YTM slow speed tracking for sweeps which cross from Band 1 to Band 2.	0-2040	−2% - +2 of YTM Frequency
52	YTM BX GAIN 3	Adjusts YTM slow speed tracking for sweeps which cross from Band 2 to Band 3.	0-2040	−1.33% - +1.33% of YTM Frequency
53	YTM BX GAIN 4	Adjusts YTM slow speed tracking for sweeps which cross from Band 3 to Band 4.	0-2040	−1% - +1% of YTM Frequency
54	STOP LIMIT	Sets maximum allowable stop frequency.	11 - 26,000	1 MHz/count
55	START LIMIT	Sets minimum allowable start frequency.	10-(STOP LIMIT −1)	1 MHz/count
56	PRESET OPTION	Selects instrument's operating conditions.		
		Bits 0 through 7 - Selects power level after **[INSTR PRESET]**.	0-110	0 dBm - −110 dBm
		Bit 10 - PMI Network Analyzer retrace compatibility.	0/1024	Disabled/Enabled
		Bit 12 - CIIL compatibility (if option is installed)	0/4096	Disabled/Enabled
57	HBIB ADDRESS	Selects instrument's operating conditions.		
		Bits 0 through 4 - selects HP-IB address.	00 - 30	Instrument's HP-IB Address
		Bit 5 - allows or disallows the HP-IB address to be changed after entering a **[SHIFT] [LOCAL]**	0/32	Allowed/Disallowed
		Bit 6 - allows or disallows the **[SHIFT] [SAVE]** function.	0/64	Allowed/Disallowed
		Bit 7 - allows or disallows the **[SHIFT] [RECALL]** function.	0/128	Allowed/Disallowed

Table 8A-3. Calibration Constants (5 of 7)

No.	Name	Function	Range (Counts)	Significance
58	RETRACE DWELL	Required for Integra Filter operation.	0-20	10 ms/count
59	ATTEN CONFIG	Selects Attenuator operating conditions.		
		Bits 0 through 9 - selects attenuator switch threshold.	0-1020	0.05 dB/5 counts
		A 0 entry sets the attenuator switch threshold at −14.95 dBm (i.e., in coupled mode, the ALC will go as low as −14.95 dBm. At −15.0 dBm, the ALC is set to −5 dBm and the attenuator switches in 10 dB of attenuation). A 1020 entry sets the attenuator switch threshold at −4.75.		
		Bit 10 - Must be set to 1. This allows attenuator to be operated over 90 dB.	1024	90 dB operation
		Bit 12 - Selects attenuator Installed or not installed.	0/4096	Installed/ Not Installed
		Bit 13 - Must be set to zero.	0	–
		Bit 14 - Selects version of A26 Linear Modulator Assembly Installed. 0 selects P/N 08340-60021, 1 selects P/N 08340-60156.	0/16,384	08340-60021/ 08340-60156
		Bit 15 - Must be set to 0. This selects how attenuator is programmed.	0	Attenuator Programming
60	CONFIGURATION	Selects instrument options		
		Bit 0 - Must be set to zero	0	
		Bit 1 - Without or With Option 001 or 005 (No attenuator option).	0/2	Without/With
		Bit 2 - Without or With Option 004 or 005 (Rear panel option).	0/4	Without/With
		Bit 13 - Without or With C75 Special.	0/8192	Without/With
61	SERIAL #	Storage location for serial number of HP 8340A.	–	–
62	AT10 SLP 20GZ	Slope compensation for RF power at 10 dB attenuator setting from 20 to 26.5 GHz.	−255 - +255	0.01 dB/GHz/ count
63	AT20 SLP 20GZ	Slope compensation for RF power at 20 dB attenuator setting from 20.0 to 26.5 GHz.	−255 - +255	0.01 dB/GHz/ count

Table 8A-3. Calibration Constants (6 of 7)

No.	Name	Function	Range (Counts)	Significance
64	AT30 SLP 20GZ	Slope compensation for RF power at 30 dB attenuator setting from 20.0 to 26.5 GHz.	−255 - +255	0.01 dB/GHz/ count
65	AT40 SLP 20GZ	Slope compensation for RF power at 40 dB attenuator setting from 20.0 to 26.5 GHz.	−255 - +255	0.01 dB/GHz/ count
66	AT50 SLP 20GZ	Slope compensation for RF power at 50 dB attenuator setting from 20.0 to 26.5 GHz.	−255 - +255	0.01 dB/GHz/ count
67	AT60 SLP 20GZ	Slope compensation for RF power at 60 dB attenuator setting from 20.0 to 26.5 GHz.	−255 - +255	0.01 dB/GHz/ count
68	AT70 SLP 20GZ	Slope compensation for RF power at 70 dB attenuator setting from 20.0 to 26.5 GHz.	−255 +255	0.01 dB/GHz/ count
69	AT80 SLP 20GZ	Slope compensation for RF power at 80 dB attenuator setting from 20.0 to 26.5 GHz.	−255 - +255	0.01 dB/GHz/ count
70	AT90 SLP 20GZ	Slope compensation for RF power at 90 dB attenuator setting from 20.0 to 26.5 GHz.	− 255 - +255	0.01 dB/GHz/ count
71	YTM OFFSET 1	UNUSED		
72	YTM OFFSET 2	UNUSED		
73	YTM OFFSET 3	UNUSED		
74	YTM OFFSET 4	UNUSED		
75	YTM TC GAIN	UNUSED		
76	YTM TC OFFSET	UNUSED		
77	YTM TC BKP GAIN	UNUSED		
78	YTM TC BKP FREQ	UNUSED		
79	OI MODEL	Specifies instrument model number outputted when HP-IB "OI" command received.	0 - 2	0=8340A 1=8341A 2=8340A-H02
80		UNUSED		
81	LOCKWORD	Defines password required to access calibration constants.	−32,768 - +32,767	

Table 8A-3. Calibration Constants (7 of 7)

No.	Name	Function	Range (Counts)	Significance
82	LOCKWORD ENABLE	Enables lockword function which is used to allow access to calibration constants only upon input of the correct password (lockword).	0/−23,875	Disabled/ Enabled
83		UNUSED		
84		UNUSED		
85		UNUSED		
86		UNUSED		
87		UNUSED		
88		UNUSED		
89		UNUSED		
90		UNUSED		
91		UNUSED		
92		UNUSED		
93		UNUSED		
94		UNUSED		
95		UNUSED		
96		UNUSED		
97		UNUSED		
98	MODEL #	Instrument model number.	0, 1, 99	0=8340A 1=8341A 99=8340A-HO2
99	CHECKSUM	Serves as check point for Cal Constant Accuracy. The sum of Cal Constants 1 through 98 is calculated, the sum is complemented, and the result is stored as the CHECKSUM.	—	—

TROUBLESHOOTING AIDS

INTRODUCTION

This section contains descriptions of the major HP 8340A troubleshooting aids.

SELF TEST

Self Test verifies the operation of the A60 Processor. It also verifies that address and data information can be transmitted accurately over the Instrument Address Bus and Instrument Data Bus. Refer to the **"OVERALL INSTRUMENT TROUBLESHOOTING"** section for complete information.

DIGITAL SIGNATURE ANALYSIS (DSA)

DSA information, instructions, and signatures are provided for the A60 Processor and various front panel assemblies. This information may be found in the troubleshooting sections for each of those assemblies. Refer to the appropriate functional group and troubleshooting procedure.

PHASE-LOCK INDICATION LEDS

Three green LEDS in the HP 8340A indicate when a phase-lock condition exists for three phase-lock loops. Each LED is lit when its specific loop is phase-locked. The LEDS and phase-lock loops are as follows:

1. A37DS1 - PLL1
2. A39DS1 - PLL3
3. A50DS1 - YO

POWER SUPPLY INDICATION LEDS

Several yellow LEDS indicate when the power supplies are at their required voltage. Each LED is lit when its specific power supply is up. The LEDS and power supplies are as follows:

1. A35DS1 - +22V
2. A52DS1 - +5.2V
3. A52DS2 - +20V
4. A52DS3 - +12V
5. A53DS1 - −5.2V
6. A53DS2 - −40V
7. A53DS3 - −10V
8. A56DS1 - −15V

Three red LEDS indicate when voltage is present on the A19 Capacitor Assembly, when the HP 8340A is in shutdown due to over temperature, and when the AC mains is connected. The LEDS are lit when the respective condition exists. The LEDS and conditions are as follows:

1. A19DS1 - voltage present on A19 Capacitor Assembly
2. A52DS4 - HP 8340A in overtemp condition
3. A62DS1 - AC mains connected

DIRECT I/O ADDRESSING

Refer to the **DIRECT I/O ADDRESSING** description on the following pages.

DIRECT I/O ADDRESSING

Introduction

Direct I/O Addressing is a tool that allows the user to directly access HP 8340A input and output devices from the front panel. It allows the user to exercise these devices and thus verify their operation.

Direct I/O Addressing may only be used when the HP 8340A self test passes (CHECK LED I and II off, see Controller functional group for more information) and the front panel (or HP-IB) is operational. It should be used when the troubleshooting has progressed to the point where the signal path has been determined and a specific I/O device needs to be checked to verify it is or is not the cause of the failure. The required equipment is:

* DVM
* Logic Probe
* Extender Boards
* Jumper Wires

I/O Device Description

Input devices are used to place data on the data bus for use by the processor. These devices consist of the HP-IB Interface and input registers/buffers. To test theses devices using Direct I/O Addressing, a known input must be placed on the device's input and a "read" command executed to cause the data to be placed on the data bus and then displayed in the front panel ENTRY DISPLAY.

Output devices are used to accept data transmitted by the processor on the data bus and then translate and transmit the data in a form required for use in other parts of the instrument. These devices consist of DACs, 3 to 8 decoders, output registers, and flip-flops. To test these devices using Direct I/O Addressing, a known input must be transmited on the data bus by means of a "write" command and the output of the device probed by a logic probe or DVM to verify that the signal was accepted and re-transmitted properly.

Table 8A-4 gives a listing of all the input and output devices that can be accessed by Direct I/O Addressing. The first two columns define the address (Channel/Subchannel) of the I/O Strobe that must be generated to cause the device to be read from or written to. The third column gives the strobe's mnemonic and the fourth column gives the IC from which the strobe is generated. The fifth and sixth columns define the IC that is being accessed (destination of the strobe) and what type of device it is. The final column defines if Direct I/O Addressing can be used for troubleshooting the specific device or if a different troubleshooting section should be referenced. Cross-referencing from an assembly schematic to this table should be done using the I/O Strobe address shown on the schematic. It will be shown on the schematic as

(x,Ry:)

which corresponds to Channel x, Subchannel y in the table.

Table 8A-4. I/O Devices (1 of 3)

I/O Chn	Strobe Subchn	Mnemonic	From IC	Destination IC	Destination Type	Direct I/O Capability
0	0	LCK2	A59U26	A42U14	Output	Yes
0	1	LCK3	A59U26	A43U9 A43U12	Output Output	Yes Yes
0	2	LCK1	A59U26	A42U12 A42U13	Output Output	Yes Yes
0	3	LCK4	A59U26	A36U5 A37U9 A37U10	Output Output Output	Yes Yes Yes
1	0	WSPAT	A59U26	A58U27 A58U29 A58U31	Output Output Output	Yes Yes Yes
1	1	WSPTM	A59U26	A58U23 A58U25 A58U26	Output Output Output	Yes Yes Yes
1	2	WRDAC	A59U26	A58U4 A58U19 A58U21	Output Output Output	Yes Yes Yes
1	3	LRSW	A59U26	A59U23	Output	Yes
2	0		A5U19	No Connection		
2	1		A59U19	No Connection		
2	2	UNASSIGNED				
2	3	UNASSIGNED				
3	0	TYOKP	A59U26	A54U9	Output	Yes
3	1	PHASE LOCK CNTRL	A59U26	A59U24	Output	Yes
3	2	WPDAC	A59U26	A54U11 A54U13	Output Output	Yes Yes
3	3	M/N OSC CONTROL	A59U26	A59U10 A59U17	Output Output	Yes Yes
4	0		A59U12	No Connection		
4	1		A59U10	No Connection		
4	2			No Connection		
4	3	READ STATUS	A59U12	A59U18	Input	Yes
5	0	STOP PROCESSOR	A59U12	A59U4	Output	Yes
5	1	WYOKW	A59U12	A54U9 A54U15	Output Output	Yes Yes

Table 8A-4. I/O Devices (2 of 3)

I/O Chn	Strobe Subchn	Mnemonic	From IC	Destination IC	Destination Type	Direct I/O Capability
5	2	RESET PWR FAIL FF	A59U12	A59U4		No
5	3	WCDAC	A59U12	A54U16	Output	Yes
6	0	LEN 4	A6U15	A6U16		See A6 Service
6	1	LEN 5	A6U15	A6U6		
6	2	LEN 6	A6U15	A6U13 A6U18 A6U19		See A6 Service
6	3	LEN 7	A6U15	A6U11 A6U12		See A6 Service
7		UNASSIGNED				
8		UNASSIGNED				
9		UNASSIGNED				
10	0	WMOD	A27U27	A26U15	Output	Yes
10	1	WLEVEL	A27U27	A24U15 A27U13 A27U16	Output Output Output	Yes Yes Yes
10	2	WBAND	A27U27	A27U28 A28U14	Output Output	Yes Yes
10	3	RLEVEL	A27U27	A27U11 A27U12 A27U15 A27U21	Output Input Input Output	Yes Yes Yes Yes
11	0	WLSWP	A27U27	A27U23 A27U30	Output Output	Yes Yes
11	1	WSYTMSLP	A27U27	A28U15	Output	Yes
11	2	UNASSIGNED				
11	3	WSYTMCTL	A27U27	A28U13	Output	Yes
12	0	WRITE RAM	A57U28	A57U2 A57U15 A57U29	 Output	See A57 Service Yes
12	1	READ STS	A57U28	A57U24	Input	Yes
12	2	READ RAM	A57U28	A57U8 A57U16 A57U29	 Output	See A57 Service Yes

Table 8A-4. I/O Devices (3 of 3)

I/O Chn	Strobe Subchn	Mnemonic	From IC	Destination IC	Destination Type	Direct I/O Capability
12	3	WRITE ADR 3	A57U28	A57U1 A57U10	Output Output	Yes Yes
13	0	TRIGGER SEL	A57U28	A57U18	Output	Yes
13	1	WRITE STROBE	A57U28	A57U25	Output	Yes
13	2	MAN DAC	A57U28	A57U9 A57U17	Output Output	Yes Yes
13	3	WRITE CONTROL	A57U28	A57U23	Output	Yes
14	0	WATNS	A27U20	A27U8	Output	Yes
14	1	UNASSIGNED				
14	2	WBP1S	A27U20	A27U9	Output	Yes
14	3	WBP2S	A27U20	A27U10	Output	Yes
15	0	UNASSIGNED				
15	1	WADCC	A27U20	A27U29	Output	Yes
15	2	UNASSIGNED				
15	3	RSTAT	A27U20	A24714 A27U22	Input Input	Yes Yes

Implementation

STROBE VERIFICATION

The equipment that is required for strobe verification is a logic probe. The procedure is as follows:

1. With the HP 8340A switched to STANDBY, place the appropriate assembly on an extender board. Switch the HP 8340A ON and connect the logic probe to +5V and ground.
2. Press **[INSTR PRESET] [MANUAL]**.
3. Press **[SHIFT] [GHz]** xx **[Hz]**.
   This key sequence sets up the I/O Strobe Channel. Enter the desired Channel number where the xx is located.
4. Press **[SHIFT] [MHz]** yy **[Hz]**.
   This key sequence sets up the I/O Strobe Subchannel. Enter the desired Subchannel number where the yy is located.
5. Press **[SHIFT] [kHz]**.
   This sequence sets up an I/O write and will allow the Strobe to be pulsed.
6. Probe the appropriate IC pin and rotate the RPG. Verify that the probe (Strobe) is pulsing.

OUTPUT REGISTER VERIFICATION

The output registers are the devices which latch the data from the data bus and then transmit it to other parts of the instrument. No other manipulation is done. The equipment that is required to test these devices is either a logic probe or a DVM. The procedure is as follows:

1. Verify the operation of the output register's I/O Strobe as described in the strobe verification procedure.
2. Press **[INSTR PRESET] [MANUAL]**.
   Setting the instrument in MANUAL mode prevents the processor from writing data to the device being tested. This ensures that the data being entered from the front panel is not changed prior to testing the device.
3. Press **[SHIFT] [GHz]** xx **[Hz]**.
   This key sequence sets up the I/O Strobe Channel. Enter the desired Channel number where the xx is located.
4. Press **[SHIFT] [MHz]** yy **[Hz]**.
   This key sequence sets up the I/O Strobe Subchannel. Enter the desired Subchannel number where the yy is located.
5. Press **[SHIFT] [kHz]**.
   This key sequence sets up an I/O write and will allow data to be written to the device being accessed.

NOTE

Steps 6 through 9 assume that the data lines are connected to the output register in sequence. If this is not the case, ensure adjacent output pins are not set to the same logic level (refer to Table 8A-5). If an adjacent pin is high that should be low, subtract the decimal value of the data line from the number given in Table 8A-5a. If an adjacent pin is low that should be high, add the decimal value to the number given in step 6 or 8.

6. Press **[2] [1] [8] [4] [5] [Hz]**.
   This key sequence places alternate 1's and 0's onto the data bus and causes the data to be latched into the output register being accessed. Alternating the 1's and 0's allows the device being tested to be checked for highs and lows on the output and also for output pins that may be shorted together.

7. Using a logic probe or DVM, probe the output pins of the device being tested. Verify that the output pins are set as shown in Table 8A-5b.
8. Press **[−] [2] [1] [8] [4] [6] [Hz]**.
   This key sequence reverses the state of the output pins set in step 6. This verifies that the pins can be set to both TTL levels.
9. Using a logic probe or DVM, probe the output pins of the device being tested. Verify that the output pins are set as shown in Table 8A-5c.

Table 8A-5. Direct I/O Data Bit Information

a. Decimal Values for Set Data Bits.

Data Line	15	14	13	12	11	10	9	8
Decimal Value	−32768	16384	8192	4096	2048	1024	512	256
Data Line	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	16	8	4	2	1

b. Bit Configuration for 21845 Entry.

Data Line	15	14 13 12	11 10 9	8 7 6	5 4 3	2 1 0
Bit Level	0	1 0 1	0 1 0	1 0 1	0 1 0	1 0 1

0 Level Typically <0.3V
1 Level Typically >3.0V

c. Bit Configuration for −21846 Entry.

Data Line	15	14 13 12	11 10 9	8 7 6	5 4 3	2 1 0
Bit Level	1	0 1 0	1 0 1	0 1 0	1 0 1	0 1 0

0 Level Typically <0.3V
1 Level Typically >3.0V

DAC VERIFICATION

The DACs which can be tested using Direct I/O Addressing are those which have a strobe listed in Table 8A-4 and the data bus connected to them. An example of one of these DACs is A54U15. Several other DACs have their data sent from an output register (eg. A54U6). These DACs may be tested in the same manner as described below but all the addressing and data entry must be to the output register. The equipment required is a DVM. The procedure is as follows:

1. Verify the operation of the DAC's I/O Strobe as described in the strobe verification procedure.
2. Press **[INSTR PRESET] [MANUAL]**. A few of the DACs only operate over a specific frequency range (eg. A27U10, frequencies >20 GHz). If this is the case for the DAC being tested, enter the appropriate MANUAL frequency.
3. Press **[SHIFT] [GHz]** xx **[Hz]**.
   This key sequence sets up the I/O Strobe Subchannel. Enter the desired Subchannel number where the xx is located.

4. Press **[SHIFT] [MHz]** yy **[Hz]**.
   This key sequence sets up the I/O Strobe Subchannel. Enter the desired Subchannel number where the yy is located.
5. Press **[SHIFT] [kHz]**.
   This key sequence sets up an I/O write and will allow data to be written to the device being accessed.
6. Press **[0] [Hz]**.
7. Connect the DVM to the output of the DAC and note the voltage reading. The measured voltage is the offset voltage associated with the DAC. (For current output DACs, voltage measurements must be made at the output of the following current to voltage stage.)
8. Enter the decimal value for the least significant data bit of the DAC (see Table 8A-5a) and press **[Hz]**.
9. Verify that the DVM reading changes (note that the change for the least significant data bit may be very small).
10. Repeat steps 8 and 9 for each of the data bits to the DAC.

3 TO 8 DECODER VERIFICATION

The 3 to 8 Decoders which may be tested using the following procedure are those which use 3 data bus lines to determine which one of eight output lines is set. These do not include the decoders which use the address bus to generate I/O Strobes. An example of a 3 to 8 Decoder which may be tested using the following procedure is A58U31 (see Block **E**, A58 Sweep Generator Assembly schematic). Using A58U34 as an example, the procedure for verifying the operation of a 3 to 8 Decoder is as follows:

1. Verify the operation of the device's I/O Strobe as described in the strobe verification procedure.
2. Press **[INSTR PRESET] [MANUAL]**.
3. Press **[SHIFT] [GHz]** xx **[Hz]**.
   This key sequence sets up the I/O Strobe Channel. Enter the desired Channel number where the xx is located.
4. Press **[SHIFT] [MHz]** yy **[Hz]**.
   This key sequence sets up the I/O Strobe Subchannel. Enter the desired Subchannel number where the yy is located.
5. Press **[SHIFT] [kHz]** to set up an I/O Write.
6. Verify the operation of the decoder by setting one output line at a time and verifying that the correct line is set and the other output lines are not. Since A58U34 is an inverting 3 to 8 Decoder, entering a **[0] [Hz]** from the front panel will set the output pin labeled 0 (pin 15) low (<0.3V) and the other output pins will remain high (>3V). To set the output labeled 1 (pin 14), press **[4] [0] [9] [6] [Hz]** (decimal value of data bit 12, see Table 8A-5a). To set the output pin labeled 7 (pin 7), press **[2] [8] [6] [7] [2] [Hz]** (sum of decimal values of set data bits 12, 13, and 14). The other five output lines are set in a similar manner.

INPUT LATCH VERIFICATION

The input latches are devices which receive information and place it on the data bus for use by the main instrument processor (eg. A59U18). Known data is placed on the input to one of these latches using jumper wires and an I/O Read is performed to verify that the latch is operating. The procedure is as follows:

1. Verify the operation of the input latch's I/O Strobe as described in the strobe verification procedure.
2. Switch the HP 8340A to STANDBY.

3. Using the jumper wires, connect +5V and ground alternately to the input pins of the latch being tested.
4. Verify that the connections were made accurately.
5. Switch the HP 8340A on.
6. Press **[INSTR PRESET] [MANUAL]**.
7. Press **[SHIFT] [GHz]** xx **[Hz]**.
   This key sequence sets up the I/O Strobe Channel. Enter the desired Channel number where the xx is located.
8. Press **[SHIFT] [MHz]** yy **[Hz]**.
9. Press **[SHIFT] [Hz]**.
   This key sequence generates an I/O Read and causes the data on the input of the latch to be displayed in the ENTRY DISPLAY.
10. The first number in the ENTRY DISPLAY is the octal equivalent of the data on the Data Bus. The second number is the decimal equivalent. Using the octal number, verify that the latch is operating correctly (see Example below).
11. Switch the HP 8340A to STANDBY. Reverse the +5V and ground connections on the input to the device being tested.
12. Repeat steps 4 through 10.

Input Latch Verification Example

Assuming that A59U18 is the device to be tested (refer to A59 Digital Interface Schematic), the inputs to the latch would be tied to +5V and ground alternately. The connections would be made as follows:

Input Pin	8	13	2	11	6	15	17	4
Voltage	+5	0	+5	0	+5	0	+5	0
Binary Value	1	0	1	0	1	0	1	0

When an I/O Read is initiated, the data on the input of A59U18 is transferred to the processor via the data bus (bits 8 through 15). The processor also reads bits 0 through 7 and displays the octal and decimal equivalents of all 16 bits in the ENTRY DISPLAY. To determine if A59U18 passed the data correctly, the following table would be constructed.

Bit Number	15	14 13 12	11 10 9	8 7 6	5 4 3	2 1 0
Binary Value	1	0 1 0	1 0 1	0 x x	x x x	x x x

Since A59U18 only sets data bits 8 through 15, bits 0 through 7 are "don't care" terms and are labeled with an x. Bits 8 through 15 are labeled with the binary value that should be set. The binary number above is not converted to an octal number and compared with the ocatal number in the ENTRY DISPLAY. The octal numbers that can be constructed are as follows:

1250xx
1251xx
1252xx
1253xx

Going from left to right, the first three octal digits are determined by bit numbers 9 through 15. The fourth octal digit is determined by bits 6 through 8 and since bits 6 and 7 are "don't care" terms, the fourth digit can range from 0 through 3. The last two octal digits are labeled as "don't care" terms because bits 0 through 5 are "don't care" terms. If one of the above octal numbers did not match the octal number in the ENTRY DISPLAY, then A59U18 would be defective.

If A59U18 passed the above test, the +5V and ground connections to the inputs of A59U18 would be reversed. The connections would be as follows:

Input Pin	8	13	2	11	6	15	17	4
Voltage	0	+5	0	+5	0	+5	0	+5
Binary Value	0	1	0	1	0	1	0	1

The following table would be constructed:

Bit Number	15	14 13 12	11 10 9	8 7 6	5 4 3	2 1 0
Binary Value	0	1 0 1	0 1 0	1 x x	x x x	x x x

The binary number above is converted to an octal number. The possible octal numbers are as follows:

0524xx
0525xx
0526xx
0527xx

If one of the above octal numbers did not match the octal number in the ENTRY DISPLAY, then A59U18 would be defective. If both the previous test and this one passed, then the operation of A59U18 would be verified.

FRONT PANEL DIAGNOSTIC FUNCTIONS

The HP 8340A has several self-checking diagnostic routines that can be activated by pressing keys on the front panel. These diagnostics are summaryized in the following text.

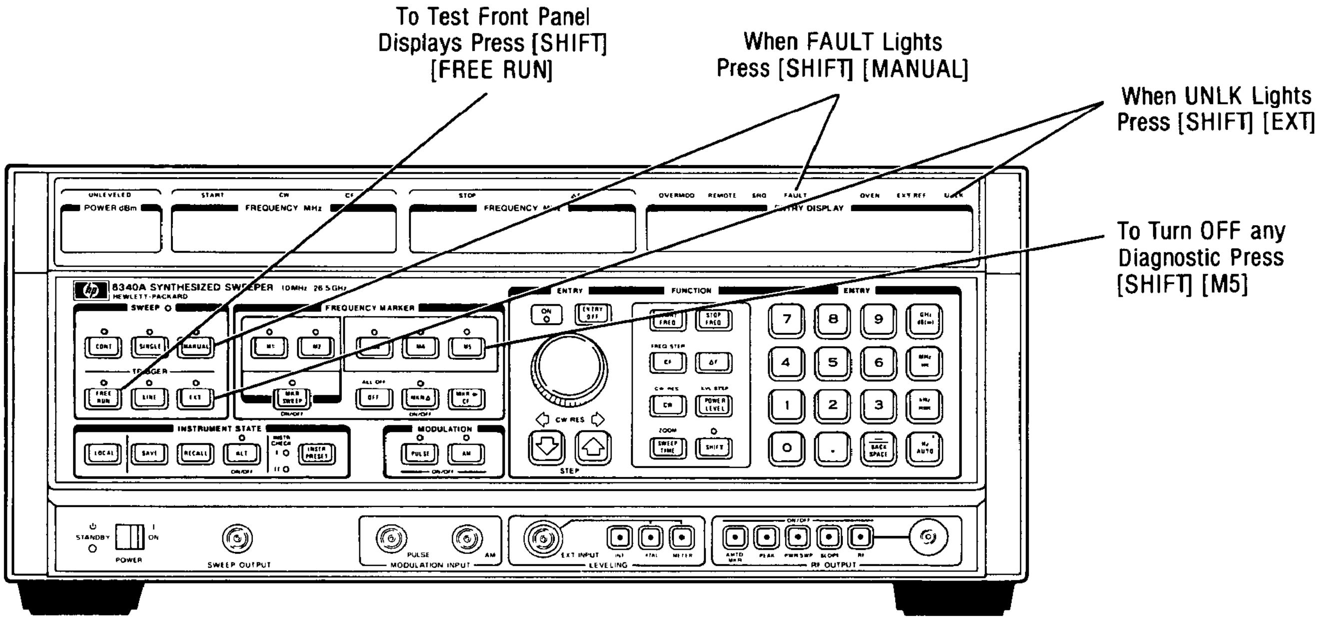


Figure 8A-5. Front Panel Diagnostics

[SHIFT] [MANUAL] (HP-IB: SHS3) activates the FAULT diagnostic routine. When the amber FAULT annunciator appears in the ENTRY DISPLAY, press **[SHIFT] [MANUAL]** to initiate the FAULT diagnostic, which will cause "FAULT: CAL KICK ADC PEAK TRK" to appear in the ENTRY DISPLAY. the flashing cursor indicates which circuit (**CAL**ibration constants, **KICK** sweep end-points, **A**nalog to **D**igital **C**onverter, power **PEAK**ing, or **TR**ac**K**ing) is causing the problem. Refer to Figure 8A-5, "Front Panel Diagnostics."

[SHIFT] [FREE RUN] (HP-IB SHT1) activates the display self-test diagnostic function. Press **[SHIFT] [FREE RUN]**, which will cause every segment of every LED in the displays to light, followed by a marching pattern of every character in the display. Press **[SHIFT] [M5]** to cancel this diagnostic routine and to restore the displays to their previous condition.

[SHIFT] [EXT] (HP-IB: SHT3) activates the oscillator diagnostic function. When the red UNLK annunciator appears in the ENTRY DISPLAY, press **[SHIFT] [EXT]**, which will cause "OSC: REF M/N HET YO N2 N1" to appear in the ENTRY DISPLAY. The flashing cursor indicates which oscillator circuit is causing the unlocked condition. Press **[SHIFT] [M5]** to cancel this diagnostic function and to return the displays to their previous condition.

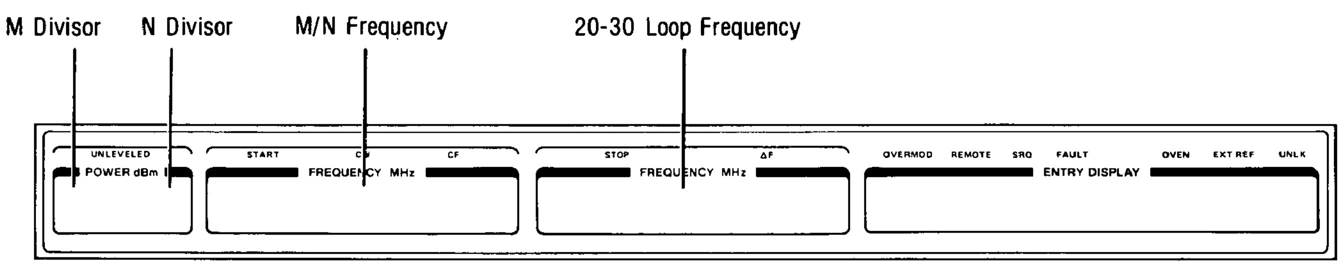


Figure 8A-6. M/N Diagnostics

[SHIFT] [M1] (HP-IB: SHM1) is a service diagnostic that shows from left to right, what the M divisor, N divisor, M/N frequency, and 20/30 loop frequency should be. See Figure 8A-6, "M/N Diagnostics."

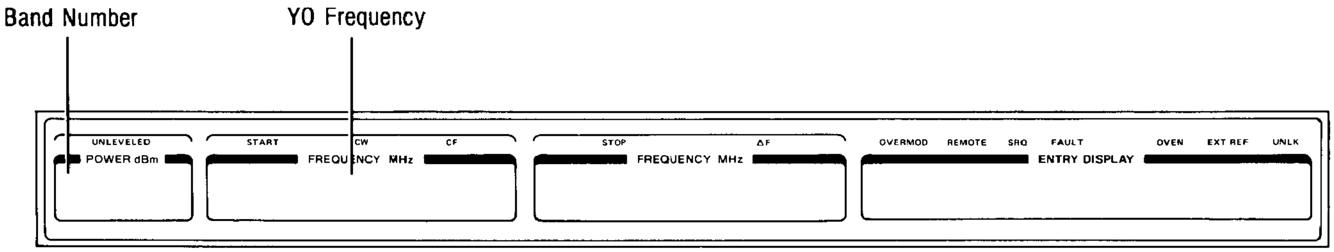


Figure 8A-7. YO Diagnostics

[SHIFT] [M2] (HP-IB: SHM2) is a service diagnostic that shows, from left to right, what the band number and the YIG oscillator (YO) frequency should be. See Figure 8A-7, "YO Diagnostics."

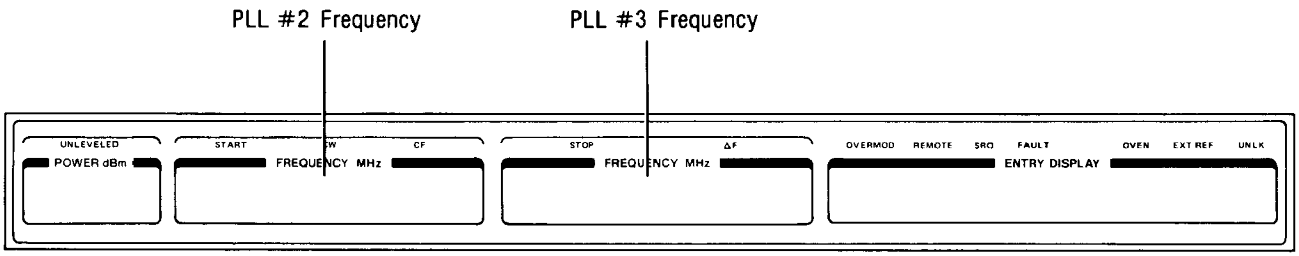


Figure 8A-8. 20-30 Loop Diagnostics

[SHIFT] [M3] (HP-IB: SHM3) is a service diagnostic that shows, from left to right, what the PLL #2 VCO frequency and the PLL #3 upconverter frequency should be. Refer to Figure 8A-8, "20-30 Loop Diagnostics."

[SHIFT] [M4] (HP-IB: SHM4) activates 32 service diagnostic routines which test several of the DACs and control circuitry on the A27 level control, A28 SYTM driver, A57 marker bandcross, and A58 sweep generator. This diagnostic also allows the results of the self-test, run at power on and after on **[INSTR PRESET]**, to be displayed in the front panel **ENTRY DISPLAY**. For more information, refer to the A60 Processor assembly troubleshooting in the Controller Section.

[SHIFT] [M5] (HP-IB: SHM5) turns off any of the above diagnostic routines and restores the displays to their previous condition.

[SHIFT] [XTAL] (HP-IB: SHA2) activates a band crossing diagnostic function. Press **[SHIFT] [XTAL]** to enable the diagnostic, then press **[SHIFT] [INT]**, which will cause the HP 8340A to sweep to the first band crossing point and stop at that point. Press **[SHIFT] [INT]** again and the HP 8340A will sweep to the next band crossing point and stop at that point. Continue pressing **[SHIFT] [INT]** to single-step through each of the bands. Press **[SHIFT] [XTAL]** again to cancel this diagnostic routine.

[SHIFT] [INT] (HP-IB: SHA1) allows single-stepping through each frequency band, and is used with **[SHIFT] [XTAL]** for a band crossing diagnostic routine. See **[SHIFT] [XTAL]** for an explanation of how these two shifted functions interact.

[SHIFT] [RF] (HP-IB: SHRF) disables the ALC (automatic leveling control) to allow direct control of the linear modulator circuit. This is useful when very narrow pulses are being generated in pulse modulation mode. When **[SHIFT] [RF]** is engaged, there is no limit on the minimum pulse repetition frequency.

The following message will be displayed in the **ENTRY DISPLAY: "POWER SEARCH: X.XX dB"** (where X.XX is the last-entered value).

To set the power level, place the HP 8340A in CW mode, or in pulse modulation mode with pulses wider than 2 usec, and use the **[STEP]** keys, the RPG, or the data entry keypad with the **[dBm]** terminator key to enter the power level desired. The **POWER dBm** display shows the actual power when the instrument is in CW of pulse modulation mode. The accuracy of the **POWER dBm** display is typically the same as when the instrument is leveled. Table 1-1 contains this information under **PULSE MODULATION** specifications, **ACCURACY OF INTERNALLY LEVELED RF PULSE Vp (relative to CW mode level)**. The actual power changes very little as the pulse width is narrowed, even though the **POWER dBm** reading drops. Therefore, at very narrow pulse widths ignore this reading.

[SHIFT] [RF] can also be used as a diagnostic function of the ALC circuits (refer to the ALC loop description/troubleshooting in the beginning of the RF Section for more information).

[SHIFT] [METER] (HP-IB: SHA3) bypasses the ALC (automatic leveling control) to allow direct control of the linear modulator circuit, which is useful when very narrow pulses are being generated in pulse modulation mode. In this mode there is no limit on the minimum pulse repetition frequency: Press **[SHIFT] [METER]**, which will cause "ATN: X-xx dB, MOD: x.x dB" (where x is the last-entered value) to appear in the ENTRY DISPLAY. To set the power, place the HP 8340A in CW mode, or in pulse modulation mode with pulses wider than 2 μsec, and use the **[STEP]** keys to set the ATN (attenuator), and the rotary **[KNOB]** or numerical keys with **[dB(m)]** terminator key to set the MOD (linear modulator), as follows: Set MOD entry at 0 dB, increment ATN until the POWER dBm follows: Set MOD entry at 0 dB, increment ATN until the POWER dBm display shows a level 5 dB to 15 dB higher than the desired output power, then reduce the power to the desired level by changing the MOD value. The POWER dBm display shows actual power when the HP 8340A is in CW or wide-pulse pulses modulation modes; this actual power changes very little as the pulse width is narrowed, even though the POWER dBm reading drops. Therefore, at this point reduce the pulse width to the desired value and ignore the POWER dBm display. The ATN and MOD values in the ENTRY DISPLAY also have a limitation: Although the ATN displayed value is always accurate, the MOD becomes saturated in the top 10 dB (approximately) of its range at which point no change occurs in the true power; consequently, rely on the POWER dBm display for the true power level instead of the MOD value. **[SHIFT] [METER]** can also be used as a diagnostic function of the ALC circuits.

[SHIFT] [PEAK] (HP-IB: SHRP) is a more extensive version of peaking: **[PEAK]**, which requires a fraction of a second to implement, aligns the output filter with a single CW frequency, while **[SHIFT] [PEAK]** aligns all of the YTM tracking calibration constants and requires 5-10 seconds to implement. Use **[SHIFT] [PEAK]** to enhance the power output and spectral purity of swept modes, and to improve tracking performance (especially in harsh environments having wide temperature variations). Press **[SHIFT] [PEAK]**, which will cause "AUTO TRACKING" to appear in the ENTRY DISPLAY; "AUTO TRACKING" will disappear after 5-10 seconds when the calibration has been completed.

[SHIFT] [PWR SWEEP] (HP-IB: SHPS) decouples the attenuator (ATN) from the automatic leveling control (ALC), as explained in the preceding function. Recouple the ATN and ALC by pressing **[POWER LEVEL]**.

[SHIFT] [SLOPE] (HP-IB: SHSL) allows front panel control of the mechanical attenuator (ATN). Press **[SHIFT] [SLOPE]**, which will cause "ATN: xdB" (where x is the last-entered value) to appear in the ENTRY DISPLAY. Use the **[STEP]** keys, or the numerical keys with any terminator key to change the attenuator value within the range 0 dB to −90 dB in 10 dB steps. Keyboard entries are automatically rounded to the nearest 10 dB. The clicking sound heard after each attenuator change is the attenuator pad being mechanically switched into the RF output path.

OVERALL INSTRUMENT TROUBLESHOOTING

INTRODUCTION

This section contains information that is critical to the timely repair of the HP 8340A. when a failure occurs on the HP 8340A, it is important to first verify that the Calibration Constants in memory are good. Refer to the first page of this Service Introduction for details.

The troubleshooting information presented here is intended to guide the troubleshooter to the appropriate information in the manual.

Figure 8A-9, Overall Instrument Troubleshooting Diagram, and Figure 8A-10, Front and rear panel Items, indicate the proper sequence to follow to isolate specific symptoms. Each of these is described in detail in the following pages. Several categories make reference to Front and rear panel items shown in the diagram on the facing page.

The descriptions in the following pages are keyed to the numbers in the diagrams.

OVERALL INSTRUMENT TROUBLESHOOTING

THE FOLLOWING DIAGRAM INDICATES THE PROPER SEQUENCE TO FOLLOW TO ISOLATE SPECIFIC SYMPTOMS.EACH OF THESE IS DESCRIBED IN DETAIL IN THE FOLLOWING PAGES.SEVERAL CATAGORIES MAKE REFERENCES TO THE FRONT AND REAR PANEL ITEMS SHOWN IN FIGURE 8A-10 ON THE FACING PAGE

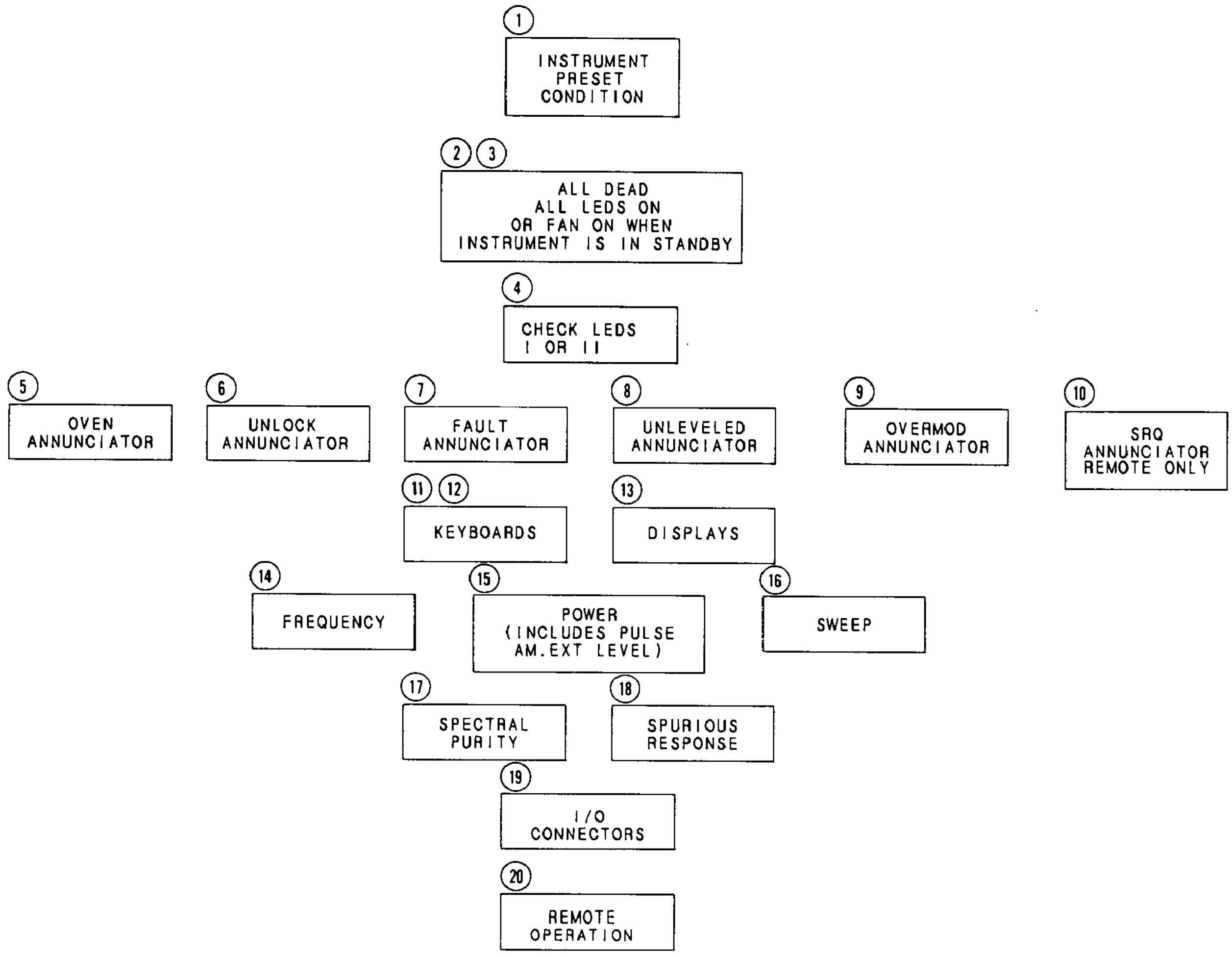
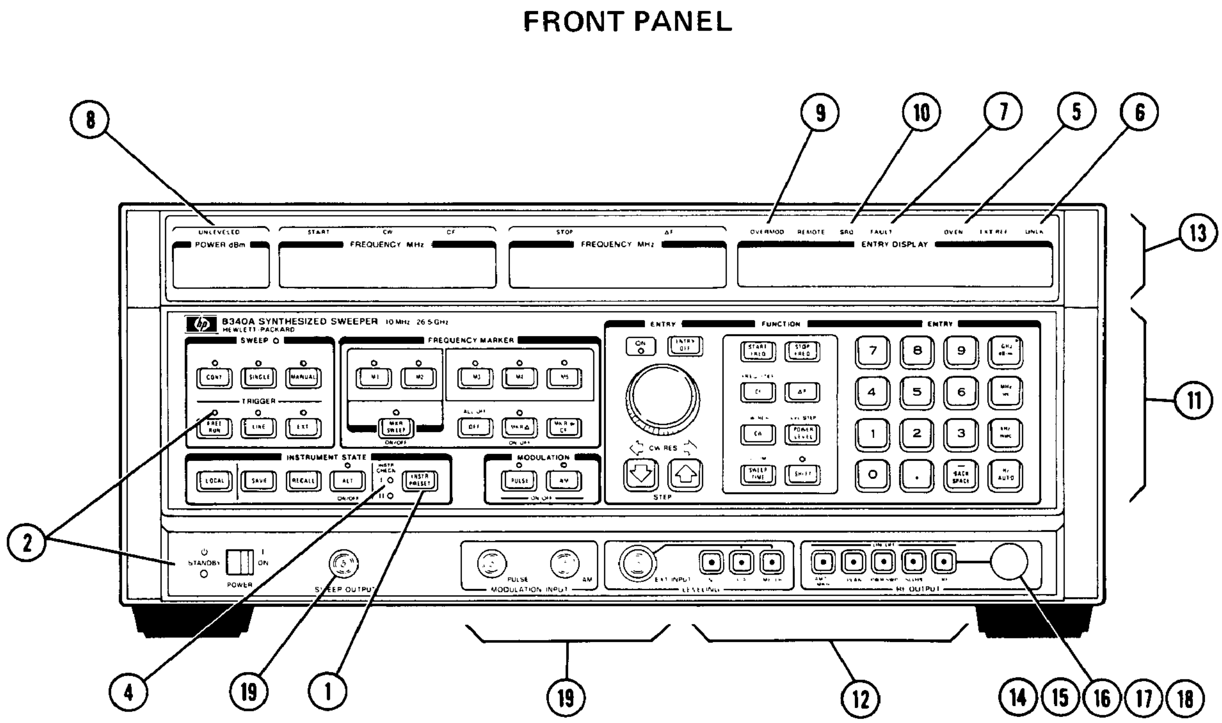


Figure 8A-9. Overall Instrument Troubleshooting Diagram



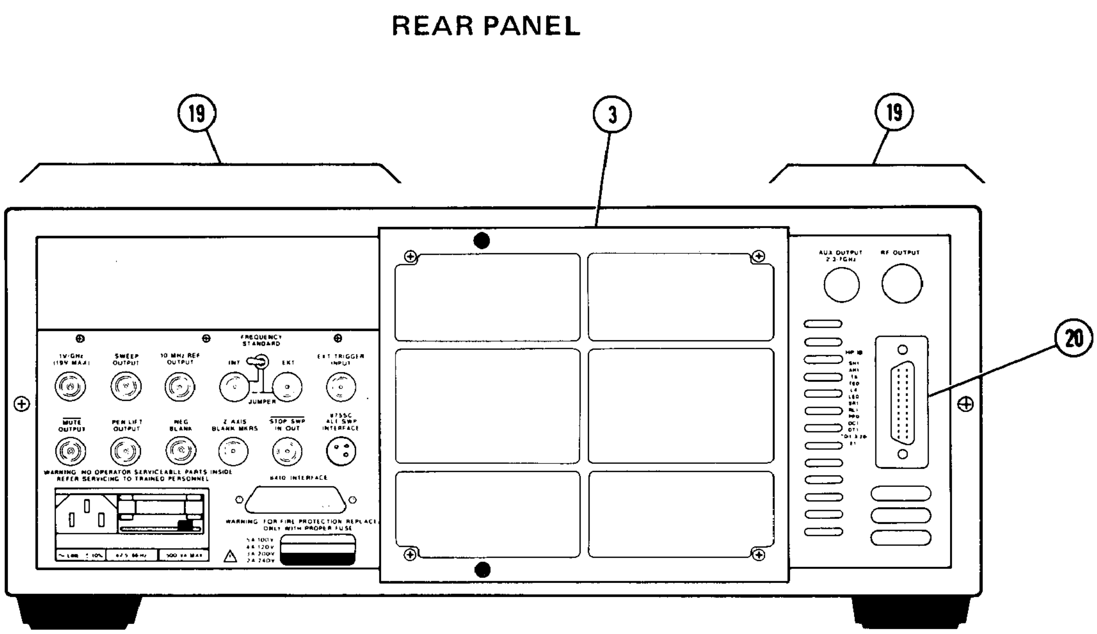


Figure 8A-10. Front and Rear Panel Items

1. **INSTRUMENT PRESET CONDITIONS [INSTR PRESET]**

After pressing **[INSTR PRESET]** the following HP 8340A settings should exist:

"POWER dBm" Display= 0.0 (Factory setting, determined by Cal Constant #56)

"FREQUENCY MHz" Display= 10.000000
"START" annunciator LED lit

"FREQUENCY MHz" Display= 26 500.000000
"STOP" annunciator LED lit

"ENTRY" Display= Blank (off)

"SWEEP" Block= Green LED flashing
"CONT" LED on
"FREE RUN" LED on

"FREQUENCY MARKER" Block= All LED's off

"INSTRUMENT STATE" Block= All LED's off

"MODULATION" Block= All LED's off

"ENTRY" Block= All LED's off

"LEVELING" Block= "INT" LED on

"RF OUTPUT" Block= "RF" LED on

After an **[INSTR PRESET]** the RF output should be a swept 10 MHz to 26.5 GHz signal leveled at 0 dBm.

EXCEPTIONS TO THE ABOVE CONDITIONS

a. If the rear panel INT/EXT REFERENCE switch is in the EXT position, then the EXT REF annunciator on the ENTRY DISPLAY will be on.

b. By changing calibration constant #56 on the HP 8340A can be set to come up with various output power levels after an **[INSTR PRESET]**. Refer to Calibration Constants in Section VIII for more detailed information.

2. **ALL DEAD**

ALL LED's OFF. If, after **[INSTR PRESET]**, all of the LED's and annunciators are off, suspect a power supply problem. Refer to the Power Supply Theory of Operation and Troubleshooting.

If some of the LED's that should be on are on and somethat should be on are off, suspect a problem in the HP 8340A front panel. Refer to the front panel Theory of Operation and Troubleshooting.

ALL LED's ON. If, after **[INSTR PRESET]**, all of the LED's and annunciators are on, suspect a problem in the instrument processor or memory (Self-Test not running). Refer to Processor Theory of Operation and Troubleshooting, in the Controller functional group.

CHARACTER MARCH. If, after an **[INSTR PRESET]**, there is a string of characters marching across the four display windows, suspect a processor or memory problem.

3. **FAN**. The HP 8340A's cooling fan should be off when the instsrument is in STANDBY and on when the POWER switch is in the ON position. If the fan will not turn on or off, refer to the Power Supply Theory of Operation and Troubleshooting.

If the fan is not working when the instrument is on, the temperature inside the HP 8340A could rise to a point that the power supplies will go into over-temperature mode and shut down (See overtemp LED, A52DS4).

4. **CHECK LED I AND II.**

The two front panel INSTR CHECK LED's are used to indicate the results of the instrument Self-Test. A Self-Test is initiated every time the POWER switch is cycled ON or **[INSTR PRESET]** is pressed. The Self-Test starts by turning both check LED's on.

CHECK LED I will be turned off when it is determined that all ROM and RAM are good and that the microprocessor is working.

CHECK LED II will be turned off when it is determined that the internal I/O Address Bus and all 16 bits of the I/O Data Bus are good.

If either one or both of the check LED's remain on, the problem is most likely on the A60 Processor board. Refer to Processor Theory of Operation and Troubleshooting, in the Controller functional group.

It is possible to have a fault in the instrument that could cause the check LED's to go out when they should stay on. The check LED's can be double checked by examining the LED's on the A60 Processor board. If the two INSTR CHECK LED's go off, all 16 Processor board LED's should be off.

5. **OVEN ANNUNCIATOR**

The front panel OVEN light is used to indicate the status of the internal frequency standard. When the OVEN light is lit, the frequency is more than 100 Hz away from 10 MHz. The A51 10 MHz Reference Oscillator has an internal circuit that monitors the temperature of its internal oven. When this oven temperature is too low the HOVC line is high ($> +15V$). When the oven temperature reaches the desired point (the frequency is within 100 Hz of 10 MHz) HOVC goes low ($\downarrow +15V$). HOVC is sent to the A59 Digital Interface board where the microprocessor reads it and determines when to turn the light on or off.

The OVEN LED is located on the A2 Display Driver board (Block **E**). These LED's are driven by the A3 Display Processor, Annunciator Latch/Driver.

The LED is turned on by the instrument processor. The processor outputs the appropriate bits on the Data Bus and then outputs address 15:R0 to latch the data bits.

6. **UNLK ANNUNCIATOR**

The UNLK light is used to indicate the status of the 6 different internal phase lock loops. If the UNLK light is on, one or more of the loops is unlocked. Press **[SHIFT] [EXT]**. The ENTRY DISPLAY will show the following:

OSC: REF M/N HET YO N2 N1

The name of the loop that is unlocked will be flashing.

REF - If the REF is flashing, refer to the Reference Loop Theory of Operation and Troubleshooting in the Reference Loop - M/N Loop functional group.

M/N - If the M/N is flashing, refer to the M/N Theory of Operation and Troubleshooting in the Reference Loop - M/N Loop Functional group.

HET - If the HET is flashing, refer to the RF Section (A8 3.7 GHz Oscillator) Theory of Operation and Troubleshooting.

YO - If the YO is flashing, refer to the YO Loop Theory of Operation and Troubleshooting in the Sweep Generator - YO Loop functional group.

N1 - If the N1 if flashing, refer to the 20/30 Loop (PLL1) Theory of Operation and Troubleshooting.

N2 - If the N2 is flashing, refer to 20/30 Loop (PLL2) Theory of Operation and Troubleshooting.

MULTIPLE LOOPS UNLOCKED

If more than one loop is unlocked at one time it is important to understand how the loops relate to each other. The REF loop generates reference signals that are required by all other loops. The YO loop uses signals generated by the M/N loop and the 20/30 loop.

The UNLK LED is located on the A2 Display Driver board (Block **E**). These LED's are driven by the A3 Display Processor, Annunciator Latch/Driver.

The LED is turned on by the instrument processor. The processor detects the unlock indication from the particular phase lock loop and outputs the appropriate bits on the Data Bus and then outputs address 15:R0 to latch the data bits.

7. **FAULT ANNUNCIATOR**

The FAULT light is used to monitor the status of 5 different internal functions. These functions are described below. If the FAULT light is on, press **[SHIFT] [MANUAL]**. The ENTRY DISPLAY will show the following.

FAULT: CAL KICK ADC PEAK TRK

The name of the function that has a problem will be flashing.

CAL - This refers to the Calibration Constants stored in RAM on the A60 Processor board. The Calibration Constants are checked only when an **[INSTR PRESET]** is done or at instrument power on. If the CAL light is flashing something has changed in the Cal Constants. Refer to Calibration Constants in Section VIII Introduction for more information. If any operation is performed that updates a Cal Constant, the processor will calculate a new checksum. After the next **[INSTR PRESET]** or power on, the FAULT light will be out, but the bad calibration constant(s) will still be there.

KICK - This refers to the kick pulses used to reset the YO and SYTM. AT end-of-sweep the YO and SYTM are tuned below their normal start frequencies by a kick pulse generated on the A54 YO Pretune DAC/Delay Compensation board or the A28 SYTM Driver board. These kick pulses last a finite period of time. If a pulses stays on longer than it should, the processor will detect it and indicate a KICK FAULT. Refer to the Sweep Generator - YO Loop Theory of Operation and Troubleshooting for the A54 Pretune and to the RF Section for the A28 SYTM Driver.

ADC - This refers to a check performed on the ADC circuits. This check is done at **[INSTR PRESET]** or power on. If the ADC light is flashing, refer to the RF Section (A27 Level Control board) Theory of Operation and Troubleshooting.

PEAK - This refers to an HP 8340A function that peaks the RF output power at one frequency by fine tuning the SYTM (Tunes the SYTM to the YO frequency). This fault can only come on if the **[PEAK]** button is pushed. If the PEAK light is flashing, something is wrong with the circuitry that peaks the SYTM. Refer to the RF Section (A28 SYTM Driver board or A27 Level Control board) Theory of Operation and Troubleshooting.

TRK - This refers to an HP 8340A function that peaks the RF output power while the instrument is sweeping. This fault can only occur if **[SHIFT] [PEAK]** has been pushed. The TRK light indicates the same things as if PEAK were flashing.

The FAULT LED is located on the A2 Display Driver board (Block **E**). These LED's are driven by the A3 Display Processor, Annunciator Latch/Driver.

The LED is turned on by the instrument processor. The processor detects the error from the particular circuitry and outputs the appropriate bits on the Data Bus and then outputs address 15:R0 to latch the data bits.

8. **UNLEVELED ANNUNCIATOR**

The UNLEVELED light is used to indicate the status of the RF output power. If the UNLEVELED light is off, the output power is leveled and if the light is on, the power is unleveled.

a. Make sure that the correct leveling mode is selected. If internal leveling is desired, the INT light should be on. If external leveling is desired, the XTAL light should be on. If power meter leveling is desired, the METER light should be on.

b. The power level requested should not be greater than the maximum power specification. If the instrument is sweeping, make sure that the power requested does not exceed the maximum power specification for the entire band or bands that are being swept.

c. If the output power is unleveled at all power levels and all frequencies, suspect a problem on the A25 ALC Detector board or the A26 Linear Modulator board. Refer to the RF Section Theory of Operation and Troubleshooting.

d. If the power will level at some frequencies and not others while the instrument is sweeping, the SYTM may not be tracking correctly. Try AUTO TRACKING. Press **[SHIFT] [PEAK]**.

e. If the power will level at some CW frequencies and not at others, press **[PEAK]** to optimize the SYTM tracking at the frequency of interest.

f. If the power is unleveled in Band 0 (10 MHz to 2.4 GHz) only, suspect a problem in the switching circuits on the A25 ALC Detector board or the A26 Linear Modulator board, the A12 Band 0 Splitter/Detector or the associated microcircuits. Refer to the RF Section Theory of Operation and Troubleshooting.

g. If the power is unleveled in Bands 1-4 (2.3 GHz to 26.5 GHz) only, suspect a problem in the switching circuits on the A25 ALC Detector board or A26 Linear Modulator board, or the A11 Band 1-4 Detector and the associated microcircuits. Refer to the RF Section Theory of Operation and Troubleshooting.

NOTE

Refer to the ALC Loop Overview in volume I, Section III, and the ALC description in the RF Section for more detailed information on troubleshooting unleveled power.

9. **OVERMOD ANNUNCIATOR**

The OVERMOD light is turned on by the instrument processor only when AM is selected and when MOD LVL (See A26 Linear Modulator, Overmodulation/Unleveled Detectors) exceeds a given limit. Refer to the RF Section Theory of Operation and Troubleshooting.

The OVERMOD LED is located on the A2 Display Driver board (Block **E**). These LED's are driven by the A3 Display Processor, Annunciator Latch/Driver.

The LED is turned on by the instrument processor. The processor outputs the appropriate bits on the Data Bus and then outputs address 15:R3 to latch the data bits.

10. **SRQ ANNUNCIATOR**

The SRQ (Service ReQuest) light should be on only during remote operation and when the instrument processor sets SRQ (to the processor) true.

Refer to Section IV, HP-IB Operation and Verification Program to read the HP 8340A Status Bytes.

Also, refer to the A60 Processor, HP-IB Interface Troubleshooting in the Controller functional group.

The SRQ LED is located on the A2 Display Driver board (Block **E**). These LED's are driven by the A3 Display Processor, Annunciator Latch/Driver.

The LED is turned on by the instrument processor. The processor outputs the appropriate bits on the Data Bus and then outputs address 15:R3 to latch the data bits.

11. **UPPER KEYBOARD**

12. **LOWER KEYBOARDS**

Refer to front panel Theory of Operation and Troubleshooting.

13. **DISPLAYS**

Refer to front panel Theory of Operation and Troubleshooting.

14. **FREQUENCY**

If the UNLK annunciator is not on and the frequency of the RF output signal is incorrect, refer to Section IV Performance Test, Frequency Range and CW Mode Accuracy. This test checks all of the divider bits that program the various phase lock loops. The test will indicate which phase lock loop is causing the problem and which bit(s) is incorrect. Then refer to the Theory of Operation and Troubleshooting for the appropriate phase lock loop.

15. **POWER**

The RF output should meet the specifications for maximum leveled power, power accuracy, and flatness.

For problems related to maximum leveled power, refer to UNLEVELED ANNUNCIATOR (number 8).

For problems related to flatness, consider the following:

The flatness adjustments in Section V improve overall flatness by varying the offset and slope correction factors. If the frequency response has large perturbations, the problem is most likely in the associated RF path. Refer to the RF Section block diagram. By observing if the problem is in Band 0 only, Band 1-4 only, or both Band 0 and Band 1-4, part of the RF circuitry may be eliminated.

If the RF power level is low at 10 MHz and increases with frequency, suspect the RF output connector. This connector contains a series capacitor that could exhibit this symptom. To verify that the problem is the RF connector, first remove the front panel - rear panel functional group, Figure 8H-4. Then, disconnect the SMA cable from the RF connector, and remove the RF connector. Measure the power level at the cable.

CAUTION

Extreme care should be taken when disconnecting or connecting the SMA cables from a mating 3.5 mm connector (RF Attenuator). The SMA cable center conductor must align with the 3.5 mm connector center conductor. If there is any axial force on the cable when disconnecting the SMA fitting, the 3.5 mm connector center conductor may be damaged. Remove any axial force on the cable by disconnecting the end of the cable that does not mate with a 3.5 mm connector first or by removing the mounting screws of the device having 3.5 mm connectors (A10 Direction Coupler).

For problems related to accuracy, consider the following:

NOTE

Option 001 and 005 instruments are not equipped with a step attenuator.

Flatness is adjusted and tested with the RF output power at 0 dBm (RF Attenuator at 0 dB and ALC at 0 dBm). The frequency response will normally remain the same over the ALC range. For accuracy problems within the ALC range, refer to the ALC adjustments in Section V and, if necessary, to the RF Section ALC Loop Theory of Operation and Troubleshooting.

If accuracy is within specifications over the ALC range and is out of specifications below the ALC range, the problem is most likely associated with the RF attenuator. Note that the RF attenuator is outside of the ALC Loop. The instrument processor programs the RF attenuator, but there is no way for the processor to know if the attenuator actually stepped properly. If the power level is off by a factor of 10 dB, the attenuator may not be responding properly. Select a CW frequency, set the power level to 0 dBm, press **[SHIFT] [PWR SWP]**. The Entry Display should indicate:

ATN: −00 dB, ALC: 0.00 dBm

Using the step keys step the RF attenuator (and RF power output) to −90 dB. The attenuator should "click" at each step and the RF power should decrease in 10 dB steps. If the attenuator does not perform properly, refer to the RF Section overall block diagram. Determine if the correct programming bits are being applied to the RF attenuator (See RF Attenuator truth table on the A24 Attenuator Driver/SRD Bias assembly, schematic diagram, located in the RF Section) or if the RF attenuator itself is not responding properly.

There is an offset and slope calibration constant correction factor for each RF attenuator step from 10 to 90 dB. These correction values are generated in the automated RF Attenuator Calibration Test program. A hard copy of values generated at the last calibration should be located inside the instrument (Remove the top cover - see pocket along left side rail). Check the calibration constants in HP 8340A memory against the hardcopy values. Restore the correct values if necessary. Refer to Section VIII Calibration Constants for more information.

If the attenuator is operating properly and the calibration constants are correct, check the RF connections from the A10 Directional Coupler to the RF attenuator and then measure the power accuracy at the attenuator output.

16. **SWEEP**

For sweep problems, refer to the Sweep Generator - YO Loop functional group, Sweep Generator Troubleshooting. The following information may be used to further define the symptom.

It is assumed that the instrument works properly in CW mode (no UNLK indication). Press **[INSTR PRESET]** and check for the following sweep indications:

1. Check front panel SWEEP LED. The LED should be blinking.

   The sweep LED is turned on at the start of sweep, turned off at each bandcross, and at end-of-sweep. The LED is controlled by LSPLD (Low Sweep LeD), see A58 Sweep Generator board Block P. The sweep LED is turned on when HSP (High Start Sweep) from A57 Block **M** is high, LRSP (Low Reset Sweep) from A59 Block **G** is low, and LBX (Low Bandcross) A58 Block **U** and A57 Block **F** is high.

   The sweep LED is turned off if HSP is low, at end-of-sweep if LRSP is low, and at bandcrossings if LBX is low.

2. Check front and/or rear panel SWEEP OUT signal.

   The SWEEP OUTPUTS come from the A57 Marker/Bandcross board Block **H** and are generated from the MKR RMP A58 Block **K**. For a detailed description of the SWEEP GENERATOR/YO LOOP Theory Of Operation under Multiband Sweeps.

   If the sweep out waveform is normal, the Ramp Generator on the A58 board is working, the WSPTM (Write Sweep TiMe) strobe (A59 Block **A**) is being generated, and LRESET (Low Reset) A58 Block **P** is OK.

3. Check rear panel 1V/GHz waveform.

   The 1V/GHz signal comes from the A28 SYTM DRIVER board Block **F** and is generated by the PRETUNE signal (A54 Block **C** TP3). The PRETUNE signal is generated from VSWP (A58 Block **N**).

   If the rear panel 1V/GHz signal is normal, VSWP and PRETUNE are OK.

NOTE

For sweep widths <500 kHz (20/30 sweeps), the 1V/GHz is fixed.

17. **SPECTRAL PURITY**

18. **SPURIOUS RESPONSES**

Normally spurious responses fall under the general category of spectral purity. However, in this instance we will consider spectral purity to be a phase noise problem and spurious responses to be discrete.

Phase Noise

It is assumed that the HP 8340A failed the Single Sideband Phase Noise test, Section IV, paragraph 4-17.

1. If the HP 8340A failed the test at offset frequencies less than 300 Hz, the problem is most likely the 100 MHz Reference section. Refer to the Reference Loop - M/N Loop. Replace the 400 MHz input to A31 M/N Phase Detector (J1) using a very stable source such as an HP 8662A. Be sure to use the 8662A Frequency Standard as the HP 8340A Frequency Standard EXT input. Repeat the failing test. If the HP 8340A now passes the test, the problem is in the HP 8340A Reference Loop.
2. If the HP 8340A failed the phase noise test at offset frequencies from 300 Hz to 50 kHz, the problem is most likely the M/N Loop. Replace the Reference Loop 400 MHz input to the M/N Loop as described in step 1 above.

   If the HP 8340A continues to fail the phase noise test, the problem is in the M/N or YO Loop. An external source could be used to replace the M/N input to the YO Loop, but the phase noise of the external source would have to be much better than the HP 8340A phase noise to eliminate the YO Loop.
3. If the HP 8340A failed the phase noise test at offset frequencies greater than 50 kHz, the problem is most likely the YO Loop.

Spurious Responses

It is assumed that the HP 8340A failed the Spurious Response test, Section IV, paragraph 4-15 or 4-16.

Spurious responses can be divided into several categories:

Harmonics/Sub-harmonics

Line Related Side Bands

Squegging

Synthesized

HARMONICS/SUB-HARMONICS

The HP 8340A is essentially three instruments in one. The instrument can function as a heterodyning (Band 0) source, an unmodified YIG oscillator source (Band 1), and a synthesized source (Bands 2-4). In Band 0 (10 MHz to 2.3 GHz) the 2.3 to 7.0 GHz YO output is mixed with a fixed 3.7 GHz oscillator to produce the RF frequency. In Band 1-4 the YO output is used directly or multiplied (by the band number) to produce the RF frequency.

In Bands 1-4 the SYTM is designed to pass only the RF output frequency and reject all other frequencies. In Band 0, the output of the Band 0 mixer passes directly through the SYTM.

To troubleshoot for harmonics and sub-harmonics in Band 0 (10 MHz to 2.3 GHz), refer to the RF Block Diagram and troubleshoot the Band 0 circuitry using a spectrum analyzer.

For Bands 1-4 the SYTM is designed to pass only the fundamental or desired harmonic of the YO. If the instrument does not meet its harmonic/sub-harmonic specification, suspect the SYTM.

LINE RELATED SIDEBANDS

Line related spurs are normally caused by magnetic radiation from the power transformer being coupled into the M/N Loop, the Reference Oscillator, or the SYTM.

The amplitude of any line related spur coupled into the M/N Loop will be greater at 6.9 GHz (maximum M/N Loop frequency). The amplitude of any line related spur coupled into the SYTM will be greater at 2.3 GHz (minimum SYTM drive current).

An increase in line voltage or the line voltage selector PC board installed incorrectly may increase the radiation and thus the spur amplitude.

Check the waveform on the unregulated power supplies. These supplies have full-wave bridge rectifiers. If one diode is open, the supply will operate similar to a half-wave rectifier. The output of the regulated supplies may be normal. However, the transformer current will be unbalanced and the magnetic radiation may increase.

Magnetic radiation coupled into the M/N Loop can sometimes be reduced by replacing A29U1 (The amplifier limiter on the Reference Phase Detector board).

SQUEGGING (Band 1-4 only)

Observe the spurious response on a spectrum analyzer while changing the HP 8340A output power level. If the frequency of the spur changes with power level, suspect squegging. Refer to the SRD Bias adjustments in Section V.

SYNTHESIZED SPURS

NOTE

The screws on the 20/30 and M/N section covers must be tight to obtain proper shielding.

Explanation of synthesized spurs - A frequency synthesizer like the HP 8340A has several internal oscillators that are used to generate the desired output frequency. All of the output frequencies that are possible can be described by the following equation:

$$Fout = k1*F1 + k2*F2 + k3*F3 \ldots\ldots\ldots\ldots$$

where k1, k2, and k3 are integers (positive or negative) and F1, F2, and F3 are the frequencies of the internal oscillators. Since F1, F2, and F3 are phase locked to the internal reference (10 MHz standard) they will be related to the reference frequency by:

$$F1 = Ref*I1/J1 \quad F2 = Ref*I2/J2 \quad F3 = Ref*I3/J3$$

where the I's and J's are integers. The combination of all these shows the relationship of the output frequency to the reference frequency:

$$Fout = Ref * (k1*I1/J1 + k2*I2/J2 + k3*I3/J3 \ldots)$$

The intended output frequency is the result of only one set of integers in the above equation. Spurs are possible at all other choices of integers. These choices are normally eliminated through careful use of filtering, attention to signal levels, shielding, etc.

The key is to treat the spurs as FAMILIES of spurs. A spur family is characterized by having the same mixing path through the instrument. For example, if it can be determined that the 5th harmonic of the M/N VCO is mixing with the 9th harmonic of the 20/30 output, then the location of the spur can be predicted as the 20/30 frequency is changed. Also more spurs in this family can be hypothesized such as the 9th 20/30 harmonic with the 6th M/N harmonic. The common thread between all of these is that somehow the M/N VCO is allowed to mix with the 20/30 to cause a spur.

The spurs normally show up as phase modulations of the YO frequency. As the spur frequency is changed (by changing the carrier frequency), its amplitude will remain constant as long as the offset from carrier remains less than the YO Loop bandwidth (50 kHz). Beyond the YO Loop bandwidth, the amplitude decreases until the spur is gone.

These spurs are called CROSSING SPURS, and are possible whenever the harmonic frequencies of any two oscillators are equal (5th harmonic of 20 MHz = 4th harmonic of 25 MHz). A characteristic of crossing spurs is that the offset of the spur from the carrier changes as the carrier is moved; therefore, there is some frequency that the offset must be zero (Assuming the sources of the spurs can be tuned to this frequency). This frequency is called the CROSSING FREQUENCY of the spur. The ratio of the change in spur offset to the change in carrier frequency is called the ORDER.

Names can be assigned to the different spur families such as: type A, B, C1, C2, C3, etc. Each of these have a set of defining conditions to determine the crossing frequencies.

Type B, crossing frequency whenever:

10*Flf/10 = I or Flf = I

where Flf = 20/30 loop output frequency

ORDER of the spur = 10

This type is caused by the 20/30 mixing with the Ith harmonic of 10 MHz in the Reference Phase Detector.

Type C1 and C3 are both due to the 20/30 output and its harmonics mixing with the M/N VCO.

Given:

Fmn = M/N Output freuency = 200 − 10*M/N (MHz)

Flf = 20/30 Output Frequency = 20 to 30 (MHz)

M, N are the divider numbers for the M/N Loop

I, J, K are integers

then the conditions for the two spurs are:

Type C1, crossing frequency whenever:

Fmn/Flf = 20 * (20-M/N)/I

ORDER of spur = I/2

This type can be caused by several factors. Some possibilities are, the A48 Sampler board 70 MHz Low Pass Filter, or the A46 Low Pass Filter Assembly.

Type C3, crossing frequency when:

Fmn/Flm = 20*I ± J/(2*K)

or

Flf = 20 * K * (20-M/N)/20*I ± J

ORDER of spur = 20*I ± J/(2*K)

This type is caused by the Ith harmonic of the PLL1 VCO sampled by the Kth harmonic of the M/N VC0.

For any CW frequency, selecting the appropriate SHIFT functions will display the M/N frequency, 20/30 frequency and YO frequency. A synthesized spurious response must be a function of these signals. As mentioned above, the elimination of these spurs is primarily a design considseration; however, any coupling from one signal path into another may result in a spurious response (i.e., loose connectors, poor shielding, cable routing, etc.).

Band 0 spurs are caused by mixing products in the Band 0 mixer. These are not crossing spurs because they are not YO Loop sidebands. Instead, they are added to the output as part of the down-conversion process. The YO output should mix with the 3.7 GHz oscillator output and produce a single mixer output at Fyo - 3.7 GHz. However, harmonics of both oscillators are present, or are generated in the mixer. These mix to form spurs on the output.

Troubleshooting synthesized spurs - One way to eliminate various RF paths is to determine the YO frequency at which the spur occurs, then select a CW frequency in both Band 0 and Band 1 that uses the YO frequency. If the spur occurs only in Band 0, troubleshoot the Band 0 RF path. If the spur occurs in Band 1, troubleshoot the Band 1-4 RF path.

Change the CW frequency such that the M/N output remains constant and only the 20/30 output changes. Determine the order of the spur (i.e., Ratio of YO frequency change to spur frequency change). If the spur is a crossing spur at some point the spur will be on top of the YO frequency and at some point (50 kHz away from the YO frequency) the spur amplitude will decrease. If the spur is a crossing spur, refer to the appropriate spur family type above.

It may help determine which internal frequency source(s) is generating the spur by:

Change the CW frequency while monitoring the SHIFT function diagnostics, looking for a sudden change in spur frequency and/or amplitude. For example, press **[SHIFT] [M1]** then change the CW frequency. Look for a correlation between any sudden change in spur frequency and/or amplitude with a change in M/N output frequency or 20/30 output frequency. If a sudden change in the spur occurs at the same time the M/N or 20/30 makes a large change, the internal frequency source that changed is probably one of the signals that is generating the spur.

If the 20/30 loop is suspected, press **[SHIFT] [M3]** to display the PLL2 VCO frequency and PLL3 Up Converter frequency and repeat the above test.

NOTE

For more information on the diagnostic modes, refer to the Frequency Range and CW Mode Accuracy test in Section IV.

19. **I/O CONNECTORS**

To determine source or destination of input or output connector signals, refer to the Front and rear panel section wiring diagrams. For troubleshooting, refer to the source or destination assembly Theory of Operation and Troubleshooting.

20. **REMOTE OPERATION**

Section IV contains an HP 8340A HP-IB Operation Verification Programming Listing. This program will verify the ability of the HP 8340A to respond to a remote input (complete HP-IB handshake).

The program will test each data bit and read the HP 8340A Status bytes.

If the HP 8340A exhibits a problem while running this test, refer to the A60 Processor Troubleshooting in the Controller functional group.

If a problem is not observed while running this program and the HP 8340A does not respond properly to other remote commands, refer to the computer documentation to read the computer HP-IB I/O card status. By outputting the I/O card status, the source of the problem may be determined.

REPAIR PROCEDURES

INTRODUCTION

This section contains important information concerning the repair of this instrument. Other important information is contained in the "**POWER SUPPLY - FAN**" and the "**RF SECTION**" portions of the manual concerning the repair of these assemblies.

CAUTION

This section contains procedures in which one must handle assemblies that contain static sensitive components. Handle any printed circuit board by the edges and never touch finger contacts. Service this instrument only at a work station that is equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to ground of no less than 1 Megohms and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and statutes.

The thermal connection between two of the instrument heat sinks and the components mounted to them is the dominant factor in the component's long term reliability. Be sure to properly apply thermal compound (HP Part Number 6040-0454 CD0) when installing or replacing any of these parts. Refer to the POWER SUPPLY - FAN functional group for thermal compount application procedure.

Use only oil based thermal compound. The use of silicone based thermal compount may cause serious reliability problems. Silicone based oil migrates to pass element sockets, switch contacts, or printed circuit board edge connectors. The compound then tends to raise contact resistance or electrically isolate the contacts. Silicone based thermal compounds disperse into the air and deposit themselves anywhere in the instrument. Applying this material to a warm component (e.g. a heat sink or pass element) increases the rate of dispersion.

Use only Rosin Mildly Activated solder when repairing a PC Board. Rosin Activated solder may cause reliability problems if used.

Never clean solder flux from a PC Board after replacing a component! This may cause serious reliability problems. The solder flux that remains on the PC Board is composed of activator that is completely encapsulated by rosin. When this flux is "cleaned" off, the rosin and the activator separate and are smeared all over the PC Board. They also flow under the edge of PC Board traces (all traces have undercuts along their edges from the etching process). Once under the edge of a trace the material collects moisture. The dissimilar metals that make up the trace react to the clorides in the activator and begin to migrate, disolving the trace. The activator will also create an electrical path from one trace to another. This allows metal migration between the two traces. As

more metal migrates the impedance between the traces decreases, allowing metal to migrate faster. This process continues until a short develops. The later process is known as dendrite growth. Dendrites form a fern-like pattern of metal growth that is visible between the traces.

Use only solder stations equipped with a grounded tip as well as low static de-soldering aids. When removing a motherboard connector it is recommended that in order to avoid the unnecessary cost and down time causesd by damaged motherboard pads, a specialized solder removal tool should be used. The Ungar HOT VAC or equivalent device is recommended. Figure 8A-2 lists recommended soldering equipment and supplies.

Cleaning P.C. Board fingers by any other method than the one described below may cause serious reliability problems. NEVER clean fingers with any kind of eraser. NEVER use tap water in the cleaning solution described below. Tap water contains chlorine. Chloride contamination from tap water, salt (from skin contact), or any other source may cause serious reliability problems (dendrite growth, trace damage, see the preceding warning). Always wear a ground strap when handling any internal HP 8340A component or assembly. Always hold printed circuit boards by the edges.

PRINTED CIRCUIT BOARD FINGER CLEANING PROCEDURE

Mix one part deionized water with two parts isopropyl alcohol. Apply this solution to a clean, lint free, cloth (HP Part Number 9310-0039 CD3). Rub the fingers carefully and then dry with a clean part of the cloth.

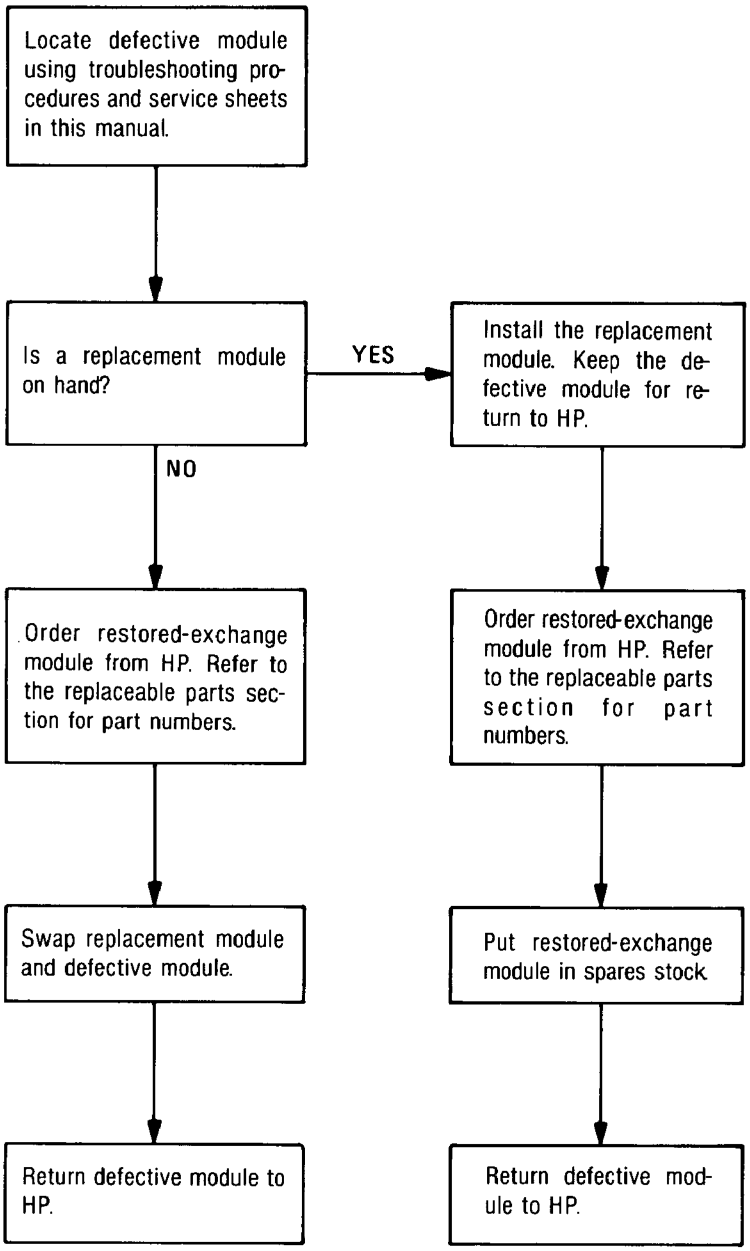
MODULE EXCHANGE PROGRAM

Table 8A-6 lists assemblies within the instrument that may be replaced on an exchange basis, thus affording a considerable cost saving. Exchange, factory-repaired and tested assemblies are available only on a trade-in basis; therefore, the defective assemblies must be returned for credit. For this reason, assemblies required for spare parts stock must be ordered by the new assembly part number.

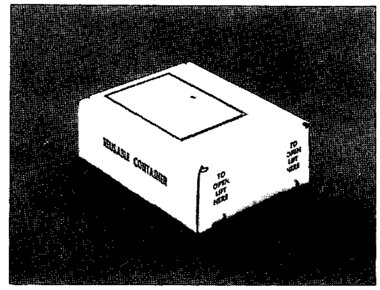
Table 8A-6. Exchange Parts

Description	New Part Number	CD	Rebuilt-Exchange Part-Number	CD
A8 Band 0 3.7 GHz Oscillator	5086-7309	3	5086-6309	1
A9 Band 0 Pulse Modulator	5086-7372	0	5086-6372	8
A13 SYTM	5086-7308	2	5086-6308	1
A14 Band 1-4 Power Amplifier (2.3 to 7.0 GHz)	5086-7407	2	5086-6407	0
A16 Band 1-4 Modulator/Splitter	5086-7304	8	5086-6304	
A17 Band 0 Mixer	5086-7374	2	5086-6374	0
A18 Band 0 Power Amplifier (0.01 to 2.4 GHz)	5086-7217	2	5086-6217	0
A44 YIG Oscillator	5086-7323	1	5086-6323	9
A63 90 dB Attenuator	08340-60175	9	08340-60223	8

The module exchange program described here is a fast, efficient, economical method of keeping your Hewlett-Packard instrument in service.



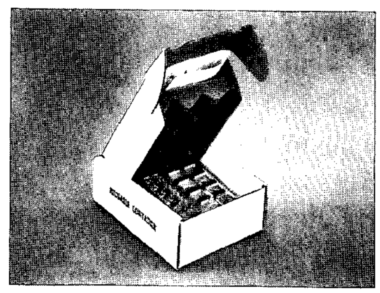
A.



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

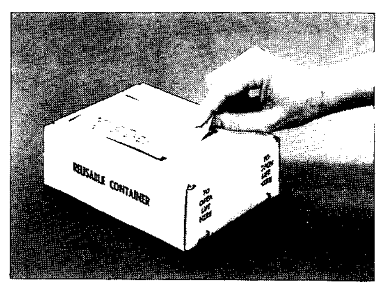
Exchange assembly failure report
Return address label

B.



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

C.



Seal box with tape. 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.

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

Figure 8A-11. Module Exchange Program Instructions

AFTER SERVICE SAFETY CHECKS

Visually inspect the interior of the instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy the cause of any such condition.

Using a suitable ohmmeter, check the resistance from the instrument enclosure to the ground pin on the power cord plug. The reading must be less than one ohm. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist.

Check the resistance from the instrument enclosure to the line and neutral (tied together) with the line switch on the ac mains disconnected. The minimum acceptable resistance is 2 megohms. If the instrument does not pass either of the above tests, **do not connect the instrument to the ac mains**. Troubleshoot the source of the problem at once.

Check the line fuse to verify that a correctly rated fuse is installed. Make sure the line module's line voltage selector pc board is set to the correct voltage.

AIR FILTER REPLACEMENT

CAUTION

The following procedure must be performed periodically to retain the safety features which have been designed into the instrument.

The air filter (HP Part Number 08340-00018 for pkg of 10), attached to the cooling fan assembly (rear panel), will require periodic replacement. Due to the variety of environmental conditions, the interval between replacement cannot be estimated. These filters are inexpensive, and do not lend themselves to cleaning. Filter replacement is therefore most cost-effective. Replace as follows:

1. Disconnect the line power cord.
2. Remove four screws holding the air filter housing to the rear panel.
3. Replace the filter and reassemble.

BASIC COMPONENT SYMBOLOGY

R, L, C	Resistance is in ohms, inductance is in microhenries, capacitance is in microfarads, unless otherwise noted.
P/O	Part of.
*	Indicates a factory selected component.
	Panel Control.
	Screwdriver adjustment.
	Encloses front panel designation.
	Encloses rear panel designation.
	Circuit assembly borderline.
	Other assembly borderline.
	Heavy line with arrows indicates path and direction of main signal.
	Indicates path and direction of main feedback.
	Earth ground symbol.
	Assembly ground. May be accompanied by a number or letter to specify a particular ground.
	Chassis ground.
n	Represents n number of transmission paths.
	Test Point: Terminal provided for test probe.
	Constant Current Source
	Pin Edge Connector output of PC board.
92	Indicates wire or cable color code. Color code same as resistor color code. First number indicates base color, second and third numbers indicate colored stripes.
	Indicates shielding conductor for cables.
	Indicates a plug-in connection.
	Indicates a soldered or mechanical connection.
	Connection symbol indicating a male connection.
	Connection symbol indicating a female connection.
	Resistor.
	Resistor (Temperature Sensitive)
	Variable Resistor.
	General purpose diode.
	Step recovery diode.
	Schottky diode.
	Breakdown Diode: Zener
	Light-Emitting Diode.
	SCR (Silicon Controlled Rectifier).
	Ferrite Bead
	FET: Field Effect Transistor (N-channel).
	FET: Field Effect Transistor-Guarded gate- (N channel).
	Dual Transistor.
	Transistor NPN
	Transistor PNP
	Electrolytic Capacitor.
	Toroid: Magnetic core inductor.
	Operational Amplifier.
	Fuse
	Pushbutton Switch.
	Toggle Switch.
	Thermal Switch.
Σ	Summing Point.
	Oscillator; RPG (Rotary Pulse Generator).
B1	Fan, Motor.
	Toroidal Transformer
	Feedthrough

Figure 8A-12. Schematic Diagram Notes (1 of 2)

LOGIC SYMBOLOGY

&	AND Gate	≥1	NOR Gate		Inverter
≥1	OR Gate	=1	Exclusive OR Gate	or	Negation symbol. Line is active low.
&	NAND Gate		Buffer/Amplifier		Indicated edge-sensitive input.
	Wired OR				

FUNCTION LABEL ABBREVIATIONS

Σ	Adder	◊	Open Collector	LED	Light-Emitting Diode
	Amplifier/Buffer	1	Non Retriggerable Monostable Multivibrator	MUX	Multiplexer
	Schmitt Trigger		Retriggerable Monostable Multivibrator	RAM	Random-Access Memory
&	AND	BCD	Binary Coded Decimal	REG	Register
≥1	OR	CTR	Counter where n = number of bits in counter	ROM	Read Only Memory
=1	Exclusive OR	DAC	Digital-to-Analog Converter	RPG	Rotary Pulse Generator
X→Y	Encoder, Decoder	FF	Flip-Flop	3-ST	3 State
	Edge sensitive	I/O	Input/Output	H PRI	Highest Priority Encoder
		AN SW	Analog Switch	SREG n	where n = number of bits shifted

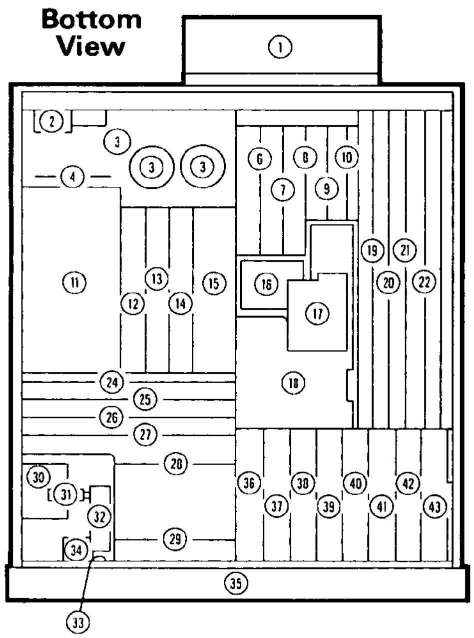
LINE LABEL ABBREVIATIONS

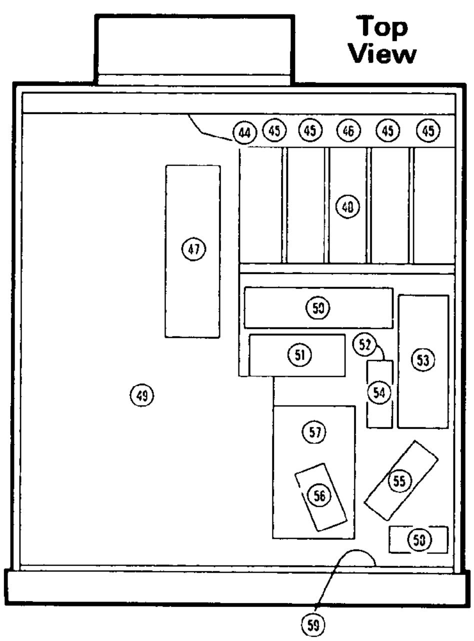
C	Control	MSB	Most Significant Bit	T	Trigger Input (Monostable)
D	Data or Delay Input (Flip-Flop)	NC	No Connection	WR	Write
◀▶	Direction	Q	Output	+1	Count Up
EN	Enable, 3-State Enable Input	$\overline{Q}$	Not Q Complement of Q	−1	Count Down
G	Gating Input	R	Reset or Clear Input		
LSB	Least Significant Bit	RD	Read		
		S	Set Input		
		▼	3 State Output		

Figure 8A-12. Schematic Diagram Notes (2 of 2)

PAGES 8-61 THROUGH 8-82 HAVE BEEN INTENTIONALLY OMITTED

REFERENCE GUIDE TO SERVICE DOCUMENTATION





Assy./Ref. Des.	Description	Location	Volume 3					Volume 4		
			Ref. M/N Loops	20-30 Loops	Swp. Gen.-YO Loop	Motherboard	Controller	Front/Rear Panel	RF Section	Power Supplies
A1	Alpha Display	33						●		
A2	Display Driver	33						●		
A3	Display Processor	33						●		
A4	Not Assigned	-								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	16							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	31							●	
A12	Band 0 Splitter/Detector	34							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	14							●	
A18	Band 0 Power Amplifier	[illegible]							●	
		[illegible]							●	
A19	Capacitor Assembly	[illegible]								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	28							●	
A25	ALC Detector	27							●	
A26	Linear Modulator	26							●	
A27	Level Control	25							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	16	●							
A33	M/N Output	15	●							
A34	Reference-M/N Motherboard	5	●							
A35	Rectifier	4								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	40		●						
A41	PLL2 Phase Detector	41		●						
A42	PLL2 Divider	42		●						
A43	PLL2 Discriminator	43		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	[illegible]			●					
A49	YO Loop Phase/Detector	16			●					
A50	YO Loop Interconnect	17			●					
A51	Reference Oscillator	[illegible]	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	10								●
A57	Marker/Bandcross	19					●			
A58	Sweep Generator	20			●					
A59	Digital Interface	21					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	[illegible]							●	
AT2	15 dB Attenuator	[illegible]			●					
B1	Fan Assembly	1								●
A62C1-3	Power Supply Filter Capacitors	3								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

Reference Loop – M/N Loop B

M/N LOOP — REFERENCE LOOP B

REFERENCE LOOP - M/N LOOP
INTRODUCTION

This section provides information and instruction for troubleshooting, repairing, or replacing assemblies and components in the Reference Loop and the M/N Loop. Information includes circuit descriptions, troubleshooting procedures, block diagrams, schematics, and component location diagrams for each printed circuit board assembly.

The Reference Loop produces all of the translation and reference signals that are used in the other phase-locked loops in the 8340A.

The Reference Loop consists of the following sections:

* A29 Reference Phase Detector Assembly

* A30 100 MHz VCXO Assembly

The M/N Loop generates the 177-197 MHz signal that drives the A48 Sampler in the YO Loop.

The M/N Loop consists of the following sections:

* A31 M/N Phase Detector Assembly

* A32 M/N VCO Assembly

* A33 M/N Output Assembly

REFERENCE LOOP AND M/N LOOP THEORY OF OPERATION

REFERENCE LOOP DESCRIPTION

The Reference Loop produces all of the translation and reference signals that are used in the other phase-locked loops in the 8340A. These signals are all derived from either the internal 10 MHz Standard (A51) or an external 10 MHz source connected to the EXT REF BNC connector on the rear panel. The frequency stability of the 8340A is directly related to the stability of this 10 MHz signal.

The Reference Loop consists of two assemblies:

1. A29 Reference Phase Detector board
2. A30 100 MHz VCXO board

The Reference Phase Detector Board compares the phase of the 10 MHz reference to the divided-by-10 output of the 100 MHz VCXO and generates a tuning voltage for the VCXO so that phase lock can be achieved. The 10 MHz reference signal is buffered and then converted into a pulse train which drives a sampler where the actual phase detection is performed. The output of the sampler is integrated and then applied as a tuning voltage to the 100 MHz VCXO on A30 100 MHz VCXO board. The VCXO is a crystal-stabilized voltage-controlled oscillator with exceptional noise performance. The tuning range of the VCXO is approximately ± 1 kHz of its nominal frequency. The output of the 100 MHz VCXO is buffered and then split several ways. One output is used to drive the sampler in the A8A1 3.7 GHz Oscillator Assembly. Another output is first quadrupled in frequency (to 400 MHz) amplified and then sent to A31 M/N Phase Detector where it drives the RF port of a down converting mixer. The remaining output is amplified and sent back to the A29 Reference Phase Detector Board where four more reference signals are derived. On A29 this 100 MHz signal is first divided by 5 to 20 MHz, and then divided by 2 to 10 MHz. The 20 MHz signal is amplified and sent to the A31 M/N Phase Detector where is becomes the reference for the M/N loop. The 10 MHz signal drives three buffers whose outputs go to:

1. 20-30 Loop A42 PLL1 Divider
2. 20-30 Loop A37 PLL2 Divider
3. Rear Panel 10 MHz Reference Output

Finally the 10 MHz signal is amplified and sent to the sampler thereby completing the return path of the Reference phase-locked loop. A block dagram of the Reference and the M/N Loops is shown in Figure 8B-1, Reference and M/N Simplified Block Diagram.

M/N LOOP DESCRIPTION

The M/N Loop generates the 177-197 MHz signal that drives the A48 Sampler in the YO Loop. Harmonics of the M/N signal are generated in the Sampler and are used to down convert the 2.3-7.0 GHz YO output to the 20-30 MHz range so that the YO can be phase locked to the output of the 20-30 Loop.

The M/N Loop consists of three assemblies:

1. A31 M/N Phase Detector board
2. A32 M/N VCO Assembly
3. A33 M/N Output board

The M/N Phase Detector Board contains a phase detector, a mixer, and two programmable frequency dividers. (Refer to Figure 8B-1, Reference and M/N Simplified Block Diagram) The mixer is used to down convert the VCO output signal (from A33) from 355-395 MHz to 5-45 MHz by using the 400 MHz reference signal from A30 100 MHz VCXO. This 5-45 MHz IF signal is then divided in frequency by the M divider, one of the two identical programmable dividers on this board. The M divider is programmed to divide by an integer ranging from 8 to 27. The phase of the output of this divider is compared to the output of the other programmable divider, the N divider, in the phase detector whose differential output is used to tune the VCO. This tune voltage keeps the M/N Loop phase locked to the output of the N divider. The N divider is programmed to divide the 20 MHz reference signal by an integer from 13 to 36.

The M/N VCO is a foreshortened cavity resonator that is varactor tuned from 355 to 395 MHz. The M/N VCO assembly consists of the cavity oscillator and a small PC board. This assembly is mounted on A33 M/N Output Board. On A33, the output of the VCO is split two ways. One output is used for closing the phase locked loop, and the other is used to generate the YO Loop Sampler drive. The phase lock path contains an amplifier that drives the down converting mixer on the A31 M/N Phase Detector board. The YO Loop Sampler path contains an amplifier and then a divide-by-2 circuit that produces a Sampler Drive signal in the range of 177-197 MHz.

The YO Loop Sampler drive output of the M/N Loop (after being divided by 2) can be related to the M and N numbers by the following equation:

$$f_{M/N} = 200 - 10 * (M/N) \text{ MHz}$$

The Nth harmonic of this signal is used in the YO Loop Sampler (A48) to down-convert the 2.3-7.0 GHz YO output to 20-30 MHz. For every increment in M number, the YO output will decrease by 10

MHz, and for every increment in N number, the output will increase by 200 MHz. This relationship is given in the following equation where $f_{20,30}$ is the output of the 20 to 30 Loop:

$$f_{YO} = 200*N - 10*M - f_{20,30} \text{ MHz}$$

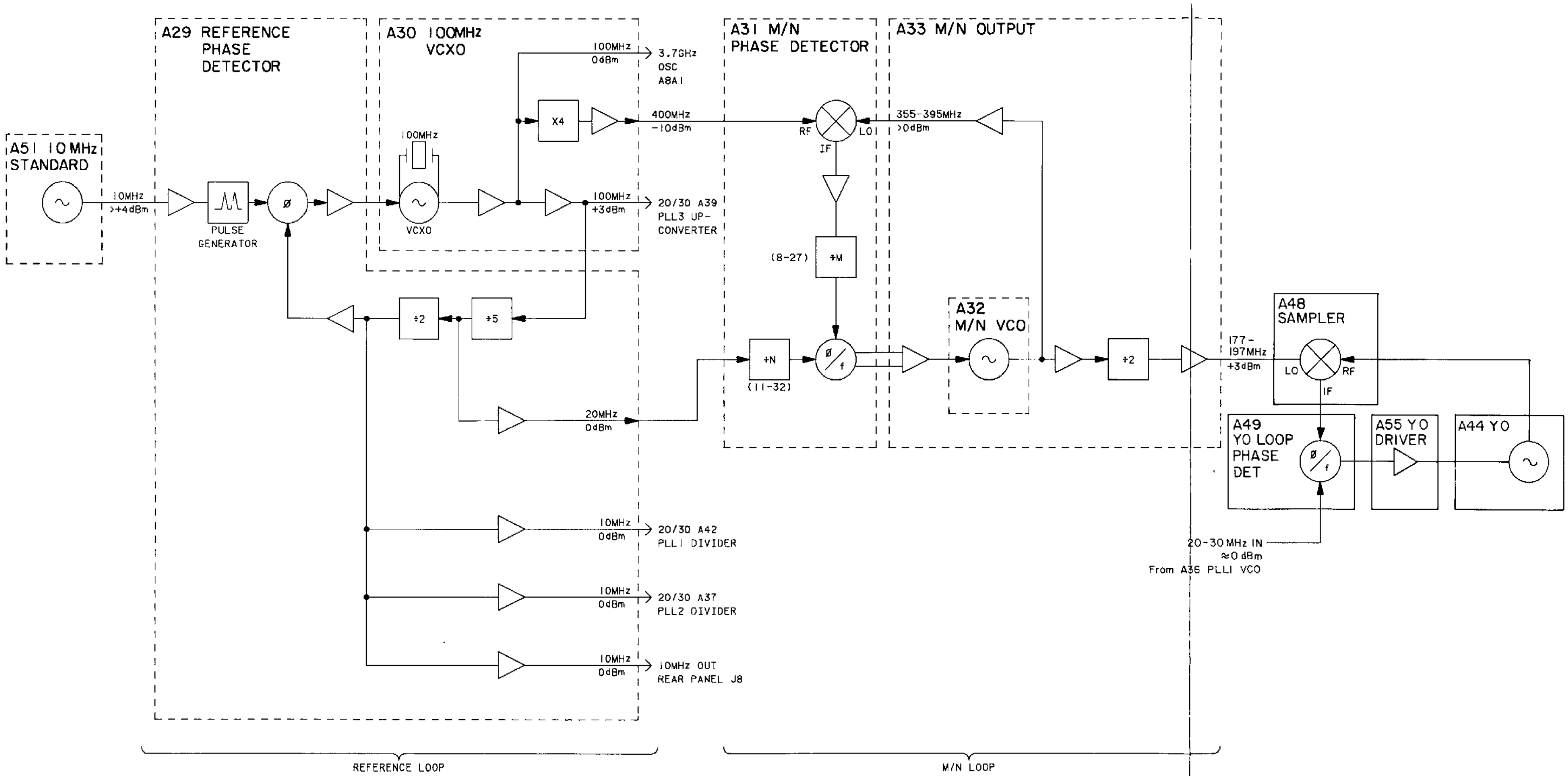


Figure 8B-1. Reference and M/N Simplified Block Diagram

REFERENCE LOOP - M/N LOOP
TROUBLESHOOTING TO ASSEMBLY LEVEL

REFERENCE UNLOCK TROUBLESHOOTING

First check that the INT/EXT switch on the rear panel is in "INT" position.

Check that a jumper cable is connected between rear panel connectors "INT" and "EXT".

Check that there is a 10 MHz, 0 dBm signal out of the "INT" jack on the rear panel.

If there is no 10 MHz signal at the rear panel, the problem is probably the 10 MHz Standard, A51, or the power supplies to it. Refer to Figure 8B-2, Reference Loop - M/N Loop Block Diagram. If the power supplies are present, and there is no 10 MHz output signal at A51J1, replace the Reference Oscillator. (Note: +20 V to A51 is switched on by "HSTD" on the positive regulator board, A52).

If there is a good 10 MHz signal at the rear panel, the problem is probably on the Reference Phase Detector board, A29, or the 100 MHz VCXO, A30.

Measure the voltage on TP1, "TUNE", on the cover of A30 board. This voltage should be approximately -8 volts. If it is at -8 volts then the Reference Loop is most likely locked up and the problem is on the unlock detector portion of the A29 Reference Phase Detector or A59 Digital Interface board.

If the voltage is not -8 volts, adjust A30C4 and see if it will vary the tune voltage.

If the tune voltage was off by more than 3 volts and A30C4 is able to bring it back to -8 volts, then the 100 MHz VCXO crystal, A30Y1, is probably drifting too much and should be replaced.

If A30C4 is not able to vary the tune voltage, then suspect low power or a missing signal out of A30J1, or a missing 10 MHz reference on A29. See Section V, Adjustments, for verification of 100MHz VCXO. See theory description of 10 MHz Reference Phase Detector, A29.

M/N UNLOCK TROUBLESHOOTING

In order for the M/N Section to lock up, the Reference Section must be locked. (Refer to Figure 8B-2, Reference Loop-M/N Loop Block Diagram)

Check that a 20 MHz signal at 0 dBm ±3dB is coming out of A29J2. If there is no 20 MHz signal or it is low in power, then there is most likely a problem on the A29 Reference Phase Detector board.

Check that there is 400 MHz at -10 dBm ± 3dB coming out of A30W1. If there is no 400 MHz signal or it is low, then there is probably a problem on the A30 VCXO board.

If both of the above signals are correct, then the problem is most likely on the A31 M/N Phase Detector board or the A33 M/N Output board.

Set up the 8340A by pressing **[INSTR PRESET] [CW] [2] [.] [4] [9] [GHz]**, **[SHIFT] [M1]**. In the "POWER dBm" window are the numbers 08 13. The number 08 is the M DIVIDE number and number 13 is the N DIVIDE number. In the first frequency window is a frequency that is expected out of A33J2 M/N OUT. Measure the frequency out of A33J2. (NOTE: When measuring the M/N frequency, it is advisable to have the 8340A and the measuring device, ie. counter or spectrum analyzer, both locked to the same 10 MHz standard.)

If the measured frequency and the frequency in the first window are the same and the M/N Loop is still unlocked, then the problem is most likely on the UNLOCK indicator portion of the A31 M/N Phase Detector board or the UNLOCK Detector portion of the A59 Digital Interface board.

If there is no signal out of A33J2, then the problem is most likely on the A33 M/N Output board or the A32 M/N VCO. See Section V, Adjustments, for details on verifying the M/N VCO and Output board.

If the measured frequency and the indicated frequency do not match, then the problem is most likely on the A31 M/N Phase Detector board or the A33 M/N Output board. It is now important to see if the M/N output frequency is off due to divider failure on A31 or VCO tuning failure on A32 or A33.

Press **[SHIFT] [CF] [1] [0] [MHz] [CW]**. This sets the 8340A up to step the CW frequency in 10 MHz increments. For each 10 MHz step, the "M" Divide number will change by a value of 1. Step the CW frequency from 2.49 GHz to 2.3 GHz ("M" Number from 8 to 27). At each step, record the measured M/N output frequency and the frequency displayed in the first window.

Check the list of frequencies. If some of the measurements match and some do not, then the problem is most likely on the M Divider portion of the A31 M/N Phase Detector board.

Press **[SHIFT] [CF] [2] [0] [0] [MHz] [CW]**. This sets the 8340A to step the CW frequency in 200 MHz increments. For each 200 MHz step, the "N" Divide number will change by a value of 1. Step the CW frequency from 2.3 GHz to 6.9 GHz ("N" Number from 13 to 36). At each step, record the measured M/N output frequency and the frequency displayed in the first window.

Check the list of frequencies. If some of the measurements match and some do not, then the problem is most likely on the N Divider portion of the A31 M/N Phase Detector board.

If the measured frequencies in the above two tests do not change as the M or N number is changed, then the problem is most likely on the A33 M/N Output board or the A32 M/N VCO.

NOTES:

1. REFER TO FIGURE 8A-12 FOR A DESCRIPTION OF THE SYMBOLOGY USED ON THIS BLOCK DIAGRAM.
2. NOT ALL POWER SUPPLY INTERCONNECTIONS ARE SHOWN ON THIS BLOCK DIAGRAM.

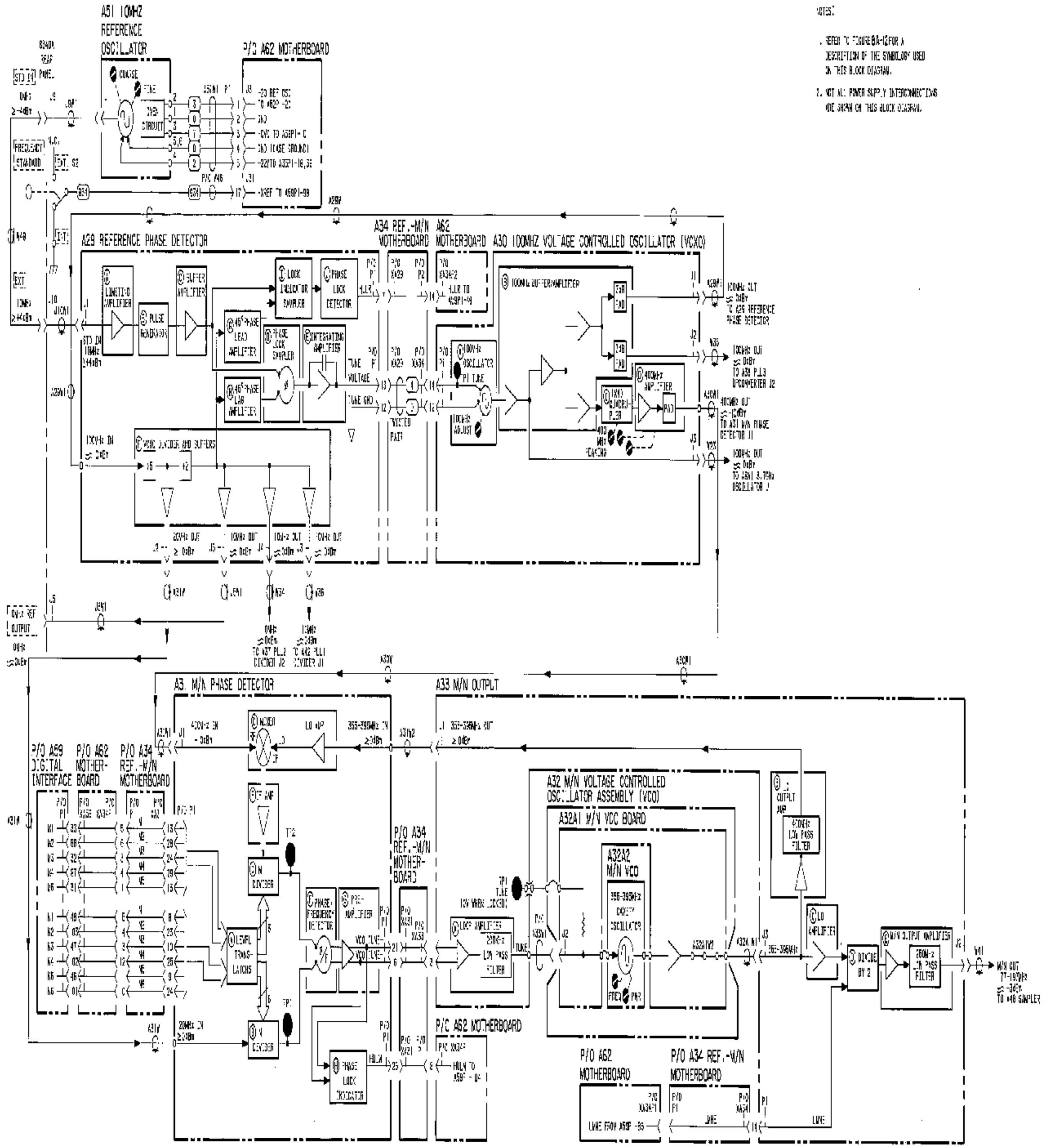


Figure 8B-2. Reference Loop – M/N Loop Block Diagram

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REPAIR PROCEDURES

Refer to the REPAIR PROCEDURES description in the beginning of Section VIII.

A29 REFERENCE PHASE DETECTOR

INTRODUCTION

The A29 Reference Phase Detector contains the frequency divider, phase detector, and integrating amplifier for the 100 MHz Reference phase-locked loop. Basically, 100 MHz from the A30 VCXO is divided by 10 and compared to the 10 MHz frequency standard by the phase detector. The error voltage from this comparison is fed back to the VCXO to keep its frequency locked to 10 times that of the frequency standard. The bandwidth of the reference phase-locked loop is 100 Hz; the 10 MHz derived from the 100 MHz VCXO must be within 100 Hz of the 10 MHz frequency standard for the loop to lock reliably. Refer to Figure 8B-4, A29 Reference Phase Detector, Schematic Diagram.

A29 REFERENCE PHASE DETECTOR CIRCUIT DESCRIPTION

Limiting Amplifier A

U1 amplifies and limits the amplitude of the 10 MHz signal from the frequency standard. U1A and U1B form a limiting differential pair, while the emitter follower, U1C, provides a low impedance output.

Pulse Generator B

U2D is biased with feedback resistor R10 to further limit the 10 MHz signal to a well-shaped square wave and set the proper logic levels for digital buffer U2C. U2A and U2B generate narrow pulses, the width being the gate delay of U2A plus the delay from R11 and C5. When the output of U2C goes low, the output of U2B goes high after one gate delay (of U2B). After a delay due to R11, C5, and U2A gate delay, the output of U2A goes high which causes U2B output to return low again, thus generating a narrow pulse.

Phase Lock Sampler D

The phase lock sampler performs the function of phase detector. The 10 MHz pulses from the buffer amplifier are applied to the primary of T1 which causes CR3 and CR4 to turn on for the duration of the pulses. This samples the divided by 10 VCXO frequency and stores this voltage on C26. When the loop is locked, the feedback due to the complete phase-locked loop forces this voltage to be nearly zero. When the loop is unlocked, this voltage may be zero or varying, depending on the reason for unlock.

Integrating Amplifier E

Q4 is a differential input pair which together with Q5 and Q6 forms a high gain amplifier. Feedback is added with C32 and R49 to make an integrating amplifier. C32 provides ac feedback only, so for the amplifier to remain linear, dc feedback is accomplished by virtue of the entire phase-lock loop.

VCXO Divider and Buffers F

A 100 MHz signal from A30 VCXO is applied to counter U3 which divides by 5, then by 2. Its outputs are 10 MHz and 20 MHz which are buffered by U4 to be used as reference frequencies by other assemblies in the instrument. The other 10 MHz output is used to drive the Phase Lock Sampler **D** and Lock Indicator Sampler **I**.

Fourty Five Degree Phase Lead Amplifier G and Fourty Five Degree Phase Lag Amplifier H

The 45 degree phase shift buffers are used to provide two 10 MHz signals which are 90 degrees apart in phase. The purpose of these signals is explained in Lock Indicator Sampler **I** description. the 45 degree phase shift in **G** is accomplished with C35 and R53, while in **H** it is done by R59 and C38.

Lock Indicator Sampler I

The lock indicator sampler functions the same as the phase lock sampler **D**. The only difference is that the 10 MHz is 90 degrees shifted in phase. This causes the output of the lock indicator sampler to be a maximum negative voltage when the loop is locked.

Phase Lock Detector J

The output of the lock indicator sampler is compared to -0.5 volt by U5. When the output voltage becomes closer to 0 than to -0.5 volt, U5 switches its output to TTL high to indicate to the A59 Digital Interface that the loop is unlocked.

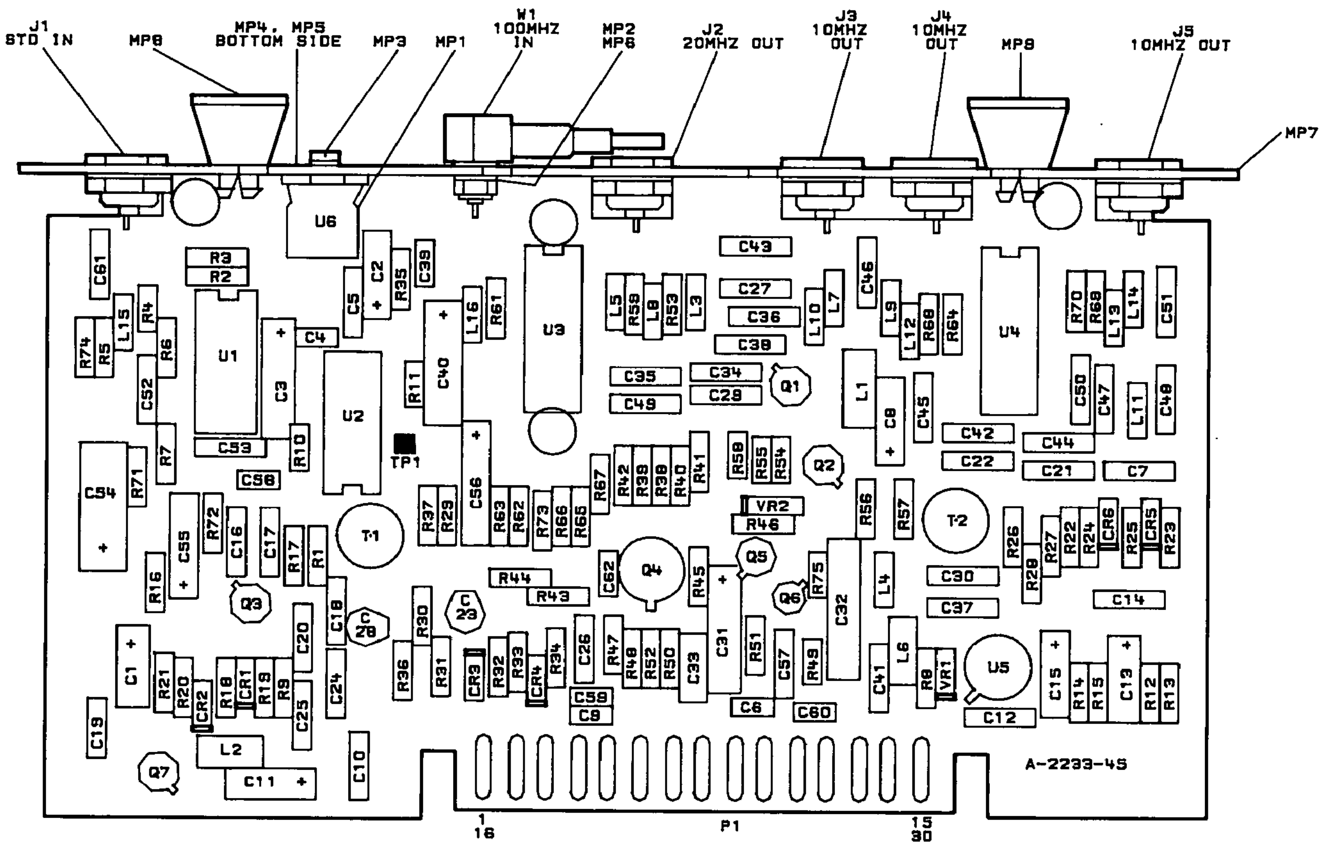


Figure 8B-3. A29 Reference Phase Detector, Component Location Diagram

A29 Reference Phase Detector Pin I/O

Pin	Mnemonic	Levels	Source	Destination
1	−10V	−10V	XA34P2-8, 9	*K
2	−40V	−40V	XA34P2-6, 7	*K
3	GND	0V	INSTRUMENT GROUND	*K
4	GND	0V	INSTRUMENT GROUND	*K
5	+20V	+20V	XA34P2-2, 3	*K
6	GND	0V	INSTRUMENT GROUND	*K
7	HULR	TTL (HIGH TRUE)	J	XA34P2-14
8	GND	0V	INSTRUMENT GROUND	*K
9	−5.2V	−5.2V	XA34P2-12, 13	*K
10	GND	0V	INSTRUMENT GROUND	*K
11	GND	0V	INSTRUMENT GROUND	*K
12	TUNE GROUND	0V	E	XA30P1-12
13	TUNE VOLTAGE		E	XA30P1-14
14	GND	0V	INSTRUMENT GROUND	*K
15	GND	0V	INSTRUMENT GROUND	*K

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A34 Reference Loop — M/N Motherboard Schematic Diagram for a complete representation of signal sources and destinations.

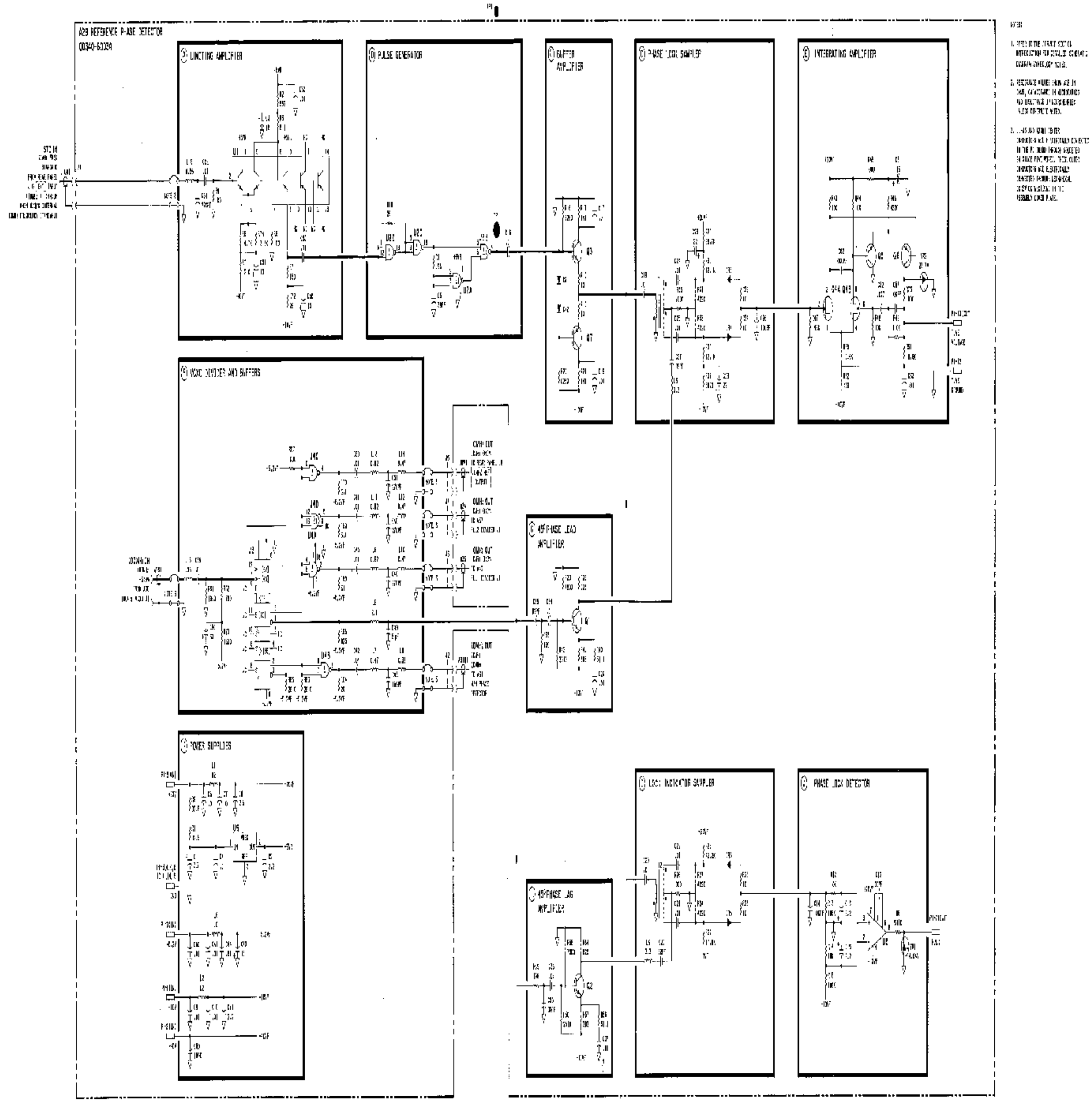


Figure 8B-4. A29 Reference Phase Detector, Schematic Diagram

A30 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

INTRODUCTION

The A30 100 MHz VCXO contains a Voltage Controlled Crystal Oscillator, a 100 MHz Buffer Amplifier, a frequency Quadrupler, and a 400 MHz Amplifier. With the A29 Reference Phase Detector, it forms the Reference Phase-Locked Loop. The 100 MHz and 400 MHz outputs are used as frequency references by other assemblies in the instrument. Refer to Figure 8B-6, A30 100 MHz VCXO, Schematic Diagram.

A30 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR CIRCUIT DESCRIPTION

100 MHz Oscillator A

Q5 and associated circuitry function as a 100 MHz Voltage Controlled Crystal Oscillator. Q5 is a common-base amplifier with positive feedback to form an oscillator. The signal at the output of Q5 goes through the parallel combination of C8 and C4, where it is limited to an amplitude swing of ±0.4 V by CR3, CR4, and R7 and becomes the output signal to the 100 MHz Buffer Amplifier (Block **B**). This output signal is also divided down by C11 and C10 to a level of ±0.25 V and fed back to the emitter of Q5 through the 100 MHz crystal, Y1, and the varactor diode, CR1. This completes the feedback loop and causes Q5 to oscillate.

The frequency controlling elements of the feedback network are Y1, CR1, C4, and C8. Y1, a 100 MHz quartz crystal, is the principle frequency-determining element. CR1, a varactor diode, provides the electrical tuning for the oscillator. Changing the (reverse) bias voltage on the varactor varies it's capacitance; this varies the phase shift of the feedback path around the oscillator and thus changes the oscillator frequency. The tuning input for the varactor comes from the output of the A29 Reference Phase Detector. It can tune the oscillator ±1 kHz as needed to lock the loop. C4 is a variable capacitor that is used to manually adjust the center of the tuning range to 100 MHz.

The tune voltage is applied to CR1 through L19, R53, R5, L4, L3, R54, and L18. This voltage, TUNE, is brought out to a test point, TP1, on the top cover of the casting that houses the board. C4 is adjusted with the loop locked so that TUNE is approximately -8.0 Vdc; this centers the tuning range. L4 is a factory-selected inductor that is used to adjust the symmetry of the oscillator output signal over the VCXO tuning range. The signal level must be maximum at 100 MHz and it must, over its tuning range, be symmetrical about 100 MHz.

R1, R2, R3, R11, R54, and L1 determine the bias and gain of Q5. TP3 should be at approximately -14.8 Vdc for correct bias.

100 MHz Buffer Amplifier B

Transistors Q9 and Q8 function as buffer amplifiers to isolate the VCXO from variations in load which would otherwise cause frequency pulling of the oscillator. Q9 is an emitter-follower amplifier which presents a high impedance to the VCXO output. Q8 buffers the output of Q9. Components L6, C15, and C16 form a tuned circuit to match the impedance of the collector output of Q8 to 50 ohms. This signal, 100 MHz OUT, is sent to the A8 3.7 GHz Oscillator.

The signal at the emitter of Q8, equal to the input signal (emitter-follower configuration), is input to the emitter of Q11, a common-base buffer amplifier. The output at the collector of Q11, through the tuned circuit of L7, C19, and C20, is applied to the power splitter, T3, which splits the signal into two paths.

In one path, the signal from T3 goes to Q6 through a 3 dB pad. Q6 is a common-emitter amplifier with emitter degeneration (R27) for gain stability. The output at the collector of Q6, through the tuned circuit of L8, C27, and C28, is applied to the power splitter, T2, which splits the signal into two paths. In each path, the signal goes through a 3 dB pad and a tuned LC circuit and becomes the 100 MHz OUT signal sent to the A29 Reference Phase Detector and the A39 PLL3 Upconverter.

In the second path from power splitter T3, the signal goes to Q7, a common-emitter buffer amplifier. The output at the collector of Q7, through the tuned circuit of L9, C32, and C33, is applied to the Quadrupler, Block **C**.

Quadrupler C

The 100 MHz signal from Q7 in Block **B** is applied to power splitter T1. The two outputs of T1 are input to transistors Q3 and Q4, which form a Class C amplifier, full-wave rectifier circuit. Positive half-cycles of the 100 MHz signal into T1 turn on Q3 while negative half-cycles turn on Q4. The collector outputs are connected together to provide a fullwave rectified signal that is rich in even harmonics. The tank circuit of C3 and L10 is tuned to pass the 4th harmonic, 400 MHz. This signal is applied to the 400 MHz Amplifier, Block **D**.

400 MHz Amplifier D

Q2 and Q1 are both common-emitter amplifiers which have approximately 20 dB gain each. Both have tuned outputs to filter undesired harmonics of 100 MHz. The output of Q1 is passed through a pad comprised of R67, R68, and R69. The nominal attenuation of the pad is 5 dB, however the actual attenuation is selected to set the 400 MHz OUT signal level to -10 dBm ±1 dB. This signal is sent to the A31 M/N Phase Detector.

Power Supplies E

Q10, R9, and C43 function as a capacitance multiplier circuit to filter the 20 V supply. The filtering takes place in the base current which controls the collector current. This provides improved noise filtering for a given capacitor value. The voltage at TP2 should be approximately 18.2 V. C48, R62, C49, and C50 filter the -10 V supply, with R62 and the parallel combination of C49 and C50 forming a low-pass filter. The voltage at TP4 should be approximately -8.6 V.

A30 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR TROUBLESHOOTING

100 MHz Oscillator A

REFERENCE UNLOCK

The output of the 100 MHz VCXO should be phaselocked at 100 MHz. When troubleshooting the VCXO for a REFERENCE UNLOCK, first disconnect the cable at A30J1, the 100 MHz OUT signal to the A29 Reference Phase Detector. This breaks the Reference loop. Apply -8.0 Vdc to the TUNE test point, TP1 (on the top cover of the casting that houses the board). This should tune the oscillator to 100 MHz ±100 Hz. (For this test, the board must be kept inside the casting.) If the signal is missing at J1, then troubleshoot Q5 and surrounding circuitry. If the signal is present, then proceed to the Oscillator Adjustment Procedure section below.

The typical bias voltage levels for Q5 are as follows: emitter, -12.8 V; base, -11.9 V; collector, 0.0 V. TP3 should be approximately -14.8 V.

OSCILLATOR ADJUSTMENT PROCEDURE

As stated in the previous section, a dc voltage of -8.0 V applied to TUNE should tune the frequency to 100 MHz ±100 Hz. To test the sensitivity to TUNE, change the voltage to -25.0 V; this should cause the frequency to increase > 1.0 kHz. Apply 0.0 V to TUNE; this should cause the frequency to decrease > 1.0 kHz. If TUNE is not working correctly, then troubleshoot Q5 and surrounding circuitry. If TUNE is working correctly and the frequency at -8.0 V is correct, then troubleshoot the A29 Reference Phase Detector. If the frequency with TUNE at -8.0 V is not 100 MHz ±100 Hz, then proceed in this section.

The value of the inductor, L4, is selected to center the VCXO tuning range about 100 MHz. This assures that the output power is maximum at 100 MHz and the tuning curve is symmetrical about its maximum point. To test this, disconnect cable A30J1 and connect a dc voltage of -8.0 V to TUNE, TP1. Measure the 100 MHz OUT signal with either a signal analyzer or a power meter and frequency counter. Adjust A30C4 so that the signal level is maximum. Record the frequency, A (measured to at least a 10 Hz resolution). Slowly tune to a higher frequency until the power drops 1 dB; record this frequency, B. Tune to a lower frequency until the power drops by 1 dB; record this frequency, C. The VCXO centering is correct if

$$0.5 \leq \frac{(A-B)}{(B-C)} \leq 2.0$$

If the above ratio is less than 0.5, then decrease A30L4 one value to increase the center frequency. If the above ratio is greater than 2.0, then increase A30L4 one value to decrease the center frequency. Repeat as necessary. Refer to Table 8B-1 for inductor values. Note: this adjustment is done at the factory and normally will not need to be repeated unless other components are changed.

Table 8B-1. L4 Inductor Values and Part Number

Value	HP Part Number	Value	HP Part Number
0.68uH	9140-0141	0.33uH	9100-0368
0.56uH	9100-2256	0.27uH	9100-2252
0.47uH	9100-2255	0.22uH	9100-2251
0.39uH	9100-2254		

With -8.0 Vdc applied to TUNE, adjust A30C4 until the oscillation frequency is 100 MHz ±100 Hz. Remove the dc source from TUNE and reconnect the cable at A30J1 to close the Reference Loop. If TUNE changes less than ±1.0 V (from -8.0 V), then readjust A30C4 until TUNE (closed loop) -8.0 V; if TUNE changes more than ±1.0 V, then trouble-shoot the A29 Reference Phase Detector.

100 MHz Buffer Amplifiers B

The signal level of the 100 MHz OUT signals at A30J1, J2, and J3 should be 0 dBm ±1 dB. If no signal is present at J3, then troubleshoot Q9, Q8, and the 100 MHz Oscillator. If the output of J3 is correct but the signal at J2 and/or J1 is low or missing, then troubleshoot the signal path that includes Q11 and Q6.

The approximate bias voltage levels for the transistors in the 100 MHz Buffer Amplifiers is shown in Table 8B-2.

Table 8B-2. Approximate Bias Voltage Levels for 100 MHz Buffer Amplifier

Transistor	Q6	Q7	Q8	Q9	Q11
Emitter	3.8	3.8	4.3	5.0	3.8
Base	4.5	4.5	5.0	5.5	4.5
Collector	9.2	9.1	10.0	11.0	9.3

The 100 MHz OUT signal at J1 and J2 and the 400 MHz OUT signal are set to the correct power level by resistive pads (R30, R31, and R32; R33, R34, and R35; and R67, R68, and R69). The attenuation of these pads is selected to give the required power. For a given level of attenuation, the required resistor values are given in Table 8B-3.

Table 8B-3. Attenuation and Resistor Values for 100 MHz OUT and 400 MHz OUT

ATTENUATION (dB)	**RESISTORS (OHMS)**		
	R30 R33 R67	R31 R34 R68	R32 R35 R69
3	261	17.8	261
4	215	23.7	215
5	178	31.6	178
6	147	38.3	147
7	133	46.4	133
8	121	51.1	121
9	110	61.9	110

Quadrupler C and 400 MHz Amplifier D

The 400 MHz OUT signal level should be between -9 and -11 dBm. If the signal level is outside these limits, then check also the harmonic levels (see below). If they are out of spec, then make the adjustment of C2 and C3 and then recheck the signal level. If the harmonic levels are correct and the signal level is still low or if the 400 MHz signal is missing, and if the 100 MHz OUT signals are correct, then troubleshoot the signal path that includes the 100 MHz Buffer Amplifier Q7 (Block **B**), the Quadrupler transistors Q3 and Q4, and the 400 MHz Amplifier Q2 and Q1. The typical bias voltage levels for Q1-4 are given in Table 8B-4. To adjust the 400 MHz OUT power level to the required level, then change R67, R68, and R69, referring to Table 8B-3 for values.

Table 8B-4. Approximate Bias Levels for Quadrupler and 400 MHz Amplifier

Transistor	Q1	Q2	Q3	Q4
Emitter	-6.6	-6.6	-4.6	-5.1
Base	-5.9	-5.9	-5.9	-5.9
Collector	0.0	0.0	0.0	0.0

The 200 and 800 MHz harmonics of 100 MHz at A30W1, relative to the 400 MHz signal level, should be at least 25 dB down. The 100, 300, 500, 600, 700, and 900 MHz harmonics should be at least 40 dB down. If the harmonic levels are too high, then adjust A30C1 and A30C2 for the maximum 400 MHz signal level with the lowest possible harmonic levels. Then recheck the 400 MHz OUT signal level.

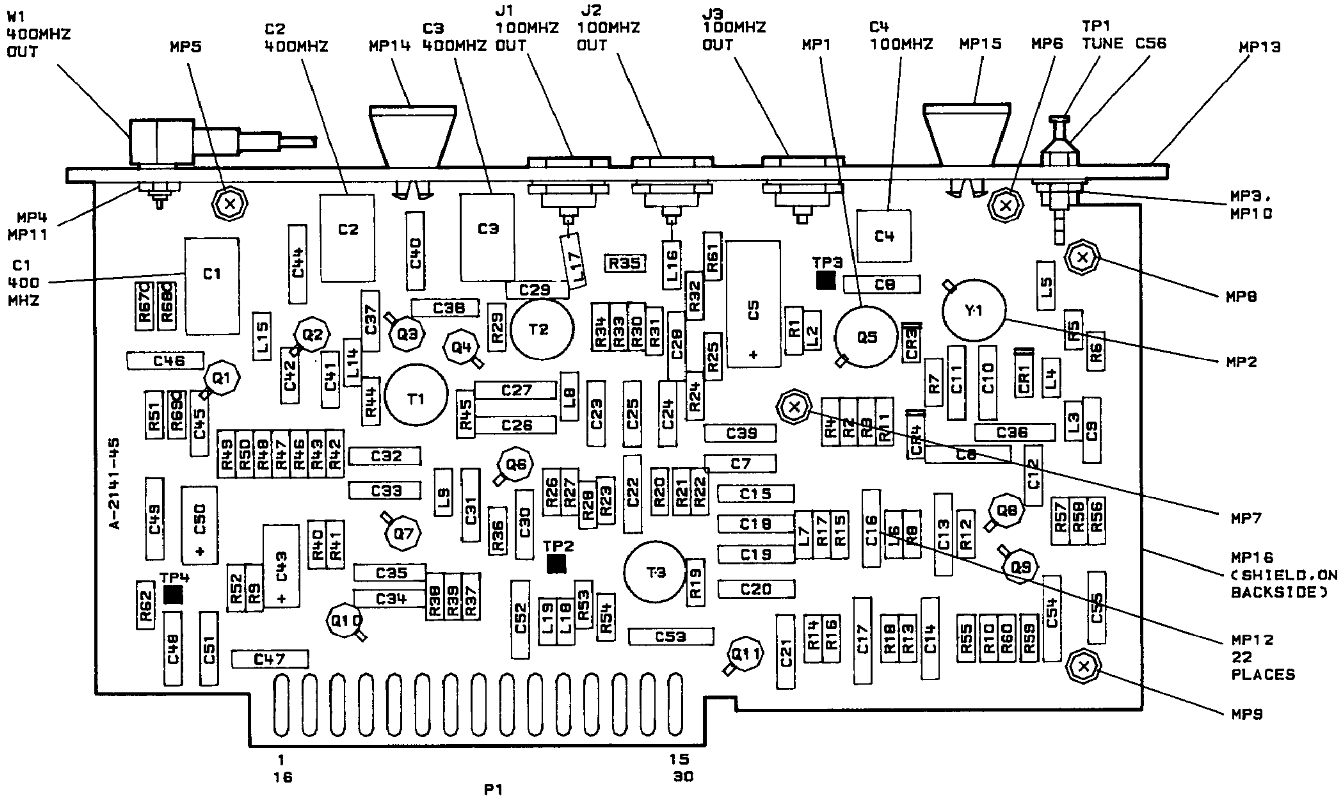


Figure 8B-5. A30 100 MHz VCXO, Component Location Diagram

A30 100 MHz VCXO Pin I/O

Pin	Mnemonic	Levels	Source	Destination
1 2	−10V	−10V	XA34P2-8, 9	*E
3 4	−40V	+40V	XA34P2-6, 7	*A
5 6	+20V GND	+20V 0V	XA34P2-2, 3 INSTRUMENT GROUND	*E *E
7 8	GND GND	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*E *E
9 10	GND GND	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*E *E
11 12	GND TUNE GROUND	0V 0V	INSTRUMENT GROUND XA29P1-12	*E A
13 14	 TUNE VOLTAGE		 XA29P1-13	 A
15	GND	0V	INSTRUMENT GROUND	*E

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A34 Reference Loop — M/N Motherboard Schematic Diagram for a complete representation of signal sources and destinations.

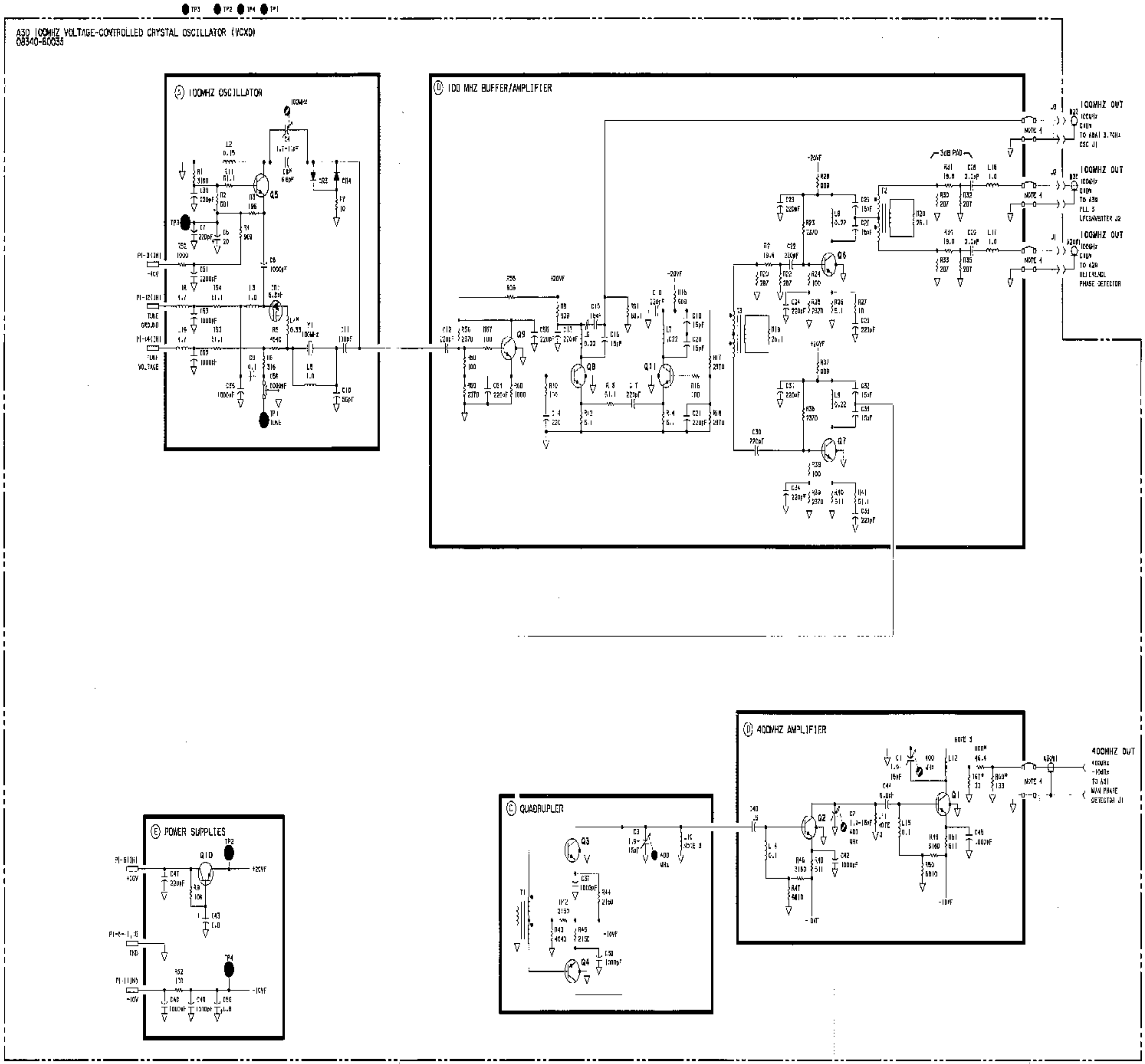


Figure 8B-6. A30 100 MHz VCXO, Schematic Diagram

NOTES:

1. REFER TO THE SERVICE SECTION INTRODUCTION FOR DETAILED SCHEMATIC DIAGRAM SYMBOLOGY NOTES.
2. RESISTANCE VALUES SHOWN ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.
3. L10, L11, AND L12 ARE PLATED ON THE BOARD.
4. J1, J2, J3 AND A3CW1 CENTER CONDUCTORS ARE ELECTRICALLY CONNECTED TO THE PC BOARD THROUGH SOLDERED 24 GAUGE FINE WIRES. THEIR OUTER CONDUCTORS ARE CONNECTED TO PC BOARD GROUND THROUGH MECHANICAL SCREW CONNECTIONS TO THE ASSEMBLY COVER PLATE.

A31 M/N PHASE DETECTOR

INTRODUCTION

The M/N phase detector has two programmable frequency dividers: an M divider and an N divider. M and N are integer numbers which give the ratio of divider input frequency to divider output frequency (i.e. the divide number). The input to the N divider is 20 MHz; the M divider input is the difference frequency between the M/N VCO (355-395 MHz) and 400 MHz. The two divider outputs are compared in a phase/frequency detector. The detector output is amplified and applied to A33 M/N Output where it is used to tune the M/N VCO.

In general, the M/N output frequency from A33 is (200-10*M/N) MHz. The M/N VCO frequency is twice the M/N output frequency. Refer to Figure 8B-10, A31 M/N Phase Detector, Schematic Diagram.

A31 M/N PHASE DETECTOR CIRCUIT DESCRIPTION

TTL ECL Level Translators A

The numbers to program the frequency dividers come from the A59 Digital Interface in binary at TTL levels. U3, U13, and U17 shift these to ECL levels which are approximately -1 volt logic high and -2 volts logic low. N1 and M1 designate the least significant bits.

N Divider B and M Divider C

The Phase Detector Assembly's M and N Dividers are essentially identical in operation. In each case the input frequency is divided by the divide number (a binary coded number input from the Digital Interface Board). The resulting output pulses are frequency and phase compared to produce an error voltage which ultimately tunes the M/N VCO. The following formulas show the frequency relationship of the inputs and outputs of the dividers:

$$f_N = (4/N)(20\ \text{MHz})$$

$$f_M = (4/M)(f_{IF})$$

Where f_N = N Divider Output pulse repetition frequency (PRF) (MHz).

f_M = M Divider Output PRF (MHz)

N = N Divide Number

M = M Divide Number

f_{IF} = M Divider Clock frequency (MHz)

20 MHz = N Divider Clock frequency

$f_N = f_M$ when the loop is phase locked;

Therefore,

$$(4/N)(20\ \text{MHz}) = (4/M)(f_{IF})$$

and f_{IF} = [(M/N) 20] MHz for the phase locked condition.

Because of the similarities of the M and N Dividers, only the N Divider will be described in detail.

The N Divider circuit is clocked by a pulse train derived from the input frequency (in this case the 20 MHz reference signal). The divider outputs 4 pulses for each sequence of clock pulses which add up to the N number. In other words, a pulse is output for each N/4 or N/4 + 1 clock pulses. If dividing the N number by 4 leaves no remainder, the number of clock pulses between output pulses is determined solely by N/4. If there is a remainder, the number of clock pulses between outputs is determined by N/4 and N/4 + 1 where N/4 + 1 replaces N/4 once for each unit in the remainder. For example, if N = 16, then N/4 = 16/4 = 4 with a remainder R = 0. An output pulse occurs for each 4 clock pulses. If N = 19, then N/4 = 19/4 = 4 with R = 3. An output pulse occurs once with a spacing of 4 clock pulses and three times with a spacing of 5 clock pulses.

a. Counting Operation and Control. Refer to the schematic block diagram and the following figure and table entitled Divider Operation, and consider the example of N = 16. At the beginning of a divide sequence (clock 1), the 4 most significant bits (MSB) of the N number (0100) are loaded into U6 (a programmable counter). Clock 2 subtracts 4 (0001) from the previous total leaving (0011); Clock 3 subtracts 4 more and the 0010 output enables the End of Count Decoder. At Clock 4, both the Count Control (U4B) and Output Flip-Flop (U4A) are set. The Count Control outputs (1) inhibit the End of Count Decoder, (2) cause U6 to enter its load mode, and (3) clock the Divider Flip-Flops (U10). The Output Flip-Flop outputs a high to the Phase/Frequency Detector. Clock 5 resets the flip-flops and loads the counter. This series of events repeats itself 3 more times for the N = 16 sequence.

b. Increment Decoder Operation. The Increment Decoder and Divider (U10) (divide-by-four) circuits come into play if the N number cannot be divided by 4 evenly. The 2 least significant bits (LSB) of the N number (N2 and N1) control the output of the Increment Decoder. The divide-by-four circuit provides a sequence of four sequential states, that are input to the Increment Decoder. Each state coincides with one of the four count down sequences whose length is characterized by N/4 or N/4 + 1. Refer to the table entitled Increment Decoder Operation. Note that for the N = 16 sequence, N2 = N1 = 0. As explained in Counting Operation and Control, the Increment Decoder Output Sequence (TP3) never leaves the low state and the count down sequences are N/4. For N = 19 (N2 = N1 = 1) the first output is low with the remaining three high. This means that the first pulse occurs after N/4 clock pulses and the other three occur after N/4 + 1 pulses. During the final three count down sequences, the high at the Increment Decoder Output inhibits U9B allowing the counter to count down to 0001 (rather than 0010) before the End of Count Decoder is enabled through U9A. This allows the extra count to occur. The rest of the sequence occurs as indicated in the previous section. See also the table and figure entitled Divider Operation for N = 19.

With the N input equal to or greater than 16, the N5 or N6 inputs are high and the Divide-by-1 or 2 Decoder is enabled. Thus the Output Flip-Flop follows the Count Control Flip-Flop and each End of Count pulse is passed directly to the output. If N < 16, then the Divide-by-1 or 2 Decoder is enabled and therefore passes only every other End of Count pulse to set the Output Flip-Flop. (Refer to the table entitled Divider Operation and the figure entitled Divider Clock Pulses versus Output Pulses). This circuit reduces the apparent gain of the Phase/Frequency Detector. This keeps the Delta F_{VCO}/Delta V sensitivity of the VCO in a specific portion of its tuning curve thereby keeping the M/N loop bandwidth constant. Note that the N5 and N6 inputs are also connected to the M-Divider in the same manner as in the N Divider. Note also that the frequency of the M and N Divider Outputs is halved for N < 16.

Mixer D

Q3 is an amplifier that drives the LO port of mixer U24. It supplies about +5 dBm over the 355 to 395 MHz range. The output of the mixer is the difference between 400 MHz and the M/N VCO frequency which gives an IF frequency between 5 and 45 MHz. The IF level is about -17 dBm.

IF Amplifier E

The 60 MHz low-pass filter rejects unwanted mixing products from the mixer. Q4 and U18B amplify and limit the IF signal and give it the proper levels to run the following ECL circuitry. These levels are approximately -0.9 volts and -1.7 volts.

Phase/Frequency Detector F

The outputs of the M and N dividers are compared in U1. When they are in phase, the outputs of U1 are narrow, coincident pulses. For unlock conditions, the outputs pulses are of varying widths.

Preamplifier G

Q1 and Q2 are a low-noise differential pair preamplifier. Their outputs are combined in the integrating amplifier of A33.

Phase Lock Indicator H

U2A and U2B are voltage comparators which compare each tune line to the average plus a small offset provided by R29. If the loop unlocks, one of the preamplifier outputs is higher than the comparison voltage, and the phase lock indicator goes high, indicating the unlock condition.

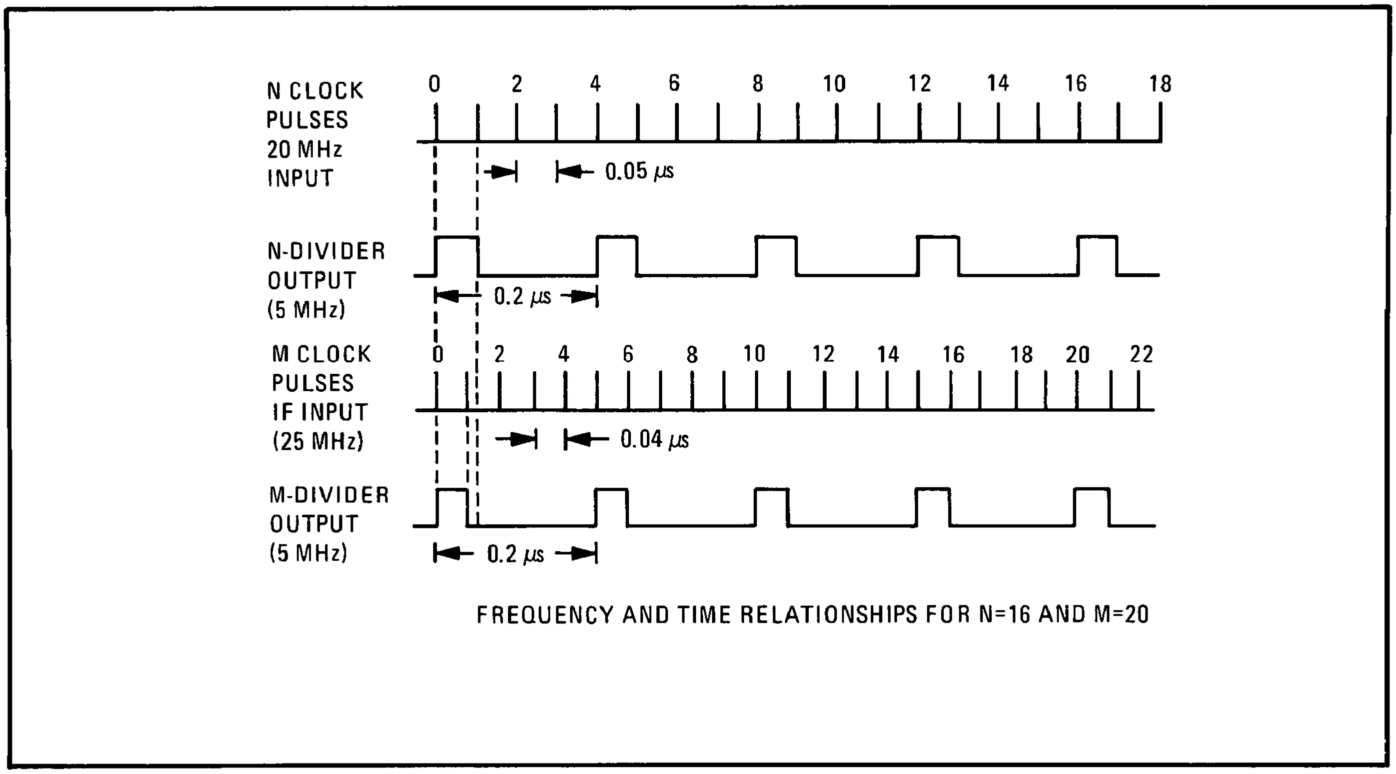


Figure 8B-7. Divider Clock Pulses Versus Output Pulses Frequency and Time Relationship

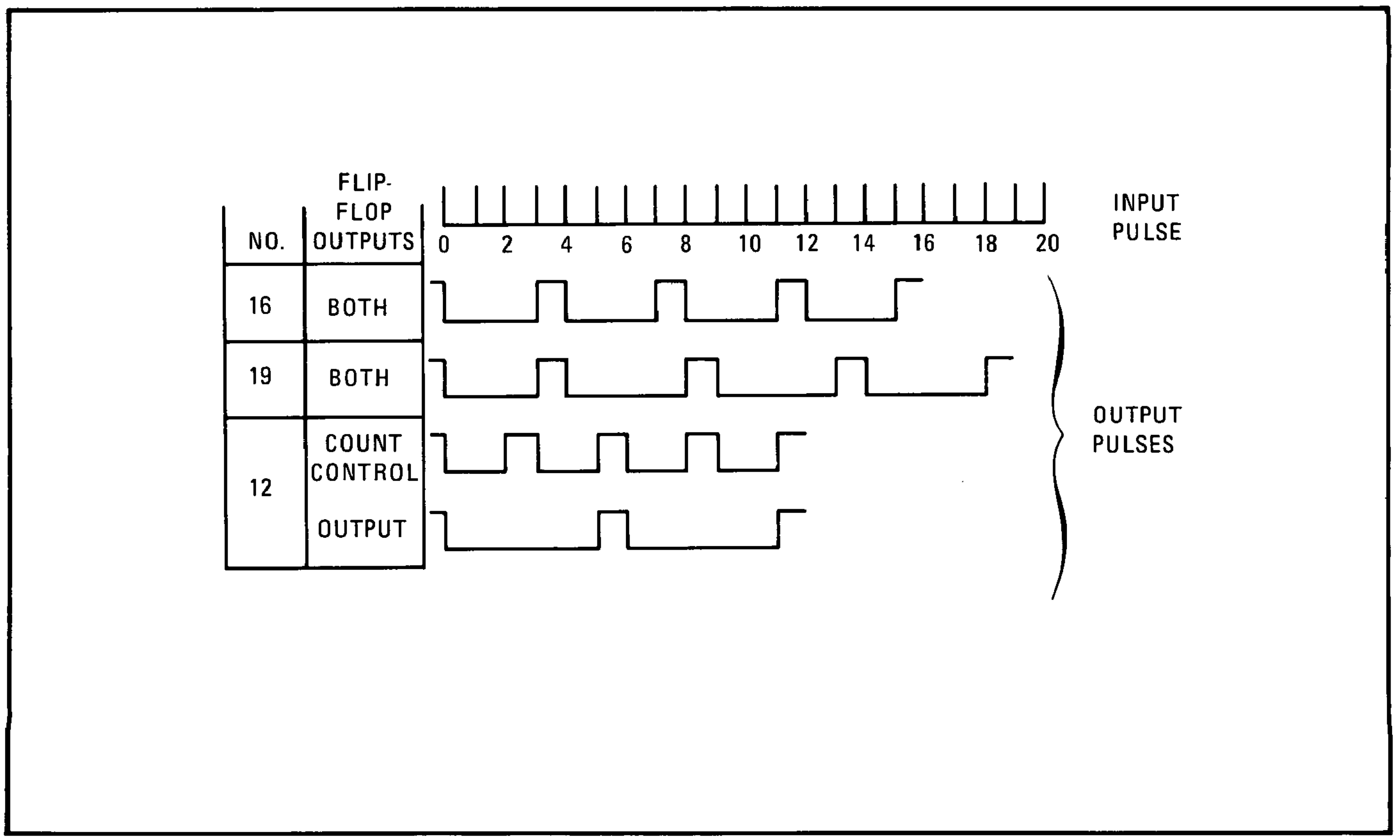


Figure 8B-8. Divider Operation

Table 8B-5. Divider Operations

N	Input Clock Pulses	Operation	N number in Counter (4 MSB)	End of Count Decoder	Flip-Flop Count Control	Flip-Flop Output
16	0, 4, 8, 12	Load Counter	0100	Inactive	Reset	Reset
	1, 5, 9, 13	Minus 4	0011	Inactive	Reset	Reset
	2, 6, 10, 14	Minus 4	0010	Active	Reset	Reset
	3, 7, 11, 15	Minus 4	0001	Inactive	Set	Set
19	0, 4, 9, 14	Load Counter	0100	Inactive	Reset	Reset
	1, 5, 10, 15	Minus 4	0011	Inactive	Reset	Reset
	2, 6, 11, 16	Minus 4	0010	Inactive[1]	Reset	Reset
	3, 7, 12, 17	Minus 4	0001	Active[2]	Reset[3]	Reset[3]
	8, 13, 18	Minus 4	0000	Inactive	Set	Set
12	0, 3, 6, 9	Load Counter	0011	Inactive	Reset	Reset
	1, 4, 7, 10	Minus 4	0010	Active	Reset	Reset
	2, 5, 8, 11	Minus 4	0001	Inactive	Set	Set[4]

[1] Active for step 3 only

[2] Inactive for step 4 only

[3] Set for step 4 only

[4] The Output Flip-Flop is set only every other time the counter control Flip-Flop is set for N<16.

Table 8B-6. Increment Decoder Operation

Increment Decoder Control Inputs		Increment Decoder Output Sequence*			
N2	**N1**	**1**	**2**	**3**	**4**
L(0)	L(0)	L	L	L	L
L(0)	H(1)	L	L	H	L
H(1)	L(0)	L	H	L	H
H(1)	H(1)	L	H	H	H

*The Sequence of four states is controlled by a modified ring counter made up of the two flip-flops contained in U10. The count sequence of U10 may be checked by verifying that the active high outputs of the flip-flops follow the sequence LL, HH, LH, and HL (U10A pin 2, and U10B pin 15, respectively).

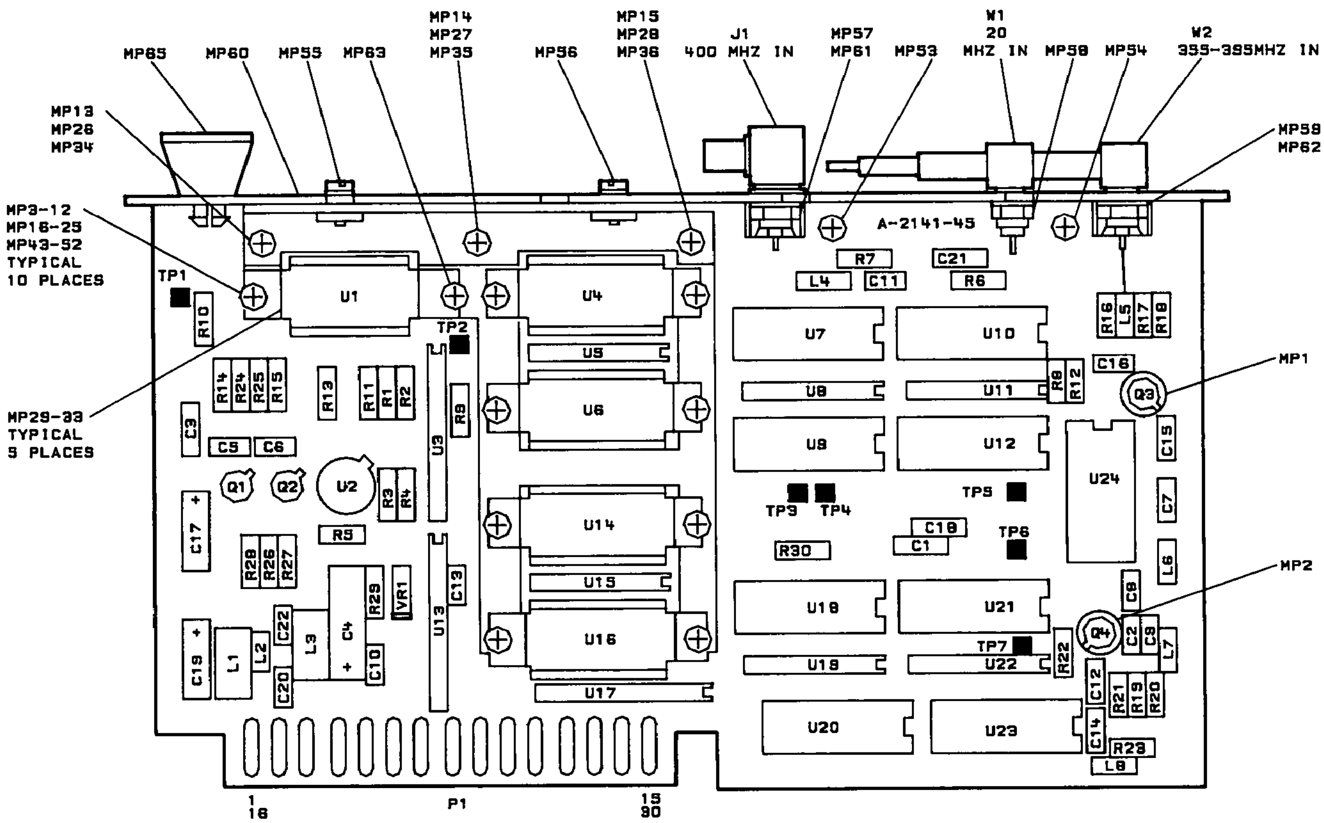


Figure 8B-9. A31 M/N Phase Detector, Component Location Diagram

A31 M/N Phase Detector Pin I/O

Pin	Mnemonic	Levels	Source	Destination
1 16	−10V −10V	−10V −10V	XA34P2-8, 9 XA34P2-8, 9	*I *I
2 17	+20V +20V	+20V +20V	XA34P2-2, 3 XA34P2-2, 3	*I *I
3 18	−5.2V −5.2V	−5.2V −5.2V	XA34P2-12, 13 XA34P2-12, 13	*I *I
4 19	GND GND	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*I *I
5 20	GND GND	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*I *I
6 21	VCO TUNE (−) VCO TUNE (+)		G G	* *
7 22	GND GND	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*I *I
8 23	N1 N2	TTL TTL	XA34P1-15 XA34P1-14	A A
9 24	N5 N6	TTL TTL	XA34P1-11 XA34P1-10	A A
10 25	N3 N4	TTL TTL	XA34P1-13 XA34P1-12	A A
11 26	GND HULM	0V TTL (HIGH TRUE)	INSTRUMENT GROUND H	*I XA34P1-8
12 27	GND GND	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*I *I
13 28	M1 M2	TTL (HIGH TRUE) TTL (HIGH TRUE)	XA34P1-5 XA34P1-6	A A
14 29	M3 M4	TTL (HIGH TRUE) TTL (HIGH TRUE)	XA34P1-3 XA34P1-4	A A
15 30	M5 LMNE	TTL (HIGH TRUE) TTL (LOW TRUE)	XA34P1-1 XA34P1-2	A NOT USED

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A34 Reference Loop — M/N Motherboard Schematic Diagram for a complete representation of signal sources and destinations.

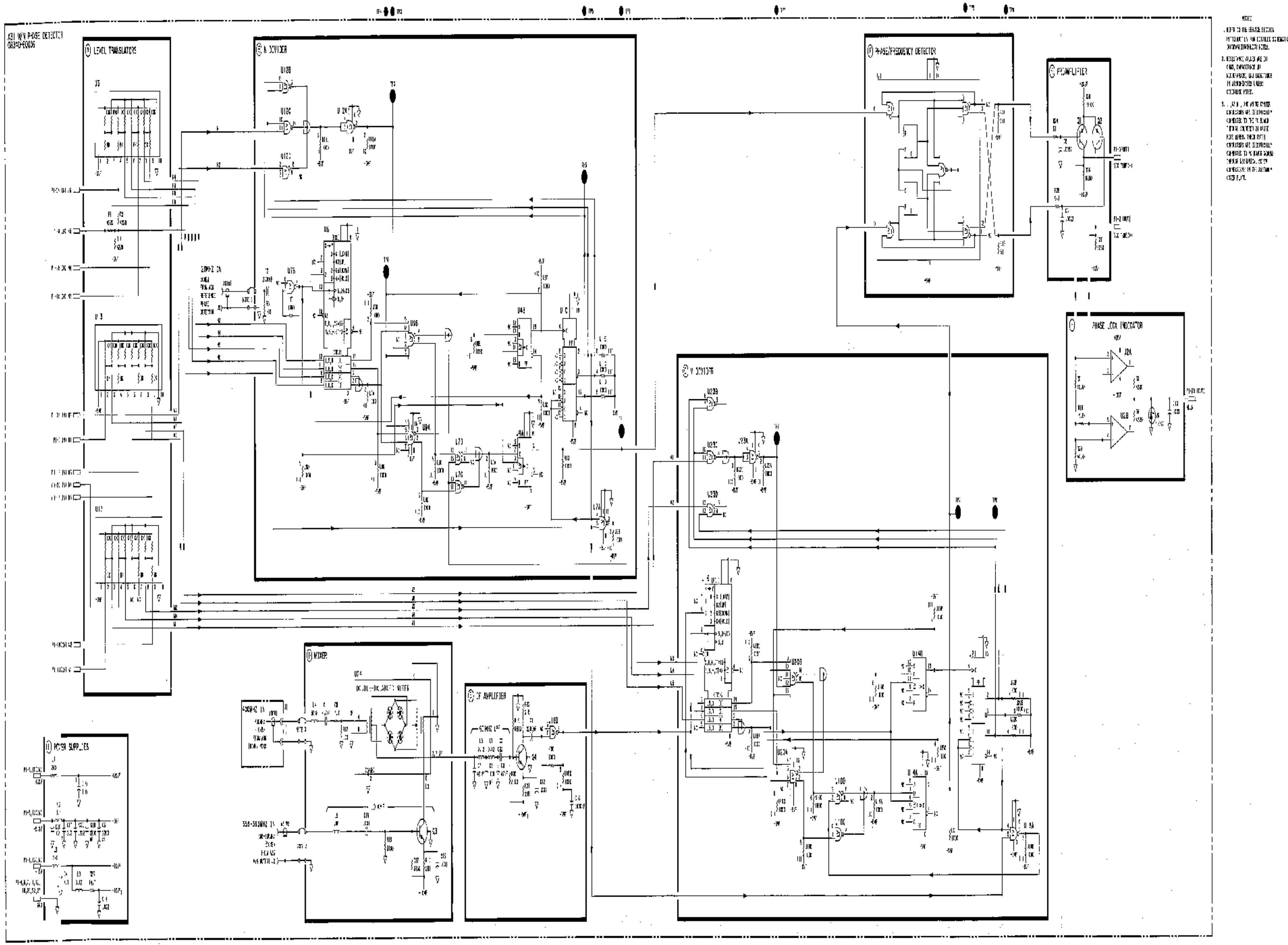


Figure 8B-10. A31 M/N Phase Detector, Schematic Diagram

A32 M/N VOLTAGE-CONTROLLED OSCILLATOR

INTRODUCTION

The M/N VCO (voltage-controlled oscillator) is a varactor-tuned cavity oscillator. It consists of a fore-shortened coaxial cavity resonator, a transistor circuit, and both a mechanical and an electrical tuning mechanism. Refer to Figure 8B-13, A32 M/N VCO and A33 M/N Output Assembly, Schematic Diagram.

A32 M/N VOLTAGE-CONTROLLED OSCILLATOR CIRCUIT DESCRIPTION

A32A2 Voltage-Controlled Oscillator A

The emitter of oscillator transistor, Q2, exhibits negative resistance because of the base inductance, L3, which consists of a fixed length of wire surrounded by air. The function of C8 and R9, together with L3, is to match the (reflective) emitter of Q2 to the cavity resonator. C2 provides a dc block required because the transistor is physically connected to the cavity center post (inductive coupling) that is at DC ground potential. R1, R4, R6, and R8 establish the dc bias for Q2. C3, C5, and C7 are bypass capacitors that also filter power supply noise.

The frequency of the oscillator can be tuned mechanically by adjusting C1, which is a tuning screw that capacitively loads the cavity center post. This is used to adjust the frequency to within the electrical tuning range. The frequency is adjusted electrically by using reverse biased varactor diodes, CR1 and CR2. The reverse bias to the diodes is the TUNE voltage from A33 M/N Output Board. The actual electrical tuning network components are physically located inside the resonator housing. Chip capacitors C2 and C3 are soldered onto the cavity center post. The anodes of varactor diodes CR1 and CR2 are soldered to C2 and C3, respectively, and their cathodes are soldered together to a post contacting the outer wall of the cavity. The result is that the combinations of CR1/C2 and CR2/C3 provide capacitive loading to the cavity resonator at the frequency of oscillaton. The (VCO) TUNe voltage is brought to the varactor diodes through inductors L1 and L2, which are also soldered to C2 and C3, respectively, and to a post that is electrically insulated from the outer wall of the cavity housing and is soldered to the A32A1 PC board.

The output of the VCO is taken directly from the cavity resonator through C5, a capacitively coupled E-field probe. The output power level is adjusted by varying the length of the probe. This signal is applied to the Buffer Amplifier, Block B.

R13 and C11 are part of the feedback network that determines the frequency response of the M/N Phase Locked Loop. (See also the M/N Loop Frequency Response section in the A31 M/N Phase Detector circuit description.)

A32A1 Buffer Amplifier B

The Buffer Amplifier provides both isolation and gain for the VCO output signal. L1 provides an impedance match to the cavity output for the base of Q1, the amplifier transistor. R3, R5, R7, R10, and R11 provide the dc bias for Q1. R3 provides negative feedback for the amplifier, and R2 and L2 provide the output impedance. The Buffer Amplifier provides at least 0 dBm output over the 355 to 395 MHz range of the VCO.

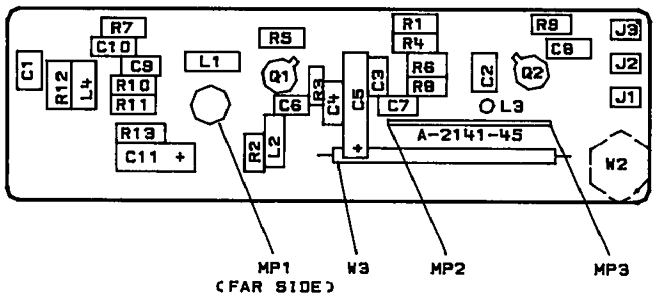


Figure 8B-11. A32 M/N VCO, Component Location Diagram

A33 M/N OUTPUT

INTRODUCTION

The A33 M/N Output board amplifies the output of the A32A2 M/N VCO in two different paths. One path contains amplification and buffering to drive the mixer in the A31 M/N Phase Detector. The other path drives a divide-by-two IC, and the output of the IC, after further amplification, goes to A48 YO Loop Sampler.

Also included on the A33 assembly is the integrating loop amplifier which generates the tuning voltage for the M/N VCO. Refer to Figure 8B-13, A32 M/N VCO and A33 M/N Output Assembly, Schematic Diagram.

A33 M/N OUTPUT CIRCUIT DESCRIPTION

Loop Amplifier A

U1 is connected as a differential-input integrating amplifier. The inputs, VCO TUNE(+) AND VCO TUNE(-), are from the A31 M/N Phase Detector. The single-ended output signal in the range of -5 to -35 volts tunes the A32A2 M/N VCO. C13 and C14 are the integrating capacitors and, with R14-17, establish the frequency response of the integrator. (See also the M/N Loop Frequency Response section in the A31 M/N Phase Detector circuit description.) C12 and C15 are feed-forward compensation capacitors for U1.

The network consisting of VR1, VR2, CR3, and CR4 function to speed up the charging-time response of the output load of U1 whenever the output voltage is changing very rapidly. It does this by bypassing R34 whenever the voltage drop across it reaches approximately 5.6 Vdc (corresponding to an output current of 1.8 mA), thus allowing the circuit to charge with a faster time constant.

At the output of U1, a 200 kHz low-pass filter provides further rejection of the sampling frequency noise (20 MHz divided by N) from the Phase/Frequency Detector (A31 M/N Phase Detector board, Block **F**). The filter has an insignificant effect on the M/N Loop frequency response within the loop bandwidth.

LO Output Amplifier B

The LO Output Amplifier functions as an isolation amplifier. Its forward gain is such that the output signal level is ≥ 0dBm, and the reverse isolation is > 60dB. Q5 is a common-emmiter amplifier followed by a resistive pad (R8, R12, and R13). Q2 is a common-base buffer amplifier which has a tuned output match (L2, L10, and C3). Q1 is another common emitter amplifier that is followed by a 400 MHz low-pass filter for rejection of harmonics. The output, 355-395 MHz OUT, is routed to the A31 M/N Phase Detector board.

LO Amplifier C

The LO Amplifier is used to amplify the coupled-off portion of the A32A2 M/N VCO output signal to increase its level back up to 0 dBm. Q6 is a common-emitter amplifier with gain, and Q7 is an emitter-follower amplifier to provide a low impedance output to drive Divide-By-2, U2, Block **D**. R24 and R25 set the proper dc bias voltage for the ECL divider, U2, so that it can be driven by the 0 dBm signal.

Divide-By-2 D

U2 is an EECL (HP ECL) divider used to generate the M/N output signal which is at one-half the frequency of the M/N VCO. LMNE (Low = M/N Enable) is an M/N Loop control line that could be used to turn on and off the divider through the operation of the TTL-ECL Level Shifter. In the 8340A, the LMNE line is hard wired to ground so that LMNE ia always low. (This board is also used in the M/N loop of the 8566 Signal Analyzer where the LMNE feature is implemented.)

M/N Output Amplifier E

The M/N Output Amplifier buffers and amplifies the output of the Divide-By-2 (Block **D**). Q3 is an emitter-follower buffer amplifier, and Q4 is a common-emitter amplifier. The output of Q4 passes through a 250 MHz low-pass filter to provide the M/N OUT signal which is input to the A48 YO Loop Sampler.

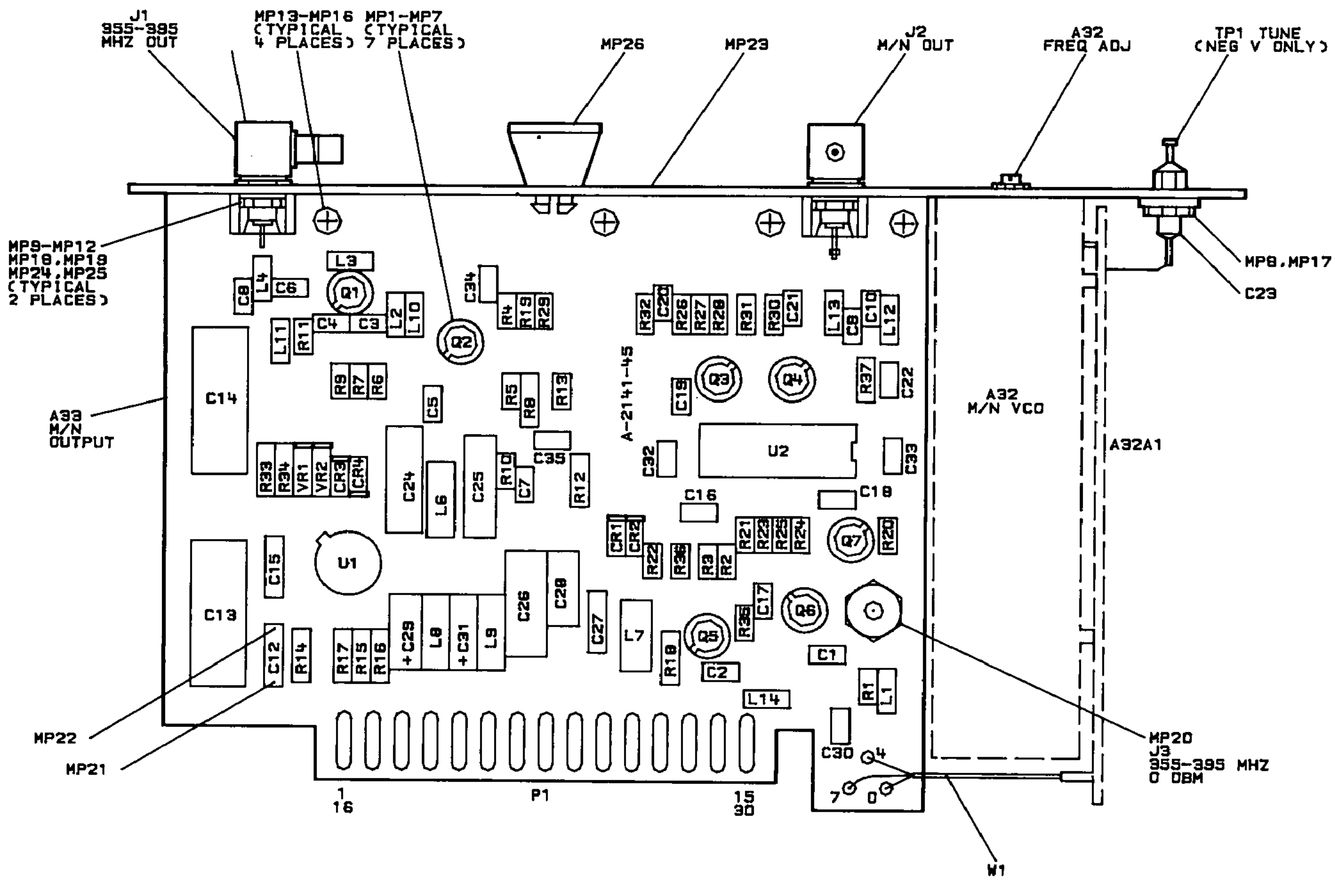


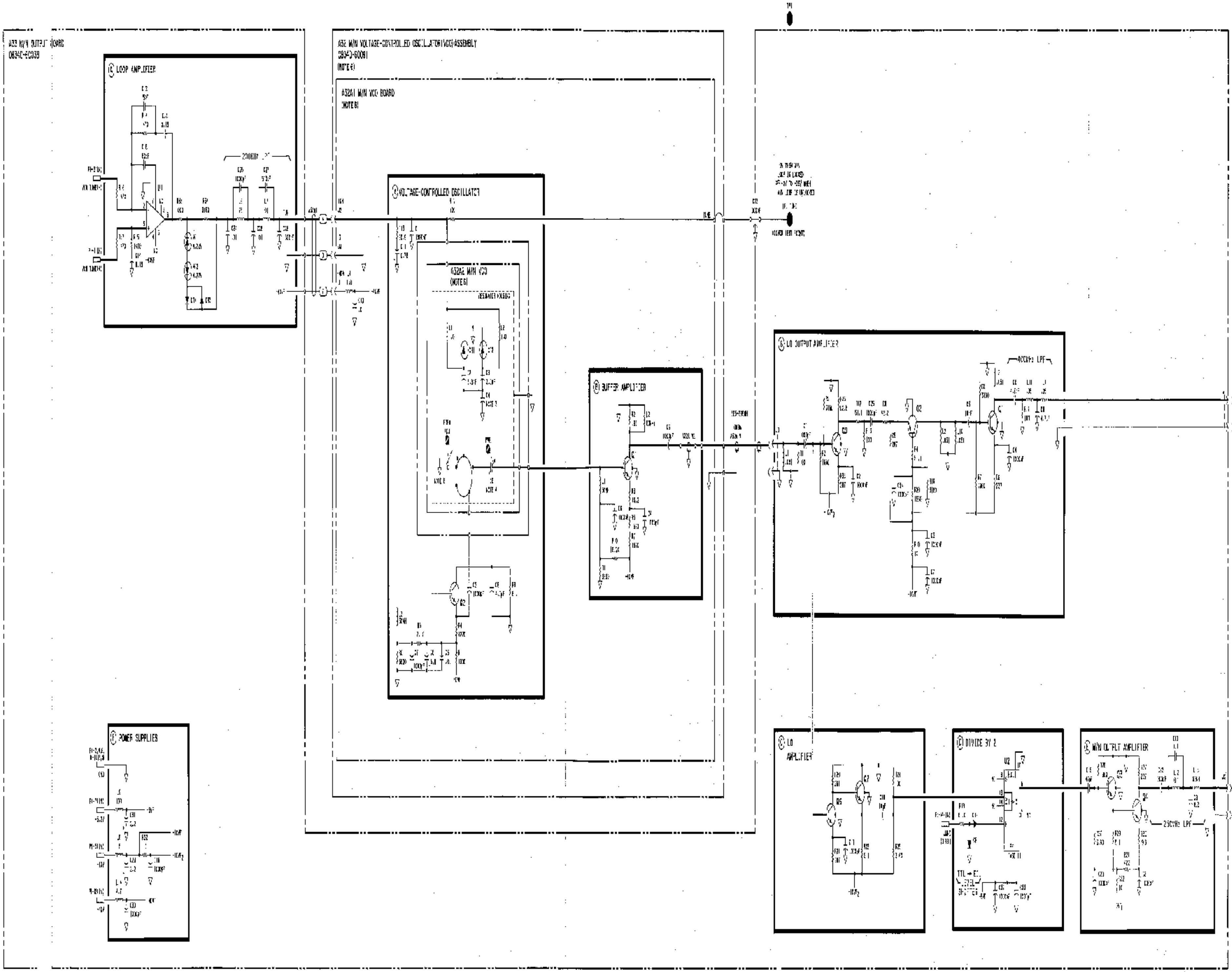
Figure 8B-12. A33 M/N Output Assembly, Component Location Diagram

A33 M/N Output Pin I/O

Pin	Mnemonic	Levels	Source	Destination
1	VCO TUNE (+)		XA31P1-21	A
2	GND	0V	INSTRUMENT GROUND	*F
3	VCO TUNE (−)		XA31P1-6	A
4	GND	0V	INSTRUMENT GROUND	*F
5	−10V	−10V	XA34P2-8, 9	*F
6	GND	0V	INSTRUMENT GROUND	*F
7	−5.2V	−5.2V	XA34P2-12, 13	*F
8	GND	0V	INSTRUMENT GROUND	*F
9	GND	0V	INSTRUMENT GROUND	*F
10	GND	0V	INSTRUMENT GROUND	*F
11	GND	0V	XA34P2-6, 7	*F
12	−40V	−40V	INSTRUMENT GROUND	*F
13	GND	0V		*F
14	LMNE	TTL (LOW TRUE)	INSTRUMENT GROUND	D
15	GND	0V		*F

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A34 Reference Loop — M/N Motherboard Schematic Diagram for a complete representation of signal sources and destinations.



NOTES:

1. REFER TO THE SERVICE SECTION INTRODUCTION FOR DETAILED SCHEMATIC DIAGRAM SYMBOLOGY NOTES.

2. RESISTANCE VALUES ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.

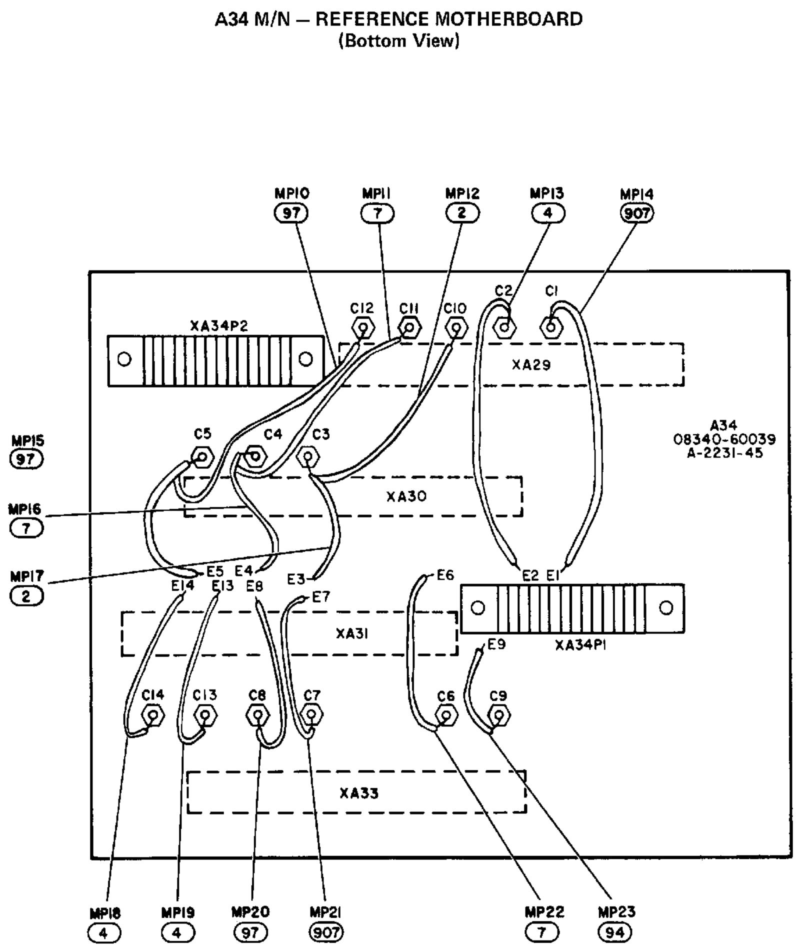
3. A32A2C1 IS AN AIR DIELECTRIC CAPACITOR FORMED BY THE RESONATOR HOUSING AND THE RESONATOR CENTER CONDUCTOR.

4. PWR ADJUSTMENT. THIS IS AN ADJUSTABLE PROBE MOUNTED ON THE A32A1 M/N VCO PC BOARD AND EXTENDING INTO THE RESONATOR HOUSING.

5. FREQ ADJ. THIS IS AN ADJUSTMENT SCREW LOCATED ON THE A32 BOARD COVER.

6. THE VCO ASSEMBLY INCLUDES A32A1 AND A32A2. INDIVIDUAL COMPONENTS IN THE A32A2 ASSEMBLY ARE NOT SEPARATELY REPLACEABLE.

Figure 8D-13. A32 M/N VCO and A33 M/N Output Assembly, Schematic Diagram



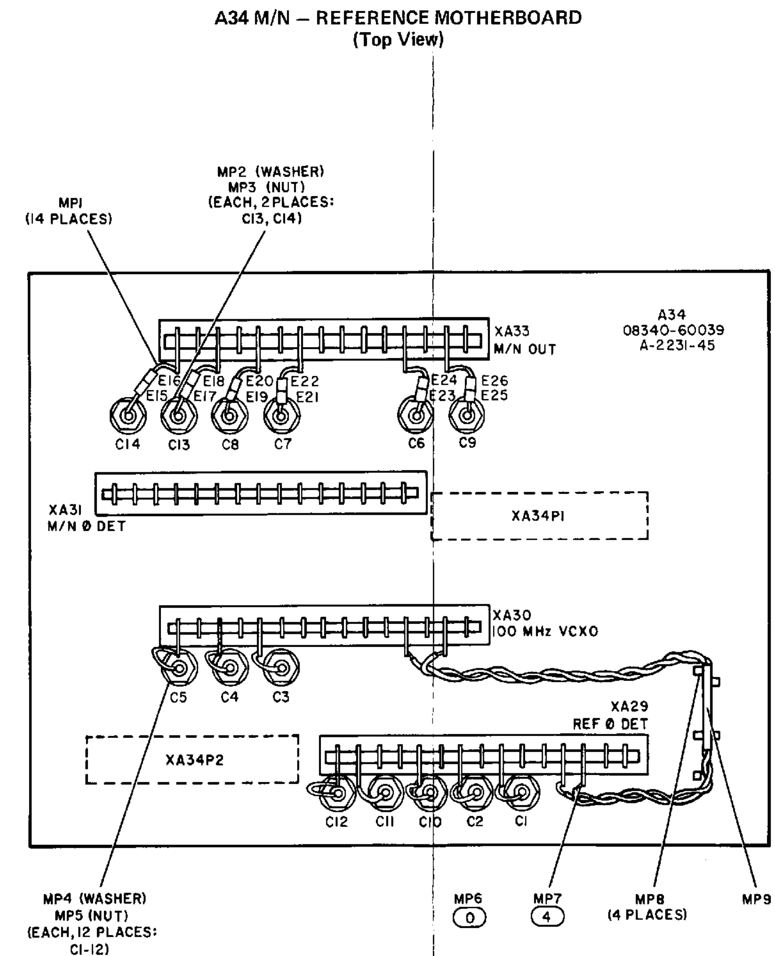


Figure 8B-14. A34 Reference Loop – M/N Loop Motherboard Component Location Diagram

A34 Reference — M/N Motherboard P1 Pin I/O

A34

Pin	Mnemonic	Levels	Source	Destination
1	M5	TTL (HIGH TRUE)	XA59P1-31	XA31P1-15
2	LMNE	TTL (LOW TRUE)	XA59P1-86	*
3	M3	TTL (HIGH TRUE)	XA59P1-32	XA31P1-14
4	M4	TTL (HIGH TRUE)	XA59P1-87	XA31P1-29
5	M1	TTL (HIGH TRUE)	XA59P1-33	XA31P1-13
6	M2	TTL (HIGH TRUE)	XA59P1-88	XA31P1-28
7				
8	HULM	TTL (HIGH TRUE)	XA31P1-26	XA31P1-26
9				
10	N6	TTL	XA59P1-101	XA31P1-24
11	N5	TTL	XA59P1-46	XA31P1-9
12	N4	TTL	XA59P1-102	XA31P1-25
13	N3	TTL	XA59P1-47	XA31P1-10
14	N2	TTL	XA59P1-103	XA31P1-23
15	N1	TTL	XA59P1-48	XA31P1-8

A34 Reference — M/N Motherboard P2 Pin I/O

A34

Pin	Mnemonic	Levels	Source	Destination
1				
2	+20V	+20V	XA52P1-16, 40	*
3	+20V	+20V	XA52P1-16, 40	*
4	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*
5	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*
6	−40V	−40V	XA53P1-11, 30	*
7	−40V	−40V	XA53P1-11, 30	*
8	−10V	−10V	XA53P1-12, 13, 31, 32	*
9	−10V	−10V	XA53P1-12, 13, 31, 32	*
10	GND	0V	A62 STAR GND	*
11	GND	0V	A62 STAR GND	*
12	−5.2V	−5.2V	XA53P1-18, 36	*
13	−5.2V	−5.2V	XA53P1-18, 36	*
14	HULR	TTL (HIGH TRUE)	XA29P1-7	XA29P1-7
15				

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A34 Reference Loop — M/N Motherboard Schematic Diagram for a complete representation of signal sources and destinations.

NOTES:

1. REFER TO THE SERVICE SECTION INTRODUCTION FOR DETAILED SCHEMATIC DIAGRAM SYMBOLOGY NOTES.

2. RESISTANCE VALUES SHOWN ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.

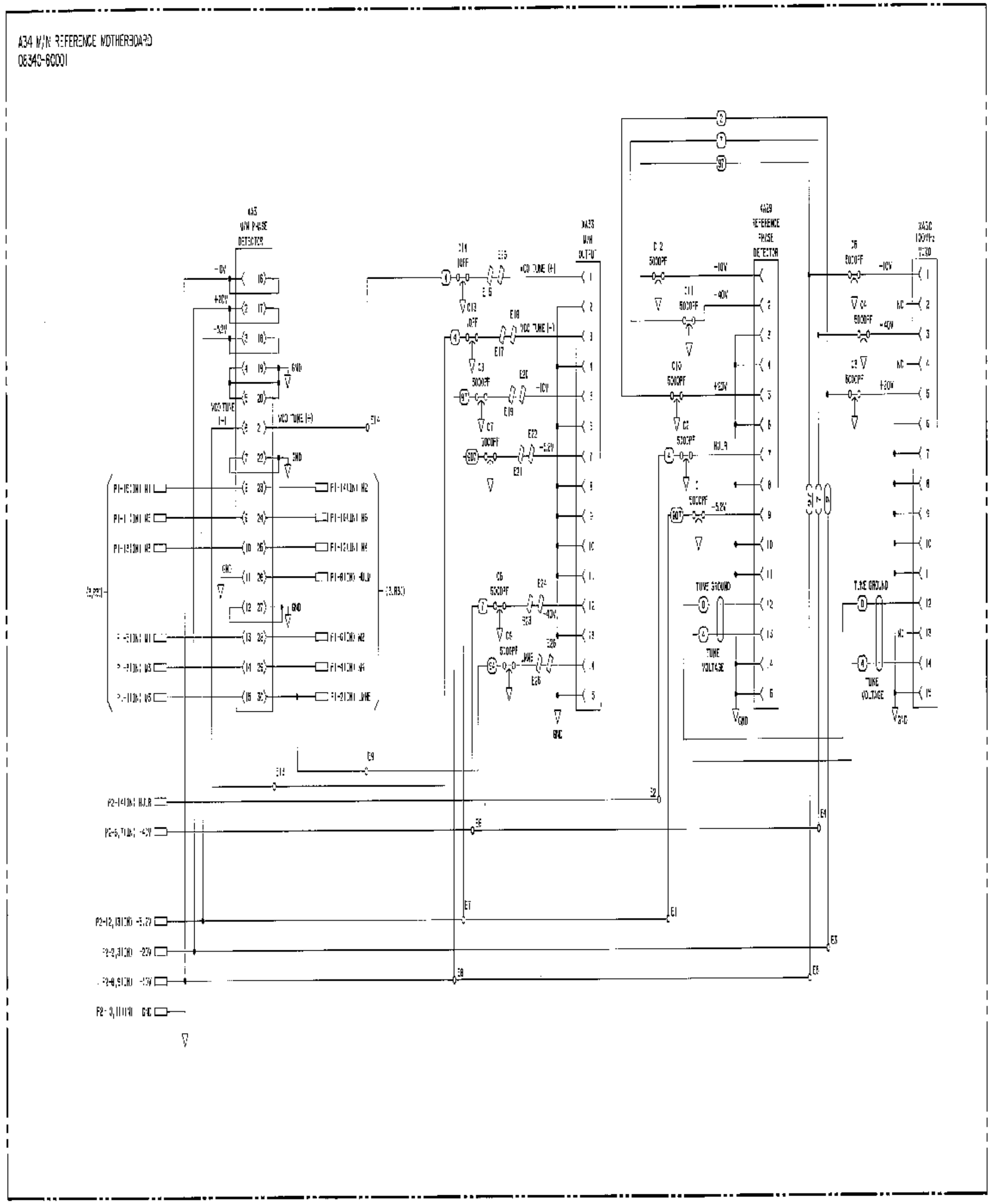


Figure 8B-15. A34 Reference Loop – M/N Loop Motherboard, Schematic Diagram

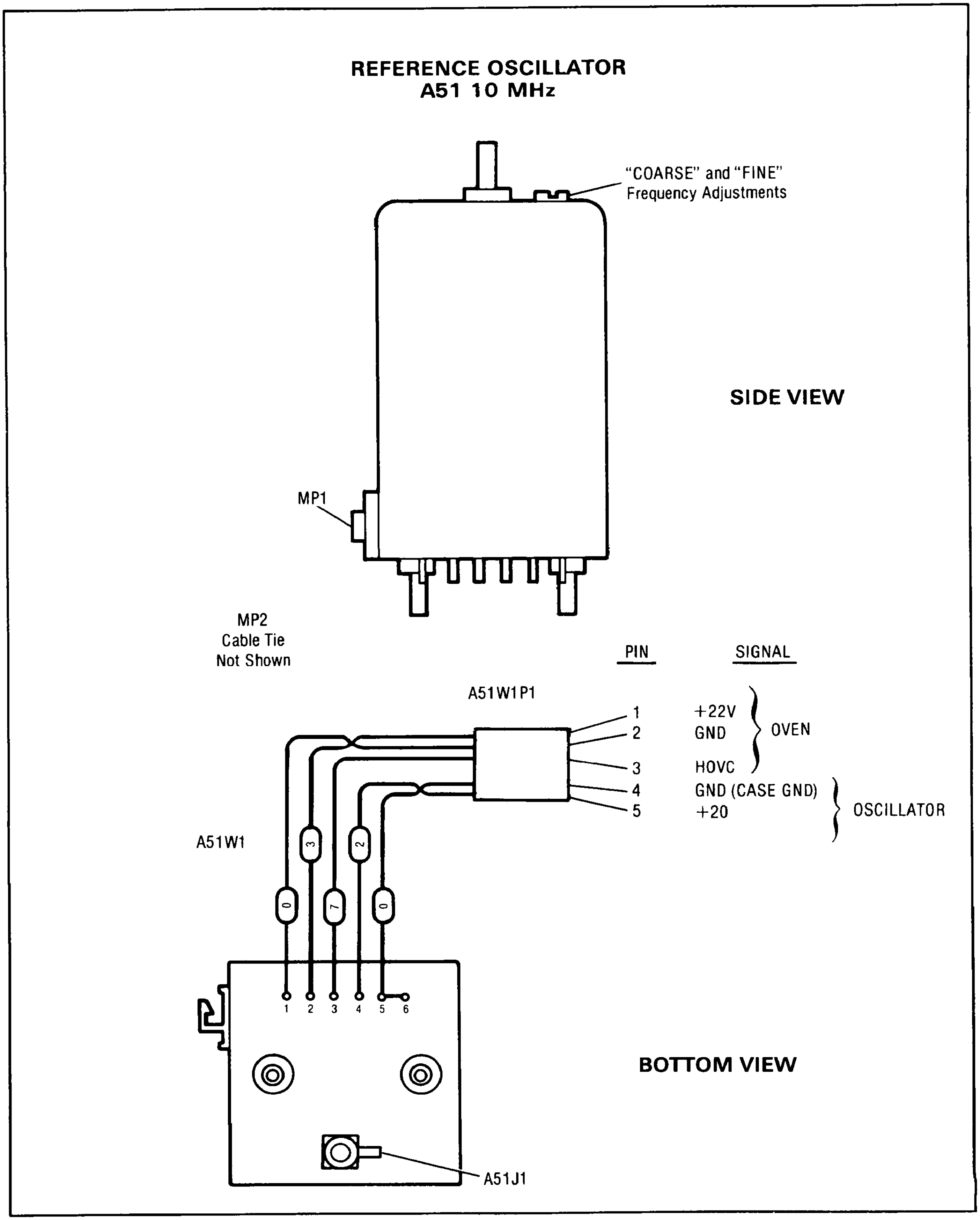


Figure 8B-16. A51 10 MHz Reference Oscillator, Component Location Diagram

A62J3 to A51W1P1 Pin I/O

A62J3

Pin	Mnemonic	A51W1P1	Levels
1	+20V REF OSC	PIN 1	0V/+20V
2	GND	PIN 2	0V
3	HOVC	PIN 3	+3V/OVEN WARM
4	GND	PIN 4	0V
5	+22V	PIN 5	+22V

Note: Refer to M/N and Reference Loops Troubleshooting Block Diagram and A62 Motherboard Wiring List for signal source and destination information.

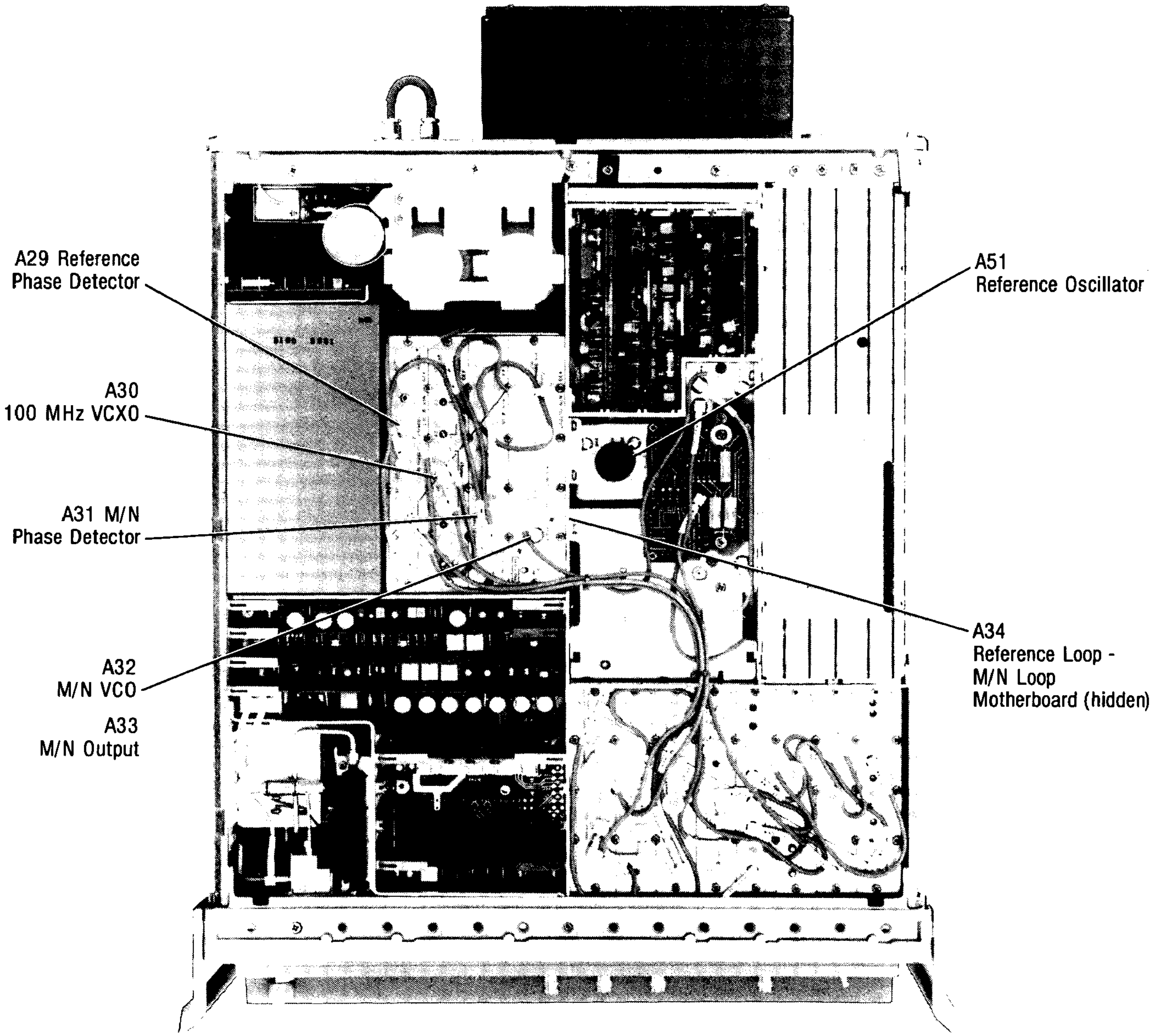
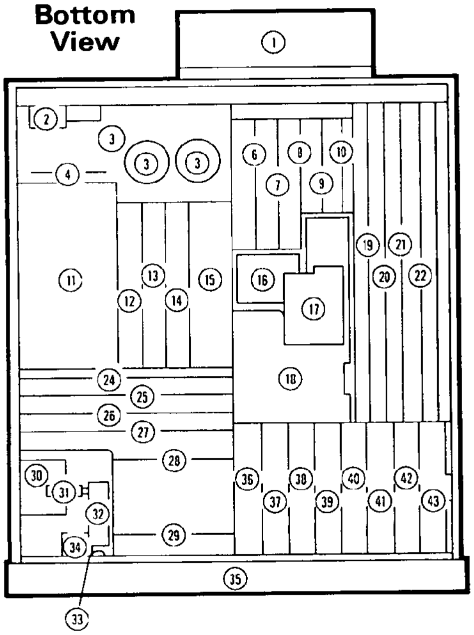
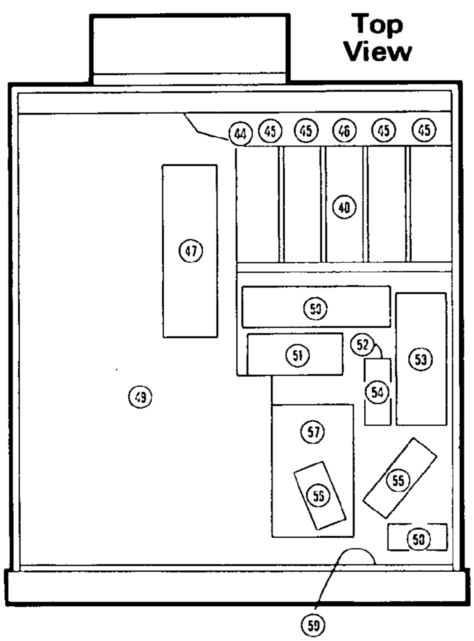


Figure 8B-17. Reference Loop - M/N Loop Major Assemblies Location

REFERENCE GUIDE TO SERVICE DOCUMENTATION





Assy./Ref. Des.	Description	Location	Ref.-M/N Loops (Volume 3)	20-30 Loops (Volume 3)	Swp. Gen.-YO Loop (Volume 3)	Motherboard (Volume 3)	Controller (Volume 3)	Front/Rear Panel (Volume 4)	RF Section (Volume 4)	Power Supplies (Volume 4)
A1	Alpha Display	33						•		
A2	Display Driver	33						•		
A3	Display Processor	33						•		
A4	Not Assigned	-								
A5	Keyboard	35						•		
A6	Keyboard Interface	35						•		
A7	Lower Keyboard	35						•		
A8	3.7 GHz Oscillator	57							•	
A9	Band 0 Pulse Modulator	56							•	
A10	Directional Coupler	32							•	
A11	Band 1-4 Detector	31							•	
A12	Band 0 Splitter/Detector	34							•	
A13	SYTM (Switched YIG Tuned Multiplier)	30							•	
A14	Band 1-4 Power Amplifier	53							•	
A15	Band 0 Low Pass Filter	52							•	
A16	Band 1-4 Modulator/Splitter	51							•	
A17	Band 0 Mixer	54							•	
A18	Band 0 Power Amplifier	55							•	
		60							•	
A19	Capacitor Assembly	48								•
A20	RF Section Filter	50							•	
A21	Pulse Modulator Driver	29							•	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	28							•	
A25	ALC Detector	27							•	
A26	Linear Modulator	26							•	
A27	Level Control	25							•	
A28	SYTM Driver	24							•	
A29	Reference Phase Detector	12	•							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	•							
A31	M/N Phase Detector	14	•							
A32	M/N VCO (Voltage Controlled Osc.)	[illegible]	•							
A33	M/N Output	15	•							
A34	Reference-M/N Motherboard	5	•							
A35	Rectifier	[illegible]								•
A36	PLL1 VCO (Voltage Controlled Osc.)	36		•						
A37	PLL1 Divider	37		•						
A38	PLL1 IF	38		•						
A39	PLL3 Upconverter	39		•						
A40	PLL2 VCO (Voltage Controlled Osc.)	40		•						
A41	PLL2 Phase Detector	41		•						
A42	PLL2 Divider	42		•						
A43	PLL2 Discriminator	43		•						
A44	YIG Oscillator (YO)	18			•					
A45	Directional Coupler	18			•					
A46	7 GHz Low Pass Filter	18			•					
A47	Sense Resistor Assembly (YO circuit)	47			•					
	(SYTM circuit)	47							•	
A48	YO Loop Sampler	[illegible]			•					
A49	YO Loop Phase/Detector	[illegible]			•					
A50	YO Loop Interconnect	[illegible]			•					
A51	Reference Oscillator	16	•							
A52	Positive Regulator	6								•
A53	Negative Regulator	7								•
A54	YO Pretune/Delay Compensation	8			•					
A55	YO Driver	9			•					
A56	−15V Regulator	10								•
A57	Marker/Bandcross	19					•			
A58	Sweep Generator	20			•					
A59	Digital Interface	21					•			
A60	Processor	22					•			
A61	Not Assigned	23					•			
A62	Motherboard	49				•				
A63	90 dB RF Attenuator	59							•	
AT1	Peripheral Mode Isolator	58							•	
AT2	15 dB Attenuator	[illegible]			•					
B1	Fan Assembly	1								•
A62C1-3	Power Supply Filter Capacitors	3								•
FL1	AC Line Module	2								•
A62Q1-4	Power Supply Regulating Transistors	45								•
A62S1	Power Supply Thermal Switch	44								•
T1	Power Supply Transformer	11								•
A62U1	Power Supply Regulator	46								•

20-30 LOOPS C

20-30 LOOP
INTRODUCTION

This functional group contains the following information:

- Overall description of the 20-30 Loop.
- Simplified Block Diagram.
- Overall descriptions of individual PLL2, PLL3, and PLL1 Loops.
- Troubleshooting Block Diagram.
- Circuit Descriptions, Component Location Diagrams, Pin I/O Tables, and Schematic Diagrams for all 20-30 Loop Assemblies.

LIST OF ASSEMBLIES

PLL2 Assemblies

- A40 PLL2 VCO (Voltage Controlled Osc.)
- A41 PLL2 Phase Detector
- A42 PLL2 Divider
- A43 PLL2 Discriminator

PLL3 Assembly

- A39 PLL3 Upconverter

PLL1 Assemblies

- A36 PLL1 VCO (Voltage Controlled Osc.)
- A37 PLL1 Divider
- A38 PLL1 IF

20-30 LOOP
OVERALL DESCRIPTION

INTRODUCTION

The 20-30 Loop consists of the following assemblies:

A36 PLL1 VCO
A37 PLL1 DIVIDER
A38 PLL1 IF
A39 PLL3 UP CONVERTER
A40 PLL2 VCO
A41 PLL2 PHASE DETECTOR
A42 PLL2 DIVIDER
A43 PLL2 DISCRIMINATOR

DESCRIPTION

The 20-30 Loop provides the 8340A with 1 Hz CW (YO) tuning resolution. In swept frequency modes the 20-30 Loop provides high resolution tuning in sweep widths from 100 Hz to 5 MHz.

In sweep widths less than 5 MHz, the YO Loop remains phase-locked during the sweep, and the 20-30 Loop is swept the desired amount. For sweep widths greater than 5 MHz, the 20-30 Loop remains fixed and the YO is swept (lock and roll sweep).

These assemblies form a frequency synthesizer with the following performance characteristics:

- Fixed frequency output range from 20 to 30 MHz
- Analog sweep widths between 100 Hz and 5 MHz
- CW frequency resolution as low as 1 Hz

The 20-30 Loop contains three phase locked loops that are used in three different configurations to achieve the required CW resolution and sweep range. The loops are referred to as PLL1, PLL2 and PLL3. PLL2 is always used in the 8340A, regardless of the instrument's mode of operation. PLL1 and PLL3 are arranged to be phase-locked to the output of PLL2, and can sweep while locked to PLL2.

NOTE:

Figure 8C-1, 20-30 Loop Simplified Block Diagram, illustrates the three configurations mentioned below.

CONFIGURATION 1

This configuration is used in YO sweep widths from 5 MHz to >100 kHz.

PLL2 phase-locks a 75 to 150 MHz VCO to a 10 MHz reference frequency derived from the Reference Loop. The PLL2 VCO is programmable in 5 kHz steps, and it can be swept a maximum of 25 MHz using a lock and roll analog sweep. To improve the linearity of this sweep, a very linear discriminator is used in a feedback loop around the VCO. This results in sweep accuracies that are mainly a function of discriminator linearity, and removes the effects of VCO tuning non-linearities. The sample-and-hold circuit for the PLL2 Loop has an extremely low amount of drift. A capacitor cannot hold the error voltage constant during a slow sweep, due to the amount of leakage that is present. Instead, the majority of the error voltage is stored in digital form so that it will remain stable during the sweep.

The output of the PLL2 VCO is divided-down through several stages of digital frequency dividers. By dividing the 75 to 150 MHz VCO by 5 an output is generated in the frequency range of 15 to 30 MHz. The VCO resolution is 5 kHz, so the divided output will have 1 kHz resolution. The VCO can be swept a maximum of 25 MHz, so the divided output will sweep up to 5 MHz sweep widths. This path is used directly as one of the three configurations of the 20-30 Loop. Notice that PLL1 and PLL3 are not used at all in this configuration.

CONFIGURATION 2 & 3

These configurations are used in sweep widths $\leq$ 100 kHz. For sweep widths below .1 MHz, configuration 1 provides insufficient resolution (1 kHz) to set the start frequency to closer than 0.5% of the sweep width. To provide for finer resolution, the output of the PLL2 VCO is divided by 25 (divided by 5 twice). The resultant signal has a 200 Hz resolution, is between 3 and 6 MHz, and can be swept with sweep widths up to 1 MHz. This PLL2 output is used in configuration 2. For sweep widths less than 5 kHz, configuration 2 will not provide sufficient resolution, so a third output (configuration 3) is provided. The PLL2 VCO is divided by 500 (divided by 5 twice, then divided by 20) and the output is used in configuration 3.

The two divided outputs of the PLL2 VCO (divided by 25, divided by 500) are used for configuration 2 and 3 to improve the resolution of PLL2. The frequency, however, is also reduced such that it is no longer in the 20 to 30 MHz range. PLL1 and PLL3

Loops are used to translate the high resolution, low frequency PLL2 output up to a 200 to 300 MHz range. Since a translation is a fixed offset in frequency, it will not change the resolution as does dividing or multiplying. After the frequency translation, the output of PLL1 is divided by 10 to reduce the frequency from 200-300 MHz to 20-30 MHz. This also increases the output resolution by a factor of 10.

PLL3 functions as a fixed 160 MHz frequency offset to the PLL2 output. PLL3 phase-locks a 160 to 166 MHz VCO to one of the divided down outputs of the PLL2 VCO, such that PLL3 VCO will be 160 MHz above the selected PLL2 output. PLL3 uses a reference signal from the 100 MHz VCXO reference to generate the 160 MHz offsetting frequency. As the PLL2 divided-down output changes frequency, the PLL3 output will also change frequency with the same resolution and sweep width, but at a higher operating frequency.

PLL1 functions as a programmable offset to the output of PLL3. Like PLL3, it will not effect the resolution since it is an offset. The selected PLL2 divided output is still determining the resolution and sweep width of the signal. PLL1 contains a 200 to 300 MHz VCO that will be locked such that its frequency will be exactly N1*10 MHz above the PLL3 output, where N1 is a number programmed between 3.60 and 13.97.

The output of the PLL1 VCO is divided by 10 to become the output of the 20-30 Loop for configuration 2 and 3. By dividing by 10, the PLL1 200-300 MHz VCO is reduced to the 20 to 30 MHz range and the PLL2 MHz resolution is increased by another factor of 10.

Refer to Figure 8C-7, 20-30 Loop Block Diagram, or Figure 8C-1, 20-30 Loop Simplified Block Diagram, for further information.

The three configurations are summarized in Table 8C-1.

Table 8C-1. 20-30 Loop Parameters

8340 SWEEP WIDTH (YO)	Loops Used: PLL1	PLL2	PLL3	PLL2 VCO divided by:	Divide by 10 (PLL1)	Total divide number	20-30 output resolution
5 MHz to >100 kHz	-	X	-	5	--	5	1 kHz
100 kHz to >5 kHz	X	X	X	25	10	250	20 Hz
5 kHz to 100 Hz and CW Mode	X	X	X	500	10	5000	1 Hz

FOR ΔF ≤ 5MHz, BAND 1 TO 11

ΔF:	5MHz TO 0.1MHz	100kHz TO 5kHz	5kHz TO 100kHz AND CW MODE
STEP SIZE: OUT OF 20-30MHz	1kHz	50Hz	1Hz
SWITCH POSITION: (CONFIGURATION)	1	2	3

WHERE n = HARMONIC MIXING NUMBER OF SYTM 11 TO 41

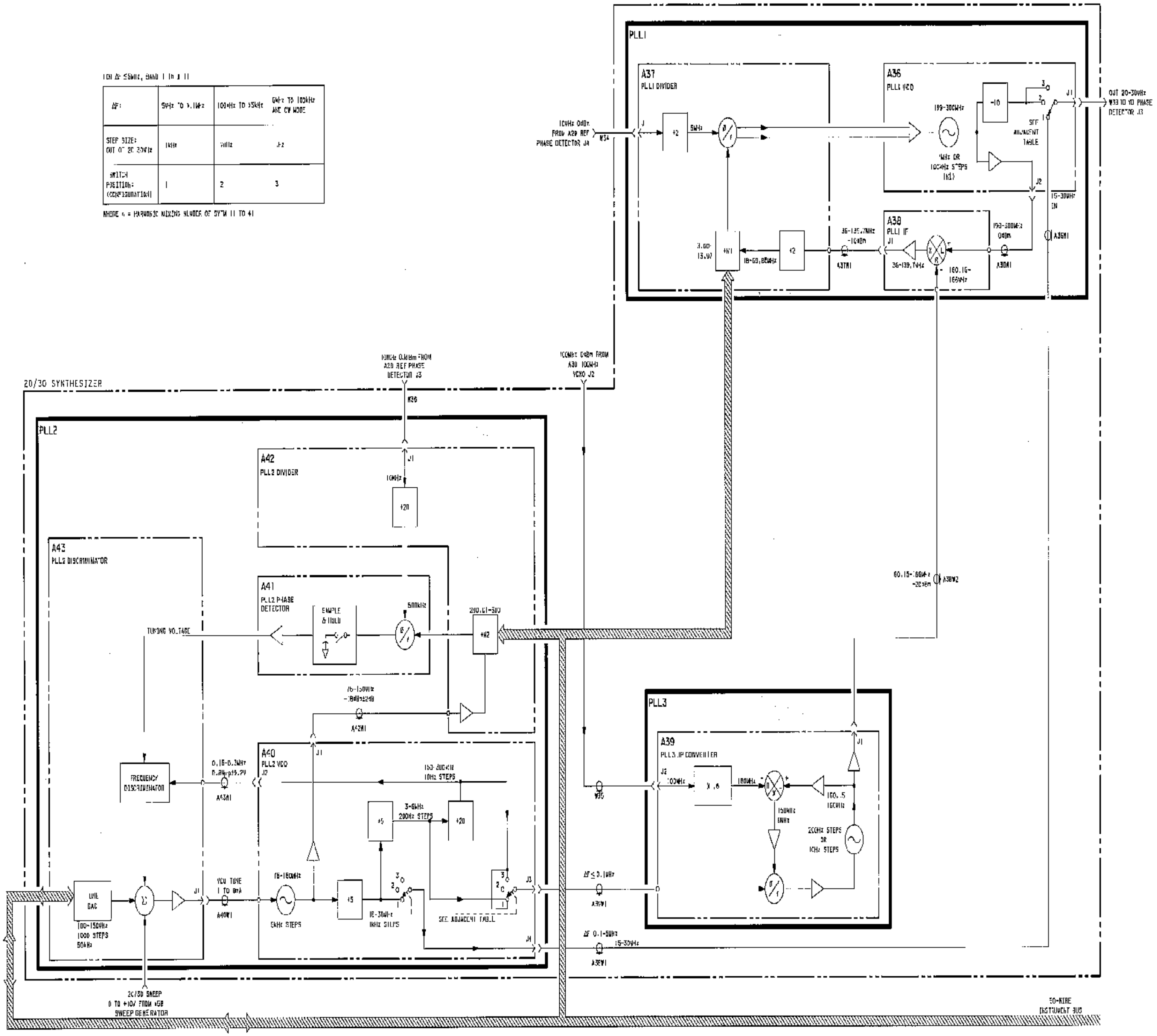


Figure 8C-1. 20/30 Loop Simplified Block Diagram

PLL2 OVERALL DESCRIPTION

INTRODUCTION

PLL2 (Phase Lock Loop 2) is part of the 20-30 Loop Synthesizer. It consists of the following assemblies:

- A40 PLL2 VCO
- A41 PLL2 PHASE DETECTOR
- A42 PLL2 DIVIDER
- A43 PLL2 DISCRIMINATOR

Unlike the PLL3 and PLL1 Loops, the PLL2 Loop is always used. PLL2 provides the 20-30 Loop output directly in swept frequency modes when YO sweep width is 100kHz to 5 MHz. During YO sweep widths of 100 Hz to <100 kHz, the output of PLL2 is divided to produce a higher resolution output. The frequency, however, is also reduced such that it is no longer in the 20 to 30 MHz range. PLL3 and PLL1 Loops are used to translate the high resolution, low frequency PLL2 output back up to the proper frequency range. The PLL3 and PLL1 Loops are phase-locked to PLL2 and will track if PLL2 is swept. PLL2, PLL3, and PLL1 operate together to produce high resolution tuning in CW Mode.

DISCRIMINATOR FEEDBACK

In narrow sweeps, ≤5 MHz, it is the 20-30 Loop that is being swept. Since PLL2 is the loop that PLL1, PLL3, and the YO Loop track, its sweep accuracy will determine the instrument's sweep accuracy. To improve the accuracy of the sweeps, a discriminator is used in a feedback loop around PLL2 VCO. The discriminator is a very accurate frequency-to-current converter. Its frequency-to-current ratio is much more linear than the VCO tuning characteristics, so using the discriminator as the feedback element will produce the equivalent of an extremely linear VCO. This is diagrammed in Figure 8C-2. The tuning linearity of this VCO/Discriminator combination is primarily a function of the discriminator and not of the VCO.

PHASE-LOCK OPERATION

There are two feedback paths around the PLL2 VCO; one is the discriminator described above, and the other is the phase-lock loop path. If one considers the discriminator to be a part of a linearized VCO, then there is only the one phase-lock loop feedback path to consider. This is shown in Figure 8C-3.

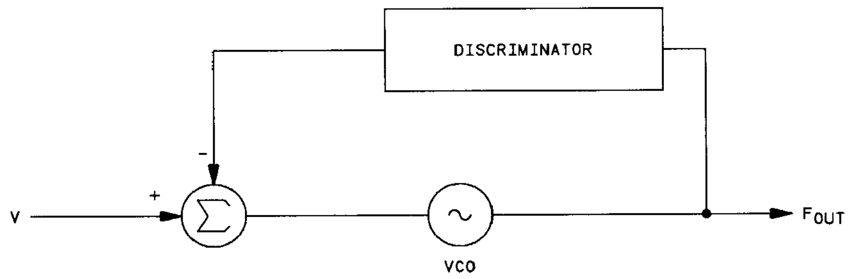


Figure 8C-2. PLL2 Discriminator Feedback

The phase lock loop path is closed during the pre-sweep interval in swept modes, and is closed at all times in CW mode of operation. While the loop is locked, the sweep ramp input is zero volts and the phase detector output tunes the VCO by changing the frequency-to-current ratio of the discriminator. After phase-lock has been established, the phase-lock loop path is opened and the error voltage (ie. tune voltage to discriminator) is stored in a sample-and-hold circuit. In this way, the start frequency of the sweep is established with phase-locked precision and the discriminator frequency-to- current ratio is calibrated to remove any warmup or drift effects. To sweep the VCO, a precision voltage ramp is summed into the input of the discriminator/VCO combination. Since the discriminator feedback loop is still intact and the phase lock loop is now opened, any voltage introduced at the input to the discriminator/VCO will be cancelled through negative feedback. The result is a ramp in the VCO frequency that will cause the discriminator output to exactly cancel the sweep ramp at the input.

SAMPLE-AND-HOLD CIRCUIT

The sample-and-hold circuit that retains the discriminator tuning voltage during the sweep must have extremely low drift to maintain the sweep accuracy over a 200 second sweep. This is accomplished by using an analog integrator to store a small portion of the error voltage, and storing the most significant portion in a digital form. The analog integrator may drift but the effect on the sweep accuracy is slight since the significant portion of the error voltage is in digital form, and will remain stable during the sweep. A simplified diagram of the sample-and-hold is shown in Figure 8C-4.

Whenever the voltage stored on the integrator capacitor exceeds

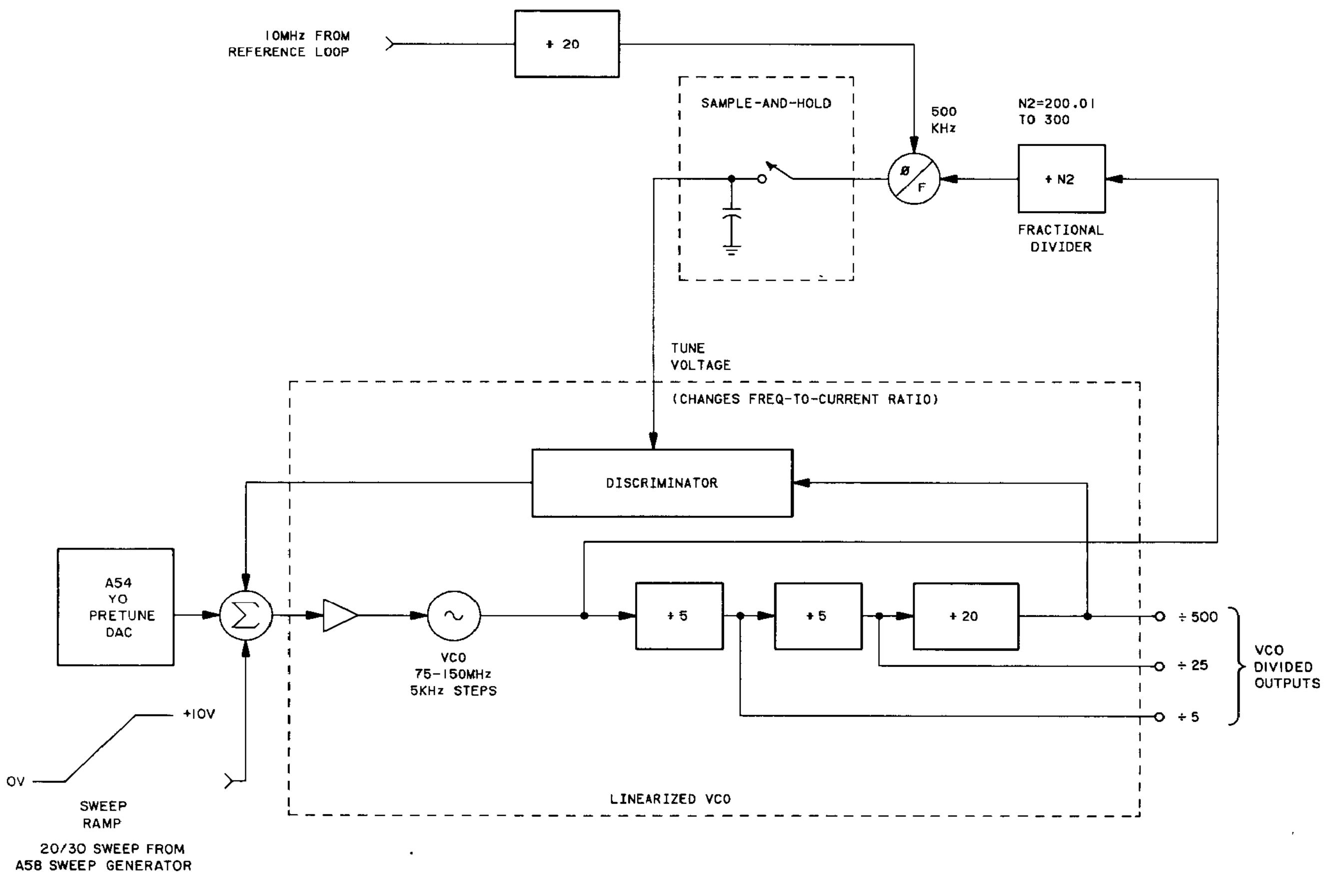


Figure 8C-3. Phase Lock Loop 2 Operation

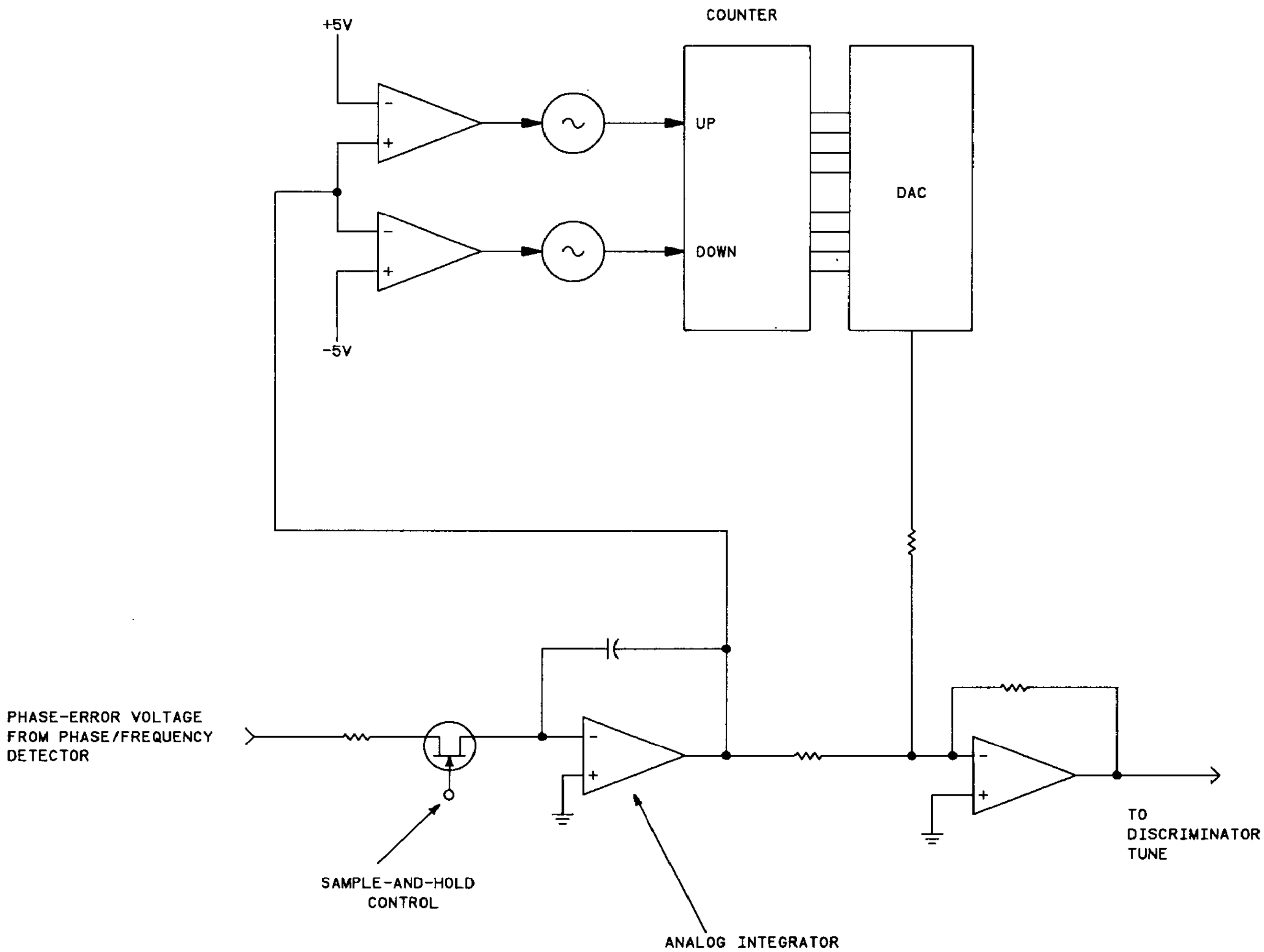


Figure 8C-4. PLL2 Simplified Sample and Hold Circuit approximately ± 5V, one of the two comparators will turn on its associated clock. The clock will either increment or decrement the counter which will increase or decrease the current out of the DAC. The DAC output will further correct the tuning voltage for the discriminator, thereby reducing the voltage on the integrator capacitor to within the ±5V window. To hold the discriminator tuning voltage during the sweep, the FET is turned off.

VCO RANGE AND STEP-SIZE

The PLL2 VCO is a varactor-tuned transistor oscillator with a tuning range of 75-150 MHz. The phase-lock loop allows it to be programmed in 5 kHz steps between 100-150 MHz. The sweep width can be as wide as 25 MHz (PLL2 VCO sweeps down in frequency) and as narrow as 500 kHz. The output of the VCO is divided by several digital frequency dividers to be sent to various destinations. These divided outputs are shown in Table 8C-2:

Table 8C-2. 20-30 Loop Frequency Range vs. Divider Configuration

OUTPUT OF PLL2 VCO	FREQ RANGE	DESTINATION
Direct output of VCO	75-150 MHz	PLL2 FRACTIONAL DIVIDER
Divided by 5	15-30 MHz	Used as a 20-30 output
Divided by 25	3-6 MHz	Sent to PLL3 Upconverter
Divided by 500	150-300 kHz	Sent to PLL3 Upconverter

DIVIDER

There are two digital frequency dividers used in the A42 PLL2 DIVIDER. One is a fixed divide-by-20 that is used to create a 500 kHz signal from a 10 MHz reference (the 10 MHz reference is from the A29 Reference Phase Detector). This 500 kHz signal is the reference signal for the PLL2 loop and is used as one input to the phase-detector.

The second divider is a fractional divider that uses pulse-swallowing techniques to divide the PLL2 VCO output by numbers between 200.01 and 300.00.

Refer to the "Frequency Range and CW Mode Accuracy" Performance Test for use as a troubleshooting aid.

PLL3 OVERALL DESCRIPTION

The PLL3 (Phase Lock Loop 3) is part of the 20-30 Loop Synthesizer. It consists of only the A39 Upconverter Assembly.

The PLL3 and PLL1 phase-lock loops are only used when in CW Mode or in swept frequency modes with YO sweep widths less than 100 kHz.

Refer to Figure 8C-1, 20-30 Simplified Block Diagram, and Figure 8C-5, PLL3 Phase Lock Loop 3 Operation.

During sweeps of 100 kHz to 5 MHz, the output of the PLL2 VCO (75 to 150 MHz) is divided by 5 to provide a 15 to 30 MHz output, which is sent directly to the 20-30 Loop output. For sweep widths less than 100 kHz, this configuration provides insufficient resolution (1 kHz) to set the start frequency to closer than 0.5% of the sweep width.

To provide for finer resolution, the output of the PLL2 VCO is divided down even further (either by 25 for YO sweep widths of 5 kHz to 100 kHz or by 500 for YO sweep widths less than 5 kHz). The frequency, however, is also reduced such that it is no longer in the 20 to 30 MHz range. PLL1 and PLL3 Loops are used to translate the high resolution, low frequency PLL2 output up to a 200 to 300 MHz range. Since a translation is a fixed offset in frequency, it will not change the resolution or sweep width as does dividing or multiplying. After the frequency translation, the output of PLL1 is divided by 10 to reduce the phase-lock range from 200-300 MHz to 20-30 MHz. This also increases the output resolution by a factor of 10.

The function of the A39 PLL3 Assembly is to mix 160 MHz with the output of the A40 PLL2 VCO and output the sum of the two frequencies. This is done using a phase-lock loop having a closed loop bandwidth of approximately 10 kHz. PLL3 uses a reference signal from the 100 MHz VCXO reference to generate the 160 MHz offsetting frequency. As the PLL2 output changes frequency, the PLL3 output will also change frequency with the same resolution and sweep width, but at a higher operating frequency.

FREQUENCY MULTIPLIER X 1.6

In order to offset the PLL2 output by 160 MHz, a 160 MHz reference signal must be generated. The FREQUENCY MULTIPLIER X 1.6 generates 160 MHz by dividing the 100 MHz input reference signal by five and then selecting the eighth harmonic.

MIXER

The output of the MIXER is amplified, filtered, and sent to the PHASE/FREQUENCY DETECTOR. The desired MIXER output is the difference frequency and lies between 150 kHz and 6 Mhz.

PHASE/FREQUENCY DETECTOR

The PHASE/FREQUENCY DETECTOR generates a differential output signal that is used by the LOOP AMPLIFIER as well as the PHASE LOCK INDICATOR.

LOOP AMPLIFIER

The phase detector differential outputs are the inputs to the LOOP AMPLIFIER. Each of the differential inputs is passed through identical low-pass filters and a voltage divider/filter. The output of the voltage divider is sent to a varactor diode that tunes the VCO.

160 to 166 MHz VCO

The 160 to 166 MHz VCO is a varactor-tuned, Colpitts transistor oscillator. A buffer transistor output provides a 160 to 166 MHz signal that drives the MIXER.

PHASE LOCK INDICATOR

The PHASE LOCK INDICATOR senses the outputs of the phase detector to determine when the loop is locked. The ON=LOCKED LED indicates that a phase locked condition exists.

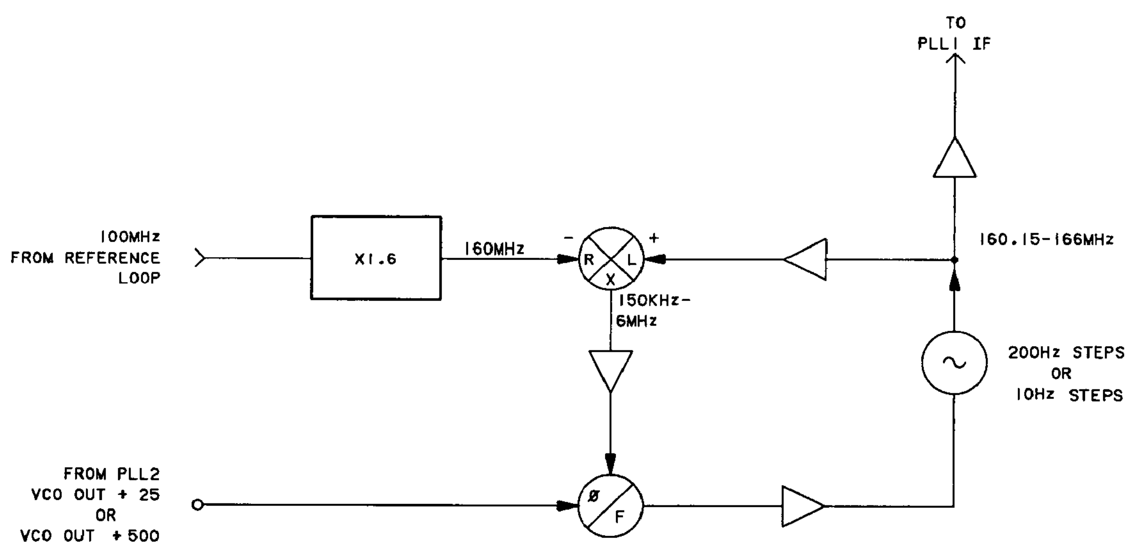


Figure 8C-5. Phase Lock Loop 3 Operation

PLL1 OVERALL DESCRIPTION

INTRODUCTION

PLL1 (Phase Locked Loop 1) is part of the 20-30 Loop Synthesizer. It consists of the following assemblies:

- A36 PLL1 VCO
- A37 PLL1 DIVIDER
- A38 PLL1 IF

DESCRIPTION

The PLL1 and PLL3 phase-lock loops are only used when in CW Mode or in swept frequency modes with YO sweep widths less than 100 kHz.

PLL1 functions as a programmable frequency translator. The input to the translator is the PLL3 output (160.15 to 166 MHz). The PLL1 VCO frequency is offset by a programmable amount from the PLL3 output. As the PLL3 output changes frequency (ie. as it tracks a sweeping PLL2) the offset frequency between the PLL3 output and the PLL1 VCO output will remain constant. The offset frequency, PLL1 IF output, is determined by the value of programmable divider N1 and is constant throughout the sweep. The result is that the precision sweeps and high resolution of the PLL2 Loop are effectively transferred up in frequency to the PLL1 VCO.

A simplified diagram of the PLL1 Loop is shown in Figure 8C-6.

The phase/frequency detector for PLL1, which resides on the A37 PLL1 DIVIDER assembly, operates at 5 MHz. One of the phase detector inputs comes from a 10 MHz (A29 Reference Phase Detector) reference which is divided by two on the A37 assembly. The second phase detector input is the PLL1 IF output, after passing through a divide-by-two and a fractional divider. The fractional divider uses pulse-swallowing techniques to divide by numbers between 3.60 and 13.97.

When the loop is locked, both phase detector inputs will be equal in frequency. The PLL1 IF output is then described by; F1 = N1 * 10 MHz, where F1 is the PLL1 IF output frequency MHz and N1 is the fractional divide number (3.60 to 13.97).

The A38 PLL1 IF assembly's primary function is to mix the output of PLL1 VCO with the output of the PLL3 Loop (Fpll3). The frequency relationships at the mixer are; F1 = F2 - Fpll3, where

F1 is the PLL1 IF frequency and F2 is the PLL1 VCO frequency. The PLL1 VCO frequency can be shown to be; F2 = Fpll3 + 10*N1 MHz. This shows that the PLL1 VCO frequency will be offset by 10*N1 MHz from the PLL3 output frequency.

PLL1 VCO operates from 200 to 300 MHz. The output of the VCO is divided by ten to place it in the 20 to 30 MHz range.

After the final divide-by-ten, the output frequency of the 20-30 loop becomes; Fout = (Fpll3)/10 + N1 MHz. Fpll3 can be determined from the 8340A diagnostics by pressing [SHIFT] [M3] and reading the right-hand "FREQUENCY MHz" display. If this display reads "0.0000" then the PLL3/PLL1 path is not being used in this mode, and PLL2 is used by itself. Fout, the 20-30 output frequency, can be determined by pressing [SHIFT] [M1] and reading the right "FREQUENCY MHz" display. N1 can be calculated from these two frequencies using the above equation.

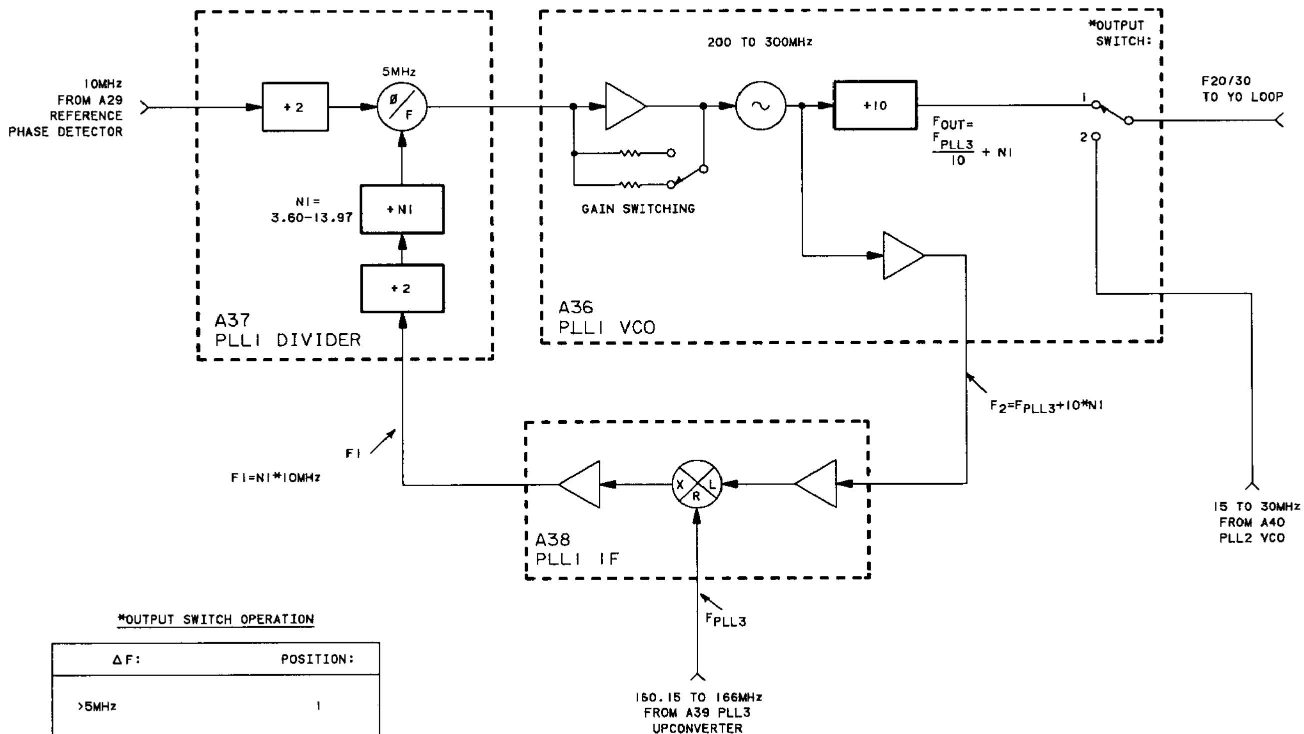
As the N1 divide number changes, the gain of the loop amplifier is adjusted to maintain an approximately constant loop gain. This is done through FET switches on the A36 PLL1 VCO assembly.

The PLL1 VCO assembly also contains an output switch to select from one of two possible 20-30 Loop paths;

1. The PLL1 VCO divided-by-ten is used as the 20-30 Output. PLL2 is translated up through PLL3 and PLL1.

2. The PLL2 VCO divided output is used directly. PLL1 and PLL3 are not used.

The switch positions are defined for the different 8340 operating modes in the table in Figure 8C-6.



*OUTPUT SWITCH OPERATION

ΔF:	POSITION:
>5MHz	1
5MHz TO >100KHz	2
100KHz TO 100Hz	1
CW MODE	1

Figure 8C-6. PLL1 Simplified Diagram

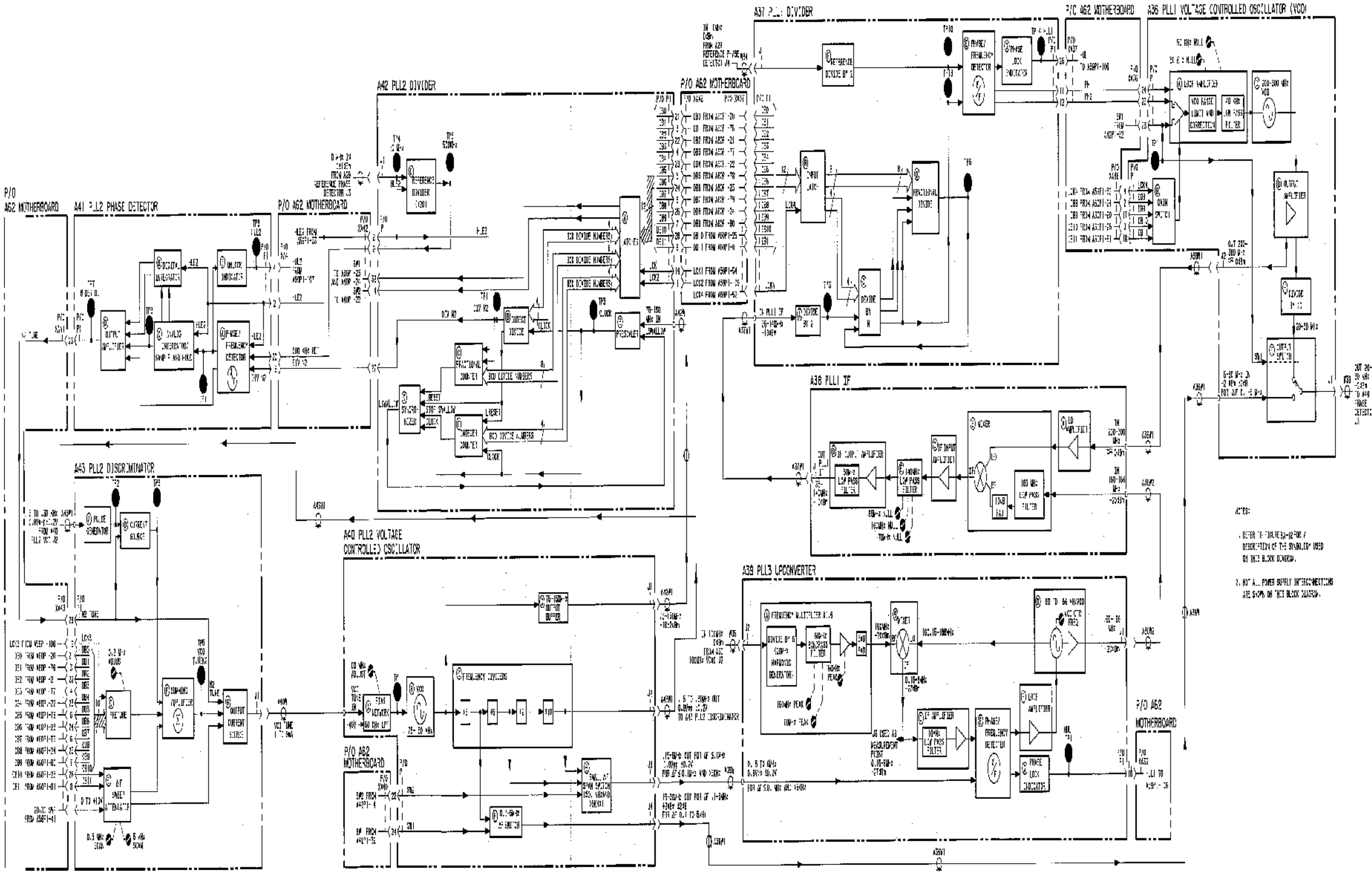


Figure 8C-7. 20-30 Loop Block Diagram

TROUBLESHOOTING TO ASSEMBLY LEVEL

Refer to "**OVERALL INSTRUMENT TROUBLESHOOTING**" in the Service Introduction.

REPAIR PROCEDURES

Refer to the "**REPAIR PROCEDURES**" description in the Service Introduction.

A36 PHASE LOCK LOOP 1 (PLL1) VOLTAGE-CONTROLLED OSCILLATOR (VCO), CIRCUIT DESCRIPTION

DESCRIPTION

The output of the 20-30 loop to be fed to the YO Loop is always taken from A36 (PLL1 VCO). If the sweep width is such that the PLL2 VCO's divided output is required as the 20-30 output, a switch on this board selects the proper source.

A36 contains the loop amplifier and voltage-controlled oscillator for the PLL1 phase lock loop. The oscillator tunes from 200 to 300 MHz for a range of about 4 to 16 volts tuning of the varactor. The oscillator drives a counter which divides the frequency by 10. The counter output goes through a switch and a filter to the 20-30 output. To prevent spurious responses, the oscillator is turned off for sweeps that are greater than 100kHz but less than or equal to 5MHz.

LOOP AMPLIFIER A

A diagram of the equivalent circuit of the loop amplifier is shown in Figure 8C-8. It functions as a differential integrator, due to the feedback presented by R30,C33, and R29,C34. The gain block shown in Figure 8C-8 is achieved by the low-noise differential pair, Q9 and Q10, in addition to operational amplifer U6A. Compensation for this high open-loop gain circuit is provided by C32 and R26. Since there is no dc feedback path in this circuit, it exhibits extremely high low frequency gain.

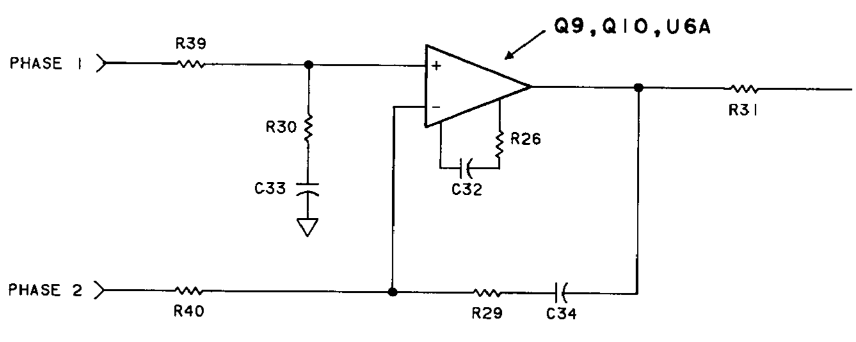


Figure 8C-8. Loop Amplifier Equivalent Circuit

The output of the differential integrator is fed through a programmable ac voltage divider formed by R31, R32, R33, R34, R35 with R36 and C36. Following this is a 40kHz low pass filter which has two notches that are tuned to reject 50kHz generated by the fractional division used in PLL1 divider.

VR1 and R37 conduct when large currents are required to charge C22. During locked conditions, VR1 should always be off.

Since there are upper AND lower sidebands generated by the PLL1 IF mixer, it is possible that the VCO could be disturbed by the presence of both sidebands. While it is impossible for the loop to actually lock onto the wrong sideband, due to the inversion in loop gain, the VCO would be tuned to an endpoint. The out of range corrector prevents this from happening by monitoring the dc tune voltage and forcing the VCO in the opposite direction should it attempt to exceed its normal range. U6B compares the dc tune voltage across C36 to +17.5V. If the tune voltage exceeds this, U6B output goes LOW, turning on CR5, and pulling the non-inverting input to the differential integrator LOW. This forces the VCO tune voltage to decrease until it reaches about +5V, at which point the hysteresis around U6B (due to R24) causes U6B to return to its inactive HIGH state.

A mode exists where the VCO may be OFF, and when programmed ON will remain disabled due to noise driving the phase detector and loop amplifier such that the VCO is continually driven to its OFF state. To ensure that the VCO will always oscillate, the VCO range limiter clamps the lower end of the tune voltage to about +3V. This should always be lower than the minimum tuned voltage in normal operation, so Q2 should never be on when phase-locked. Q2 functions as a clamp due to its base being biased at about +4.4V by R10 and R7. If the tune voltage drops to a low enough voltage, Q2 and CR7 will conduct, and clamp the tune line to two diode drops below +4.4V (+3V).

GAIN SWITCH B

U5 latches the four most significant bits of the programming of PLL1 divider (N=3 to 13). These are level translated by U4 which drives four FET switches. By activating combinations of FET`s, a programmable resistance is placed in parallel with R31, changing the amount of attenuation. As the digital divider changes numbers, the loop gain directly follows it. By increasing the amount of gain in the loop amplifier, switching the FETs in or out, a constant loop bandwidth of 5 kHz is approximated. A table of the states of the FET's is shown in Table 8C-3.

200 to 300 MHz VCO C
OUTPUT AMPLIFIER D

The VCO consists of Q11 which operates in the grounded-base mode. The resonator is principally CR3, CR4, and L4. Feedback is accomplished with L5, R16, and C17. The output, taken at C14, is coupled through R42 and C12 to common base buffer amplifier Q5. See Figure 8C-9 for a simplified block diagram. The capacitor C14 actually behaves as a small inductor over the frequency range of interest (200-300 MHz). This characteristic allows a signal to be developed across the capacitor and then coupled out whereas an ideal capacitor would short the signal to ground. The VCO is turned off in sweeps greater than 100 kHz and less than or equal to 5 MHz by forward biasing the varactor diodes CR3 and CR4. A low input on SW1 causes CR2 (in Block A) to conduct and pull the base of Q2 to about 0.7V. This sets the clamp voltage at the cathode of CR7 to about -0.7V. This maximum voltage of -0.7V quarantees that the diodes will be biased on, disabling the VCO. The output of Q5 is applied to Q4 where it is amplified and sent to A38 PLL1 IF and to Block F DIVIDE BY 10.

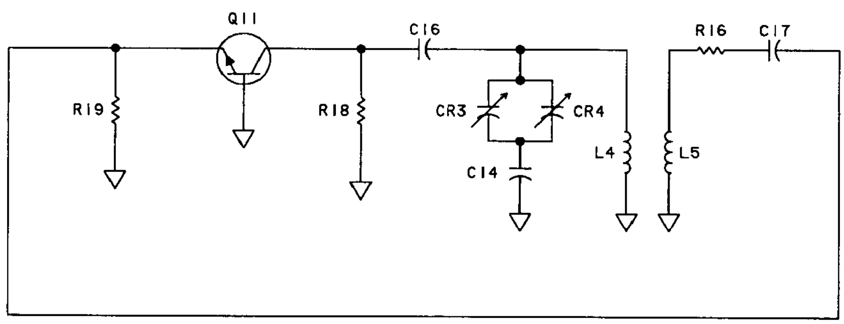


Figure 8C-9. 200-300 MHz VCO Simplified Block Diagram

OUTPUT SWITCH E

The output switch is U2, a quad ECL NOR gate. For sweep widths greater than 100 kHz and less than or equal to 5 MHz the SW1 line is a TTL low. This low disables the LOOP AMPLIFIER by causing CR6 (Block A) to conduct and pull the base of Q9 low. A low input on Q9 causes the output of U6A to go negative which causes the varactor diodes CR3 and CR4 to be biased on, disabling the VCO. The low on SW1 also disables U2D by causing U2C to go to a high output level. U2B is enabled in this condition and so routes the

15-30 MHz input from PLL2 VCO to the output. For all other sweep conditions the SW1 line is high and the loop is enabled. The output is then taken from U1D which has the divided by 10 VCO frequency as its input.

DIVIDE BY 10 F

Q3 is a common-emitter amplifier which drives U3 through a high-pass filter. U3 is an ECL divide by 10 counter which generates the necessary 20 to 30 MHz from the VCO output.

Table 8C-3. FET Switch Programming Table

Divide Number	Active FET			
	Q1	Q7	Q8	Q6
3	X	X		
4				X
5		X		X
6	X			X
7	X	X		X
8			X	
9		X	X	
10	X		X	
11	X	X	X	
12			X	X
13		X	X	X

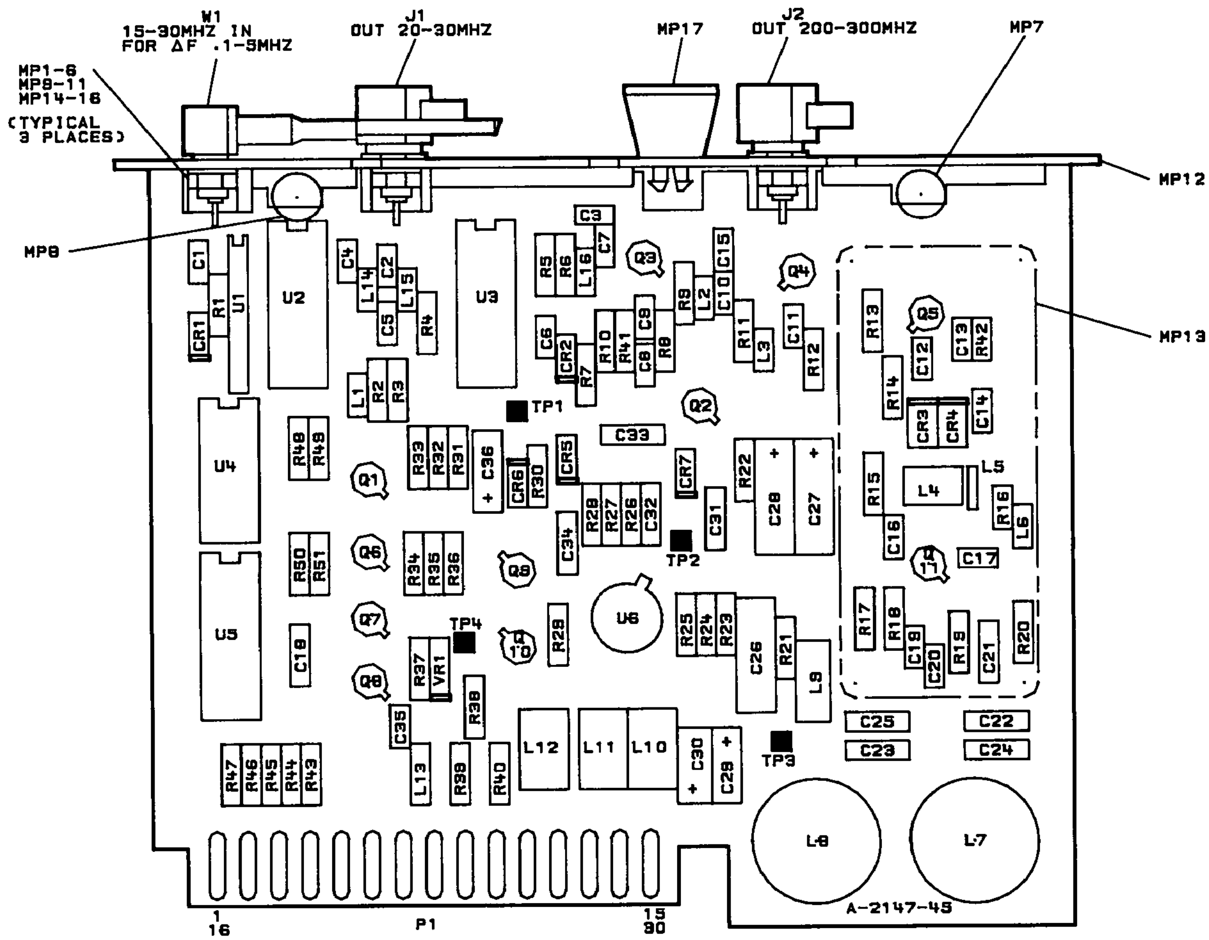


Figure 8C-10. A36 PLL1 VCO, Component Location Diagram

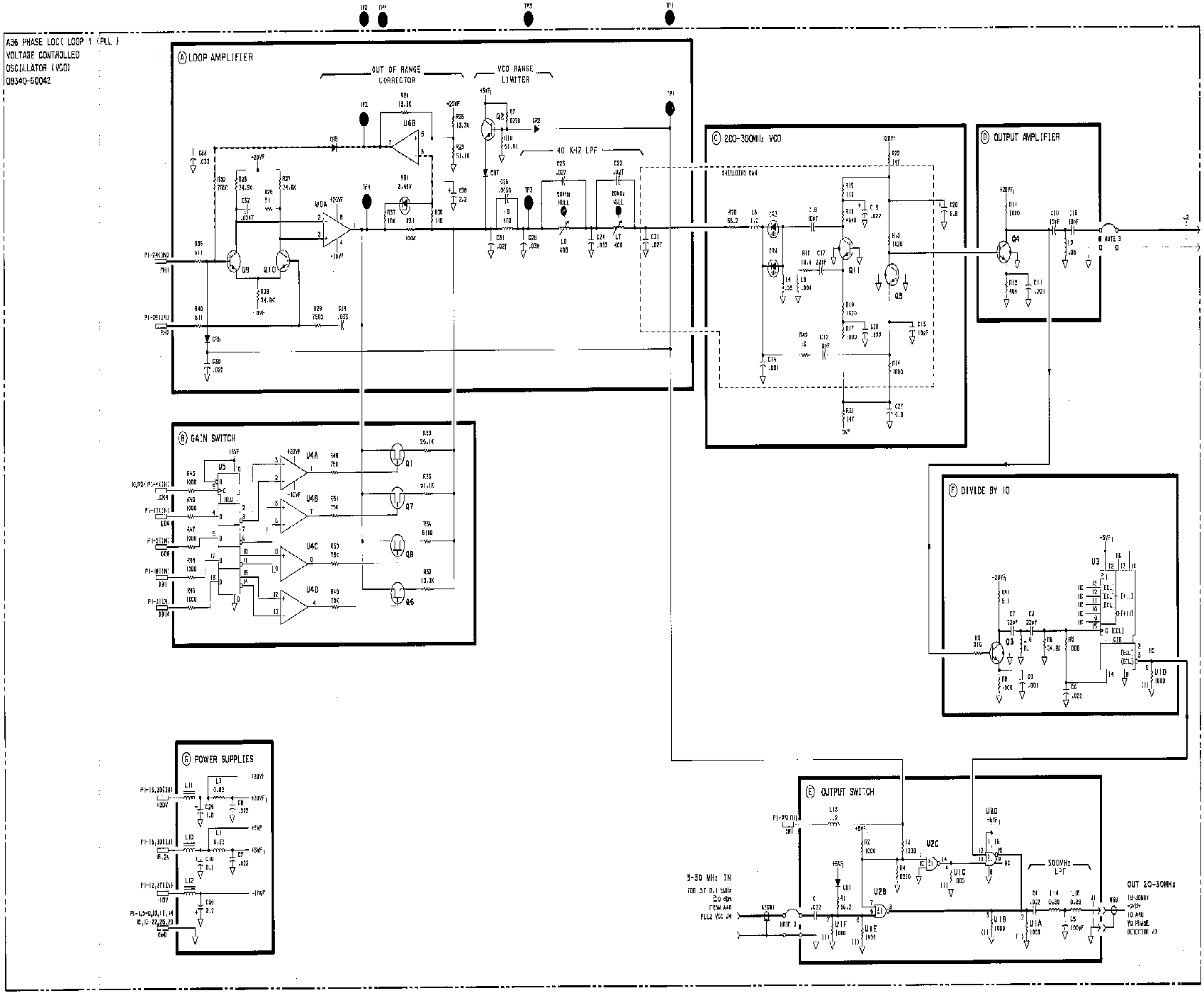
A36 PLL1 VCO, Pin I/O

A36

Pin	Mnemonic	Levels	Source	Destination
1	GND	0V	A62 STAR GND	*G
16	GND	0V	A62 STAR GND	*G
2	DB8	TTL	*	*THRU A62R7 TO B
17	DB9	TTL	*	*THRU A62R8 TO B
3	DB10	TTL	*	*THRU A62R9 TO B
18	DB11	TTL	*	*THRU A62R10 TO B
4	LCK4	TTL (LOW TRUE)	XA59P1-52	*THRU A62R11 TO B
19	GND	0V	A62 STAR GND	*G
5	GND	0V	A62 STAR GND	*G
20	GND	0V	A62 STAR GND	*G
6	GND	0V	A62 STAR GND	*G
21	GND	0V	A62 STAR GND	*G
7	GND	0V	A62 STAR GND	*G
22	GND	0V	A62 STAR GND	*G
8	GND	0V	A62 STAR GND	*G
23	SW1	TTL	XA42P1-32	*E
9				
24	PH1	0 TO +5V	A62R12	A
10	GND	0V	A62 STAR GND	*G
25	PH2	0 TO +5V	A62R13	A
11	GND	0V	A62 STAR GND	*G
26	GND	0V	A62 STAR GND	*G
12	−10V	−10V	XA53P1-12, 13, 31, 32	*THRU A62L8 TO G
27	−10V	−10V	XA53P1-12, 13, 31, 32	*THRU A62L8 TO G
13	+12V UI ADJ	+10.5V	XA52P1-10	*THRU A62L2 TO G
28	+12V UI ADJ	+10.5V	XA52P1-10	*THRU A62L2 TO G
14	GND	0V	A62 STAR GND	*G
29	GND	0V	A62 STAR GND	*G
15	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*THRU A62L1 TO G
30	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*THRU A62L1 TO G

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.



NOTES:

1. REFER TO THE SERVICE SECTION INTRODUCTION FOR DETAILED SCHEMATIC DIAGRAM SYMBOLOGY NOTES.
2. RESISTANCE VALUES SHOWN ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.
3. J1, J2 AND A35W1 CENTER CONDUCTORS ARE ELECTRICALLY CONNECTED TO THE PC BOARD THROUGH SOLDERED 24 GAUGE TIE WIRES. THEIR OUTER CONDUCTORS ARE ELECTRICALLY CONNECTED TO PC BOARD GROUND THROUGH MECHANICAL SCREW CONNECTIONS IN THE ASSEMBLY COVER PLATE.

Figure 8C-11. A36 PLL1 VCO, Schematic Diagram

A37 PHASE LOCK LOOP 1 (PLL1) DIVIDER, CIRCUIT DESCRIPTION

INTRODUCTION

A37 functions as a programmable frequency divider and a phase/frequency detector.

DESCRIPTION

The divider is programmed by the A60 Processor to divide the input frequency down to 5 MHz. This is then compared with a 5 MHz reference in the phase/frequency detector. The detector output, after amplification, controls the frequency of the PLL1 voltage-controlled oscillator.

The divide number is always between 3.60 and 13.97. The integer part is coded in binary while the fractional part is coded in BCD.

The PLL1 Divider works on the pulse swallowing technique. Figure 8C-12 shows the basic diagram of a pulse swallowing divider.

The rate multiplier is formed by 2 TTL decade rate multiplier IC`s. The input to the rate multplier is the output of the overall divider. For 100 divider output pulses, the rate multiplier will output X pulses where X is a two digit BCD number that is between 0 and 99. The pulses out of the rate multiplier are not necessarily evenly spaced, but will always be X/100 times the number of input pulses to the rate multiplier. Each time the rate multiplier outputs a pulse, the input signal in the DIVIDE-BY-N block is effectively ignored for one entire input pulse. This means that N+1 input pulses will transpire before the next output pulse will occur; or the integer divide number is effectively N+1 for this particular output pulse. If the rate multiplier does not output a pulse, then the DIVIDE-BY-N continues to divide by N normally.

The result of this is that for 100 output pulses, the integer counter was dividing by N+1 for X output pulses, and dividing by N for the remaining 100-X output pulses. The total number of input pulses that occurred was : (N+1)*X + N*(100-X) = 100*N + X . The divide number (input pulses divided by output pulses) is (100*N + X)/100 = N + X/100. So N becomes the integer portion of the overall divide number, and X becomes fractional part. For example: to divide by 8.57, the DIVIDE-BY-N would be set to 8 and the rate multiplier would be programmed to 57.

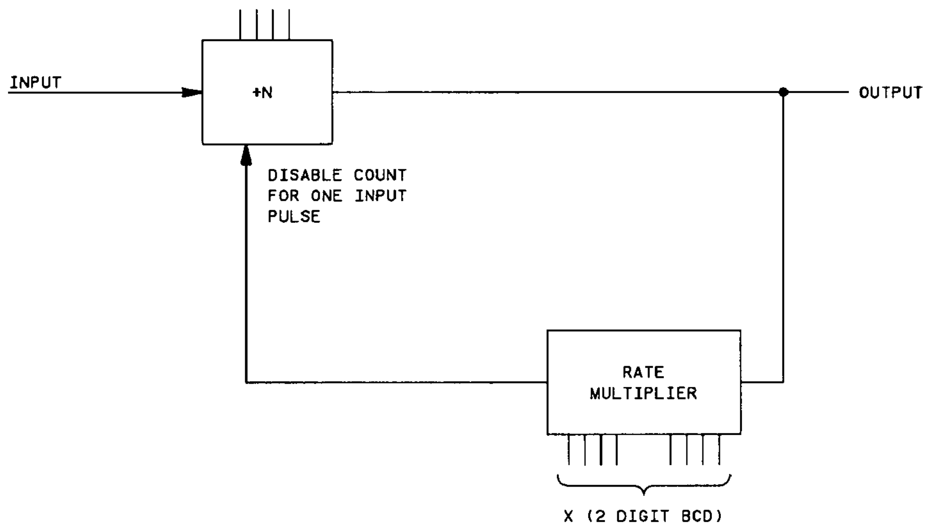


Figure 8C-12. Fractional Division Using Pulse Swallowing

Refer to the "Frequency Range and CW Mode Accuracy" Performance Test for use as a troubleshooting aid.

DIVIDE-BY-2 A

U5 constitutes a 3-stage limiting amplifier. U5 is an ECL triple line receiver which changes the input to the proper amplitude and and dc level (approximately +3 volts LOW and +4 volts HIGH) for driving the subsequent divider. U4A is a D-type flip flop which divides the limiting amplifier output by 2.

INPUT LATCH B

U9 and U10 are latches which store the divider programming number. The number is clocked into the latches with LCK4.

DIVIDE-BY-N C

U12 is a 4-bit binary counter which is programmed with the integer part (3 to 13) of the divide number. It is an ECL device which is in one of three states at all times : counting down, loading, or in a hold state. The state of U12 is determined by the status of TP6 LNLOAD [Low N LOAD] and TP5 HSWALLOW (HIGH SWALLOW input pulse). The input clock is the output of the DIVIDE-BY-2 (Block **A**). This output is also the clock for U14A,B and U4B. The divider is loaded with the integer portion of the divide number, and then decrements at each clock pulse until the count of 2 is reached. At this time, the wire-OR`d bits (TP8) will be 0 and U14B pin 15 will be set up to be clocked LOW on the following clock pulse. U14B pin 15 is LNLOAD, so the counter will be loaded with the integer divide number synchronously with the next rising clock edge. This operation repeats every N clock pulses unless the SWALLOW CONTROL causes HSWALLOW to go HIGH. Figure 8C-13 shows the operation of the DIVIDE-BY-N without a HSWALLOW pulse. U4B is a synchrously cleared, asynchronously set flip-flop, due to its D and S inputs tied together. Its relationship to TP6 LNLOAD is also shown in Figure 8C-13. The asynchronous clear is necessary to widen the width of the output pulse for timing purposes in the SWALLOW CONTROL (Block **D**).

FRACTIONAL DIVIDER D

The Fractional Divider determines whether or not to cause the Divide-By-N to ignore an input pulse and divide by N+1. It does this by controlling the state of HSWALLOW. U1 and U2 are the actual TTL decade rate multipliers, with U3B and Q1 used to translate the ECL levels to TTL. Each time there is an output pulse (TP13) from the Divide By N, U1 and U2 may or may not output a pulse, depending upon what they are programmed to. If they do output a pulse, it will cause TP7 to go low and then high

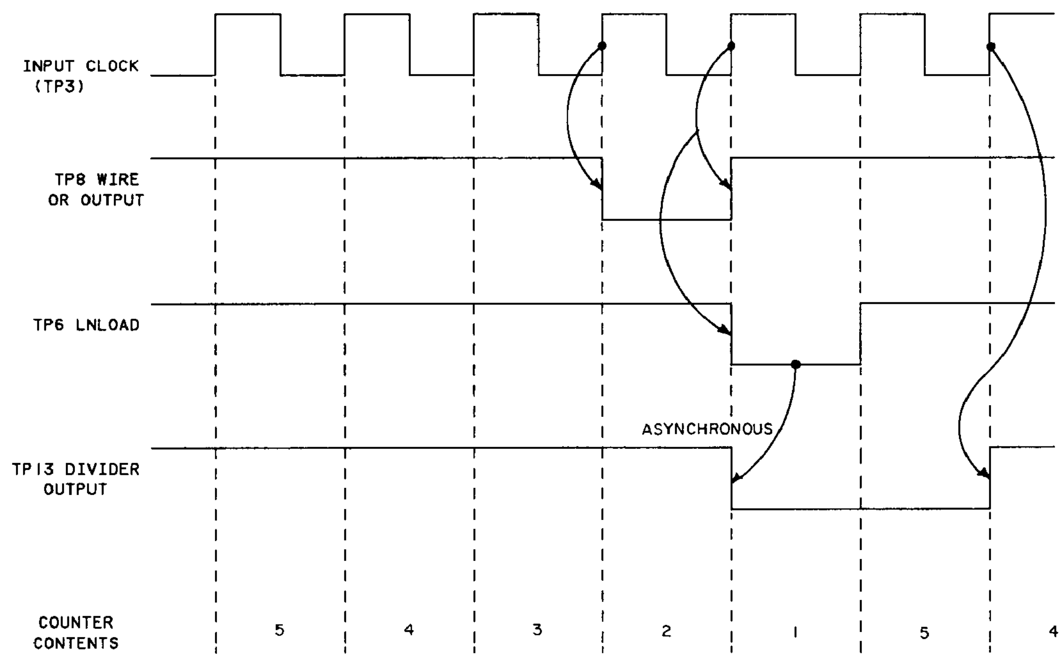


Figure 8C-13. N-Divider Operation; N = 5 (HSWALLOW not used) in synch with the output pulse (TP13). The low-to-high transition of TP7 will clock U15B and leave it in the RESET state. U15B pin 15, LOW SWALLOW ENABLE is connected to the reset of U14B. As long as LOW SWALLOW ENABLE is HIGH, HSWALLOW will be forced LOW independently of its clock changing. But if the rate multipliers U1 and U2 cause a pulse on TP7, LOW SWALLOW ENABLE will be left LOW, and HSWALLOW will be allowed to go HIGH when the next output pulse (TP13) occurs.

The only time that states can potentially change in the Swallow Control is when there is an output pulse. The Swallow Control must decide to do one of two things for the subsequent output pulse (TP13); either divide by N or N+1. To divide by N+1, the HSWALLOW line is clocked HIGH for only one input clock pulse. To divide by N, the Divide-By-N block is left uninterrupted. The decision to swallow an input pulse is made by considering two things; whether the rate multipliers U1 and U2 output a pulse, and the state of LOW SWALLOW ENABLE prior to the output pulse (TP13). All four possible combinations are diagrammed in Figure 8C-14.

The things to notice in Figure 8C-14 are:

- Whenever LOW SWALLOW ENABLE was HIGH prior to the output pulse (TP13), HSWALLOW always remained LOW throughout the sequence, and no input pulse was swallowed.

- Whenever the rate multipliers U1 and U2 did output a pulse, LOW SWALLOW ENABLE was left in the LOW state, regardless of the previous state of the line.

The definition of these lines can then be stated:

- LOW SWALLOW ENABLE - When LOW, an input pulse will be swallowed during the next output pulse (TP13) sequence.

- HSWALLOW - When HIGH, causes U12 to hold its count. This will only be HIGH for a period of 1 input clock pulse, and will be timed such that the counter is never loading and holding at the same time.

R10 and C11 are important for the proper operation of State # 2 as shown in Figure 8C-14. Since the rate multipliers U1 and U2 did NOT output a pulse in this state, the LOW SWALLOW ENABLE line must be left in the HIGH state after the sequence is over to prevent a pulse from being swallowed next time. There would be a potential race condition occurring at the inputs to U15B if it were not for R10 and C11. U14A pin 2 HSWALLOW is going LOW, and is also clocking U15B through U3A NOR gate. U15B pin 10 is also changing and an illegal setup violation would occur. Instead, R10

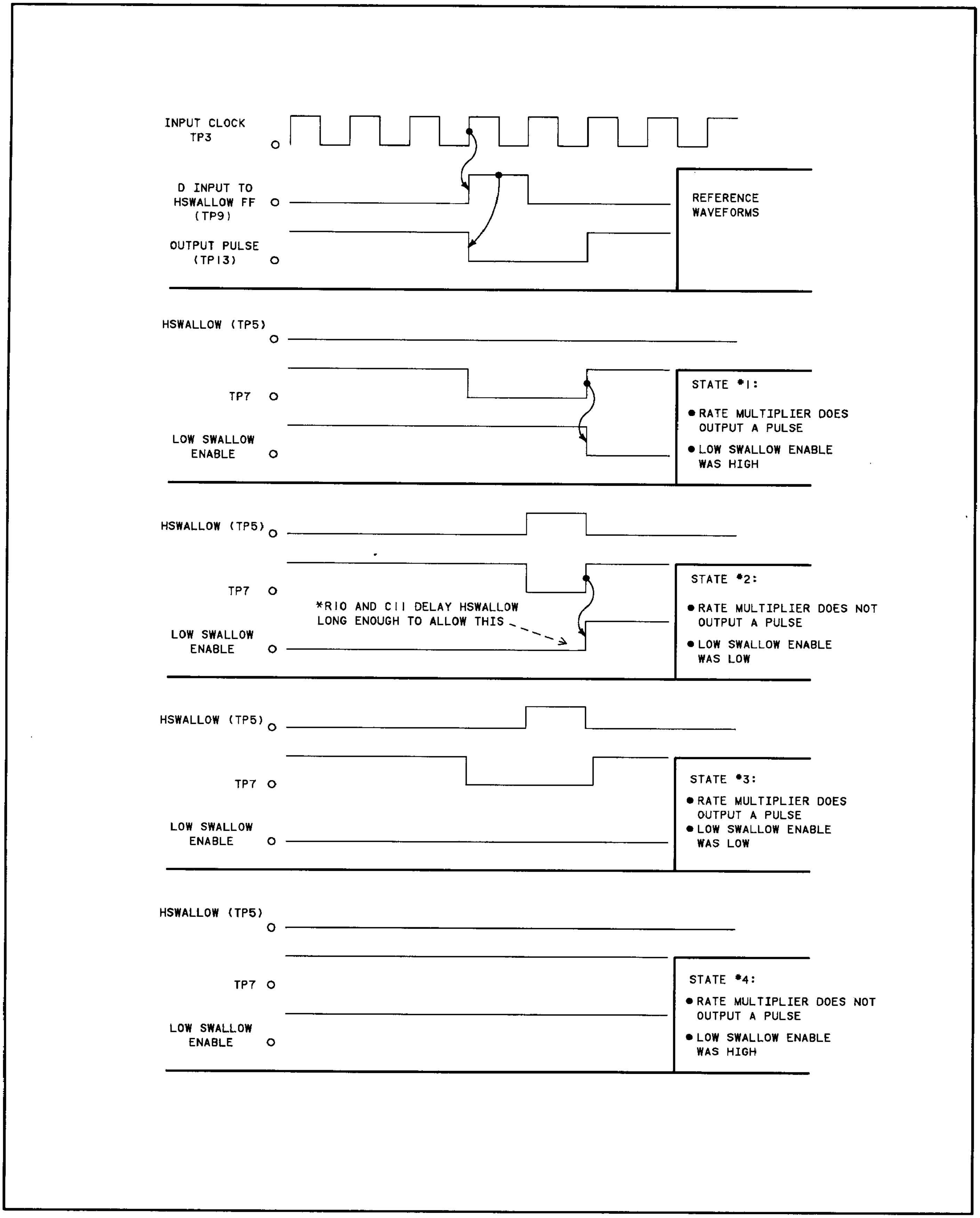


Figure 8C-14. Possible Fractional Divider Sequences and C11 will delay the HIGH-to-LOW transition at U15B pin 10 by several nanoseconds to allow the clock to reach U15B before the HIGH on pin 10 input goes away. This leaves U15B set, as desired.

If there is a rate multiplier output, as in State # 3, then R10 and C11 are not nearly as important. In this case there are two things that are forcing TP7 LOW through U3A; the rate multiplier(s) U1/U2 and HSWALLOW. Since the rising edge of the signal at TP7 will clock U15B, then the last signal to be removed from forcing TP7 LOW will be the signal that clocks U15B. As shown in Figure 8C-14, STATE # 3, the rising edge of the signal at TP7 occurs after HSWALLOW has gone LOW. The reason is that both the signals that are forcing TP7 LOW are beginning to be removed at the same input clock pulse. HSWALLOW will be removed much sooner than the rate multiplier U1/U2 since it is an ECL device, so U1/U2 are actually clocking U15B. Since U1 and U2 have very long TTL delays compared to ECL, the effect of the R10 and C11 time delay on HSWALLOW is insignificant. The U15B pin 10 input will still go low before the clock pulse from U1/U2 arrives.

PHASE/FREQUENCY DETECTOR E

The Phase/Frequency Detector compares the divider output with a 5 MHz reference frequency. When the two inputs are in phase, the outputs are ECL HIGH, approximately +4 volts, with very narrow pulses at a 5 MHz rate. When the inputs are the same frequency but different in phase, one output line is a pulse with a width corresponding to the phase difference; the other output is HIGH with very narrow pulses. For a difference in input frequencies, the outputs are pulses of varying widths, but average dc voltage levels will be different. The sign of this dc voltage is set by which frequency is higher.

REFERENCE DIVIDE BY 2 F

U7C is an input buffer amplifier which generates the proper level for ECL (approximately +3 volts LOW and +4 volts HIGH). R5,R6, and C4 provide dc feedback around U7C to enable it to operate as a linear amplifier. U15A divides the 10 MHz input by 2 and applies this 5 MHz to the phase/frequency detector.

PHASE LOCK INDICATOR G

The input to the Phase Lock Indicator is the wire OR outputs of the phase/frequency detector (A16B pin 14 and A16A pin 3). This input is ECL LOW (approximately 3 volts) when the loop is locked; in this condition, the dc voltage at the base of Q3 is lower than that at the base of Q2 so Q3 is ON and Q2 is OFF. If the loop unlocks, the input to the phase lock indicator consists of varying width pulses, the average dc value of which is about half way between a logic LOW and HIGH. The voltage divider consisting of R35 and R15 causes the voltage at Q2 base to be lower than that at Q3 base, so Q2 turns ON indicating an unlock condition.

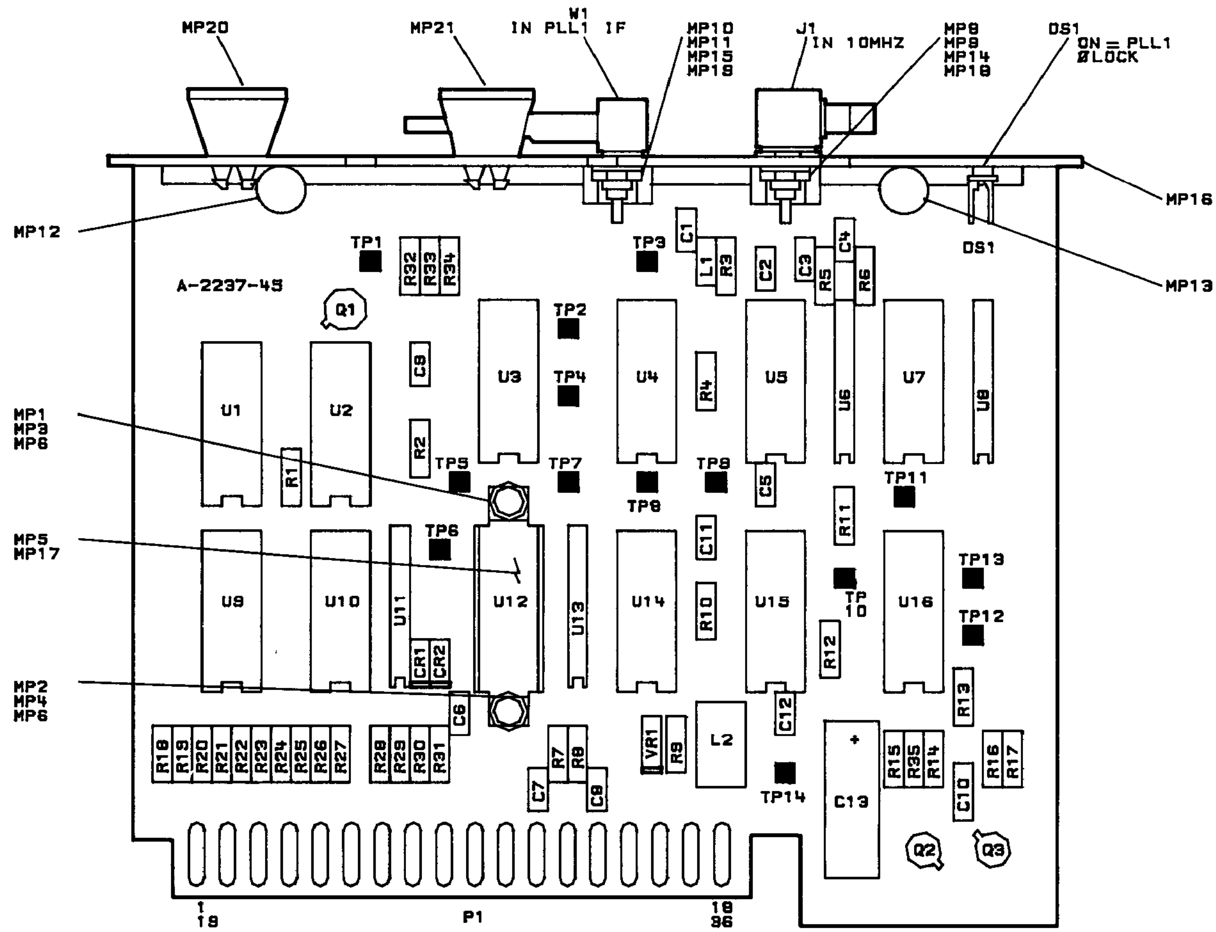


Figure 8C-15. A37 PLL1 Divider, Component Location Diagram

A37 PLL1 Divider, Pin I/O

A37

Pin	Mnemonic	Levels	Source	Destination
1 19	DB0 DB1	TTL TTL	XA60P1-20 XA60P1-76	*B *B
2 20	DB2 DB3	TTL TTL	XA60P1-21 XA60P1-77	*B *B
3 21	DB4 DB5	TTL TTL	XA60P1-22 XA60P1-78	*B *B
4 22	DB6 DB7	TTL TTL	XA60P1-23 XA60P1-79	*B *B
5 23	DB8 DB9	TTL TTL	* *	*B *B
6 24	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
7 25	DB10 DB11	TTL TTL	* *	*B *B
8 26	LCK4 HULI	TTL (LOW TRUE) TTL (HIGH TRUE)	XA59P1-52 *G	*B XA59P1-106
9 27	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
10 28	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
11 29	PH1 GND	0 TO +5V 0V	E A62 STAR GND	XA36P1-24 *H
12 30	PH2 GND	0 TO +5V 0V	E A62 STAR GND	XA36P1-25 *H
13 31	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
14 32	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
15 33	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
16 34	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
17 35	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
18 36	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*THRU A62L3 TO H *THRU A62L3 TO H

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

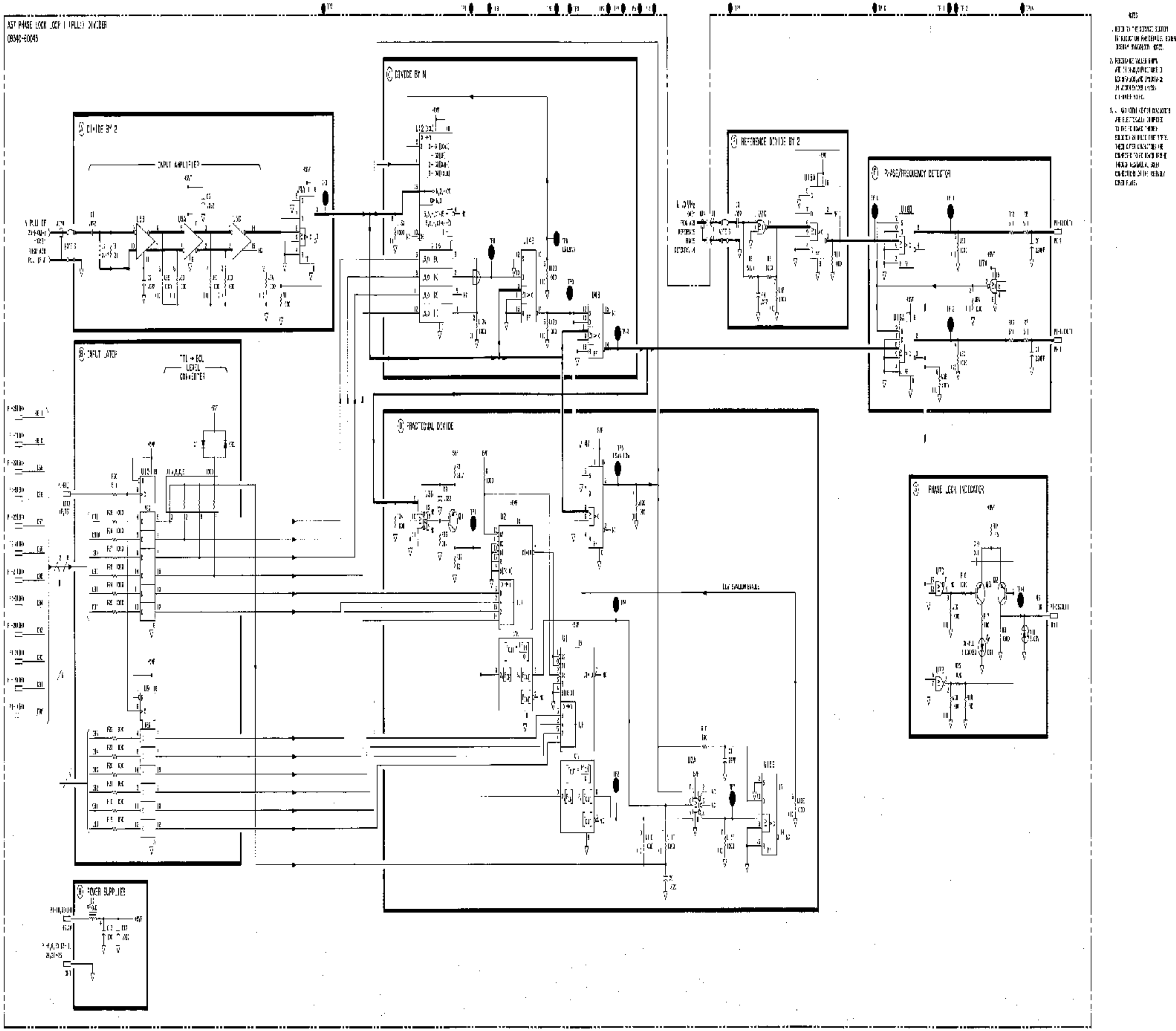


Figure 8C-16. A37 PLL1 Divider, Schematic Diagram

A38 PHASE LOCK LOOP 1 (PLL1) IF, CIRCUIT DESCRIPTION

INTRODUCTION

The function of the A38 Phase Lock Loop 1 is basically to mix the output of the A39 PLL3 Up Converter (160.15 to 166 MHz) with the LO output from the A36 PLL1 VCO (200 to 300 MHz). The output of this assembly is the difference frequency suitably filtered and amplified to about -10 dBm.

LO AMPLIFIER A

The LO Amplifier consists of common-emitter amplifiers Q1 and Q2. CR1 and CR2 provide limiting to prevent overdriving Q2 near 200 MHz where Q1 has more gain.

MIXER B

The double-balanced mixer U1 operates with about +7 dBm LO drive and with approximately -30 dBm RF signal input. The IF output is about -36 dBm and covers 30 MHz to 140 MHz. The 185 MHz Low-Pass Filter attenuates the harmonics of the RF signal input. The 10 dB pad, R10, R11, and R12 reduces the RF signal input from approximately -20 dBm to approximately -30 dBm.

IF INPUT AMPLIFIER C

The IF INPUT AMPLIFIER has an input filter to partially filter the RF and LO signals from the mixer. The amplifier Q3 has emitter degeneration R17 to reduce distortion.

IF OUTPUT AMPLIFIER D

The IF OUTPUT AMPLIFIER consists of two common emitter stages and an output low-pass filter. The two stages are coupled by C14 and L17 which provide high frequency peaking.

140 MHZ LOW-PASS FILTER E

The 140 MHz LOW-PASS FILTER is a modified elliptic filter which must pass 140 MHz while rejecting 160 to 166 MHz by at least 60 dB. The three adjustable coils optimize the stop band by providing nulls at the frequencies shown on the schematic (Figure 8C-18). This filter also filters the LO frequencies (200-300 MHz).

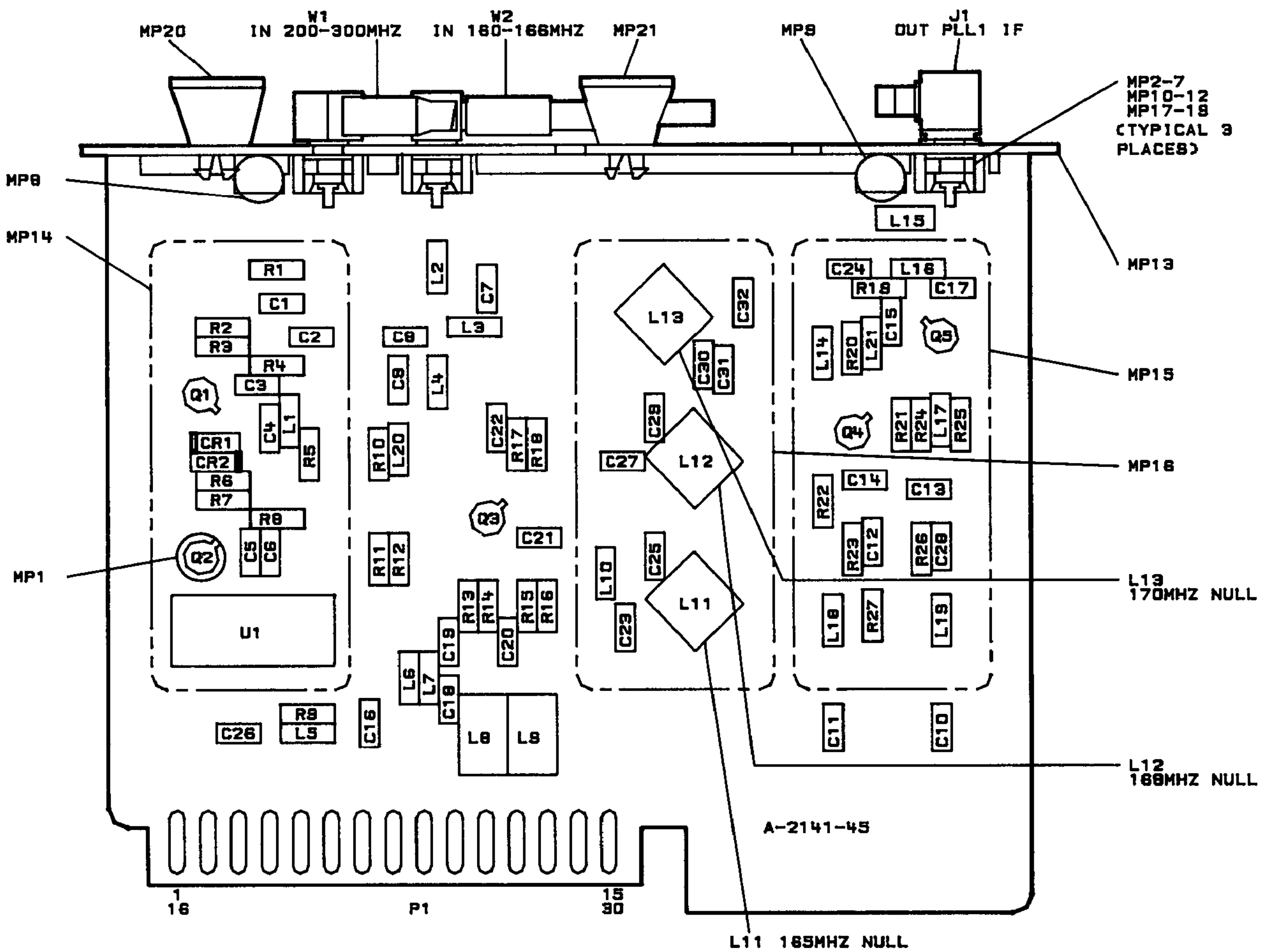


Figure 8C-17. A38 PLL1 IF, Component Location Diagram

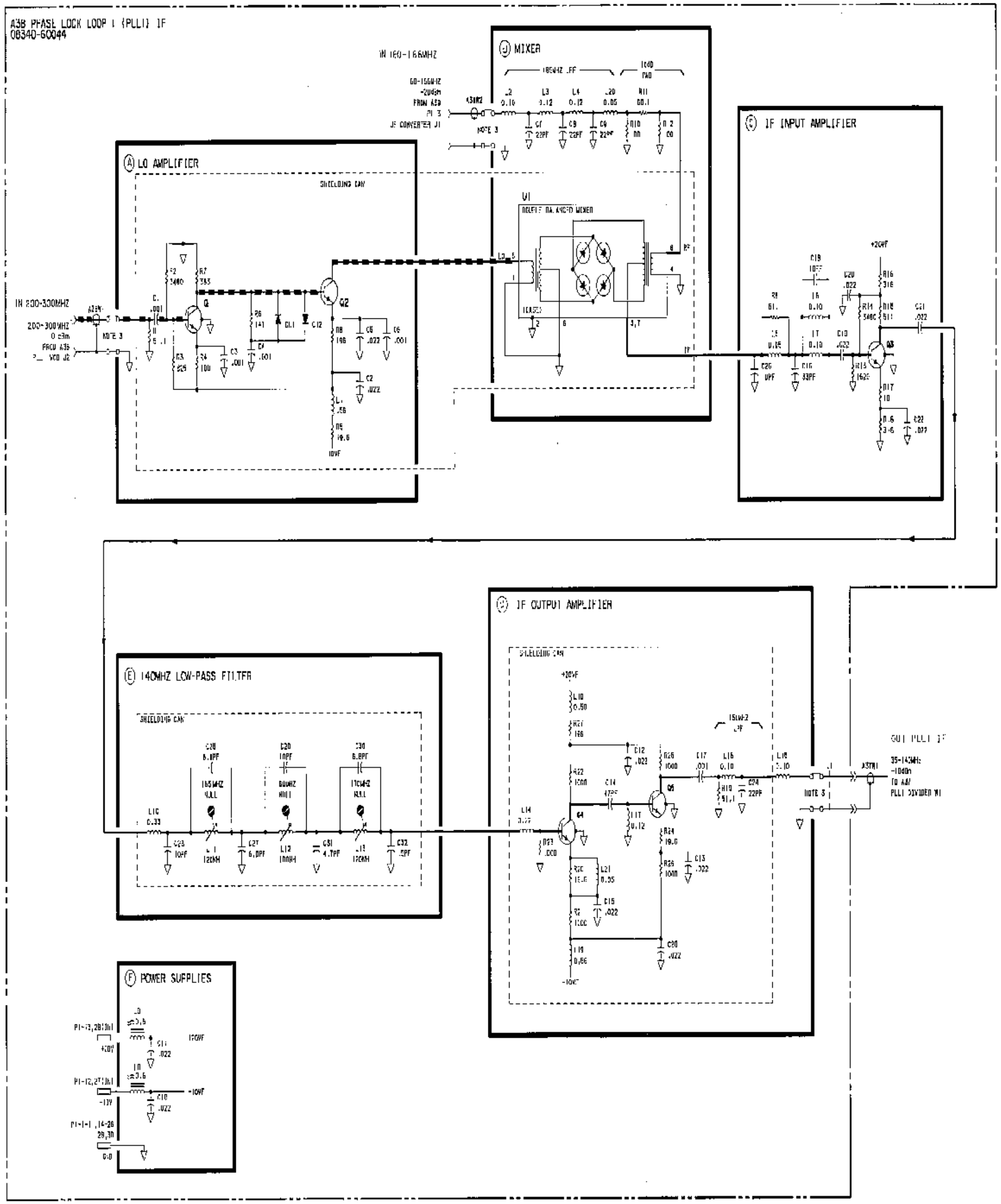
A38 PLL1 IF, Pin I/O

A38

Pin	Mnemonic	Levels	Source	Destination
1 16	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
2 17	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
3 18	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
4 19	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
5 20	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
6 21	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
7 22	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
8 23	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
9 24	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
10 25	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
11 26	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
12 27	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*THRU A62L8 TO F *THRU A62L8 TO F
13 28	+12V UI ADJ +12V UI ADJ	+10.5V +10.5V	XA52P1-10 XA52P1-10	*THRU A62L5 TO F *THRU A62L5 TO F
14 29	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
15 30	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.



NOTES:

1. REFER TO THE SERVICE SECTION INFORMATION FOR DETAILED SCHEMATIC DIAGRAM SYMBOLOGY NOTES.
2. RESISTANCE VALUES SHOWN ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.
3. J1, A38W1, AND A38W2 CENTER CONDUCTORS ARE ELECTRICALLY CONNECTED TO THE PC BOARD THROUGH SOLDERED 24 GAUGE FINE WIRES. THEIR OUTER CONDUCTORS ARE CONNECTED TO PC BOARD GROUND THROUGH MECHANICAL SCREW CONNECTIONS TO THE ASSEMBLY COVER PLATE.

Figure 8C-18. A38 PLL1 IF Schematic Diagram

A39 PHASE LOCK LOOP 3 (PLL3) UPCONVERTER, CIRCUIT DESCRIPTION

INTRODUCTION

The function of the A39 Phase Lock Loop 3 Upconverter is to mix 160 MHz with the output of the A40 PLL 2 VCO (.15 to 6 MHz) and output the sum of the two frequencies. This is done using a phase-lock loop which has a closed loop bandwidth of approximately 10 kHz.

FREQUENCY MULTIPLIER (X 1.6) A

In order to offset the PLL2 output by 160 MHz, a 160 MHz reference signal must be generated. The frequency multiplier x 1.6 generates 160 MHz by dividing the 100 MHz input reference signal by five and then selecting the eighth harmonic.

U3 is an ECL bi-qinary counter that is connected so that the output skips one pulse every five input counts as can be seen from the waveforms in Figure 8C-19.

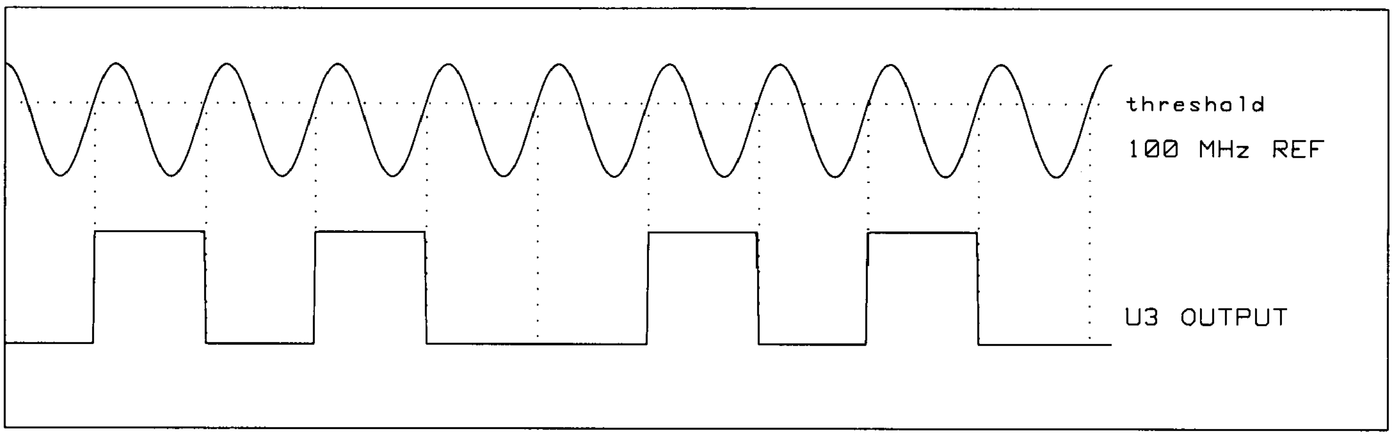


Figure 8C-19. A39 PLL3 Frequency Multiplier Waveforms

The net effect of the pulse skipping is to produce a double narrow pulse (refer to Q3 output in figure 8C-19) at a 20 MHz rate. This gives better results than simply dividing the 100 MHz reference by 5 to obtain a 20 MHz pulse train because the narrower pulses generate stronger harmonics than a 20 MHz pulse train would.

The 160 MHz bandpass filter selects the 160 MHz signal that is amplified by Q5. L18, C49 and C50 form a tank circuit that is tuned to 160 MHz which also helps to reject unwanted frequency components from the output of U3.

R46, R47 and R48 form a 5 dB pad keeping the distortion down in the mixer by providing a better 50 ohm match to the mixer input.

MIXER B

U7 is a double-balanced mixer which operates with about +7 dBm of LO power and approximately -20 dBm of RF signal power at 160 MHz. The desired output is the difference frequency and lies between 150 kHz and 6 MHz.

IF AMPLIFIER C

The output of the mixer U7 is filtered by an 8-section elliptic 10 MHz Low Pass filter which must reject 14 to 20 MHz, and other higher frequencies. The filter output is amplified by Q3.

160 TO 166 MHZ VCO D

The 160 to 166 MHz VCO uses Q1 in a Colpitts configuration. The tank circuit is formed by L11, C33, C36, C37 and CR3 (a varactor diode). C33 and C36 provide a capacitive divider for the signal that is fed back into the emitter of Q1. L11 is adjustable allowing the center of the VCO tuning range to be varied.

Q2 is connected in a common base configuration and is used by PLL1 as a buffer amplifier for the 160-166 MHz output. Q4 is connected in a common emitter configuration and is used as a buffer amplifier for the 160-166 MHz signal that drives the LO port of the mixer.

PHASE/FREQUENCY DETECTOR E

The PHASE/FREQUENCY DETECTOR generates a differential output signal that is used by the LOOP AMPLIFIER (Block F) as well as the PHASE LOCK INDICATOR (Block G). The main components of the PHASE/FREQUENCY DETECTOR consist of two ECL flip-flops and three ECL NOR gates.

U6B and U6C generate ECL level inputs for the flip flops from the two frequencies to be compared. R25 and R26 center the input frequency signals to the midpoint of the ECL logic level thresholds so the PHASE/FREQUENCY DETECTOR will be less sensitive to amplitudes of the two comparison frequencies.

The SET inputs to both flip-flops are tied together and are driven by the output of the NOR gate U6A. Whenever the non-inverted outputs of the flip-flops are both low the SET lines on both flip-flops are asserted and the non-inverted outputs of the flip-flops will both go high.

As can be seen in Figure 8C-20, when one of the clock inputs goes high, the corresponding non-inverting output will go low and remain low until the other clock input goes high which sends the other non-inverting input low. Once both non-inverting outputs are low, the SET inputs will be asserted as previously described and both non-inverting outputs will go high until the next clock pulse is received.

When the inputs are out of phase the non-inverting outputs will differ. The non-inverting output with the longer negative going pulse corresponds to the input that is leading in phase. When the inputs are locked together the non-inverting outputs will both be high with low narrow pulses coincident with the input rising edge. The width of the narrow pulses correspond to the propogation delays of the NOR gate (U6A) and the flip-flops.

LOOP AMPLIFIER F

The phase detector differential outputs are the inputs to the LOOP AMPLIFIER. Each of the differential inputs is passed through identical low-pass filters (R5, R9, C2, R6, R10, and C3). C9, R16, C8, and R17 provide a large dc gain for the loop amplifier while insuring that each of the differential inputs see the same impedance over all frequencies. R14, R15 and C7 form an ac voltage divider which sets the loop bandwidth to about 10 KHz and limits the amount of noise introduced by U2.

The output of the divider goes to the varactor diode (CR3 in Block D) and tunes the VCO.

R18, CR4 and CR5 reduce the charging time of C7 whenever the frequency is abruptly changed.

If the VCO is tuned to a frequency that is lower than the 160 MHz reference frequency (Block A), the mixer output frequency still is equal to the difference of the two input frequencies but the loop will provide positive feedback instead of negative feedback and will drive the VCO to the low end of its frequency range. U1B prevents the VCO tune voltage from latching at a positive value by sensing when the voltage goes above 0 volts. When this occurs, the output of U1B pulls the tune voltage down to the proper lock range. R13 provides hysteresis to allow time for the loop to lock. CR2 prevents the output of U1B from interfering with the VCO when it is tuned to the correct side of 160 MHz.

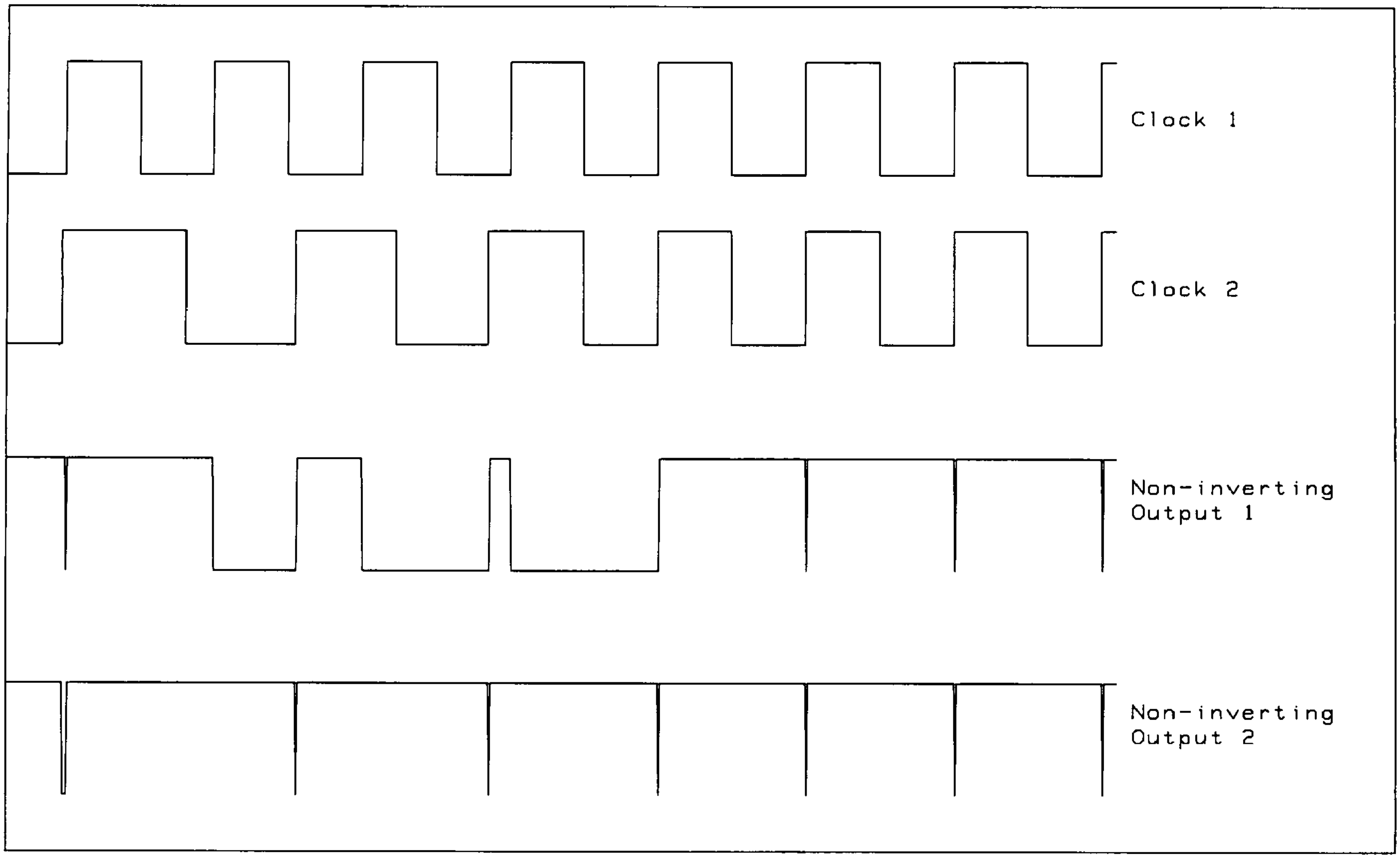


Figure 8C-20. A39 PLL3 Phase/Frequency Detector Waveforms

PHASE LOCK INDICATOR G

The PHASE LOCK INDICATOR senses the outputs of the PHASE DETECTOR to determine when the loop is locked. The non-inverting outputs of the phase detector flip-flops are attenuated by R23 and summed into the inverting input of U1A. The inverted outputs of the flip-flops are tied together (wire-or) and input to the non-inverting input of U1A. C1 filters out the high frequency components of the flip-flop outputs so the phase lock indicator is looking at the average voltages on each input. When the inverting input of U1A is more positive than the non-inverting input, the indicator will show that a phase locked condition occurs by lighting DS1 and outputting a TTL low level signal for HUL1.

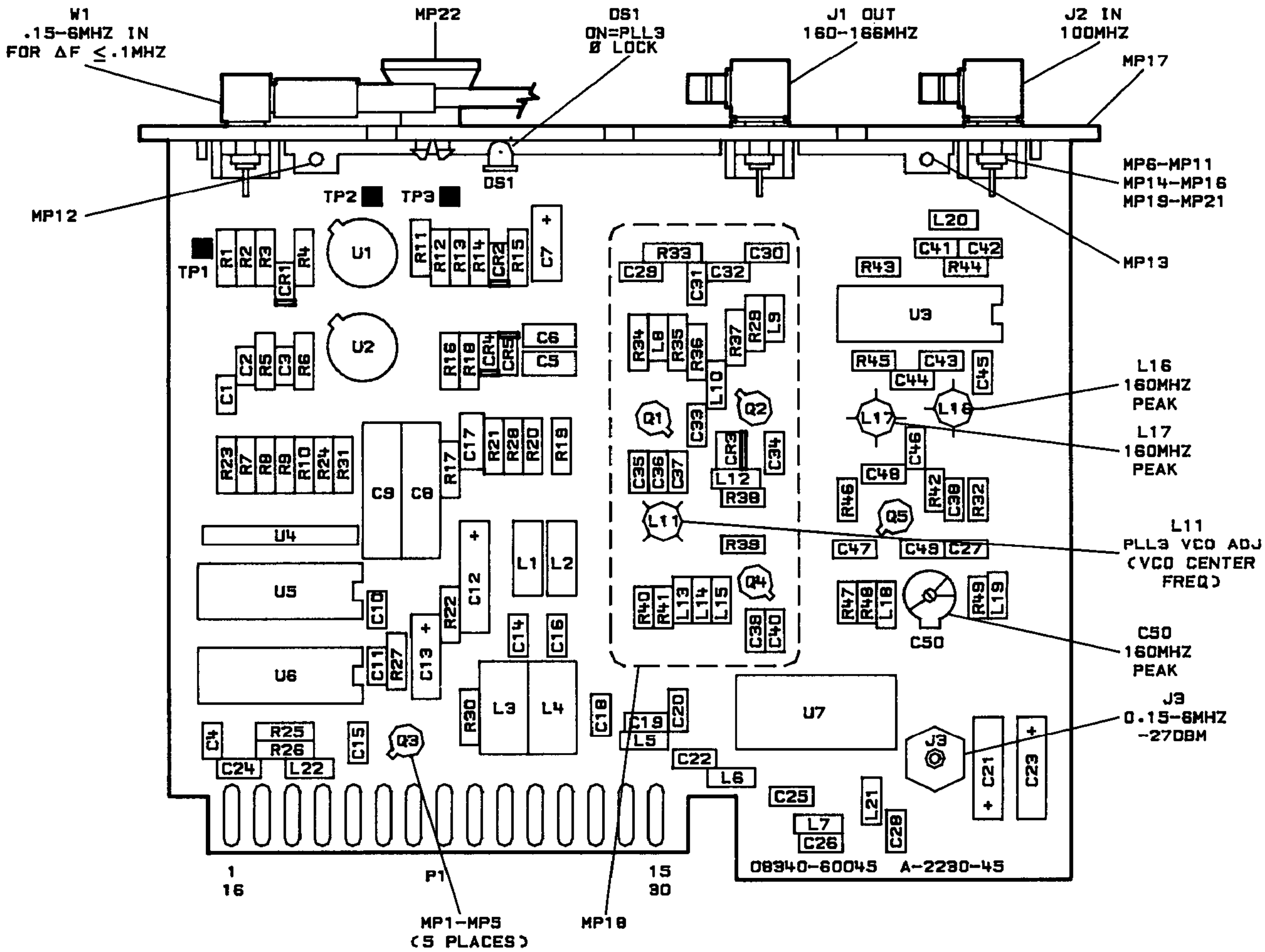


Figure 8C-21. A39 PLL3 Upconverter, Component Location Diagram

A39 PLL3 Upconverter, Pin I/O

A39

Pin	Mnemonic	Levels	Source	Destination
1 16	HUL1 HUL1	TTL (HIGH TRUE) TTL (HIGH TRUE)	*G *G	XA59P1-106 XA59P1-106
2 17	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
3 18	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
4 19	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
5 20	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
6 21	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
7 22	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
8 23	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
9 24	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
10 25	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
11 26	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
12 27	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32, XA53P1-12, 13, 31, 32	*THRU A62L4 TO H *THRU A62L4 TO H
13 28	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
14 29	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
15 30	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*THRU A62L3 TO H *THRU A62L3 TO H

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

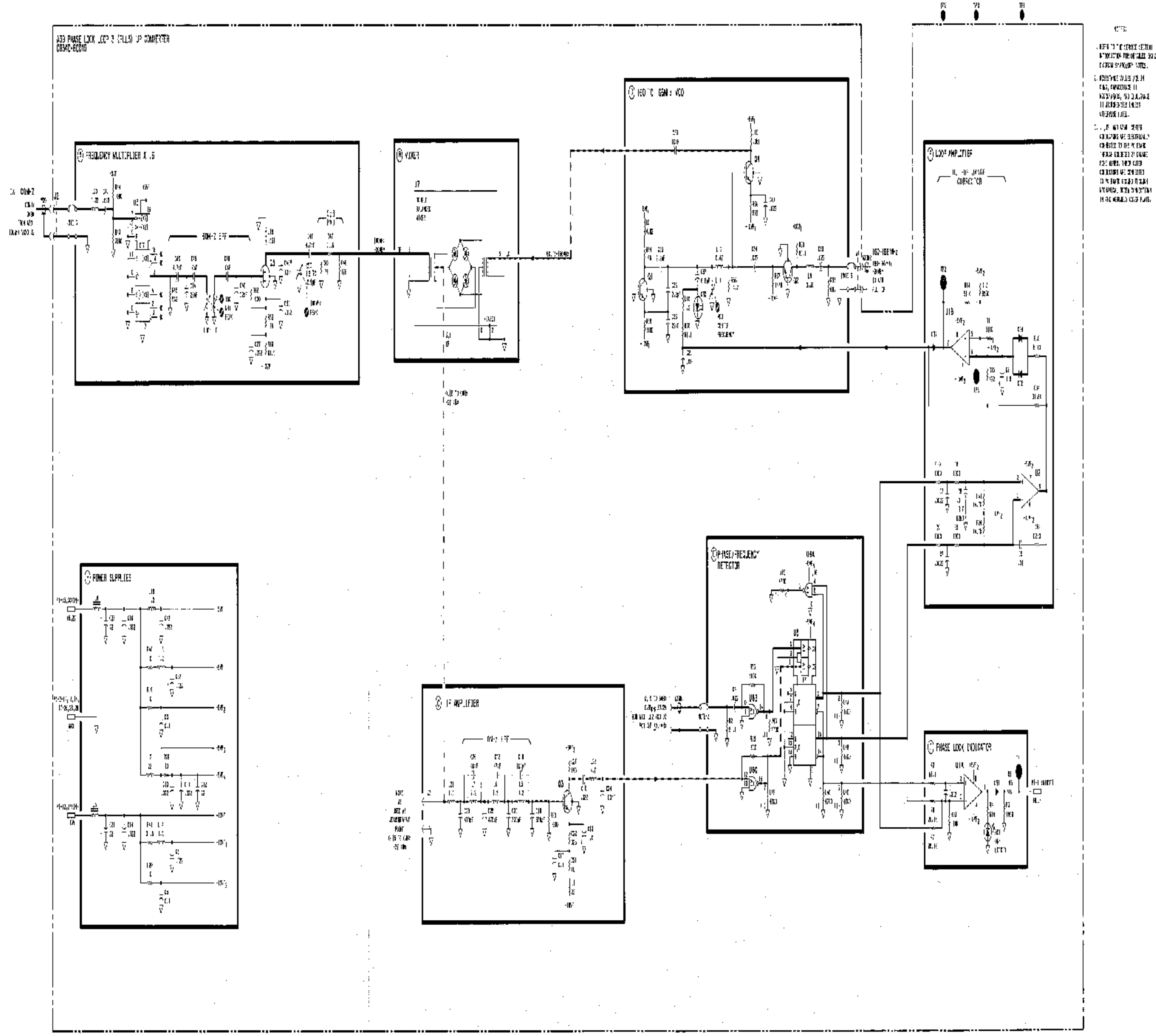


Figure 8C-22. A39 PLL3 Upconverter Schematic Diagram

A40 PHASE LOCK LOOP 2 (PLL2) VCO, CIRCUIT DESCRIPTION

INTRODUCTION

The A40 Phase Lock Loop 2 VCO assembly accepts a tuning current from the A43 PLL 2 Discriminator board to adjust the VCO frequency between 150 and 75 MHz. The output of the VCO is sent to the A42 PLL2 Divider and also is divided by 500 and sent to the A43 PLL2 Discriminator. In addition an output is sent to the A39 PLL3 Up Converter that is divided by either 25 or 500, depending on the sweep width selected.

BIAS NETWORK/50 kHz LOW PASS FILTER A

C1, C2, C3, L1, and L2 form a low pass (Chebyshev) filter. Although the cut-off frequency is 50 kHz the input frequencies (from the A43 PLL2 Discriminator board) to be rejected will normally be between 150 kHz to 300 kHz. The input signal is a current (1 to 9 mA). The filter is in series with the tuning current to minimize the effects of hum. Any stray signals coupled to the filter inductors will appear as a series voltage signal. Since the tuning current comes from a current source on the A43 Discriminator, it will be unaffected by any voltage fluctuations on the inductors.

The VCO tuning voltage at TP1 in VCO (Block **B**) is a function of the current from the A43 PLL2 Discriminator flowing through the equivalent resistance of R1-R5, which is essentially a current to to voltage converter. The tuning current passes through the 50kHz filter and into R1-R5. Since the varactors CR1-CR4 are reverse biased, negligible current is flowing through L3.

At the minimum tuning current, the varactor bias is set by R2 (150 MHz ADJUST). This functions as a VCO offset adjustment. As tuning current from the A43 PLL2 Discriminator increases, it forces the tune voltage in a positive direction, proportional to the setting of R4 (100 MHz ADJUST). This functions as the VCO gain adjustment, which is set to yield about -10 MHz/mA sensitivity. These adjustments are normally made with the loop phase-locked. When phase-locked, the VCO frequency will exactly equal the programmed frequency, so rather than adjusting for a frequency indication, the adjustments are made by monitoring the tuning voltage on the A43 PLL2 Discriminator and setting the end points to the appropriate voltages.

Transistors Q5 and Q6 and associated components form a low impedance filtered -32V source to bias the VCO varactor tuning diodes. Q5 and Q6, in a darlington configuration, minimize the fluctuations in base drive requirements as the tuning current is varied. Any fluctuations in base current cause a long time-constant change in the -32V output level due to the large resistors and capacitors in the base circuit.

VCO B

The VCO is a varactor tuned oscillator which tunes from 75 to 150 MHz. Varactors CR1, CR2, CR3, and CR4 form a series resonant circuit with L4 and L5. Figure 8C-23 shows the oscillators equivalent circuit. This series circuit connects the emitters of Q1 and Q2. Q2 is a common-base amplifier whose load impedance is made up primarily of L9, R14, and R15. The voltage across the load is coupled to the base of emitter-follower Q1, which drives the series resonant circuit. There is no phase inversion through Q2 emitter-to-collector or through Q1 base-to-emitter; therefore, the feedback signal is in phase with the input signal.

The load for the VCO is dependent upon Q4 in 75-150 MHz Output Buffer (Block **C**) and Q3 in Frequency Dividers (Block **D**) providing low input impedances. In the normal case, R14 and R15 dominate. If Q3 or Q4 are defective, the VCO may not oscillate since its load will no longer be dominated by R14 and R15.

75-150 MHz OUTPUT BUFFER C

Q4 is a grounded-base amplifier which isolates the VCO from the load circuits. The output of Q4 is filtered, attenuated, and used to drive the A42 PLL2 Divider.

A 13 dB attenuator (R20, R21, and R22) is used to reduce the output signal level and thus reduce the possibility of coupling this signal into other circuits. A pre-amplifier on the A42 PLL2 Divider returns the signal to the appropriate level. This signal path is used during phase-locking only, so its response below 100 MHz is not important since PLL2 is only programmable to phase-lock frequencies between 100 MHz and 150 MHz.

FREQUENCY DIVIDERS D

Q3 isolates the VCO from the dividers and develops the required drive voltage. All of the dividers and gates are ECL with Vcc connected to +5V and Vee grounded. As shown in Figure 8C-24, U3 divides the VCO frequency by 5 to obtain 15 to 30 MHz. U6C provides isolation. U2 divides by 5 to obtain 3 to 6 MHz. U2 then further divides by 2 and U1 divides by 10, so the output of U1 is 0.15 to 0.30 MHz. The output of U1 is fed to the A43 PLL2 Discriminator.

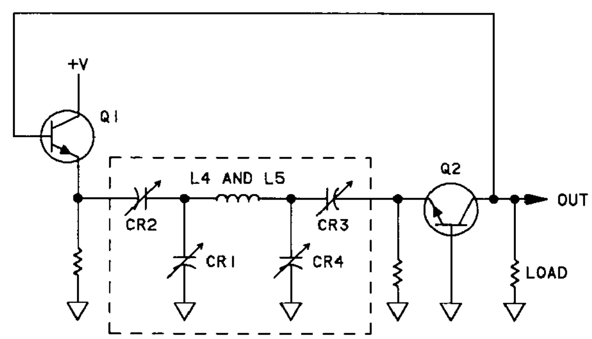


Figure 8C-23. Equivalent VCO Resonant Circuit

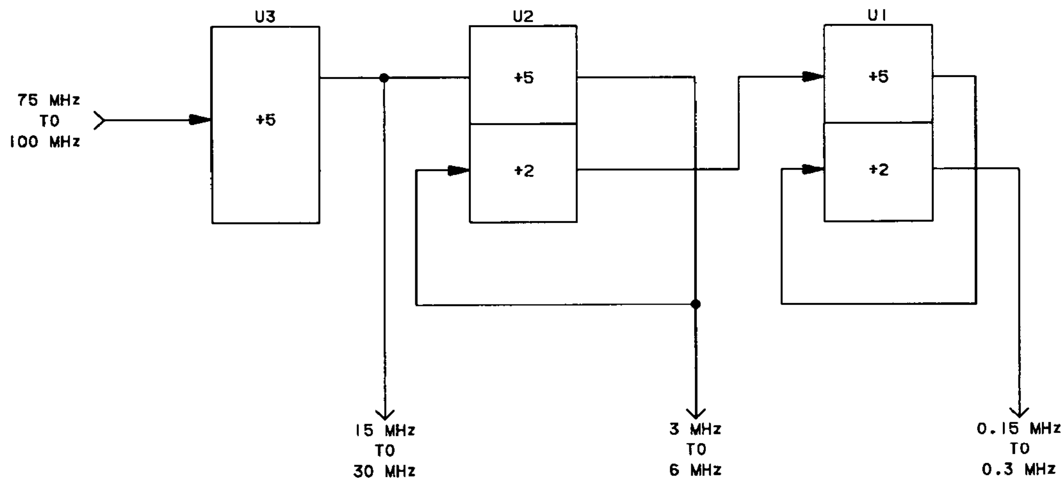


Figure 8C-24. Simplified Divider Circuit

SMALL DELTA F SWITCH E

U5 functions as a single-pole double-throw switch, routing either 3 to 6 MHz from U2 or 0.15 to 0.30 MHz from U1, to the A39 PLL3 Up Converter. The required range is selected by a TTL signal (SW2 from the A42 PLL2 Divider) on P1-22. R33 and R34 shift the TTL levels to ECL levels.

For 20-30 loop sweeps between 5 kHz and 100 kHz, SW2 is a TTL HIGH and the 3 to 6 MHz divider output is routed to the A39 PLL3 Up Converter. For sweeps less than 5 kHz, SW2 is a TTL LOW, selecting the 0.15 to 0.30 MHz output.

0.1-5 MHz DELTA F SWITCH F

For delta F or sweep widths of 0.1 to 5 MHz, the 15 to 30 MHz output is used. The output of U3 in Frequency Dividers (Block **D**) is routed through U6D, U7D, and T1. This combination serves as a switch with 90 dB of isolation in the off state. The TTL signal (SW1 from the A42 PLL2 Divider) on P1-24 controls this switch.

For maximum isolation, the two gates (U6D, U7D) are contained in separate packages. Any stray signals that do reach the output will be a common-mode input to transformer T1. Since T1 will only respond to differential mode signals from U7D, these common-mode signals will be rejected.

C25 and L14 filter the output to reduce spurious responses.

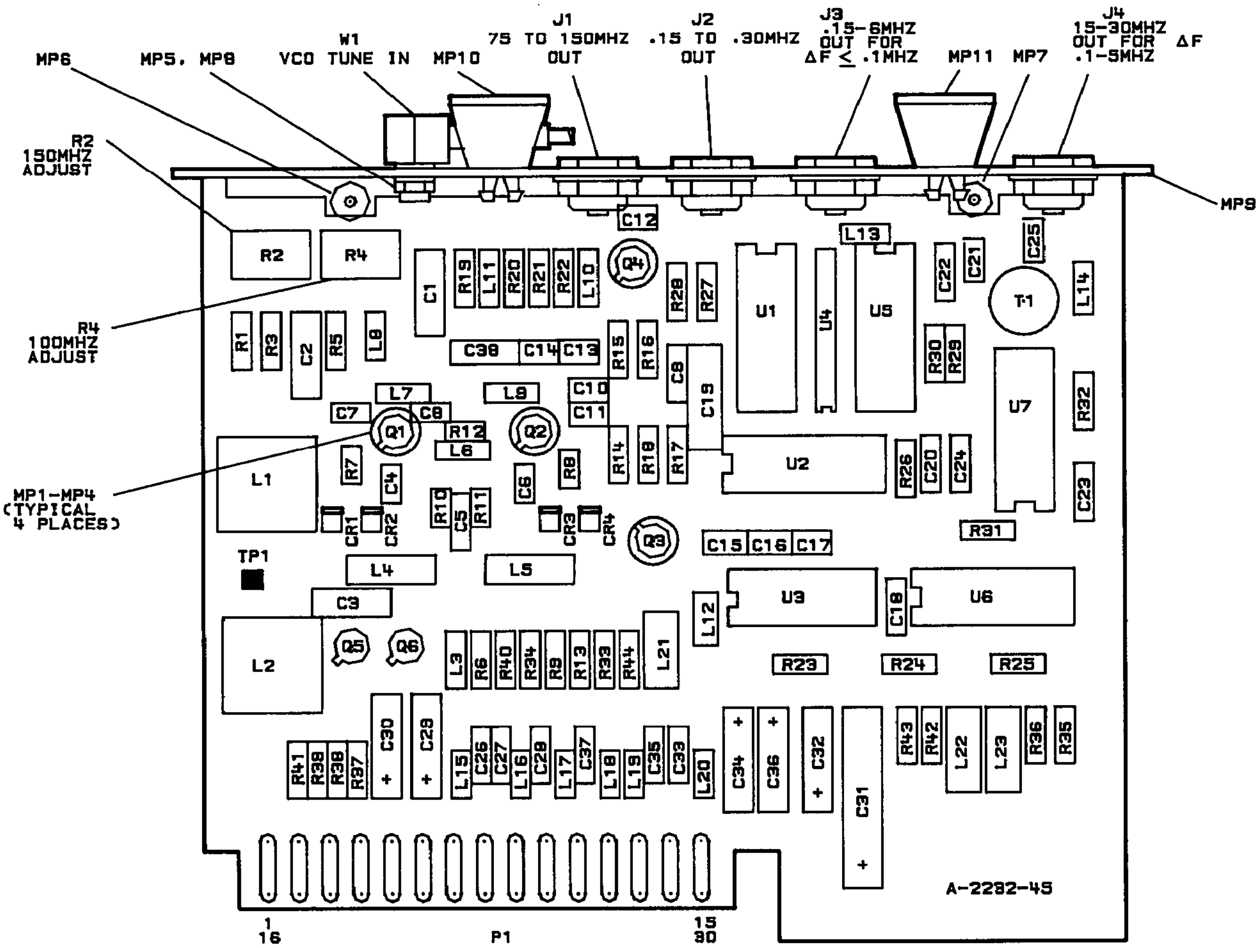


Figure 8C-25. A40 PLL2 VCO, Component Location Diagram

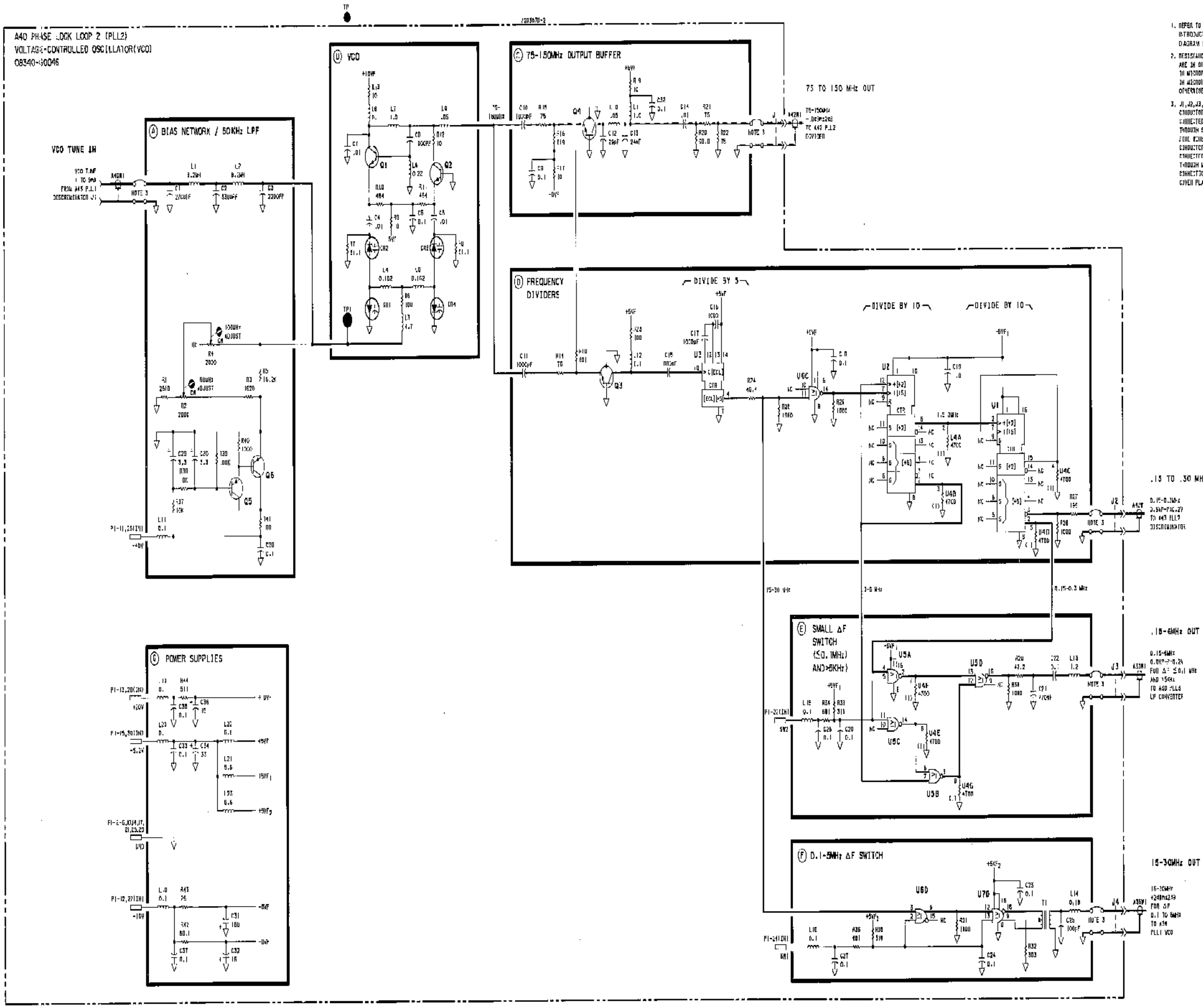
A40 PLL2 VCO, Pin I/O

A40

Pin	Mnemonic	Levels	Source	Destination
1 16				
2 17	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*G *G
3 18	GND	0V	A62 STAR GND A62 STAR GND	*G
4 19	GND	0V	A62 STAR GND A62 STAR GND	*G
5 20	GND	0V	A62 STAR GND A62 STAR GND	*G
6 21	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*G *G
7 22	SW2	TTL	XA42P1-14	E
8 23				
9 24	SW1	TTL	XA42P1-32	*F
10 25	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*G *G
11 26	−40V/−40V SENSE (−) −40V/−40V SENSE (−)	−40V −40V	XA53P1-11, 30/XA53P1-23 XA53P1-11, 30/XA53P1-23	*A *A
12 27	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*G *G
13 28	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*G *G
14 29	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*G *G
15 30	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*G *G

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.



NOTES

1. REFER TO THE SERVICE SECTION INTRODUCTION FOR DETAILED SCHEMATIC DIAGRAM SYMBOLOGY NOTES.
2. RESISTANCE VALUES SHOWN ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.
3. J1, J2, J3, J4 AND A40W1 CENTER CONDUCTORS ARE ELECTRICALLY CONNECTED TO THE PC BOARD THROUGH SOLDERED 24 GAUGE [illegible]. THEIR OUTER CONDUCTORS ARE ELECTRICALLY CONNECTED TO PC BOARD GROUND THROUGH MECHANICAL SCREW CONNECTIONS IN THE ASSEMBLY COVER PLATE.

Figure 8C-26. A40 PLL2 VCO, Schematic Diagram

A41 PHASE LOCK LOOP 2 (PLL2) PHASE DETECTOR, CIRCUIT DESCRIPTION

INTRODUCTION

The purpose of the A41 PLL2 Phase Detector is to compare the phase of the A40 PLL2 VCO output signal (after division by N2 on the A42 PLL2 Divider) to a 500 kHz Reference signal (10 MHz from the A29 Reference Phase Detector divided by 20 on the A42 PLL2 Divider). The phase difference is converted to an error voltage used to fine-tune the sensitivity of the PLL2 Discriminator thereby correcting the PLL2 VCO frequency.

PHASE-FREQUENCY DETECTOR A

The Phase-Frequency Detector responds to the difference in phase between the 500 kHz reference input, P1 pin 20 (10 MHz from the A29 Reference Phase Detector divided by 20 on the A42 PLL2 Divider) and the 75 to 150 MHz from the A40 PLL2 VCO divided by N2 on the A42 PLL2 Divider board (P1 pin 19). Assuming both flip-flops U6A and U6B have been cleared, Q9 is ON and Q10 is OFF. Q9 supplies about 3 ma current which is sunk by current source Q8, resulting in approximately zero current flow through the 50 kHz low-pass filter (LPF) consisting of C2, L1, and C3. C4 is used to stabilize the two grounds between the sample and the hold modes.

Q8 is ON when High Lock Enable (HLE2) is HIGH.

A pulse from the PLL2 Divider, on P1 pin 19 clocks the Q output of U6A pin 5 HIGH turning Q9 off. With both Q9 and Q10 off, Q8 will sink current out of the 50 kHz LPF. A subsequent reference pulse on P1 pin 20 clocks the Q output of U6B pin 9 HIGH which immediately resets both flip-flops through U7A. Thus the effect of a pulse at P1 pin 19 leading one at P1 pin 20 is to route current from the 50 kHz LPF into Q8, momentarily reducing the current flow into the 50 kHz LPF.

Similarly, if the reference phase leads the divided input phase, Q9 current will be sunk by Q8 and Q10 current will be routed through the 50 kHz LPF, momentarily increasing the current flowing into the 50 kHz LPF. A net current flow into the LPF will cause the voltage at TP1 to decrease.

If the two inputs have different frequencies, the pulse relationships become complicated, but the net effect is a negative voltage at TP1 if the divided output frequency (P1 pin

19) is higher than the 500 kHz Reference (P1 pin 20).

U3 serves as an amplifier to provide the high currents necessary to rapidly charge the integrating capacitor C7 in the following stage in the ANALOG INTEGRATOR/SAMPLE AND HOLD (Block **C**). VR2 and VR3 serve as clamps, limiting the output swing to ±5.8V.

HLE2 (P1 pin 2) controls U6A and Q8. During sweep mode Q8 is OFF, U6A is set, shutting OFF Q9. HLE2 also goes to the A42 PLL2 Divider shutting OFF the 500 kHz input to U6B. With the 500 kHz input OFF , U7A forces U6B to reset which causes Q10 to shut OFF. With Q8, Q9, and Q10 all OFF, the voltage at TP1 during a sweep is forced to zero volts. This prevents any negative voltage from turning Q3 ON, and changing the charge stored on C7.

DIGITAL INTEGRATOR B

The error voltage necessary to phase-lock the loop must be sampled, and then held very constant during a sweep to preserve frequency accuracy at the end of sweep. If the entire error correction were to be retained in the analog integrator, it would require very low-leakage components to avoid a droop at the end of sweeps. Instead, the digital integrator is used to store the majority of the error voltage, and the analog integrator is left with a much less significant portion.

When the analog error voltage (TP3 in ANALOG INTEGRATOR/SAMPLE AND HOLD, Block **C**) goes below -4.7V, Q5 is turned ON and its collector voltage is pulled down to -1.4V. At this point, CR4 and CR3 become forward biased, clamping U2 and preventing further negative movement of TP3. Simultaneously, the input of U7B will have been pulled LOW, which turns ON a 2 kHz oscillator made up of U7C, R20, and C11. This clocks the count up input of counters U8 and U9, which drives DAC U10. U10 sources negative current to the summing junction of U4 in OUTPUT AMPLIFIER (Block **D**) and this current increases in magnitude as U8 and U9 count up. When the current reaches a value which tunes the VCO to the proper frequency the voltage at TP3 moves positive, shutting OFF the oscillator. An analogous sequence occurs when the analog error voltage (TP3) rises above +6.4V. This occurs during the phase-lock interval, before the sweep begins. During the sweep, any drop in the remaining analog error voltage is insignificant, since the UP-DOWN counters, U8 and U9, contain the majority of the error correction in digital form.

ANALOG INTEGRATOR-SAMPLE AND HOLD C

U2 and C7 form an integrator which integrates current flowing from U3 in Phase/Frequency Detector (Block **A**) through R8. The output of the integrator is summed with other signals in U4 of OUTPUT AMPLIFIER (Block **D**) and ultimately controls the VCO frequency. In steady state conditions, TP3 will settle to a constant voltage which tunes the VCO to the correct frequency. If the voltage at TP3 is constant, the integrator's input current must be zero, so opening the Sample and Hold FET switch Q3 will not change the voltage at TP3. When PLL2 is being used in its swept mode, the loop is locked to a start frequency set by A42 PLL2 Divider, then Q3 is opened. This breaks the lock loop, permitting a sweep to be executed.

Q3 is closed with zero gate voltage, and open with -7V on the gate. The gate drive comes from Q6 and Q7, which translates the TTL HLE2 signal level on P1 pin 2 to the 0/-7V levels. P1 pin 2 also controls U6A and Q8 in the Phase/Frequency Detector (Block **A**).

OUTPUT AMPLIFIER D

U4 serves to sum signals from the analog integrator, the digital integrator, and R11. R11 is a high frequency signal path that bypasses the slow responding integrators, and speeds up the phase locking process. U4, C8, C9, R12, and the internal 10K ohm resistor in U10 of DIGITAL INTEGRATOR (Block **B** between pins 1 and 16) form an active 3kHz low-pass filter.

The output of U4 is the tuning voltage that goes to the A43 PLL2 Discriminator board, and effectively changes the gain of the discriminator to tune the PLL2 VCO frequency.

UNLOCK INDICATOR E

When the phase lock loop is in a steady state condition (locked), the voltage at TP1 in the PHASE/FREQUENCY DETECTOR (Block **A**) is zero. If unlocked, the voltage will not be zero except for transients passing through zero. When the voltage exceeds ±3V, either Q1 or Q2 is turned ON, discharging C15 or C14 respectively and tripping comparator U1 (notice opposite polarity voltage on C14 and C15). When the voltage settles to less than ± 3V, the appropriate capacitor must recharge before the comparator is reset , essentially holding the unlocked condition. Recharging takes about 1 ms so the unlocked condition is held long enough for the processor to recognize it. Comparator U1 output is a TTL HIGH for an unlock condition.

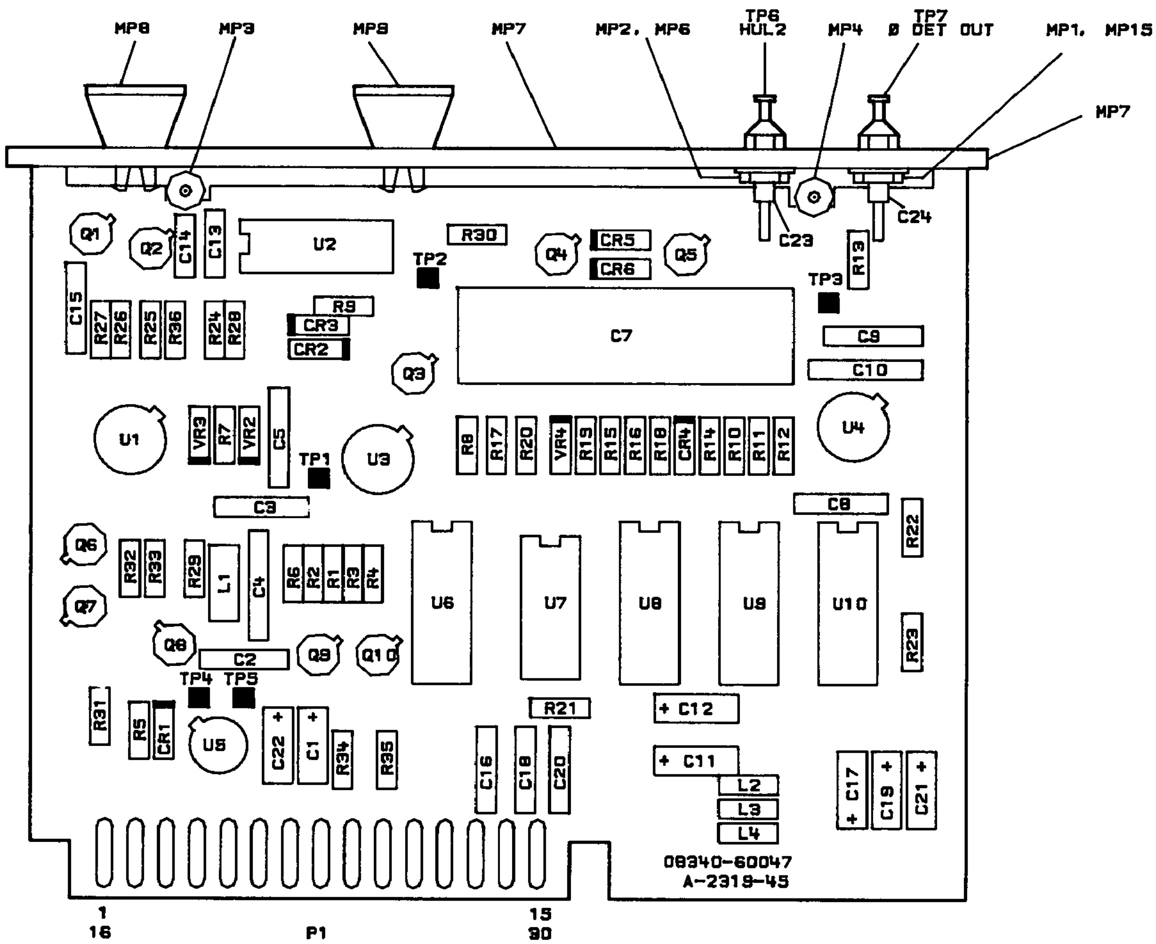


Figure 8C-27. A41 PLL2 Phase Detector, Component Location Diagram

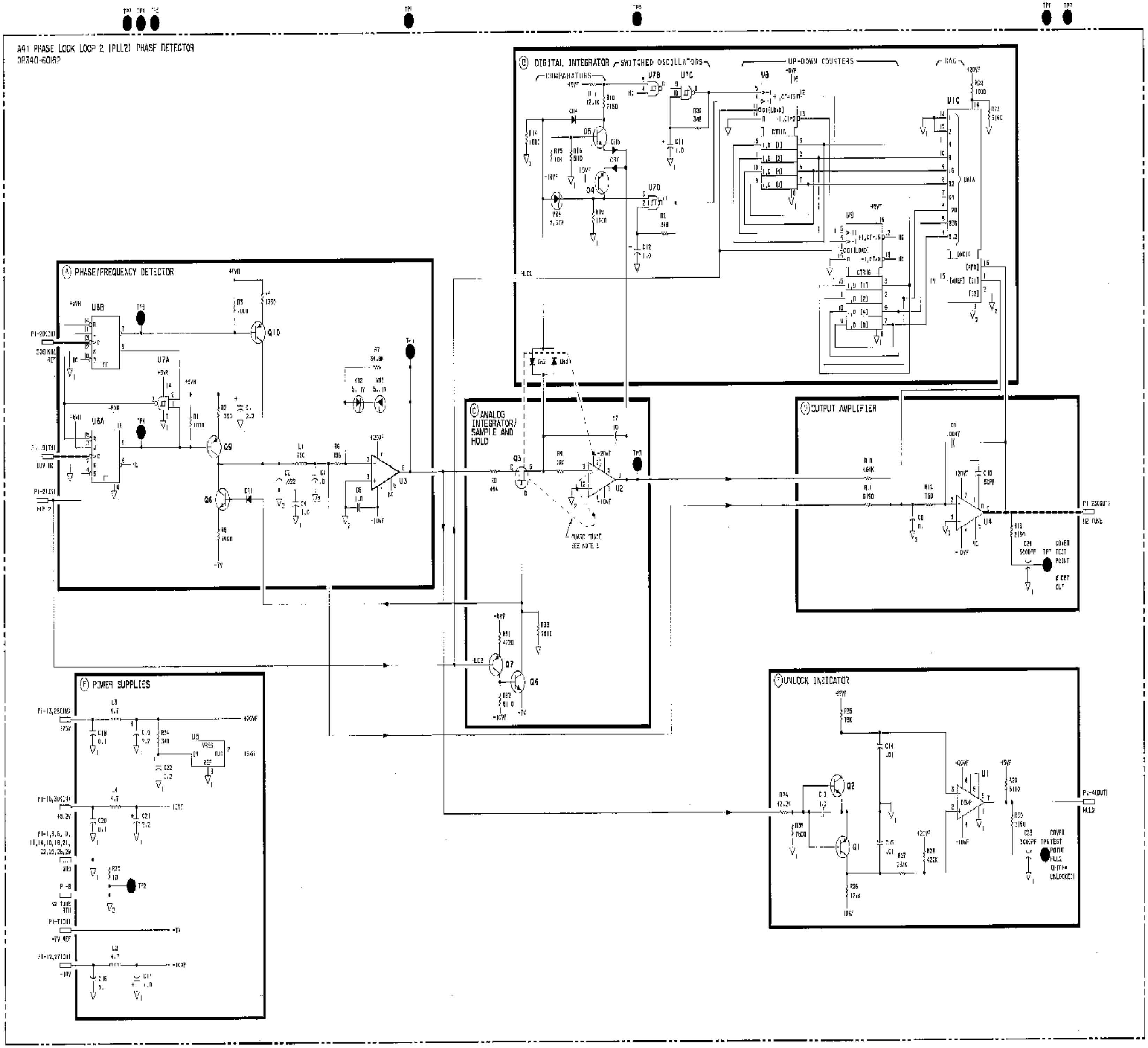
A41 PLL2 Phase Detector, Pin I/O

A41

Pin	Mnemonic	Levels	Source	Destination
1 16	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
2 17	HLE2	TTL (HIGH TRUE)	XA59P1-53	*A B C
3 18	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
4 19	HUL2 DIV N2	TTL (HIGH TRUE) TTL (LOW TRUE)	E XA42P1-27	XA59P1-107 A
5 20	 500 KHZ REF	 TTL	 XA42P1-9	 A
6 21	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
7 22	−7V REF GND	−7V 0V	XA43P1-9 A62 STAR GND	F *F
8 23	N2 TUNE RTN N2 TUNE	0V 0 TO +7 VOLTS	F D	XA43P1-10 XA43P1-28
9 24				
10 25	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
11 26	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
12 27	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*F *F
13 28	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*F *F
14 29	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
15 30	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*F *F

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.



NOTES:

1. REFER TO THE BEGINNING OF SECTION 8 FOR DETAILED SCHEMATIC DIAGRAM NOTES.

2. RESISTANCE VALUES ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.

3. PINS 2 AND 4 OF OP AMP PACKAGE U2 HAVE NO INTERNAL CONNECTION TO THE OP AMP CIRCUIT. THE GUARD TRACE IS ELECTRICALLY CONNECTED TO U2 PINS 2, 4, AND 12.

Figure 8C-28. A41 PLL2 Phase Detector, Schematic Diagram

A42 PHASE LOCK LOOP 2 (PLL2) DIVIDER, CIRCUIT DESCRIPTION

INTRODUCTION

The PLL2 Divider Board has two functions:

- Generate the 500 kHz reference signal which is used by the PLL2 Phase Detector Board. This is accomplished by dividing the 10MHz quartz crystal reference oscillator by 20.
- Divide the PLL2 VCO output signal A42W1 (which can range from 100 to 150 MHz when not sweeping) by some number between 200.01 and 300 so that the resulting frequency is 500 kHz.

The two signals above are sent to the PLL2 Phase Detector board so that phase lock can be achieved.

The circuit which performs the first function is explained in REFERENCE DIVIDER (Block **D**). The remaining circuitry on the PLL2 Divider board performs the second function. Refer to Figure 8C-29 for a simplified block diagram of this section of the PLL2 DIVIDER.

Refer to the "Frequency Range and CW Mode Accuracy" Performance Test for use as a troubleshooting aid.

LATCHES A

Latches U12, U13, and U14 store the BCD numbers used to preset the various counters on the PLL2 Divider board. The schematic (Figure 8C-32) shows the relationship of each output line to the frequency of the PLL2 VCO. The frequency of the VCO can be determined by adding the total of each individual output's contribution (if the output is HIGH) and subtracting that total from 150 MHz. For example, if U14 pin 10 and U14 pin 2 are both HIGH and all the other outputs of U14 as well as U2 and U13 were LOW the total contribution would be 40 MHz + 5 MHz = 45 MHz. The frequency of the PLL2 VCO would then be 150-45 = 105 MHz.

U14 pin 12 and U14 pin 15, SW1 and SW2 respectively, are routed to the PLL2 VCO board and are used for control.

REFERENCE DIVIDER D

A 10 MHz signal derived from the quartz crystal reference oscillator is amplified by Q2 and used to drive divider U4. The divide by 10 output of U4 drives U16, whose divide by 2 output goes to the A41 PLL2 Phase Detector. This 500 kHz signal is used as a reference to which the programmable divide output of the PLL2 Divider is compared. The TTL input on P1-2 (HLE2) disables the reference divider during sweeps.

There are five main blocks to the programmable fractional divider which divides the output of PLL2 VCO. They are:

- PRESCALER
- DIRECT DIVIDER
- INTEGER COUNTER
- FRACTIONAL COUNTER
- SYNCHRONIZER

PRESCALER E

The -18 dBm, 75-150 Mhz input from A40 PLL2 VCO, is amplified by Q1 and used to drive prescaler U1A. The prescaler is a selectable divide by 10 or divide by 11 device. In terms of pulses, if the LSWALLOW line is LOW the device is in the divide by 11 mode; that is it takes 11 input pulses to produce 1 output pulse. If the LSWALLOW line is HIGH (divide by 10 mode) then it requires 10 input pulses to produce 1 output pulse. The divide by 11 mode can be thought of as a ``pulse swallowing'' mode since it requires one more pulse than the divide by 10 mode to produce the same output pulse. The output of the prescaler after being converted to TTL signal levels by U1B and buffered by U9C becomes the clock signal for all the other circuits of the fractional divider. Everything is referenced to this clock signal.

DIRECT DIVIDE B

The direct divide block contains two presettable counters U8 and U15 followed by two flip flops U10A and U10B. The direct divide block determines the number of clock pulses in a cycle. A cycle being the time from one LRESET pulse to the next. The Q and Q not outputs of U10A (pin 5 and 6) are the divided output signal and LRESET signal respectively. It should be noted that the frequency of the divided output signal (and the LRESET pulse) is always 500 kHz (when the PLL2 loop is locked) because it is this signal that is phase locked to the 500 kHz Reference signal. The frequency of the input signal (PLL2 VCO output) will change with changes in divide number.

The number of clock pulses in a cycle is determined by the number sent to the presettable counter U8. U15 is also presettable but is always preset to 0 (U15 is most significant digit). U9B produces a HIGH output at a U8 and U15 count of 25 but because four additional clock pulses are required for this signal to get through U10B and U10A the cycle lasts for four more clock pulses. So, if the counter was preset to 0 a cycle would be 29 clock pulses long; if preset to 9 a cycle would be 20 clock pulses long. Thus a cycle is (29-N) clock pulses long if N is the number preset in the counter.

INTEGER COUNTER F

The integer counter consists of a presettable counter U7 and NAND gate U9A. The purpose of the integer counter block is to control the number of clock cycles that the prescaler will be in the "pulse swallow" (divide by 11) mode. Suppose that U7 was preset to 5 via the LRESET pulse. The next clock pulse after LRESET goes HIGH, causes U7 to increment its count and after 4 clock pulses U7 reaches a count of 9 and the output of U9A, STOP SWALLOW, goes HIGH. This HIGH output is clocked into U3A at the next clock pulse, thereby forcing U3B pin 9 (LSWALLOW) HIGH. Summarizing, it took 6 clock pulses after LRESET went HIGH before LSWALLOW was asserted HIGH. However it should be mentioned that LSWALLOW is not forced LOW until one clock pulse after LRESET. Thus with the integer counter preset to 5 the LSWALLOW line was LOW for 5 clock pulses which means the prescaler was in divide by 11 mode for 5 clock pulses. If the counter had been preset to 4 one additional clock pulse would have been required so that the divide by 11 mode would have lasted for 6 clock pulses. Thus if the integer counter is preset to some number N, then the prescaler will divide by 11 for (10-N) clock pulses.

Ignoring the fractional counter block for the moment a general description of the circit can now be given. Suppose the direct divider is preset to 21 and the integer counter is preset to 5. Using previous discussions it is known that there will be 21 clock pulses in a cycle and that (10-5) or 5 of them will be in the divide by 11 mode and (21-5) or 16 of them will be in the divide by 10 mode. Since it requires 55 input pulses to produce 5 clock pulses when in divide by 11 mode and 160 input pulses to produce 16 clock pulses in the divide by 10 mode we have the following relationship:

55 + 160 = 215 input pulses produces 21 clock pulses or 1 output pulse. We are therefore dividing the input signals frequency by 215.

FRACTIONAL COUNTER C

The FRACTIONAL COUNTER block is the section that provides non-integer divide numbers. The fractional counter block contains rate multipliers U5 and U6 and one shot multivibrator U11. The rate multipliers produce M1 M2 pulses (M1 M2 is a two digit BCD number) for 100 pulses input, or the frequency out is (M1 M2 / 100) times the frequency in. So if M1=3 and M2=2 then 32 pulses will come out for every 100 pulses input. The rate multipliers are enabled through U2D and the control line HLE2. A HIGH on HLE2 causes the rate multipliers to be enabled. The rate multipliers have as their clock inputs the Divided Output signal. The output of this block is the STOP SWALLOW EARLY line which when HIGH causes the SYNCHRONIZER to bypass the normal routing of the integer counter output and forces the LSWALLOW line HIGH one clock pulse earlier than it normally would have. So for the particular cycle that STOP SWALLOW EARLY is HIGH one less input pulse is required to produce the same output pulse. The one shot U11 holds the STOP SWALLOW EARLY line HIGH for about 1.6 microseconds (when triggered by rate multiplier U5) so that the SYNCHRONIZER will properly respond to it. Assume the rate multipliers have been set to 32. Therefore 32 output pulses are produced for every 100 input pulses. So 32 out of 100 cycles the prescaler is ``swallowing'' one less pulse than it normally would have, causing the input frequency to decrease (the output frequency is fixed because of phase lock). In fact the amount of decrease is (32/100) X 500 kHz or 160 kHz. In terms of pulses and using the previous example of divide by 215 we would have 32 cycles of divide by 214 and 100-32 or 68 cycles of divide by 215. Adding things up we have:

32 X 214 + 68 X 215 = 21,468

So we have 21,468 input pulses for 100 output pulses or a divide number of 21,468/100= 214.68 and the input frequency should be 500 kHz X 214.68 = 107.34 MHz because of phase lock.

SYNCHRONIZER G

The SYNCHRONIZER controls the state of the LSWALLOW line based on two inputs, the STOP SWALLOW line and the STOP SWALLOW EARLY line. The LRESET line going LOW causes U3A pin 6 to go HIGH and U3B pin 9 (LSWALLOW) to go HIGH forcing the prescaler to the divide by 10 mode. The next CLOCK pulse after LRESET goes HIGH (LRESET is LOW for 2 CLOCK pulses) causes the U3A pin 6 output through U2B to change the state of U3B , forcing the LSWALLOW line LOW. Thus every cycle starts (one CLOCK pulse after LRESET) with LSWALLOW LOW and the prescaler in the divide by 11 mode. U2A and U2B serve to route the STOP SWALLOW signal around U3A when the STOP SWALLOW EARLY line is HIGH thereby causing U3B pin 9 to go HIGH one clock pulse earlier than normal.

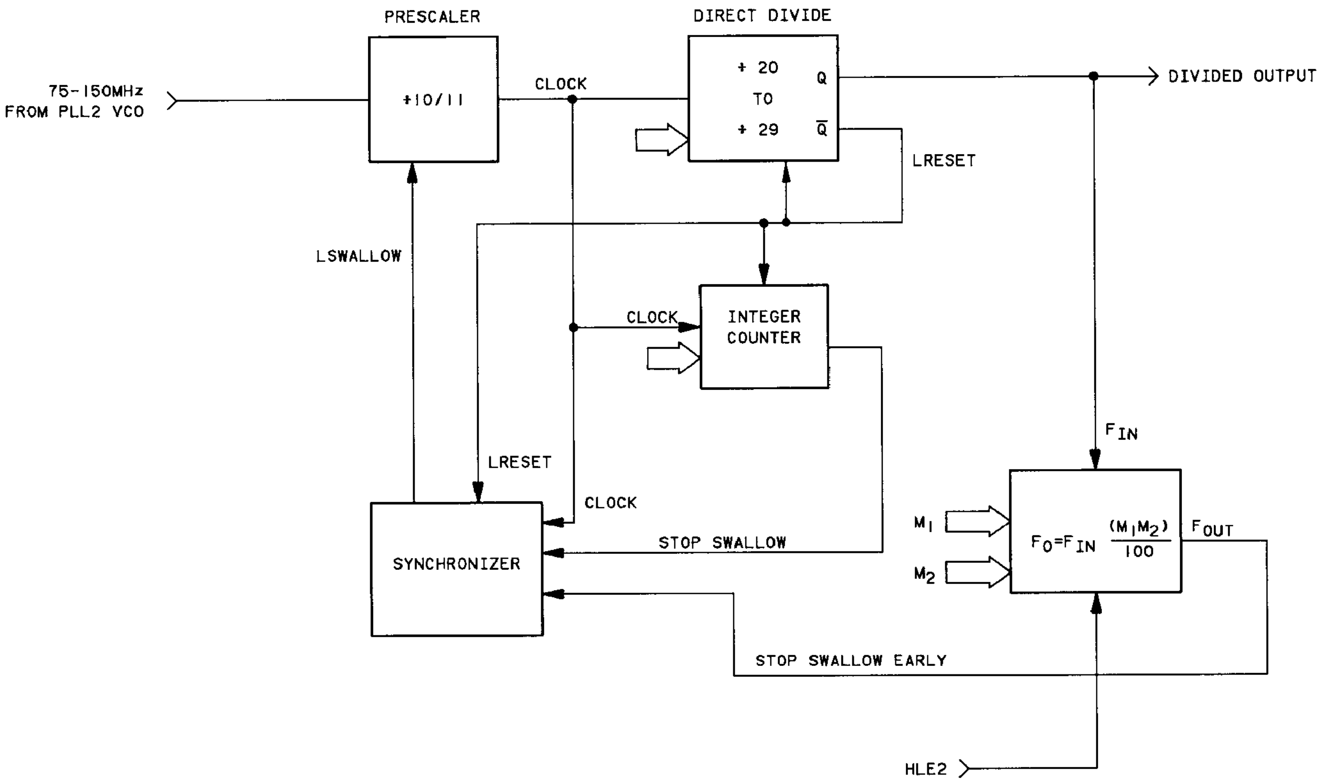


Figure 8C-29. PLL2 Divider Simplified Block Diagram

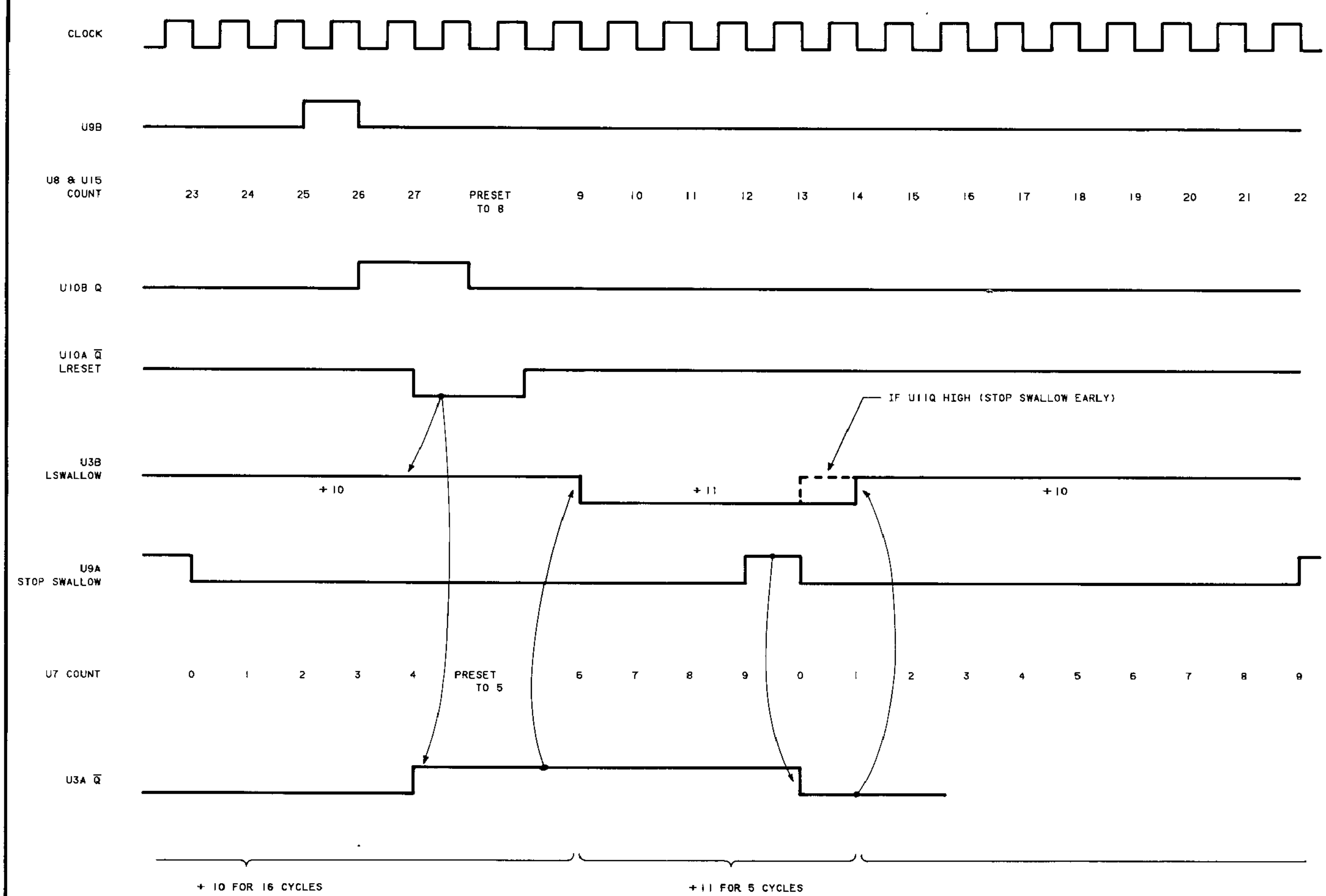


Figure 8C-30. Partial Circuit Timing for ÷ 215 Example

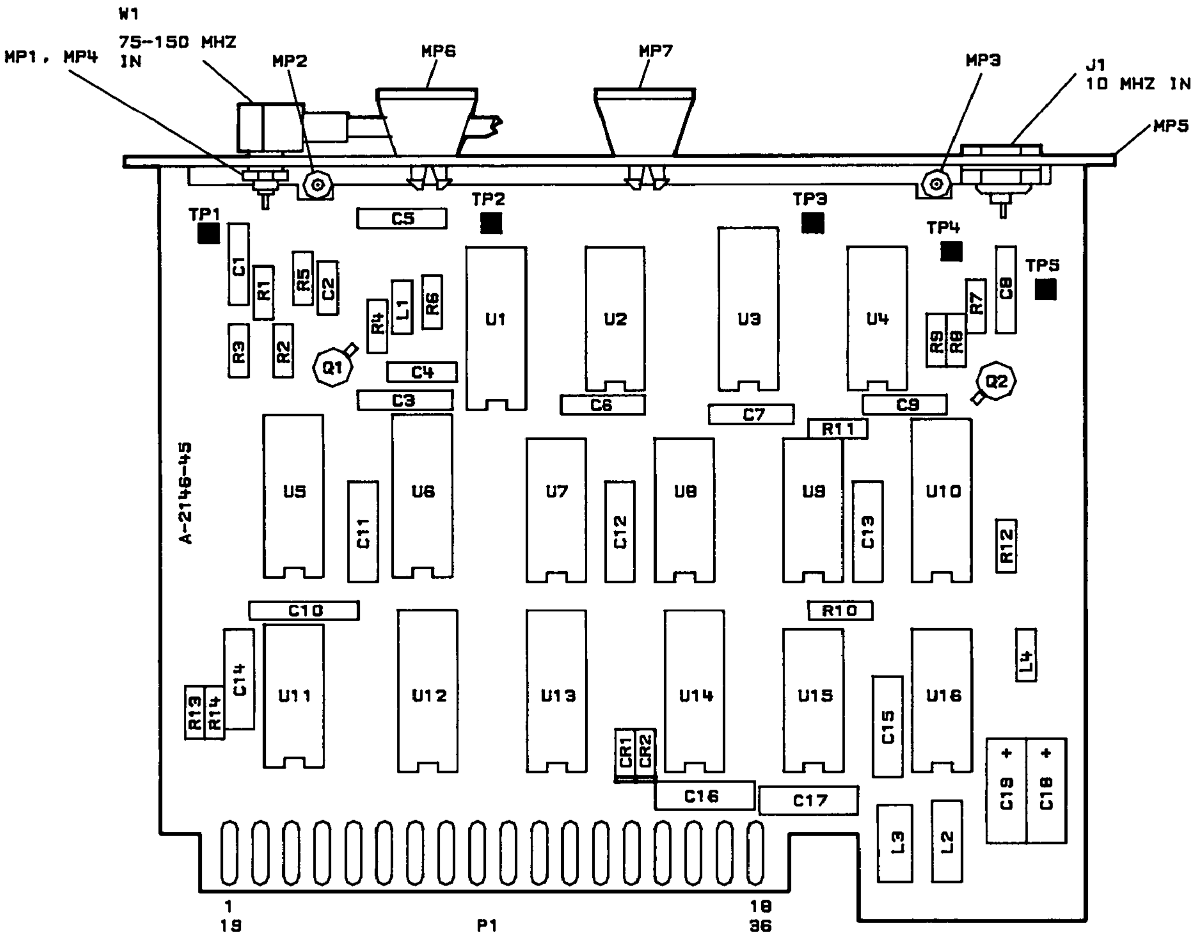


Figure 8C-31. A42 PLL2 Divider, Component Location Diagram

A42 PLL2 Divider, Pin I/O

A42

Pin	Mnemonic	Levels	Source	Destination
1 19	LCK2 LCK1	TTL (LOW TRUE) TTL (LOW TRUE)	XA59P1-109 XA59P1-54	A A
2 20	HLE2 GND	TTL (HIGH TRUE) 0V	XA59P1-53 A62 STAR GND	*C D *H
3 21	DB1 DB0	TTL TTL	XA60P1-76 XA60P1-20	*A *A
4 22	DB3 DB2	TTL TTL	XA60P1-77 XA60P1-21	*A *A
5 23	DB5 DB4	TTL TTL	XA60P1-78 XA60P1-22	*A *A
6 24	DB7 DB6	TTL TTL	XA60P1-79 XA60P1-23	*A *A
7 25	DB9 DB8	TTL TTL	* *	*A *A
8 26	DB11 DB10	TTL TTL	* *	*A *A
9 27	500 KHZ REF DIV N2	TTL TTL (LOW TRUE)	D B	XA41P1-20 *C
10 28	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
11 29				
12 30				
13 31				
14 32	SW2 SW1	TTL TTL	A A	XA40P1-22 *
15 33	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*NOT USED *NOT USED
16 34	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*NOT USED *NOT USED
17 35	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
18 36	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*H *H

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

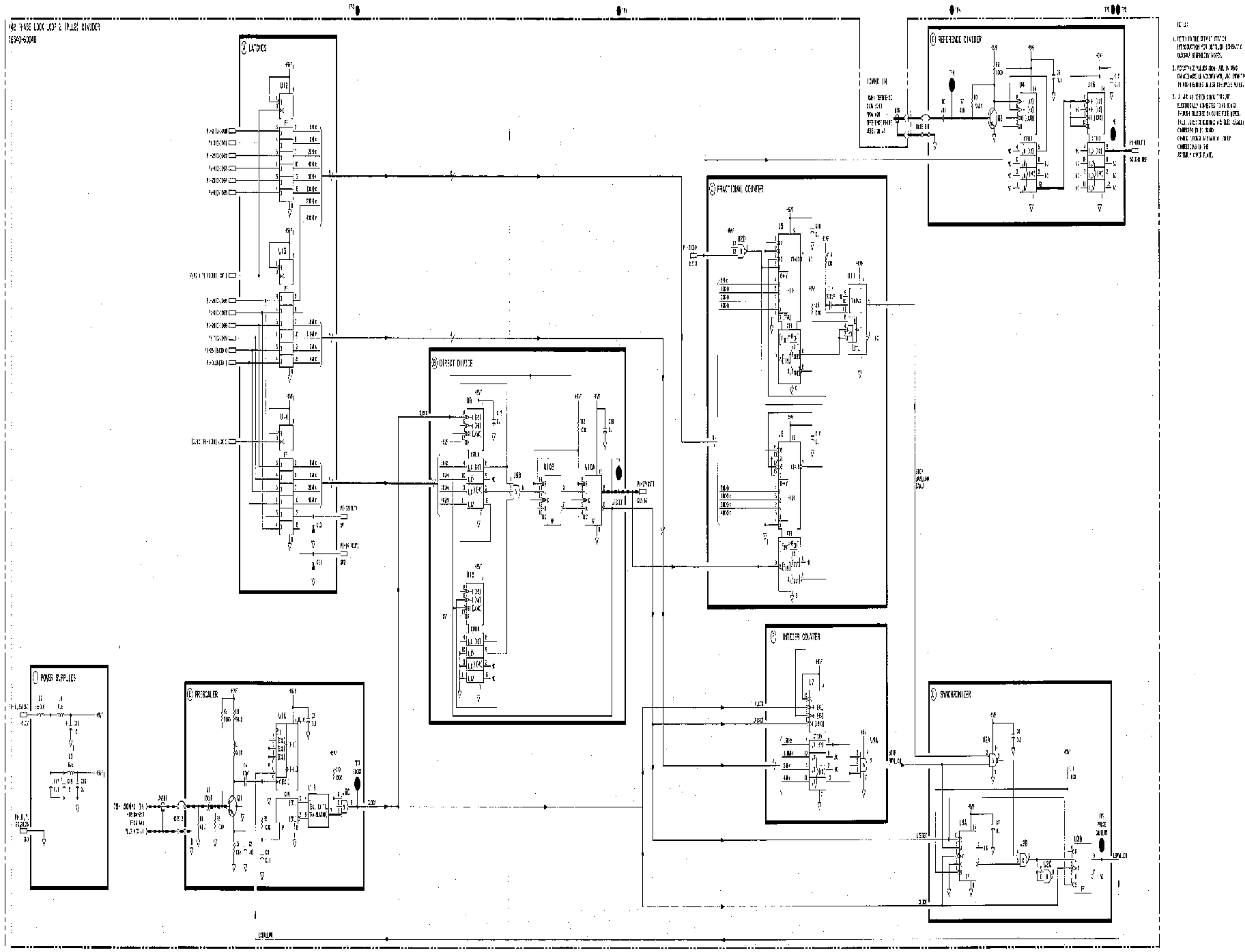


Figure 8C-32. A42 PLL2 Divider, Schematic Diagram

8-25978-260

A43 PHASE LOCK LOOP 2 (PLL2) DISCRIMINATOR, CIRCUIT DESCRIPTION

INTRODUCTION

The A43 PLL2 Discriminator Assembly contains the discriminator used to control the PLL2 VCO. The sensitivity of the discriminator is adjusted by control signal N2 Tune into CURRENT SOURCE (Block **B**) from A41 PLL2 Phase Detector. In addition, the A43 Phase Lock Loop 2 Discriminator assembly contains the summing circuitry to combine the 0 to 10V 20-30 sweep ramp signal into P1 pin 1 of the DELTA F SWEEP ATTENUATOR (Block **E**) from the A58 Sweep Generator, the PRETUNE (Block **D**) from the A60 Processor, and the discriminator output to produce a 1 to 9mA current to tune the A40 PLL2 VCO.

The method used to combine these signals is to mix all three input currents together at the input to an integrator (junction of R43 in SUMMING AMPLIFIER (Block **F**) and R40 in PRETUNE Block **D**). If the voltage at this node is not zero, then the integrator output will change, and force the PLL2 VCO to a different frequency. The frequency continues to change until the discriminator`s output current to the summing node is at a level to produce zero volts at the summing node. This forms a frequency-locked loop, with the discriminator as the feedback element. The result is the equivalent of having a very linear VCO. (See Figure 8C-33).

This "discriminator-linearized-VCO" is used inside a phase lock loop. In this configuration the phase lock loop tunes the VCO indirectly, by changing the gain of the discriminator. This provides the capability to establish an accurate, synthesized start frequency by using the phase lock loop to fine tune the discriminator during pre-sweep phase locking. To sweep the loop, the discriminator`s fine tune voltage is stored in a sample and hold circuit, and the phase-locked loop is opened. This establishes an accurate, synthesized start frequency for the sweep and calibrates the discriminator gain. The current summing node is still forced to zero volts, so if a ramp of current is injected into the node, the discriminator/VCO loop causes the VCO to ramp in frequency and exactly cancel the injected current by a reduction in discriminator output current. Since the discriminator remains active at all times, the sweep linearity is primarily a function of the discriminator, and not the PLL2 VCO.

The discriminator itself is formed by two of the blocks of the A43 circuit; the PULSE GENERATOR (Block **A**) and the CURRENT SOURCE

(Block **B**). The input to the discriminator is used to trigger a very stable 1.6 microsecond pulse. The current source is activated by this pulse, and outputs a fixed amount of current for 1.6 microseconds. These current pulses are averaged to yield some net current flow that is proportional to the frequency of the input to the discriminator; the higher the frequency, the more frequent the 1.6 microsecond pulses, and the greater the average current. The gain of the discriminator (current out/frequency in) can be adjusted by changing the magnitude of the current pulses, but the width will always be a constant 1.6 microsecconds.

PULSE GENERATOR A

The PULSE GENERATOR functions as a one shot multivibrator. However, in a standard multivibrator the pulse width is determined by an RC time constant and the trigger point may vary with circuit components and also with noise. In this case, pulse width (about 1.6 microseconds) repeatability is critical. The signal at TP2 then is a 1.6 microsecond pulse, with a repetition rate equivalent to the input frequency. This signal will be integrated in the Current Source (Block **B**) to produce an average current related to the input frequency. The 150 to 300 kHz (ECL level) input from the A40 PLL2 VCO assembly is amplified and level shifted by Q6 and Q7. At the begining of a cycle, both inputs to U7D are LOW. When Q7 collector goes HIGH, U7D output goes LOW saturating Q11 and causing resonator L4, C15, and C16 to ring at 5.2 MHz. This damped oscillation appears at Q9 collector, is clipped by Q10, and used to drive counter U6.

Q10 is a comparator. The signal appears across L5 driving the base of Q10A and Q10B in opposite directions. U6 is preset to a count of 6. When the count reaches 8, the "8" output of U6 goes high. This is fed back to U7D pin 11, holding its output LOW . After 1.6 microseconds, the count reaches 16, the 8 output goes LOW again, U7D output goes HIGH turning Q11 OFF resulting in the resonance being damped by R17. At the count of 16, U7C and U7B reset the counter to 5. Before the oscillation is fully damped, the counter gets clocked to 6. U6 should always be reset to either 5 or 6 depending upon how quickly Q11 can dampen the resonator. The actual number is not relevant, since the pulse output starts at the count of 8, effectively ignoring the first several pulses, and the width will always be a constant 1.6 microseconds.

U7D output going LOW starts the resonator ringing. If for some reason the counter did not reach an 8 count, U7D output would be held low causing a latch-up condition. When U7D output is HIGH, U7A output turns CR1 ON discharging C14. When U7D output goes LOW, CR1 is reversed biased and C14 starts to charge through U6 pin 14 towards Vcc until the U6 input circuit trips, reseting U6 and preventing a latch-up condition.

The pulse width at TP2 should be equivalant to eight pulses at TP3.

CURRENT SOURCE B

With the tuning voltage input (P1 pin 28) at zero volts, the voltage divider from -7V through R6, Q3A/B, R7 to +20V sets the input to U4 pin 3 at about +13V. U4 and Q4 form a voltage controlled current source, where the magnitude of the current flowing out of Q4 drain is proportional to the voltage on U4 pin 3. The ratio of current to voltage is calibrated by R9, .3 MHz Adjust. The output of the current source flows through Q5A when the "8" output of U6 is LOW. If an input pulse has triggered the pulse generator, the current is switched through Q5B for 1.6 microseconds. Since Q4 and its associated circuit is a constant current source, when Q5A is ON all the current flows through Q5A, leaving no current for Q5B. When Q5A is shut OFF all the current flows through Q5B. Q5B current is integrated by C20 and goes through a low-pass filter to the summing point of the discriminator loop. The average value of this current is directly proportional to the input frequency, being about 1.5 mA at 0.3 MHz. The 0.3 MHz Adjust (R9) in the U4 feedback loop adjusts the the discriminator gain by changing the amplitude of the 1.6 microsecond current pulses into the filter.

The tuning voltage input (N2 Tune) from the A41 PLL2 Phase Detector (P1 pin 28) is also able to adjust the gain of the discriminator by ±1% by changing the voltage at U4 pin 3, and thereby changing the amplitude of the 1.6 microsecond current pulses.

C21 is used to stabilize the two grounds when Q5A/B is switching.

-7V SUPPLY C

U13 maintains a constant current through reference diode CR1. R35 sets this current to approximately 7.7mA. The 6.3V reference is amplified due to the ratio of R33 and R34 to yield -7V. Q8 provides a low impedance, high current output.

PRETUNE D

The pre-tune circuit tunes the discriminator loop approximately to the desired frequency. The phase lock loop then applies small corrections to get the frequency exact. The A60 Processor outputs a 10-bit binary word representing the pretune frequency and then strobes the data into latches U9 and U12 by outputting address

0,R1: (channel 0, subchannel 1). The data programs DAC U11, whose output goes to U10. If the input is all zeros, the output of U10 is zero volts. The 1.5 mA into the summing node must then come entirely from the discriminator (sweep ramp =0). 1.5 mA out of the discriminator corresponds to 0.3 MHz into the discriminator. To pretune the input frequency to 200 kHz, a binary word representing decimal 1000 is programmed into the the DAC U11. This results in +6.84V at TP1 and a corresponding current into the summing node, through R41 and R42, of 0.5mA. Adding 0.5mA to the summing node causes the discriminator output current to equal 1.5-0.5 or 1.0 mA which corresponds to a discriminator input frequency of 0.2MHz. R41 (0.2 MHz Adjust) is used to adjust the VCO frequency to 100 MHz and thus the discriminator input frequency to 0.2 MHz (100 MHz/500). R41 (0.2 MHz Adjust) and R9 (0.3 MHz Adjust) function as slope and offset adjustments to calibrate the discriminator system to exactly 5mA/MHz.

DELTA F SWEEP ATTENUATOR E

The 0 to 10 volt A58 20-30 Sweep Generator sweep ramp (P1-1) is selected and attenuated depending upon the state of U12 pin 15 and U12 pin 2 (the latched outputs for data lines IOB10 and IOB11). The state of each switch of U1 and U2 is shown in a table on the schematic diagram (Figure 8C-35) for any combination of HIGHS and LOWS on these latched control lines. Switch U1A when closed passes the 0 to 10 volt ramp un-attenuated to the summing junction in SUMMING AMPLIFIER (Block **F**). Switch U1B and switch U1C are used for cancellation of the ON resistance of switch U1A. Cancellation is achieved by scaling the sweep ramp with R29 and switch U1C and then feeding it to the summing junction through R30 and U1B. When switch U1D is closed the sweep ramp is routed through R26 and R25 which results in one tenth of the current being summed in due to the ramp than in the previous case with U1A being closed. Refer to Figure 8C-34 for the simplified SWEEP ATTENUATOR circuit diagram.

U2 switch A and B route the sweep ramp directly to the OUTPUT CURRENT SOURCE (Block **G**) which directly tunes the PLL2 VCO. This "feed forward" path helps compensate for the rather slow response of the discriminator loop. U2 switches C and D perform logic functions. See the table on the schematic diagram for details.

SUMMING AMPLIFIER F

U3 is configured as a non-inverting integrator. The voltage at the input to the integrator (junction of R43, R50 in CURRENT SOURCE Block **B** and R40 in PRETUNE Block **D**, etc.) is forced to zero volts by the discriminator feedback through R50. With zero volts at the input, R40 will sink 1.5mA. Since no current is flowing into the integrator, the following condition applies:

Pretune current + Discriminator current + Sweep current = 1.5 mA

The sensitivity of this node is 5mA/MHz; that is, if 0.005mA of sweep current is added to the node, the input to the PULSE GENERATOR (Block **A**) will decrease by 0.001 MHz, causing the discriminator to reduce its output current by 0.005mA, exactly cancelling the sweep current.

OUTPUT CURRENT SOURCE G

The emitter of Q2 provides a virtual ground to sum error currents from U3 and feed-forward signals from the DELTA F SWEEP ATTENUATOR (Block **E**) and phase-lock inputs. The phase-lock feed-forward path reduces the lock time by feeding the discriminator tune voltage ahead to the output current source.

To achieve a low noise junction, there is an optimum input impedance to be presented by Q2. This requires a constant emitter current. Q1 is used to achieve a constant Q2 emitter-current of about 0.14 mA. Q2 will conduct only enough current to cause a 0.7 V drop across R47, at which point Q1 will turn on and conduct the remaining current. The changing tuning current of 1 to 9 mA will then flow through Q1, leaving Q2 with a constant current, hence a constant input impedance.

The output of the current source is a current of 1 to 9 mA sent to the A40 PLL2 VCO.

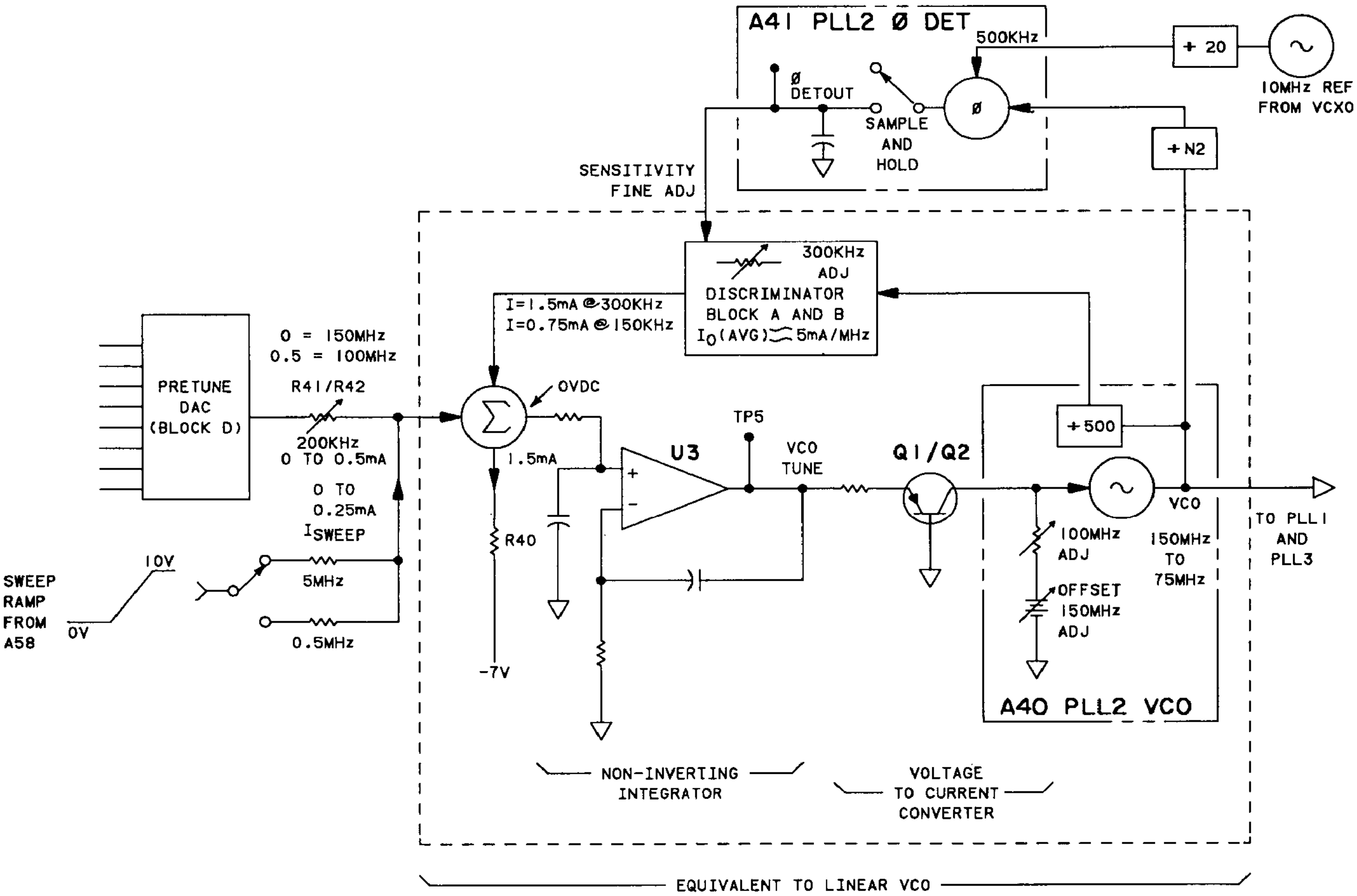


Figure 8C-33. Simplified A43 PLL2 Discriminator Diagram

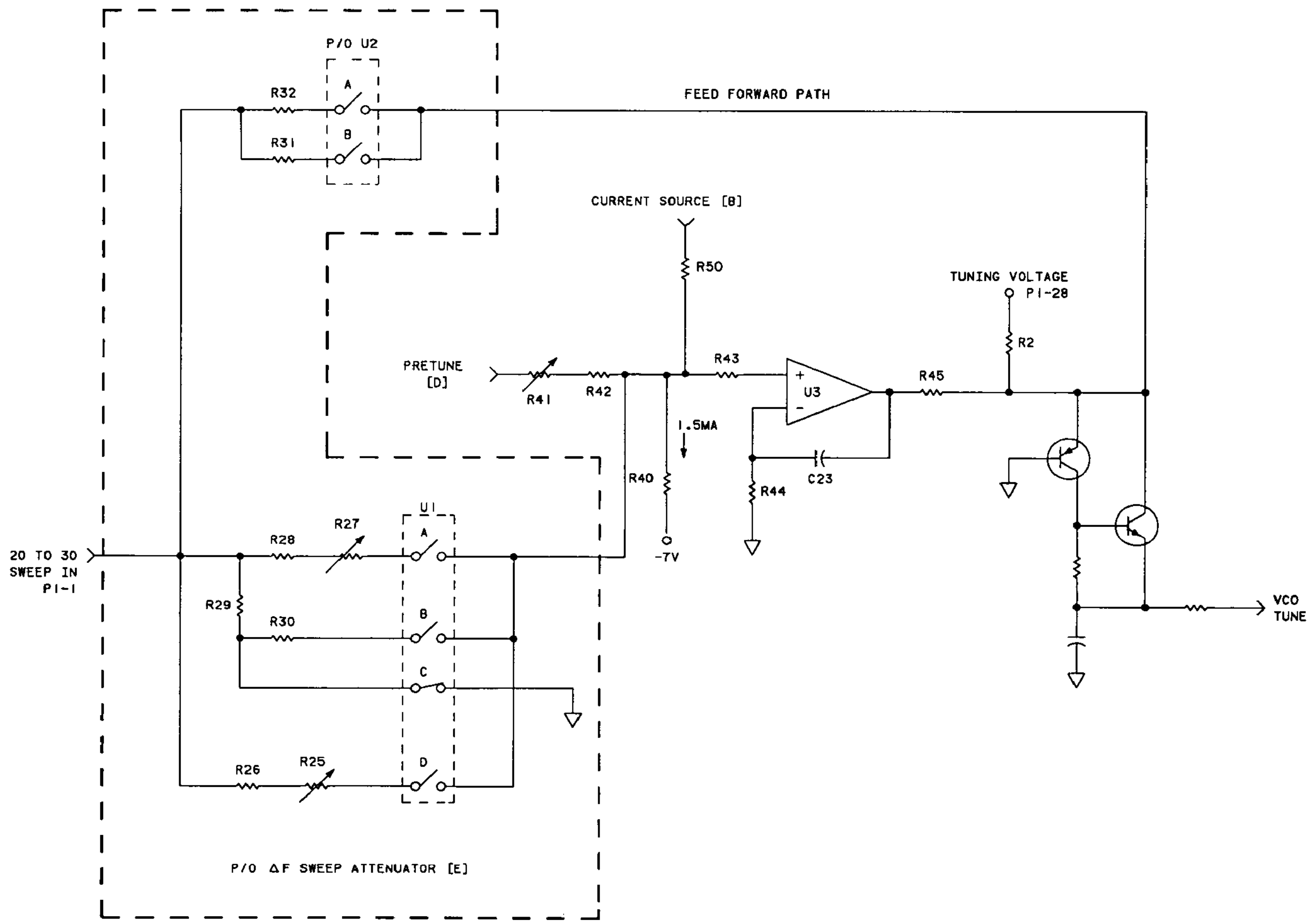


Figure 8C-34. Simplified ΔF Sweep Attenuator Circuit

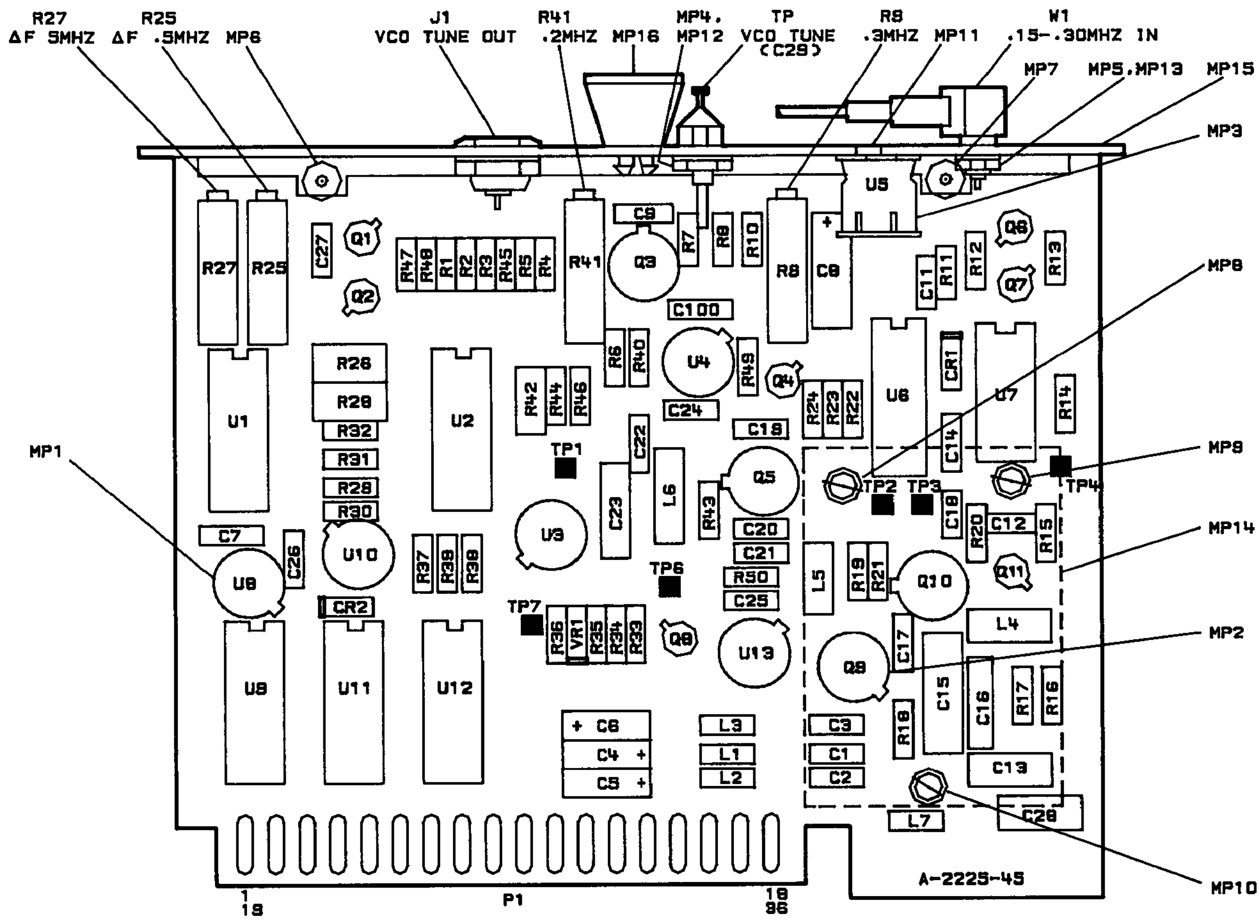


Figure 8C-35. A43 PLL2 Discriminator, Component Location Diagram

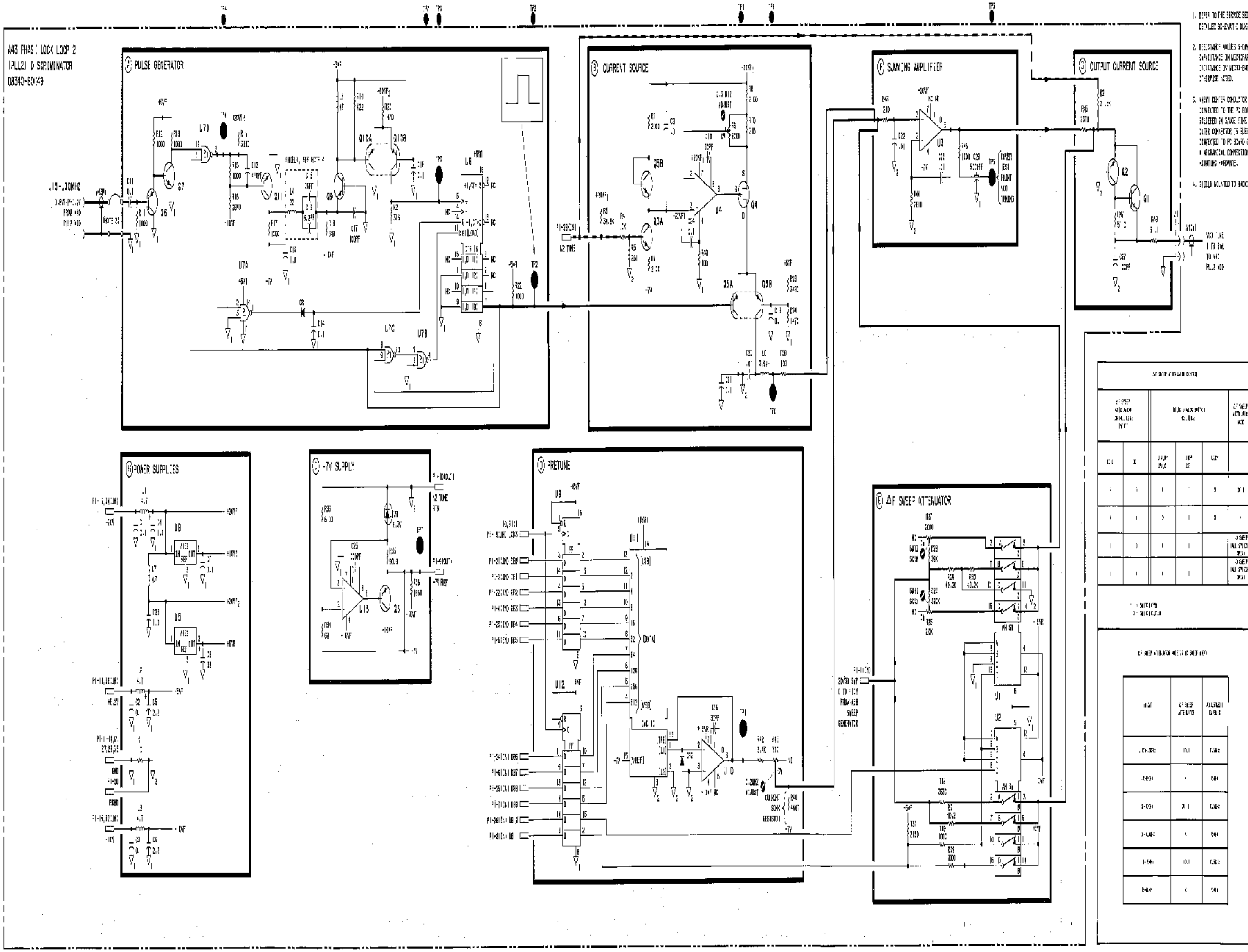
A43 PLL2 Discriminator, Pin I/O

A43

Pin	Mnemonic	Levels	Source	Destination
1 19	20/30 SWP LCK3	0 TO +10V TTL (LOW TRUE)	XA58P1-41 XA59P1-108	E D
2 20	HLE2 RGND	TTL (HIGH TRUE) 0V	XA59P1-53 A62 STAR GND	*NOT USED *H
3 21	DB1 DB0	TTL (LOW TRUE) TTL (LOW TRUE)	XA60P1-76 XA60P1-20	*D *D
4 22	DB3 DB2	TTL (LOW TRUE) TTL (LOW TRUE)	XA60P1-77 XA60P1-21	*D *D
5 23	DB5 DB4	TTL (LOW TRUE) TTL (LOW TRUE)	XA60P1-78 XA60P1-22	*D *D
6 24	DB7 DB6	TTL (LOW TRUE) TTL (LOW TRUE)	XA60P1-79 XA60P1-23	*D *D
7 25	DB9 DB8	TTL (LOW TRUE) TTL (LOW TRUE)	* *	*D *D
8 26	DB11 DB10	TTL (LOW TRUE) TTL (LOW TRUE)	* *	*D *D
9 27	−7V REF GND	−7V 0V	C A62 STAR GND	XA41P1-7 *H
10 28	N2 TUNE RTN N2 TUNE	0V 0 TO +7V	XA41P1-8 XA41P1-23	C B G
11 29	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
12 30	GND	0V	A62 STAR GND	*H
13 31	GND	0V	A62 STAR GND	*H
14 32	GND	0V	A62 STAR GND	*H
15 33	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*H *H
16 34	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*H *H
17 35	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
18 36	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*H *H

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.



NOTES:

1. REFER TO THE SERVICE SECTION INTRODUCTION FOR DETAILED SCHEMATIC DIAGRAM SYMBOLOGY NOTES.

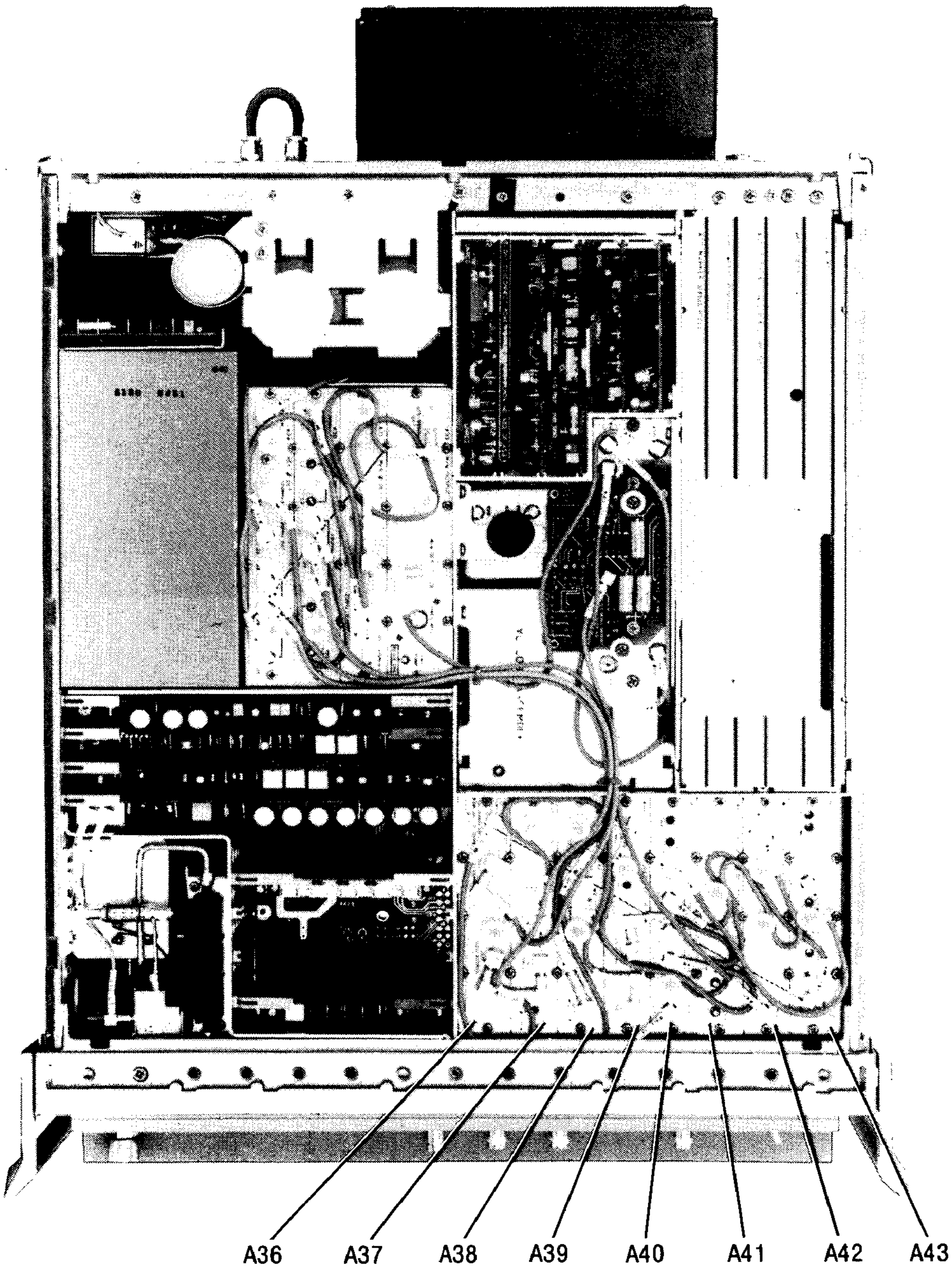
2. RESISTANCE VALUES SHOWN ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICRO-HENRIES UNLESS OTHERWISE NOTED.

3. WHEN CENTER CONDUCTOR IS ELECTRICALLY CONNECTED TO THE PC BOARD THROUGH A SOLDERED 24 GAUGE BARE WIRE. THE OUTER CONNECTOR IS ELECTRICALLY CONNECTED TO PC BOARD GROUND THROUGH A MECHANICAL CONNECTION IN THE ASSEMBLY MOUNTING HARDWARE.

4. SHIELD MOUNTED TO BACKSIDE OF BOARD.

Figure 8C-36. A43 PLL2 Discriminator, Schematic Diagram

8-273/8-274

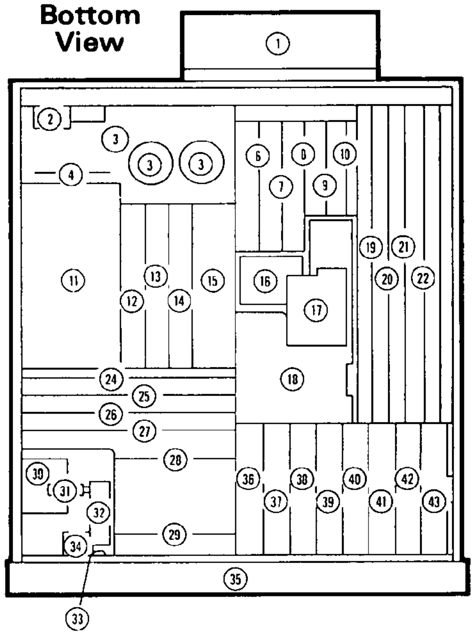


Bottom View (Bottom Cover Removed)

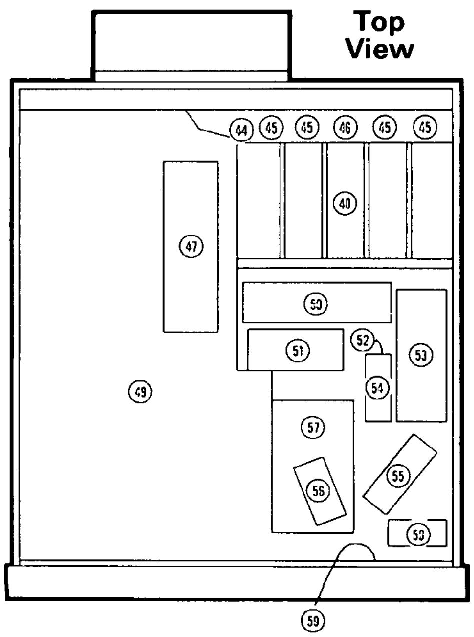
Figure 8C-37. 20-30 Loop Major Assembly Diagram

REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



Top View



Assy./Ref. Des.	Description	Location	Ref.-M/N Loops (Vol. 3)	20-30 Loops (Vol. 3)	Swp. Gen.-YO Loop (Vol. 3)	Motherboard (Vol. 3)	Controller (Vol. 3)	Front/Rear Panel (Vol. 4)	RF Section (Vol. 4)	Power Supplies (Vol. 4)
A1	Alpha Display	33						●		
A2	Display Driver	33						●		
A3	Display Processor	33						●		
A4	Not Assigned	-								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	[illegible]							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	31							●	
A12	Band 0 Splitter/Detector	34							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	54							●	
A18	Band 0 Power Amplifier	55							●	
		[illegible]							●	
A19	Capacitor Assembly	[illegible]								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	[illegible]							●	
A25	ALC Detector	[illegible]							●	
A26	Linear Modulator	26							●	
A27	Level Control	25							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	[illegible]	●							
A33	M/N Output	[illegible]	●							
A34	Reference-M/N Motherboard	[illegible]	●							
A35	Rectifier	[illegible]								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	[illegible]		●						
A41	PLL2 Phase Detector	[illegible]		●						
A42	PLL2 Divider	42		●						
A43	PLL2 Discriminator	[illegible]		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	[illegible]			●					
A49	YO Loop Phase/Detector	[illegible]			●					
A50	YO Loop Interconnect	[illegible]			●					
A51	Reference Oscillator	[illegible]	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	[illegible]								●
A57	Marker/Bandcross	[illegible]					●			
A58	Sweep Generator	[illegible]			●					
A59	Digital Interface	[illegible]					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	[illegible]							●	
AT2	15 dB Attenuator	[illegible]			●					
B1	Fan Assembly	[illegible]								●
A62C1-3	Power Supply Filter Capacitors	[illegible]								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

Sweep Generator — YO Loop D

SWEEP GENERATOR – YO LOOP D

SWEEP GENERATOR - YO LOOP
INTRODUCTION

This section provides information and instructions for troubleshooting, repairing, or replacing assemblies and components in the Sweep Generator and the YO Loop. Information includes circuit descriptions, troubleshooting procedures, block diagrams, schematics, and component location diagrams for each printed circuit board assembly.

The Sweep Generator and YO Loop circuitry generate the signals used to tune the YO according to the mode of operation selected.

The Sweep Generator consists of the following assemblies:

- A54 YO Pretune/Delay Compensation Assembly
- A55 YO Driver Assembly
- A58 Sweep Generator Assembly

The YO Loop phase-locks the YO at the appropriate frequency when the instrument is operated in the CW and Manual-Sweep modes.

The YO Loop consists of the following assemblies:

- A44 YO Assembly
- A45 Pre-Leveler Assembly
- A46 7 GHz Low-Pass Filter Assembly
- A48 YO Loop Sampler Assembly
- A49 YO Loop Phase Detector Assembly
- A50 YO Loop Interconnect Assembly
- A54 YO Pretune Delay Compensation Assembly
- A55 YO Driver Assembly

SWEEP GENERATOR/YO LOOP
THEORY OF OPERATION

SWEEP GENERATOR/YO LOOP - OVERALL DESCRIPTION

The Sweep Generator and YO Loop circuitry generate the signals used to tune the YO according to the mode of operation selected. The assemblies included in this section are the A44 YO, A45 Preleveler, A46 7 GHz Low Pass Filter, A47 Sense Resistor Assembly, A48 YO Loop Sampler, A49 YO Loop Phase Detector, A50 YO Loop Interconnect Board, A54 YO Pretune Delay Compensation board, A55 YO Driver Assembly, and A58 Sweep Generator board. A block diagram of the Sweep Generator/YO Loop is shown in Figure 8D-1.

The inputs to this section come from the instrument processor, the 20-30 Loop, and the M/N Loop. The main output is YO RF Output. Other important outputs are PRETUNE, used to tune the YO and the SYTM; BVSWP (Buffered Voltage SWeeP), used on the A27 Level Control board; 20-30 SWP, used to sweep the 20-30 Loop for sweep widths $\leq$5MHz; and MKR RAMP, used as the reference for all sweep events.

The operation of each block can best be described by considering the two main instrument modes of operation: CW/Manual, and Swept Frequency. The Swept mode can be in one of three conditions: single band sweep, multiband sweep, or narrow band sweep.

CW/MANUAL SWEEP OPERATION

When the CW mode is selected, the Sweep Generator/YO Loop Circuitry phase-locks the YO at the appropriate frequency. The processor addresses and sends a number to the A54 YO Pretune Delay Compensation board which is converted to a voltage, VDAC, and summed with the constant DC voltage, VREF. This produces the PRETUNE voltage, which tunes the YO to approximately the desired frequency (ie, to within the capture range of the YO Phase Locked Loop). VSWP and LKICK have no contribution to the Pretune voltage in CW operation.

The processor also sets the frequencies of the M/N and 20-30 Loops according to the CW frequency selected. The outputs of these two loops are used by the YO Loop to exactly tune and phase-lock the YO. The A45 Preleveler couples a portion of the YO RF Output back through a low-pass filter to the A48 Sampler, where it is mixed with the Nth harmonic of the M/N Output. This generates a difference signal, Sampler IF, in the range of 20-30 MHz which is input to the A49 YO Loop Phase Detector. There the phase is compared to the 20-30 MHz Output signal. The resultant error signal, YO TUNE, is used to phase-lock the YO. The high frequency portion of YO TUNE (>100 Hz) is applied to the YO FM

Coil by the FM Coil Driver on the A49 YO Loop Phase Detector board. The low frequency portion (<100 Hz) is summed with PRETUNE on the A55 YO Driver and applied to the YO Main Coil. This completes the YO Loop and phase-locks the YO.

Manual Sweep operation is identical to CW in the operation of the Sweep Generator and YO Loop circuitry.

SWEPT MODE

Single Band Sweeps

In swept mode, the instrument phase-locks the YO at the beginning of each sweep, undergoing the same sequence of events as in the CW mode. The Sample and Hold on the A49 YO Loop Phase Detector board is then activated, and it holds the YO TUNE error signal constant at its phase-locked value. In the hold mode the YO phase-lock loop is opened, allowing a ramp signal, VSWP, to be summed into the PRETUNE signal and subsequently applied to the YO Main Coil to sweep the YO. This sequence is called Lock and Roll. The processor writes to the A58 Sweep Generator board the sweep time and sweep width numbers to generate the voltage ramp, VSWP, with the appropriate slope and duration. This board also generates a 0-to-10V voltage ramp (MKR RAMP), which has the same duration as VSWP.

Because of the inherent delay characteristics of the YO during sweeps, a ramping compensation voltage, VCOMP, is summed with PRETUNE in the A55 YO Driver. VCOMP is generated by summing correction data from the processor with the VSWP ramp. This is done in the YO Delay Compensation portion of the A54 YO Pretune Delay Compensation board.

At each YO sweep retrace, the YO Retrace Kick Pulse Generator (on the A54 board) produces a pulse with a programmable width pulse (via the processor) which is summed with PRETUNE. When activated, this momentarily tunes the YO lower in frequency (by about 2.5 GHz) to remove the effects of YO magnetic hysteresis.

Multiband Sweeps

The operation of the Sweep Generator/YO Loop circuitry in multiband sweeps is essentially the same as in single band sweeps. The difference is that at each band crossing, the YO is retraced and the lock and roll sequence is initiated again. This produces a pause in the instrument sweep at each bandcrossing while each loop is being reset. VSWP is reset to zero volts between bands, however the MKR RAMP signal remains fixed at its end-of-band value until the lock and roll sequence for the next band begins. The sum of the durations of the ramping portions of MKR RAMP will still equal the selected instrument sweep time.

Narrow Band Sweep

Sweep widths ≤5 MHz are achieved by sweeping the 20-30 Loop. The A58 Sweep Generator board produces the 20-30 SWP (from inputs from the processor) which causes the 20-30 Output to sweep in frequency. The A49 YO Loop Phase Detector keeps the YO phase-locked to this signal for the duration of the sweep. For narrow band YO sweep widths between 500 kHz and 5 MHz, PRETUNE is also swept (VSWP summed in) a proportional amount so that the pretuned YO frequency will remain within the capture range of the YO Phase Lock Loop. This is in addition to the phase-locked error correction by YO TUNE. For YO sweep widths < 500 kHz, VSWP is dissabled, and YO TUNE alone supplies the correction to keep the YO phase-locked for the entire sweep ramp voltage.

SWEEP GENERATOR DESCRIPTION

Introduction

The assemblies documented in this functional group that cause the frequency of the 8340A to sweep are A58 Sweep Generator, A54 YO Pretune/Delay Compensation board, and A55 YO Driver.

When the YO loop phase-locks at the start frequency of an instrument sweep or at the start of a new band, the A54 YO Pretune/Delay Compensation board provides PRETUNE voltage to the A55 YO Driver. PRETUNE is a dc voltage proportional to the frequency at which the YO is locking. The sensitivity of this voltage is -2.5 volts/GHz. The A55 YO Driver converts this voltage to a current which is also proportional to the lock frequency. This current is fed to the YO Main Coil where it tunes the frequency of the YO to be within the phase-lock range of the YO loop.

For sweep widths >5 MHz, the A49 YO Loop Phase Detector opens the YO phase-locked loop by activating the sample and hold, thus holding YO TUNE constant at its phase-locked value. The A58 Sweep Generator then provides a voltage ramp which is summed with the PRETUNE voltage on the A54 YO Pretune/Delay Compensation board. The resulting voltage ramp produces a current ramp from the A55 YO Driver board which in turn sweeps the frequency of the YO.

VSWP is also used on the A54 YO Pretune/Delay Compensation board to produce another negative going ramp called VCOMP. This is added to PRETUNE on the A55 YO Driver board to compensate for the eddy-current induced swept frequency error inherent in the YO magnetic structure.

When a bandcrossing or end of sweep is reached, LBX (Low Bandcross) and HSP (High SweeP) are pulled LOW by the A57 Marker/Bandcross board. This causes VSWP to pause (stop ramping). Then the instrument processor pulls LRSP (Low Reset SweeP) LOW which resets VSWP to zero volts.

To erase the magnetic memory of the YO magnetic structure, the instrument processor initiates a retrace kick via the YO RETRACE KICK PULSE Generator (Block G) in the A54 YO Pretune/Delay Compensation board. This pulse is summed with the PRETUNE voltage. The effect is to temporarily offset the YO frequency by approximately -2.5 GHz. This intializes the domains in the YO magnets.

Finally, the instrument processor sets PRETUNE to a value proportional to the next lock frequency. When the loop is locked, the sweep sequence is repeated.

In sweeps where the YO is to move less than 5 MHz, the 20-30 loop is swept and the YO loop remains phase-locked. Since the YO loop is phase-locked to the 20-30 loop output, the YO frequency will follow that of the 20-30 Loop.

The 20-30 Loop is swept by a voltage ramp, 20-30 SWP, generated by the A58 Sweep Generator board. For YO sweeps <500 kHz, the Sweep Width Range Attenuator on the A58 Sweep Generator board is open-circuited so that VSWP remains at zero volts.

START/STOP Sweep Operation

Starting and stopping of the sweep ramp is controlled primarily by HSP (High SweeP), which is generated on A57 Marker/Bandcross board. When HSP is HIGH, the A58 Sweep Generator is free to sweep. When HSP is LOW, the A58 Sweep Generator stops, but does not reset sweep voltage, VSWP.

The A57 Marker/Bandcross board pulls HSP LOW, stopping the sweep whenever any one of the following three events takes place.

(1) LBX (Low Bandcross) goes LOW. The A57 Marker/Bandcross board pulls LBX and HSP LOW at bandcrossings and at the end of the sweep. The A58 Sweep Generator pulls LBX LOW if there is an instrument malfunction which allows VSWP to go beyond its normal limits.

(2) LSSP (Low Stop SweeP) on the rear panel is pulled LOW. Note: this line is meant for special, dedicated applications and is not designed to be a general purpose stop sweep input.

(3) The instrument processor issues a STOP SWEEP.

The A57 Marker/Bandcross board drives HSP HIGH, starting a sweep whenever any one of the following three events takes place.

(1) A line trigger input is received after line trigger mode has been selected.

(2) An external trigger input is received after external trigger mode has been selected.

(3) The instrument processor issues GO SWEEP IMMEDIATE.

(4) LSSP on the rear panel goes HIGH after the instrument processor has completed its tasks and is waiting for the input.

The A57 Marker/Bandcross board keeps track of when to initiate the various sweep events (marker on/off, bandcross, and end of sweep) by monitoring MARKER RAMP. This is a zero to ten volt ramp generated by the A58 Sweep Generator board. A buffered version of this, SWEEP OUTPUT, is available on the front and rear panels. MARKER RAMP is a monotonic ramp with pauses for bandcrossings. It starts at zero at the beginning of each sweep. It reaches five volts at the center frequency of the sweep and goes to ten volts at the end of the sweep.

YO LOOP DESCRIPTION

Introduction

The assemblies (documented in this functional group) that comprise the YO Loop are A44 YO, A45 Pre-Leveler, A46 7 GHz Low Pass Filter, A48 YO Loop Sampler, A49 YO Loop Phase Detector, A50 YO Loop Interconnect, A54 YO Pretune/Delay Compensation, and A55 YO Driver.

In the CW and Manual Sweep instrument modes, the YO Loop phase-locks the YO at the appropriate frequency. The information to tune the YO comes from two sources, PRETUNE and YO TUNE, which combine to form the YO FM COIL DRIVE and the YO MAIN COIL DRIVE.

Pretune

The PRETUNE voltage is generated on the A54 YO Pretune/Delay Compensation board. It is the scaled sum (A54, Block **C**) of VDAC, a tune voltage generated from inputs from the instrument processor, and VREF, a constant dc offset voltage. PRETUNE has a sensitivity of -2.5V/GHz YO.

LKICK and VCOMP have no contribution to PRETUNE in the CW/Manual Sweep instrument modes. LVSX (Low Voltage Sweep disable) is LOW to shunt out any unwanted noise contribution from the VSWP line.

YO Tune

The YO TUNE voltage is generated by the A49 YO Loop Phase Detector from the 20-30 MHz input (from the 20-30 Loop) and the Sampler IF, which is the down-converted product of the YO RF OUTput and the Nth harmonic of the M/N OUTput. The A45 Preleveler couples a portion of the YO Output back through the A46 7 GHz Low Pass Filter to the A48 YO Loop Sampler. There it is mixed with the Nth harmonic of the M/N Output to produce the Sampler IF, which is in the frequency range of 20-30 MHz. This signal and the one from the 20-30 Loop are compared in the Phase/Frequency Detector (A49, Block **D**) of the A49 YO Loop Phase Detector. The resulting error signal is amplified and integrated to produce YO TUNE, with a sensitivity of -3 MHz/Volt. When HLEY (High Lock Enable Yig Oscillator) is HIGH, the YO Loop is closed. When HLEY is LOW, the Sample And Hold (A49, Block **H**) holds constant the phase-locked value of YO TUNE, thus breaking the loop to allow a voltage ramp (VSWP) to be summed into PRETUNE to sweep the YO.

YO FM Coil Drive

The FM Coil Driver (A49, Block I) has a 100 Hz high pass filter, so that only the high frequency (>100 Hz) portion of YO TUNE is applied to the YO FM Coil. The resulting output is the YO FM COIL DRIVE current. The low frequency portion (<100 Hz) of YO TUNE is summed with PRETUNE and applied to the YO Main Coil.

YO Main Coil Drive

The YO MAIN COIL DRIVE current is derived at the A55 YO Driver from the PRETUNE and YO TUNE voltages. YO TUNE is summed (A55, Block **E**) with the OFFSET voltage, and PRETUNE is scaled (A55, Block **A**) by the GAIN adjustment. The YO MAIN COIL DRIVE current is constructed as a linear function of the desired YO frequency. The OFFSET adjustment varies the offset of the curve; the GAIN adjustment varies the slope. These two adjustments are used to ensure the tuning accuracy of the YO versus PRETUNE voltage over its full range of operating frequency. OFFSET has greater effect on the low end of the range (2.30 GHz), and GAIN has greater effect on the high end (6.99 GHz).

The Voltage-to-Current Converter (A55, Block **B**) on the A55 YO Driver and the A47 Sense Resistor Assembly are part of the same circuit. (A47R6 and A47Q1 are located externally to be properly heat sunk.) This circuit converts the (scaled) sum of the PRETUNE and YO TUNE voltages to the YO MAIN COIL DRIVE current that drives the YO Main Coil. This completes the YO loop which tunes and phase-locks the YO.

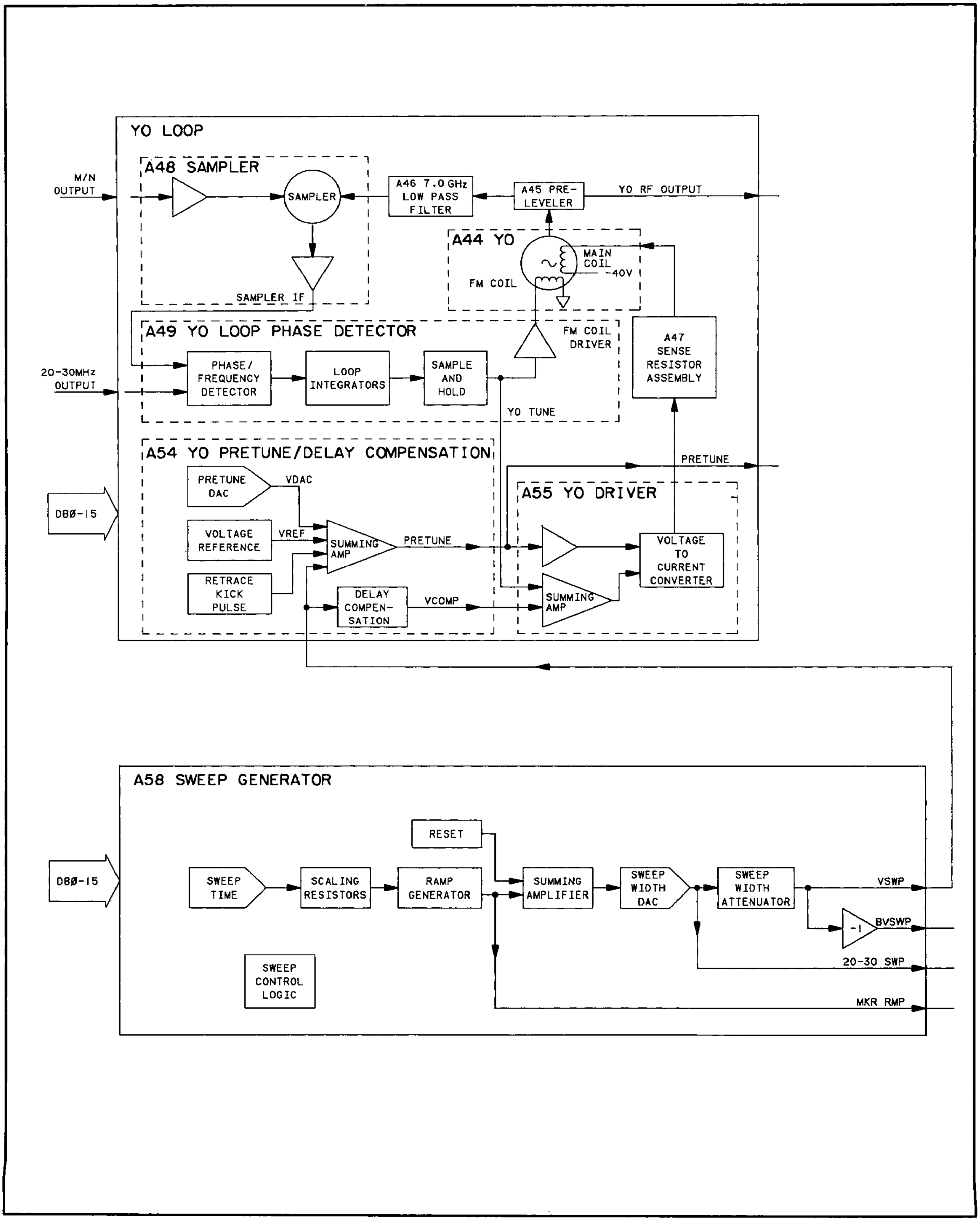


Figure 8D-1. Sweep Generator and YO Loop, Block Diagram

SWEEP GENERATOR - YO LOOP TROUBLESHOOTING TO ASSEMBLY LEVEL

YO LOOP TROUBLESHOOTING

Introduction

The YO UNLOCKED error condition can be caused by a number of different failure mechanisms. The YO Loop Troubleshooting Flow Chart, Figure 8D-2a, provides a systematic way to identify the board or boards at fault for the majority of the cases. Refer also to the Sweep Generator and YO Loop Block Diagram, Figure 8D-1. Each of the following headings refer to the Troubleshooting Flow Chart and assumes that the Front Panel UNLK indicator is lit.

YO UNLK - CW/MANUAL Mode

The instrument UNLK diagnostics can be selected by pressing **[SHIFT] [EXT]** on the front panel. This will display the following:

OSC: REF M/N HET YO N2 N1

A YO unlock condition exists when the "YO" indicator is flashing.

In the majority of cases, the error condition will occur in the CW/MANUAL mode, and the troubleshooting should be done in this mode first. If the YO Loop will not acquire phase-lock in CW/MANUAL at all frequencies, then it will also not function properly in the SWEPT mode.

To troubleshoot in the CW/MANUAL mode, answer the following questions:

(1) ARE OTHER LOOPS LOCKED?

Check to see that the UNLK indicators for the REF, M/N, N2, and N1 loops are not also flashing. If these other loops are unlocked, then the YO Loop will not function correctly; troubleshoot the other loops first. If they are all locked, then proceed to question 2.

(2) IS FRONT PANEL RF POWER OK?

Check that RF is present at the front panel at a level close to the selected power. If not, there is a problem in the RF path; go to question 14. If the front panel RF is present at the correct power, then proceed to question 3.

(3) IS YO FREQUENCY WITHIN ±25 MHZ?

The correct YO frequency can be found by pressing **[SHIFT] [M2]** on the front panel that will display the following:

BAND # YO FREQUENCY (MHz)

Typically PRETUNE will tune the YO within ±5 MHz. YO tune can change the YO frequency by ±20 MHz (capture range of YO Phase Lock Loop).

If the YO frequency offset is more than ±25 MHz, then the offset is more than the YO TUNE can normally cause; go to question 17. If the YO offset is less that 25 MHz, then the problem is most likely with YO TUNE; proceed to question 4.

(4) IS YO TUNE AT MAXIMUM POSITIVE OR NEGATIVE? (APPROXIMATELY ± 6.9 V)

This test must be made at a CW frequency that exhibits the UNLK error condition. The YO TUNE and FM COIL cables must remain connected so that the YO Loop is closed. Check the YO TUNE voltage at TP3 (TUNE) on the A55 YO Driver. When the loop is operating properly, the YO TUNE voltage should be close to zero volts. If YO TUNE is within the range of nominally ±6.0 V dc, then the YO Loop is locked and the UNLK indication is false; proceed to question 5. If YO TUNE is at maximum positive or negative (approximately ±6.9 V), then the YO Loop is unlocked; go to question 6.

NOTE:

In the CW/MANUAL mode, whenever the YO is locked, YO TUNE should be within the range of ±2 V dc. If the actual magnitude is between 2V and 6V dc, then proceed to question 5 and 6, and then return to question 4. If the actual magnitude of YO TUNE is greater than approximately 6.9 V, then troubleshoot the A49 YO Loop Phase Detector board.

(5) IS HULY HIGH?

If the YO Loop is actually locked but HULY (High UnLock Yig oscillator) is HIGH indicating unlock, then the Unlocked Detector on the A49 YO Loop Phase Detector is at fault. If HULY is LOW, then the problem is on the A59 Digital Interface board.

(6) IS HLEY HIGH?

HLEY (High Lock Enable Yig oscillator) must be HIGH for the YO Loop to lock. If HLEY is LOW or intermittent, then troubleshoot the A59 Digital Interface board. If not, then proceed to question 7.

(7) IS M/N OUTPUT FREQUENCY AND POWER OK?

Check for the proper M/N signal frequency and power at the output of A33J2. The correct frequency can be found by pressing **[SHIFT]** **[M1]** on the front panel that will display the following.

M # N # M/N FREQUENCY (MHz) 20-30 FREQUENCY (MHz)

The correct M/N signal power is 0 dBm ±3 dB. If no signal is present or if the power and/or frequency is incorrect, then troubleshoot the M/N Loop. If the M/N signal is correct, then proceed to question 8.

(8) IS 20-30 OUTPUT FREQUENCY AND POWER OK?

Check for the proper 20-30 signal frequency and power at the output of A36J2. The correct frequency can be found by pressing SHIFT M1 on the front panel (see question 7 above). The correct power is 0 dBm ±3 dB. If no power is present or if the power and/or frequency is incorrect, then troubleshoot the 20-30 Loop. If the signal is correct, then proceed to question 9.

(9) IS THE YO FREQUENCY CHANGE PROPORTIONAL TO YO TUNE?

Record the actual YO frequency. Then disconnect YO TUNE and FM COIL DRIVE, cables A49J1 and A49J2. Place a 50 Ohm load on the YO TUNE cable, A49J2. (These cables will remain disconnected for the remainder of the troubleshooting.)

Note the YO frequency now and compare it with the value recorded before the cables were removed. It should have changed approximately 20 MHz. The YO frequency sensitivity to YO TUNE is approximately -3.0 MHz/Volt. If the frequency does not change or else changes an amount much greater than 20 MHz, this indicates a problem on the A55 YO Driver (Block **E**).

If the frequency change is proportional to the YO TUNE voltage, then proceed to question 10.

(10) IS THE OPEN-LOOP YO FREQUENCY ACCURACY ±5 MHz AT 2.300 AND 6.999 GHz?

With the YO TUNE and FM COIL cables disconnected (and a 50 Ohm load on the YO TUNE cable, A49J2), the YO frequency accuracy should be within a ±5 MHz window over the entire YO operating range. The YO accuracy should be checked at 2.300 and 6.999 GHz. If the actual YO frequency is outside of these limits, then go to question 17; if not, then proceed to question 11.

(11) IS SAMPLER IF FREQUENCY AND POWER OK?

Check for the correct frequency and power for the SAMPLER IF. The frequency accuracy (open loop) should be ±5 MHz, the same as the YO. If the SAMPLER IF frequency and power are correct, then troubleshoot the A49 YO Loop Phase Detector; if not correct, then proceed to question 12.

(12) IS RF POWER INTO THE A48 YO LOOP SAMPLER OK?

Check the RF signal power into the A48 YO Loop Sampler. If the RF power is correct, then troubleshoot the A48 YO Loop Sampler. If no signal is present or if the power is incorrect, then proceed to question 13.

(13) IS PRE-LEVELER POWER OUT OF A45J2 OK?

Check the coupled-back RF power out of the A45 Preleveler at A45J2. If no signal is present or the power level is incorrect, then troubleshoot the A45 Preleveler. If the RF power is correct, then troubleshoot the A46 7 GHz Low Pass Filter and connecting cables.

(14) IS PRE-LEVELER POWER OUT OF A45J3 OK?

This portion of the troubleshooting guide is a branch from question 2.

Check the RF power out of the A45 Preleveler at A45J3. If the signal is present at the correct power, then a problem also exists in the Main RF path. To continue to troubleshoot the YO UNLK, however, go to question 3. If no signal is present or if the power output is low, then proceed to question 15.

(15) IS YO POWER OUT OK?

Check the RF power out of the YO. If the power is correct, then troubleshoot the A45 Preleveler. If no signal is present or if the power is low, proceed to question 16.

(16) IS THE YO MAIN COIL DRIVE OK?

Check the YO MAIN COIL DRIVE. This can be done by testing the

SENSE voltage, TP4 on the A55 YO Driver board. (The SENSE voltage is related to the YO frequency by -2.4 V/GHz.) If the YO Main Coil is greatly mistuned, then no YO signal will be present. If the SENSE voltage (hence the YO MAIN COIL DRIVE current) is correct to within ±1 V, then troubleshoot the YO; if not, then proceed to question 17.

(17) IS THE PRETUNE VOLTAGE OK?

This portion of the troubleshooting guide is a branch from question 3, question 10, and question 16.

Check the PRETUNE voltage. PRETUNE has a sensitivity of -2.5 V/GHz of YO frequency. If the PRETUNE voltage is correct, then troubleshoot the A55 YO DRIVER (OFFSET and GAIN) and the A47 Sense Resistor Assembly. If PRETUNE is not correct, then proceed to question 18.

(18) IS THE VSWP VOLTAGE OK?

Check the VSWP voltage; it should be zero volts. If it is correct, then troubleshoot the A54 YO Pretune/Delay Compensation board. If VSWP is much different than zero volts, then proceed to question 19.

(19) IS LVSX LOW?

If the VSWP voltage is much different than zero volts, it will affect the PRETUNE voltage only if the Sweep Disable Switch (A54, Block **E**) is also not operating correctly. If LVSX (Low Voltage Sweep Disable) is HIGH or intermittent, then troubleshoot the A59 Digital Interface board. If LVSX is LOW (that should be the case for CW/MANUAL), then troubleshoot Block **E** on the A54 YO Pretune/Delay Compensation board. In either case, also troubleshoot VSWP on the A58 Sweep Generator board.

YO UNLK - Swept Mode

To troubleshoot in the swept mode with the YO unlocked, answer the following questions:

(1) IS CW/MANUAL MODE OK?

If the YO UNLK error condition can be made to occur in the CW/MANUAL mode, then go to the YO UNLK - CW/MANUAL troubleshooting section. It will also be helpful if the YO UNLK condition can be made to occur in the SINGLE SWEEP mode, for this will hold the YO Loop (error) condition constant while troubleshooting.

If the error condition can only be made to occur in the SWEPT mode and CONTINUOUS SWEEP mode, then the error will be more difficult to resolve. Proceed to question 2 in this section. There are several mechanisms that could cause a YO Loop unlock in only the SWEPT mode; these relate to the function and operation of VSWP, LKICK, HLEY (High Lock Enable Yig Oscillator), and possibly VCOMP, LVSX, and LYSP. Most of the potential causes of the error are related to timing, mainly at the start of sweep.

(2) IS VSWP OK?

Check to see that VSWP is at zero volts at the start of each sweep. LVSX (Low Voltage Sweep Disable) is HIGH in SWEPT mode for sweep widths > 500 kHz, but LOW in CW/MANUAL. Thus, any offset in VSWP would only affect the YO tuning in the SWEPT mode. Because of the high sensitivity of the YO frequency to VSWP (500 MHz/V), an offset of as little as 50 mV added from VSWP to PRETUNE will result in the YO being tuned outside of the capture range of the YO Phase Locked Loop. If VSWP is zero, then proceed to question 3. If VSWP is not zero, then troubleshoot the A58 Sweep Generator board.

(3) IS THE YO KICK PULSE OK?

Check to see that the YO Kick Pulse is being generated correctly. The LKICK line should be < 2V for a time at the start of the sweep and then return to zero volts before the sweep occurs. PRETUNE should also change a proportional amount. (It is normal for PRETUNE to have an intermediate voltage step if the PRETUNE DAC, A54 Block B, is set before the end of the kick pulse.) If the YO kick pulse, LKICK, is not generated, or if it does not return to zero volts, then troubleshoot the A54 YO Pretune/Delay Compensation board. If LKICK is good, then proceed to question 4.

(4) IS HLEY HIGH AT START OF SWEEP?

Check the HLEY (High Lock Enable Yig oscillator) voltage at the start of sweep. If it is LOW or intermittent, then the YO Loop will not lock; troubleshoot the A59 Digital Interface Board.

SWEEP GENERATOR TROUBLESHOOTING

Introduction

There are two basic failure modes that have to do with the sweep function of the instrument. One, the instrument is simply not sweeping. Two, it is sweeping, but the sweep is incorrect; the frequency limits of the sweep are wrong and/or bandcrossings are not occurring. The first task is to get the instrument to do repetitive sweeps of any kind.

If the MARKER RAMP is sweeping zero to ten volts and the Front Panel LED is blinking then the instrument is considered to be sweeping even though the output frequency may not be moving. If, on the other hand, MARKER RAMP is stuck and the front panel sweep LED is continuously on or off, then the instrument is not considered to be sweeping. When looking at the LED, care must be taken because in fast sweeps it may appear to be on all the time, even though it is actually blinking.

No Sweep

Assuming that the instrument processor is functioning correctly, the only external lines that can prevent the A58 Sweep Generator from sweeping are HSP (High SweeP), LBX (Low Bandcross) and LRSP (Low Reset SweeP). HSP and LRSP are standard TTL lines with HSP being driven by the A57 Marker/Bandcross board and LRSP being driven by the A59 DIGITAL INTERFACE board. LBX is an open collector line that can be driven by both the A58 Sweep Generator and A57 Marker/Bandcross boards. HSP is coupled to LBX on the A57 Marker/Bandcross board so that if LBX is pulled down, the A57 Marker/Bandcross board pulls down on HSP also.

If the instrument is in the continuous sweep mode and is not sweeping, then remove the A57 Marker/Bandcross board. If the instrument now sweeps, the problem is most likely on the A57 Marker/Bandcross board. Note that in this mode, the frequency limits that the instrument is sweeping over will not be correct. This is because it is the OVER SWEEP DETECTOR (Block **U**) on the Sweep Generator that is pulling down on LBX to stop the sweep when the MARKER RAMP reaches 12 volts.

If the instrument still will not sweep with the A57 Marker/Bandcross board removed, next check the state of the HSP line. Since only the A57 Marker/Bandcross board can pull down on this line, it should be HIGH in this mode. If it is LOW, then troubleshoot this problem. If HSP is HIGH, then check the state of LBX. If it is LOW, then determine what is pulling it down by looking at HBX on the A58 Sweep Generator. If HBX is HIGH, then the OVER SWEEP DETECTOR is pulling down on LBX. If HBX is LOW, then something off the board is at fault.

Finally, look at LRSP, TP11, on the A58 Sweep Generator board. If it is stuck LOW, troubleshoot this problem.

If the three lines just discussed, LBX, HSP and LRSP are all HIGH, then the problem is indeed on the Sweep Generator board. Reinstall the Marker/Bandcross board and consult the troubleshooting section for the A58 Sweep Generator board.

Incorrect Sweep

If the instrument sweeps, as defined above, but the YO does not sweep or the frequency limits are incorrect, check the two sweep ramps from the A58 Sweep Generator board, 20-30 SWP (TP8) and VSWP (TP10). The sensitivities of these lines are discussed below.

YO sweeps widths >5 MHz are derived from VSWP. Note that the instrument sweep width, delta F, is related to the YO sweep width by the harmonic number of the band being used. For example, if the instrument is sweeping from 8 to 10 GHz, the instrument sweep width is 2 GHz. However, this is the second harmonic of the YO so that the YO is sweeping from 4 to 5 GHz; a sweep width of 1 GHz. The sensitivity of VSWP is +2 volts/GHz of YO sweep width. In the example above, VSWP should be a ramp starting at zero and going to +2 volts.

If VSWP is correct, then look at PRETUNE (TP3) on the A54 Pretune/Delay Compensation board. It has a sensitivity of -2.5 volts/GHz of YO frequency. In the foregoing example where the YO swept from 4 to 5 GHz, PRETUNE should go from -10 to -12.5 volts.

If PRETUNE is correct, look at SENSE (TP4) on the A55 YO Driver board. This point has a sensitivity of about -2.34 volts/GHz of YO frequency. If this is correct, the problem is most likely in the A44 YIG Oscillator assembly.

YO sweep widths ≤ 5 MHz are derived from 20-30 SWP. The sensitivity of 20-30 SWP is related to YO sweep width but changes depending upon the particular sweep width selected, as shown in Table 8D-1.

Table 8D-1. Sensitivity of 20-30 SWP Line

SWEEP WIDTH	SENSITIVITY
5 MHz ≥ YO sweep width > 500 KHz	500 KHz/volt
500 KHz ≥ YO sweep width > 100 KHz	50 KHz/volt
100 KHz ≥ YO sweep width > 10 KHz	10 KHz/volt
10 KHz ≥ YO sweep width > 1 KHz	1 KHz/volt
5 KHz ≥ YO sweep width > 500 Hz	500 Hz/volt
500 Hz ≥ YO sweep width > 100 Hz	50 Hz/volt

Verify that VSWP is not sweeping more than 0.0 to 15 mV and that 20-30 SWP is correct. If both of these are correct, the problem is most likely in the 20-30 Loop.

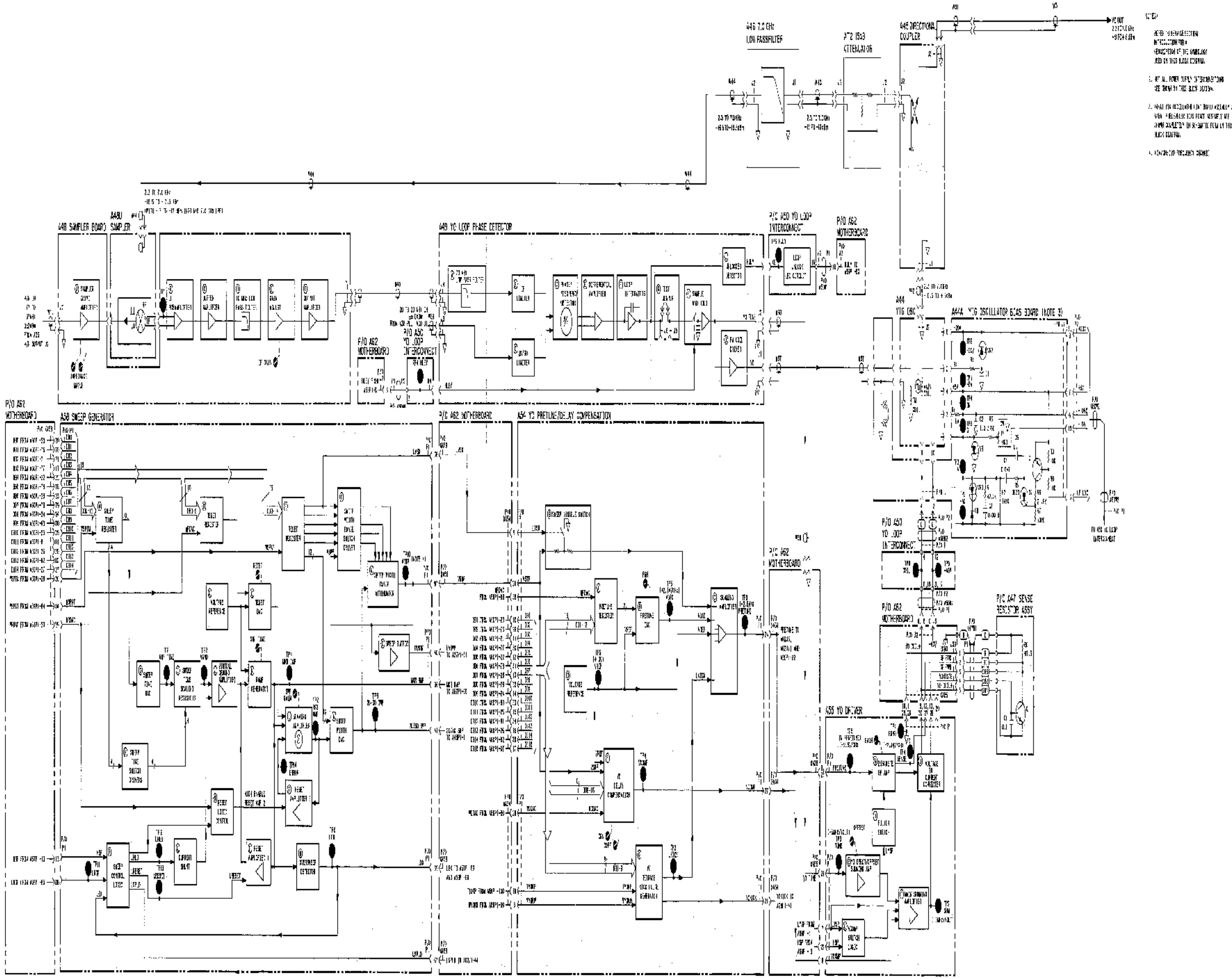


Figure 8D-2a. Sweep Generator and YO Loop Troubleshooting Block Diagram

8-299/8-300

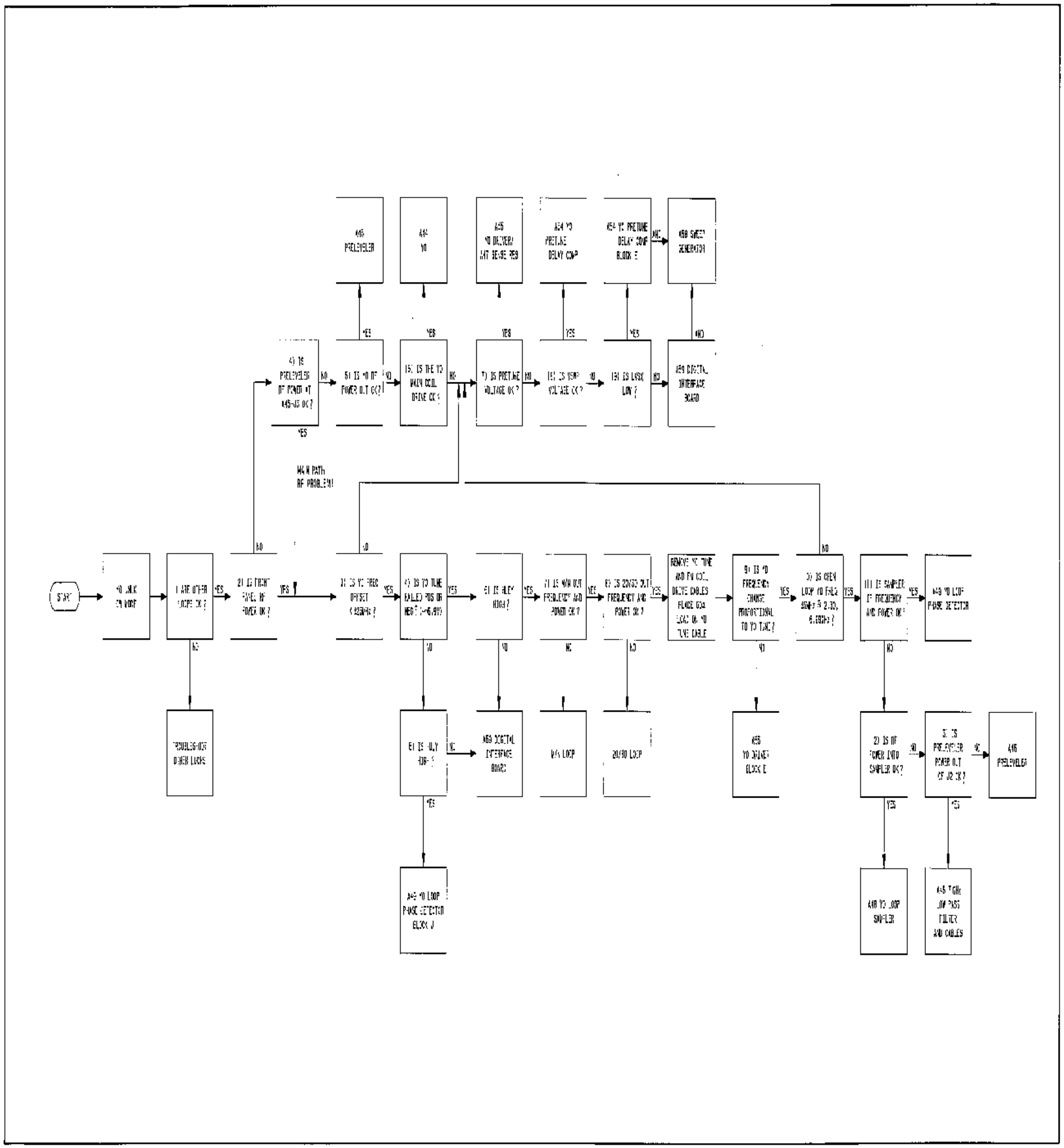


Figure 8D-3a. Sweep Generator and YO Loop Troubleshooting Flowchart

8-30168-302

REPAIR PROCEDURES

Refer to the **REPAIR PROCEDURES** description in the beginning of Section VIII.

CAUTION

Disengage W3 from where it connects to the YO Loop via a hole in the motherboard (refer to Figure 8I-8, View C, in the RF Section) before lifting out the YO Loop or damage to the instrument will result.

When replacing the YO Loop assembly be careful not to smash the ribbon connector, A50W1.

A44 YIG OSCILLATOR

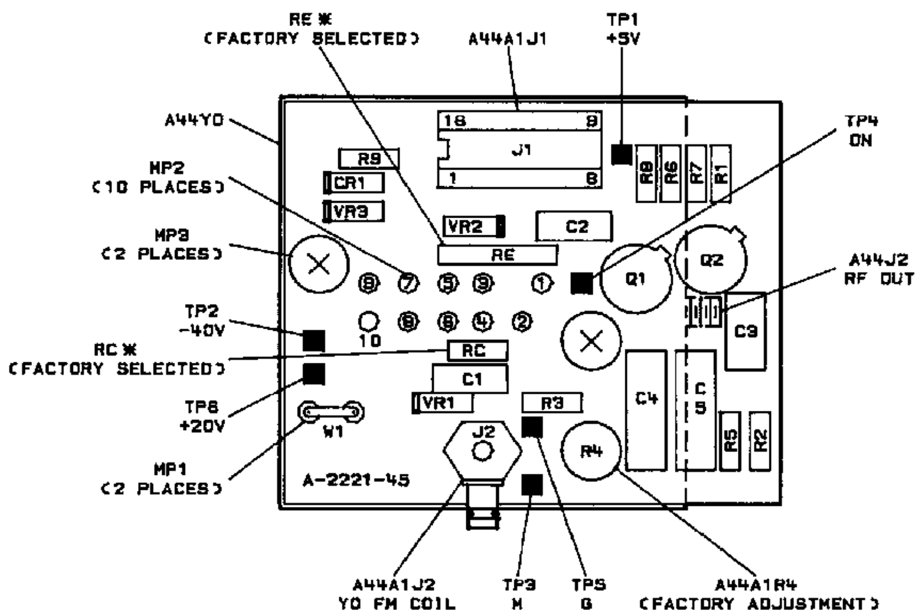
A44A1 YO BIAS BOARD CIRCUIT DESCRIPTION

Selected Resistors

Two resistors (Re and Rc) are selected when the YO is tested. A44A1R4 is adjusted to set up the proper gate bias required by the YO. The FM coil in the 8340A is connected to chassis ground at the Bias Board. During testing, however, the coil must be floating so a jumper has been provided to connect ground after testing.

YO Switchable Filtering

The filtering required at the YO main coil depends upon whether the instrument is in the CW mode or in the Swept mode. A switch circuit is provided to accomplish this filter change. A signal from the processor (HFIL) goes HIGH in CW mode. This signal is buffered on the A50 YO Loop Interconnect board by an open collector darlington inverter. The resulting signal (LFIL) goes to the YO Bias board where it pulls down on the base of Q1 through R9. This turns Q1 ON and pulls R6 UP to +5 volts. R6 and R7 form a voltage divider going to the gate of an SCR. When its gate is pulled positive with respect to its cathode, it turns ON and provides a very low impedance path for the CW filter circuit. The CW filter circuit consisting of C4, C5, and R5 is connected directly across the YO Main Coil when Q2 is ON. C5 is used to reduce the phase noise of the YO and is also effective in reducing the radiated susceptibility of the 8340A. The swept mode filter consisting of R1, R2, and C3 is used to match the delay characteristics of the YO main coil to those of the YO main coil driver circuitry.



NOTE

Refer to Sweep Generator — YO Loop Troubleshooting Block Diagram for schematic of A44.

Figure 8D-3. A44A1 YIG Oscillator, Component Location Diagram

A45 DIRECTIONAL COUPLER

A45 DIRECTIONAL COUPLER DESCRIPTION

The A45 directional coupler divides the RF Output of the A44 YO into two paths. The output of the coupled arm goes to A45J1. This signal is attenuated by AT2 and goes through the A46 7.0 GHz Low Pass Filter to the A48 YO Loop Sampler where it is mixed with the Nth harmonic of the M/N Out signal. The result is the Sampler IF signal to the A49 YO Loop Phase Detector.

The RF Signal from the coupler's main line path is the YO Out signal at A45J3. This signal is sent to the A16 Modulator/Splitter.

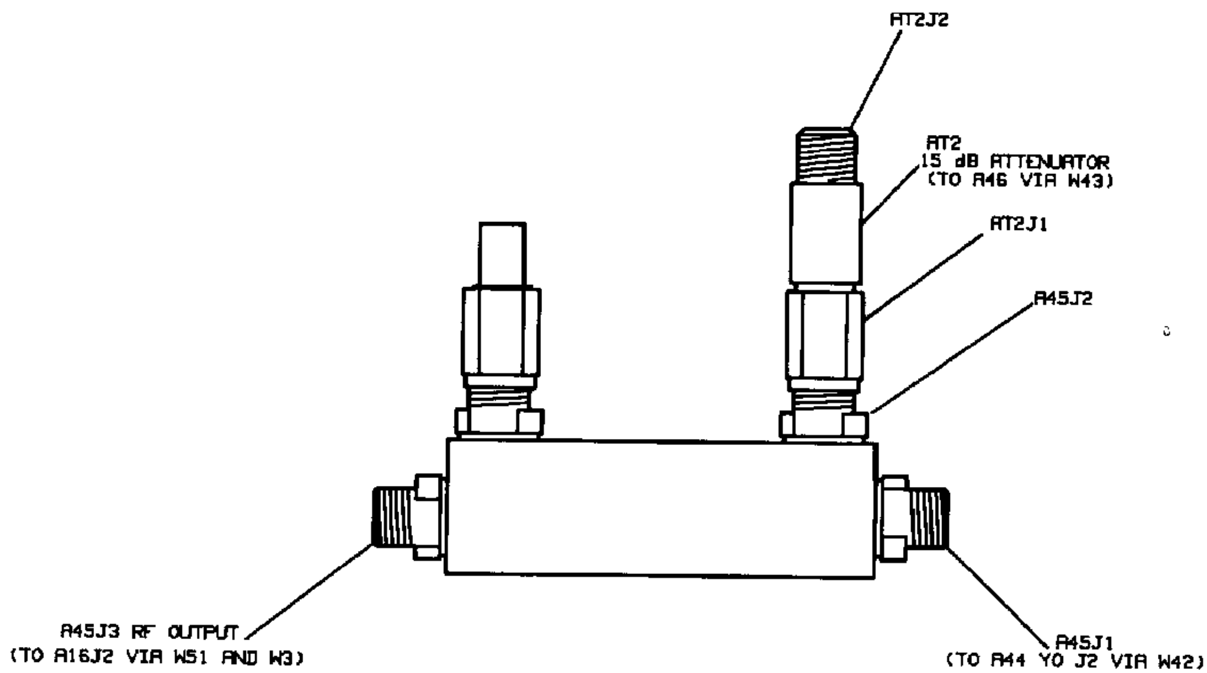
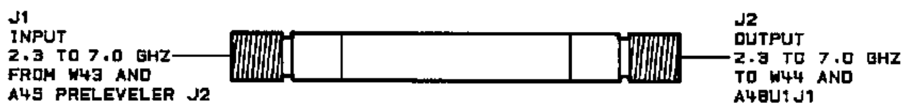


Figure 8D-4. A45 Directional Coupler Component Location Diagram

A46 7 GHz LOW PASS FILTER

A46 7 GHz LOW PASS FILTER CIRCUIT DESCRIPTION

The A46 7 GHz Low Pass Filter is connected by coaxial cables between the A45 Pre-leveler and the A48 YO Loop Sampler. It is used to filter out the harmonics of the coupled-back portion of the YO Output from the Pre-leveler to prevent unwanted mixing products in the Sampler.



NOTE

Refer to Sweep Generator — YO Loop Troubleshooting Block Diagram for schematic of A46.

Figure 8D-5. A46 7.0 GHz Low Pass Filter, Component Location Diagram

A47 SENSE RESISTOR ASSEMBLY

A47 SENSE RESISTOR ASSEMBLY CIRCUIT DESCRIPTION

The A47 Sense Resistor Assembly contains the high-power portions of the A55 YO Driver and the A28 SYTM Driver. (For the schematic of the A47 Sense Resistor Assembly, see schematics for A28 and A55.) A47Q1, A47C1, and A47R6 are part of the compound PNP transistor in the voltage-to-current converter (Block **B**) of the A55 YO Driver, A47R6 being the sense resistor referred to in the A55 circuit description. A47Q2 and A47R1 through 5 are part of the Current Driver (Block **H**) of the A28 SYTM Driver. These components are located externally so they will be properly heat sunk.

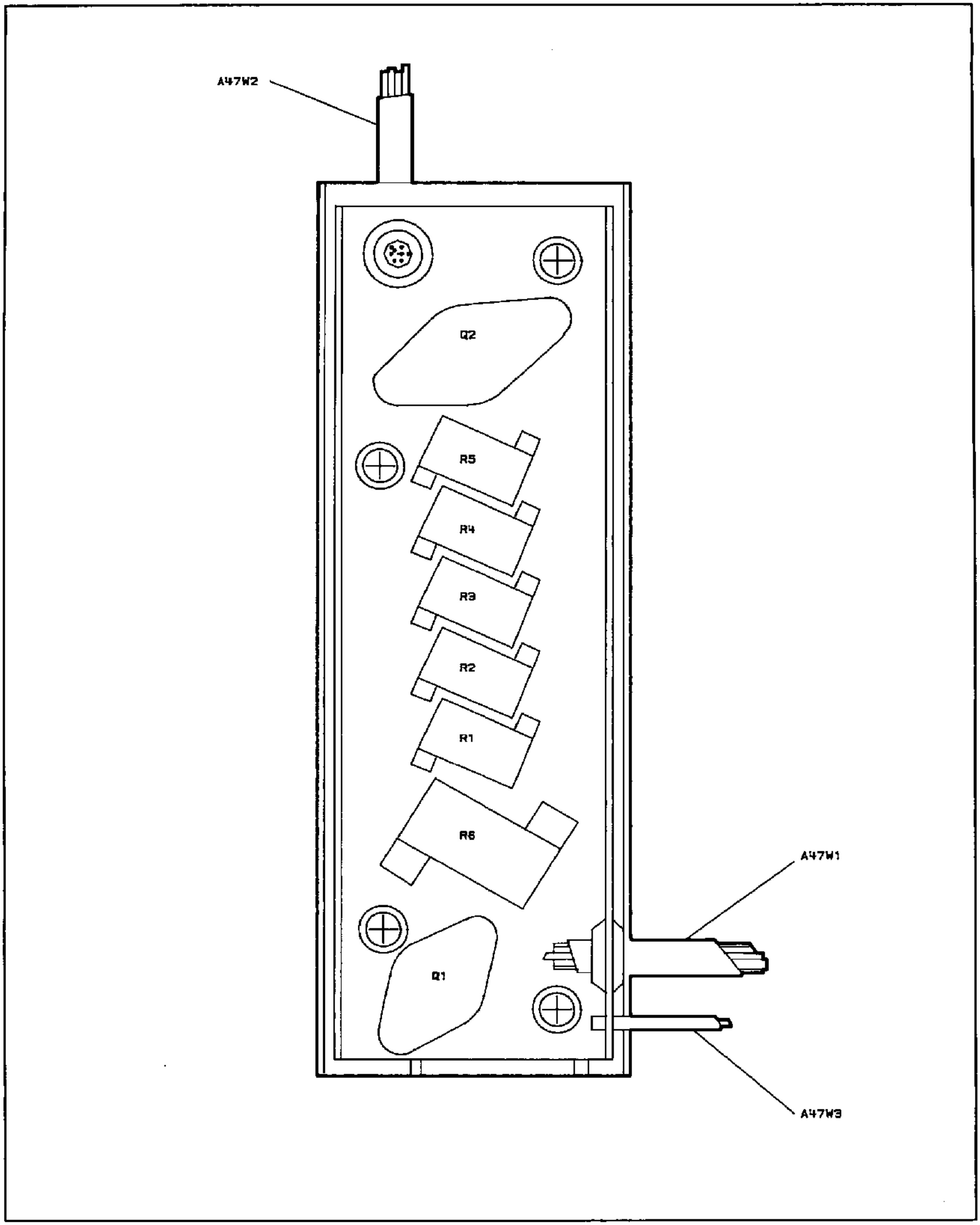


Figure 8D-6. A47 Sense Resistor Assembly, Component Location Diagram

A62J32 TO A47W2P1 PIN I/O

Pin	Mnemonic	A47W2P1	Levels
1	RGND	PIN 1	0V
2	SYTMDB	PIN 2	−22V TO −39V
3	SYTM COIL +	PIN 3	−40V TO −25V
4	SYTMDC	PIN 4	−.6V TO −6V
5	SYTMRES	PIN 5	−.9V LOW BAND CW

Note: Refer to A28 SYTM Driver Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

A62J29 TO A47W1P1 PIN I/O

Pin	Mnemonic	A47W1P1	Levels
1	RGND	PIN 1	0V
2	SR FBK	PIN 2	−5V TO −17V
3	SR PWR	PIN 3	−5V TO −17V
4	YOXISTB	PIN 4	−30V TO −39V
5	YO COIL +	PIN 5	−40V TO −20V

Note: Refer to A55 YO Driver Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

A48 YO LOOP SAMPLER

INTRODUCTION

The A48 YO Loop Sampler mixes the output of the A44 YO (via the A45 Pre-leveler and A46 7 GHZ Low Pass Filter) with the Nth harmonic of the output of the M/N-Reference Loop (M/N IN). The 20 to 30 MHz difference signal, SAMPLER IF, is output to the A49 YO Loop Phase Detector and is compared with the 20-30 MHz output from the A36 PLL1 VCO assembly for the purpose of phase-locking the YO.

A48 YO LOOP SAMPLER CIRCUIT DESCRIPTION

Sampler Drive Amplifier A

The output of the M/N-Reference Loop (M/N IN) is applied to common-base amplifier Q3. The output of Q3 is AC coupled to common-emitter amplifier Q8. The output of Q8 is passed through an impedance matching network that provides maximum drive power to A48U1 Sampler. Adjustments C1 and C2 optimize this impedance match.

A48U1 Sampler B

A48U1 Sampler contains a step recovery diode (SRD) circuit to create harmonics of the M/N signal which are mixed with the low-level (-15 dBm) signal from the A44 Yig Oscillator via the A46 7 GHz Low Pass Filter (LPF).

When the YO Loop is phase-locked, the mixing product of the Nth harmonic of the M/N signal and the A44 YO signal is precisely equal to the 20-30 signal from the A36 PLL1 VCO assembly. This allows the YO Loop to become phase-locked to that harmonic.

IF Preamplifier C

The IF Preamplifier consists of common-source amplifier Q4, common-emitter amplifier Q2, and feedback divider R20/R16. Overall gain provided is approximately 14 dB.

Buffer Amplifier D and 70 MHz LPF E

The A48U1 Sampler output, after being amplified, is buffered by emitter-follower Q7 and applied to the 70 MHz Low-Pass Filter (Block **E**). This filtering is done to remove any unwanted signals produced by the mixing action of the sampler.

Gain Adjust F

After being filtered, the IF signal is applied to a common-emitter amplifier Q6 which has adjustable gain. IF Gain adjustment R1 can be adjusted to provide from 5 dB to 20 dB of gain. This is used to adjust the IF signal to the proper level for comparison to the 20-30 signal in the A49 YO Phase Detector.

Output Amplifier G

The IF signal is further amplified by output amplifier Q5 and Q1. Gain is approximately 21 dB. This provides the proper signal level to drive the A49 YO Phase Detector.

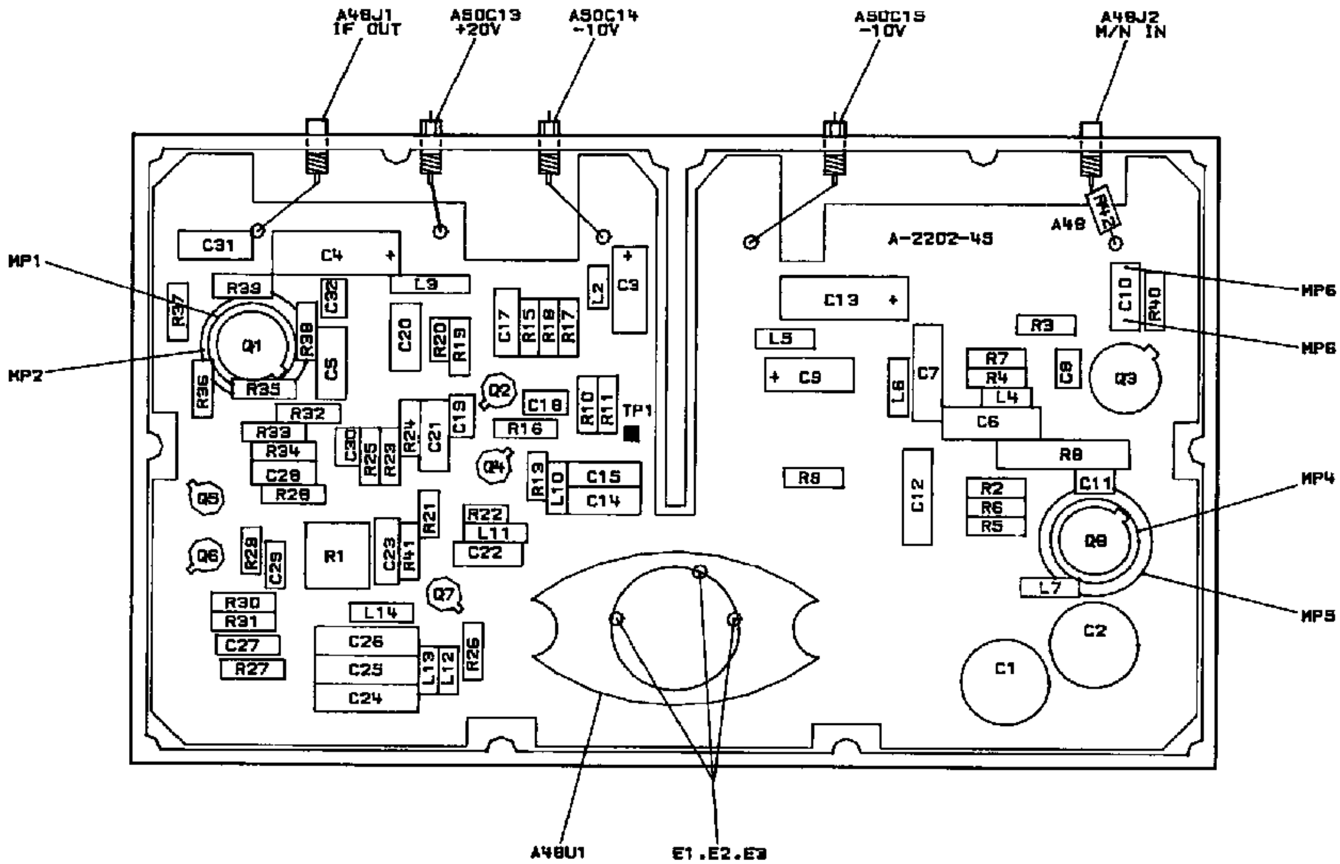


Figure 8D-7. A48 YO Loop Sampler, Component Location Diagram

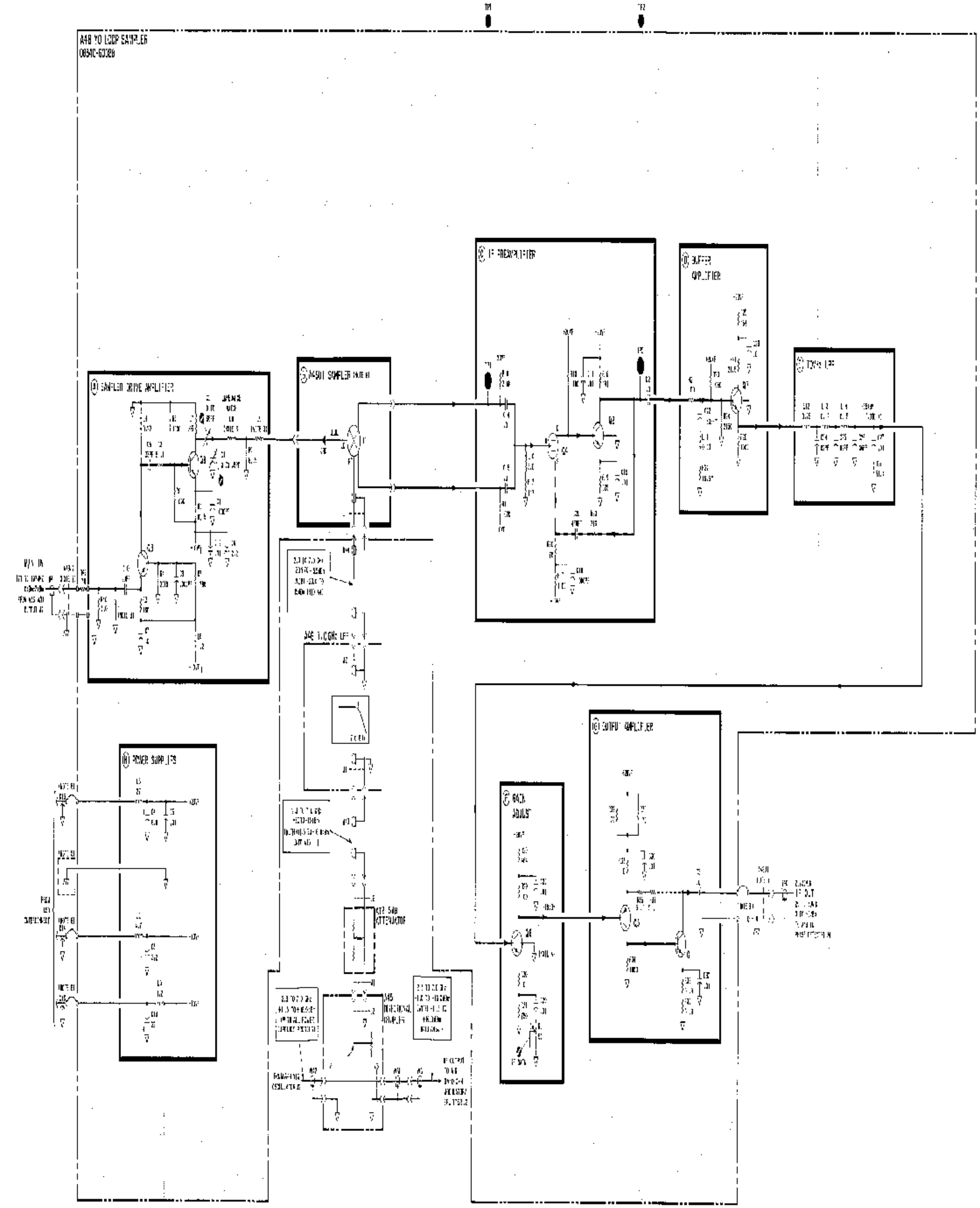


Figure 8D-8. A48 YO Loop Sampler, Schematic Diagram

A49 YO LOOP PHASE DETECTOR

INTRODUCTION

The A49 YO Loop Phase Detector Board receives as inputs the Sampler IF signal and the 20-30 signal from the A36 PLL1 VCO. These signals are phase-compared and the result is integrated to produce the YO TUNE signal as well as the FM Coil Drive signal, which are its main outputs. It also generates the High Unlock YO (HULY) signal.

The A54 YO Pretune/Delay Compensation board generates the PRETUNE voltage required to tune the A44 YO main coil to approximately the desired frequency. A portion of the YO output is coupled back to the sampler (A48U1) where the YO signal is mixed with the Nth harmonic of the output of the A33 M/N Output assembly. This generates a difference signal of 20 to 30 MHZ (Sampler IF) which is input to the A49 YO Loop Phase Detector where it is phase compared to the 20-30 MHz reference signal from the A36 PLL1 VCO. The resulting error signal tunes the YO to achieve phase-lock.

The YO frequency is related to the M/N Output frequency and the 20-30 MHz reference loop frequency in the following manner:

$$F_{YO} = (N)(Fm/n) - F20\text{-}30$$

Where:

F_{YO} = YO output frequency (MHz)
N = N number input to the M/N Loop
(harmonic near the frequency to which the YO Loop is tuned)
Fm/n = M/N Loop output frequency (MHz)
F20-30 = 20-30 Loop output frequency (MHz)
(the 20-30 frequency can be changed in 1 Hz steps)

The YO TUNE output from the A49 YO Loop Phase Detector board is routed to the A55 YO Driver board where it is summed with the Pretune voltage from the A54 Pretune/Delay Compensation board. This sum is then applied to the YO main coil. The YO FM Coil Drive from the A49 YO Loop Phase Detector board is routed to the A44A1 YO Bias board and applied to the YO FM coil.

A49 YO LOOP PHASE DETECTOR CIRCUIT DESCRIPTION

70 MHz Low Pass Filter A

The 20-30 MHz Sampler IF into the A49 YO Loop Phase Detector board is passed through the 70 MHz Low Pass Filter to remove any unwanted frequencies which may have been introduced during the sampling process.

IF Limiter B and 20-30 Limiter C

Each of the two input signals, Sampler IF IN and 20-30 REF IN, are passed through a limiter to establish ECL signal levels and to sharpen the edges of the two signals. The limited SAMPLER IF can be measured at TP5; the limited 20-30 signal can be measured at TP4.

Phase/Frequency Detector D

The two signals, Sampler IF IN and 20-30 REF IN, are applied to the phase/frequency detector (U6). The function of U6 is to output a pulse which is related to the phase and frequency difference of the two input signals. The width of this pulse is directly proportional to the amount of phase and frequency difference. When the two signals are at the same frequency, the output is proportional to the difference in phase. If the Sampler IF signal leads the 20-30 REF signal, then a negative pulse appears at U6 pin 3 (TP 2), the width being proportional to the amount of phase difference. If the 20-30 REF signal leads the Sampler IF signal, a negative pulse appears at U6 pin 12 (TP 3). In each case, the other output pin remains at an ECL HIGH level (approximately -0.6V). If the inputs are in phase, one of the detector outputs is an ECL HIGH (approximately -0.6v) with long narrow negative spikes and the other is an ECL HIGH with short spikes. The detector outputs are averaged in a 1.5 MHz low pass filter (L8, L9, C15, C16 in Differential Amplifier Block **E**) before being applied to the differential amplifier.

Differential Amplifer E

The outputs of the 1.5 MHz filters are applied directly to Differential Amplifier Q1. The output of this differential amplifier is directly related to the difference between the Sampler IF and the 20-30 MHz REF signals. The collector supply to this differential amplifier is provided by a 15V three-terminal regulator, U5, in the Power Supplies (Block **K**) which is referenced to the instrument REFerence ground system. This was done to transform the remainder of the YO drive circuitry from the normal chassis ground to the clean, controlled reference ground.

Loop Integrators F

Integrators U4 and U7 and the Phase-Lag Filter help determine the frequency response of the loop.

Integrator U4 has a pole at f=0 and a zero at f=4000 Hz (R17 and C19). Integrator U7 has a pole at f=0 and a zero at f=400 Hz (R19 and C21). The Phase-Lag Filter (FM Coil Driver, Block I) has a pole at 400 Hz (cancelling the zero of integrator U7) and a zero at 4000 Hz (R20, R21, and C23). The YO has an inherent pole at f=0 Hz.

The combined frequency response has a slope of -60 dB/decade until f=4000 Hz where the slope changes to -20 dB/decade. The unity-gain crossover frequency (Loop Bandwidth) is set to nominally 50 kHz by varying the gain of integrator U7. The effect of this frequency response is to provide high gain at frequencies below 4000 Hz and thus reduce (proportional to the loop gain) the YO close-in phase noise and line-related spurs.

R18 is a selected resistor which may be adjusted upward in value to reduce the YO Loop Bandwidth or downward to increase the YO Loop Bandwidth.

If the A55 YO Driver board is misadjusted (Offset and Gain adjustments), there will be a dc offset voltage at the INTG output. There is normally a small offset at any given frequency due to non-linearities in the YO tracking, but the value should vary about zero volts. If the average value is different from zero, it will limit the capture range of the loop.

The resistor-capacitor combinations of R39-C17, R40-C18, R41-C30, and R42-C31 are used to provide additional filtering of the power supply inputs to U4 and U5. R30 and R31 are used to protect the inputs of U4 and U5 from being damaged by a dc voltage accidentally applied to pins 2 or 3 during troubleshooting.

Test Jumper G

The test jumper provides a way to break the YO Loop and insert a test fixture to measure the loop gain, bandwidth, and phase margin.

Sample And Hold H

The purpose of the Sample and Hold (U3 and associated circuitry) is to apply the integrated output of the phase-detector to the YO to tune the YO and achieve phase-lock. It then holds this dc voltage during the sweep to improve the swept frequency accuracy. This is called Lock and Roll.

The Sample and Hold has two modes of operation:

- Sample Mode - This is essentially the no-memory mode where the input to the Sample and Hold circuit is used directly to tune and phase-lock the YO. This occurs:

(a) When the instrument is in the CW/MANUAL mode or in the Swept mode for YO sweep widths less than 5 MHz. This means that the YO is phase-locked during the entire sweep for sweep widths less than 5 MHz.

(b) Just prior to the sweep in the Swept mode for sweep widths greater than 5 MHz. This tunes and phase-locks the YO at the beginning of each sweep.

- Hold Mode - This is used for sweep widths of greater than 5 MHz. The YO is allowed to achieve phase-lock at the beginning of each sweep. Afterwards the Hold mode is enabled which causes the YO TUNE voltage to be held constant (using C24) while the YO is swept. This sequence is repeated at the beginning of each YO sweep.

The mode of operation of U3 is selected by the control signal LLEY (Low=Lock Enabled, YO) from the Logic Inverter/Translator, Block **L**. When this signal is a TTL LOW, the sample mode is enabled. When LLEY is a TTL HIGH, the hold mode is enabled.

The sample and hold IC, U3, was chosen for its low droop rate, which translates directly into improved YO sweep accuracy. R52 is used to allow the IC to operate with the large 2.0 uF hold capacitor, C24. CR7 and CR8 are used to bypass R52 during large signal operation (lock acquisition). An on-chip current-booster-charging circuit is also activated at this time. C35 is a compensation capacitor required for stable operation during large signal operation, and it also provides part of the hold circuitry.

FM Coil Driver I

The FM Coil Driver provides the tune signal for the YO FM Coil. It consists of two parts:

- 100 Hz High Pass Filter. This filter allows only the high frequency portion (greater than 100 Hz) of the error voltage signal to be applied to the YO FM Coil. (The YO Tune circuitry on the A55 YO Driver board has a 100 Hz Low Pass Filter applying only the low frequency portion of the error signal to the Main Coil.) There is also a ground transformation (provided by C26, R33, and R34) from Reference ground to FM GND.

- Output Amplifier. This circuit amplifies and filters the high frequency portion of the error signal to provide the drive current (through R36) to the YO FM Coil. A Phase-Lag Filter is incorporated in the feedback of the amplifier which completes the YO Loop frequency response and improves the overall noise performance of the YO Loop. The output voltage signal is clamped (by VR4 and VR5) to a maximum of ±3.8V to prevent the op-amp from becoming saturated during phase-lock.

The resistor-capacitor combination of R44-C28 and R43-C29 are used to provide additional filtering of the power supply inputs to A49U1.

Unlocked Detectors J

The output of integrator U7 in Loop Integrators (Block **F**) is a voltage representing the amount of frequency or phase error between the YO actual output and what it is supposed to be based upon the M/N and 20-30 frequencies. This output voltage is divided by 12 and presented to the comparators of the Unlock Detector.

Comparator U2B compares the output to -0.51V which is equivalent to approximately -6.1V at the output of integrator U7. Comparator U2A compares the output to +0.51V which is equivalent to approximately +6.1V at the output of integrator U7.

The outputs of these two comparators are wire OR'ed together. When the input to the Unlock Detector circuit exceeds approximately ±6.1V, one of the comparators will pull up to +20V which will pull HULY up to 4.64V (where it is clamped by zener diode VR3). This High Unlock (HULY) signal is routed (via the A50 Loop Interconnect board) to the A59 Digital Interface board where the processor is able to detect this error condition. HULY is also routed through A50R6, and U1B and U1C (darlington open collector inverters) on the A50 YO Loop Interconnect board, where it causes a green LED (A50 DS1) to light whenever the YO Loop is LOCKED.

When the output of the Loop Integrators (Block **F**) is within approximately 6.1V, both comparator outputs will pull down to -10V and will thus reverse bias the two diodes CR3 and CR4. The HULY signal will then be pulled LOW by R29, being limited to -0.6V by the (forward biased) zener diode VR3.

Power Supplies K

This circuitry filters the supplies used on this board. The -5.2VFA supply routed to the analog circuitry is separately filtered from the -5.2VFB supply for the digital circuitry to prevent crosstalk. The chassis ground is isolated from the Reference ground through R38. FM ground is connected to Reference ground through R37.

Transistor Q1 and surrounding circuitry form a capacitance multiplier circuit used to provide a filtered +15V supply, TP1, for the Differential Amplifier, Block **E**. The output voltage is determined by the voltage divider of R49 and R50 less the 0.6V base-emitter voltage drop. The circuit also provides a one-pole lowpass filter with Fc = 5.2 Hz (determined by the parallel combination of R49, R50, and C14). This circuit also provides a ground transformation from the chassis ground to the reference ground.

Logic Inverter/Translator L

The Logic Inverter/Translator inverts the HLEY (High=Lock Enable, YO) signal from the A59 Digital Interface assembly through the A50 YO Loop Interconnect assembly. The circuit has two outputs:

* LLEY (Low=Lock Enable, YO) is a TTL signal used to control the Sample and Hold, Block **H**. (LOW = sample; HIGH = hold.)

* YO LOOP DISABLE is an ECL logic signal that is used to disable the YO loop when in the hold mode (during sweeps). It does this by pulling HIGH the second input of IF Limiter U8A, Block **B**, causing U8B's output to remain LOW. This disables the Sampler IF input to the Phase/Frequency Detector, Block **D**, and causes the output of loop integrator U5 to rail to its +6.9V limit. This prevents the YO phase detector from responding to the sweeping YO signal which would produce noise. This noise, present at the input of U3, could feed through to cause low-level disturbances of the YO TUNE signal.

C32 is present to delay the YO Loop Disable signal to assure that the sample and hold circuit is activated before the loop is disabled. The circuit is designed so that the discharge rate of C32 (through Q2) is several times faster than the charge rate (through R46). The result is that, although the disable signal is delayed, the loop is quickly enabled so that the YO lock time is not affected.

A49 YO LOOP PHASE DETECTOR TROUBLESHOOTING

YO Unlock

A YO UNLOCK error condition can be caused by a number of different failure mechanisms in any of a number of assemblies. When the YO UNLOCK indicator is on, the YO Loop Troubleshooting Procedure should first be used to determine which assembly is at fault. It will also help locate which block of the assembly is malfunctioning. The following procedure should be used only when reasonably certain that the problem is with the A49 YO Loop Phase Detector.

NOTE

When troubleshooting the A49 YO Loop Phase Detector, the YO Loop should be placed in its service position and the cover removed. The YO TUNE and FM COIL cables must be connected and all assemblies involved with the YO Loop kept in place so that the loop remains closed.

The YO UNLOCK is signaled by the HULY (High = UnLocked Yo) line going HIGH. This is accompanied by the green LED on the A50 YO Loop Interconnect board turning off. This condition is indicated by the Unlocked Detector whenever the YO TUNE voltage at A49J2 goes outside the ±6.0 V range. Using a 3-way connector at A49J2 to keep the YO Loop closed, measure YO TUNE. If it is not outside the ±6.0 V range, then troubleshoot the Unlocked Detector, Block J.

Limiters

To verify the operation of the Limiters, Blocks **B** and **C**, use a 100 MHz oscilloscope with a 10:1 probe to measure the input at A49J3 and A49J4 and the outputs of the limiters at TP4 and TP5. The signals at TP4 and TP5 should be square waves at ECL voltage levels (-5.0 to -0.7 V).

For a signal to exist at TP5, HLEY must be HIGH and the Logic Inverter/Translator circuitry must be functioning properly. This provides an ECL LOW (-2V to -5V) to pin 5 of U8A which enables the second IF Limiter.

Phase/Frequency Detector

To verify the operation of the Phase/Frequency Detector, make measurements with an oscilloscope at the two inputs, TP4 and TP5 (see previous section), and the two outputs, TP2 and TP3. The correct output waveforms are described in the circuit theory section for the Phase Frequency Detector, Block **D.** Use a 10:1 test probe with a short ground clip. If the grounding is not good, there will be ringing on the signal edges. Also refer to the Open Loop Test, below.

Differential Amplifier and Loop Integrators

The bias voltages for Q3 will change with loop conditions. The three conditions of interest are (1) Loop Locked, (2) Sampler IF frequency less than the 20-30 frequency ("lag", YO TUNE ≤ -6.0 V), and (3) Sampler IF frequency greater than the 20-30 frequency ("lead", YO TUNE ≥ +6.0 V). The approximate bias voltages for these three conditions are given in Table 8D-2. Also refer to the Open Loop Test, below.

Table 8D-2. Bias Voltages on A49Q3 Under Different Loop Conditions

Loop Condition	Q3A			Q3B		
	Emitter (pin 4)	Collector (pin 1)	Base (pin 2)	Emitter (pin 3)	Collector (pin 6)	Base (pin 5)
(1) LOCKED	−1.5 V	+15.0 V	−0.9 V	−1.5 V	+6.7 V	−0.9 V
(2) LAG	−1.5 V	+15.0 V	−1.8 V	−2.1 V	+3.7 V	−0.8 V
(3) LEAD	−2.1 V	+15.0 V	−0.8 V	−1.5 V	+9.9 V	−1.8 V

Open Loop Test

The following is an open-loop test that can be used to troubleshoot the A49 YO Loop Phase Detector. Set the instrument to CW mode. Disconnect the cables at A49J1 and A49J2, and measure the YO TUNE voltage at A49J2. The voltage will be either -6.9 V, corresponding to case Number 2 above (lag), or else +6.9 V corresponding to case Number 3 (lead). The bias voltages of Q3 should be close to those listed in Table 8D-2. Switch the Sampler IF and the 20-30 MHz input cables (A49J3 and A49J4). This should reverse the polarity of YO TUNE. The corresponding bias voltages for Q3 can now be verified. If the bias voltages of Q3 are correct for both cases but the polarity of YO TUNE does not reverse, then troubleshoot the Loop Integrators, Block **F**, and the Sample and Hold, Block **H**.

Sample and Hold

With HLEY (High Lock Enable Yig Oscillator) HIGH, and LLEY LOW (CW or MANUAL mode), the output of the Sample-and-Hold, Block **H**, should track the input. Verify that HLEY is HIGH and LLEY is LOW, then measure the input and output of U3; they should be identical.

FM Coil Driver

If the FM Coil Driver, Block **I**, is malfunctioning, the YO Loop will acquire phase-lock, but the residual FM on the YO Output will be far greater than the typical specification of 60 Hz. The dc output of the op-amp should be 0 V.

Logic Inverter/Translator

To test the Logic Inverter/Translator, TP3 (HLEY) on the A50 YO Loop Interconnect assembly can be used to force a logic condition to occur. Connect HLEY to +5V and then to ground, verify that the outputs are within the given limits. LLEY can be measured at U3 pin 14; YO Loop Disable can be measured at U8 pin 5.

HLEY	LLEY	YO LOOP DISABLE
+5V	2.4 to 5.0V	-0.5 to -1.0V
0V	0.0 to 0.5V	-2.0 to -5.0V

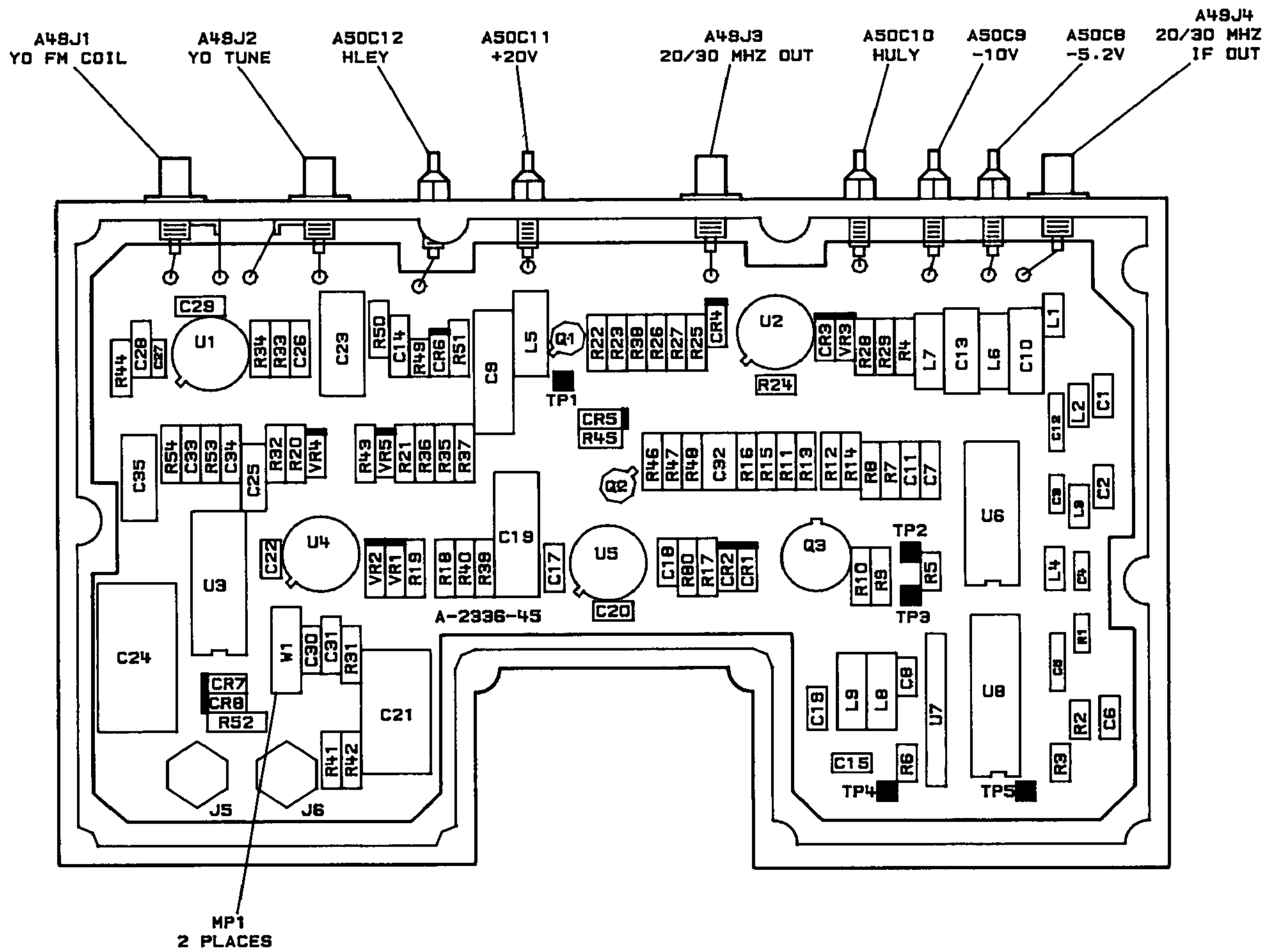


Figure 8D-9. A49 YO Loop Phase Detector, Component Location Diagram

A50 YO LOOP INTERCONNECT BOARD

A50 YO LOOP INTERCONNECT BOARD CIRCUIT DESCRIPTION

The A50 YO Loop Interconnect board is used to distribute power and signals to the A48 YO Sampler Assembly, the A49 YO Phase Detector, the A45 Directional Coupler, and the A44A1 YO Bias board. It also contains the following signals, and each is provided with a testpoint.

TP3 HFIL HIGH = YO CW Filter is switched IN
TP4 HLEY HIGH = Lock is Enabled, YO
TP6 HULY HIGH = UnLocked YO

The test points serve two purposes. Each test point can be used to monitor the state of the digital signal. (The level will be somewhat less than the actual signal level due to the resistors on each side of the test points.) The test point can also be used to force a logic condition to occur by tying it to +5V or ground. These features are useful for troubleshooting and to verify circuit operation.

Also provided on the YO Loop Interconnect board are test points for each supply voltage and for the YO Coil voltage.

The A50 YO Loop Interconnect board also isolates and separately filters supplies going to different portions of the YO Loop Assembly.

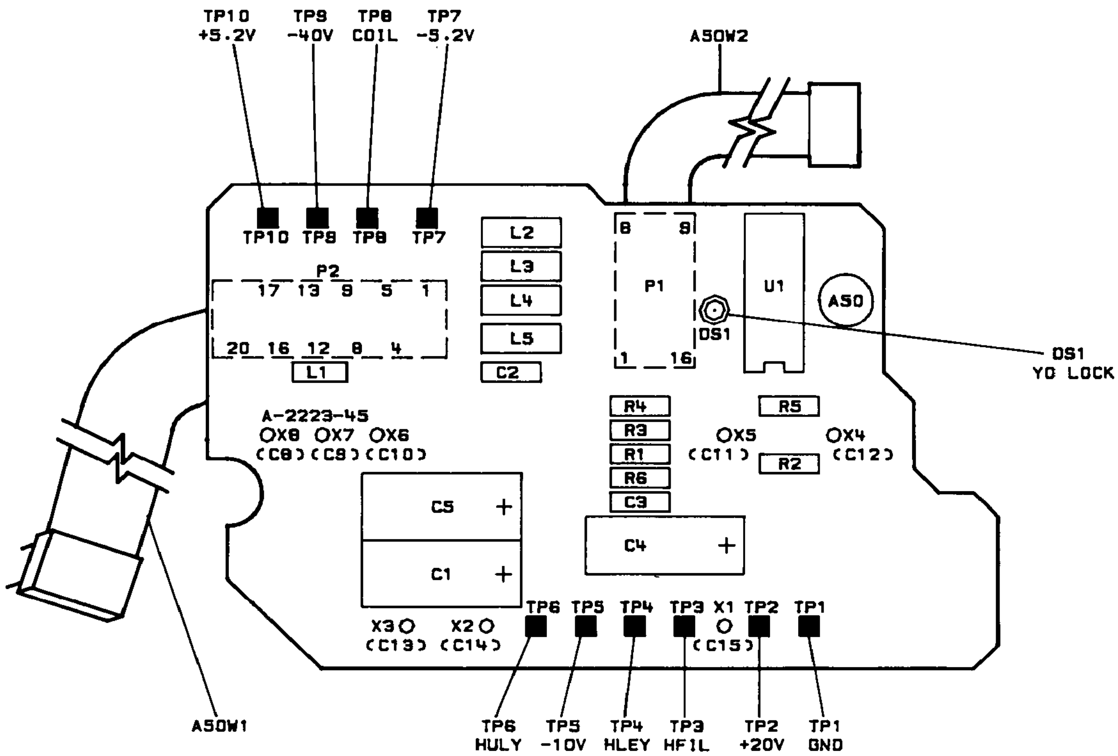


Figure 8D-10. A50 YO Loop Interconnect, Component Location Diagram

A62J2 TO A50W1P2 PIN I/O

Pin	Mnemonic	A50W1P2	Levels
1	−5.2V	PIN 1	−5.2V
2	GND	PIN 2	0V
3	HLEY	PIN 3	TTL (HIGH TRUE)
4	+5.2V	PIN 4	+5.2V
5	HFILYO	PIN 5	TTL (HIGH TRUE)
6	YO COIL +	PIN 6	−40V TO −20V
7			
8	YO COIL −/−40V	PIN 8	−40V
9	+20V	PIN 9	+20V
10	−10V	PIN 10	−10V
11	−10V	PIN 11	−10V
12	+20V	PIN 12	+20V
13	YO COIL −/−40V	PIN 13	−40V
14			
15	YO COIL +	PIN 15	−40V TO −20V
16	HULY	PIN 16	TTL (HIGH TRUE)
17	+5.2V	PIN 17	+5.2V
18			
19	GND	PIN 19	0V
20	−5.2V	PIN 20	−5.2V

Note: Refer to A50 YO Loop Interconnect Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

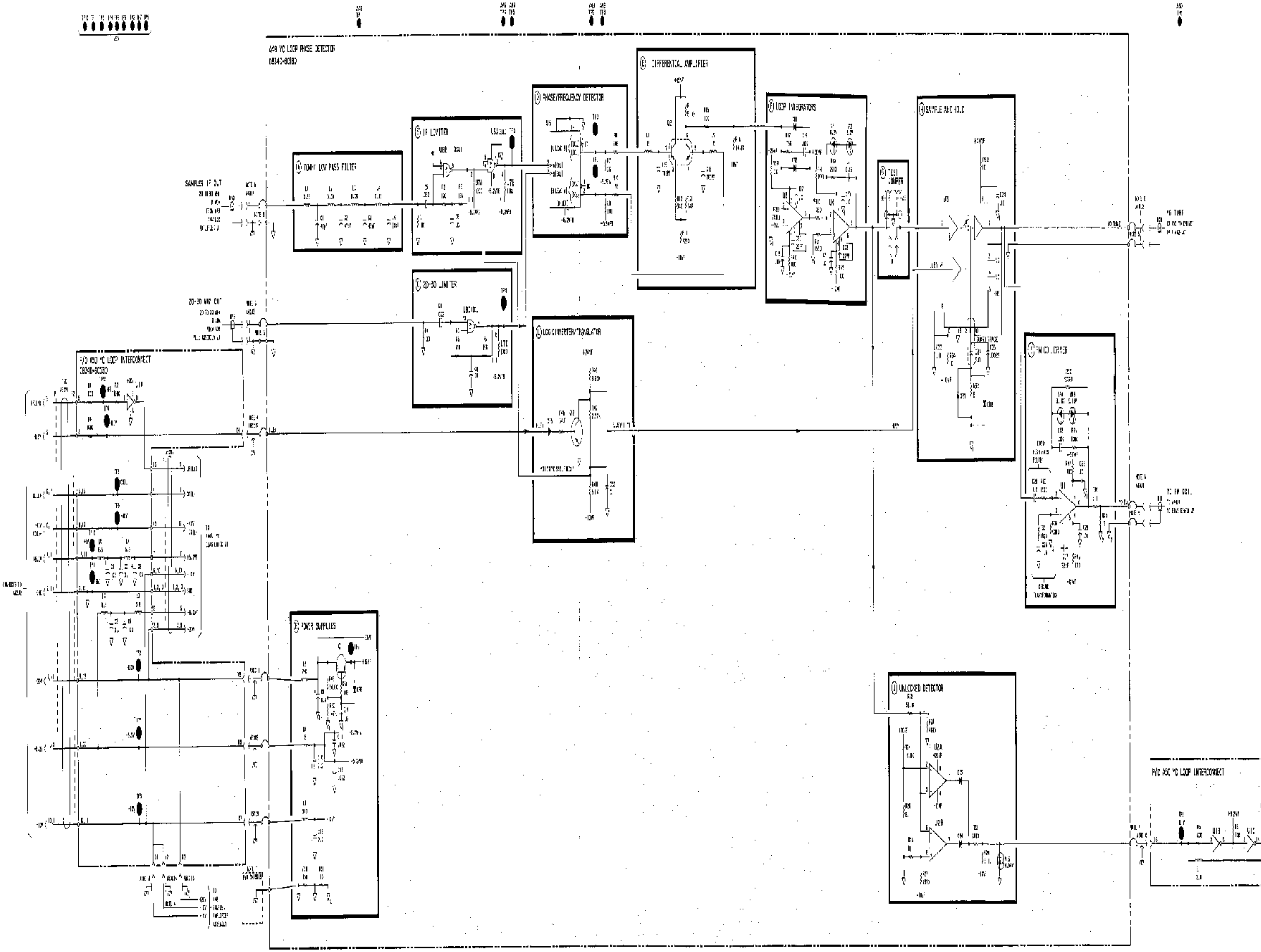


Figure 8D-11. A49 YO Loop Phase Detector and A50 YG Loop Interconnect, Schematic Diagram

A54 YO PRETUNE/DELAY COMPENSATION

INTRODUCTION

The A54 YO Pretune/Delay Compensation board performs three major functions:

- It provides a dc voltage, Pretune, to the A55 YO DRIVER which is proportional to the frequency to which the YO is being phase-locked. The YO sensitivity of this line is -2.5 V/GHz. Pretune is also used by the A28 SYTM Driver to tune the SYTM.
- It generates the kick pulses which are necessary at a YO retrace to preset the magnetic domains of the YO to eliminate the affects of magnetic hysteresis. These pulses are of constant amplitude, corresponding to about 2.5 GHz, and are of varying width. The width is a function of the YO start frequency and sweep width of the previous sweep as well as the YO start frequency of the next sweep. These pulses are subtracted from the phase-lock Pretune voltage and have the affect of temporarily tuning the YO 2.5 GHz below the next lock frequency.
- It provides a voltage, VCOMP, to the A55 YO Driver which is used to compensate for the YO frequency delay.

A54 YO PRETUNE/DELAY COMPENSATION CIRCUIT DESCRIPTION

Pretune Register A

U11 and U13 latch data bits 1-12 from the 16 bit instrument data bus to set the Pretune voltage. The strobe that activates the latch is WPDAC (Write Pretune DAC). This strobe is channel 3, sub-channel 2 from the processor (3,R2:). U10 AND U12 contain pull-up resistors to back bias the output stages of the latches when the outputs are HIGH so that bus noise cannot come through to the DAC.

Pretune DAC B

U6 is a 12 bit bipolar DAC. It takes the 10 volt reference voltage and the latched data bits to give a dc voltage at TP6, VDAC, given by the formula:

$$VDAC = 2.10V/(f_{YO} - 2.3)GHz$$

The voltage corresponding to 2.3 GHz is derived from the reference voltage and added at the Summing Amplifier (Block C). The sensitivity of this block is +2.100 Volts/GHz.

The formula for calculating the digitized number that is present at the input of U6 at any given frequency is:

[Lock frequency (GHz) - 2.3 (GHz)] ⊠ 870.

Note that the latches pick off data bits 1-12, NOT 0-11. This means that the number sent by the processor and the number that shows up at the input of the DAC differ by a factor of 2. The formula for the number sent by the processor is:

[Lock frequency (GHz) - 2.3 (GHz)] ⊠ 1740.

R14 takes out the tolerance of the summing resistors R19 and R20 as well as the gain tolerance of U6 itself. CR4 is a protection diode to insure that pin 9 of U6 does not go much below pin 12. U2 is a high performance OP-AMP chosen for its low offset voltage, good temperature characteristics, and low noise. C15 provides stability compensation for the DAC.

Summing Amplifier C

The Summing Amplifier combines four signals to give the final Pretune voltage. These signals are:

- A voltage corresponding to 2.3 GHz (R22-24)
- The DAC voltage which is proportional to lock frequency minus 2.3 GHz (R19, R20)
- The sweep ramp (R25, R26)
- The retrace kick pulse (R46)

The combined signal is called PRETUNE, TP3, and has a YO sensitivity of -2.5 V/GHz. R22 adjusts for the tolerance of R21, R22, R23, the +10 volt reference, and the offset voltage of U4.

A further note about PRETUNE: The 2.3 GHz offset is used so that the greatest resolution can be achieved from the DAC. 2.3 GHz is the lowest frequency that the YO can be tuned to and corresponds to a DAC number of zero. The highest frequency that the YO can be tuned to is 7.0 GHz and this corresponds to a DAC number of 4089. Note that this is not all digital ones at the DAC input but a slightly smaller number. This was done to simplify the calculations that the processor has to do. Pretune is also routed to the A28 SYTM Driver where it is scaled and used to tune the SYTM.

Voltage Reference D

The voltage reference for the whole Pretune system is derived from VR1, a low noise, 1%, 5 ppm reference zener diode. The circuit provides a constant bias current of 7.5 mA through the diode. R10 and C11 give extra filtering of diode noise.

Note that C11 is a polycarbonate capacitor which has low leakage, noise, and current, and has good temperature stability. The current from the op-amp is not sufficient to cover the worst case needs of the board, so R49 provides the remainder of the current.

Sweep Disable Switch E

FET Q3 is a switch that grounds the junction of R25 and R26 (Block C) when LVSX (Low Voltage Sweep disable) is LOW. This prevents noise from the sweep generator from being added to the PRETUNE voltage when the instrument is in the CW, MANUAL, or narrow sweep modes. Narrow sweeps are sweep widths ≤ 500 kHz.

LVSX is HIGH any time that the 8340A is in the sweep mode and the sweep width is >500 kHz. Therefore, any slight dc offset that might be at the output of the sweep generator when it is reset (and supposed to be at zero) is added to the PRETUNE voltage while the instrument is acquiring phase-lock. This offset will not effect the sweep accuracy, however, as long as it is not great enough to keep the YO from acquiring phase-lock.

YO Delay Compensation F

The frequency lag or delay in the YO during a sweep due to eddy currents in the magnetic poles is described by the equation:

Delay(Freq) = [A+(B*F)]*dF/dt

where:

Delay(freq) = Frequency lag or delay

F = (measurement frequency) - (start frequency)

dF/dt = sweep rate

The YO DELAY COMPENSATION circuit generates a voltage, VCOMP (TP4), proportional to the delay shown above. This voltage is sent to the A55 YO DRIVER board where it is used to speed up the sweep to make the frequency more closely follow the PRETUNE voltage and thus compensate for the YO frequency delay.

To generate this voltage, the circuit sums a dc voltage (COFF adjustment) and the VSWP voltage ramp (CGN adjustment) to generate the (A + B*F) term. (This is done through resistors R30 through R34.) The resulting voltage is used as the analog input to an 8 bit DAC whose digital input, provided by the processor, is related to the sweep rate, dF/dt. The DAC then performs the multiplication, and thus the voltage, called VCOMP, is of the desired form. The strobe for this DAC is 5,R3: (Write Compensation DAC). C31 is used for stability compensation of the DAC.

In the configuration used, U16 gives a high impedance voltage output at pin 21. U14A buffers this voltage and provides the necessary low output impedance. R35 was chosen to match the 5K Ohm internal DAC impedance to ensure unity gain for U14A. CR6 clamps the maximum DAC output at ground.

YO Retrace Kick Pulse Generator G

Through the use of an 8 bit DAC, U15, this circuit generates a programmable width pulse. This LOW-going pulse is applied to the gate of Q1 (Block **C**) which switches in an additional current to offset the PRETUNE voltage. This offset is 6.2 volts in the positive direction, which has the effect of tuning the YO lower in frequency (about 2.5 GHz).

The instrument processor initiates a kick pulse by first writing to the pulse width DAC address, 5,R1: (WYOKW, Write YO Kick Width), a number that corresponds to the desired pulse width. This write loads U15 and resets the pulse circuit through U9. At the appropriate time, the processor sends a trigger 3,R0: (TYOKP, Trigger YO Kick Pulse), which starts the pulse. The circuit then terminates the pulse after the programmed length of time has elapsed.

The write to the pulse width DAC (WYOKW, Write YO Kick Width) initializes the pulse width circuitry as follows. U9 is set. (Note: U9 is an LS74, and the set and reset inputs function as a standard flip-flop.) The positive edge triggered clock input clocks the D input to the Q output or in this case effectively sets the flip-flop. The Q output of U9 (pin 9) through U7B turns off switch Q1 (Block **C**) which turns off the kick pulse. The Q_O output of U9, pin 8, turns on switch Q4, which zeros the integrator formed by U14B and C29. The write (WYOKW) also programs the DAC, U15, to a voltage between 0 and +10 volts which corresponds to the desired pulse width.

Since the inverting input of U14B is a virtual ground and the reference voltage from U15, pins 13 & 14, is a constant +5 volts, there is a constant current of about 64 microamps into the integrator. Because the capacitor is shorted by Q4 at this point, the output of U14B is zero volts.

When the trigger pulse (TYOKP, Trigger YO Kick Pulse) is received from the processor, U9 is reset and Q1 is turned on through U7B. When U9 is reset, pin 8 goes HIGH turning Q4 off through U7D. The constant current of 64 microamps into the integrator now gives rise to a negative going ramp at the output of U14B with a constant slope of about -291 volts/second. When this ramp reaches a value equal in magnitude, but opposite in polarity, to the voltage at the output of the DAC (U15), then comparator U8 fires and clocks U9. This effectively sets U9, turning off the kick pulse and zeroing the integrator.

The only adjustment in this circuit is R36, that varies the current to the integrator to take out tolerances in the integrating capacitor, C29, and current setting resistor, R37.

The number written to the pulse width DAC address is related to the desired pulse width by the formula:

Pulse width (msec) = [(Number) / 512] * 34 msec

Since the DAC input itself is bits 1-8 rather than 0-7, the number that appears at the input of U15 is the number calculated above, divided by two.

Power Supplies H

L1-L5 and C1-C5 form standard low-pass power supply filters. The inductor type was chosen to have a relatively high series resistance, while the capacitor was chosen to have a low series resistance. This results in a Q of about 2 for the filter formed by the LC circuit.

U1 and U3 are 3-terminal 5 volt and 15 volt regulators. CR1 and CR2 are protection diodes. If the input to either regulator is somehow shorted to ground the discharge currents of C9, C35 and any onboard capacitance is shunted through these diodes rather than through the regulators. Reverse current through these regulators results in catastophic failures.

Q2 is a simple voltage follower. C7, R3 and R4 provide noise filtering to the base of the transistor.

R2 provides a back-up connection between reference and chassis grounds so that if the motherboard connection between the grounds is broken for some reason, this board will continue to operate, although not necessarily within specifications.

A54 YO PRETUNE/DELAY COMPENSATION TROUBLESHOOTING

In all modes, the sensitivity of the PRETUNE output, TP3, is -2.5 volts/GHz. This is the place to start in troubleshooting the board. In CW mode, run the frequency from 2.3 GHz to 6.99 GHz and see if the correct voltage is present on the PRETUNE test point. Note, if you set the CW frequency to 7.0 GHz, the PRETUNE will be -8.75 volts, corresponding to 3.5 GHz. This is because the instrument switches to the second harmonic band at this point.

If the PRETUNE voltage (TP3) is not correct, then check all inputs to the summing amplifier. VDAC (TP6) should have a sensitivity of 2.10 volts/[(f_{YO}-2.3)GHz] and VREF should be +10 volts, ± 10%. Also BLVSX (TP1) should be <+0.5 volts and LKICK should be +5 volts. If these last two lines are not correct, they will add unwanted voltages to PRETUNE. In particular, if LKICK is LOW, <+0.5 volts, it will add +2.5 Volts error to the PRETUNE signal. If VDAC (TP5) is not at the correct voltage, check the digital inputs and the input from VREF. The formula for calculating what the VDAC and digital input should be is given in the theory section for Pretune DAC, Block **B**.

In the sweep mode, if the PRETUNE voltage does not ramp, check to see that VSWP, P1-26, is present. Then see that BLVSX, TP1, is HIGH, +15 volts, so that the sweep voltage is summed with the start frequency PRETUNE voltage.

If there is no retrace kick pulse, check LKICK to see that it goes LOW, <+0.5 volts, during the period of the kick. If LKICK is not working correctly, then the YO Retrace Kick Pulse Generator, Block **G**, must be checked. The operation of U15 can be verified by writing to its address, WYOKW 5,R1: (Refer to A60 Processor documentation). Writing zero to this address should result in zero volts at U15, pin 18. Writing 511 should result in +10 volts at U15 pin 18.

To test U16 (YO Delay Compensation, Block **F**), set the instrument to sweep from 2.3 GHz to 7.0 GHz with a 10 msec sweep time. VCOMP should then be a negative-going ramp with a step at the start as shown on the schematic. The voltage should go from approximately -0.5 to -2 volts. These voltages are very loose limits and depend upon how the COFF and CGN pots have been adjusted. Variations of ±50% are to be expected. However, as the sweep time is increased to half a second, the step at the start of sweep should decrease smoothly to zero as should also the slope of the ramp.

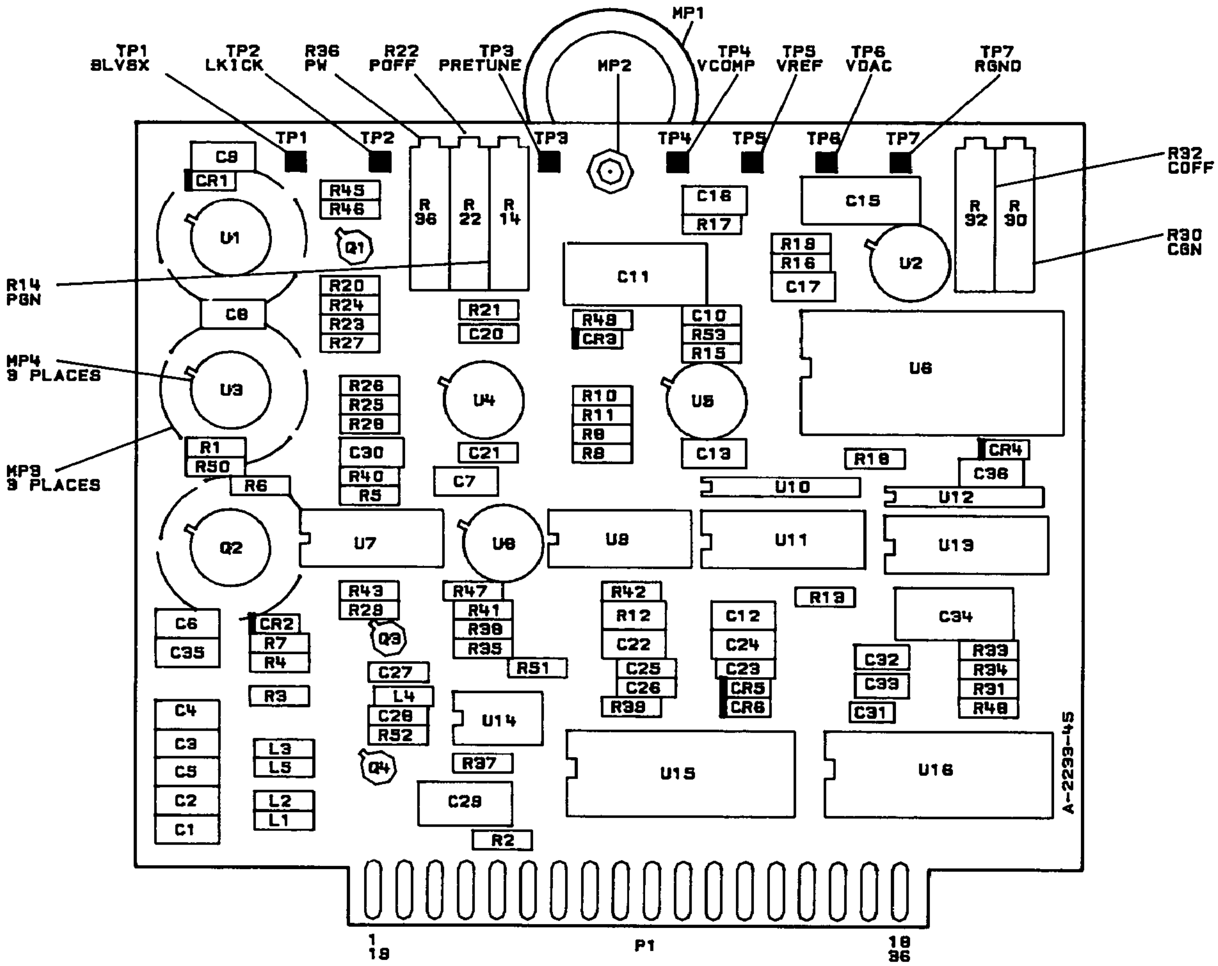


Figure 8D-12. A54 YO Pretune/Delay Compensation, Component Location Diagram

A54 YO Pretune DAC/Delay Compensation P1 Pin I/O

A54

Pin	Mnemonic	Levels	Source	Destination
1	+20V	+20V	XA52P1-16, 40	*H
19	+20V	+20V	XA52P1-16, 40	*H
2	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*H
20	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*H
3	−40V/−40V SENSE (−)	−40V	XA53P1-11, 30/XA53P1-23	*H/H
21	YOKICK	TTL (HIGH TRUE)	G	*
4	−10V	−10V	XA53P1-12, 13, 31, 32	*H
22	−10V	−10V	XA53P1-12, 13, 31, 32	*H
5	GND	0V	A62 STAR GND	*H
23	GND	0V	A62 STAR GND	*H
6	WYOKW	TTL (LOW TRUE)	XA59P1-99	G
24	PRETUNE	−2.5V/GHZ, 0V = 2.3 GHZ	C	*
7	RGND	0V	STAR GND POINT	*H
25	RGND	0V	STAR GND POINT	*H
8	−15V	−15V	XA56P1-15, 30	*H
26	VSWP	0 TO 10V SWEEP	XA58P1-97	*C F
9	LVSX	TTL (LOW TRUE)	XA58P1-68	E
27	VCOMP	−26 MHZ/VOLT	F	XA55P1-9
10	DB1	TTL	XA60P1-76	*A G
28	WCDAC	TTL (LOW TRUE)	XA59P1-30	F
11	DB3	TTL	XA60P1-77	*A G
29	DB2	TTL	XA60P1-21	*A G
12	DB5	TTL	XA60P1-78	*A G
30	DB4	TTL	XA60P1-22	*A G
13	DB7	TTL	XA60P1-79	*A G
31	DB6	TTL	XA60P1-23	*A G
14	DB9	TTL	*	*A F
32	DB8	TTL	*	*A F G
15	DB11	TTL	*	*A F
33	DB10	TTL	*	*A F
16	DB13	TTL	XA60P1-82	*F
34	DB12	TTL	*	*A F
17	DB15	TTL	XA60P1-83	*F
35	DB14	TTL	XA60P1-27	*F
18	TYOKP	TTL (LOW TRUE)	XA59P1-100	*G
36	WPDAC	TTL (LOW TRUE)	XA59P1-68	A

A circled letter in the source or destination column refers to a function block on this assembly schematic.

An asterisk (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete listing of signal destinations.

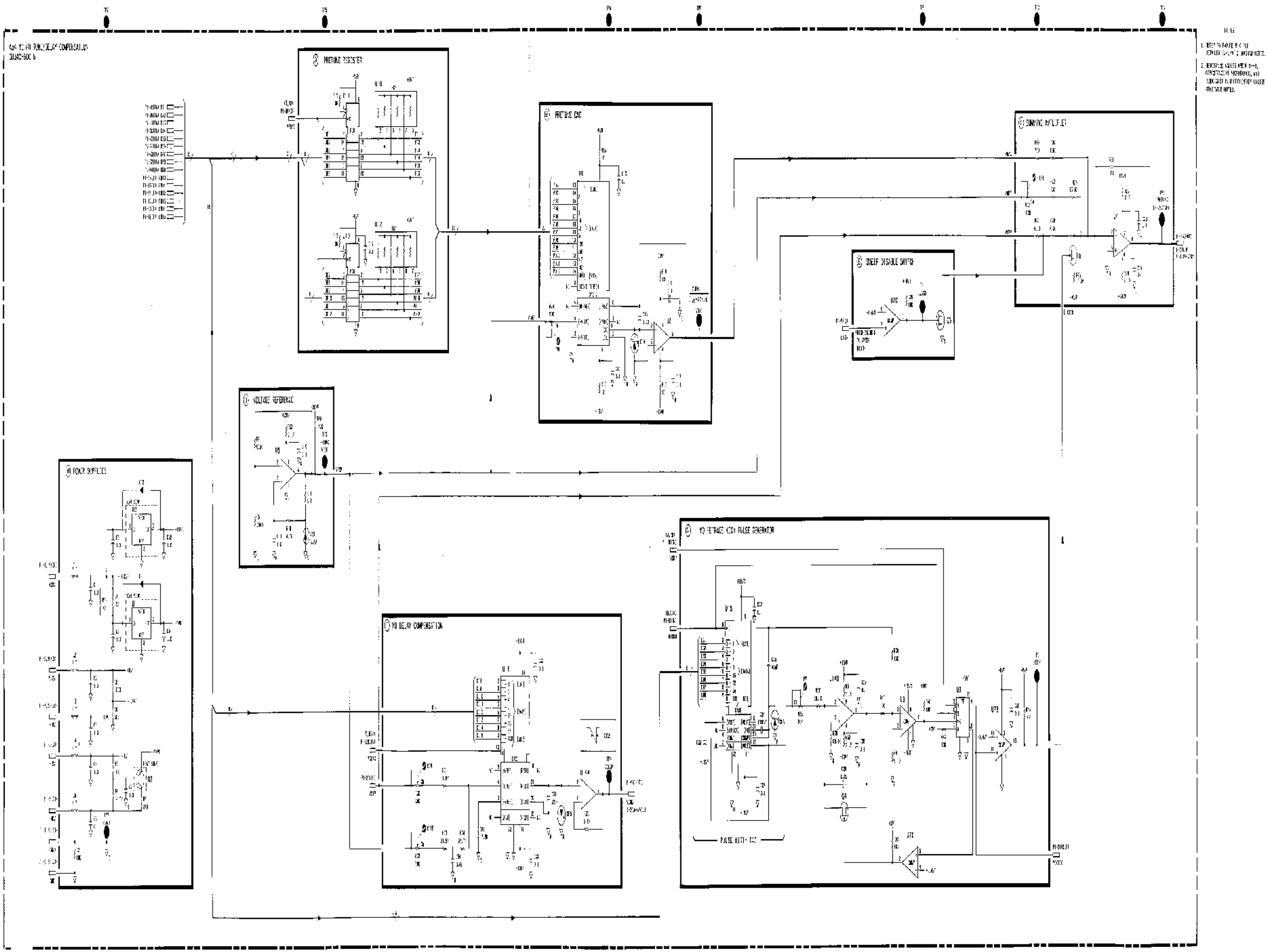


Figure 5D-13. A34 YO Pretune/Delay Compensation, Schematic Diagram

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A55 YO DRIVER ASSEMBLY

INTRODUCTION

The YO Driver board performs several functions in the 8340A.

- It acts as a voltage to current converter to transform the Pretune voltage (sensitivity = -2.5 Volts/GHz) to YO MAIN COIL current (sensitivity is approximately 24 ma/GHz).
- It provides the summing point for the low frequency portion (less than 100 Hz) of the YO phase-locked loop error voltage (YO TUNE).
- It provides the summing point for the YO Delay Compensation voltage (VCOMP).
- It provides the summing point for the YO coil offset current.

Figure 8D-14 shows a simplified block diagram of the YO Driver circuit. Notice that the sense resistor and part of the Compound PNP Transistor circuit (A47Q1) are physically located on the A47 Sense Resistor Assembly.

The Discrete Op-Amp (Block **A**) is connected with the Compound PNP Transistor (Voltage-to-Current Converter, Block **B**) to form a current source which sets the YO coil current and hence the YO frequency. The negative feedback for the Discrete OP-Amp is taken from the sense resistor (A47R6); therefore the voltage present at the inverting input of the Discrete OP-Amp will also be present at the sense resistor. Since the other end of the sense resistor is connected to ground, this voltage defines the current through the sense resistor and thus through the YO coil. The voltage at the non-inverting input of the Discrete OP-Amp (TP5) is slightly lower than the PRETUNE voltage due to the GAIN adjustment potentiometer, which acts as a voltage divider. The coil current is related to the voltage at TP5, the IN test point, by the following equation:

I(coil) = V(IN)/R(sense), with R(sense) = 97.5 Ohms

The feedback point to the Discrete OP-Amp, TP4, also forms a current summing node. Any current that is injected at this point from the Main Summing Amplifier, Block **E**, must flow through the YO coil and not the sense resistor. This is because the feedback loop maintains a given voltage at the feedback point which in turn maintains a given current through the sense resistor. This arrangement provides a way to vary the YO frequency without upsetting the feedback loop.

Several signals are summed at the feedback point. The delay compensation voltage, VCOMP, is applied through Q4 in Main Summing Amplifier, Block **F**, and a 411 kHz low pass filter formed by C8 and R55. The function of this filter is to round the leading edge of VCOMP in order to properly match the delay characteristics at the start of the sweep. The YO phase-locked loop error voltage (YO TUNE) is summed through the network of R51, R52, R32 and C14. This network is a 100 Hz low pass filter to pass the desired low frequency component of the error voltage. The YO coil OFFSET current (R47 in YO Error/Offset Summing Amp, Block **E**) is summed through the same path as the YO TUNE voltage.

The YO coil OFFSET current is necessary because the YO coil current verses YO frequency characteristic does not go through the origin. That is to say, if you extrapolate the characteristic down to zero current, you do not get zero frequency. This offsetting could have been handled by the processor by varying the number sent to the Pretune DAC except for the fact that the SYTM also uses that voltage and has its own independent offset.

A55 YO DRIVER ASSEMBLY CIRCUIT DESCRIPTION

Discrete Op-Amp A

The Discrete OP-Amp is arranged in a standard configuration. Q3 provides the differential input with TP4 the - input and TP5 the + input. The Q2 circuitry forms a current source for biasing the input stage. C1 is for noise filtering; CR2 and CR3 provide temperature stablization. CR1 limits the differential input voltage to the OP-Amp.

Q1, Q5, R8 and R9 form a current mirror to provide maximum gain from the differential input to the single ended output. Q6 is the output stage of the Discrete OP-Amp. R10 and C2 are for loop compensation.

The gain of the YO Driver is set by the adjustable voltage divider formed by R1 through R4. This adjustment is made at the high end of the YO frequency range (i.e., 6.99 GHz). The GAIN adjustment is interactive with the OFFSET adjustment, R47 in YO Error/Offset Summing Amplifier (Block **E**), which is made at the low end of the frequency range (2.3 GHz). See the adjustment section.

R13, R20, and C3 form a noise filter used in the CW and MANUAL modes. In YO sweeps, however, to avoid unwanted delay in the response of YO Driver, the filter can be switched out by the Filter Switch (Block **D**). This filter also severely limits the slew rate of the Discrete Op-Amp so Q7 and Q9 serve as speed up transistors by shunting resistor R13 when the Op-Amp is slewing and when the voltage across the resistor is sufficient to turn on one of the other of the transistors. Q8 is a current limiter stage.

Voltage-To-Current Converter B

Transistors Q10 and Q12 are connected as a complementary darlington pair. This circuit, together with A47Q1 on the A47 Sense Resistor Assembly, function as a compound PNP Transistor with its emitter connected to the sense resistor, its base connected to the output of the Discrete Op-Amp, and its collector connected to the YO Main Coil. See Figure 8D-14. The sense resistor, A46R6, and A47Q1 are mounted externally to the board for heat sinking and so the reference grounds of the YO and SYTM can be connected to chassis ground at the same point without any intervening PC edge connections. This configuration results in improved 60 Hz performance as well as better YO/SYTM tracking.

CR6, CR7, CR8 and VR1 protect the darlington transistor against the inductive voltage spikes generated by the YO coil whenever a step change in current is desired. C4, C25 and R23 stablize the Compound PNP Transistor. Oscillation of this stage is aggravated by the inductance of the leads connecting the on-board and off-board components. R24 provides for a slight bias current through Q12 and defines the impedance seen by the base of A47Q1. C26 bypasses the base-emitter junction of Q10 and improves the radiated susceptibility performance of the instrument.

VCOMP Switch Logic C

This circuitry determines when the delay compensation voltage (VCOMP) is applied to the Main Summing Amplifier (Block **F**). When both HSP (High SweeP), and HCEN (High Comp ENable) inputs are HIGH, the output at U5B is LOW, turning on Q4 in the Main Summing Amplifier (Block **F**). This allows the VCOMP signal to be summed with the YO TUNE input. When either HSP or HCEN are LOW, Q4 is turned off, removing the VCOMP signal. HCEN is a latched line that is HIGH whenever the sweep width is greater than 50 MHz. R40 is a pull-up resistor to ensure that the output of U5B goes high enough to turn off Q4.

Filter Switch D

In YO sweeps, switch Q11 is turned on by LYSP (Low Yo SweeP). This grounds R22 in Discrete Op-Amp (Block **A**) which sources current through R13 and R20, thus turning on Q9 and providing a straight through path in shunt with the one resistor, R13. This bypasses the filter and eliminates its associated delay.

YO Error/Offset Summing Amp E

The OFFSET voltage is derived from a 6.2 volt reference zener. R47 provides an adjustment for this voltage and R48 with C15 provide noise filtering. The YO phase-locked loop error voltage, YO TUNE, from the A49 YO Loop Phase Detector (A49J2) is summed with the offset voltage at U2.

Main Summing Amplifier F

The delay compensation voltage (VCOMP) from A54 YO Pretune/Delay Compensation board is added to the output of YO Error/Offset Summing Amp (Block **E**). Q4 switches VCOMP in and out. The resultant voltage (SUM, TP2) is injected through R29 as a current into the summing node of the Voltage-To-Current Converter (Block **B**).

Power Supplies G

The power supply filtering is the standard shunt capacitance, series resistance type. Series resistors were used rather than series inductors to provide a wide-band, low Q impedance for the shunt capacitors to work against.

A55 YO DRIVER ASSEMBLY ADJUSTMENTS

Before the YO Driver adjustments are made, the A54 YO Pretune/Delay Compensation assembly must first be adjusted. Once this is done, carry out the following procedure:

NOTE

> **GAIN Adjust R4, and OFFSET Adjust R47 are interactive. With the following procedure, however, the number of iterations can be minimized.**

Open the YO phase-locked loop by removing Cable A49W1 from between A49J5 and A49J6 on the YO Loop Assembly. Connect a short circuit or a 50 Ohm load to connector A49J6.

Set the instrument to CW, 2.30 GHz. Measure the actual YO frequency and call it F_1. Now set the instrument to CW, 6.99 GHz. Again measure the YO frequency and call it F_2.

Without changing the state of the instrument, adjust the GAIN Adjust R4 in Discreet Op-Amp (Block **A**) so that the YO frequency in GHz is:

$$F_{YO}(GHz) = (4.6 * F_1)/(F_2-F_1) + 4.6$$

where:

F_1 and F_2 are the frequencies in GHz that were measured previously in the procedure.

Finally, set the instrument to CW at 2.3 GHz and adjust the OFFSET Adjust R47 so that the YO frequency is 2.3 GHz. (In setting the YO frequency, an accuracy of 1 MHz is sufficient).

As a final check, reconnect cable A49W1 between A49J5 and A49J6 and measure YO TUNE (A55TP3) in the CW mode over the frequency range of 2.30 to 6.99 GHz. The dc value should vary about 0 volts. The PRETUNE should set the YO within about 5 MHz of the desired frequency. The sensitivity of YO TUNE is about -3 MHz/volt. Therefore, YO TUNE should be < ±2 Volts.

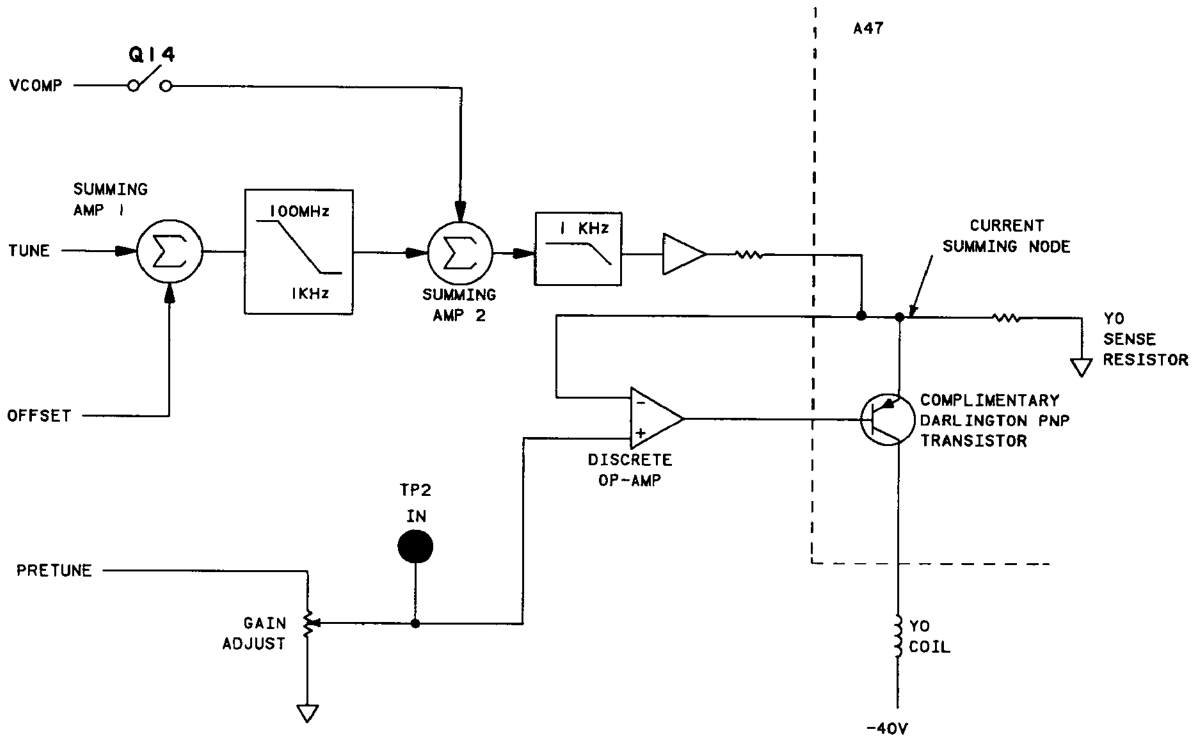


Figure 8D-14. A55 YO Driver Simplified Diagram

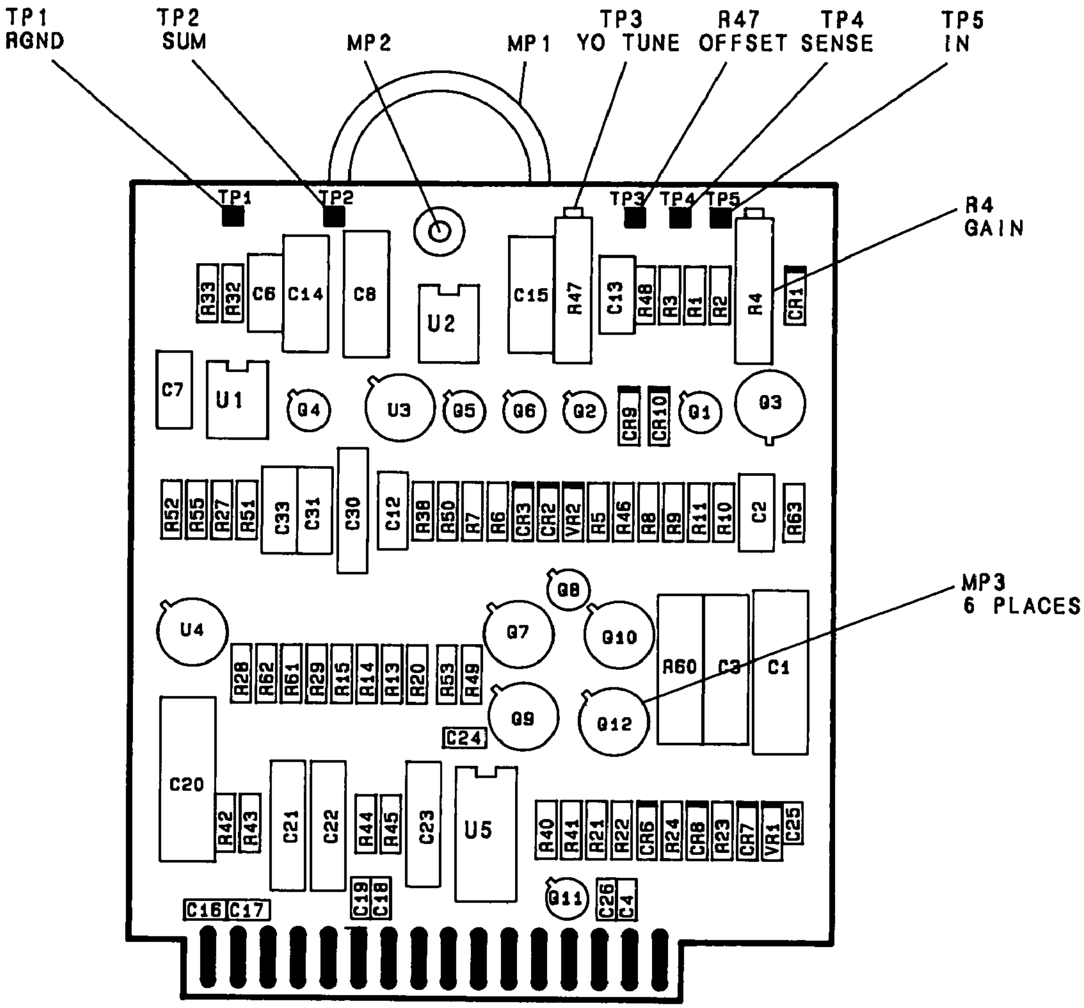


Figure 8D-15. A55 YO Driver, Component Location Diagram

A55 YO Driver P1 Pin I/O

Pin	Mnemonic	Levels	Source	Destination
1	+20V	+20V	XA52P1-16, 40	*G
16	+20V	+20V	XA52P1-16, 40	*G
2	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*G
17	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*G
3	−40V/−40V SENSE (−)	−40V	XA53P1-11, 30/XA53P1-23	*G/NOT USED
18	−40V/−40V SENSE (−)	−40V	XA53P1-11, 30/XA53P1-23	*G/NOT USED
4	−10V	−10V	XA53P1-12, 13, 31, 32	*G
19	−10V	−10V	XA53P1-12, 13, 31, 32	*G
5	GND	0V	A62 STAR GND	*G
20	GND	0V	A62 STAR GND	*G
6	GND	0V	A62 STAR GND	*G
21	GND	0V	A62 STAR GND	*G
7	LYSP	TTL (LOW TRUE)	XA59P1-11	C D
22	HSP	TTL (HIGH TRUE)	XA57P1-13	*C
8	PRETUNE	−25V/GHZ, 0V = 2.3 GHZ	XA54P1-24	*A
23	PRETUNE	−25V/GHZ, 0V = 2.3 GHZ	XA54P1-24	*A
9	VCOMP	−26 MHZ/VOLT	XA54P1-27	F
24	YO TUNE	0V ± 6 V	E	A62J6-SMC CENTER
10	RGND	0V	STAR GND POINT	*H
25	RGND	0V	STAR GND POINT	*H
11	RGND	0V	STAR GND POINT	*H
26	RGND	0V	STAR GND POINT	*H
12	SR FBK	−5V TO −17V	A	A62J29-2
27	SR FBK	−5V TO −17V	A	A62J29-2
13	SR PWR	−5V TO −17V	B	A62J29-3
28	SR PWR	−5V TO −17V	B	A62J29-3
14	HCEN	TTL (HIGH TRUE)	XA59P1-67	XA55P1-14
29	YOXISTB	−30V TO −39V	B	A62J29 PIN 4
15	YO COIL +	−40V TO −20V	B	*
30	YO COIL +	−40V TO −20V	B	*

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

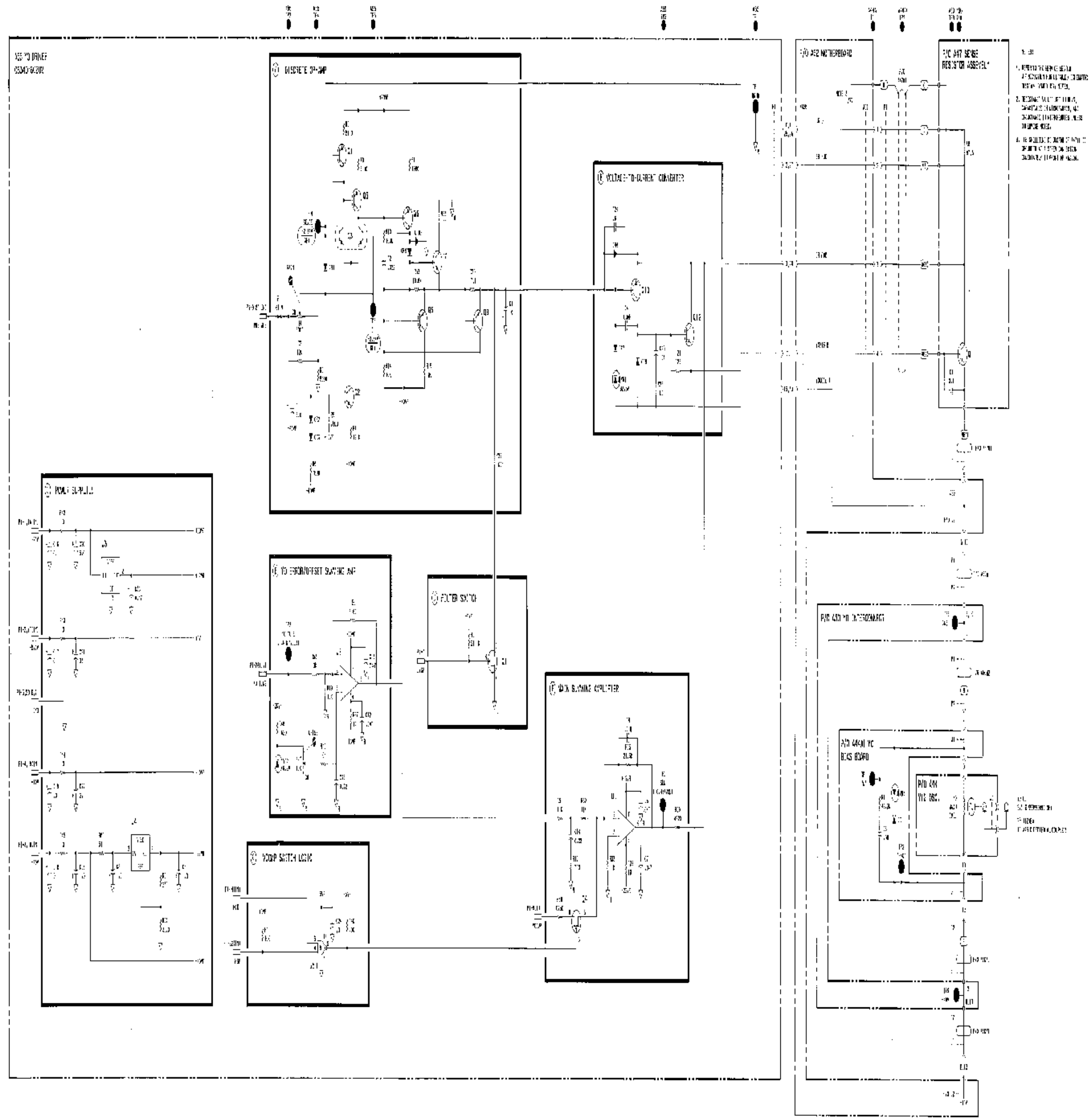


Figure 8D-16. A55 YO Driver, Schematic Diagram

A58 SWEEP GENERATOR

INTRODUCTION

The major function of the A58 Sweep Generator board is to generate three voltage ramps: VSWP (TP10), MKR RMP (TP4), and 20-30 SWP (TP8). VSWP is the ramp voltage that will sweep the YO over the frequency range of interest. When the 8340A is set for a sweep width of greater than or equal to 500 KHz and the entire sweep is contained on one band, the A54 YO Pretune board generates the voltage that tunes the YO to the start frequency of the sweep. VSWP is then summed into the PRETUNE voltage. (VSWP is zero volts at the beginning of the sweep.) Next the 8340A acquires phase-lock at the start frequency. When the sweep is initiated, the YO error voltage (YO TUNE) is sampled and held by the A49 YO Loop Phase Detector, and it remains constant for the duration of the sweep. Finally the loop is opened, and VSWP is allowed to ramp up and sweep the YO from the start frequency to the stop frequency. Thus the PRETUNE voltage always corresponds to the YO frequency. This type of sweep scheme is called lock and roll.

When the sweep is contained in two or more multiply bands, the 8340A re-phase-locks the YO and VSWP resets to zero at each bandcrossing. Thus, in the multi-band case, VSWP provides the voltage to sweep the YO from the last phase-lock frequency (start frequency or last bandcross frequency) to the stop frequency or the next bandcross frequency, whichever the case may be.

VSWP has a sensitivity of +2 Volts/GHz of YO frequency. The distinction between YO frequency and instrument frequency is important because the instrument frequency is not necessarily the same as the YO frequency. In the 10 MHz to 2.5 GHz band (Band 0), the YO output is heterodyned with a 3.7 GHz oscillator. Consequently, the YO frequency in this case is 3.7 GHz higher than the instrument frequency.

In the higher bands (SYTM multiply bands 1 through 4), the instrument frequency is derived from the first, second, third, or fourth multiple of the YO frequency as shown in Table 8D-3 below.

Table 8D-3. Instrument Frequency vs. YO Frequency

Band	Instrument Frequency	YO Frequency
Heterodyne 0	0.01 to 2.5 GHz	3.71 to 6.2 GHz
Multiply 1	2.3 to 7.0 GHz*	2.3 to 7.0 GHz
Multiply 2	7.0 to 13.5 GHz	3.5 to 6.75 GHz
Multiply 3	13.5 to 20.0 GHz	4.5 to 6.67 GHz
Multiply 4	20.0 to 26.5 GHz	5.0 to 6.625 GHz

* Refer to Section I, Figure 1 in Table 1-1, Specifications, for specific bandcross information versus swept mode used.

It is because of this harmonic operation of the 8340A that bandcrossings are necessary. At each crossing, VSWP resets to zero and the YO is phase-locked to the appropriate frequency for the start of the next band. The result is that in a multi-band sweep the Marker Ramp is a monotonic ramp which pauses for bandcrossings, and VSWP is a series of ramps each starting at zero volts. The slope of any particular ramp depends upon the YO harmonic being used in that band. Figure 8D-17 shows the basic characteristics of the Marker Ramp and VSWP for a full-band, 10 MHz to 26.5 GHz sweep.

The MKR RMP is a 0 to +10 Volt ramp that is used as the reference for all sweep events. It is related to the Sweep Out, but since there is other circuitry between the Ramp Generator (Block **K**) and Sweep Out, the Ramp Generator output is called Marker Ramp. On the A58 Sweep Generator board, the Marker Ramp is fed through the Summing Amplifier (Block **L**) and Sweep Width DAC (Block **M**) to give the 20-30 SWP ramp that sweeps the 20-30 Loop for narrow instrument sweeps (YO sweep width less than 5 MHz). This voltage is then run through the Sweep Width Range Attenuator (Block **N**) to give VSWP. In addition, the Marker Ramp goes to the A57 Marker/Bandcross board where it is buffered and sent to the SWEEP OUT (X-axis) ports on the front and rear panels. Finally, the A57 Marker/Bandcross board uses the Marker Ramp to determine when all sweep events (markers, bandcrossings and ends of sweeps) are to occur.

As mentioned before, the Marker Ramp is always a 0 to +10 volt ramp. In a single band sweep, the voltage goes linearly from 0 to +10 volts in the selected sweep time. In a multi-band sweep, the voltage is a segmented ramp where the linear ramp portions correspond to the particular bands being swept and the flat portions correspond to the time necessary to re-phase-lock the instrument for the next band to be swept. In the multi-band case the sum of the times for the various linear ramp portions will equal the selected instrument sweep time. That is to say, the sweep time of the instrument is the time during which the instrument is actually sweeping and does not include the re-phase-lock time at each bandcrossing. Figure 8D-18 shows a "typical" Marker Ramp in the single and multi-band cases.

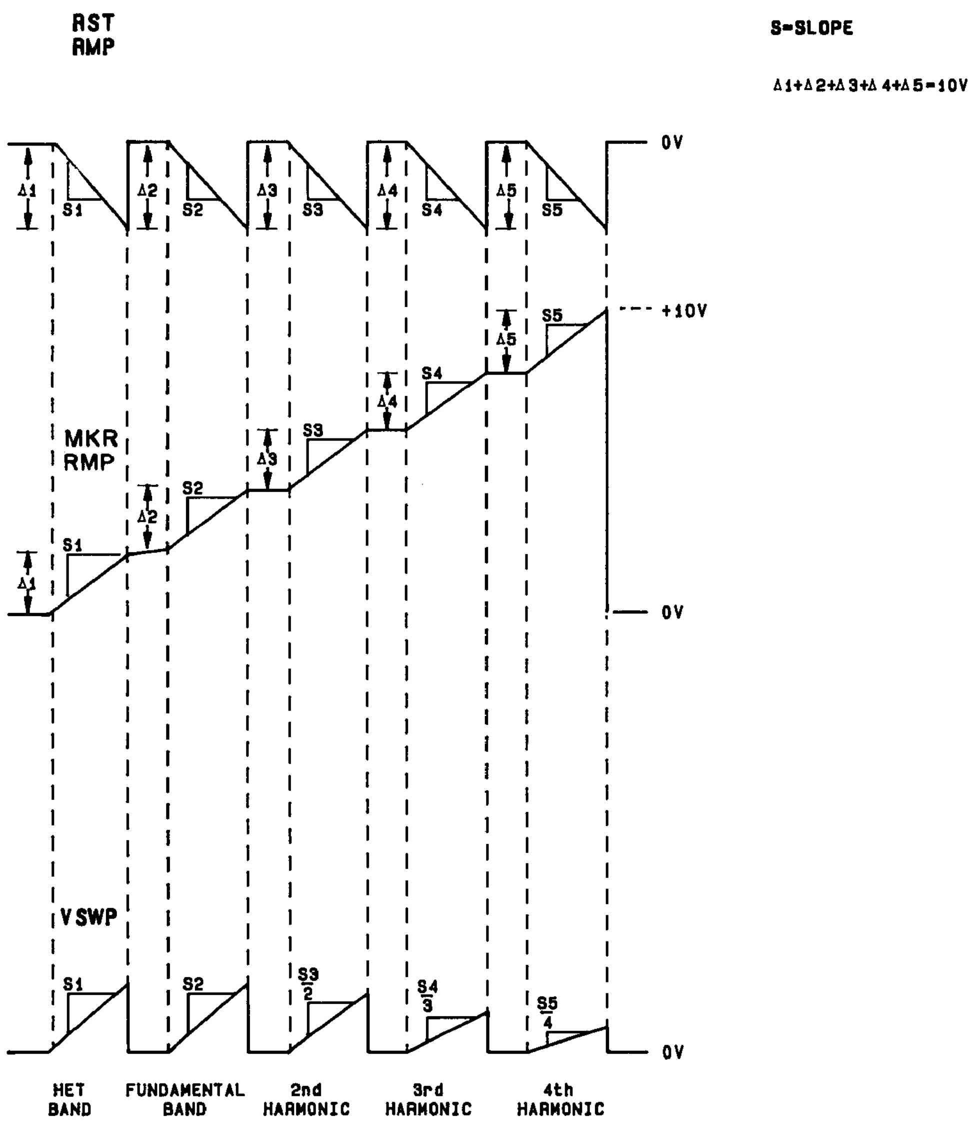


Figure 8D-17. Marker Ramp and VSWP Waveforms

A58 SWEEP GENERATOR CIRCUIT DESCRIPTION

Sweep Time Register A

U20 and U22 latch digital information from the instrument Data Bus which is then sent to the Sweep Time DAC (Block **G**). The strobe for these two latches is 1,Rl:, WSPTM (Write Sweep Time). Resistors in U19 and U21 back bias the output stages of the latches when they are HIGH. This helps keep bus noise from feeding through to the DAC. U23 is a latched 3-to-8 decoder that latches the information for the Sweep Time Switch drivers. U23 is latched using the same strobe as U20 and U22.

Reset Register B

U25 and U27 latch information from the instrument Data Bus and direct it to the Reset DAC, U5. The latch strobe is WRDAC (Write Reset DAC 1,R2:). U24 and U26 contain pull-up resistors to back bias the outputs of U25 and U27 when the outputs are HIGH. This keeps noise on the bus from getting to the Reset DAC (Block **C**).

Reset DAC C

This is a current output DAC. It is referenced to the -7V Voltage Reference (Block **D**), and its output goes to the Summing Amplifier (Block **L**). R1, R19 and R20 set the gain of the DAC. C19 provides DAC compensation.

This block can be checked out by setting the instrument to any single band sweep and stopping it at the end of the sweep by using the "SHIFT XTAL" function. This will stop the Marker Ramp at +10 volts. Now, by writing to the Reset DAC (Block **C**) the voltage at the RST RMP test point (TP2) can be changed. If zero is written to the DAC, the voltage at TP2 should be +10 volts. If 1023 is written to the DAC, the voltage at TP2 should be zero. Refer to Direct I/O Addressing in Section VIII, "Service", for the front panel programming information.

Voltage Reference D

The reference voltage is derived from VR1, a low noise, low TC, reference diode. R3 maintains a constant current through the diode, and R18 together with C1 give noise filtering. Operational amplifier U15 buffers and provides the gain necessary to make the reference voltage nominally -7V. R2 and R17 set the gain of U15.

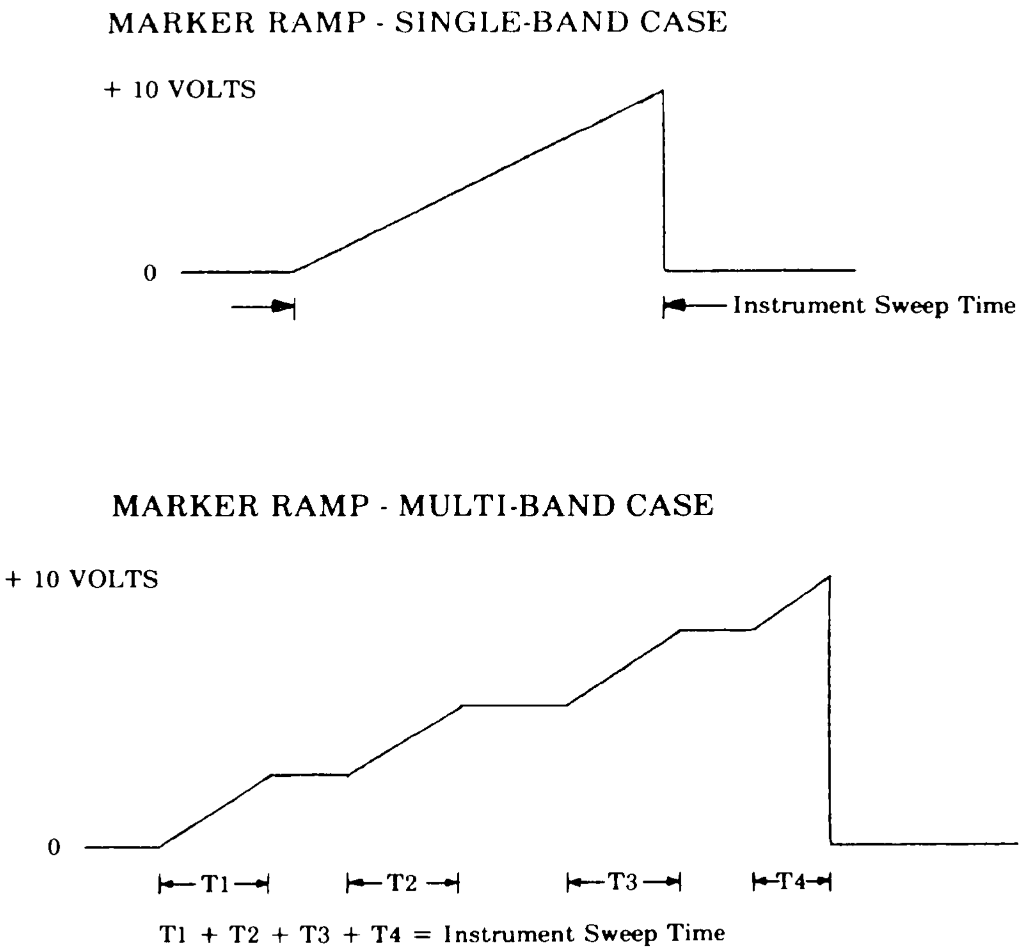


Figure 8D-18. Typical Marker Ramp Waveforms

Sweep Width Register E

U34 is a latched 3 to 8 decoder which latches information from the instrument Data Bus and feeds it to the Sweep Width Range Switch Driver (Block **F**). A given line is selected when it is a TTL LOW.

U29 and U31 latch the information for the Sweep Width DAC (Block **M**). The strobe for the entire Sweep Width Register is 1,R0:, WSPAT (Write SweeP ATtenuator). U28 and U30 reverse bias any HIGH output stages in U29 and U31 to keep bus noise from getting into the Sweep Width DAC.

Sweep Width Range Switch Driver F

U35 and U37 are open collector comparators that convert the digital information from the Sweep Width Register (Block **E**) to voltages that will drive the switches in the Sweep Width Range Attenuator (Block **N**). The outputs of these comparators are pulled up by U36 to a voltage equal to VSWP. This ensures that the switch drivers can turn on the switches (in the SWP Width Range Attenuator, Block **N**) for every value of VSWP.

Sweep Time DAC G

U2 and U1 take the digital input from the Sweep Time Register (Block **A**) and convert it to the appropriate voltage. R39 provides a fixed trim for the gain of U2. C22 is for op-amp stablization.

The voltage at TP1 should be +10 volts when all the input bits to U2 are HIGH. This will occur whenever the selected sweep time is at the low end of a particular decade range (i.e., 10 msec, 100 msec, 1 sec, 10 sec or 100 sec). As the sweep time is increased the voltage at TP1 will decrease until it is +1 volt at the top end of the particular decade range of sweep time.

Sweep Time Switch Drivers H

The Sweep Time Switch Drivers take the digital input from the Sweep Time Register (Block **A**) and convert it to a voltage that drives switches Q1 through Q4. U3 serves to pull up the open-collector outputs of U4.

When an output of U4 is at ground, the FET that it is connected to will be turned on. When the output is at -10 volts, the FET will be off.

Sweep Scaling Resistors I

The Sweep Time DAC (Block **G**) and the Sweep Time Scaling Resistors (Block **I**) function together as a current source that produces a current proportional to the selected sweep time. The higher the current, the shorter the sweep time. The Sweep Time DAC (Block **G**) produces a voltage which is applied to the Sweep Time Scaling Resistors (Block **I**). Since the output of the Sweep Time Scaling Resistor block is held at ground, the voltage from the DAC is converted to a current which then goes through the Virtual Ground Amplifier (Block **J**) and then into C30. In deriving the current, which corresponds to the selected sweep time, the Sweep Time Scaling Resistors (Block **I**) select the appropriate decade range, and the Sweep Time DAC (Block **G**) does the interpolation within the range.

Virtual Ground Amplifier J

Figure 8D-19 is a simplified schematic of the Ramp Generator (Block **K**). The input to the Ramp Generator is a current source formed by the Sweep Time DAC (Block **G**), the Sweep Time Scaling Resistors (Block **I**), and the Virtual Ground Amplifier (Block **J**). Since the non-inverting input of U8 is connected to ground, the op-amp will keep its inverting input at ground also. That is, it will create a virtual ground at the Virtual Ground test point (VGND, TP3). It does this by varying the voltage at the gate of Q5. This varies the resistance of that FET and therefore varies the voltage drop across it. The voltage across C30 (Ramp Generator, Block **K**) is always negative, and the conventional current flow is always into the source and out of the drain of Q5.

CR2 and CR3 are low leakage diodes used for current steering.

Ramp Generator K

The Marker ramp signal is generated by feeding a constant current into C30. The voltage across the capacitor is buffered and offset to produce the 0 to +10 volt Marker Ramp. Figure 8D-19 is a simplified schematic showing the ramp generating scheme. These ramp generating circuits operate in one of three distinct states or modes, depending upon the positions of S1 and S2. Since the current source formed by the Sweep Time Scaling Resistors (Block **I**) and the Sweep Time DAC (Block **G**) is always on, the positions of S1 and S2 determine where the current will go.

The first mode is the sweep mode. In this case both S1 and S2 are open, and the current flows into C30. The second mode is the pause or hold mode. Here S1 is open and S2 is closed. This turns on the Current Shunt and diverts the current through through CR3, a current steering diode. The third mode is the reset mode. Here S1 is closed and S2 is open, and the current through CR2 is diverted by switch S1 into the output of U14.

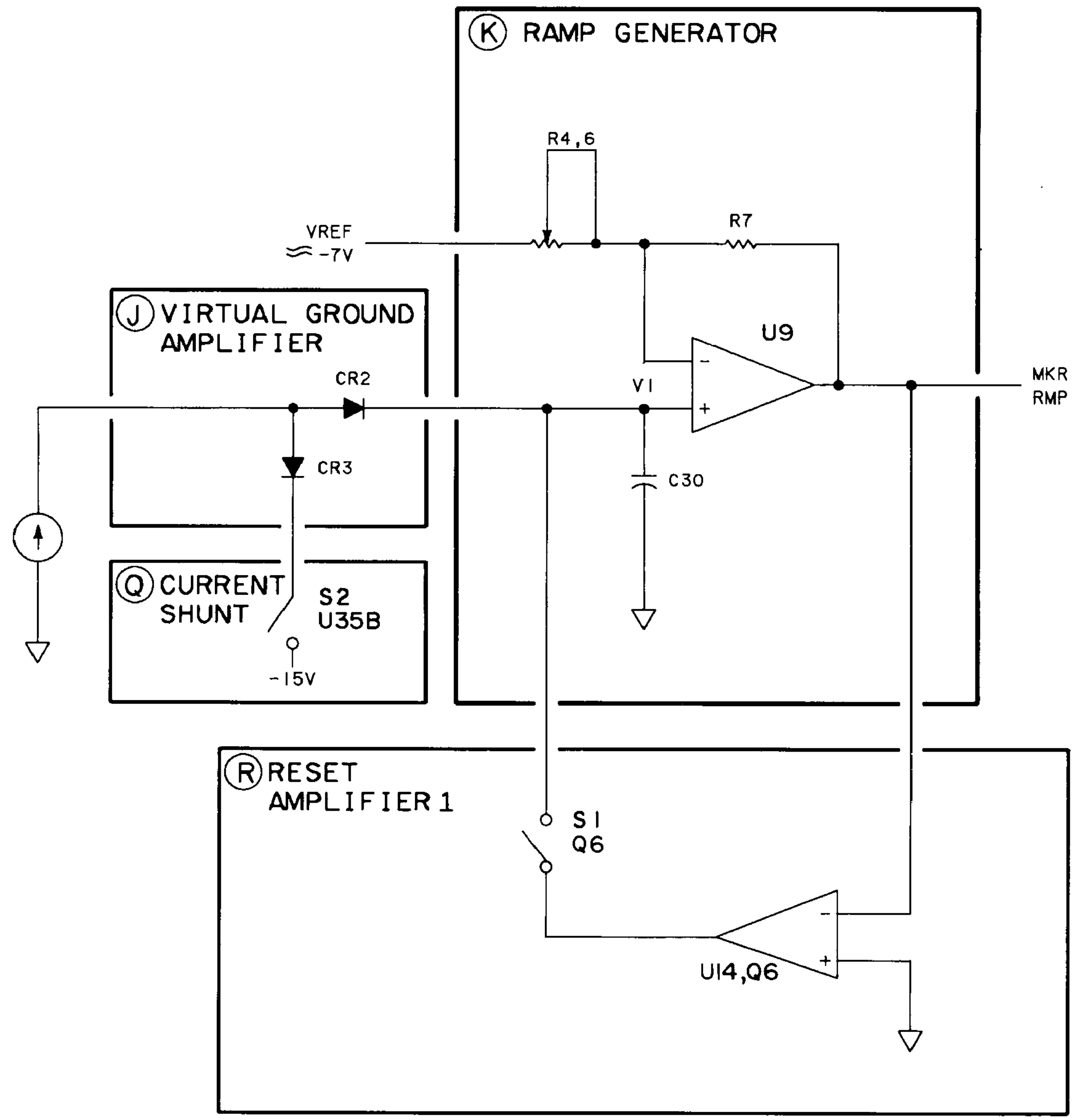


Figure 8D-19. Simplified Ramp Generator

When the sweep is reset, switch S1 (Q6) in Reset Amplifier 1 (Block **R**) is closed. Since the non-inverting input of U14 is grounded, it forces the inverting input to be at ground also. To accomplish this, U14 will discharge C30 to its reset voltage and divert the current from the current source away from C30 (once it is reset) so that the voltage across C30 does not change. The voltage across C30, after the ramp has been reset, is dependent upon the gain from the non-inverting input to the output of U9, and upon the gain from the VREF input to the output of U9.

Since the output of U9 is held at zero by the loop, it is possible to write an equation which describes the voltage at the output of U9 as a function of VREF and the voltage across C30, V1. One can then solve for V1.

$$0 = V1[1+(4640/1620)] - VREF(4640/1620)$$

$$V1 = VREF \times 0.74$$

VREF = approx. -7 volts; therefore, V1 = approx. -5.18 volts.

This assumes that potentiometer R4 is set to zero Ohms. V1 will vary with VREF.

A sweep is initiated by opening switch S1 (Q6) in the Reset Amplifier 1 (Block **R**). The output of the current source is now directed into C30. This constant current into a constant capacitance gives rise to a voltage across C30 that increases linearly. The output of the Ramp Generator (Block **K**), MKR RMP, will increase linearly from 0 to +10 volts where the sweep will be stopped. At this point, the voltage across C30 will have increased, become less negative, to a value that is dependent upon the gain from C30 to the output of U9. This gain is 1+(4640/1620) = 3.864. So when Marker Ramp increases by 10 volts, the voltage across C30 will increase by 10/3.864 = 2.56 volts. Thus at the end of any sweep, the voltage across C30 will be approximately -5.18 + 2.56 = -2.62 volts.

The foregoing discussion of Marker Ramp has been for the single band case. During a multi-band sweep the ramp must pause at each bandcrossing while the instrument phase-locks for the next band. To do this, the Current Shunt (Block **Q**) is turned on and U35B diverts the output of the current source away from C30. CR2 keeps the Current Shunt (Block **Q**) from discharging C30. Since current is no longer going into C30, the voltage across it will simply stay constant at the value that was present when the Current Shunt was turned on. When the bandcrossing is finished, the Current Shunt (Block **Q**) is turned off and the Ramp Generator

(Block **K**) continues to sweep up to +10V. This pause in the ramp will occur once at each bandcrossing. CR3 keeps U35B from sourcing current through CR2 and into C30.

Because any stray current flowing into C30 will cause an error, a guard trace surrounds the entire node comprised of C30, pin 3 of U9, the cathode of CR2, and the source of Q6. To keep the voltage on the guard trace always at the same potential as the node that it protects, the voltage at the inverting input of U9 is buffered by U10B and applied to the guard trace.

R4 is the SWEEP TIME adjustment. It varies the gain from C30 to the output of U9. This varies the slope of Marker Ramp. Since Marker Ramp is always at +10 volts at the end of a sweep, varying the slope of the ramp will vary the time that it takes to complete the sweep (i.e., it will vary the sweep time).

Summing Amplifier L

During single band sweeps the output of the summing amplifier is a 0 to -10V ramp. During multi-band sweeps, however, Marker Ramp will pause at each bandcrossing. At this time VSWP resets to zero for the next phase-lock point. This resetting is accomplished by summing the output of the Reset DAC (Block **C**), the Ramp Generator (Block **k**), and the Reset Amplifier 2 (Block **T**) via the Summing Amplifier (Block **L**). At any particular lock point the instrument processor knows what value the Marker Ramp voltage should be. The processor then programs the Reset DAC (Block **C**) to sink a current that is subtracted from the current generated by Marker Ramp, R8, and R9. This drives the output of U6 toward zero. Since the Reset DAC has finite resolution, it is also necessary to provide analog circuitry to bring the output of U6 to exactly 0 volts. Reset Amplifier 2 (Block **T**) generates an error voltage from the output of the Summing Amplifier (Block **L**) which, when applied to the Summing Amplifier, will force that output to zero. R13, SWP GAIN, varies the gain of U6 slightly to adjust for any gain error in the path from MKR RMP to VSWP.

Refer to Figure 8D-17, MKR RMP, RST RMP, and VSWP Waveforms. The output of the Summing Amplifier (Block **L**) is a series of voltage ramps, each ramp corresponding to one of the bands being swept. During single band sweeps the output of the summing amp will be a single 0 to -10V ramp. During multi-band sweeps the output duplicates the slope and delta-voltage of Marker Ramp, but is inverted and resets to 0V at each bandcrossing. When the first bandcrossing occurs, MKR RMP signal pauses and the output of the summing amplifier increases to 0V. When the MKR RMP signal resumes, the summing amp output matches the slope and delta-amplitude of Marker Ramp from this bandcrossing point to the next. This process repeats until the end of sweep. If the voltage change of each summing amplifier ramp is added together, the total will equal 10 volts, regardless of the number of ramps during one sweep.

Sweep Width DAC M

The Sweep Width DAC performs two functions. First, it attenuates its input by a factor of 1, 2, 3 or 4 depending upon which harmonic is being swept. Secondly, it attenuates its input to give the appropriate sweep width. The actual sweep width is determined jointly by the Sweep Width DAC and the Sweep Width Range Attenuator (Block **N**). The Sweep Width Range Attenuator (Block **N**) selects the correct decade range, and the Sweep Width DAC then interpolates within that selected range. The two Sweep Width DAC attenuation factors are multiplied together by the instrument processor, and the result is applied to the digital input of the Sweep Width DAC.

CR5 protects U11, which is a CMOS device, in the event that the +5 volt supply comes up before the +15 volt supply. CR7 protects CR5 in the event that the +15 volt supply is shorted to ground. CR6 protects the output of U11 by keeping it from going much below ground. C39 is a compensation capacitor.

To check out this DAC, use the "SHIFT, XTAL" function in a single band sweep to stop the sweep with Marker Ramp at +10 volts. The voltage at TP2 (RST RMP in Summing Amplifier, Block **L**) should also be at +10 volts. Now the Sweep Width DAC can be programmed directly and the output voltage at TP8 (20-30 SWP in Sweep Width DAC Block **M**) observed. A digital input of zero should give zero volts out, and an input of 4096 should give +10 volts out.

Sweep Width Range Attenuator N

R58, R59, R61, and R62 form a decade voltage divider stack. The voltage at each node is a factor of 10 smaller than the voltage at the node above it. This particular arrangement was used so that the impedance at each node is low and approximately equal. This was necessary in order to reduce the susceptibility to radiated noise. Q8, Q10, or Q12 is turned on to select the appropriate node. U17 is a unity gain buffer which drives the VSWP line.

In instrument sweeps of greater than 5 GHz, a gain of six is necessary in this block. To accomplish this, Q7 is turned on and the output of U16 is fed to the buffer.

Only one of the FET switches in this block should be on at any given time. VSWP is fed back to U36 in Sweep Width Range Switch Driver (Block **F**) and becomes the supply voltage for the range switch pull-up resistors. When a FET is on, the voltage at its gate should be equal to VSWP. When the FET is off, the gate voltage should be approximately -15 volts.

In sweep widths where the YO would be sweeping less than 5 MHz, the 20-30 Loop is swept and the YO loop stays phase-locked. This scheme gives better noise performance for narrow sweeps. However, for the first range of sweep widths where the YO sweep width is between 500 kHz and 5MHz, the PRETUNE voltage is also swept. Since the SYTM also uses the PRETUNE voltage, this improves the YO/SYTM tracking. In this case Q9 is turned on.

For sweeps narrower than 500 kHz, tracking is not a problem (the SYTM bandwidth is about 25 MHz), and only the 20-30 Loop is swept.

It is important to note that the sweep mode used, 20-30 Loop sweep, or PRETUNE sweep, depends not on the actual instrument sweep width but the YO sweep width. For instance, if the instrument is set to sweep from 20 GHz to 24 GHz, the instrument sweep width is 4 GHz but the YO sweep width is 1 GHz. This is because the fourth harmonic of the YO is being used.

For YO sweep widths less than 500 kHz, in MANUAL or CW modes, VSWP is turned off. This is done by turning on Q11 which grounds the input of the buffer U17. This keeps any noise from the Sweep Generator from getting to the Pretune DAC and degrading the phase noise performance.

Sweep Buffer O

U18 simply inverts VSWP. This output (BVSWP) is used on the A27 Level Control board ADC to measure VSWP when trouble-shooting the sweep circuitry.

Sweep Control Logic P

The Sweep Control Logic takes HSP (High Sweep), LRSP (Low Reset Sweep), and LBX (Low Bandcross) and generates control signals to drive the front panel sweep LED (LSPLD Low Sweep LED), Reset Amplifier 1 (Block **R**), the Current Shunt, and the Reset Control Logic.

The Sweep Control Logic timing diagram, Figure 8D-20, shows what happens at the end of sweep and at bandcrossings. The arrows and numbers indicate the sequence of events as well as the cause and effect relationship of various transitions.

When Marker Ramp gets to +10 volts, indicating the end of a sweep, LBX (Low Bandcross, TP6) goes LOW. This interrupts the instrument processor which pulls down HSP (High SweeP) on the A57 Marker Bandcross board. HSP going LOW causes the LOW ENABLE RESET AMP 2 line to go LOW. This in turn forces LHLD (Low Hold Sweep, TP12) LOW, turning on the Current Shunt (Block **Q**). Finally LSPLD (Low Sweep LED U32A pin 3) goes HIGH, turning off the front panel sweep LED.

At the appropriate time the instrument processor asserts LRSP (Low Reset Sweep, TP11) which causes LRESET (Low Reset, TP13) to go LOW. This allows Reset Amplifier 1 (Block **R**) to pull the output of U9 to ground. LRESET going LOW causes LHLD to go HIGH, turning off the Current Shunt.

During the re-phase-lock sequence, the instrument processor releases LBX and LRSP. These events do not cause any changes on the Sweep Generator board.

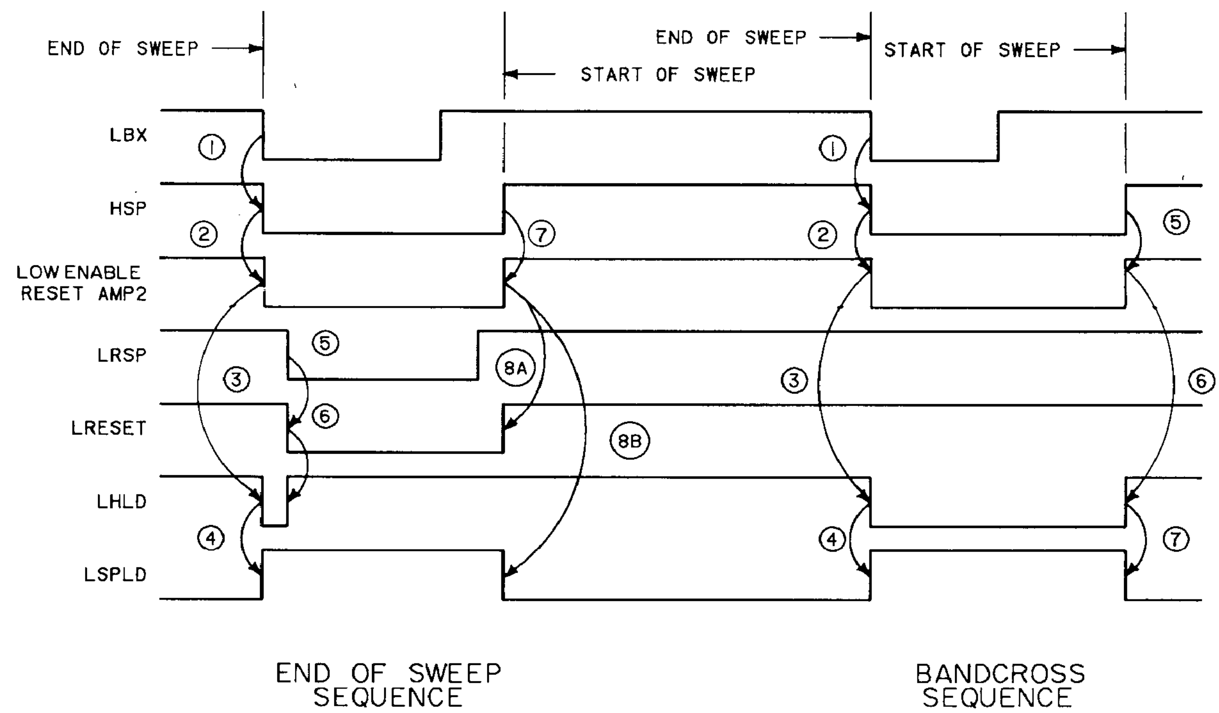


Figure 8D-20. Sweep Control Logic Timing Diagram

When the processor is ready for the next sweep, it lets HSP go HIGH. This causes LOW ENABLE RESET AMP 2 to go LOW. This forces LRESET HIGH and LSPLD LOW, and the sweep proceeds.

At a bandcrossing, the A57 Marker/Bandcross board pulls down LBX, which is coupled to HSP at U33C. This enables LOW ENABLE RESET AMP 2, and LSPLD HIGH and LHLD LOW. This causes the ramp to pause, but since LRSP is not pulled down by the processor, Marker Ramp does not reset. When the new information is written to the Reset Register (Block **B**), its strobe, WRDAC, causes the output of the Reset Control Logic (Block **S**) to go LOW which in turn forces the output of U6 (Block **L**) to ground.

During the re-phase-lock routine, the instrument processor lets LBX go HIGH. Then when it is ready for the next portion of the sweep, it releases HSP. This pulls LOW ENABLE RESET AMP 2 HIGH which ultimately releases the output of U6. It also makes LHLD go HIGH and LSPLD go LOW, and the sweep continues.

U33A and U33D are connected as an R/S flip-flop. As long as only one of its inputs (U33A pin 1, U33D pin 12) is LOW at any given time, its outputs (U33A pin 3, U33D pin 11) will be the opposite TTL level. That is, if one is HIGH, the other will be LOW, and vice versa. It would seem that U32D, which is used as an inverter, could be eliminated by connecting U33A pin 3 to U32D pin 2. However, when the instrument is in the CW or MANAL mode, LBX and HSP are HIGH while LRSP is LOW. This causes both outputs of the flip-flop to be HIGH. Hence the need for U32D.

Current Shunt Q

When the voltage at the non-inverting input of U35B is a TTL logic LOW, <1.4 volts, the output of U35B pulls to -10 volts. This shunts the current coming through Q5, in the Virtual Ground Amplifier (Block **J**), through CR3 and back biases CR2 so that C30 cannot discharge. When the input to U35B is a logic HIGH, its open collector output is pulled to +5 volts by R5. This reverse biases CR3 so that no current is diverted away from C30.

Reset Amplifier 1 R

When the inverting input of U35A, LRESET, is a TTL logic LOW, the output of U35A is pulled to +20 volts by R36. This reverse biases CR1 allowing Q6 to turn on through R34. This closes the reset loop shown in Figure 8D-19. Since the non-inverting input of U14 is connected to ground, the loop forces the inverting input of U14 to also be at ground. This ensures that Marker Ramp is at zero volts at the start of a sweep.

C26, R43 and R44 are loop compensation components.

Reset Control Logic S

At any phase-lock event LOW ENABLE RESET AMP 2 (Block **T**) goes LOW. Then the instrument processor writes to the Reset Register (Block **B**). This LOW-going strobe, WRDAC, comes to the Reset Control Logic (Block **S**) and forces its output to go LOW. This puts U13 in Reset Amplifier 2 (Block **T**) in the sample mode and causes the output of U6 in Summing Amplifier (Block **L**) to be driven to zero. When a sweep is initiated, LOW ENABLE RESET AMP 2 (Block **T**) goes HIGH. This drives the output of U32B HIGH which puts U13 into the hold mode, thereby opening the loop and allowing the output of U6 to start sweeping.

Reset Amplifier 2 T

Since the inverting input of U7 is connected to ground, the reset loop will force the non-inverting input to be at ground also. The error voltage generated by U7 is fed to U13, which is a sample and hold. C31 is the sample and hold capacitor. R83 limits the charging rate of C31 and is required to make U13 stable.

When pin 14 of U13 is LOW, U13 is in the sample mode. This closes the loop and forces the output of U6 (pin 6) in the Summing Amplifier (Block **L**) to be at ground. When pin 14 of U13 goes HIGH, U13 goes into the hold mode and the loop is opened. As the sweep progresses and the output of U6 ramps up, the output of U13 will not change.

There is a guard trace around the node containing the sample and hold capacitor and U13 pin 11. This trace is connected to the output of U13 to keep it at the same potential as the sensitive end of C31.

Oversweep Detector U

When the instrument is operating correctly, the A57 Marker/Bandcross board will stop the sweep when the Marker Ramp gets to +10 volts. However, if that board is not working and the Marker Ramp reaches +12 volts, the OVERSWEEP DETECTOR pulls down the LBX line which stops the sweep and wakes up the processor. This allows the SWEEP GENERATOR to make repetitive sweeps even when the MARKER/BANDCROSS board is not functioning. This makes troubleshooting much easier. It should be noted however, that in the case when the OVERSWEEP DETECTOR is stopping the sweep, no bandcrossings will occur, and the frequency over which the instrument is sweeping will be incorrect.

LBX is an open-collector line that can be pulled down by several boards. Q13 provides the open-collector function on this board and buffers the output of U10A so that by looking at TP5, the HBX test point, one can determine if the SWEEP GENERATOR is the board pulling down on LBX. CR9 is a protection diode for the base-emitter junction of Q13, while R45, R46, and CR4 provide hysteresis for the detector function.

Power Supply Filtering V

The filtering is the standard low pass configuration. The particular L and C components were chosen to have a low-Q self resonance. R48 provides a reference ground for the board in the event that the connection between reference ground and chassis ground on the instrument is broken. Q14 and the associated components create a +15V supply referenced to RGND, This supply is used to provide symetrical ±15V supplies. R49 and R50 divide the +20V supply down to +1.4V to be used as the comparitor threshold for comparitors with TTL inputs. All supplies except +5V and +1.4V are filtered to RGND to prevent digital ground noise from being injected into the analog circuitry via the power supplies.

A58 SWEEP GENERATOR TROUBLESHOOTING

There are two basic failure modes that have to do with the sweep function of the instrument. One, the instrument is simply not sweeping. Two, it is sweeping, but the sweep is incorrect; the frequency limits of the sweep are wrong and/or bandcrossings are not occurring. The first task is to get the instrument to do repetitive sweeps of any kind.

If the Marker Ramp is sweeping and the front panel green LED is blinking, then the instrument is considered to be sweeping even though the output frequency may not be moving. If on the other hand Marker Ramp is stuck and the front panel sweep LED is continuously on or off, then the instrument is considered not to be sweeping. When looking at the LED, care must be taken because in fast sweeps it may appear to be on all the time, even though it is actually blinking.

No Sweep

Set the instrument to sweep continuously from 3 GHz to 7 GHz with a sweep time of 10 msec. Check the voltage at the SWP TIME DAC test point, TP1. It should be +9.77 volts. If you now press **[SINGLE]** SWEEP and then vary the sweep time from 10 to 99 msec, the voltage at this test point should go from +9.77 to +0.977 volts. Varations from these voltages by several tenths of a volt will affect the sweep time accuracy but not the board's ability to sweep.

Return to the continuous sweep mode with a sweep time of 10 msec. Look at the VGND test point, TP3. It should be at ground potential. Anything greater than ±50 millivolts indicates a problem.

If VGND is at zero volts but the instrument still is not sweeping, that is, Marker Ramp is not ramping, then check the output of the CURRENT SHUNT (U35B, pin 1). It should be +5 volts. If it is at -10 volts, then the SWEEP CONTROL LOGIC is erroneously turning on the CURRENT SHUNT.

At this point look at the voltage at the MRK RMP test point, TP4. If it is at ground, then the RESET AMPLIFIER 1 loop is probably closed and holding down the Marker Ramp. Check LRESEST, U35A pin 2, to make sure that it is LOW.

Once the Marker Ramp is behaving correctly, the instrument is considered to be sweeping, and if the output of the SWEEP GENERATOR board is not correct then the trouble-shooting proceedure for an incorrect sweep should be followed.

Incorrect Sweep

If the Marker Ramp waveform is correct, but the output of the SWEEP GENERATOR is still incorrect, then the various gain and attenuation stages must be checked. Set the instrument to sweep from 2.3 GHz to 7 GHz with a sweep time of 10 msec. The voltage at the MKR RMP test point, TP4, should be a ramp from 0 to +10 volts with a forward sweep time of 10 msec. Looking at the RST RMP test point, TP2, should show a ramp going from 0 to -10 volts in 10 msec. If this test point is stuck at ground, then check U13 pin 14 in the RESET AMPLIFIER 2 block. It should be a TTL HIGH during the forward sweep of the ramp and LOW the rest of the time.

Next look at the 20-30 SWP test point, TP8. It should be a ramp going from 0 to +9.4 volts. If it is not, then go to the single sweep mode and press the following key sequence: **[SHIFT] [XTAL]** (leveling). Then press the **[SINGLE]** SWEEP key once. This will cause the Marker Ramp to sweep to +10 volts and stop. Now, using Direct I/O, write a 0 to channel 1 sub-channel 0 by pressing this key sequence:

[SHIFT] [GHz] [1] [Hz]

[SHIFT] [MHz] [0] [Hz]

[SHIFT] [KHz] [0] [Hz].

Check the digital input to U11 (pins 4-15), they should all be LOW. TP8 should be at ground.

Now write a 4095 to the same strobe using the following key sequence: **[4] [0] [9] [5] [Hz]**. This should make all the digital inputs to U11 HIGH. The voltage at TP8 should now be the opposite of the voltage at TP2. That is, since TP2 should be at approximately -10 volts, TP8 should be at about +10 volts. By turning the front panel RPG slowly and decreasing the number written to this strobe from 4095 to zero, the voltage at TP8 should go smoothly from +10 volts to ground. Press **[SHIFT] [XTAL]** to return the instrument to the normal operating mode.

Go to the continuous sweep mode and now check to see that the VSWP test point, TP10, is going from 0 to +9.4 volts. If not, then check to see that the gates of Q7-Q12 in the SWEEP WIDTH RANGE ATTENUATOR are at the correct voltage. See the circuit description Block **N** for the appropriate values.

Finally, if the instrument does single band sweeps correctly but does not do multi-band ones, check U5. This can be done by going to the SINGLE SWEEP mode with the instrument set to sweep from 2.3 GHz to 7 GHz with a 10 msec sweep time. Press **[SHIFT] [XTAL]** (leveling) and **[SINGLE]** SWEEP to get the Marker Ramp to stop at +10 volts. While looking at TP2, write 1023 to Reset DAC (U5) as follows:

[SHIFT] [GHz] [1] [Hz]

[SHIFT] [MHz] [2] [Hz]

[SHIFT] [KHz] [1] [0] [2] [3] [Hz]

This should cause the voltage at TP2 to go to zero. By turning the RPG slowly and decreasing the number from 1023 to 0 the voltage at TP2 should decrease smoothly from zero to -10 volts. With zero written to U5, all the digital inputs to U5 should be LOW. With 1023 written, all inputs should be HIGH.

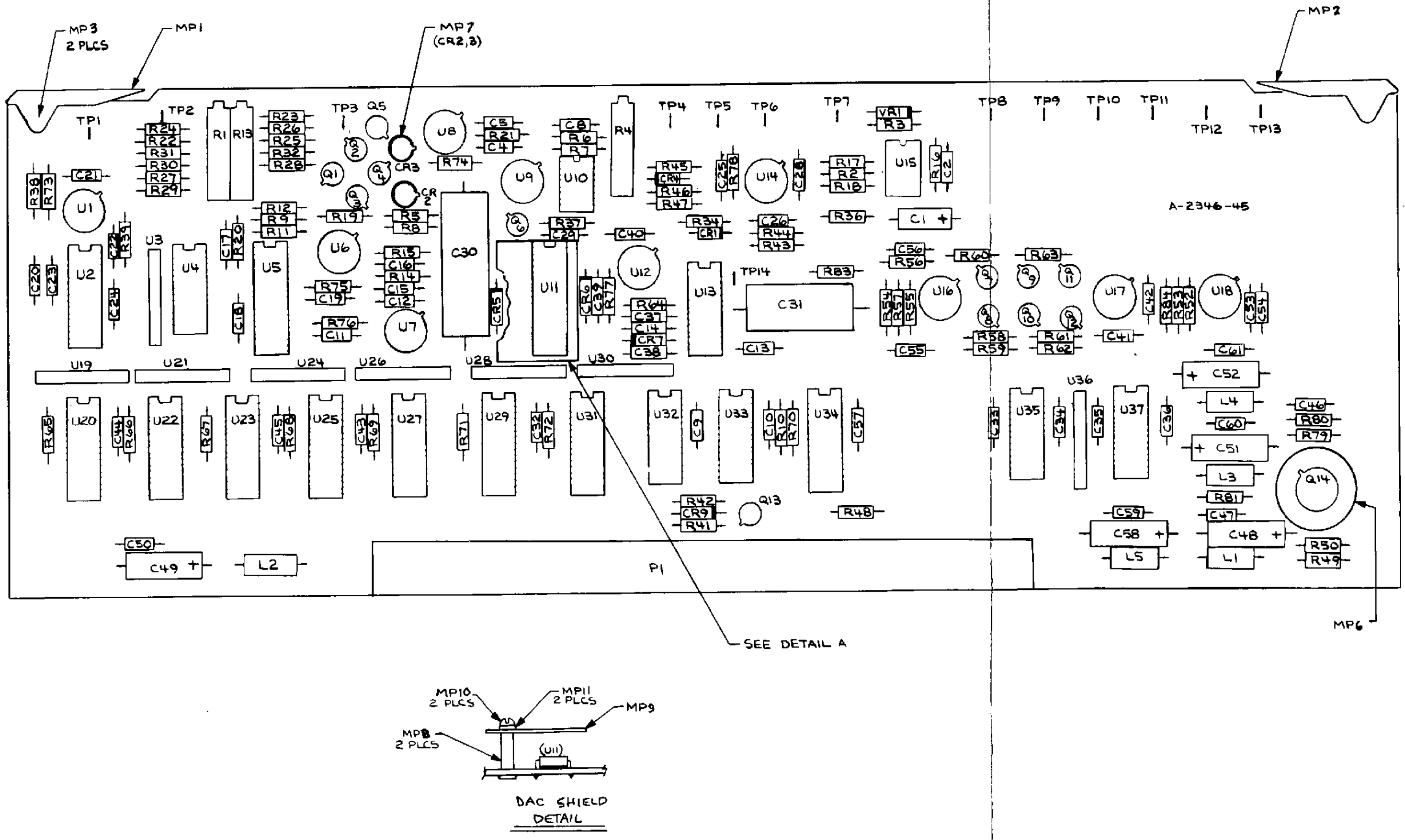


Figure 8D-21. A58 Sweep Generator, Component Location Diagram

A58 Sweep Generator P1 Pin I/O (1 of 3)

Pin	Mnemonic	Levels	Source	Destination
1 56	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*V *V
2 57				
3 58				
4 59				
5 60				
6 61				
7 62				
8 63				
9 64				
10 65				
11 66				
12 67	 LSPLD	 TTL	 P	 A62J1-44
13 68	HSP LVSZ	TTL (HIGH TRUE) TTL (LOW TRUE)	XA57P1-13 E	*P XA54P1-9 F
14 69	LIPS LBX	TTL (LOW TRUE) TTL (LOW TRUE)	* *U	*NOT USED XA59P1-69 P
15 70	SIOA GND PLANE	TTL (LOW TRUE) 0V	XA60P1-15 INSTRUMENT GROUND	*NOT USED *V
16 71	SIOB GND PLANE	TTL (LOW TRUE) 0V	XA60P1-16 INSTRUMENT GROUND	*NOT USED *V
17 72	ADR0 HFILYO	TTL TTL (HIGH TRUE)	XA60P1-17 XA59P1-72	*NOT USED *NOT USED
18 73	ADR2 ADR1	TTL TTL	XA60P1-18 XA60P1-73	*NOT USED *NOT USED
19 74	ADR4 ADR3	TTL TTL	XA60P1-19 XA60P1-74	*NOT USED *NOT USED

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A58 Sweep Generator P1 Pin I/O (2 of 3)

Pin	Mnemonic	Levels	Source	Destination
20 75	DB0 GND PLANE	TTL 0V	XA60P1-20 INSTRUMENT GROUND	*A B E *V
21 76	DB2 DB1	TTL TTL	XA60P1-21 XA60P1-76	*A B E *A B E
22 77	DB4 DB3	TTL TTL	XA60P1-22 XA60P1-77	*A B E *A B E
23 78	DB6 DB5	TTL TTL	XA60P1-23 XA60P1-78	*A B E *A B E
24 79	DB8 DB7	TTL TTL	XA60P1-24 XA60P1-79	*A B E *A B E
25 80	DB10 DB9	TTL TTL	XA60P1-25 XA60P1-80	*A E *A B E
26 81	DB12 DB11	TTL TTL	XA60P1-26 XA60P1-81	*A E *A E
27 82	DB14 DB13	TTL TTL	XA60P1-27 XA60P1-82	*A E *A E
28 83	WSPTM DB15	TTL (LOW TRUE) TTL	XA59P1-28 XA60P1-83	A *NOT USED
29 84	WRDAC WSPAT	TTL (LOW TRUE) TTL (LOW TRUE)	XA59P1-29 XA59P1-84	B S E
30 85	TYOKP LRSP	TTL (LOW TRUE) TTL (LOW TRUE)	XA59P1-100 XA59P1-85	*NOT USED P
31 86				
32 87				
33 88				
34 89	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*V *V
35 90	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*V *V
36 91	+5.2V +12V	+5.2V +12V	XA52P1-17, 18, 41, 42 XA52P1-9, 33	*V *NOT USED
37 92	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*V *V

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A58 Sweep Generator P1 Pin I/O (3 of 3)

Pin	Mnemonic	Levels	Source	Destination
38 93	−15V −5.2V	−15V −5.2V	XA56P1-15, 30 XA53P1-18, 36	*V *NOT USED
39 94	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*V *V
40 95	BVSWP	10V SWEEP	O	XA27P1-31
41 96	20/30 SWP MKR RMP	0V TO +10V 0 TO 10V SWEEP	M K	XA43P1-1 N XA57P1-96 R L
42 97	RGND VSWP	0V 0 TO 10V SWEEP	STAR GND POINT N	*V *F O
43 98	RGND RGND	0V 0V	STAR GND POINT STAR GND POINT	*V *V
44 99	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*V *V
45 100	GND PLANE LCHNG	0V TTL (LOW TRUE)	INSTRUMENT GROUND *	*V *NOT USED
46 101	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*V *V
47 102	HFILYO	TTL (HIGH TRUE)	XA59P1-72	*NOT USED
48 103				
49 104				
50 105				
51 106				
52 107				
53 108	 HXREF	 TTL (HIGH TRUE)	 A62J31-17	 *NOT USED
54 109	LSRQ	TTL (LOW TRUE)	*	*NOT USED
55 110	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*V *V

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

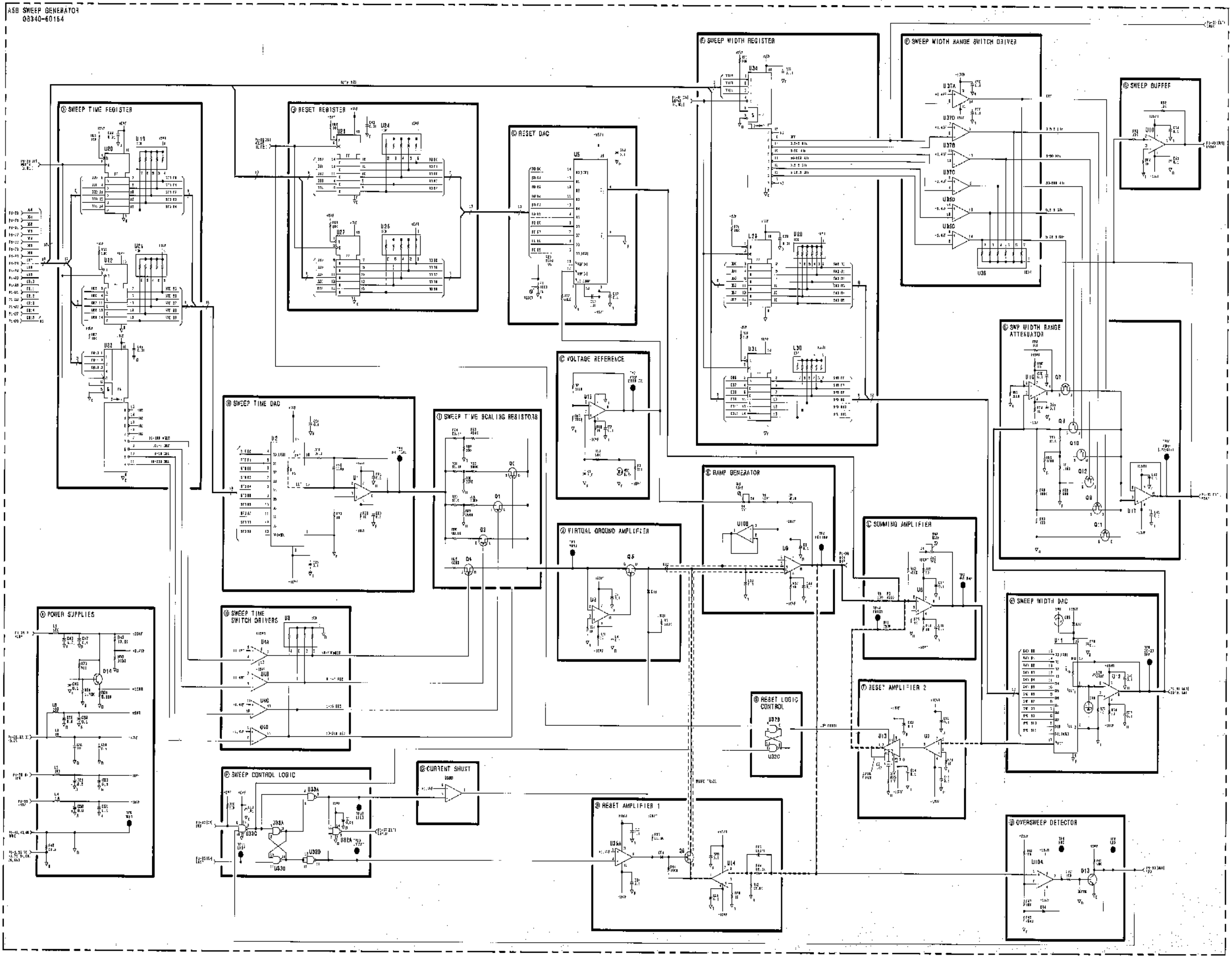


Figure 8D-22. A5 Sweep Generator, Schematic Diagram

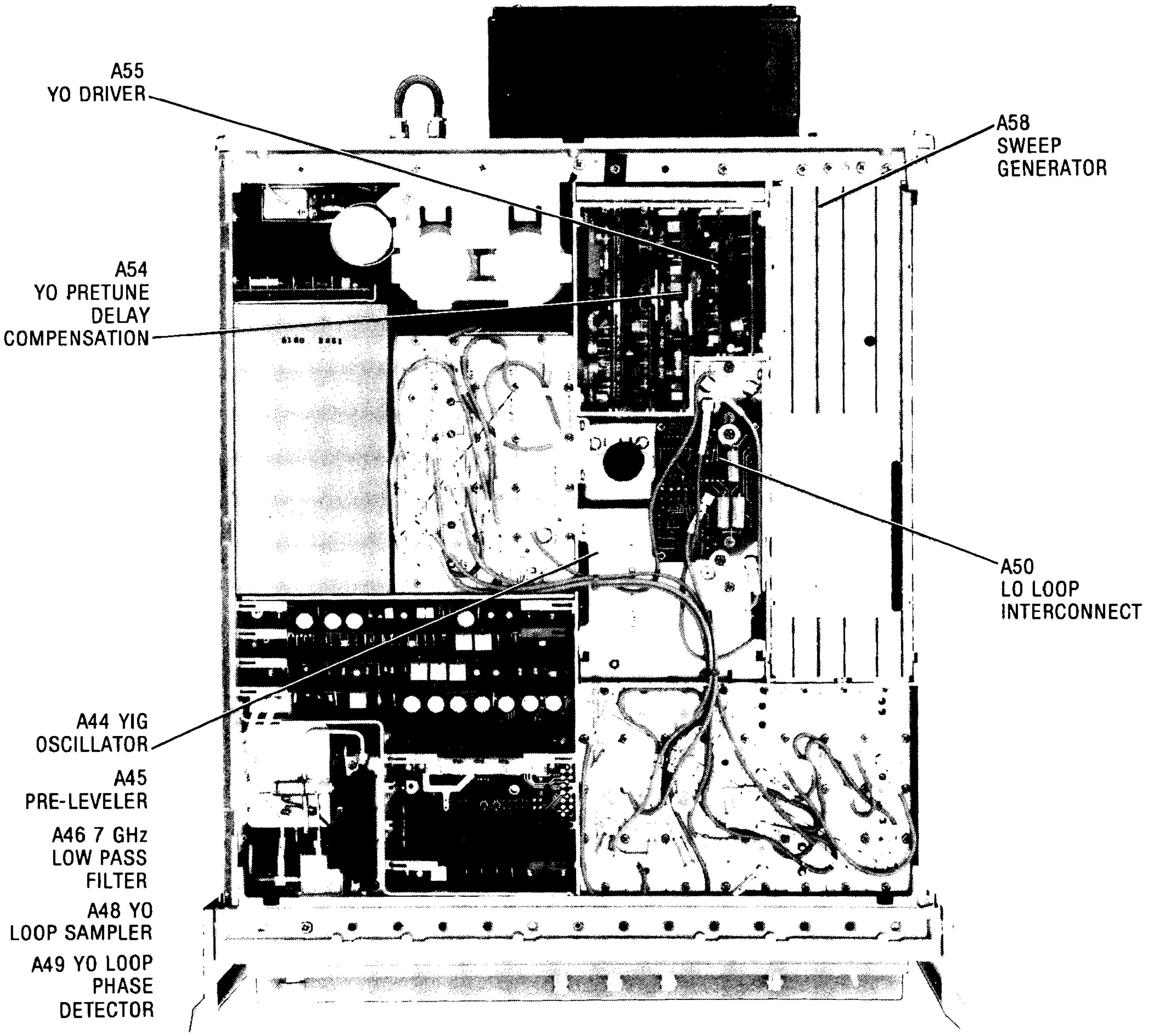
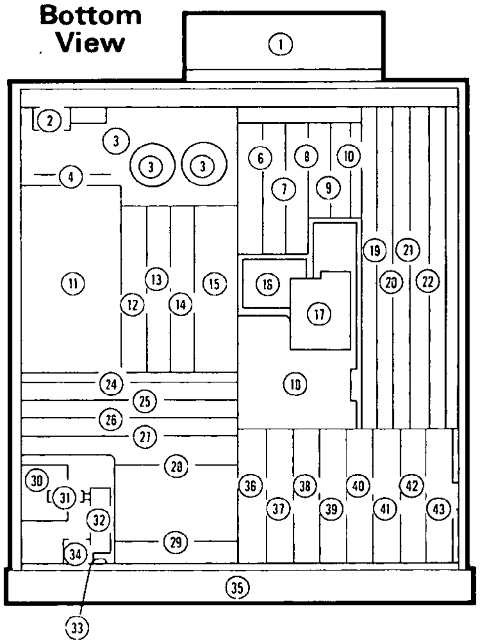


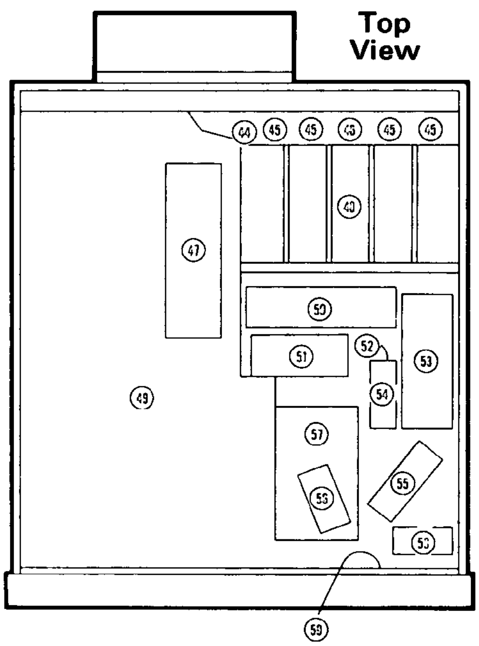
Figure 8D-23. Sweep Generator and YO Loop Major Assemblies Location Diagram

REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



Top View



Assy./Ref. Des.	Description	Location	Ref.-M/N Loops (Volume 3)	20-30 Loops (Volume 3)	Swp. Gen.-YO Loop (Volume 3)	Motherboard (Volume 3)	Controller (Volume 3)	Front/Rear Panel (Volume 3)	RF Section (Volume 4)	Power Supplies (Volume 4)
A1	Alpha Display	[illegible]						●		
A2	Display Driver	33						●		
A3	Display Processor	[illegible]						●		
A4	Not Assigned	[illegible]								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	[illegible]							●	
A10	Directional Coupler	[illegible]							●	
A11	Band 1-4 Detector	[illegible]							●	
A12	Band 0 Splitter/Detector	[illegible]							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	[illegible]							●	
A18	Band 0 Power Amplifier	[illegible]							●	
		[illegible]							●	
A19	Capacitor Assembly	[illegible]								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	[illegible]							●	
A25	ALC Detector	[illegible]							●	
A26	Linear Modulator	[illegible]							●	
A27	Level Control	[illegible]							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	[illegible]	●							
A33	M/N Output	[illegible]	●							
A34	Reference-M/N Motherboard		●							
A35	Rectifier	[illegible]								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	[illegible]		●						
A41	PLL2 Phase Detector	[illegible]		●						
A42	PLL2 Divider	[illegible]		●						
A43	PLL2 Discriminator	[illegible]		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	[illegible]			●					
A49	YO Loop Phase/Detector	[illegible]			●					
A50	YO Loop Interconnect	[illegible]			●					
A51	Reference Oscillator	[illegible]	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	[illegible]								●
A57	Marker/Bandcross	[illegible]					●			
A58	Sweep Generator	[illegible]			●					
A59	Digital Interface						●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator								●	
AT2	15 dB Attenuator				●					
B1	Fan Assembly									●
A62C1-3	Power Supply Filter Capacitors									●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

MOTHERBOARD — WIRING LIST E

Motherboard — Wiring List E

A62 MOTHERBOARD

Introduction

This section consists of the following items:

- A62 Motherboard description.
- Information concerning Motherboard troubleshooting techniques which includes a component location diagram and Motherboard repair and replacement procedures.
- A Motherboard wiring list that identifies signal mnemonics, typical levels, and sources and destinations of signals used on the Motherboard.

List of Assemblies Covered

Several components appear to be routed to the A62 Motherboard but are not actually discussed in detail in this section. Some of these items include the A47 Sense Resistor Assembly, the A51 Reference Oscillator Assembly, various mechanical parts, and certain casting assemblies. Refer to the following to determine which assemblies are covered and which are not covered in this section:

- Reference Guide to Service Documentation located on the front of each Service Section tab.
- The Illustrated Parts Breakdown List at the end of Section VI, Replaceable Parts.
- The A62 Motherboard Component Location Diagram (Figure 8E-2).
- The A62 Motherboard Wiring List (Table 8E-1).

A62 MOTHERBOARD DESCRIPTION

Introduction

The A62 Motherboard is the common board to which numerous other assemblies are connected and serves to route signals to other printed circuit boards where needed.

CAUTION

The A62 Motherboard is large and complex; it contains six trace layers with several hundred seperate signal paths. Read the entire Motherboard Section before attempting any troubleshooting, component replacement, or repairs on the A62 Motherboard or costly damage may result.

Grounds

Several different grounds are employed on the A62 Motherboard:

- **STAR GND** - STAR GND is the single ground reference point for analog circuitry in all major assemblies. Each assembly block is referenced to STAR GND via individual traces; this minimizes ground noise crosstalk between major assemblies. STAR GND is a screw terminal located between the A62XA57 Marker Bandcross and A62J3 connectors and is visible with the instrument top cover removed.

- **GND** - GND is used to designate individual analog ground traces connecting major assembly blocks to STAR GND. Many of these traces are physically large and are used for high current power supply applications.

- **GND PLANE** - Refer to Figure 8E-1, A62 Motherboard Cross Section for the following explanation.

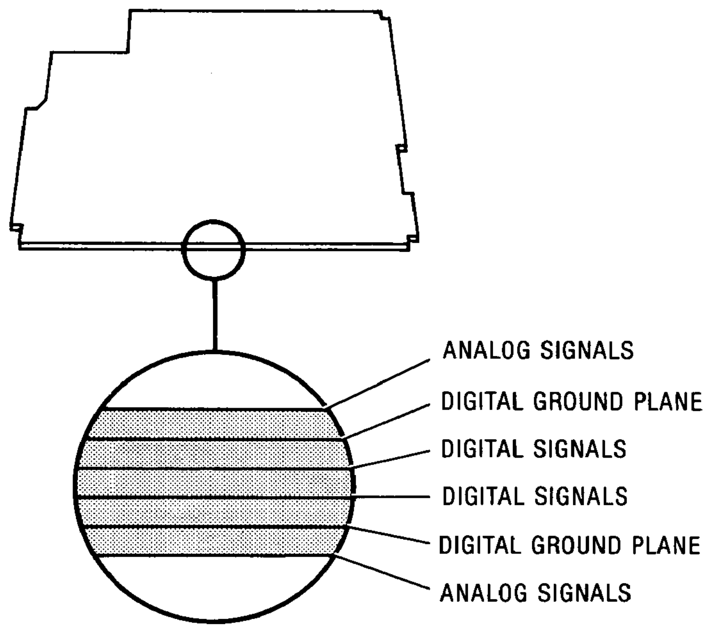


Figure 8E-1. A62 Motherboard Cross Section

As shown in Figure 8E-1, A62 Motherboard Cross Section, the GND PLANE exists between the two innermost and two outermost Motherboard printed circuit layers. These layers were designed to disperse any digital noise into the GND PLANES and act as an electrostatic shield between the digital and analog signal traces. The GND PLANES extend to each edge of the Motherboard and are connected to STAR GND. With this scheme, isolation between analog and digital grounds is maximized and signal crosstalk minimized.

- **REFERENCE GND** - This ground is connected to STAR GND and is used as a low current reference for integrated circuits, cable shields, etc. where a very clean reference is desired.

- **MISCELLANEOUS GROUND PLANES**
  A. The ground plane under the 20/30 Loops' aluminum casting completes a radio frequency interference (RFI) "box" comprised of the casting, assembly covers, and the 20/30 loops' ground plane. This ground plane is connected to STAR GND via a GND trace, and to chassis GND through the aluminum casting.

  B. Under the M/N Loop's aluminum casting is a ground plane which connects to STAR GND and is used as an RFI shield.

- **CHASSIS GND** - All grounds and ground planes are mechanically secured to the 8340A chassis (CHASSIS GND) around the perimeter and at various other places on the A62 Motherboard.

A62 MOTHERBOARD TROUBLESHOOTING

Introduction

Troubleshooting the A62 Motherboard is straightforward since the most common problems encountered are opens and shorts. Table 8E-1, A62 Motherboard Wiring List is included in this manual in lieu of an A62 Motherboard schematic diagram. If a signal is not present or is incorrect, refer to Table 8E-1, A62 Motherboard Wiring List and Figure 8E-2, A62 Motherboard Component Location Diagram to determine the signal source and its location. Ensure that the signal source circuitry is functioning properly and, if so, isolate the source by removing destination assemblies where possible. In most cases, the trouble will occur on other assemblies rather than on the Motherboard itself. Visually inspect the Motherboard for possible loose hardware, stray trim leads, solder splashes, and shorted or open traces. Be aware of feedthrough holes that may be making intermittent contact with inner layer Motherboard traces.

REPAIR PROCEDURES

Introduction

Repair and replacement of A62 Motherboard components and connectors is possible but successful only when the following guidelines are followed.

Component And Connector Replacement

NOTE

Unless otherwise mentioned, do not use a soldering iron with a tip temperature greater than 700 degrees F on Motherboard pads, and, in no case leave the iron on the connection any longer than absolutely necessary. Care must be taken when soldering and desoldering on the A62 Motherboard not to damage wires, cables, or other components located near the work area.

Where soldering iron accessability to Motherboard components is difficult, removal of individual assemblies may be necessary; refer to the replacement procedures of those assemblies for specific removal instructions.

To remove a component, heat one side of the component pad from either side of the board and carefully lift that lead out of the hole. Repeat the procedure with the remaining lead and, after the component has been removed, reheat each pad and use solder wick or an anti-static solder removing tool (vacuum type) to remove the solder from each hole. It is often helpful to have one person pull the component lead while another person heats the pad from the other side of the Motherboard.

Connectors A62XA57-61 are 110-pin male connectors whose pins may be individually replaced without need for replacing the entire connector. The one other connector with the same feature is A62J31.

NOTE

Individual pins are not available and if an individual male pin repair is required, an extra A62J31 connector should be ordered and pins removed from it for replacement purposes.

Have one person gently grab and pull the pin to be replaced from the component side of the Motherboard while another person heats the pin from the other side. Reheat the pad and use solder wick or an anti-static solder removal tool to remove the solder from the hole. Reverse the procedure when installing the new pin by holding the pin straight in the connector while the second person solders it.

On all other Motherboard connectors having the prefix XA, replacement begins with completely masking the connector with tape and then carefully breaking the connector apart (without pulling it) until only contacts remain. The use of paper and masking tape to isolate the area being worked on will help eliminate foreign materials from entering other areas of the 8340A.

WARNING

Whenever soldering or unsoldering and when breaking out bad connectors, always wear safety glasses to protect the eyes.

Using the two-person method previously described, unsolder and remove individual connector contacts; then reheat each pad and remove the old solder. Insert the new connector and hold it straight and flush against the Motherboard while another person solders all connector pins.

Single and dual in-line connectors having the prefix "J" (with the exception of J31) may be successfully removed by heating each connector pin and using a solder removing tool to remove the old solder. If necessary, resolder the connection and try removing the solder again to remove all adhering solder; do not use excessive heat.

To replace type SMC push-on coaxial connectors, heat the body from the component side of the board and remove it when the heat is sufficient. The center conductor will remain on the board. Unsolder the center conductor, then reheat each pad and remove the old solder. Solder the new connector from the non-component side of the board while another person holds it straight and flush against the Motherboard from the other side.
Connector A62J1 may be replaced in the same manner as used in replacing other single and dual in-line "J" prefix package connectors (with the exception of J31).

Motherboard Replacement

The 8340A A62 Motherboard is not customer replaceable. Any questions concerning Motherboard replacement should be directed to your nearest HP Sales and Service Center for more specific instructions. Refer to the HP Sales And Service Offices listing at the end of the Service section in this manual.

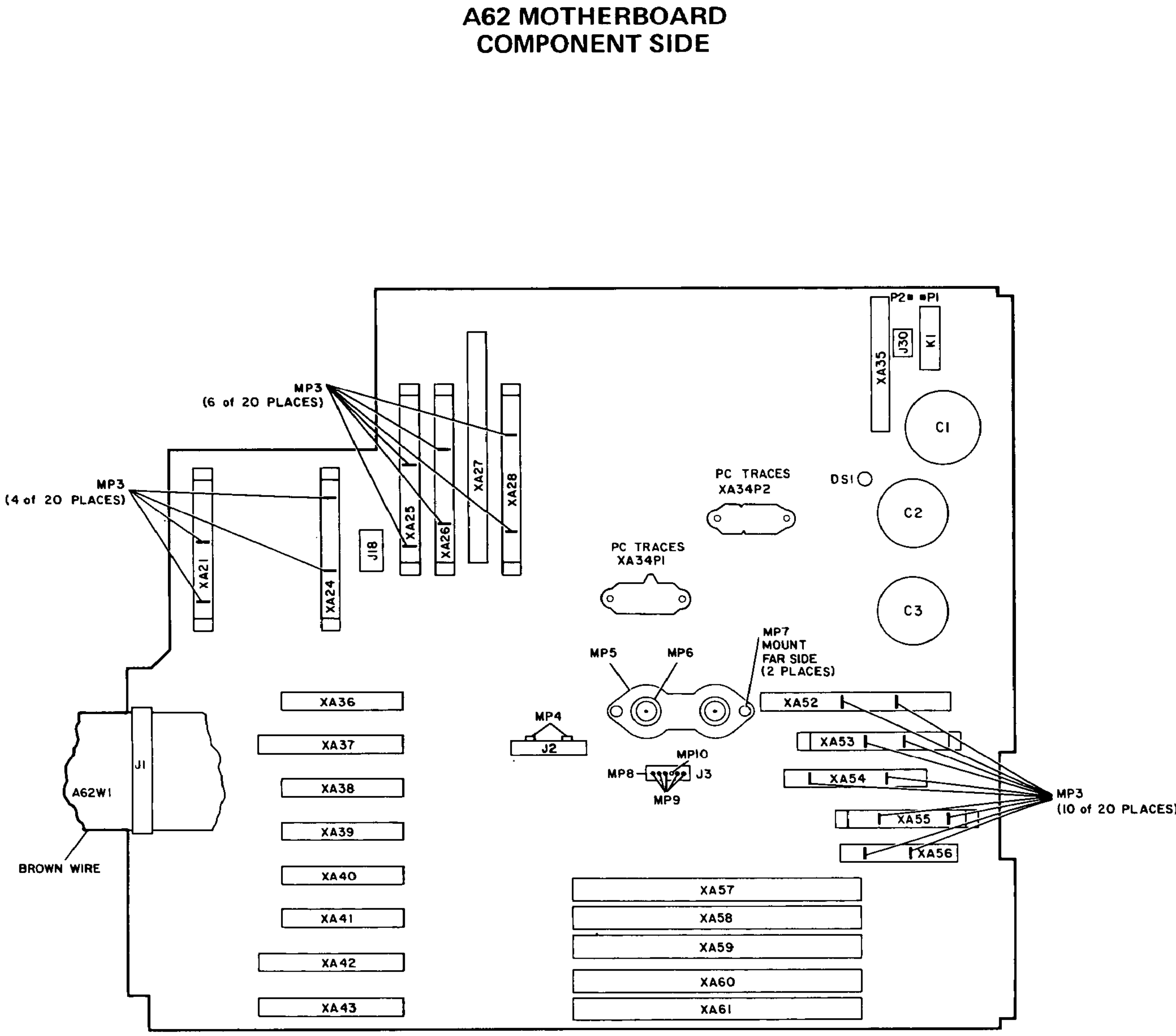


Figure 8E-2. A62 Motherboard Component Location Diagram (1 of 2)

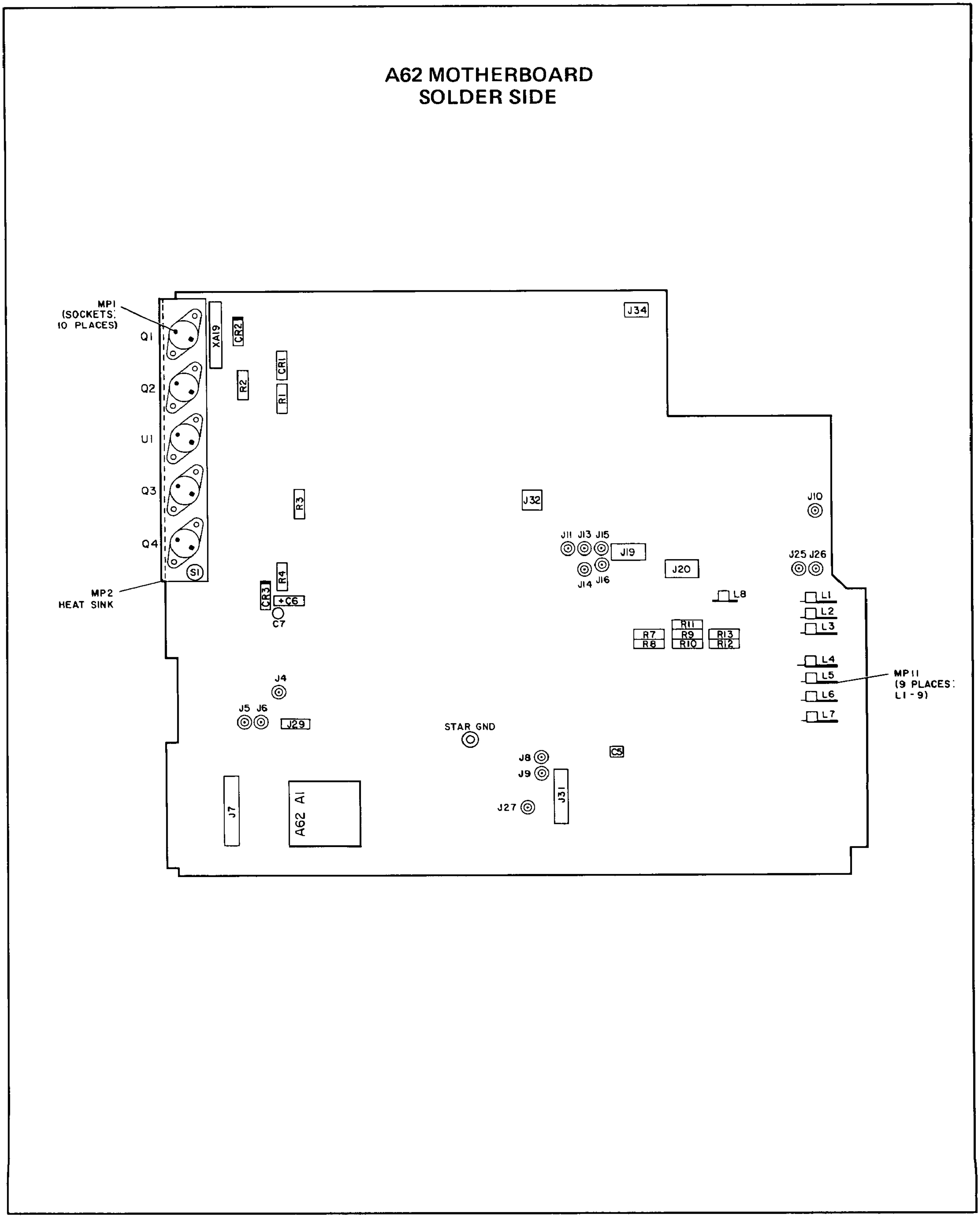


Figure 8E-2. A62 Motherboard Component Location Diagram (2 of 2)

MNEMONIC	DESCRIPTION	TYPE	LEVELS	SOURCE	MISCELLANEOUS A62 MOTHERBOARD CONNECTORS	TI WIRE COLORS	A62 MOTHERBOARD COAX CONNECTORS J4-J6, J8-J17, J21-J26	A62 NON-CABLED COMPONENTS	GROUNDS AND GROUND PLANES	MNEMONICS
ADD0	INSTRUMENT I/O ADDRESS BUS BIT 0	DIGITAL	TTL	XA60P1-17	A62J1 PIN 23					ADD0
ADD1	INSTRUMENT I/O ADDRESS BUS BIT 1	DIGITAL	TTL	XA60P1-73	A62J1 PIN 24					ADD1
ADD2	INSTRUMENT I/O ADDRESS BUS BIT 2	DIGITAL	TTL	XA60P1-13	A62J1 PIN 25					ADD2
ADD3	INSTRUMENT I/O ADDRESS BUS BIT 3	DIGITAL	TTL	XA60P1-74	A62J1 PIN 26					ADD3
ADD4	INSTRUMENT I/O ADDRESS BUS BIT 4	DIGITAL	TTL	XA60P1-13	A62J1 PIN 27					ADD4
AM IN	AMPLITUDE MODULATION INPUT	ANALOG	±1V MAX.	A62J15 CENTER			A62J15 SMC CENTER			AM IN
AM RTN	AMPLITUDE MODULATION GROUND RETURN	GROUND	0V	A62J15 SHIELD; NOTE 10			A62J15 SMC SHIELD AND GUARD TRACE AROUND AM IN			AM RTN
ATN	IEEE-488 ATTENTION (ATN)	DIGITAL	TTL	XA59P1-6	A62J7 PIN 21					ATN
ATNAT1	ATTENUATOR ATTENUATION CARD 1	DIGITAL	OPEN COLLECTOR	XA24P1-30	A62J20 PIN 2					ATNAT1
ATNAT2	ATTENUATOR ATTENUATION CARD 2	DIGITAL	OPEN COLLECTOR	XA24P1-29	A62J20 PIN 9					ATNAT2
ATNAT3	ATTENUATOR ATTENUATION CARD 3	DIGITAL	OPEN COLLECTOR	XA24P1-28	A62J20 PIN 5					ATNAT3
ATNAT4	ATTENUATOR ATTENUATION CARD 4	DIGITAL	OPEN COLLECTOR	XA24P1-27	A62J20 PIN 10					ATNAT4
ATN COIL+	ATTENUATOR SOLENOID COILS SUPPLY	POWER SUPPLY	+5V	XA24P1-7	A62J20 PIN 6					ATN COIL+
ATNTH1	ATTENUATOR THROUGH CARD 1	DIGITAL	OPEN COLLECTOR	XA24P1-12	A62J20 PIN 13					ATNTH1
ATNTH2	ATTENUATOR THROUGH CARD 2	DIGITAL	OPEN COLLECTOR	XA24P1-11	A62J20 PIN 3					ATNTH2
ATNTH3	ATTENUATOR THROUGH CARD 3	DIGITAL	OPEN COLLECTOR	XA24P1-10	A62J20 PIN 11					ATNTH3
ATNTH4	ATTENUATOR THROUGH CARD 4	DIGITAL	OPEN COLLECTOR	XA24P1-9	A62J20 PIN 4					ATNTH4
0VSWP	BUFFERED 0-10V SWEEP RAMP	ANALOG	10V/SWEEP	XA58P1-40						0VSWP
DAV	IEEE-488 DATA VALID (DAV)	DIGITAL	TTL	XA59P1-6	A62J7 PIN 11					DAV
DB0	INSTRUMENT I/O DATA BUS BIT 0	DIGITAL	TTL	XA60P1-20; NOTE 9	A62J1 PIN 3					DB0
DB1	INSTRUMENT I/O DATA BUS BIT 1	DIGITAL	TTL	XA60P1-76; NOTE 9	A62J1 PIN 4					DB1
DB2	INSTRUMENT I/O DATA BUS BIT 2	DIGITAL	TTL	XA60P1-21; NOTE 9	A62J1 PIN 5					DB2
DB3	INSTRUMENT I/O DATA BUS BIT 3	DIGITAL	TTL	XA60P1-77; NOTE 9	A62J1 PIN 6					DB3
DB4	INSTRUMENT I/O DATA BUS BIT 4	DIGITAL	TTL	XA60P1-22; NOTE 9	A62J1 PIN 7					DB4
DB5	INSTRUMENT I/O DATA BUS BIT 5	DIGITAL	TTL	XA60P1-78; NOTE 9	A62J1 PIN 8					DB5
DB6	INSTRUMENT I/O DATA BUS BIT 6	DIGITAL	TTL	XA60P1-23; NOTE 9	A62J1 PIN 9					DB6
DB7	INSTRUMENT I/O DATA BUS BIT 7	DIGITAL	TTL	XA60P1-79; NOTE 9	A62J1 PIN 10					DB7
DB8	INSTRUMENT I/O DATA BUS BIT 8	DIGITAL	TTL	XA60P1-24; NOTE 9	A62J1 PIN 11					DB8
DB9	INSTRUMENT I/O DATA BUS BIT 9	DIGITAL	TTL	XA60P1-80; NOTE 9	A62J1 PIN 12					DB9
DB10	INSTRUMENT I/O DATA BUS BIT 10	DIGITAL	TTL	XA60P1-25; NOTE 9	A62J1 PIN 13					DB10
DB11	INSTRUMENT I/O DATA BUS BIT 11	DIGITAL	TTL	XA60P1-81; NOTE 9	A62J1 PIN 14					DB11
DB12	INSTRUMENT I/O DATA BUS BIT 12	DIGITAL	TTL	XA60P1-28; NOTE 9	A62J1 PIN 15					DB12
DB13	INSTRUMENT I/O DATA BUS BIT 13	DIGITAL	TTL	XA60P1-82; NOTE 9	A62J1 PIN 16					DB13
DB14	INSTRUMENT I/O DATA BUS BIT 14	DIGITAL	TTL	XA60P1-27; NOTE 9	A62J1 PIN 17					DB14
DB15	INSTRUMENT I/O DATA BUS BIT 15	DIGITAL	TTL	XA60P1-83; NOTE 9	A62J1 PIN 10					DB15
DETLVL	DETECTED LEVEL INPUT TO A.D.C.	ANALOG	0.5V/dB, 0V=0dB	XA25P1-33						DETLVL
DETOUT	DETECTED LEVEL INPUT TO LINEAR MOD BOARD	ANALOG	0.5V/dB, 0V=0dB	XA25P1-32						DETOUT
DET S/H+	DETECTOR SAMPLE/HOLD CONTROL	DIGITAL	+15V/-3.5V	XA21P1-1						DET S/H+
DET S/H	DETECTOR SAMPLE/HOLD CONTROL	DIGITAL	-15V/+4.5V	XA21P1-21						DET S/H–
DIV N2	500 MHZ DIVIDED OUTPUT FROM PLL 2 DIVIDER	DIGITAL	TTL (ON TRUE)	XA42P1-27						DIV N2
DIO1	IEEE-488 I/O DATA BUS BIT 1	DIGITAL	TTL	XA59P1-57	A62J7 PIN 1					DIO1
DIO2	IEEE-488 I/O DATA BUS BIT 2	DIGITAL	TTL	XA59P1-58	A62J7 PIN 3					DIO2
DIO3	IEEE-488 I/O DATA BUS BIT 3	DIGITAL	TTL	XA59P1-59	A62J7 PIN 5					DIO3
DIO4	IEEE-488 I/O DATA BUS BIT 4	DIGITAL	TTL	XA59P1-60	A62J7 PIN 7					DIO4
DIO5	IEEE-488 I/O DATA BUS BIT 5	DIGITAL	TTL	XA59P1-61	A62J7 PIN 2					DIO5
DIO6	IEEE-488 I/O DATA BUS BIT 6	DIGITAL	TTL	XA59P1-62	A62J7 PIN 1					DIO6
DIO7	IEEE-488 I/O DATA BUS BIT 7	DIGITAL	TTL	XA59P1-63	A62J7 PIN 3					DIO7
DIO8	IEEE-488 I/O DATA BUS BIT 8	DIGITAL	TTL	XA59P1-64	A62J7 PIN 3					DIO8
EOI	IEEE-488 END OR IDENTIFY (EOI)	DIGITAL	TTL	XA59P1-1	A62J7 PIN 9					EOI
EXDET	EXTERNAL DETECTOR INPUT	ANALOG	25MV-2V	A62J16 CENTER			A62J16 - SMC CENTER			EXDET
EXDETR	EXTERNAL DETECTOR INPUT GROUND RETURN	GROUND	0V	A62J16 SHIELD; NOTE 10			A62J16 - SMC SHIELD AND GUARD TRACE AROUND EXDET			EXDETR

MNEMONIC	REF N/A LOOP XA34P1	REF N/A LOOP XA34P2	20/30 LOOP XA36P1	XA37P1	XA38P1	XA39P1	XA40P1	XA41P1	XA42P1	XA43P1	SWEEP GENERATOR Y/O LOOP XA54P1	XA55P1	XA58P1
ADD0													17
ADD1													13
ADD2													18
ADD3													14
ADD4													19
AM IN													
AM RTN													
ATN													
ATNAT1													
ATNAT2													
ATNAT3													
ATNAT4													
ATN COIL+													
ATNTH1													
ATNTH2													
ATNTH3													
ATNTH4													
0VSWP													40
DAV													
DB0				1					21	21			23
DB1				19					3	3	11		71
DB2				2					22	22	29		21
DB3				20					4	4	[illegible]		77
DB4				3					23	23	30		22
DB5				21					5	5	12		78
DB6				4					24	24	31		21
DB7				22					6	6	11		79
DB8			THRU F7 TO PIN 2	5					25	28	32		24
DB9			THRU F8 TO PIN 1	23					7	7	14		80
DB10			THRU F9 TO PIN 3	1					28	26	31		25
DB11			THRU F10 TO PIN 15	35					0	8	15		81
DB12											34		28
DB13											11		32
DB14											35		21
DB15											12		33
DETLVL													
DETOUT													
DET S/H+													
DET S/H													
DIV N2								10	27				
DIO1													
DIO2													
DIO3													
DIO4													
DIO5													
DIO6													
DIO7													
DIO8													
EOI													
EXDET													
EXDETR													

MNEMONIC	CONTROLLER XA57P1	XA59P1	XA60P1	XA61P1	RF SECTION XA21P1	XA22P1 NOTE 8	XA23P1 NOTE 8	XA24P1	XA25P1	XA26P1	XA27P1	XA28P1	POWER SUPPLIES XA19P1	XA35P1	XA52P1	XA53P1	XA56P1
ADD0	17	17	17								3						
ADD1	13	13	73								40						
ADD2	18	16	15								10						
ADD3	14	14	74								4						
ADD4	19	15	13								[illegible]						
AM IN										13							
AM RTN										41							
ATN		6	6														
ATNAT1								30									
ATNAT2								29									
ATNAT3								28									
ATNAT4								27									
ATN COIL+								7									
ATNTH1								12									
ATNTH2								11									
ATNTH3								10									
ATNTH4								9									
0VSWP											37						
DAV		6	1														
DB0	20	21	20		10		9			15	22	11					
DB1	73	71	70		11		27			37	53	34					
DB2	21	21	21				10			16	23	12					
DB3	77	77	77				28			38	54	35					
DB4	22	22	22		12		11			17	24	13					
DB5	78	78	70		13		29				55	36					
DB6	23	23	23		14		12			39	25	14					
DB7	70	79	39		15		30			40	56	37					
DB8	24	24	24		31		13				25	15					
DB9	80	50	32				31	14			57	30					
DB10	25	25	25				14	15			21	16					
DB11	81	81	81		32			32		38	56						
DB12	28	28	28					16									
DB13	82	82	82					34									
DB14	27	27	27														
DB15	83	83	83														
DETLVL									33		38						
DETOUT									32								
DET S/H+					1				2								
DET S/H					21				34								
DIV N2																	
DIO1		57	67														
DIO2		58	61														
DIO3		59	65														
DIO4		60	60														
DIO5		61	61														
DIO6		62	62														
DIO7		63	63														
DIO8		64	64														
EOI		1	7														
EXDET									41								
EXDETR									43								

Refer to Table 8E-1. Motherboard Wiring List (7 of 7) for NOTES

MNEMONIC	DESCRIPTION	TYPE	LEVELS	SOURCE
EXT TRIG	EXTERNAL TRIGGER INPUT	TTL/ANALOG	EXT SOURCE LVL	A63J31-4, 16
FAN1	SWITCHED FAN POWER	AC LINE	110 VAC	A62J1-7
FAN2	SWITCHED FAN POWER	AC LINE	110 VAC	A62J1-10
FAN3	PRIMARY FAN POWER	AC LINE	110 VAC	A62 SQ PIN P2
FAN4	PRIMARY FAN POWER	AC LINE	110 VAC	A62 SQ PIN P1
FPNLSWP	FRONT PANEL SWEEP RAMP	ANALOG	10V/SWEEP	XA60P1-43
FPNLSWP RTN	FRONT PANEL SWEEP RAMP GROUND RETURN	GROUND	0V	XA60P1-89
GND	ANALOG GROUND	GROUND	0V	A62 STAR GND
GNDHIB	IEEE-488 GROUND	GROUND	0V	CONNECTED TO REAR PANEL
GND PLANE	DIGITAL GROUND	GROUND	0V	INSTRUMENT GROUND
HADCEN	A.D.C. CONVERT ENABLE	DIGITAL	TTL (HIGH TRUE)	XA21P1-1
HDCEN	YO DELAY COMPENSATION ENABLE	DIGITAL	TTL (HIGH TRUE)	XA55P1-67
HEYOKICK	YO AND YTM KICK PULSE COMPLETE	DIGITAL	TTL (HIGH TRUE)	XA26P1-13
HFILYO	FILTER YO ENABLE	DIGITAL	TTL (HIGH TRUE)	XA56P1-72
HINT	INTERNAL/EXTERNAL LEVELING CONTROL	DIGITAL	TTL (HIGH TRUE)	XA26P1-42
HIPMOD DRV	HIGH BAND PULSE MODULATOR DRIVE	ANALOG	PIN DIODE CURRENT	XA21P1-33
HLSW	ALC LOOP BANDWIDTH CONTROL	DIGITAL	TTL (HIGH TRUE)	XA26P1-33
HLB0	ENCODED BAND INFO BIT 0	DIGITAL	TTL (HIGH TRUE)	XA27P1-46
HLB1	ENCODED BAND INFO BIT 1	DIGITAL	TTL (HIGH TRUE)	XA27P1-16
HLB2	ENCODED BAND INFO BIT 2	DIGITAL	TTL (HIGH TRUE)	XA27P1-47
HLEY	LOCK ENABLE FOR YO LOOP	DIGITAL	TTL (HIGH TRUE)	XA58P1-51
HLE2	LOCK ENABLE TO PLL2	DIGITAL	TTL (HIGH TRUE)	XA58P1-53
HMRKR	MARKER ASSERTED	DIGITAL	TTL (HIGH TRUE)	XA57P1-2, 12
HMTR	EXTERNAL METER LEVELING CONTROL	DIGITAL	TTL (HIGH TRUE)	XA26P1-13
HNUP	NEGATIVE POWER SUPPLIES UP SIGNAL	DIGITAL	TTL (HIGH TRUE)	XA53P1-17; XA56P1-1, 10
HOVC	INTERNAL 10 MHZ STANDARD TEMP ERROR	ANALOG	+5V — OVEN WARM	A63J3-3
HPLSEN	PULSE MODULATION ENABLED	DIGITAL	TTL (HIGH TRUE)	XA25P1-3
HPNT	PROGRAM ENABLE (USED FOR PROGRAMMING)	DIGITAL	TTL (HIGH TRUE)	SEE A61 CKT DESCRIPTION
HPUP	POSITIVE POWER SUPPLIES UP SIGNAL	DIGITAL	TTL (HIGH TRUE)	XA52P1-46
HRFON	RF OUTPUT POWER ON	DIGITAL	TTL (HIGH TRUE)	XA57P1-105
HSP	SWEEP IN PROGRESS	DIGITAL	TTL (HIGH TRUE)	XA57P1-13
HSTD	INTERNAL 10 MHZ STANDARD ENABLE	DIGITAL	TTL (HIGH TRUE)	XA58P1-60
HSTM	START MEMORY FETCH CYCLE	DIGITAL	TTL (HIGH TRUE)	XA60P1-45
HULH	3.7 GHZ OSCILLATOR UNLOCKED	DIGITAL	TTL (HIGH TRUE)	A62J15-16
HULM	M/N OSCILLATOR UNLOCKED	DIGITAL	TTL (HIGH TRUE)	XA34P1-8
HULR	REFERENCE OSCILLATOR UNLOCKED	DIGITAL	TTL (HIGH TRUE)	XA34P2-14
HULY	YO 2-7 GHZ OSCILLATOR UNLOCKED	DIGITAL	TTL (HIGH TRUE)	A62J2-16
HUL1	PLL1 OSCILLATOR UNLOCKED	DIGITAL	TTL (HIGH TRUE)	XA37P1-36, XA39P1-1, 18
HUL2	PLL2 OSCILLATOR UNLOCKED	DIGITAL	TTL (HIGH TRUE)	XA40P1-4
HXREF	EXTERNAL REFERENCE ENABLE	DIGITAL	TTL (HIGH TRUE)	A62J31-17
IFC	IEEE-488 INTERFACE CLEAR (IFC)	DIGITAL	TTL (LOW TRUE)	A62J3-17
LALTEN	ALTERNATE MODE ENABLED	DIGITAL	TTL (LOW TRUE)	XA57P1-60
LALTSEL	CURRENT INST. STATE (FORE/BACK GROUND)	DIGITAL	TTL (LOW TRUE)	XA57P1-59
LATTN	ATTENUATOR INSTALLED SENSING	DIGITAL	TTL (LOW TRUE)	A62J20-11
LBX	BAND CROSS	DIGITAL	TTL (LOW TRUE)	XA57, 58, 56 P1-60
LCHNG	INSTRUMENT STATE CHANGED	DIG. OPEN COLL.	TTL (LOW TRUE)	NOTE 9

MNEMONIC	XA34P1 (REF/YIG LOOP)	XA34P2 (REF/YIG LOOP)	XA36P1 (20/30 LOOP)	XA37P1	XA38P1	XA39P1	XA40P1	XA41P1	XA42P1	XA43P1	XA54P1 (SWEEP GENERATOR Y/O LOOP)	XA55P1	XA56P1
EXT TRIG													
FAN1													
FAN2													
FAN3													
FAN4													
FPNLSWP													
FPNLSWP RTN													
GND		10, 11	1, 5-8, 10, 11, 14, 16, 19-22, 28, 29	2, 3, 12, 13-17, 24, 27-36	1-11, 14-20, 25, 30	2-11, 13, 14, 17-26, 35, 39	2-6, 10, 14, 17, 21, 25, 29	1, 3, 6, 12, 13, 14, 15, 18, 21, 22, 25, 26, 29	10, 17-20, 30-35	11-14, 17, 27, 29, 35	5, 22	5, 6, 20, 21	
GNDHIB													
GND PLANE													1, 34, 44-46, 55, 53, 70, 71, 75, 85, 93, 101, 110
HADCEN													
HDCEN												14	
HEYOKICK													
HFILYO													47, 72
HINT													
HIPMOD DRV													
HLSW													
HLB0													
HLB1													
HLB2													
HLEY													
HLE2							1	1	1				
HMRKR													
HMTR													
HNUP													
HOVC													
HPLSEN													
HPNT													
HPUP													
HRFON													
HSP												22	13
HSTD													
HSTM													
HULH													
HULM	8												
HULR		14											
HULY													
HUL1				36		1, 18							
HUL2							4						
HXREF													106
IFC													
LALTEN													
LALTSEL													
LATTN													
LBX													55
LCHNG													100

MNEMONIC	XA57P1 (CONTROLLER)	XA58P1	XA60P1	XA61P1	XA21P1 (RF SECTION)	XA22P1 NOTE 8	XA23P1 NOTE 8	XA24P1	XA25P1	XA26P1	XA27P1	XA28P1	XA19P1 (POWER SUPPLIES)	XA33P1	XA52P1	XA53P1	XA56P1 (POWER SUPPLIES)
EXT TRIG	105																
FAN1																	
FAN2																	
FAN3																	
FAN4																	
FPNLSWP	43																
FPNLSWP RTN	33																
GND					8, 25	3, 8, 14, 23, 24, 32	5, 26	8	5, 10, 31	6, 28	6, 37	5, 28	10, 22	4, 22	13, 39, 43	4-16, 33-36	5, 20
GNDHIB																	
GND PLANE	1, 29-31, 34, 40, 53, 66, 70-72, 75, 84-85, 93, 110	1, 40-44, 55, 56, 75, 96, 97, 110	1, 40-44, 55, 68, 70-72, 75, 96-100, 110	1, 34, 40-44, 55, 59, 70-72, 75, 89, 96-103, 110			6, 24	26			7, 13, 30, 50						
HADCEN					1						5						
HDCEN		67															
HEYOKICK								31				15					
HFILYO		72															
HINT					20				41	42							
HIPMOD DRV					36												
HLSW					3				11	33							
HLB0								20		29	46	31					
HLB1								21		30	16	32					
HLB2								22		31	47	33					
HLEY		51															
HLE2		53															
HMRKR	2, 12									43							
HMTR					20				36	13							
HNUP															40	17	1, 16
HOVC		10		85													
HPLSEN					9				3	2							
HPNT				30													
HPUP		55	33	35											46		
HRFON	105				27					24							
HSP	73	13								7		36					
HSTD		60													21		
HSTM			45	45													
HULH	45, 104	105															
HULM		104															
HULR		40															
HULY		30															
HUL1		105															
HUL2		107															
HXREF		98															
IFC		9	0														
LALTEN	60																
LALTSEL	59																
LATTN											33						
LBX	60	65															
LCHNG		43									27						

MNEMONIC	MISCELLANEOUS A62 MOTHERBOARD CONNECTORS	TI WIRE COLORS	A62 MOTHERBOARD COAX CONNECTORS W-1E-J6-J17, J21-J25	A62 MOTHERBOARD COMPONENTS	GROUNDS AND GROUND PLANES	MNEMONICS
EXT TRIG	A62J31 PINS 4, 16					EXT TRIG
FAN1	A62J30 PIN 3			A62J1 PIN 7		FAN1
FAN2	A62J30 PIN 1			A62J1 PIN 10		FAN2
FAN3				A62J1 PIN 5, A62P2		FAN3
FAN4				A62J1 PIN 14, A62P1		FAN4
FPNLSWP			A62J9 - SMC CENTER			FPNLSWP
FPNLSWP RTN			A62J9 - SMC SHIELD AND GUARD TRACE AROUND FPNLSWP			FPNLSWP RTN
GND	A62J2 PINS 2, 19 A62J3 PINS 3, 4	WHT, WHT		A62C1 (-) A62C2 (-); THRU A62CE TO +12V; A62C6 (-) A62C7 (-); A62DS1 CATHODE; THRU A62R5 TO +5V UNREG THRU A62R4 TO +12V UNREG	NOTES 2 THRU 6	GND
GNDHIB	A62J7 PINS 12-14, 16, 18, 20, 22, 23, 24					GNDHIB
GND PLANE	A62J1 PINS 1, 21, 29, 38 THRU 41; A62J1 PINS 45, 46, 52; A62J19 PINS 1, 9; A62J20 PIN 1; A62J31 PIN 12, 35				GND NOTE 7	GND PLANE
HADCEN						HADCEN
HDCEN						HDCEN
HEYOKICK						HEYOKICK
HFILYO	A62J2 PIN 5					HFILYO
HINT						HINT
HIPMOD DRV			A62J25 - SMC CENTER			HIPMOD DRV
HLSW						HLSW
HLB0						HLB0
HLB1						HLB1
HLB2						HLB2
HLEY	A62J2 PIN 3					HLEY
HLE2						HLE2
HMRKR						HMRKR
HMTR						HMTR
HNUP						HNUP
HOVC	A62J3 PIN 3					HOVC
HPLSEN						HPLSEN
HPNT	A62J1 PIN 23					HPNT
HPUP						HPUP
HRFON						HRFON
HSP						HSP
HSTD						HSTD
HSTM						HSTM
HULH	A62J19 PIN 16					HULH
HULM						HULM
HULR						HULR
HULY	A62J18 PIN 16					HULY
HUL1						HUL1
HUL2						HUL2
HXREF	A62J31 PIN 17					HXREF
IFC	A62J3 PIN 17					IFC
LALTEN	A62J31 PINS 9, 23					LALTEN
LALTSEL	A62J31 PINS 10, 24					LALTSEL
LATTN	A62J20 PIN 14					LATTN
LBX						LBX
LCHNG						LCHNG

Refer to Table 8E-1. Motherboard Wiring List (7 of 7) for NOTES

MNEMONIC	DESCRIPTION	TYPE	LEVELS	SOURCE	MISCELLANEOUS A62 MOTHERBOARD CONNECTORS	W1 WIRE COLORS	A62 MOTHERBOARD COAX CONNECTORS J4-J6, J8-J17, J21-J26	A62 MOTHERBOARD COMPONENTS	GROUNDS AND GROUND PLANES	MNEMONICS
LCK1	DATA STROBE TO PLL2 COUNTERS (0, R2)	DIGITAL	TTL (LOW TRUE)	XA59P1-51						LCK1
LCK2	DATA STROBE TO PLL3 D.R. DIVIDER (0, R0)	DIGITAL	TTL (LOW TRUE)	XA59P1-109						LCK2
LCK3	DATA STROBE TO PLL2 PRETUNE DAC (0, R1)	DIGITAL	TTL (LOW TRUE)	XA59P1-110						LCK3
LCK4	DATA STROBE TO PLL1 YCO GAIN SWITCH (0, R2)	DIGITAL	TTL (LOW TRUE)	XA59P1-52						LCK4
LDETBW	DETECTOR LOW BAND WIDTH CONTROL	DIGITAL	TTL (LOW TRUE)	XA26P1-9	A62J34 PIN 2					LDETBW
LHET	HETRODYNE BAND ENABLED	DIGITAL	TTL (LOW TRUE)	XA27P1-20	A62J19 PINS 7, 8					LHET
LHBND	FUNDAMENTAL OR MULTIPLIED BAND ENABLED	DIGITAL	TTL (LOW TRUE)	XA26P1-2	A62J19 PIN 15					LHBND
LHSOT	HEAT SINK OVER TEMPERATURE SENSOR	DIGITAL	TTL (LOW TRUE)	A62J31-26	A62J31 PIN 26					LHSOT
LHSOT RTN	HEAT SINK OVER-TEMP SENSOR GND RETURN	GROUND	0V	A62J31-12	A62J31 PIN 12				GND PLANE	LHSOT RTN
LDA0	PROCESSOR/MEMORY PRIVATE BUS BIT 0	DIGITAL	TTL (LOW TRUE)	XA60P1-54						LDA0
LDA1	PROCESSOR/MEMORY PRIVATE BUS BIT 1	DIGITAL	TTL (LOW TRUE)	XA60P1-109						LDA1
LDA2	PROCESSOR/MEMORY PRIVATE BUS BIT 2	DIGITAL	TTL (LOW TRUE)	XA60P1-53						LDA2
LDA3	PROCESSOR/MEMORY PRIVATE BUS BIT 3	DIGITAL	TTL (LOW TRUE)	XA60P1-108						LDA3
LDA4	PROCESSOR/MEMORY PRIVATE BUS BIT 4	DIGITAL	TTL (LOW TRUE)	XA60P1-52						LDA4
LDA5	PROCESSOR/MEMORY PRIVATE BUS BIT 5	DIGITAL	TTL (LOW TRUE)	XA60P1-107						LDA5
LDA6	PROCESSOR/MEMORY PRIVATE BUS BIT 6	DIGITAL	TTL (LOW TRUE)	XA60P1-51						LDA6
LDA7	PROCESSOR/MEMORY PRIVATE BUS BIT 7	DIGITAL	TTL (LOW TRUE)	XA60P1-106						LDA7
LDA8	PROCESSOR/MEMORY PRIVATE BUS BIT 8	DIGITAL	TTL (LOW TRUE)	XA60P1-50						LDA8
LDA9	PROCESSOR/MEMORY PRIVATE BUS BIT 9	DIGITAL	TTL (LOW TRUE)	XA60P1-105						LDA9
LDA10	PROCESSOR/MEMORY PRIVATE BUS BIT 10	DIGITAL	TTL (LOW TRUE)	XA60P1-49						LDA10
LDA11	PROCESSOR/MEMORY PRIVATE BUS BIT 11	DIGITAL	TTL (LOW TRUE)	XA60P1-104						LDA11
LDA12	PROCESSOR/MEMORY PRIVATE BUS BIT 12	DIGITAL	TTL (LOW TRUE)	XA60P1-48						LDA12
LDA13	PROCESSOR/MEMORY PRIVATE BUS BIT 13	DIGITAL	TTL (LOW TRUE)	XA60P1-103						LDA13
LDA14	PROCESSOR/MEMORY PRIVATE BUS BIT 14	DIGITAL	TTL (LOW TRUE)	XA60P1-47						LDA14
LDA15	PROCESSOR/MEMORY PRIVATE BUS BIT 15	DIGITAL	TTL (LOW TRUE)	XA60P1-102						LDA15
LINE TRIG	LINE TRIGGER SENSING BY SECONDARY	RECTIFIED AC	LINE FREC 7-10V	A62-CR1 CATHODE/A62R1				A62CR1 CATHODE THRU A62R1 TO PWR ON LED		LINE TRIG
LIPS	INSTRUMENT — PRESET	DIG OPEN COLL	TTL (LOW TRUE)	XA59P1-38/A62J1-19	A62J1 PIN 19					LIPS
LWNE	M/N OSCILLATOR LOCK ENABLED	DIGITAL	TTL (LOW TRUE)	XA55P1-55						LWNE
LMODHLD	LINEAR MODULATOR SAMPLE/HOLD	DIGITAL	TTL	XA21P1-2						LMODHLD
LOMD	OVER-MODULATION DETECTED	DIG OPEN COLL	TTL (LOW TRUE)	XA26P1-5						LOMD
LOPMOD DRV	LOW BAND PULSE MODULATOR DRIVE	ANALOG	CURRENT SOURCE	XA21P1-16			A62J15 - SMC CENTER			LOPMOD DRV
LRETRACE	RETRACE	DIGITAL	TTL (LOW TRUE)	XA57P1-58	A62J31 PINS 11, 25					LRETRACE
LRSP	RESET SWEEP CONTROL	DIGITAL	TTL (LOW TRUE)	XA58P1-68						LRSP
LSBY	STANDBY CONTROL	DIGITAL	0V TO +22V	A62J1-20	A62J1 PIN 20					LSBY
LSOB	STAY OFF BUS SIGNAL	DIGITAL	TTL (LOW TRUE)	XA60P1-46						LSOB
LSPLD	SWEEP LED CONTROL OF YCK	DIGITAL	TTL	XA58P1-67	A62J1 PIN 44					LSPLD
LSSP	STEP SWEEP	DIG. OPEN COLL.	TTL (LOW TRUE)	XA57P1-107	A62J31 PINS 5, 13					LSSP
LSRQ	SERVICE REQUEST	DIG. OPEN COLL.	TTL (LOW TRUE)	NOTE 9	A62J1 PIN 45					LSRQ
LSTEPUP	STEP UP FOR EXTERNAL FOOT SWITCH	DIGITAL	TTL (LOW TRUE)	A62J31-14	A62J1 PIN 29; A62J31 PIN 14					LSTEPUP
LSTP	PROCESSOR STOPPED	DIGITAL	TTL (LOW TRUE)	XA59P1-86	A62J1 PIN 43					LSTP
LUNLVL	INSTRUMENT UNLEVELED	DIG. OPEN COLL.	TTL (LOW TRUE)	XA26P1-36						LUNLVL
LVLCOR	LEVELING CORRECTION	ANALOG	1.25dB/V CW=0dB	XA25P1-14						LVLCOR
LVLREF	A.L.C. LEVEL REFERENCE	ANALOG	.2V/dB CW=0dBM	XA27P1-30						LVLREF
LVSX	DISABLE YO SWEEPS	DIGITAL	TTL (LOW TRUE)	XA58P1-63						LVSX
LWRT	WRITE TO RAM	DIGITAL	TTL (LOW TRUE)	XA60P1-101						LWRT
LYOLCK										LYOLCK
LYSP	Y.O. SWEEP	DIGITAL	TTL (LOW TRUE)	XA59P1-11						LYSP
WRT16IN	MEMORY ADDRESS BIT 16 (IN)	DIGITAL	TTL	SEE A61 CKT DESCRIPTION						WRT16IN
WRT16OUT	MEMORY ADDRESS BIT 16 (OUT)	DIGITAL	TTL	SEE A61 CKT DESCRIPTION						WRT16OUT
MKR SWP	SWEEP RAMP TO MARKER BAND/CROSS BOARD	ANALOG	0 TO 10V/SWEEP	XA58P1-90						MKR SWP
MM CLK EN	MILLIMETER CLOCK ENABLE			XA59P1-71	A62J31 PIN 17		A62J26-SMC CENTER			MM CLK EN
MM ENABLE	MILLIMETER ENABLE			XA21P1-24	A62J31 PIN 16					MM ENABLE
MM HEAD DET	MILLIMETER HEAD DETECT			XA25P1-12	A62J31 PIN 24					MM HEAD DET
MM REF	MILLIMETER REFERENCE			XA26P1-14						MM REF
MM RFOK	MILLIMETER RF OK			XA21P1-34	A62J31 PIN 15					MM RFOK
MM SER IN	MILLIMETER SERIAL INPUT			XA59P1-12	A62J31 PIN 36					MM SER IN
MM SER OUT	MILLIMETER SERIAL OUTPUT			XA59P1-70	A62J31 PIN 13					MM SER OUT
MM UNLVL	MILLIMETER UNLEVELED			XA26P1-26	A62J31 PIN 32					MM UNLVL

MNEMONIC	REF M/N LOOP XA34P1	XA34P2	20/30 LOOP XA36P1	XA37P1	XA38P1	XA39P1	XA40P1	XA41P1	XA42P1	XA43P1	SWEEP GENERATOR Y/O LOOP XA54P1	XA55P1	XA58P1	XA57P1	CONTROLLER XA59P1	XA60P1	XA61P1	RF SECTION XA21P1	XA22P1 NOTE B	XA23P1 NOTE B	XA24P1	XA25P1	XA26P1	XA27P1	XA28P1	POWER SUPPLIES XA19P1	XA35P1	XA32P1	XA33P1	XA56P1
LCK1									11						54															
LCK2									1						109															
LCK3										13					108															
LCK4			THRU R11 TO R24	3											52															
LDETBW																						39	9							
LHET																		23				37	14	30						
LHBND																							22							
LHSOT																										12				
LHSOT RTN																														
LDA0																54	54													
LDA1																103	109													
LDA2																53	53													
LDA3																103	108													
LDA4																52	52													
LDA5																107	107													
LDA6																51	51													
LDA7																105	106													
LDA8																50	50													
LDA9																105	105													
LDA10																49	49													
LDA11																104	104													
LDA12																48	48													
LDA13																103	103													
LDA14																41	47													
LDA15																102	102													
LINE TRIG														57, 65																
LIPS													14	14	14	14	14									30				
LWNE	7														68															
LMODHLD																		2					1							
LOMD																							5	48						
LOPMOD DRV																		16												
LRETRACE														58																
LRSP													65		15															
LSBY																										46				
LSOB																46	46													
LSPLD													67																	
LSSP														107																
LSRQ													64	54	39	89														
LSTEPUP																														
LSTP															86	65														
LUNLVL																							36	52						
LVLCOR																						14		52						
LVLREF																						12		30						
LVSX											9		63																	
LWRT																101	101													
LYOLCK											21														4					
LYSP												7			11															
WRT16IN																	9													
WRT16OUT																	34													
MKR SWP													93	96																
MM CLK EN															71															
MM ENABLE																		24				0								
MM HEAD DET																								13						
MM REF																							14							
MM RFOK																		34												
MM SER IN															12															
MM SER OUT															70															
MM UNLVL																							26							

MNEMONIC	DESCRIPTION	TYPE	LEVELS	SOURCE
MOD RTN	ALC MODULATORS GROUND RETURN	GROUND	0V	XA26P1-21
MODHI	HIGH BAND MOD. ALC DRIVE	ANALOG	CURRENT SOURCE	XA26P1-20
MODLO	LOW BAND MODULATOR DRIVE	ANALOG	CURRENT SOURCE	XA26P1-22
MODLVL	MODULATOR LEVEL	ANALOG	0 TO 3 LEVELED	XA26P1-32
MUTE	PLOTTER MUTE CONTROL	DIGITAL	TTL (HIGH TRUE)	XA57P1-61
N1	N NUMBER TO M/N OSCILLATOR BIT 1	DIGITAL	TTL (HIGH TRUE)	XA59P1-33
N2	N NUMBER TO M/N OSCILLATOR BIT 2	DIGITAL	TTL (HIGH TRUE)	XA59P1-58
N3	N NUMBER TO M/N OSCILLATOR BIT 3	DIGITAL	TTL (HIGH TRUE)	XA59P1-32
N4	N NUMBER TO M/N OSCILLATOR BIT 4	DIGITAL	TTL (HIGH TRUE)	XA59P1-57
N5	N NUMBER TO M/N OSCILLATOR BIT 5	DIGITAL	TTL (HIGH TRUE)	XA59P1-31
NDAC	IEEE 488 NOT DATA ACCEPTED (NDAC)	DIGITAL	TTL	XA60P1-4
NEG BLANK	NEGATIVE BLANKING SIGNAL	DIGITAL	0, -5V	XA57P1-41
NRFD	IEEE 488 NOT READY FOR DATA (NRFD)	DIGITAL	TTL	XA60P1-5
M1	M NUMBER TO M/N OSCILLATOR BIT 1	DIGITAL	TTL	XA59P1-48
M2	M NUMBER TO M/N OSCILLATOR BIT 2	DIGITAL	TTL	XA59P1-103
M2 TUNE	TUNE SIGNAL TO PLL VCO	ANALOG	0V TO -7V	XA41P1-23
M2 TUNE RTN	GROUND RETURN	GROUND	0V	XA41P1-8
M3	M NUMBER TO M/N OSCILLATOR BIT 3	DIGITAL	TTL	XA59P1-47
M4	M NUMBER TO M/N OSCILLATOR BIT 4	DIGITAL	TTL	XA59P1-102
M5	M NUMBER TO M/N OSCILLATOR BIT 5	DIGITAL	TTL	XA59P1-46
M6	M NUMBER TO M/N OSCILLATOR BIT 6	DIGITAL	TTL	XA59P1-101
PEN LIFT	PLOTTER PEN LIFT	OPEN COLLECT.	CLAMP AT 35V	XA57P1-106
PEN LIFT RTN	PLOTTER PEN LIFT GROUND RETURN	GROUND	0V	XA57P1-105
PH1	PLL1 PHASE DETECTOR OUTPUT	ANALOG	0V TO +5V	A62J12
PH2	PLL1 PHASE DETECTOR OUTPUT	ANALOG	0V TO +5V	A62J13
PINBIAS	SYNTH PIN DIODE BIAS	DIGITAL	-4V TO +12V	XA21P1-24
PLS IN	EXTERNAL PULSE INPUT	DIGITAL	TTL	A62J23 CENTER
PLS IN RTN	EXTERNAL PULSE GROUND RETURN	GROUND	0V	NOTE 10
PMOD RTN	PULSE MODULATOR DRIVE GROUND RETURN	GROUND	0V	XA21P1-35
PRETUNE	YO PRETUNE	ANALOG	-2.5V/GC D = 2GC	XA51P1-21
PWR ON LED	+5 VAC 2 THROUGH CR1 AND R1 TO CR1	POWER SUPPLY	+.78V ANODE — 0V	A62J1
Q1B	TRANSISTOR Q1 BASE	ANALOG		XA53-4
Q1E	TRANSISTOR Q1 EMITTER	ANALOG		XA53-7, 8, 25, 26
Q2B	TRANSISTOR Q2 BASE	ANALOG		XA53P1-21
Q2E	TRANSISTOR Q2 EMITTER	ANALOG		XA53P1-1, 19
Q3B	TRANSISTOR Q3 BASE	ANALOG		XA52-7
Q3C	TRANSISTOR Q3 COLLECTOR	ANALOG		XA52-6, 30
Q3E	TRANSISTOR Q3 EMITTER	ANALOG		XA52-8, 32
Q4B	TRANSISTOR Q4 BASE	ANALOG		XA52-3, 27
Q4C	TRANSISTOR Q4 COLLECTOR	ANALOG		XA52-1, 2, 25, 26
Q4E	TRANSISTOR Q4 EMITTER	ANALOG		XA52-4, 5, 28, 29
REN	IEEE 488 REMOTE ENABLE (REN)	DIGITAL	TTL (LOW TRUE)	A62J7-10
RFSWP	SWEEP RAMP TO RF OUTPUT SECTION	ANALOG	10V/SWEEP	XA57P1-42

MNEMONIC	REF N/A LOOP XA34P1	XA34J1	20/30 LOOP XA30P1	XA37P1	XA38P1	XA39P1	XA40P1	XA41P1	XA42P1	XA43P1	SWEEP GENERATOR Y/O LOOP XA51P1	XA55P1	XA58P1
N1	5												
N2	6												
N3	3												
N4	4												
N5	1												
M1	15												
M2	14												
M2 TUNE								20		21			
M2 TUNE RTN								8		19			
M3	13												
M4	12												
M5	11												
M6	10												
PH1			24	THRU R12 TO PIN 11									
PH2			25	THRU R13 TO PIN 12									
PRETUNE											21	6, 25	

MNEMONIC	CONTROLLER XA57P1	XA59P1	XA60P1	XA61P1	RF SECTION XA21P1	XA22P1 NOTE 3	XA23P1 NOTE 4	XA24P1	XA25P1	XA26P1	XA27P1	XA28P1	POWER SUPPLIES XA18P1	XA15P1	XA52P1	XA53P1	XA50P1
MOD RTN										21							
MODHI										20							
MODLO										22							
MODLVL										32	61						
MUTE	61																
N1		33															
N2		58															
N3		32															
N4		57															
N5		31															
NDAC		4	4														
NEG BLANK	41																
NRFD		5	5														
M1		48															
M2		103															
M3		47															
M4		102															
M5		46															
M6		101															
PEN LIFT	106																
PEN LIFT RTN	105																
PINBIAS						24											
PLS IN					18												
PLS IN RTN					17												
PMOD RTN					35												
PRETUNE												22 NOTE 6					
Q1B																4	
Q1E																7, 8 25, 26	
Q2B																21	
Q2E																1, 19	
Q3B															7		
Q3C															6, 30		
Q3E															8, 32		
Q4B															3, 27		
Q4C															1, 2 25, 26		
Q4E															4, 5 28, 29		
REN		2	1														
RFSWP	42										17						

MNEMONIC	MISCELLANEOUS A62 MOTHERBOARD CONNECTORS	T1 WIRE COLORS	A62 NON-ONBOARD SMC CONNECTORS J1-J5, J9-J17, J21-J29	A62 NON-ONBOARD COMPONENTS	GROUNDS AND GROUND PLANES	MNEMONICS
MOD RTN			A62J13 - SMC SHIELD A62J14 - SMC SHIELD AND GUARD TRACE AROUND MODHI AND MODLO			MOD RTN
MODHI			A62J13 - SMC CENTER			MODHI
MODLO			A62J14 - SMC CENTER			MODLO
MODLVL						MODLVL
MUTE	A62J31 PINS 6, 22					MUTE
N1						N1
N2						N2
N3						N3
N4						N4
N5						N5
NDAC	A62J7 PIN 15					NDAC
NEG BLANK	A62J1 PINS 1, 15					NEG BLANK
NRFD	A62J7 PIN 13					NRFD
M1						M1
M2						M2
M2 TUNE						M2 TUNE
M2 TUNE RTN						M2 TUNE RTN
M3						M3
M4						M4
M5						M5
M6						M6
PEN LIFT	A62J31 PINS 6, 30					PEN LIFT
PEN LIFT RTN	A62J31 PIN 21					PEN LIFT RTN
PH1						PH1
PH2						PH2
PINBIAS	A62J18 PIN 10					PINBIAS
PLS IN			A62J26 - SMC CENTER			PLS IN
PLS IN RTN			A62J26 - SMC SHIELD AND GUARD TRACE AROUND PLS IN			PLS IN RTN
PMOD RTN			A62J19/J25 - SMC SHIELD AND GUARD TRACE AROUND HIPMOD AND LOPMOD DRV			PMOD RTN
PRETUNE			A62J15 - SMC CENTER			PRETUNE
PWR ON LED				A62DS1 ANODE THRU A62R1 TO LINE TRIG		PWR ON LED
Q1B						Q1B
Q1E						Q1E
Q2B						Q2B
Q2E						Q2E
Q3B						Q3B
Q3C						Q3C
Q3E						Q3E
Q4B						Q4B
Q4C						Q4C
Q4E						Q4E
REN	A62J7 PIN 10					REN
RFSWP						RFSWP

Refer to Table 8E-1. Motherboard Wiring List (7 of 7) for NOTES

MNEMONIC	DESCRIPTION	TYPE	LEVELS	SOURCE	REF M/N LOOP		22/38 LOOP								SWEEP GENERATOR YO LOOP			CONTROLLER				RF SECTION								POWER SUPPLIES					MISCELLANEOUS A62 MOTHERBOARD CONNECTORS	T1 WIRE COLORS	A62 MOTHERBOARD COAX CONNECTORS J4-J6, J8-J17, J21-J28	A62 MOTHERBOARD COMPONENTS	GROUNDS AND GROUND PLANES	MNEMONICS
					XA34P1	XA34P2	XA36P1	XA37P1	XA38P1	XA39P1	XA40P1	XA41P1	XA42P1	XA43P1	XA54P1	XA55P1	XA56P1	XA57P1	XA59P1	XA60P1	XA61P1	XA21P1	XA22P1 NOTE 8	XA23P1 NOTE 8	XA24P1	XA25P1	XA26P1	XA27P1	XA28P1	XA51P1	XA52P1	XA62P1	XA63P1	XA66P1						
RGND	REFERENCE GROUND	GROUND	0V	STAR GND POINT										24	7 25	10, 11 25, 26	42 43 99	45, 46 101							36	12, 34	11, 34	13, 28 45, 60	21 43						A62J29 PIN 1 A62J32 PIN 1		A62J11 - SMC SHIELD AND GUARD TRACES AROUND PRETUNE, VSWP YO TUNE, AND SYTM RES; A62J21 - SMC SHIELD AND GROUND TRACES NEAR 20/30 SWP AND VSWP; A62J5, J6, J11, J13 - SMC SHIELD AND STANDOFF FOR LLE NEAR A62J3			RGND
RPNLSWP	REAR PANEL SWEEP OUTPUT	ANALOG	0-10V/SWEEP	XA57P1-44														44																			A62J8 - SMC CENTER			RPNLSWP
RPNLSWP RTN	REAR PANEL SWEEP GROUND RETURN	GRD. RET	0V	XA57P1-101														101																			A62J8 - SMC SHIELD AND GUARD TRACE AROUND RPNLSWP			RPNLSWP RTN
ISTAT	READ STATUS I/O STROBE (15, R2)	DIGITAL	TTL (LOW TRUE)	XA24P1-35																				27	35			45	10											ISTAT
SIOA	I/O STROBE (FIRST HALF ADDRESSES)	DIGITAL	TTL (LOW TRUE)	XA28P1-42													15	15	15	15								42							A62J11 PIN 49					SIOA
SIOB	I/O STROBE (SECOND HALF ADDRESSES)	DIGITAL	TTL (LOW TRUE)	XA28P1-16													15	16	15	16															A62J11 PIN 47					SIOB
SR FBK	YO SENSE RESISTOR FEEDBACK	ANALOG	-6V TO -17V	XA55P1-12, 27												12, 27																			A62J29 PIN 2					SR FBK
SR PWR	YO SENSE RESISTOR POWER	ANALOG	-6V TO -17V	XA55P1-13, 20												13, 20																			A62J29 PIN 3					SR PWR
SRD BIAS	STEP RECOVERY DIODE BIAS	ANALOG	-10V TO 15V	XA24P1-25																					25										A62J18 PIN 2					SRD BIAS
SRD BIAS CONT	STEP RECOVERY DIODE BIAS CONTROL	DIGITAL	CTL (SELECTED)	XA24P1-13																					13		15													SRD BIAS CONT
SRQ	IEEE-488 SERVICE REQUEST (SRQ)	DIGITAL	TTL	A62J7-11															9	5															A62J7 PIN 11					SRQ
STAT10	STATUS WORD INPUT BIT 10	DIGITAL	TTL (LOW TRUE)	XA24P1-4																				77	4															STAT10
SW1	PULSE 10 MHZ ON/OFF CONTROL	DIGITAL	TTL	XA40P1-24			23				24		32																											SW1
SW2	PULSE 10 TO 3 KHZ/0-8 MHZ CONTROL	DIGITAL	TTL	XA42P1-14							22		14																											SW2
SYTM COIL	POSITIVE INPUT TO SYTM COIL	ANALOG	+12V TO +23V	XA28P1-42																									42						A62J18 PIN 1, A62J32 PIN 3					SYTM COIL+
SYTM COIL-	NEGATIVE INPUT TO SYTM COIL	ANALOG	-12V	XA28P1-3, 27																									3, 27						A62J18 PIN 12					SYTM COIL-
SYTM GND	SYTM GROUND	GROUND	0V	A62J18-13, 14, 15																					35										A62J18 PINS 13 THRU 15, A62J32 PIN 2					SYTM GND
SYTMCB	SYTM DRIVE TRANSISTOR BASE	ANALOG	-20 TO -23V	XA28P1-19																									19						A62J32 PIN 2					SYTMCB
SYTMCC	SYTM DRIVE TRANSISTOR COLLECTOR	ANALOG	-6 TO -19	XA28P1-30																									30						A62J32 PIN 1					SYTMCC
SYTMHTR	REGULATOR HEATER OF YIG TO SYTM	ANALOG	+1.0 TO -20V	XA24P1-19																					19										A62J18 PIN 3					SYTMHTR
SYTMRES	SYTM CURRENT SENSE FEED BACK	ANALOG	-5V LOW END CW	XA28P1-44																									44						A62J32 PIN 5					SYTMRES
SYTMTHERM	TEMP FEED BACK THERMISTOR IN SYTM	ANALOG	APPROX. 5V	XA24P1-2																					2										A62J18 PIN 3					SYTMTHERM
TCREF	A-D TEMP COMPENSATED REFERENCE	ANALOG	5V (10°C) NOM	XA25P1-35																						35	12													TCREF
THERM1	LOW BAND DETECTOR THERMISTOR	ANALOG	-10 TO -5V	A62J25-3																						4									A62J34 PIN 3					THERM1
THERM2	LOW BAND DETECTOR THERMISTOR	ANALOG	-12V	A62J24-1																						26									A62J34 PIN 1					THERM2
TYOKP	TRIGGER YO KICK PULSE	DIGITAL	TTL (LOW TRUE)	XA59P1-100											13		33		100																					TYOKP
YOCMP	YO DELAY COMPENSATION VOLTAGE	ANALOG	-25 MHZ/VOLT	XA54P1-27											27	3																								YOCMP
VSWP	YO SWEEP RAMP	ANALOG	0V TO 10V/SWEEP	XA56P1-97											28 NOTE 7		97																				A62J21 - SMC CENTER			VSWP
WBAND	BAND DAC I/O STROBE (10 R2)	DIGITAL	TTL (LOW TRUE)	XA27P1-43																								41	29											WBAND
WDDAC	DELAY COMPENSATION DAC DATA STROBE (6, R2)	DIGITAL	TTL (LOW TRUE)	XA59P1-30											26				30																					WDDAC
WLEVEL	ALC REFERENCE DAC DATA STROBE (10, R1)	DIGITAL	TTL (LOW TRUE)	XA27P1-12																					33			12												WLEVEL
WMOD	MODULATION DATA STROBE (10, R2)	DIGITAL	TTL (LOW TRUE)	XA27P1-59																		32		33			41	58												WMOD
WPDAC	PRETUNE DAC DATA STROBE (5, R2)	DIGITAL	TTL (LOW TRUE)	XA59P1-68											36				68																					WPDAC
WRDAC	RESET DAC DATA STROBE (7, R2)	DIGITAL	TTL (LOW TRUE)	XA56P1-29													29		39																					WRDAC
WSPAT	SWEEP ATTENUATOR DATA STROBE (7, R6)	DIGITAL	TTL (LOW TRUE)	XA56P1-64													64		64																					WSPAT
WSPTM	SWEEP TIME DAC DATA STROBE (6, R6)	DIGITAL	TTL (LOW TRUE)	XA56P1-20													20		38																					WSPTM
WYOKP	YO KICK PULSE WIDTH DATA STROBE (5, R6)	DIGITAL	TTL (LOW TRUE)	XA59P1-59											6				59																					WYOKP
WYTMCTL	YTM CONTROL SIGNALS STROBE (11, R5)	DIGITAL	TTL (LOW TRUE)	XA27P1-14																								14	6											WYTMCTL
WYTMSLP	YTM DRIVE SLOPE DAC DATA STROBE (11, R6)	DIGITAL	TTL (LOW TRUE)	XA27P1-44																								44	30											WYTMSLP
WXTRA	EXTRA I/O STROBE (1, R2)	DIGITAL	TTL (LOW TRUE)	XA27P1-15																				15				15												WXTRA
YO COIL+	POSITIVE INPUT TO YO COIL	ANALOG	-40V TO -20V	XA55P1-15, 30												15, 30																			A62J8 PINS 15, A62J29 PIN 5					YO COIL+
YO COIL-	NEGATIVE INPUT TO YO COIL	POWER SUPPLY	-40V	A62J20 13																															A62J8 PIN 13					YO COIL-
YO TUNE	LOW FREQ PHASE LOCK TO YO DRIVER	ANALOG	0V ±5V	XA55P1-21												21																					A62J6 - SMC CENTER			YO TUNE
YOSBTB	YO DRIVER BASE STOP BASE	ANALOG	-30V TO -35V	XA55P1-29												29																			A62J29 PIN 4					YOSBTB
2-40S BLANK	2-40S BLANK, Z-MARKER	DIGITAL	+5V/-0V	XA57P1-37														37																	A62J31 PINS 2, 15					2-40S BLANK
1.4V/GHZ	1.4V PER GHZ REFERENCE	ANALOG	1.4V/GHZ	XA23P1-7																					6				7											1.4V/GHZ
5 MHZ CLK	5 MHZ CLOCK TO 1P1B CHIP	DIGITAL	TTL	XA60P1-34															34	34																				5 MHZ CLK
20/30 SWP	20/30 MHZ REFERENCE OSCILLATOR SWEEP	ANALOG	0V TO -10V	XA43P1-41										1			4																							20/30 SWP
500 KHZ REF	PLL 500 KHZ REFERENCE	DIGITAL	TTL	XA42P1-3								20	3																											500 KHZ REF
8410 TRIG	SYNCHRONIZING TRIGGER TO 8410B INTERFACE	DIGITAL	TTL	XA57P1-62														62																	A62J31 PIN 7					8410 TRIG

Refer to Table 8E-1. Motherboard Wiring List (7 of 7) for NOTES

MNEMONIC	DESCRIPTION	TYPE	LEVELS	SOURCE
+1.0V/GHZ +1.0V/GHZ RTN +5V AC1	+1.0V/GHZ FREQUENCY REFERENCE +1.0V/GHZ FREQUENCY REFERENCE GROUND RETURN +5V TRANSFORMER SECONDARY	ANALOG GROUND T1 SEC	1.0V/GHZ 0V 7 VAC	XA28P1-10 XA28P1-39 A62 LUG (5)
+5V AC2	+5V TRANSFORMER SECONDARY (GREEN)	T1 SEC	7 VAC	A62 LUG (5)
+5V SENSE (+) +5V SENSE (−) +5V UNREG	+5.2 VOLT SUPPLY POSITIVE SENSE +5.2 VOLT SUPPLY POSITIVE SENSE UNREGULATED SUPPLY TO +5V	POWER SUPPLY POWER SUPPLY POWER SUPPLY	+5.2V 0V +7V TO +9V	XA52P1-5 XA52P1-39 XA52P1-1,2,3,19,20,21
+5.2V	REGULATED +5.2 VOLT SUPPLY	POWER SUPPLY	+5.2V	XA52P1-17,18,41,42
+12V +12V UNREG +12V UI ADJ	REGULATED +12 VOLT SUPPLY UNREGULATED SUPPLY TO +12V +12V REGULATOR ADJUSTMENT TERMINAL	POWER SUPPLY POWER SUPPLY POWER SUPPLY	+12V +20V +10.5V	XA52P1-9,33 XA52P1-11,35 XA52P1-10
+20V	REGULATED +20 VOLT SUPPLY	POWER SUPPLY	+20V	XA52P1-16,40
+20V AC1 +20V AC2 +20V REF OSC +20V UNREG	TRANSFORMER SECONDARY FOR +20V SUPPLY TRANSFORMER SECONDARY FOR +20V SUPPLY SWITCHED +20V SUPPLY TO 10 MHZ REF. UNREGULATED SUPPLY TO +20V	POWER SUPPLY POWER SUPPLY POWER SUPPLY POWER SUPPLY	28.4 VAC 28.4 VAC 0V/20V +31.2V	A62 LUG (2) A62 LUG (2) XA52P1-20 XA52P1-7,25
+21 VPP +22V +.25V/GHZ −5.2V −7V REF −10V	PROGRAMMING SUPPLY REGULATED +22 VOLT SUPPLY +.25 VOLTS/GHZ OUTPUT FREQUENCY REGULATED −5.2 VOLT SUPPLY −7V REFERENCE SUPPLY REGULATED −10 VOLT SUPPLY	POWER SUPPLY POWER SUPPLY POWER SUPPLY POWER SUPPLY POWER SUPPLY POWER SUPPLY	+5V/+21V 22V +.25V/GHZ −5.2V −7V −10V	SEE A61 CKT DESCRIPTION XA56P1-6,36 XA20P1-40 XA53P1-8,38 XA43P1-9 XA53P1-12,13,31,32
−10V AC1	TRANSFORMER SECONDARY FOR −10V SUPPLY	POWER SUPPLY	13.5 VAC	A62 LUG (3)
−10V AC2	TRANSFORMER SECONDARY FOR −10V SUPPLY	POWER SUPPLY	13.5 VAC	A62 LUG (3)
−10V RETURN	−10V SUPPLY SERIES PASS COLLECTOR	POWER SUPPLY	+6.4V AT 13.3 GHZ	XA53P1-2,20
−10V UNREG	UNREGULATED SUPPLY TO −10V	POWER SUPPLY	−16V	XA19P1-11,12,23,24
−15V −40V −40V AC1 −40V AC2	REGULATED −15V SUPPLY REGULATED −40V SUPPLY TRANSFORMER SECONDARY FOR −40V SUPPLY TRANSFORMER SECONDARY FOR −40V SUPPLY	POWER SUPPLY POWER SUPPLY POWER SUPPLY	−15V −40V 42.8 VAC 42.8 VAC	XA50P1-15,30 XA53P1-11,30 A62 LUG (4) A62 LUG (4)
−40V RETURN −40V SENSE (+) −40V SENSE (−) −40V UNREG	−40V SUPPLY SERIES PASS COLLECTOR −40V SUPPLY POSITIVE SENSE −40V SUPPLY NEGATIVE SENSE UNREGULATED SUPPLY TO −40V	POWER SUPPLY POWER SUPPLY POWER SUPPLY POWER SUPPLY	12.7V AT 13.5 GHZ 0V −40V −40V	XA53P1-3,22 XA53P1-5 XA53P1-23 XA33P1-6,24
A62J12 CENTER A62J12 SHIELD A62J17 CENTER A62J17 SHIELD A62J21 CENTER A62J21 SHIELD	EXTRA SHIELDED CABLE CONNECTOR TO XA23 EXTRA SHIELDED CABLE CONNECTOR TO XA23 EXTRA SHIELDED CABLE CONNECTOR TO XA23 EXTRA SHIELDED CABLE CONNECTOR TO XA23 EXTRA SHIELDED CABLE CONNECTOR TO XA22 EXTRA SHIELDED CABLE CONNECTOR TO XA22			XA23P1-36 XA23P1-35 XA23P1-18 XA23P1-17 XA22P1-11 XA22P1-23
A62J22 CENTER A62J22 SHIELD A62J23 CENTER A62J23 SHIELD A62J24 CENTER A62J24 SHIELD	EXTRA SHIELDED CABLE CONNECTOR TO XA22 EXTRA SHIELDED CABLE CONNECTOR TO XA22 EXTRA SHIELDED CABLE CONNECTOR TO XA22 EXTRA SHIELDED CABLE CONNECTOR TO XA22 EXTRA SHIELDED CABLE CONNECTOR TO XA22 EXTRA SHIELDED CABLE CONNECTOR TO XA22			XA22P1-13 XA22P1-25 XA22P1-9 XA22P1-27 XA22P1-16 XA22P1-24

MNEMONIC	REF MAN LOOP XA34P1	XA34P2	20/30 LOOP XA36P1	XA37P1	XA38P1	XA39P1	XA40P1	XA41P1	XA42P1	XA43P1	SWEEP GENERATOR Y/O LOOP XA54P1	XA55P1	XA56P1	CONTROLLER XA57P1	XA58P1	XA59P1	XA51P1
+1.0V/GHZ +1.0V/GHZ RTN +5V AC1																	
+5V AC2																	
+5V SENSE (+) +5V SENSE (−) +5V UNREG																	
+5.2V		4,5	THRU 11 TO 15,30	THRU 13 TO 18,36		THRU 17 TO 15,30	15,30	15,30	16,26	13,36	2,20	2,17	36,37,92	36,37,92	36,37,92	36,37,92	36,37,92
+12V +12V UNREG +12V UI ADJ			THRU 12 TO 13,20		THRU 15 TO 13,28								91	91	91	91	91
+20V		2,3					13,29	13,23	16,24	15,34	1,19	1,13	35,90	36,90	35,90	35,90	35
+20V AC1 +20V AC2 +20V REF OSC +20V UNREG																	
+21 VPP +22V +.25V/GHZ −5.2V −7V REF −10V		12,13 5,3	THRU 16 TO 12,27		THRU 14 TO 12,27	THRU 15 TO 12,27	12,27	7 12,27	15,35	9 15,33	4,22	4,19	93 33,94	93 33,94	93 39,94	93 39,94	3,58 93 93 39,94
−10V AC1																	
−10V AC2																	
−10V RETURN																	
−10V UNREG																	
−15V −40V −40V AC1 −40V AC2		6,7					11,26				6 5	3,18	16	30	38	38	38
−40V RETURN −40V SENSE (+) −40V SENSE (−) −40V UNREG		6,7					11,26				3	3,18					
A62J12 CENTER … A62J21 SHIELD																	
A62J22 CENTER … A62J24 SHIELD																	

MNEMONIC	RF SECTION XA21P1	XA22P1 NOTE A	XA23P1 NOTE B	XA24P1	XA25P1	XA26P1	XA27P1	XA28P1	POWER SUPPLIES XA19P1	XA33P1	XA52P1	XA53P1	XA50P1
+1.0V/GHZ +1.0V/GHZ RTN +5V AC1								17 30		8-10 26-28			
+5V AC2										12-14 30-32			
+5V SENSE (+) +5V SENSE (−) +5V UNREG										1-3 19-21	16 39 13,14 37,38		
+5.2V	5,23	2,20	3,21	3	5,26	4,23	3,34	2,24			17,18 41,42		
+12V +12V UNREG +12V UI ADJ			2,22								9,33 11,35 10		
+20V	4,22	1,19	1,13	1	6,21	3,25	2,31	1,23			16,40	29	
+20V AC1 +20V AC2 +20V REF OSC +20V UNREG									1,13 3,14 3,2	7,25	30 23,24 47,48		
+21 VPP +22V +.25V/GHZ −5.2V −7V REF −10V	7,25	4,22	4 6,23	6	30 7,23	6,27	51 1,32 4,35	40 3,25		13,38	22	16,38 12,13 31,32	4,19
−10V AC1									3,4 15,16				
−10V AC2									5,6 17,18				
−10V RETURN									7,8 19,20			2,20	
−10V UNREG									11,12 23,24			9,10 27,28	
−15V −40V −40V AC1 −40V AC2		3,21	1,25				5,35	4 6,27		15,33 15,34		11,30	15,30 3,18
−40V RETURN −40V SENSE (+) −40V SENSE (−) −40V UNREG		3,21	1,25					6,27		6,23 6,24		3,22 5 23 6,24	3,13
A62J12 CENTER … A62J21 SHIELD		11 23	36 35 18 17										
A62J22 CENTER … A62J24 SHIELD		13 25 9 27	16 24										

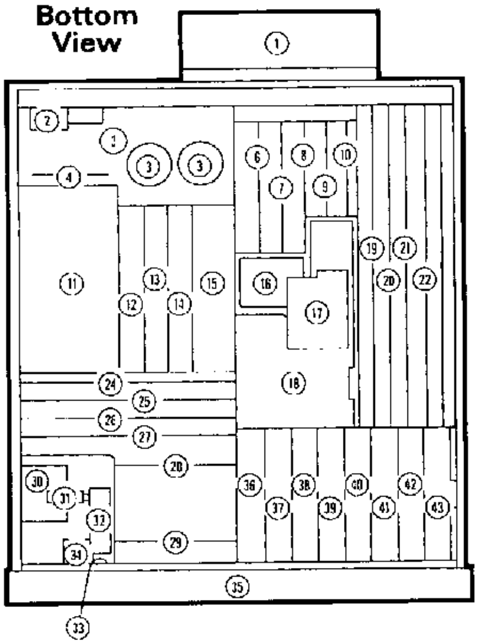
MNEMONIC	MISCELLANEOUS A62 MOTHERBOARD CONNECTORS	T1 WIRE COLORS	A62 MOTHERBOARD COAX CONNECTORS J4-J5 J8-J17, J21-J28	A62 MOTHERBOARD COMPONENTS	GROUND RING GROUND PLANES	MNEMONICS
+1.0V/GHZ +1.0V/GHZ RTN +5V AC1	A62J31 PIN 27, 32 A62J31 PIN 13	GRN				+1.0V/GHZ +1.0V/GHZ RTN +5V AC1
+5V AC2		GRN		A62CR1 ANODE		+5V AC2
+5V SENSE (+) +5V SENSE (−) +5V UNREG	A62J1 PINS 31 THRU 37; A62J31 PIN 3			A62C2 (+); A62C2 (−); THRU A62R3 TO GND	NOTE 2	+5V SENSE (+) +5V SENSE (−) +5V UNREG
+5.2V	A62J2 PINS 4, 17; A62J19 PINS 3, 11					+5.2V
+12V +12V UNREG +12V UI ADJ	A62J1 PIN 2			A62CR3 CATHODE; A62U1 CASE A62C7 (+); A62U1 PIN 1 C6 (−); CR3 ANODE; U1 PIN 2; THRU A62R4 TO GND		+12V +12V UNREG +12V UI ADJ
+20V	A62J2 PINS 9, 12; A62J18 PIN 8; A62J19 PINS 2, 10					+20V
+20V AC1 +20V AC2 +20V REF OSC +20V UNREG	A62J5 PIN 1	RED RED				+20V AC1 +20V AC2 +20V REF OSC +20V UNREG
+21 VPP +22V +.25V/GHZ −5.2V −7V REF −10V	A62J1 PIN 30; A62J3 PIN 5 A62J19 PIN 11 A62J1 PIN 42; A62J2 PINS 1, 20; A62J19 PINS 4, 14 A62J2 PINS 10, 11; A62J16 PIN 1; A62J19 PINS 5, 13			A62CR2 CATHODE; A62U1 PIN 2		+21 VPP +22V +.25V/GHZ −5.2V −7V REF −10V
−10V AC1		BLU				−10V AC1
−10V AC2		BLU				−10V AC2
−10V RETURN						−10V RETURN
−10V UNREG						−10V UNREG
−15V −40V −40V AC1 −40V AC2	A62J2 PINS 6, 13; A62J18 PIN 6	YEL YEL		THRU A62C5 TO GND		−15V −40V −40V AC1 −40V AC2
−40V RETURN −40V SENSE (+) −40V SENSE (−) −40V UNREG	A62J2 PINS 8, 13; A62J18 PIN 6			C1 (+); THRU R2 TO −40V UNREG THRU A62C6 TO GND C1 (−); THRU R2 TO −40V RETURN	NOTE 2	−40V RETURN −40V SENSE (+) −40V SENSE (−) −40V UNREG
A62J12 CENTER A62J12 SHIELD A62J17 CENTER A62J17 SHIELD A62J21 CENTER A62J21 SHIELD			A62J12 CENTER A62J12 SHIELD A62J17 CENTER A62J17 SHIELD A62J21 CENTER A62J21 SHIELD			A62J12 CENTER A62J12 SHIELD A62J17 CENTER A62J17 SHIELD A62J21 CENTER A62J21 SHIELD
A62J22 CENTER A62J22 SHIELD A62J23 CENTER A62J23 SHIELD A62J24 CENTER A62J24 SHIELD			A62J22 CENTER A62J22 SHIELD A62J23 CENTER A62J23 SHIELD A62J24 CENTER A62J24 SHIELD			A62J22 CENTER A62J22 SHIELD A62J23 CENTER A62J23 SHIELD A62J24 CENTER A62J24 SHIELD

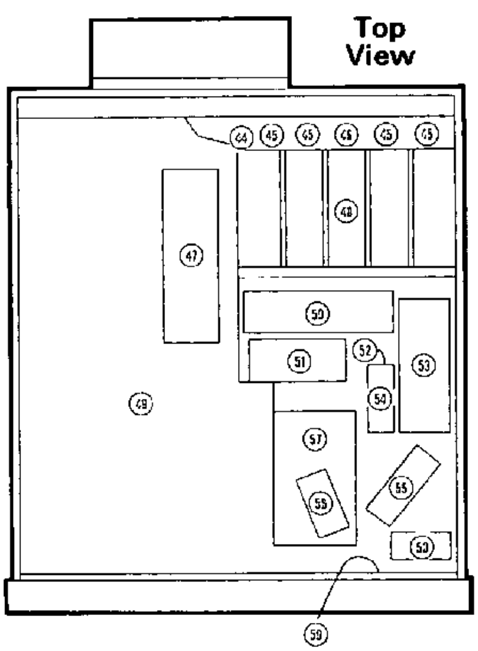
Refer to Table 8E-1. Motherboard Wiring List (7 of 7) for NOTES

NOTES

1. Gnd Plane is located near the RF Section.
2. M/N Assembly Ground Plane (connected to Star Gnd through W45).
3. 20/30 Loops Casting.
4. Star Gnd (Connected to M/N Assembly Ground Plane through W45; connected also to A47W3).
5. Gnd is connected to the HP 8340A chassis.
6. Pretune is routed to this pin from A62J5 through W48 to A62J11.
7. Vswp is routed to this pin from A62J27 through W47 to A62J4.
8. Reserved for future expansion.
9. Open collector bus — multiple sources.
10. Multiple sources.
11. The mnemonics in this table exist on the A62 Motherboard assembly. Other mnemonics contained only within other assemblies such as the YO Loop, M/N Loop and Front Panel assemblies are not shown; to locate these, refer to the Pin I/O Tables and Schematic Diagrams of those assemblies.

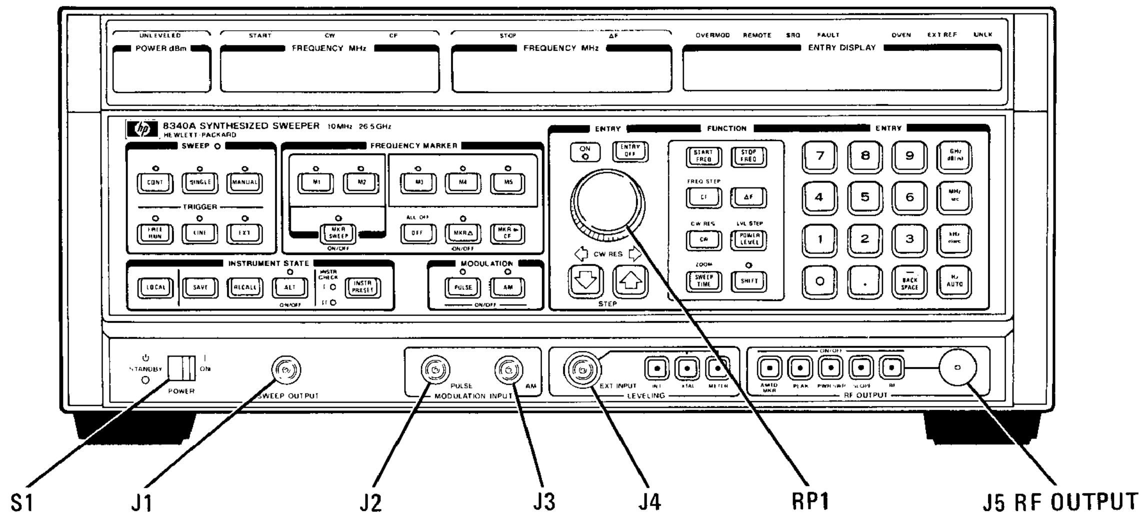
REFERENCE GUIDE TO SERVICE DOCUMENTATION





Assy./Ref. Des.	Description	Location	Ref.-M/N Loops (Volume 3)	20-30 Loops (Volume 3)	Swp. Gen.-YO Loop (Volume 3)	Motherboard (Volume 3)	Controller (Volume 3)	Front/Rear Panel (Volume 4)	RF Section (Volume 4)	Power Supplies (Volume 4)
A1	Alpha Display	33						●		
A2	Display Driver	33						●		
A3	Display Processor	33						●		
A4	Not Assigned									
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	[illegible]							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	31							●	
A12	Band 0 Splitter/Detector	34							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	54							●	
A18	Band 0 Power Amplifier	[illegible]							●	
		56							●	
A19	Capacitor Assembly	[illegible]								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	[illegible]							●	
A25	ALC Detector	[illegible]							●	
A26	Linear Modulator	[illegible]							●	
A27	Level Control	[illegible]							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	[illegible]	●							
A33	M/N Output	[illegible]	●							
A34	Reference-M/N Motherboard		●							
A35	Rectifier	[illegible]								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	[illegible]		●						
A41	PLL2 Phase Detector	[illegible]		●						
A42	PLL2 Divider	[illegible]		●						
A43	PLL2 Discriminator	[illegible]		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	[illegible]			●					
A49	YO Loop Phase/Detector	[illegible]			●					
A50	YO Loop Interconnect	[illegible]			●					
A51	Reference Oscillator	[illegible]	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	[illegible]								●
A57	Marker/Bandcross	[illegible]					●			
A58	Sweep Generator	[illegible]			●					
A59	Digital Interface	[illegible]					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	[illegible]							●	
AT2	15 dB Attenuator	[illegible]			●					
B1	Fan Assembly	[illegible]								●
A62C1-3	Power Supply Filter Capacitors	[illegible]								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

FRONT PANEL



REAR PANEL

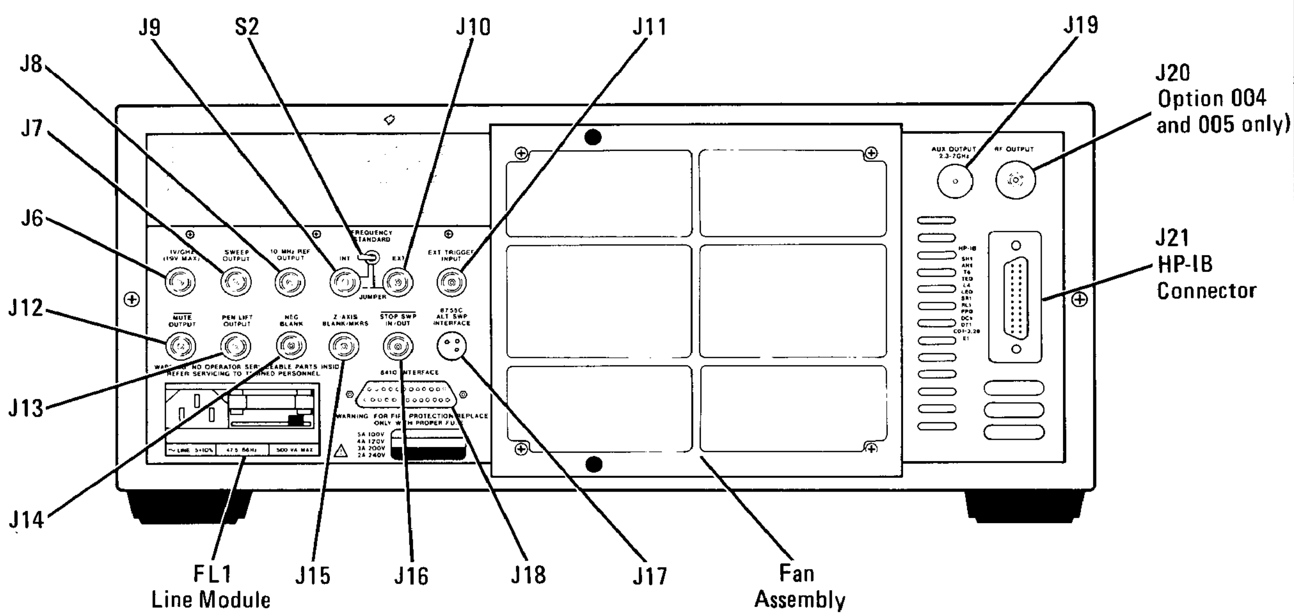


Figure 8F-1. Front and Rear Panels

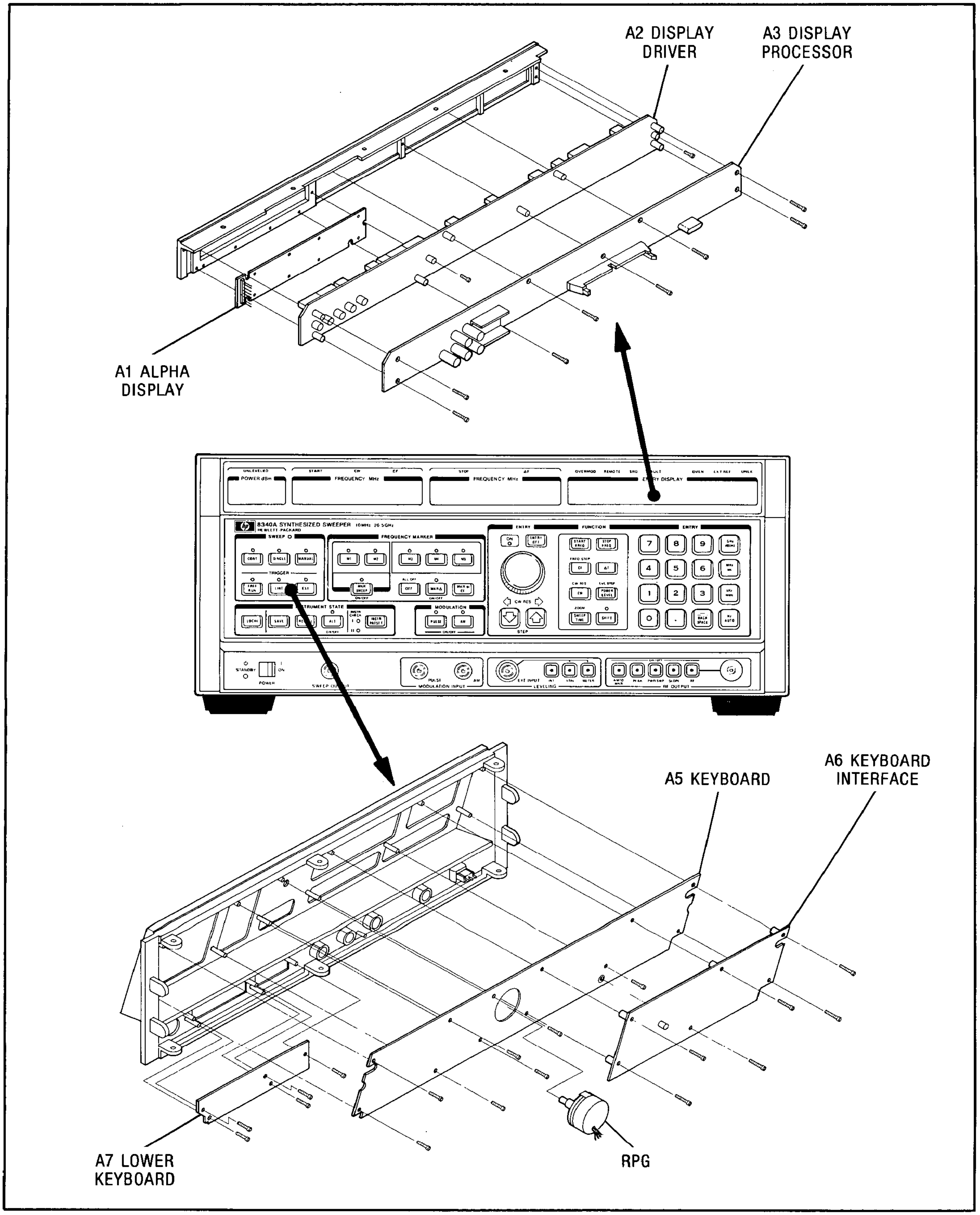


Figure 8F-2. Front Panel Assemblies

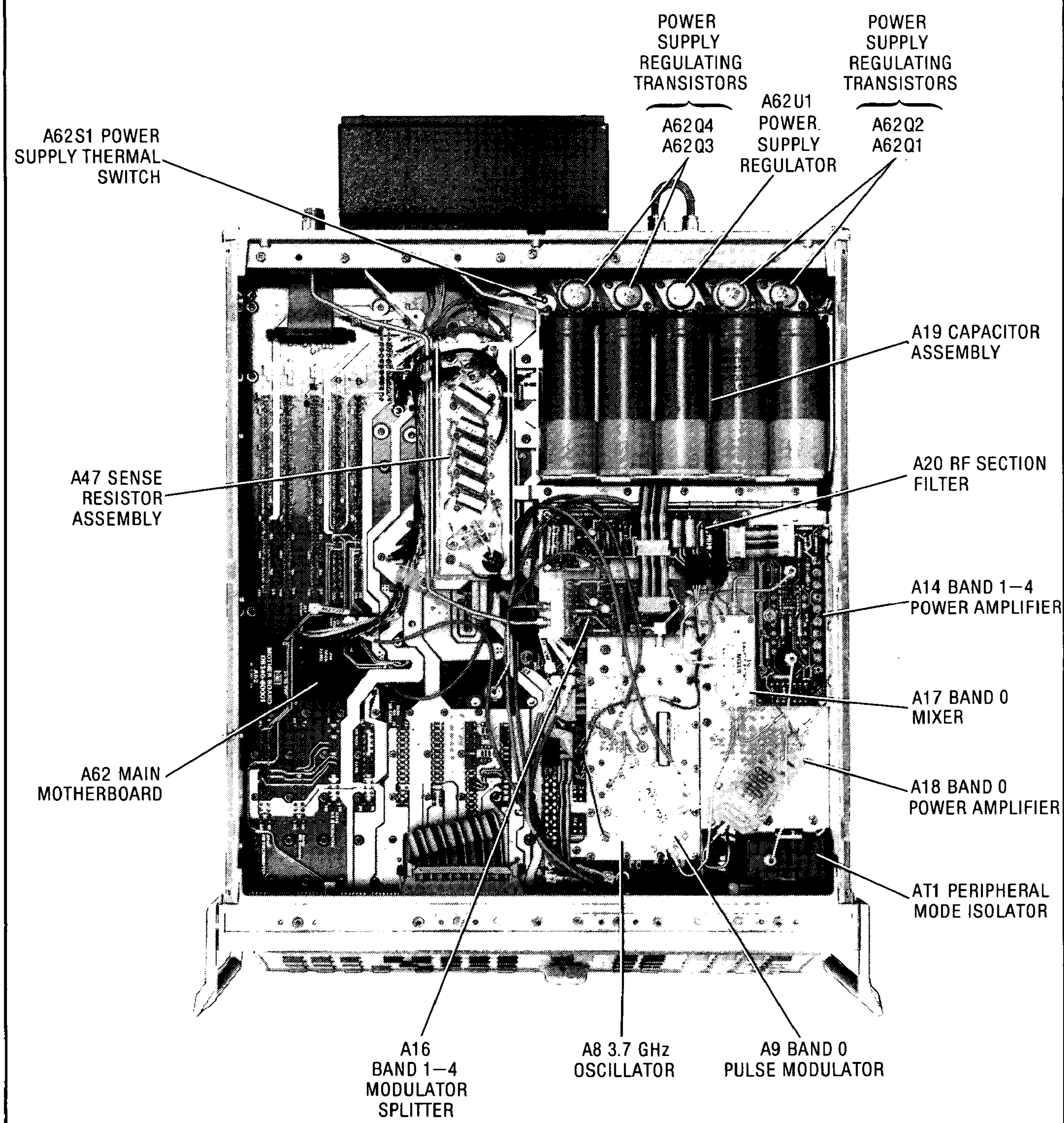


Figure 8F-3. 8340A - Top View (1 of 3)

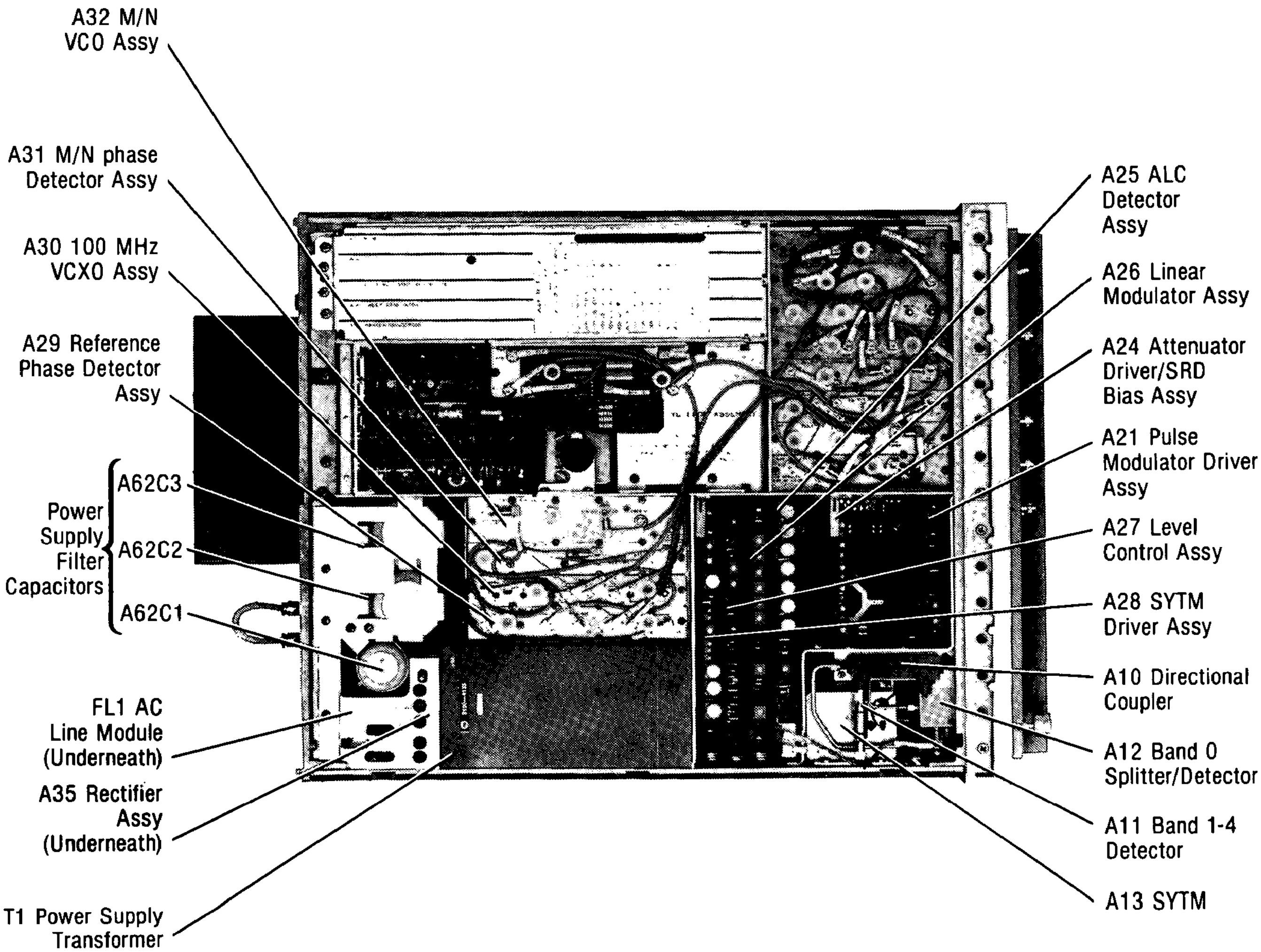


Figure 8F-3. 8340A - Bottom View (2 of 3)

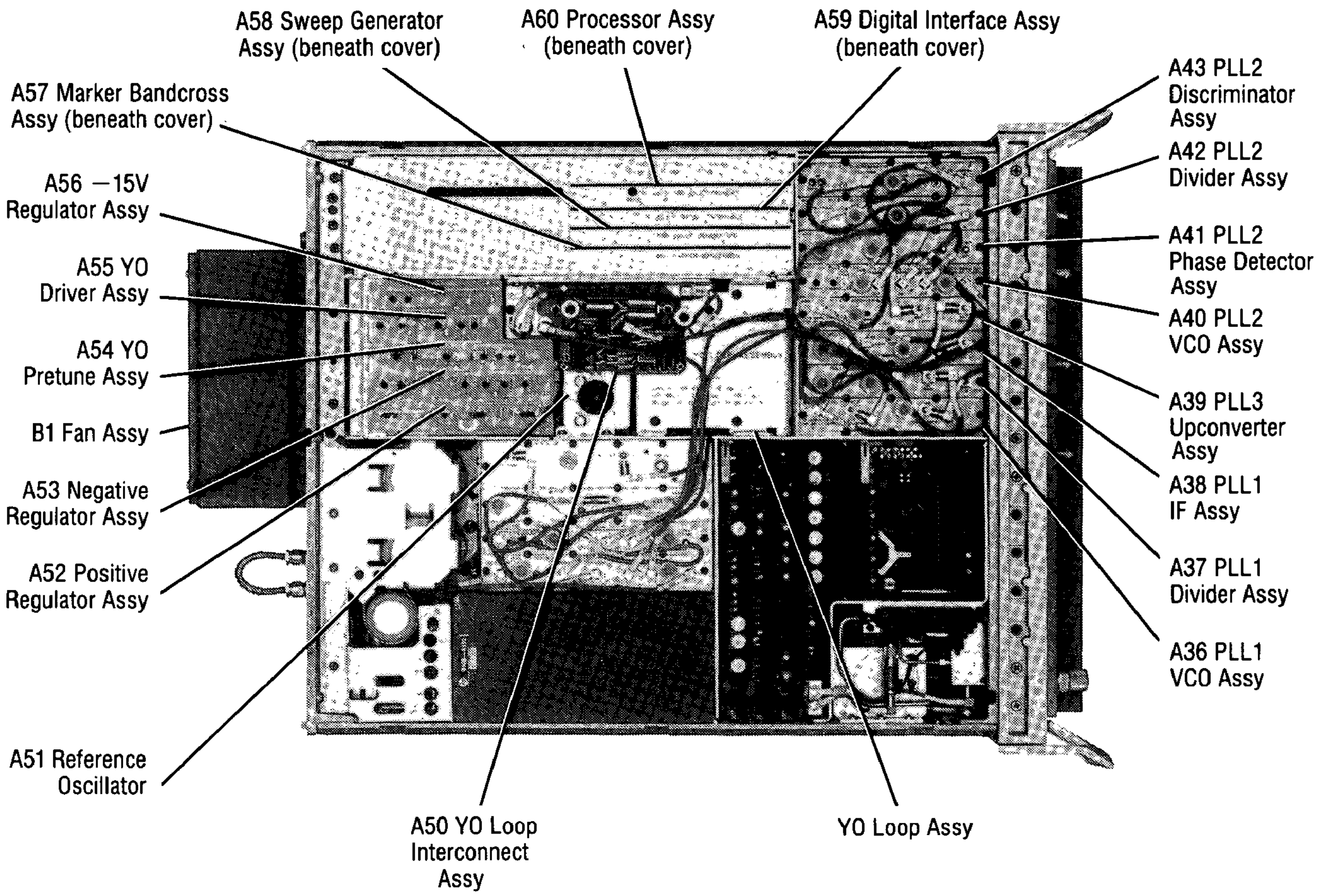
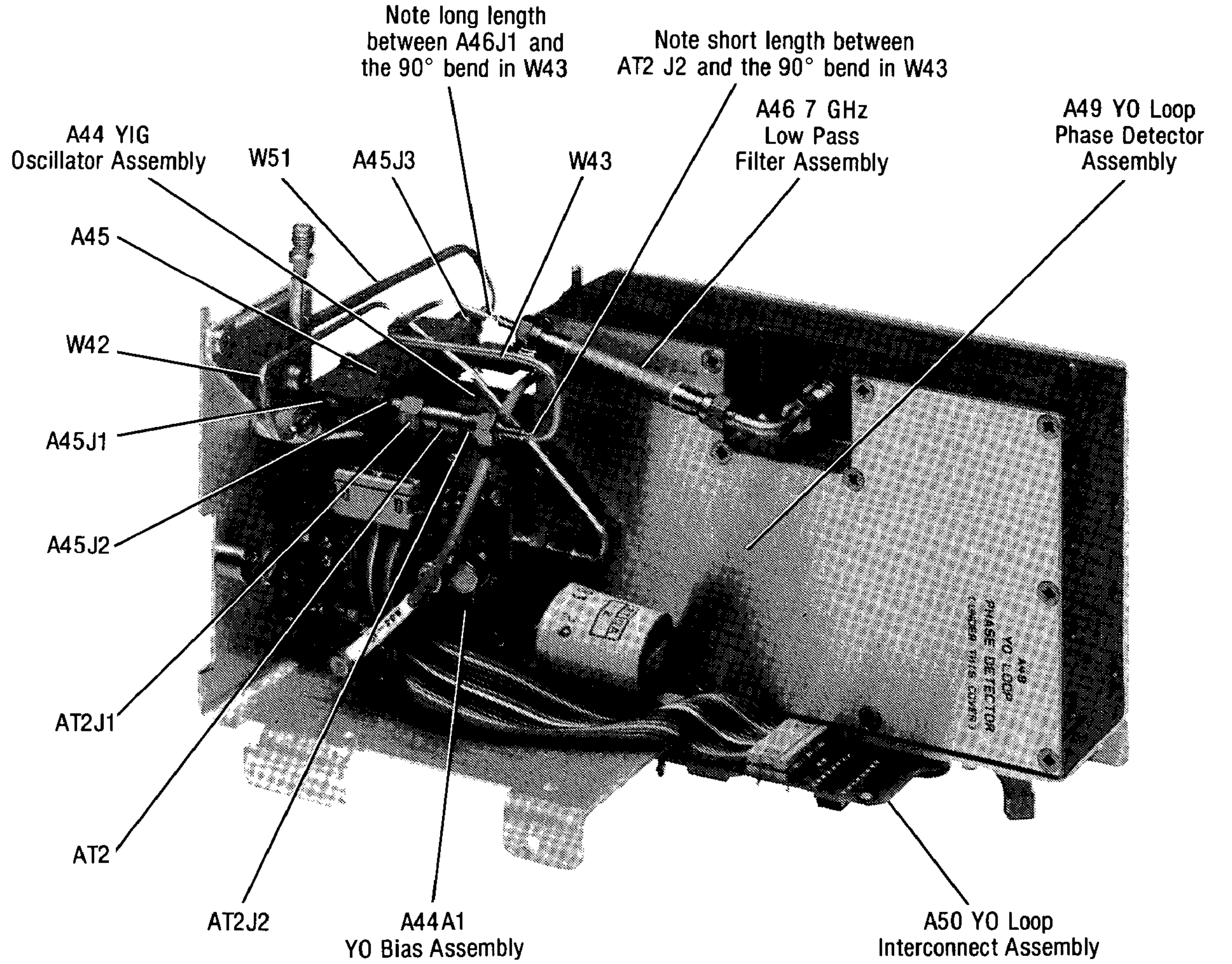


Figure 8F-3. 8340A - Bottom View (3 of 3)



CAUTION: W51 Must be disengaged from W3 before removing the YO Loop from the instrument or damage to these cables will result. Refer to Figure 8I-8, View C, in the RF Section (Volume 4).

Figure 8F-4. YO Loop Assembly (1 of 3)

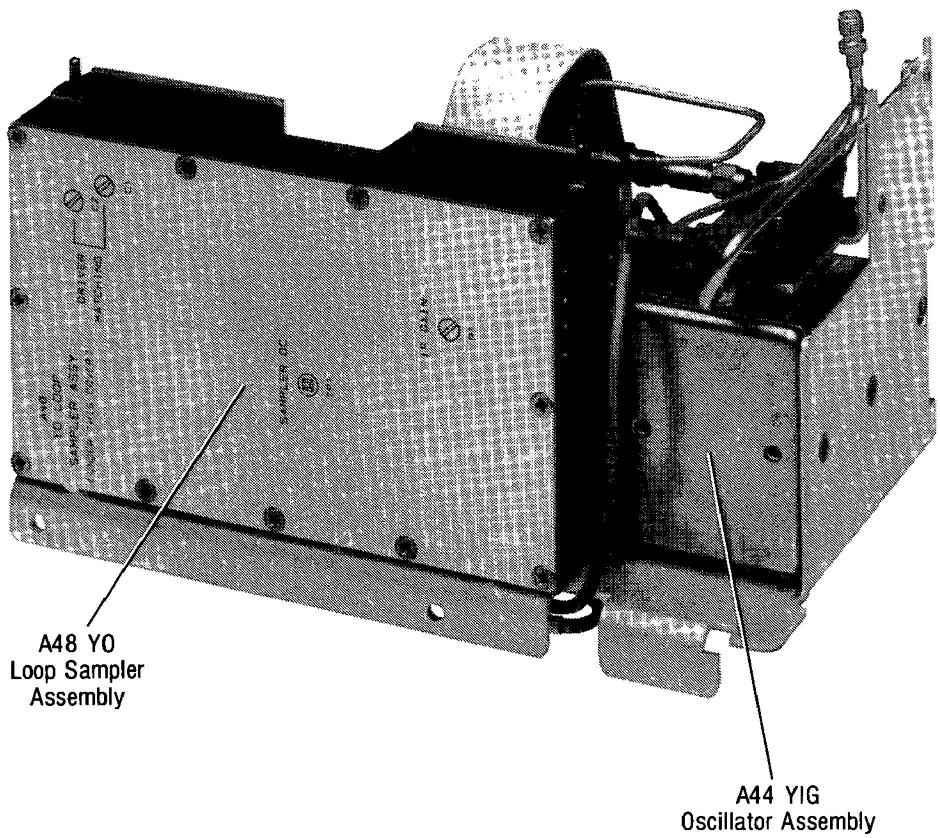


Figure 8F-4. YO Loop Assembly (2 of 3)

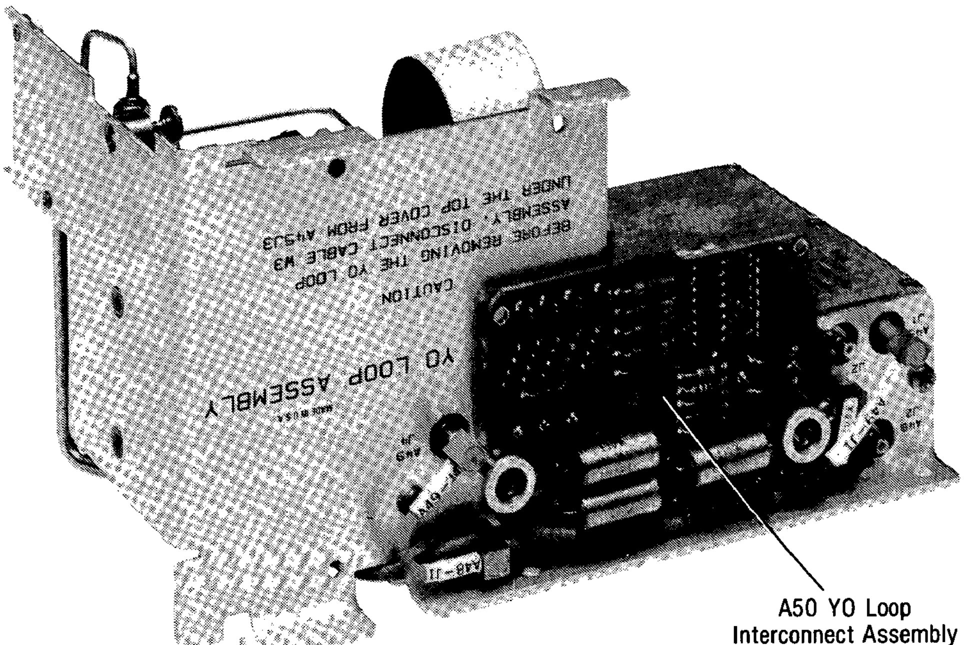


Figure 8F-4. YO Loop Assembly (3 of 3)

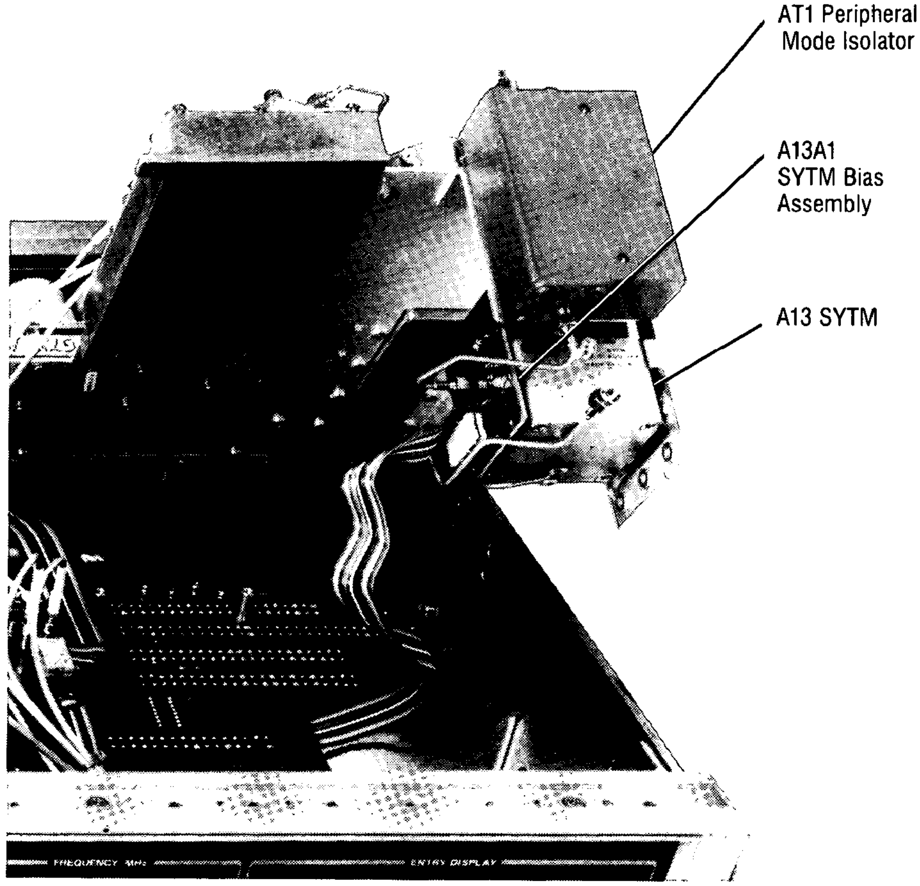
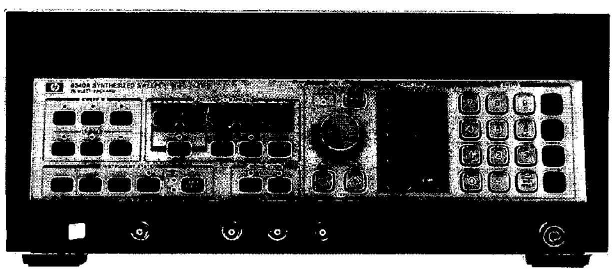


Figure 8F-5. RF Section Swung Out

SERVICE MANUAL

HP 8340A SYNTHESIZED SWEEPER

10 MHz to 26.5 GHz



HEWLETT PACKARD

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

⚠ Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

ϟ Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SAFETY EARTH GROUND

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an autotransformer, make sure the common terminal is connected to the neutral (grounded) side of mains supply.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

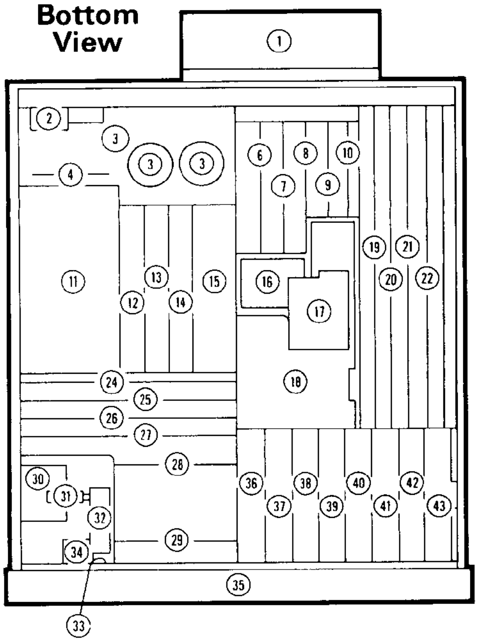
Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

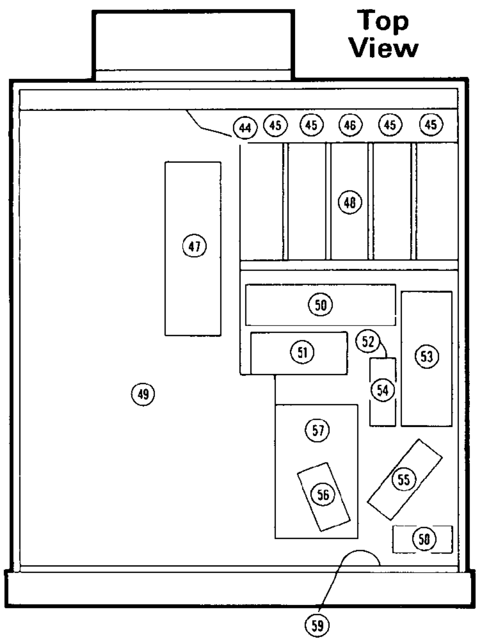
VOLUME 4 TABLES

REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



Top View



Volume 3 / Volume 4

Assy./Ref. Des.	Description	Location	Ref.-M/N Loops	20-30 Loops	Swp. Gen.-YO Loop	Motherboard	Controller	Front/Rear Panel	RF Section	Power Supplies
A1	Alpha Display	33						●		
A2	Display Driver	33						●		
A3	Display Processor	33						●		
A4	Not Assigned	-								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	56							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	31							●	
A12	Band 0 Splitter/Detector	34							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	54							●	
A18	Band 0 Power Amplifier	55							●	
		60							●	
A19	Capacitor Assembly	48								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	28							●	
A25	ALC Detector	27							●	
A26	Linear Modulator	26							●	
A27	Level Control	25							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	15	●							
A33	M/N Output	15	●							
A34	Reference-M/N Motherboard	5	●							
A35	Rectifier	4								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	40		●						
A41	PLL2 Phase Detector	41		●						
A42	PLL2 Divider	42		●						
A43	PLL2 Discriminator	43		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	18			●					
A49	YO Loop Phase/Detector	18			●					
A50	YO Loop Interconnect	17			●					
A51	Reference Oscillator	16	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	10								●
A57	Marker/Bandcross	19					●			
A58	Sweep Generator	20			●					
A59	Digital Interface	21					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	58							●	
AT2	15 dB Attenuator	18			●					
B1	Fan Assembly	1								●
A62C1-3	Power Supply Filter Capacitors	3								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

CONTROLLER SECTION G

CONTROLLER
INTRODUCTION

The controller functional group consists of three assemblies:

A57 Marker/Bandcross board
A59 Digital Interface board
A60 Processor board

The following service information contains the theory of operation, schematic diagrams, component location diagrams, and troubleshooting information for all of these boards. A table of contents on the binder tab that precedes this section shows the organization of this information.

Several troubleshooting approaches are documented in this section, including:

Self Test
Direct addressing of I/O devices
by front panel key entries. (Direct I/O Addressing)
Checks of individual circuitry

The troubleshooting information in the A60 Processor board service section describes all of these procedures as they apply to the entire functional group, and this is where you should begin. The troubleshooting information in the service section of the other boards applies only to the individual boards.

The first troubleshooting test should always be the 8340A's self test that is run automatically either at power-on, or following an instrument preset.

The second troubleshooting step is to observe the 16 LEDs on the A60 Processor board. A fault diagnostic table that interprets these LEDs is contained in the A60 Processor board troubleshooting section.

The direct I/O method of troubleshooting is useful when other, non-controller group boards are contributing to the service problem; direct I/O methods can check boards throughout the instrument. These methods are described in the general troubleshooting information found at the beginning of Section VIII in the Service Introduction. The A60 Processor troubleshooting section, as mentioned above, has a truncated version of this same information.

THEORY OF OPERATION

CONTROLLER SECTION - OVERALL DESCRIPTION

The controller group contains 3 PC boards:

A57 Marker/Bandcross board
A59 Digital Interface board
A60 Processor board

The A60 Processor will still operate if the A57 and A59 boards have been removed from the instrument.

The HP 8340A has a 16-bit I/O data bus (DB 0-15) and a 5-bit I/O address bus (ADR 0-4) which runs throughout the instrument. The I/O data bus is bidirectional, it sends and receives data from the instrument's various digital circuits.

The **|INSTR PRESET|** key on the front panel activates the Low-Instrument-PreSet signal (LIPS). The LIPS signal is also generated when the instrument is turned on. LIPS initiates several events in the controller, these are:

Override the A59 board's ability to shut down the processor.
Disable access to RAM.
Reset both the instrument and display processors.
Activates all front panel LEDs as well as the 16 self-test LEDs.
The self test LEDs are located on the A60 Processor board.

When LIPS is released the controller performs a self test containing the following steps:

Instrument processor internal registers are checked.
RAM is partially checked.
ROM is checked.
I/O address bus (ADR 1-5) is checked.
I/O data bus (DB 0-15) is checked.
The checksum of the calibration data is verified.
Refer to the **Calibration Constants** description in the Service Introduction.
The Analog-to-Digital Converter (ADC) is checked.
This circuit is located on the A27 Level Control board. The ADC is essentially an internal voltmeter which allows the instrument processor to monitor several dc levels in the instrument. Examples of these are; Modulation level, sweep voltage, and ALC level.

If the self test was initiated by an **|INSTR PRESET|**, the instrument sets all front panel functions to a *preset condition* and begins operation.

If the power switch was just turned on, a signal called "Hi Power UP" (HPUP) goes low. This signal tells the processor that, after self test is completed, it should restore *previous instrument settings*. The current instrument state, as well as all SAVE/RECALL registers, are stored in battery powered RAM for this purpose.

Processor and Memory Description

The heart of the controller is a 16 bit microprocessor. This processor directly interfaces with RAM and ROM.

Memory consists of the following:

UV ERASABLE PROGRAMMABLE ROM - 32k x 16.
The instruments firmware is stored in this memory as well as default calibration data.

ELECTRICALLY ERASABLE PROGRAMMABLE ROM - 2k x 16.
Protected calibration data is stored here.

RAM - 8k x 16.
Working calibration data and SAVE/RECALL register values are stored in RAM. A backup battery provides power to the RAM for at least one year when the instrument is disconnected from ac mains (or if the processor board has been removed from the instrument).

If the backup power to the ram should fail, working calibration data and SAVE/RECALL register information will be lost. When the instrument is turned on, protected calibration data will be placed in RAM and "CALIBRATION RESTORED" will be displayed in the front panel ENTRY display.

A59 Digital Interface Assembly Description

The digital interface links the processor to the sweep generator, M/N oscillator, and the 20-30 synthesizer. The microprocessor read/write strobes are used to enable either buffers that send data to the processor, or clock registers that store data sent from the processor. Several of these strobes operate registers located on other assemblies. For example, the phase-lock indicators allow the controller to determine which of the instrument's phase-lock loops are unlocked, while the M/N controls are registers that operate the M/N oscillator.

The digital interface connects to the 16-bit data bus (DB 0-15). By use of the LSTP (Low SToP) signal, this assembly has the ability to stop all processor operations. When the processor stops, the green "RUN" LED on the processor board is turned off. LSTP stops the processor when it is not needed, or when it is necessary to eliminate all potential sources of digital noise (e.g. during forward sweeps). When the LSTP signal releases the processor to perform a task, the processor defers processing until it determines that the LSRQ (Low Service ReQuest) signal is low. LSRQ can be sent low by the digital interface or by the front panel processor. Once LSRQ is sensed low it can go high again and the processor will still finish all pending tasks before checking this signal again.

By use of the change detectors and the processor SRQ blocks, the controller responds to the following:

Changes in the UNLOCK or OVEN indicators
Changes in OVERMOD or UNLEVELED conditions
Changes in the "EXTERNAL REFERENCE" switch position.
Any keystroke or RPG activity.

The processor also distinguishes between Power On and Instrument Preset, and responds to sweep events as indicated by the marker bandcross assembly.

A57 Marker/Bandcross Assembly Description

The marker bandcross assembly generates markers, controls the start and stop sweep points, and determines bandcrossing points. The marker/bandcross board also provides the front and rear panel sweep signal as well as several other rear panel interface signals. The sweep-event memory stores numbers that correspond to voltages on the 0-10 volt sweep signal. Each number stored in the memory represents a single sweep event. Sweep events are detected by the sweep comparator, which compares them against the 0-10 volt sweep ramp. Sweep events include:

Turning markers on and off.
Stopping the sweep for a bandcrossing.
Stopping the sweep for the end of sweep and retrace.

The manual sweep DAC is used to offset the sweep-out signal when the instrument is in CW or Manual mode. This DAC is also used as part of an algorithm to find the current sweep position when changes are made in frequency parameters during an analog sweep longer than 300 ms.

The sweep control block provides the capability of starting and stopping the sweep either from the rear panel or by the sweep comparator. CRT Z-axis control circuits provide the capability of blanking the sweep on a display for bandcrossings or retrace. Z-axis control is also used to intensify the display for markers.

The marker/bandcross board uses the LBX (Low Bandcross) signal to stop the analog sweep at positions previously loaded in the sweep event memory by the processor. When LBX is low, the A59 Digital Interface causes the processor to run, allowing the processor to perform the tasks necessary for the sweep to proceed. This will be either at a bandcrossing, or at a retrace at the end of a sweep.

CONTROLLER SECTION

TROUBLESHOOTING TO ASSEMBLY LEVEL

The controller functional group consists of the A57, A59, and A60 assemblies. Troubleshooting this section should begin by going to the Overall Instrument Troubleshooting guide in the Service Introduction. There are generally three levels of troubleshooting for these boards.

Self Test
The self test is run on Power-On after pressing **[INSTR PRESET]**. Two front panel LED's, CHECK I and II, give a visual indication of the self test results. These indicators, and their meaning, are explained in in the above mentioned portion of the Service Introduction.

Front Panel Initiated Direct I/O Addressing tests
The front panel can be used to write to or read from any I/O device.

Component Level Troubleshooting
Schematic diagrams, circuit theory, and troubleshooting information are provided.

The component level troubleshooting section associated with the A60 Processor board has the majority of the Controller functional group assembly level troubleshooting. Therefore, some diagnostics for A57 and A59 are also included in this section.

Problems in either the A57 Marker/Bandcross or A59 Digital Interface assemblies show up indirectly in other areas of the instrument's operation. Therefore, most troubleshooting for A57 and A59 should be done first through the overall instrument troubleshooting guide (located in the Service Introduction).

REPAIR PROCEDURES

BATTERY A60B1 REPLACEMENT

A60B1 (HP Part Number 1420-0331) provides backup power to the instrument's RAM IC's. This RAM holds working calibration data and the SAVE/RECALL register values. When the battery is defective or replaced, the above information will be lost. However, as soon as the instrument is reassembled and turned on, the protected calibration data stored in EEROM will be retrieved and placed in RAM. "CALIBRATION RESTORED" will be displayed in the instrument's ENTRY display

This battery will provide backup power for at least two years, and has a shelf life exceeding 10 years. It is not rechargeable.

NOTICE

A60BT1 has a strong outer case. The case has been shown to remain intact even when the battery is shorted or forcibly charged at a rate not exceeding 50 ma. However, if the battery is abused mechanically, electrically, or thermally, the following warning should be taken into account.

WARNING

This battery contains Lithium and Thionyl Chloride ($SOCL_2$), the latter in liquid form. If abused, this battery represents a fire, explosion, and severe burn hazard.

Lithium can burn or explode on contact with moisture in the air or water.

Thionyl Cloride is highly toxic, and on contact with air will partially break down into Hydrochloric acid and Sulfur Dioxide fumes which are also toxic and are extremely repulsive, strongly irritating, and are corrosive to the eyes, skin, lungs, and mucous membranes. CONTACT A POISON CONTROL CENTER OR DOCTOR IMMEDIATELY if a person comes in contact with or breathes this material.

Do not attempt to charge this battery, as this may cause it to rupture.

Do not damage or attempt to open the battery.

Do not heat above 212 degrees Fahrenheit (100 degrees Celsius), expose contents to water, or incinerate. Determine if state and local laws require disposal of Thionyl Chloride or Lithium in a chemical waste disposal site, or return the battery to the Hewlett-Packard Company, 1412 Fountaingrove Parkway, Santa Rosa, Ca. 95401, Attention: Environmental Engineering Department.

Batteries that are dead have converted most of the Lithium and Thionyl Chloride into non-toxic chemicals.

Replacement Procedure

CAUTION

The assembly mentioned below contains static sensitive components. Any work performed on instrument PC board assemblies should be done at a work station equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to earth ground of no less than 1 Megohm and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and statutes. When handling a PC board always hold it by the edges. Never touch the finger contacts.

1. Disconnect ac mains from the instrument. Wait three minutes before proceeding to step 2.

2. Remove the instrument's top cover and remove the A60 Processor board. Refer to the front of any Service Section tab for an assembly location guide, if necessary, to locate this assembly.

3. Remove the battery and dispose of it in a safe manner, i.e. do not damage or incinerate it. This battery is not rechargeable. Do not attempt to charge it or internal pressure may cause it to rupture. Measure the voltage of the new battery before installing it. The voltage should be about 3.6 Vdc. Test the battery by placing a 10K Ohm resistor across it and measuring the voltage output. The voltage should not drop to less than 3.4 Vdc. If the battery is within voltage tolerance, install it. **Do not set the A60 Processor on bare metal as this may short out the new battery, possibly damaging it.**

4. Reinstall the A60 Processor board. Replace the top cover and turn the power switch ON. "CALIBRATION RESTORED" will be displayed in the front panel ENTRY display.

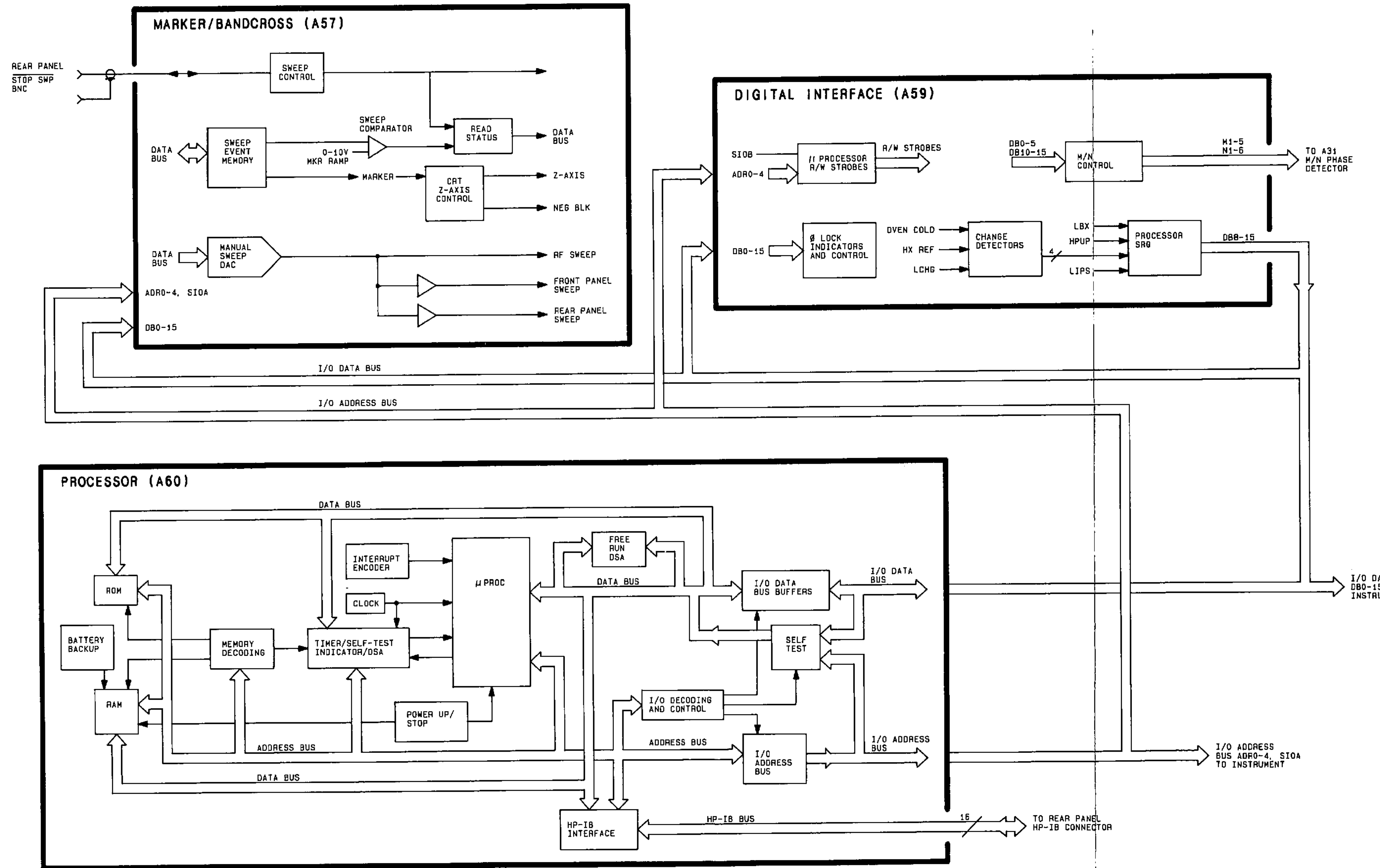


Figure 8G-1. Controller Section Simplified Block Diagram

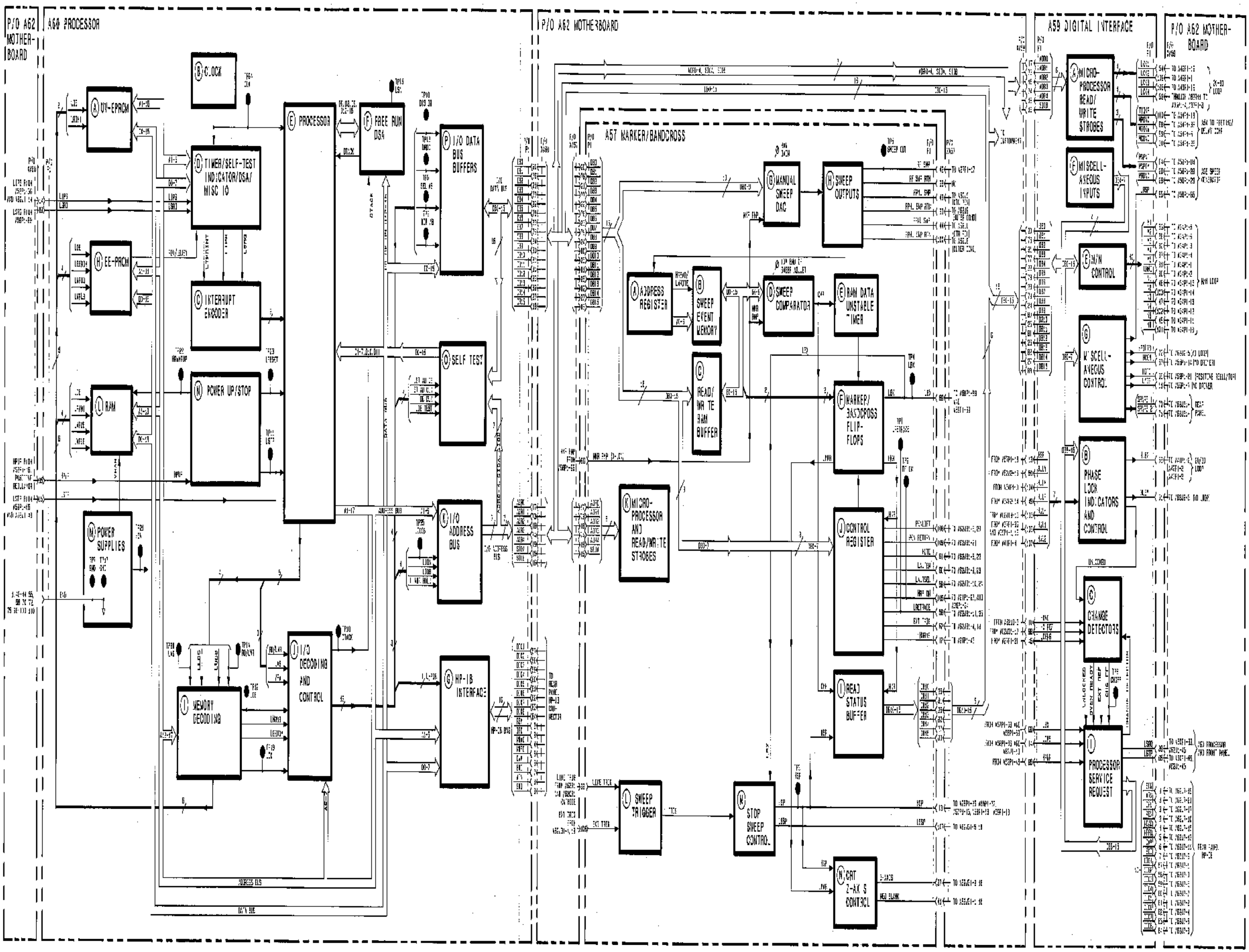


Figure 8C-2. Controller Section Block Diagram

8-4378-438

A57 MARKER BANDCROSS ASSEMBLY, CIRCUIT DESCRIPTION

INTRODUCTION

The A57 Marker Bandcross board generates the Z-axis signal required to place intensity markers on a CRT. If enabled by the front panel, amplitude markers will be generated by sending a marker signal to the leveling circuits. The same circuits that detect markers are used to detect band crossings or the end of sweep. These circuits will cause the sweep to be stopped and the microprocessor to be activated. Other circuits interface with rear panel interface connections. Hardware on this board is used during self test to verify the operation of the 16-bit microprocessor data bus.

SWEEP EVENT DETECTION (BLOCKS A, B, C, D, E, AND F)

A sweep event is a Marker, a Band Crossing or the End of Sweep. Prior to the beginning of a sweep, the microprocessor will store in the Sweep Event Memory (Block **B**) a series of numbers which correspond to all the sweep events that are to take place during a sweep. These numbers are loaded in the following manner:

1. The processor sets the Address Register (Block **A**) to 0 (i.e., sets DB0-6 to zero then outputs address 12,R3:)

2. The processor writes into the Sweep Event Memory (Block **B**) a series of numbers corresponding to the sweep events. The Address Register (Block **A**) is automatically incremented after each write to memory (address 12,R0: to U1 pin 5).

3. The processor sets the Address Register (Block **A**) back to 0.

Before a sweep begins, the processor determines how many sweep events there will be in the sweep. For example, for a sweep containing one bandcrossing and a marker, there would be four sweep events: two for the marker, one for the bandcrossing, and one for the end of sweep. The processor then computes at what point in the sweep each event occurs and converts this information to a number from 0-999 which corresponds to the 0-10V sweep. This series of numbers is written into the Sweep Event Memory (Block **B**) via data lines B0-B9. When the Address Register (Block **A**) is set to location 0, the first number stored in the memory appears at the input of the Sweep Comparator DAC U3 (Block **D**). The DAC converts this number to a voltage between 0-10V. This voltage is not available at the output of U3 but is compared internally to the MKR RMP (marker ramp) 0-to-10V signal. When the MKR RMP rises to a voltage equal to the value at which the DAC is set, the output of U3 (pin 15) will fire comparator U6, and the first sweep event occurs. This causes the Marker and the Bandcross flip flops (Block **F**) to be clocked. The data stored in the flip flops and taken from data bits 10 and 11 of the RAM (Block **B**, U15) determines what kind of sweep event will occur. A marker is created by two sweep events. The first event turns the marker on; the second turns the marker off. Markers are 1/1000 of the display width. When a user attempts to change one of the frequency parameters in the middle of a slow sweep (300 ms or longer), the Sweep Event Detection circuitry (combination of Blocks **A** through **F**) determines the position of the sweep, allowing the instrument to phase-lock to a frequency appropriate to the current sweep position. For faster sweep times, the instrument will wait until the beginning of the next sweep to make frequency changes.

ADDRESS REGISTER A

U1 and U10 comprise a 6 bit counter register. The counter is preset when the microprocessor writes to I/O address 12,R3: via U1 pin 11. The Address Register can be counted or incremented two ways: first by the microprocessor writing to I/O address 12,R0:, and secondly when timer U5B (Block **E**) fires. The signal from U5B indicates that a sweep event has occured and that the Sweep Event Detection circuitry (Blocks **A** through **F**) should get ready for the next sweep event. The outputs of the Address Register (A0 through A6) are used to address the Sweep Event Memory (Block **B**).

SWEEP EVENT MEMORY B

U2 and U15 are RAMs each containing 128 8 bit bytes. They are combined to provide 128 16 bit words of memory. Sweep events are stored into the RAM when the microprocessor does a write to I/O address 12,R0:. U8 and U16 (Block **C**) are buffers through which the microprocessor reads or writes RAM data. The RAM is addressed by the Address Register (Block **A**). In normal operation of the instrument, only about 15 of the 128 words of RAM are used. Each location used corresponds to a single sweep event that is to occur during the sweep. The RAM has stored in it, the position along the sweep where each event is to occur, as well as informaton indicating what kind of sweep event each one is.

READ/WRITE RAM BUFFER C

U8 and U16 make a 16 bit bidirectional buffer which connects the microprocessor with the Sweep Event Memory (Block **B**). When the microprocessor sends I/O Address 12,R0:, the buffer transfers data from the instrument data bus (DB0 thru DB15) to B0 thru B15. When the microprocessor sends I/O Address 12,R2: data is transfered the opposite direction (i.e., from the Sweep Event Memory to the microprocessor).

SWEEP COMPARATOR D

U3 is a 10 bit DAC which compares the 0-to-10V MKR RMP (marker ramp) to the binary number placed at its input by the Sweep Event Memory (Block **B**). The MKR RMP (0-10V) is connected to the V-Feedback input of U3 (pin 16). At the beginning of a sweep, the output of the DAC will be below 0 volts. When the voltage applied by the MKR RMP (0-10V) is equal to the corresponding digital number at the DAC's input, the output will go above 0 volts. Comparator U6 is set to trip when the output of the DAC rises above 0 volts. For example if a Sweep Event is to occur at mid-sweep, the following conditions would exist: the DAC would have the number 500 decimal or 111110100 binary placed at its digital input. Before the Marker Ramp gets to 5 volts, which represents the exact middle of the sweep, the DAC output would be below 0 volts and Comparator U6 output (pin 7) would be LOW. As the MKR RMP approaches 5 volts, the output of the DAC would approach 0 volts. When this occurs, the comparator will fire, causing its output to go HIGH. When the comparator fires, R28, R26 and R27 cause a 2 mV offset to be made to the positive input of the comparator (pin 2). This ensures that the comparator that just fired will not change states due to noise on the MKR RMP. R32 (10V END OF SWP ADJ.) is adjusted to make the end of sweep voltage equal 10.000 V.

RAM DATA UNSTABLE TIMER E

This circuit debounces the output of the Sweep Comparator (Block **D**) and causes the Address Register (Block **A**) to be incremented after each sweep event has been detected. U5B is triggered by the comparator firing and outputs a 700 ns pulse. The pulse sets timer U5A and also clocks the Marker/Bandcross Flip-Flops (Block **F**). Timer U5A resets after 5.7 us and is used to keep Timer U5B from being fired again until the circuits in Blocks A, B, C, and D have had time to settle following a sweep event. U20B controls the reset input of Timer U5B. The inputs of U20B are used to disable the timer. pin 5 of U20B is connected to U12B pin 6 (Block **M**) and is HIGH when the sweep is stopped. This keeps the timer from firing after the sweep has been stopped. pin 6 of U20B is controlled by the microprocessor through register U18 (Block **L**). This is set HIGH to disable the timer when the instrument does its self-test.

MARKER/BANDCROSS FLIP-FLOPS F

U11B and U11A are used to store B10 and B11 from the Sweep Event Memory (Block **B**). These two signals indicate what kind of sweep event is to take place. Bit 10 is connected to U11B pin 12 and sets the state of the MKR control line connected to its output (pin 9). When a Bandcrossing occurs the sweep will be stopped so that the microprocessor can initiate phase-lock for that bandcrossing. This is done by the LBX signal. When a Marker occurs, the sweep is not stopped and the marker is generated as the sweep progresses.

MANUAL SWEEP DAC G

The manual sweep DAC U4 is used only in MANUAL SWEEP mode. A binary number between 0-1000 is written to the DAC. The digital input of the DAC is connected to registers U9 and U17. The microprocessor is connected to U9 and U17 via the I/O Data Bus. Data is clocked into these registers by strobe 13,R2: (Block **K**). In MANUAL SWEEP mode the MKR RAMP should always be at 0 volts. The U4 DAC converts its digital input to a voltage (0 to -10 V) at its output, U4 pin 15. The Op Amp, U7, will invert this signal to provide the 0 to +10V SWEEP OUT at TP5 (Block **H**).

The SWEEP OUT of Block **G** (U7 pin 6) is the result of either the manual sweep DAC, U4, when MANUAL SWEEP mode is selected, or the MKR RAMP when MANUAL SWEEP is not selected.

When the instrument is not in MANUAL SWEEP mode the input of the DAC is set to 0 by the microprocessor and the MKR RAMP is simply buffered by Op Amp U7.

The MAN GAIN (manual gain) adjustment, R33, is adjusted to obtain 10.000V at the sweep output when in MANUAL SWEEP and the manual frequency is set to the maximum possible value for a given sweep. For example: Set R33 to obtain 10.000V at TP4 when MANUAL SWEEP is on and the rotary knob is turned clockwise until the manual frequency is equal to the STOP frequency.

SWEEP OUTPUTS H

The SWEEP OUT is buffered by U30 and U27 which are connected to the front and rear panel Sweep Output connectors. Floating grounds are needed to eliminate ground loops which would cause 60Hz signals to appear on the sweep outputs. The front and rear panel sweep output connectors are floating. Any low frequency noise found on the floating front or rear panel sweep output connectors is connected by the RTN lines to the non inverting inputs of the buffer Op Amps. This allows the Op Amps to sense and remove this unwanted noise. C21 and C22 are provided to eliminate high frequecy noise.

READ STATUS BUFFER I

Buffer U24 enables the processor to monitor the state of the following signals by doing a read from I/O address 12,R1:

1. The Sweep Comparator (CMP) pin 12

2. The Marker flip flop (MKR) pin 14

3. The High Sweep (HSP) line, pin 2

CONTROL REGISTER J

Register U23 enables the processor to directly control the state of the various interface lines connected to the register. This is done when the microprocessor writes data to I/O address 13.R3:. The data is then available continuously at the output of the register.

AND gate U29A is used to control the RF Marker signal. When the RF Marker signal is HIGH, it causes the RF Power Control circuits to slightly increase the RF power. This is used as a marker. U29A pin 1 is used to turn this feature on or off.

MICROPROCESSOR READ AND WRITE STROBES K

The instrument processor outputs I/O address information on the I/O Address Bus (ADR0 thru ADR4 plus ADR5 which becomes SIOA). U28 decodes the address and generates the appropriate strobe.

These strobes are used throughout this assembly to either clock registers causing them to store data found on the I/O data bus or to enable buffers to place data on the I/O data bus so that the Microprocessor can read it.

The outputs of U28 are LOW true pulses of about 500 ns.

SWEEP TRIGGER L

Multiplexer U19 selects either LINE or EXT (external) trigger when the processor outputs the appropriate bits to the instrument Data Bus (DB 10 thru DB 13), and U28 outputs address 13,R0: (Block **K**). The output of U18 pins 5 or 7 will select the appropriate U19 input (i.e., U18 pin 7 HIGH selects Line Trigger, U18 pin 5 HIGH selects External Trigger). U18 pin 10 is used to disable the RAM Data Unstable Timer (Block **E**).

The ZON (Z axis ON) line is also controlled by U18 in a similar manner. The ZON signal when HIGH will force the Z-Axis line (Block **N**) to be +5V. U25 is a 3 to 8 decoder which generates 500 ns pulses at its output each time the microprocessor writes to I/O address 13,R1:. By writing appropriate numbers to this register, the following events can occur:

- Start the Sweep (U25 pin 11)
- Stop the Sweep (U25 pin 12)
- Trigger Enable (U25 pin 10)
- Clear the Bandcross Flip-Flop (Block **F**), (U25 pin 15).

U26B pin 9 is used to stop the sweep, or keep it stopped when it has already been stopped by a sweep event. The sweep is stopped when the signal is LOW.

STOP SWEEP CONTROL M

The sweep can be stopped by any of the following:

1. The Bandcross signal (LBX) applied to U12B pin 5 from the Sweep Event Detection (Block **F**).
2. The Bandcross signal (LBX) applied to U12B pin 5 when driven LOW by the Sweep Generator board. (NOTE: This will only occur if the Marker Bandcross board fails to stop the sweep before it gets to 12 volts.)
3. The Sweep Trigger (Block **L**, U12B pin 4) is told to stop by the processor.
4. The Low Stop Sweep (LSSP) BNC on the rear panel is held LOW.

The Low Stop Sweep (LSSP) is an IN/OUT signal. As an input signal, LSSP is applied to U12C pin 9 and is used to generate HSP. As an output signal, it is taken from U13A pin 1 which is an open collector line pulled up to +5V.

The HSP signal goes to all devices in the instrument that need to respond to the sweep starting and stopping.

CRT Z-AXIS CONTROL N

The Z-AXIS signal is normally used to drive the Z-axis input of a CRT display. When this signal is 0 volts, the display will turn its beam on with normal brightness. When it is at +5 volts, the display turns its beam off (ie. blanks). When it is at -5 volts, the display intensifies its beam. The 8340A Z-AXIS signal may be used to turn the display off for bandcrossings, when the sweep is being reset (sweeper retrace), or at other times when the instrument is waiting for a sweep to start. Z-AXIS is also used to show markers by brightening the display. During all other times the Z-AXIS output is at 0 volts.

U21 is a TTL NOR gate. The outputs (U21C and U21D) are pulled up to +5 volts in the high state by R37 and R38. U21B is used to provide Op Amp U14 with a LOW TTL reference voltage. U21D pin 13 is LOW when either HSP or ZON is high. This output is connected thru R19 to Op Amp U14 that will put 0 volts on the NEG BLANK (negative blanking) output. When both HSP and ZON are low, U21D pin 13 will be HIGH and the NEG BLANK output will be at -5 Volts. When U21 pins 10 and 13 are both LOW the Z-AXIS will be 0 Volts. When pin 10 is HIGH and pin 13 is LOW Z-AXIS should be -5 Volts. Pins 10 and 13 should never both be HIGH in normal operation. When pin 10 is LOW and pin 13 is HIGH, Z-AXIS should be +5 Volts. VR1, VR2, and VR3 provide protection against a DC voltage that might be applied to the output connector. C23 and C24 provide frequency compensation to keep the Op amps stable.

INTERFACE SIGNALS

1. 8410B INTERFACE: The following signals from this board are needed when the 8340A is connected to the 8410B:

    a. 0-to-10v SWEEP (Drives the X-axis of the Display)
    b. STOP SWP (Allows the 8410B/C to stop the Sweep)
    c. NEG BLANK (Does Display blanking)
    d. Z-AXIS (Used to generate markers on the Display)
    e. 8410 EXT TRIG (Used to initiate 8410B/C to phase-lock every time the 8340 phase-locks i.e., new CW frequency or start of sweep.)

2. 8755C INTERFACE: The following signals from this board are needed when the 8340A is connected to the 8755C and it is desired to use ALTERNATE SWEEP:

    a. 0-to-10V SWEEP (Drives the X-axis on a Display)
    b. Z-AXIS (Controls Blanking and Marker generation)
    c. LALTEN (Low indicates Alternate Mode Enabled)
    d. LALTSEL (Low indicates Alternate State Active)
    e. LRETRACE (Low indicates Retrace used to synchronize with the start of sweep)

3. PLOTTER INTERFACE:

    a. MUTE bar (Used to freeze the servo for Bandcrossings)
    b. PEN LIFT (Used to raise the pen for retrace and, optionally, for bandcrossings)
    c. 0-to-10V SWEEP (Used to drive the X-axis)

A57 MARKER BANDCROSS ASSEMBLY, TROUBLESHOOTING

CHECKING MICROPROCESSOR I/O ADDRESS STROBES

U28 (Block **K**) is connected to the I/O address bus and generates all of the I/O strobes used on this assembly. The strobes on the output of U28 can be checked using the front panel to write directly to U28's I/O address while monitoring the IC's outputs. This would be done as follows: Press **[INSTR PRESET]**, then **[MANUAL]** sweep key. Connect a Logic probe to the output that is to be checked. At the front panel, enter the corresponding I/O address. The I/O address is written on the lines connected to the output of U28. For example, the WRITE RAM signal is marked, 12,R0:. The number 12 is called the CHANNEL and the number 0 is called the SUBCHANNEL. This is entered in the front panel as follows: **[SHIFT] [GHz] [1] [2] [Hz]** - setting the I/O channel and **[SHIFT] [MHz] [0] [Hz]** - setting the I/O subchannel. Once this has been done, Press **[SHIFT] [KHz]**. Make entries by pressing the step keys, using the RPG or by making data pad entries. Each entry will cause the WRITE RAM strobe to be generated. This will be a LOW True signal, approximately 500 ns wide, that can be monitored with the logic probe. It can also be seen on a storage scope. Refer to "Direct I/O Addressing" in Section VIII, Service Introduction, for more informaion.

CHECKING MICROPROCESSOR OUTPUT DEVICES

The following devices are microprocessor output devices: U1, U10, U8, U16, U18, U25, U9, U17 and U23. These can be checked by using the front panel to write directly to the I/O addresses as described above. To do this, the I/O channel and subchannel must be entered at the front panel. These numbers can be found by reading the I/O address from the schematic on the write input of the device. After the address has been entered, Press **[SHIFT] [KHz]**. Entries can now be made directly to the device you are interested in. Monitor the outputs at the same time you enter numbers that will affect the signals of interest. For example, if the signal of interest is taken from DB2 of the I/O data bus, enter the number 0 and observe the register output; it should go LOW. Then enter the number 4 and observe that DB2 goes Hign. Note that if U8 and U16 are being checked, the outputs are only valid during the time the write strobe is LOW. Note that the instrument should be in MANUAL sweep mode so that the normal operation of the instrument does not cause the devices being tested to be written into.

CHECKING MICROPROCESSOR INPUT DEVICES

Input devices can be checked in a similar manner as the output devices. The front panel is used to set up the I/O channel and subchannel as before. U24, U8, and U16 are the only input devices on this assembly. After setting the correct address on the front panel, press **[SHIFT] [Hz]**. Each time **[Hz]** is pressed, the instrument will read from the addressed I/O device and display the results in the entry display in both decimal and octal formats. By shorting each input of the input devices to +5v or ground, each input can be checked.

VERIFICATION

Power On Checks

When the 8340A goes through Power On or Instrument Preset, the Marker Bandcross board is partially checked out. The instrument processor uses the circuitry in Blocks **A**, **B**, **C**, and **K** to verify the I/O data bus. This is done by sending data to the Sweep Event Memory (Block **B**) and then reading it back. In this manner, it can determine if any of the 16 data bits are open or shorted. If the Instrument Check light II goes off following Power On or Instrument Preset, this indicates that the above test has passed.

If the light is on, a problem is indicated. Further information about the problem can be obtained by decoding the 16 self test LEDs on the processor board. (Refer to the A60 Processor board documentation). When the Marker Bandcross board is removed from the instrument, the front panel Instrument Check light II should go on indicating that this test has failed.

Isolating the Problem

To help verify that the problem is on the A57 MARKER/BANDCROSS board, it may be usefull to remove the A57 assembly and observe the instrument behavior. With A57 removed, the following should occur:

1. Following Power ON or Instrument Preset, Instrument Check light II should stay on and instrument Check light I should go off. All 16 self test LEDs on the processor board should remain on.

2. When sweeping, the sweep should stop at 12 volts before resetting. NOTE: the sweep will not be measurable at the front or rear panel connectors since the buffers for these signals are on the A57 board which has been removed. The sweep can be checked on the A58 Sweep Generator.

3. The instrument should lock up properly in CW or MANUAL and perform normally except for the absence of sweep output and display blanking.

4. In a multi band sweep, bandcrossings will all occur when the sweep gets to 12 volts instead of the correct places.

SWEEP DETECTION CIRCUITS: (Blocks A through F)

Verification of Blocks A Through F

Press the following controls: **[INSTR PRESET] [SWEEP TIME] [2] [0] [SEC] [SHIFT] [M2]**. Observe the left most front panel display. This should indicate the band number as the instrument goes from band to band. Observe that the green SWEEP LED goes out at band crossings. If the numbers are not changing, this indicates that LBX (Block **F**) is not being generated. If the numbers seem to rapidly count from 1 through 5 , this indicates that LBX (Block **F**) is not being pulled LOW as it should when the sweep progresses. LBX is the main output of the SWEEP DETECTION circuits.

Troubleshooting Blocks A Through F

Once deterimined that the problem is in Blocks **A** through **F**, perform the following tests:

Block **D**:

1. Press the following keys: **[INSTR PRESET] [delta F] [1] [Mz] [SWEEP TIME] [1] [0] [sec]**.

2. Verify that U3 pin 16 has a 10 second 0-to-10V ramp present.

3. Check the B9 through B0 inputs of DAC U3 for the following: (B9) 1 1 1 1 1 0 1 0 0 0 (B0).

4. U3 pin 15 should be below 0 volts until the sweep gets to 10 volts. As the sweep rises above 10 volts, the voltage at pin 15 should rise above 0 volts, and comparator U6 should fire, forcing CMP (U6 pin 7) HIGH for about 50 ms.

Block **E**:

1. Press the following keys: **[INSTR PRESET] [delta F] [1] [MHz]**.

2. Trigger a scope on the rising edge of CMP (U6 pin 7) and observe that U5B should have a 700 ns positive pulse at pin 5 and an inverted identical pulse at pin 12.

3. Observe that each time U5B fires, U5A should also fire, creating a 5.7 us positive pulse at U5A pin 13.

4. Make sure that U5B pin 11 is not stuck LOW. It should only go LOW when the 8340A is not sweeping.

Block **F**:

1. Press the following Keys: **[INSTR PRESET] [START FREQ] [1] [GHz] [STOP FREQ] [1] [3] [GHz] [SWEEP TIME] [1] [0] [0] [msec] [M1] [8] [GHz] [M2] [1] [1] [GHz] [MKR delta]**.

2. U11B pin 9 MKR should be a HIGH for 30 ms, then LOW for about 100 ms repetitively.

3. U11A pin 5 should go HIGH for about 50 ms when the SWEEP OUT TP5 gets to about 4 volts. When the SWEEP OUT gets to 10 volts, there should be another 50 ms pulse.

4. U11A pin 1 should have a single 500 ns pulse applied by U25 at the end of each sweep. If not present, check U25 (Block **L**) using direct I/O addressing. Refer to the direct I/O addressing description in the Service Introduction.

Block **C**:

Bi-directional buffers U8 and U16 are thoroughly verified by the Instrument Preset/Power On tests. If Instrument Check Led II is off, the buffers are good. Use direct I/O addressing to verify that data can be sent from DB0-DB15 to B0-B15. To verify the other direction from B0-B15 to DB0-DB15, do the following:

1. Press **[INSTR PRESET]** then **[SINGLE]** SWEEP. Do a read from address 12,R2: (reads sweep event from RAM). Press **[SHIFT] [GHz]**, enter address **[1] [2]** and press any terminator (i.e., **[GHz]**, **[MHz]**, **[kHz]**, **[Hz]**), press **[SHIFT] [MHz]**, enter subchannel **[2]**, press any terminator, press **[SHIFT] [Hz]** (read).

NOTE

Pressing [SHIFT] [XTAL] will cause the 8340A to pause at the next band crossing. Pressing [SHIFT] [Hz] may read a different value. Then press [SHIFT] [INT] to advance to the next band crossing and [SHIFT] [Hz] to read.

2. The entry display should show an octal number and its decimal

equivalent. Convert the octal number to binary. This is the number that should be setting on B0 through B15. It is important to realize that in order for B0 through B15 to be correct, the SWEEP EVENT MEMORY must have been properly loaded with this number. This loading is done through U8 and U16. It is therefore necessary to first check to see if U8 and U16 can transfer data from the instrument Data Bus to the Marker Bandcross Bus (B0 through B15). Before Replacing U8 or U16, verify that the two I/O strobes 12,R2: and 12,R0 are being generated by U29 (Block **K**). If the problem only involves a few bits, the self test leds on the A60 Processor board can be used to indicate which bits are incorrect. If all leds are on, this indicates that the problem may have to do with Blocks **A, B, E,** or **K.**

Block **A:**

1. Do the following: Press **[INSTR PRESET], [SINGLE] SWEEP, [SHIFT] [XTAL], [SHIFT] [GHz]**, enter **[1] [2]** and press any terminator, **[SHIFT] [MHz]**, enter **[3]** and press any terminator, **[SHIFT] [KHz]** (write), enter **[0]** and press **[Hz]**. This should Clear U1 and U10. Verify that lines A0 through A6 are LOW.

2. Enter the numbers **[1], [2], [4], [8], [1] [6], [3] [2], [6] [4],** using the front panel. These entries should be latched into U1 and U10 and appear on the A0 through A6 lines. For example, when the number 16 has been entered, the A bus should be (A6) 0 0 1 0 0 0 0 (A0).

3. Press **[0] [Hz] [SHIFT] [MHz] [0] [Hz]**. The A Bus should be all LOW. Note that each time a **[STEP]** key is pressed, the number on the A Bus should be incrememted by 1. The numbers should be 0 = (A6) 0 0 0 0 0 0 0 (A0); 32 = (A6) 0 1 0 0 0 0 0 (A0); 15 = (A6) 0 0 0 1 1 1 1 (A0). U29B pin 5 should be HIGH throughout this entire test. U29B pin 6 should follow U29B pin 4.

Block **B:**

Use direct I/O addressing to check that the READ/WRITE RAM BUFFER (Block **C**) is able to place data on the B-BUS (B0 through B15). Use this Test for Block A to verify that the A-BUS can be controlled properly. Make sure that U8 and U16 can read the B-Bus as follows:

1. Press **[INSTR PRESET], [SINGLE]** SWEEP, **[SHIFT] [GHz]**, enter **[1] [2]** and press any terminator, press **[SHIFT] [MHz]**, enter **[2]** and press any terminator, press **[SHIFT] [Hz]** to read, then **[SHIFT] [MHz] [2] [SHIFT] [Hz]**.

2. Alternately short each B-BUS line to + 5V and ground. After each short is made, press **[SHIFT]** **[Hz]**, and note that the octal number in the entry display should indicate the appropriate bit forced HIGH for shorts to +5V, and LOW for shorts to ground.

3. In the above check, if all pass, it should be possible to store and read back numbers in the SWEEP EVENT RAM by doing the following:

   Press **[INSTR PRESET] [SHIFT] [XTAL] [SHIFT] [SINGLE] SWEEP [SHIFT] [GHz] [1] [2] [Hz]**

   Locations in RAM can now be written as follows:

   Press **[SHIFT] [MHz] [3] [Hz] [SHIFT] [kHz]** to write then:

   [a] [a] [a] [Hz] (aaa = RAM address from 0 through 127)

   Then press **[SHIFT] [MHz] [0] [Hz] [SHIFT] [kHz]** to write then:

   [d] [d] [d] [Hz] (ddd = data to be written to RAM)

   It is only necessary to check through address 15. Use the above commands to write into RAM a sequece of numbers. Then verify that the numbers are properly stored in the RAM by pressing:

   [SHIFT] [MHz] [3] [Hz] [SHIFT] [kHz] [a] [a] [a] [Hz] [SHIFT] [MHz] [2] [Hz] [SHIFT] [Hz]

   Note: aaa is the RAM address. The read data from the RAM will be displayed in decimal and octal in the entry display. Verify that it matches the sequence of numbers entered.

VERIFICATION AND TROUBLESHOOTING OF BLOCKS G THROUGH N

The Manual Sweep DAC (Block **G**) and the Sweep Outputs (Block **H**) can be checked simply by putting the front panel in MANUAL and while monitoring the sweep outputs on the front or rear panel turn the rotary control and observe that the voltage is 10 volts when the MANUAL frequency is as high as possible and that it is 0 volts when the frequency is adjusted as low as possible. It should be continuously variable in between. Note: for this test to work, the MKR RAMP must be at 0 volts. This should always be the case in MANUAL sweep.

The Sweep Trigger (Block **L**) can be checked from the front panel. Press **[INSTR PRESET]** and observe the green SWEEP LED. It should be on during the sweep and go out momentarly for each bandcrossing and for the end of sweep. Press the EXT (external) Trigger button, make sure there is no external trigger signal, and observe that the sweep stops. Then use a logic pulser or other means to create a single external trigger. Verify that the instrument makes a complete sweep but does not continue to sweep. To check the line trigger, select **[delta F]** and enter **[1] [MHz]** so the instrument will be able to make 10 ms sweeps. Observe that the sweep repitition rate is slower when in **[LINE]** trigger.

The Sweep Event Detection circuitry can be verified by making the following set up:

> **[INSTR PRESET] [START] [3] [GHz] [STOP] [6] [GHz] [M1] [4] [GHz] [M2] [5] [GHz] [MKR delta] [1]**

Monitor the Sweep Output and the Z-axis signal on a scope. The Sweep Output should stop at 10 volts before being reset for the next sweep. If the sweep goes to 12 volts, something is wrong. Observe the Z-axis signal to see if the **[MKR delta]** is on for the middle portion of the sweep. Now turn off the Delta Marker and observe if two markers are indicated by the Z-axis signal. U6 pin 7 should have a pulse on it for each sweep event. If this does not occur, slow down the sweep to 200 sec and turn all markers off. Measure the inputs of U3 to see if the binary number that is input is correct. It should be 1000 decimal or in binary it should be: (bit 10) 1 1 1 1 1 0 1 0 0 0 (bit 0). This number represents a 10V set point for the comparator.

The Ram Data Unstable Timer (Block **E**) should be checked for the 5.7 us and 200 ns pulse widths. Make this check by clocking a scope on the CMP signal (Block D, U6 pin 7). The instrument should be in Instrument Preset state.

If U2 and U15 are suspected, A0 through A6 can be checked via DSA using the I/O data test found with the A60 Processor documentation. If these signatures are incorrect, make sure that the Ram Data Unstable Timer (Block **E**) is not clocking the Address Register. This should be disabled by putting the instrument in MANUAL sweep while performing the test.

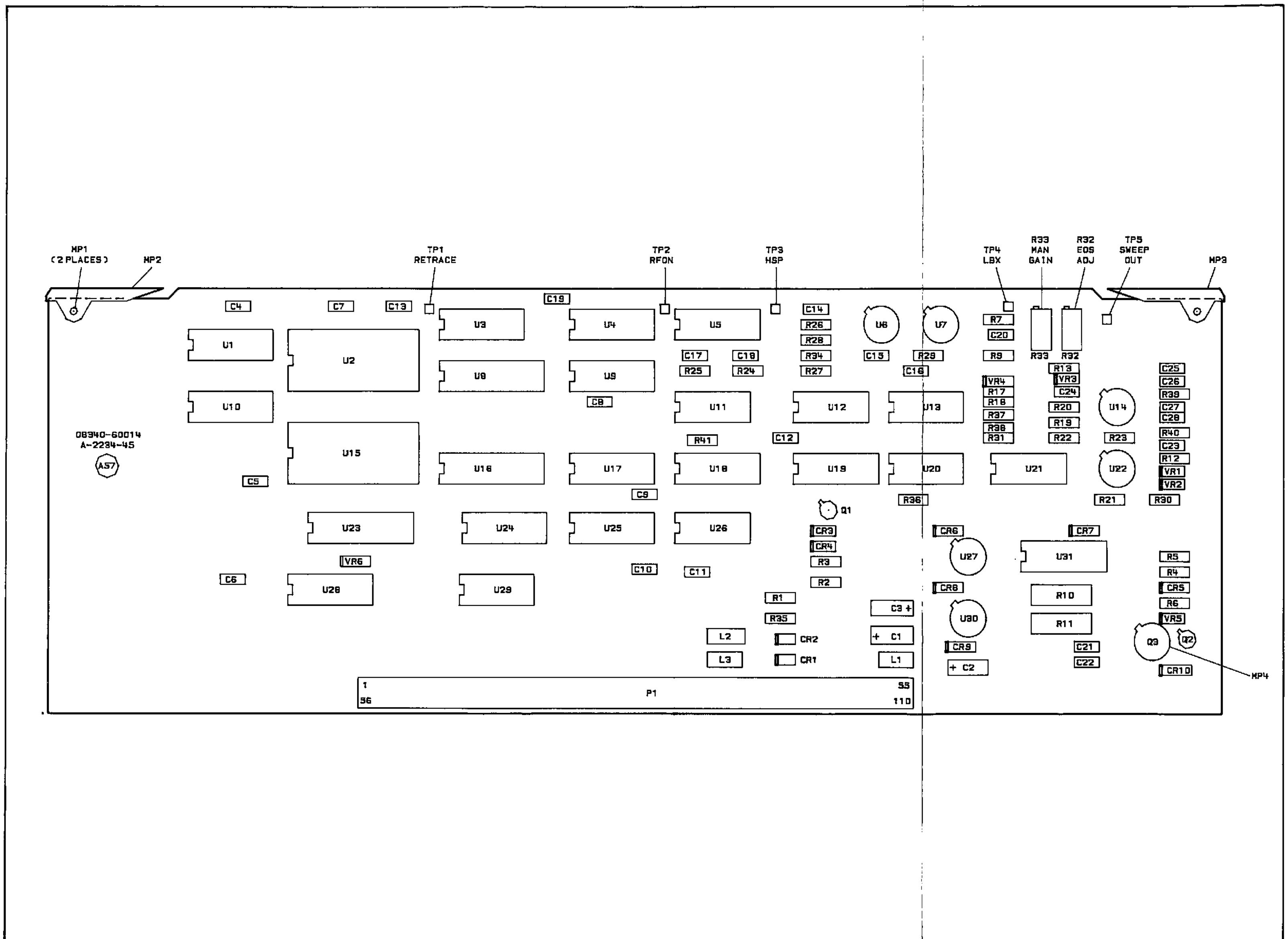


Figure 8G-3. A57 Marker/Bandcross, Component Location Diagram

A57 Marker/Bandcross P1 Pin I/O (1 of 3)

Pin	Mnemonic	Levels	Source	Destination
1 56	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*0 *0
2 57	HMRKR LINE TRIG	TTL (HIGH TRUE) LINE FREQ 7 TO 10V	J A62-CR1 CATHODE/A62R1	XA26P1-43 L
3 58	 LRETRACE	 TTL (LOW TRUE)	 J	 F A62J31-11, 25
4 59	 LALTSEL	 TTL (LOW TRUE)	 J	 A62J31-10, 24
5 60	 LALTEN	 TTL (LOW TRUE)	 J	 A62J31-9, 23
6 61	 MUTE	 TTL (HIGH TRUE)	 J	 A62J31-8, 22
7 62	 8410 TRIG	 TTL	 J	 A62J31-7
8 63				
9 64				
10 65				
11 66				
12 67	HMRKR	TTL (HIGH TRUE)	J	XA26P1-43
13 68	HSP LINE TRIG	TTL (HIGH TRUE) LINE FREQ 7 TO 10V	M A62-CR1 CATHODE/A62R1	*I N L
14 69	LIPS LBX	TTL (LOW TRUE) TTL (LOW TRUE)	XA52P1-36/A62J1-19 *F	*NOT USED M XA59-69
15 70	SIOA GND PLANE	TTL (LOW TRUE) 0V	XA60P1-15 INSTRUMENT GROUND	*K *0
16 71	SIOB GND PLANE	TTL (LOW TRUE) 0V	XA60P1-16 INSTRUMENT GROUND	*NOT USED *0
17 72	ADR0 GND PLANE	TTL 0V	XA60P1-17 INSTRUMENT GROUND	*K *0
18 73	ADR2 ADR1	TTL TTL	XA60P1-18 XA60P1-73	*K *K
19 74	ADR4 ADR3	TTL TTL	XA60P1-19 XA60P1-74	*K *K

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A57 Marker/Bandcross P1 Pin I/O (2 of 3)

Pin	Mnemonic	Levels	Source	Destination
20 75	DB0 GND PLANE	TTL 0V	*C XA60P1-20 INSTRUMENT GROUND	*A C G J *0
21 76	DB2 DB1	TTL TTL	*C XA60P1-21 *C XA60P1-76	*A C G J *A C G J
22 77	DB4 DB3	TTL TTL	*C XA60P1-22 *C XA60P1-77	*A C G J *A C G J
23 78	DB6 DB5	TTL TTL	*C XA60P1-23 *C XA60P1-78	*A C G J *A C G J
24 79	DB8 DB7	TTL TTL	*C XA60P1-24 *C XA60P1-79	*C G *C G J
25 80	DB10 DB9	TTL TTL	*C I XA60P1-25 *C XA60P1-80	*C L *C G
26 81	DB12 DB11	TTL TTL	*C I XA60P1-26 *C I XA60P1-81	*C L *C L
27 82	DB14 DB13	TTL TTL	*C I XA60P1-27 *C I XA60P1-82	*C L *C L
28 83	 DB15	 TTL	 *C I XA60P1-83	 *C L
29 84	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*0 *0
30 85	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*0 *0
31 86	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*0 *0
32 87				
33 88				
34 89	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*0 *0
35 90	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*0 *0
36 91	+5.2V +12V	+5.2V +12V	XA52P1-17, 18, 41, 42 XA52P1-9, 33	*0 *NOT USED
37 92	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*0 *0

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A57 Marker/Bandcross P1 Pin I/O (3 of 3)

Pin	Mnemonic	Levels	Source	Destination
38 93	−15V −5.2V	−15V −5.2V	XA56P1-15, 30 XA53P1-18, 36	*0 *0
39 94	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*NOT USED *NOT USED
40 95	GND PLANE	0V	INSTRUMENT GROUND	*0
41 96	NEG BLANK MKR RMP	0, +5V 0 TO 10V SWEEP	N XA58P1-96	A62J31-1, 15 D G
42 97	RFSWP Z-AXIS BLANK	10V/SWEEP +5V/−5V	H N	XA27P1-17 A62J31-2, 16
43 98	FPNLSWP	10V/SWEEP	H	A62J9-SMC CENTER
44 99	RPNLSWP FPNLSWP RTN	10V/SWEEP 0V	H H	A62J8-SMC CENTER
45 100	RGND RPNLSWP RTN	0V 0V	STAR GND POINT H	*0 *
46 101	RGND RGND	0V 0V	STAR GND POINT STAR GND POINT	*0 *0
47 102				
48 103				
49 104	HULH HULH	TTL (HIGH TRUE) TTL (HIGH TRUE)	A62J19-16 A62J19-16	*NOT USED *NOT USED
50 105	 HRFON	 TTL (HIGH TRUE)	 J	 *
51 106	 EXT TRIG	 EXTERNAL SOURCE LEVEL	 A62J31-4, 18	 L A62J31-4, 18
52 107	 LSSP	 TTL (LOW TRUE)	 M	 A62J31-5, 19
53 108	 PEN LIFT	 CLAMP AT 56V	 J	 A62J31-6, 20
54 109	LSRQ PEN LIFT RTN	TTL (LOW TRUE) 0V	* J	*NOT USED A62J31-21
55 110	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*0 *0

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

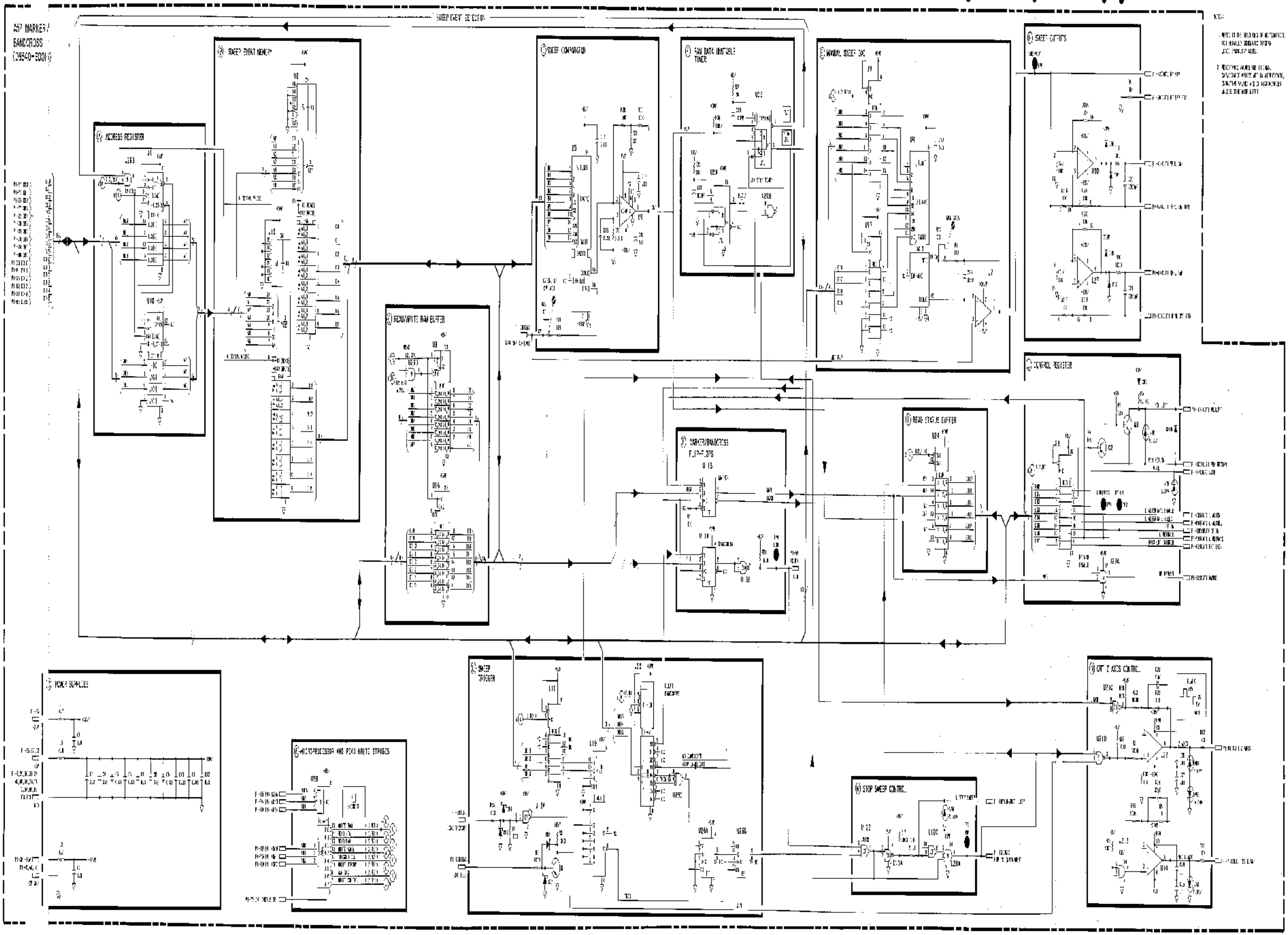


Figure 5G-4. A57 Marker/Bandcross Schematic Diagram

8-461/8-462

A59 DIGITAL INTERFACE ASSEMBLY, CIRCUIT DESCRIPTION

INTRODUCTION

The Digital Interface board communicates to the Microprocessor the tasks which need to be performed. In normal operation of the instrument, the Microprocessor stops running when all tasks are completed. This control (when the processor runs) is done via the LSTP (Low STop Processor) control line (Block **H**). Many I/O addresses are decoded on the board that are used to latch data from the I/O data bus for several assemblies that are external to this board. Some signals are latched on the A59 Digital Interface and then sent to other assemblies via the motherboard. An example is Block **E**.

Phase Lock Indicators and Control (Block **B**) also reside on the board.

MICROPROCESSOR READ/WRITE STROBES A

The three decoders (U12, U19, and U26) decode 24 possible I/O addresses. The outputs of these 3-to-8 line decoders are used by circuits both on and off the A59 board to clock latches connected to the I/O bus or to enable buffers connected to the bus for input operations. There are also several decoders on other PC boards where additional addresses are decoded. SIOB is a 500 ns pulse which enables the three decoders. While they are enabled, the logic signals on ADR0 through ADR4 are used to select specific I/O addresses. For example, I/O address 3,R3: (Channel 3, Subchannel 3) causes a 500 ns strobe at U19 pin 7 when lines ADR4 through ADR0 are (ADR4) 0 1 1 1 1 (ADR0) and at the same time SIOB is LOW.

PHASE LOCK INDICATORS AND CONTROL B

The six Phase-lock loops in the instrument can be monitored to determine if they are locked by writing into the U24 register a mask that will select individual Lock Indicator signals and allow the processor to test them via U18 Processor Service Request circuits (Block **H**). During instrument operation, the instrument processor sends data to U24 register that sets up U25 and U11 to monitor the Phase Lock Indicators. These indicate either a locked or unlocked condition for a particular 8340A function. The outputs of U24, pins 2 and 12, are inverted by U22A and U22B. U22A and U22B are RS flip-flops wired as inverters. These inverted signals are used to set flip-flops U22C and U22D. Tne outputs of these flip-flops control the LOCK/ROLL signals for the 20-30 Loop and the YO Loop. Once these flip-flops are set, the corresponding phase-lock loop will try to lock. This condition will persist until the set signals are removed and the High Sweep signal (HSP) goes True indicating the start of a sweep. This will cause the appropriate oscillator to switch from LOCK to ROLL mode. When the instrument is sweeping, either the YO or the 20-30 oscillator will be allowed to sweep by having its LOCK/ROLL control line set to ROLL. The 20-30 is swept when the YO Delta F is < 5 mHz. NOTE: The YO Delta F is the overall sweep width divided by the harmonic number (1 thru 4). The remaining outputs of U24 are ANDed with the corresponding Oscillator LOCKED signals and ORed together by U11 and U25 to generate the UNLOCKED signal.

The DLI (TP4) test point can be pulled to +5 Volts for troubleshooting to cause the processor to think all oscillators are locked up when they are not. This should cause the front panel UNLOCKED light to go out.

CHANGE DETECTOR C

Several conditions need to be continuously monitored and responded to by the Instrument Controller when they change state. Since the Controller stops running when it has completed its tasks, this circuit detects changes in instrument conditions and causes the controller to run again so that the changes can be responded to. The changes that are detected are:

1. OVEN becoming cold or up to temperature.

2. Change in enabled Phase LOCK indicators.

3. Rear panel frequency reference switch set to EXT.

4. LCHNG line being driven LOW due to one of the following conditions:

    a. Change in the OVERMODULATION indicator.
    b. Change in UNLEVELED indicator.
    c. Service request from the ADC.

When the control signal from the OVEN HOVC falls below 3.5 volts, the output of comparitor U13 goes HIGH. This signal is buffered by U7A which drives U6B. U6B immediately produces a LOW at pin 4 in response to the positive-going change at input pin 6. When C2 is charged up some 100 us later, pin 5 of U6B goes HIGH, forcing the exclusive OR gate to return its output to a HIGH. The resulting negative-going pulse from U6B will cause flip-flop U4C to be Set. The output of U4C goes to Block H and causes the instrument processor to check for a change in one of the conditions listed above. When the OVEN control signal changes in the opposite direction (i.e., rises above 3.5 volts), U13 will change states again. This change will again cause U6B to create a LOW-going pulse about 100 us wide. Changes in the UNLOCKED and External

Reference signals also cause LOW-going pulses on the LCHNG line. The LCHNG line runs on the A62 Motherboard so that other circuits in the instrument can indicate the need for service from the instrument controller. Where this is done an exclusive OR gate similar to U6B is also used to create LOW-going pulses on LCHNG.

M/N CONTROL E

Two registers, U10 and U17, are used by the processor to latch control signals necessary to program the M/N Oscillator. This is done when the processor does a WRITE to I/O address 3,R3:. The M/N off signal could be used to turn the M/N oscillator off. Currently the oscillator is never turned off.

MISCELLANEOUS INPUTS F

The buffer, U7B, is used to allow the processor to determine if any options are set. Currently none are used. The input on I/O bit 4 (DB4) is tied LOW and can be used by the processor to determine that the digital interface is present.

MISCELLANEOUS CONTROL G

The register, U23, is used by the processor to latch eight bits of information that are sent to the motherboard to control various functions. This is done when the processor does a WRITE to I/O address 1,R3:. The control signals are:

HSTD (High STandarD) A HIGH indicates the Internal Frequency Standard has been selected. The rear panel switch should cause this signal to change state.

HFILYO (High FILtered YO) A HIGH places a large filter capacitor across the YO coil. This is done in the CW or MANUAL mode.

LRSP (Low Reset SweeP) A LOW causes the Sweep Generator to reset the sweep. This is done at the end of every sweep. The reset signal is removed before the sweep starts.

LYSP (Low YO SweeP) This signal goes to the A55 YO Driver board. It is a TTL signal that is LOW for YO sweep widths greater than 5 MHz. This signal switches out a filtering capacitor on the driver board so that it does not add any swept frequency delay.

HCEN (High Compensation ENable) This signal goes to the A55 YO Driver board. It is a TTL signal that, when HIGH, allows the ramp voltage VCOMP to be added to PRETUNE on the driver board. This compensates for the swept frequency delay of the YO.

PROCESSOR SERVICE REQUESTS H

Buffer/Register U18 is used by the processor to determine which tasks need to be performed. All conditions that need the processor's attention are communicated through this register except for the front panel, which can generate its own service request. All possible reasons for service are ORed by U5 and the result is sent to the processor on the LSRQ line, indicating that service is requested. The LSTP line is driven by flip-flop U4D that is used to stop the processor from running when all tasks have been completed. U9B in an inverting open collector output buffer. Flip-flop U4D is set when the processor does a WRITE to I/O address 5,R0:. This is done to stop the processor when all pending tasks have been completed. U4D is reset to cause the controller to run again any time LSRQ is driven LOW. LSRQ can be driven LOW by U5 through U3E and U9F, or by the front panel to indicate a key has been pushed or the rotary control has been turned.

The Following conditions can be monitored when the processor does a READ from I/O address 4,R3: through U18:

- BANDCROSS - This line is driven by the LBX from A57 Marker Band Cross board. After being inverted by A59U3C, A59TP6 "BC" will go HIGH whenever a sweep event occurs. The Sweep Generator can also drive the LBX line if the sweep ever excedes 13 volts.
- UNLOCKED - An oscillator is unlocked
- EXT. REF. - External Reference is selected by the rear panel Frequency Standard INT/EXT Switch.
- OVEN Ready
- POWER FAIL - This indicates that a Power On has just occured. This is used by the processor to determine whether to do an Instrument Preset or a Power On restore of the last state. The processor cannot otherwise distinguish between Power On and Instrument Preset.
- CHANGE FF - One of the Change Detector inputs has changed.

POWER SUPPLY I

The only supply for the board is +5V. L1 and C1 through C18 provide required digital filtering.

A59 DIGITAL INTERFACE ASSEMBLY, TROUBLESHOOTING

CHECKING MICROPROCESSOR I/O ADDRESS STROBES (BLOCK A).

U12, U19, and U26 (Block **A**) are connected to the I/O address bus and generate 24 I/O strobes which are used either on this assembly or are sent via the motherboard to other assemblies. These strobes on the outputs of U12, U19, and U26 can be checked using the front panel to write directly to the I/O addresses (Direct I/O), while monitoring the outputs of the 3-to-8 line decoders. This can be done as follows: Press **[INSTR] [PRESET]**, then **[MANUAL]** sweep key. Connect a logic probe to the output that is to be checked. Enter into the front panel the corresponding I/O address. The I/O address is shown on the schematic printed above the outputs of U12, U19, and U26 in the following form: m,Rn: Where "m" is called the I/O CHANNEL and "n" is the I/O SUBCHANNEL. For example, assume that we wish to test U19 pin 7. The I/O address is 3,R3: This is entered into the front panel as follows: **[SHIFT] [GHz] [3] [Hz]** sets the I/O channel, and **[SHIFT] [MHz] [3] [Hz]** sets the I/O subchannel. Pressing **[SHIFT] [KHz]** activates the selected I/O address. Make entries by pressing the step keys, using the RPG, or by making data pad entries. Each entry will cause the M/N Oscillator Control strobe to be generated. This will be a LOW-True signal approximately 500 ns wide that can be monitored with the logic probe. It can also be seen on a storage scope.

Refer to Direct I/O Addressing in Section VIII, "Service Introduction", for more information.

CHECKING MICROPROCESSOR OUTPUT DEVICES (BLOCKS B, E, AND G)

The following devices are microprocessor output devices: U24 (Block **B**), U10 and U17 (Block **E**) and finally U23 (Block **G**). These can be checked using the front panel in a similar manner as above. To do this, the I/O channel and subchannel numbers must be entered at the front panel. These numbers can be found by reading the I/O address on the write input of the device. After the address has been entered, press **[SHIFT] [KHz]**. Number entries can now be made directly to the device you are interested in. Monitor the outputs at the same time you enter numbers which will affect the signals of interest. For example, if the signal of interest is taken from DB2 of the I/O data bus, enter the number 0 and observe the register output; it should go LOW. Then enter the number 4, and observe that DB2 goes HIGH. Note that if U16 is being checked, the outputs are only valid during the time the write strobe is LOW. Note that the instrument should be in MANUAL sweep mode so that the normal operation of the instrument does not cause the device being tested to be written to.

CHECKING MICROPROCESSOR INPUT DEVICES (BLOCKS F, AND H)

Input devices can be checked in a similar manner as the output devices. The front panel is used to set up the I/O channel and subchannel as before. U7 and U18 are the only input devices on this assembly. After setting the correct address on the front panel, press **[SHIFT] [Hz]**. Each time **[HZ]** is pressed, the instrument will read from the addressed I/O device and display the results in the entry display in both decimal and octal formats. By shorting each input of the input devices to +5V or ground, each input can be checked. Note that U18 is an inverting buffer so that a LOW at its input should appear as a HIGH at its output.

CHANGE DETECTORS (BLOCK C)

Connect a logic probe or storage scope to TP8 "CHGFF" (Block **C**). Observe that a LOW-True pulse is generated each time the rear panel Frequency Standard INT/EXT switch is switched. This should happen for both INT or EXT positions. Also note that the front panel EXT REF LED should go on when EXT is selected and off when INT is selected. The UNLOCKED input can be checked by putting the 8340A into CW and then disconnecting one of the snap on cables that is part of the phase-locked loop. This should cause a pulse at TP8 and also cause the front panel UNLOCKED LED to go on. Reconnecting the cable should make the LED go out. HOVC can be checked by unplugging the 8340A from the AC mains for five minutes and then quickly plugging it in and turning it on. The OVEN light should go on and then after a few minutes, the light should go off.

PROCESSOR SERVICE REQUEST (BLOCK H)

U18 can be checked out as indicated in the general troubleshooting of input devices. To check the basic function press the following front panel keys: **[INSTR PRESET] [CW]**. Note that the RUN light on the processor board should be out. If it is not, something is pulling down the LSRQ line, or U4D is not being set by the processor as it should. LSTP must be LOW for the processor run light to go out. NOTE: If the instrument is UNLOCKED due to some hardware problem, the processor will run continously, and in this case, LSTP should remain HIGH.

Note that by grounding the LBX test point on the Marker Bandcross board, TP6 should go HIGH, LSRQ should go LOW, and LSTP should go HIGH. By doing a direct READ using Direct I/O, U18 Bit 14 should appear HIGH in the entry display. This is done by pressing the following sequence: **[INSTR PRESET] [SHIFT] [GHz] [4] [HZ] [SHIFT] [MHZ] [3] [Hz] [SHIFT] [Hz]**. Note that the entry display will have two numbers, the one on the right will be in the form dddddd. This is an OCTAL (ie. base 8) number. The second digit from the LEFT must be a 4, 6, or 7 in order for BIT 14 to be HIGH.

ISOLATING A PROBLEM BY REMOVING THE A59 DIGITAL INTERFACE BOARD

To help verify that the problem is on the A59 DIGITAL INTERFACE board, it may be useful to remove the A59 assembly and observe the instrument behavior. With A59 missing, the instrument should do the following:

1. Following Power On or Instrument Preset, Both Instrument Check lights should go off. All 16 self test leds on the processor board should go off.

2. When the POWER is turned to STANDBY and then ON, the instrument should do an Instrument Preset instead of restoring the prior state.

3. The OVEN annunciator should be on and the EXT. REF, UNLOCKED, SRQ and REMOTE annunciators should be off.

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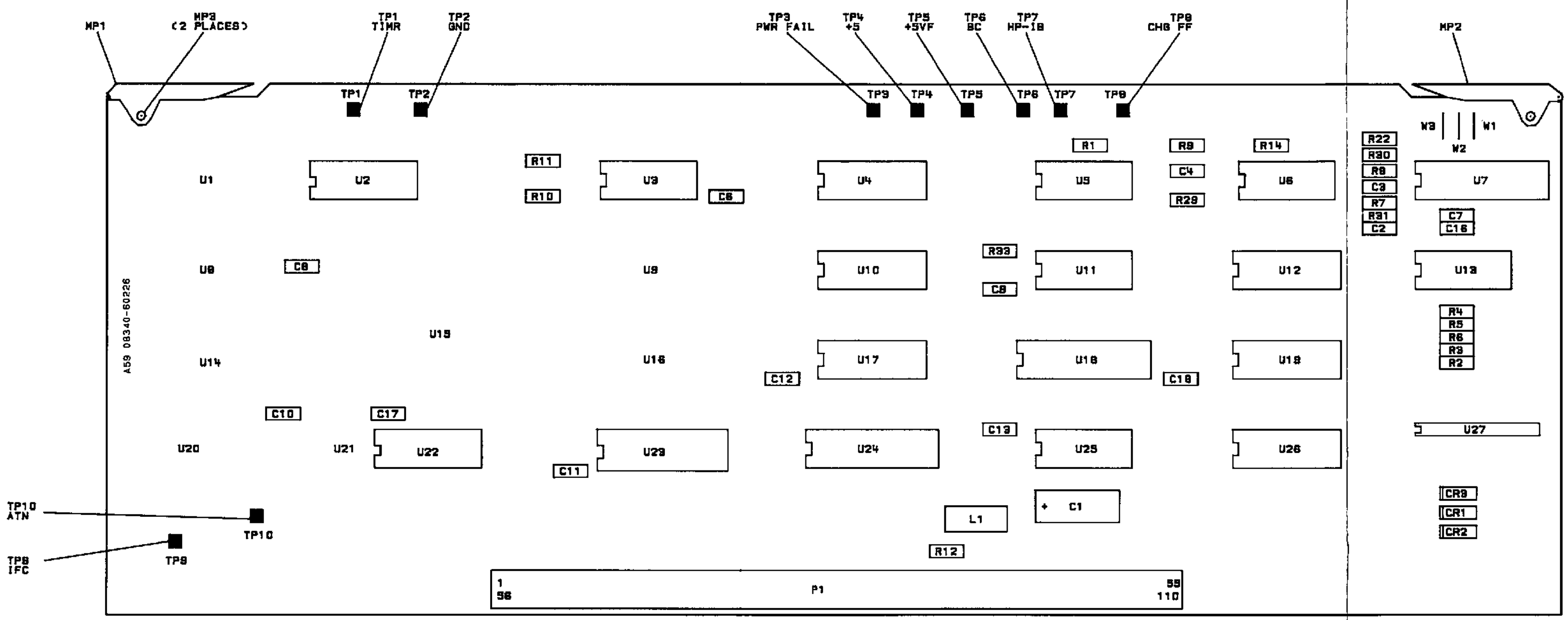

Figure 8G-5. A59 Digital Interface, Component Location Diagram

A59 Processor P1 Pin I/O (1 of 3)

Pin	Mnemonic	Levels	Source	Destination
1 56	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*J *J
2 57				
3 58				
4 59				
5 60				
6 61				
7 62				
8 63				
9 64				
10 65	HOVC LSTP	+3 VOLTS - OVEN WARM TTL (LOW TRUE)	A62J3-3 I	C XA6101-85 *
11 66	LYSP HSTD	TTL (LOW TRUE) TTL (HIGH TRUE)	G G	XA55P1-7 XA52P1-21
12 67	 HCEN	 TTL (HIGH TRUE)	 G	 XA55P1-14
13 68	HSP WPDAC	TTL (HIGH TRUE) TTL (LOW TRUE)	XA57P1-13 A	*B XA54P1-36
14 69	LIPS LBX	TTL (LOW TRUE) TTL (LOW TRUE)	XA52P1-36/A62J7-19 *	*I I
15 70	SIOA	TTL (LOW TRUE)	XA60P1-15	*NOT USED
16 71	SIOB	TTL (LOW TRUE)	XA60P1-16	*A
17 72	ADR0 HFILYO	TTL TTL	XA60P1-17 G	*A *XA58P1-47, 72
18 73	ADR2 ADR1	TTL TTL	XA60P1-18 XA60P1-73	*A *A
19 74	ADR4 ADR3	TTL TTL	XA60P1-19 XA60P1-74	*A *A

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterisk (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A59 Digital Interface P1 I/O (2 of 3)

Pin	Mnemonic	Levels	Source	Destination
20 75	DB0 GND PLANE	TTL 0V	*D XA60P1-20 INSTRUMENT GROUND	*D E G *J
21 76	DB2 DB1	TTL TTL	*D XA60P1-21 *D XA60P1-76	*D E G *D E G
22 77	DB4 DB3	TTL TTL	*D F XA60P1-22 *D XA60P1-77	*D E G *D E G
23 78	DB6 DB5	TTL TTL	*D F XA60P1-23 *D F XA60P1-78	*D G *D E G
24 79	DB8 DB7	TTL TTL	*XA60P1-24 *D F XA60P1-79	*B D I *D G
25 80	DB10 DB9	TTL TTL	*XA60P1-25 *XA60P1-80	*B E I *B I
26 81	DB12 DB11	TTL TTL	*XA60P1-26 *XA60P1-81	*B E I *B E I
27 82	DB14 DB13	TTL TTL	*XA60P1-27 *XA60P1-82	*B E I *B E I
28 83	WSPTM DB15	TTL (LOW TRUE) TTL	A *XA60P1-83	XA58P1-28 *B E I
29 84	WRDAC WSPAT	TTL (LOW TRUE) TTL (LOW TRUE)	A A	XA58P1-29 XA58P1-84
30 85	WCDAC LRSP	TTL (LOW TRUE) TTL (LOW TRUE)	A G	XA54P1-28 XA58P1-85
31 86	M5 LMNE	TTL (HIGH TRUE) TTL (LOW TRUE)	E E	XA34P1-1 XA34P1-2
32 87	M3 M4	TTL (HIGH TRUE) TTL (HIGH TRUE)	E E	XA34P1-3 XA34P1-4
33 88	M1 M2	TTL (HIGH TRUE) TTL (HIGH TRUE)	E E	XA34P1-5 XA34P1-6
34 89	5 MHZ CLK LSRQ	TTL TTL (LOW TRUE)	XA60P1-34 *I	D *
35 90	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*NOT USED *NOT USED
36 91	+5.2V +12V	+5.2V +12V	XA52P1-17, 18, 41, 42 XA52P1-9, 33	*J *NOT USED
37 92	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*J *J

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A59 Digital Interface P1 I/O (3 of 3)

Pin	Mnemonic	Levels	Source	Destination
38	−15V	−15V	XA56P1-15, 30	*NOT USED
93	−5.2V	−5.2V	XA53P1-18, 36	*NOT USED
39	−10V	−10V	XA53P1-12, 13, 31, 32	*NOT USED
94	−10V	−10V	XA53P1-12, 13, 31, 32	*NOT USED
40	GND PLANE	0V	INSTRUMENT GROUND	*J
95	HPUP	TTL (HIGH TRUE)	XA52P1-46	*D I
41	GND PLANE	0V	INSTRUMENT GROUND	*J
96	GND PLANE	0V	INSTRUMENT GROUND	*J
42	GND PLANE	0V	INSTRUMENT GROUND	*J
97	GND PLANE	0V	INSTRUMENT GROUND	*J
43	GND PLANE	0V	INSTRUMENT GROUND	*J
98	HXREF	TTL (HIGH TRUE)	A62J31-17	*C
44	GND PLANE	0V	INSTRUMENT GROUND	*J
99	WYOKW	TTL (LOW TRUE)	A	XA54P1-6
45	LCHNG	TTL (LOW TRUE)	*	C
100	TYOKP	TTL (LOW TRUE)	A	*
46	N5	TTL	E	XA34P1-11
101	N6	TTL	E	XA34P1-10
47	N3	TTL	E	XA34P1-13
102	N4	TTL	E	XA34P1-12
48	N1	TTL	E	XA34P1-15
103	N2	TTL	E	XA34P1-14
49	HULR	TTL (HIGH TRUE)	XA34P2-14	B
104	HULM	TTL (HIGH TRUE)	XA34P1-8	B
50	HULY	TTL (HIGH TRUE)	A62J2-16	B
105	HULH	TTL (HIGH TRUE)	A62J19-16	*B
51	HLEY	TTL (HIGH TRUE)	B	A62J2-3
106	HUL1	TTL (HIGH TRUE)	XA37P1-26; XA39P1-1, 16	B
52	LCK4	TTL (LOW TRUE)	A	*
107	HUL2	TTL (HIGH TRUE)	XA41P1-4	B
53	HLE2	TTL (HIGH TRUE)	B	*
108	LCK3	TTL (LOW TRUE)	A	XA43P1-19
54	LCK1	TTL (LOW TRUE)	A	XA42P1-19
109	LCK2	TTL (LOW TRUE)	A	XA42P1-1
55	GND PLANE	0V	INSTRUMENT GROUND	*J
110	GND PLANE	0V	INSTRUMENT GROUND	*J

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

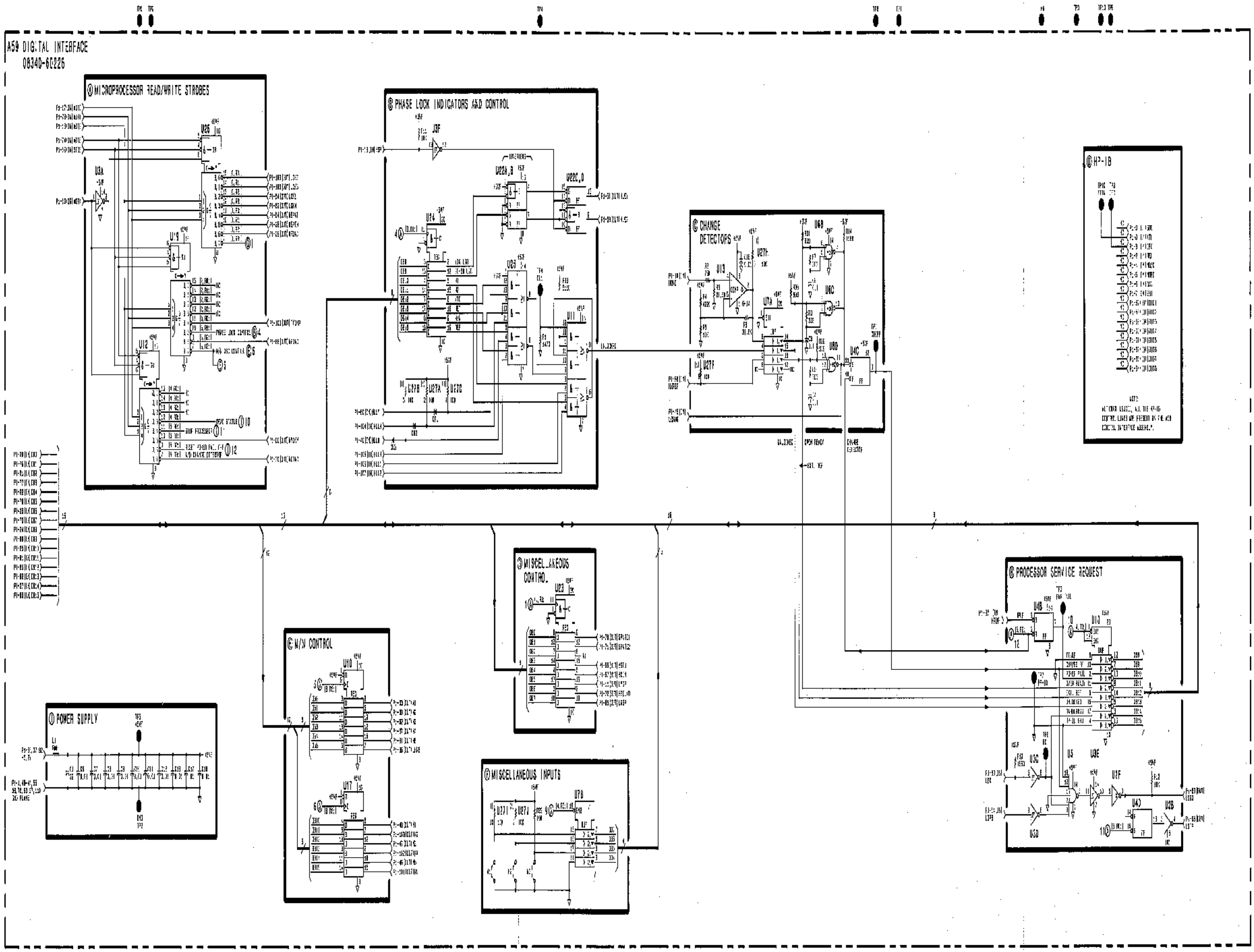

Figure 8G-6. A59 Digital Interface, Schematic Diagram

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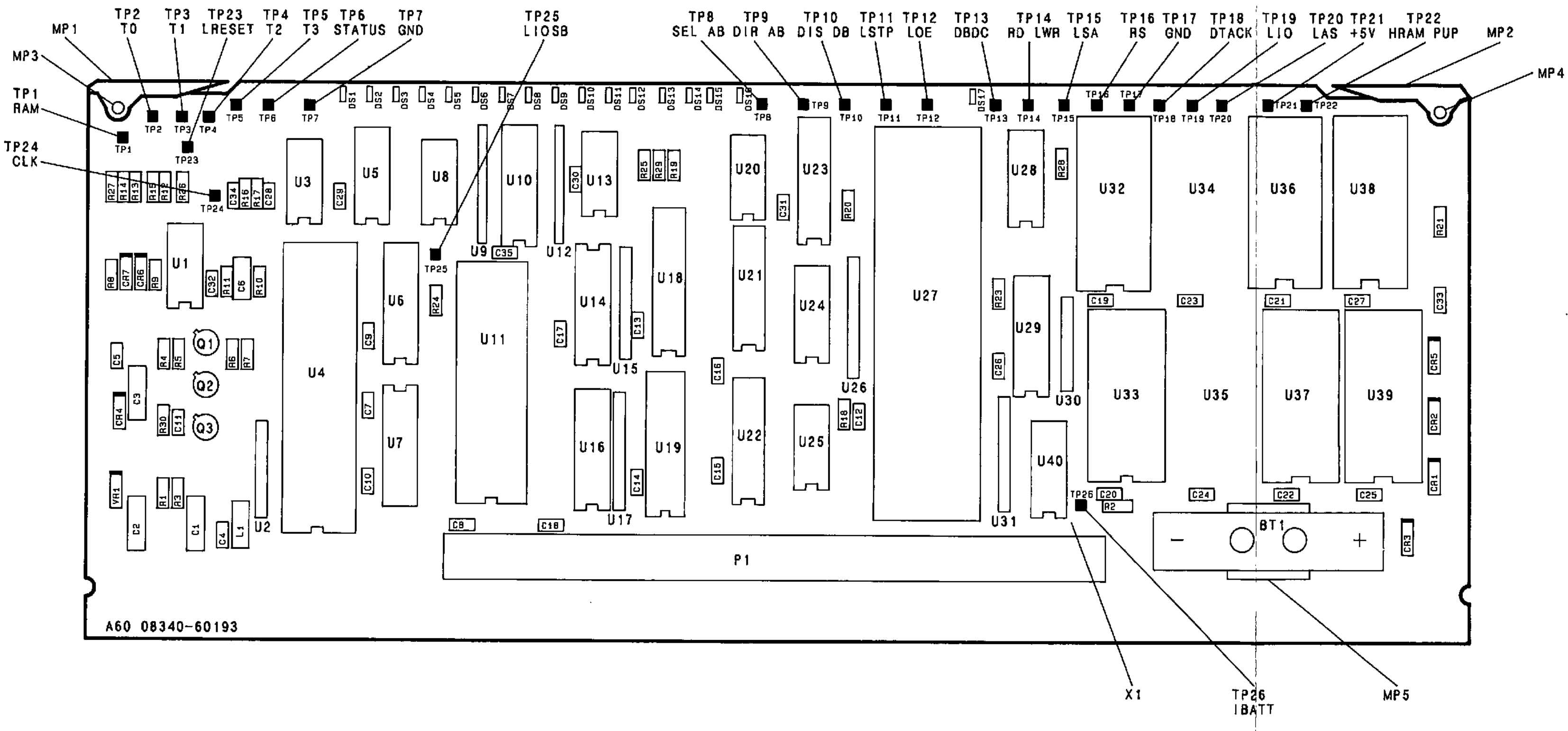


Figure 8G-11. A60 Processor, Component Location Diagram

A60 Processor P1 Pin I/O (1 of 3)

Pin	Mnemonic	Levels	Source	Destination
1 56	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*L *L
2 57	REN DI01	TTL (LOW TRUE) TTL	A62J7-10 D	D A62J7-1
3 58	IFC DI02	TTL (LOW TRUE) TTL	A62J7-17 D	D A62J7-3
4 59	NDAC DI03	TTL TTL	D D	A62J7-15 A62J7-5
5 60	NRFD DI04	TTL TTL	D D	A62J7-13 A62J7-7
6 61	DAV DI05	TTL TTL	D D	A62J7-11 A62J7-2
7 62	EOI DI06	TTL TTL	D D	A62J7-9 A62J7-4
8 63	ATN DI07	TTL TTL	D D	A62J7-21 A62J7-6
9 64	SRQ DI08	TTL TTL	A62J7-19 D	D A62J7-8
10 65	 LSTP	 TTL (LOW TRUE)	 XA59P1-65	 D A62J1-43
11 66				
12 67				
13 68				
14 69	LIPS	TTL (LOW TRUE)	XA52P1-36/A62J1-19	*E
15 70	SIOA GND PLANE	TTL (LOW TRUE) 0V	*G INSTRUMENT GROUND	*J *L
16 71	SIOB GND PLANE	TTL (LOW TRUE) 0V	*G INSTRUMENT GROUND	*J *L
17 72	ADR0 GND PLANE	TTL 0V	*G INSTRUMENT GROUND	*J *L
18 73	ADR2 ADR1	TTL TTL	*G *G	*J *J
19 74	ADR4 ADR3	TTL TTL	*G *G	*J *J

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterisk (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A60 Processor P1 Pin I/O (2 of 3)

Pin	Mnemonic	Levels	Source	Destination
20 75	DB0 GND PLANE	TTL 0V	*J K I INSTRUMENT GROUND	*I K *L
21 76	DB2 DB1	TTL TTL	*I K *I K	*I K *I K
22 77	DB4 DB3	TTL TTL	*I K *I K	*I K *I K
23 78	DB6 DB5	TTL TTL	*I K *I K	*I K *I K
24 79	DB8 DB7	TTL TTL	*J K I *I K	*I K *I K
25 80	DB10 DB9	TTL TTL	*J K I *J K I	*I K *I K
26 81	DB12 DB11	TTL TTL	*J K I *J K I	*I K *I K
27 82	DB14 DB13	TTL TTL	*J K I *J K I	*I K *I K
28 83	 DB15	 TTL	 *J K I	 *I K
29 84				
30 85				
31 86				
32 87				
33 88				
34 89	5 MHZ CLK LSRQ	TTL TTL (LOW TRUE)	B *	C F XA59P1-34 *I
35 90	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*NOT USED *NOT USED
36 91	+5.2V +12V	+5.2V +12V	XA52P1-17, 18, 41, 42 XA52P1-9, 33	*L *L
37 92	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*L *L

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A60 Processor P1 Pin I/O (3 of 3)

Pin	Mnemonic	Levels	Source	Destination
38 93	−15V −5.2V	−15V −5.2V	XA56P1-15, 30 XA53P1-18, 36	*NOT USED *L
39 94	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*NOT USED *NOT USED
40 95	GND PLANE HPUP	0V TTL (HIGH TRUE)	INSTRUMENT GROUND XA52P1-46	*L *NOT USED
41 96	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*L *L
42 97	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*L *L
43 98	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*L *L
44 99	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*L *L
45 100	HSTM GND PLANE	TTL (HIGH TRUE) 0V	H INSTRUMENT GROUND	XA61P1-45 *L
46 101	LSOB LWRT	TTL (LOW TRUE) TTL (LOW TRUE)	H H	XA61P1-46 XA61P1-101
47 102	LIDA14 LIDA15	TTL (LOW TRUE) TTL (LOW TRUE)	I I	XA61P1-47 XA61P1-102
48 103	LIDA12 LIDA13	TTL (LOW TRUE) TTL (LOW TRUE)	I I	XA61P1-48 XA61P1-103
49 104	LIDA10 LIDA11	TTL (LOW TRUE) TTL (LOW TRUE)	I I	XA61P1-49 XA61P1-104
50 105	LIDA8 LIDA9	TTL (LOW TRUE) TTL (LOW TRUE)	I I	XA61P1-50 XA61P1-105
51 106	LIDA6 LIDA7	TTL (LOW TRUE) TTL (LOW TRUE)	I I	XA61P1-51 XA61P1-106
52 107	LIDA4 LIDA5	TTL (LOW TRUE) TTL (LOW TRUE)	I I	XA61P1-52 XA61P1-107
53 108	LIDA2 LIDA3	TTL (LOW TRUE) TTL (LOW TRUE)	I I	XA61P1-53 XA61P1-108
54 109	LIDA0 LIDA1	TTL (LOW TRUE) TTL (LOW TRUE)	I I	XA61P1-54 XA61P1-109
55 110	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*L *L

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

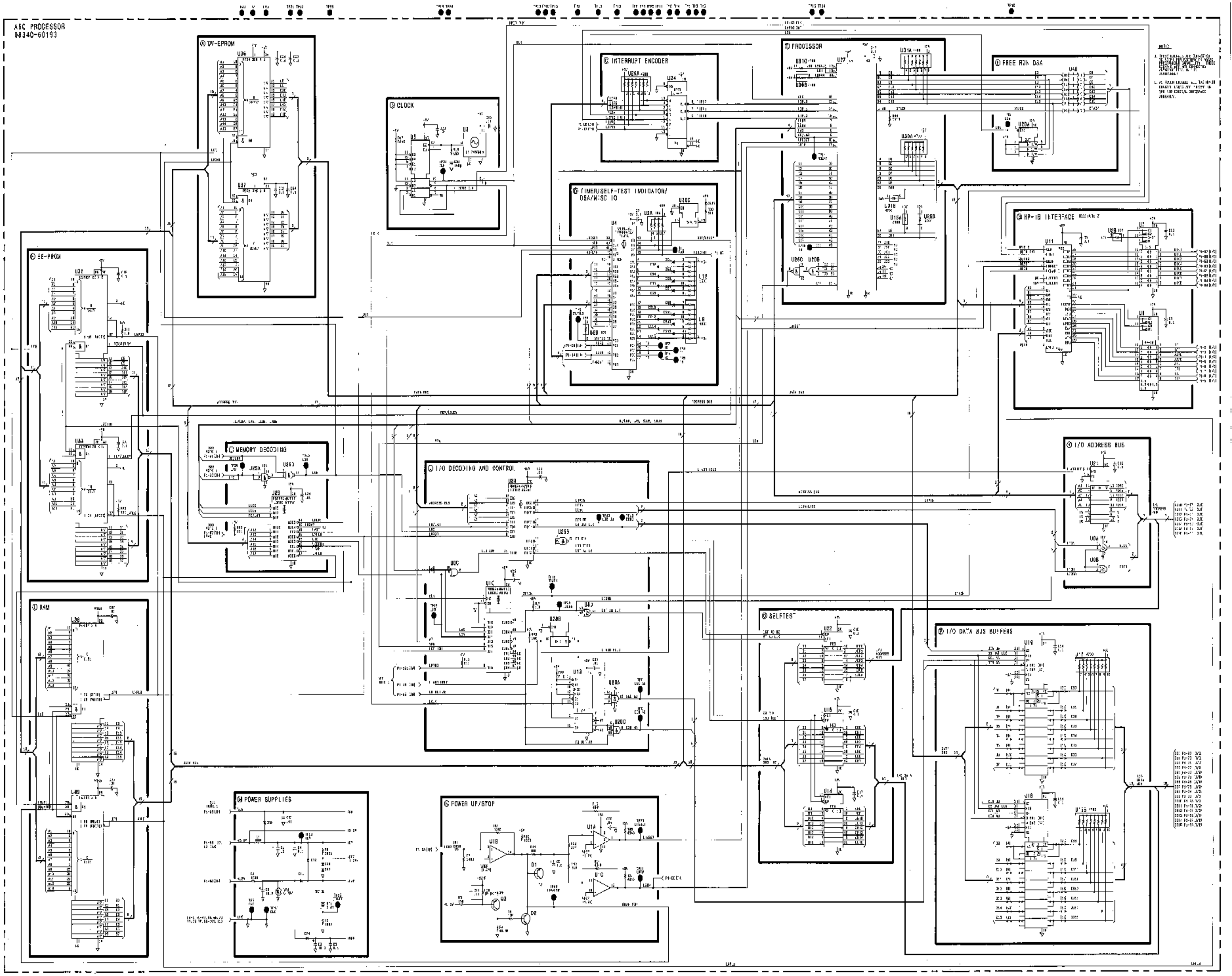


Figure 8C-12. A6C Processor, Schematic Diagram

PAGES 8-537 THROUGH 8-556 HAVE BEEN INTENTIONALLY OMITTED

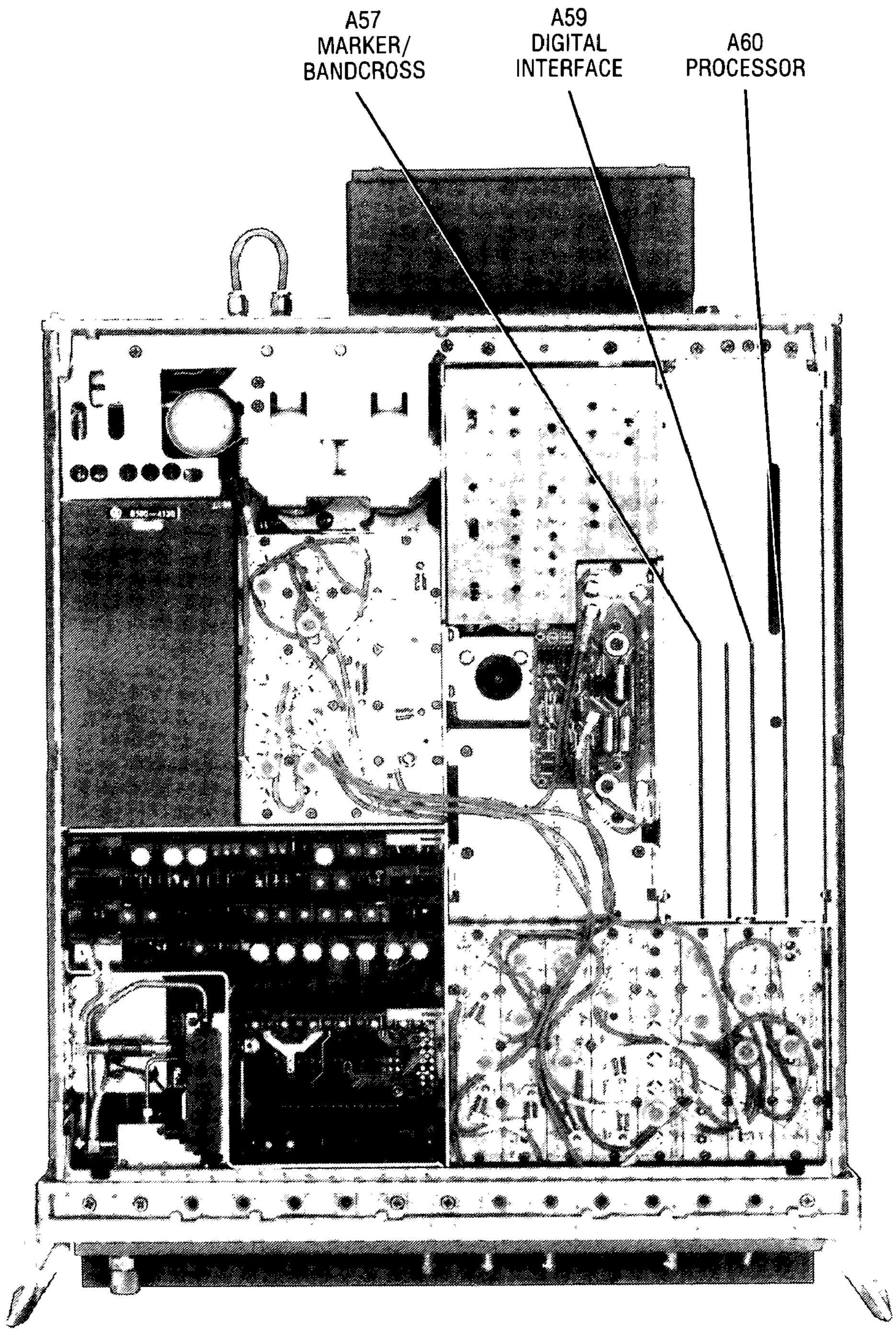
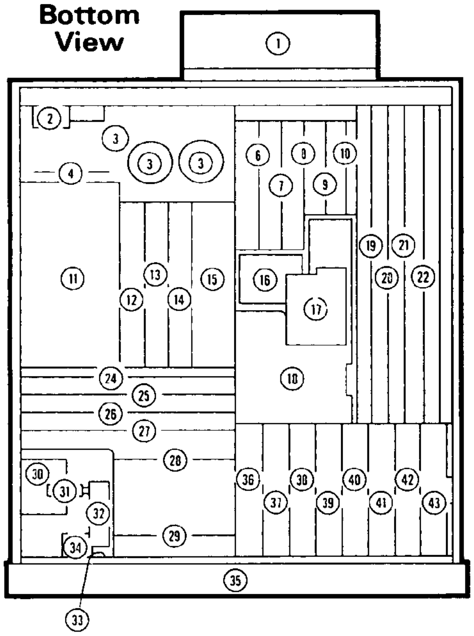


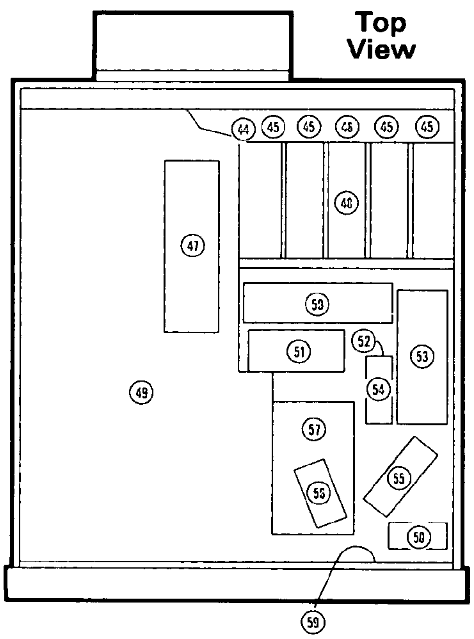
Figure 8G-16. Controller Section Major Assemblies Location Diagram

REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



Top View



Assy./Ref. Des.	Description	Location	Volume 3: Ref.-M/N Loops	Volume 3: 20-30 Loops	Volume 3: Swp. Gen.-YO Loop	Volume 3: Motherboard	Volume 4: Controller	Volume 4: Front/Rear Panel	Volume 4: RF Section	Volume 4: Power Supplies
A1	Alpha Display	33						●		
A2	Display Driver	33						●		
A3	Display Processor	33						●		
A4	Not Assigned	-								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	56							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	31							●	
A12	Band 0 Splitter/Detector	34							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	54							●	
A18	Band 0 Power Amplifier	55							●	
		60							●	
A19	Capacitor Assembly	48								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	28							●	
A25	ALC Detector	27							●	
A26	Linear Modulator	26							●	
A27	Level Control	25							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	15	●							
A33	M/N Output	15	●							
A34	Reference-M/N Motherboard	5	●							
A35	Rectifier	4								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	40		●						
A41	PLL2 Phase Detector	41		●						
A42	PLL2 Divider	42		●						
A43	PLL2 Discriminator	43		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	18			●					
A49	YO Loop Phase/Detector	18			●					
A50	YO Loop Interconnect	17			●					
A51	Reference Oscillator	16	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	10								●
A57	Marker/Bandcross	19					●			
A58	Sweep Generator	20			●					
A59	Digital Interface	21					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	58							●	
AT2	15 dB Attenuator	13			●					
B1	Fan Assembly	1								●
A62C1-3	Power Supply Filter Capacitors	3								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

FRONT PANEL — REAR PANEL H

FRONT AND REAR PANEL INTRODUCTION

This section provides information for servicing the front and rear panel keys, connectors, switches, RPG, annunciators, and displays, and is organized as follows:

FRONT PANEL OVERALL DESCRIPTION

TROUBLESHOOTING TO ASSEMBLY LEVEL

DISASSEMBLY

FRONT PANEL BLOCK DIAGRAM

A1 ALPHA DISPLAY, CIRCUIT DESCRIPTION

A1 ALPHA DISPLAY TROUBLESHOOTING

A2 DISPLAY DRIVER, CIRCUIT DESCRIPTION

A2 DISPLAY DRIVER BLOCK-BY-BLOCK TROUBLESHOOTING

A3 DISPLAY PROCESSOR, CIRCUIT DESCRIPTION

A3 DISPLAY PROCESSOR TROUBLESHOOTING

REQUIRED EQUIPMENT

PREPARATION

SYMPTOMATIC TROUBLESHOOTING

A3 DISPLAY PROCESSOR BLOCK-BY-BLOCK TROUBLESHOOTING

A3 DISPLAY PROCESSOR DSA TROUBLESHOOTING

A5 KEYBOARD AND A7 LOWER KEYBOARD, CIRCUIT DESCRIPTION

A5 KEYBOARD AND A7 LOWER KEYBOARD TROUBLESHOOTING

A6 KEYBOARD INTERFACE, CIRCUIT DESCRIPTION

A6 KEYBOARD INTERFACE TROUBLESHOOTING

REQUIRED EQUIPMENT

PREPARATION

SYMPTOMATIC TROUBLESHOOTING

A6 KEYBOARD INTERFACE BLOCK-BY-BLOCK TROUBLESHOOTING

FRONT PANEL OVERALL DESCRIPTION

INTRODUCTION

The front panel includes the following assemblies:

A1 Alpha Display
A2 Display Driver
A3 Display Processor
A5 Upper Keyboard
A7 Lower Keyboard

The A4 Assembly is unassigned.

OVERALL DESCRIPITON

The front panel assembly contains a separate microprocessor (A3U1) used to refresh the displays. The main instrument processor sends data to be displayed to the front panel processor via the Instrument Data Bus and Instrument Address Bus. The front panel processor stores this data in an internal RAM buffer. The front panel processor has 2K of internal ROM which contains a program to generate the necessary control signals to display the data.

There are two types of displays. The ENTRY DISPLAY includes 28 5X7 dot matrix characters. Both alpha and numeric data can be displayed in the dot matrix ENTRY DISPLAY. The frequency and POWER dBm displays are 7 segment/character displays. Only numeric data is normally displayed in the segment displays.

The front panel processor determines what segments and/or dots to illuminate and then outputs the appropriate digital signals to the circuitry that illuminates the displays. The processor continuously refreshes the displays about 80 times per second.

The main instrument processor controls the LED annunciators via the Instrument Data Bus and Instrument Address Bus.

The two keyboards (A5 Upper Keyboard and A7 Lower Keyboard) and the RPG (Rotary Pulse Generator) communicate with the main instrument processor via the A6 Keyboard Interface. When a key is pressed, a low true column and a low true row signal are generated. These signals are encoded by the Keyboard Interface. A service request to the main instrument processor is generated. The processor then reads the encoded signal via the Instrument Data Bus and Instrument Address Bus.

When the RPG is rotated, a counter is either incremented or decremented, a service request is generated and the main insturment processor reads the counter output.

The front panel POWER STANDBY/ON switch is an open circuit in the

ON position. In STANDBY a ground is supplied to the yellow STANDBY LED and to the fan relay (A62K1). This ground is also LSBY (Low StanBY). In STANDBY, the fan relay is energized and the power to the fan is removed. The LSBY signal is fed to the +20V regulator which shuts down the +20V supply. Since the +20V supply is used as a reference for all other regulated supplies, all of the regulated supplies are shut down as well. In the STANDBY mode, line power is still applied to the power transformer primary and to the unregulated supplies.

TROUBLESHOOTING TO ASSEMBLY LEVEL

8340A TROUBLESHOOTING SETUP

1. Disconnect all cables from the HP 8340A. It is especially important that any HP-IB controller be removed.

2. Cycle the power - turn the POWER switch to STANDBY, wait several seconds for all power supply capacitors to discharge, turn the POWER switch to ON.

3. Press **[INSTR PRESET]**, and compare the resultant instrument configuration with this expected configuration:

   Start Frequency - 10 MHz

   Stop Frequency - 26.5 GHz.

   Power level - 0.0 dBm (this is the factory-set value and may have been changed by the user by changing calibration constant 56).

   Sweep Time - AUTO (44.15 msec, seen by pressing **[SWEEP TIME]** if in doubt).

   Sweep - CONT

   Trigger - FREE RUN.

   RF - on.

   LEVELING - INT.

INSTR CHECK LEDs should be off. If either or both of these LEDs remain lit after power-on or an INSTR PRESET refer to the Overall Instrument Troubleshooting in Section VIII Service Introduction.

If upon power on the front panel goes into the front panel diagnostic mode (i.e., same as pressing **[SHIFT] [FREE RUN]**), suspect the main instrument processor. At power on, the instrument processor should initiate the self test. One of the first things the self test does is a write to the front panel processor. If upon power on the front panel processor does not receive a write from the main instrument processor, and does not receive a LOW instrument preset, the front panel processor will automatically go into the diagnostic mode.

If upon power on, all front panel LED's are on (similar to holding **[INSTR PRESET]**) check the negative power supplies. The main instrment processor requires both the positive and negative supplies. The front panel LED's require only the positive supplies.

LED AND ANNUNCIATOR TEST

1. Turn the POWER switch to ON. Press and hold **[INSTR PRESET]**. All the LED's and annunciators should light and remain lighted for as long as **[INSTR PRESET]** is pressed. If any LED or annunciator fails to light, use Figures 8H-2 and 8H-3 to identify the affected boards for subsequent disassembly and repair.

ALPHANUMERIC DISPLAY TEST

1. Press **[SHIFT]** **[FREE RUN]** to activate the display self-test diagnostic mode. The following should be observed in a correctly operating instrument:

   The ENTRY DISPLAY shows "DISPLAY RAM TEST PASSED," for 3 seconds.

   "DISPLAY CHECKSUM = 3A" is shown in the ENTRY DISPLAY for another 3 seconds.

   All segments of the numeric displays will light, and all dots in the ENTRY DISPLAY will flash, for 6 seconds.

   The entire available character set will be scrolled across the displays, and will continue scrolling until this diagnostic routine is terminated.

2. If any discrepancies are noted, refer to "A1, A2, A3 DISPLAY TROUBLESHOOTING." After examining the display for failures, press **[SHIFT]** **[M5]** to terminate this diagnostic routine.

KEY AND RPG TEST

1. With the POWER switch set to STANDBY (no fan noise), examine the mechanical action of each key. Check for height differences, unusual sounds when pressed, and differences in the force required to depress each key. Check the RPG for smoothness of rotation.

2. Turn the POWER switch ON and press each key on the front panel. Check for the proper ENTRY DISPLAY message and for the lighting of the appropriate annunciators and LEDs.

3. Press **[INSTR PRESET]** **[POWER LEVEL]**. Rotate the RPG very slowly in both directions, watching for a 0.05 dB increment (clockwise rotation) or decrement (counter-clockwise) in the power level. Rapid rotation of a quarter-turn in either direction should cause a large change in power level.

4. Examine the connectors for contamination or deformation.

Any display or keyboard problems should be evident after the above tests. If the problem appears to be in the front panel, disassemble the front panel as described in **DISASSEMBLY** and then refer to either the display troubleshooting or keyboard troubleshooting following the appropriate circuit description. If the displays and keyboard appear to work correctly, go to the Overall Instrument Troubleshooting in the Section VIII Service Introduction to determine if some other malfunctioning circuit assembly could be causing the problem.

DISASSEMBLY

Figures 8H-4 through 8H-9 show the disassembly procedures for the front panel boards and components. Begin by performing the minimum disassembly necessary to expose the boards and associated cables, then check the integrity of the cable connections before continuing. Typically, faulty connectors cause many service problems and, because they are difficult to see and tend to be intermittent, such faults can be extremely difficult to identify. If faulty connections might be the cause of the problem, separate the connectors, examine the contacts for obvious damage, then reassemble the connectors and see if the symptoms have changed. Clean or replace the connectors as needed.

NOTE

Incorrect cleaning procedures can damage connector contacts. When cleaning contacts, observe these three precautions: 1) Avoid any rubbing motion that might generated static electricity, with subsequent ESD destruction of semiconductor components. 2) Avoid solvents that might chemically react with the contacts - halogenated compounds (containing chlorine or bromine) are especially hazardous. Common rubbing alcohol (70% isopropyl alcohol, 30% water) is generally recognized as a safe and effective cleaning agent. Use a lintless cloth with the solvent. 3) Do not use rubber erasers for abrasive cleaning because they remove part of the very thin gold plating, and they deposit a residue on the metal surfaces.

Continue the disassembly to obtain two, 3-board clusters - the keyboard cluster and the display cluster (note the "service position" for the display cluster in Figure 8H-6) - and proceed with the appropriate troubleshooting procedure (Display or Keyboard).

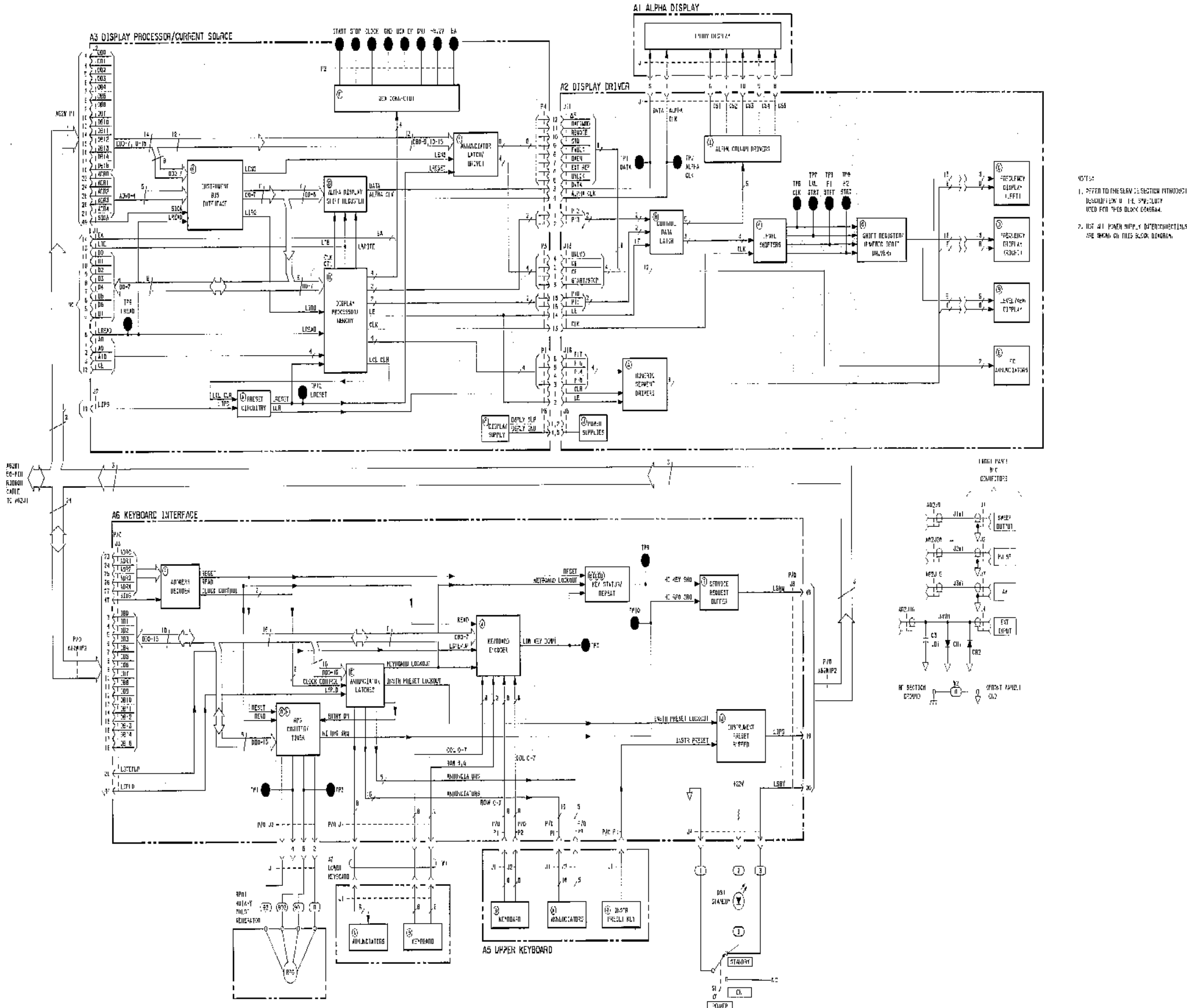


Figure 8H-1. Detailed Block Diagram

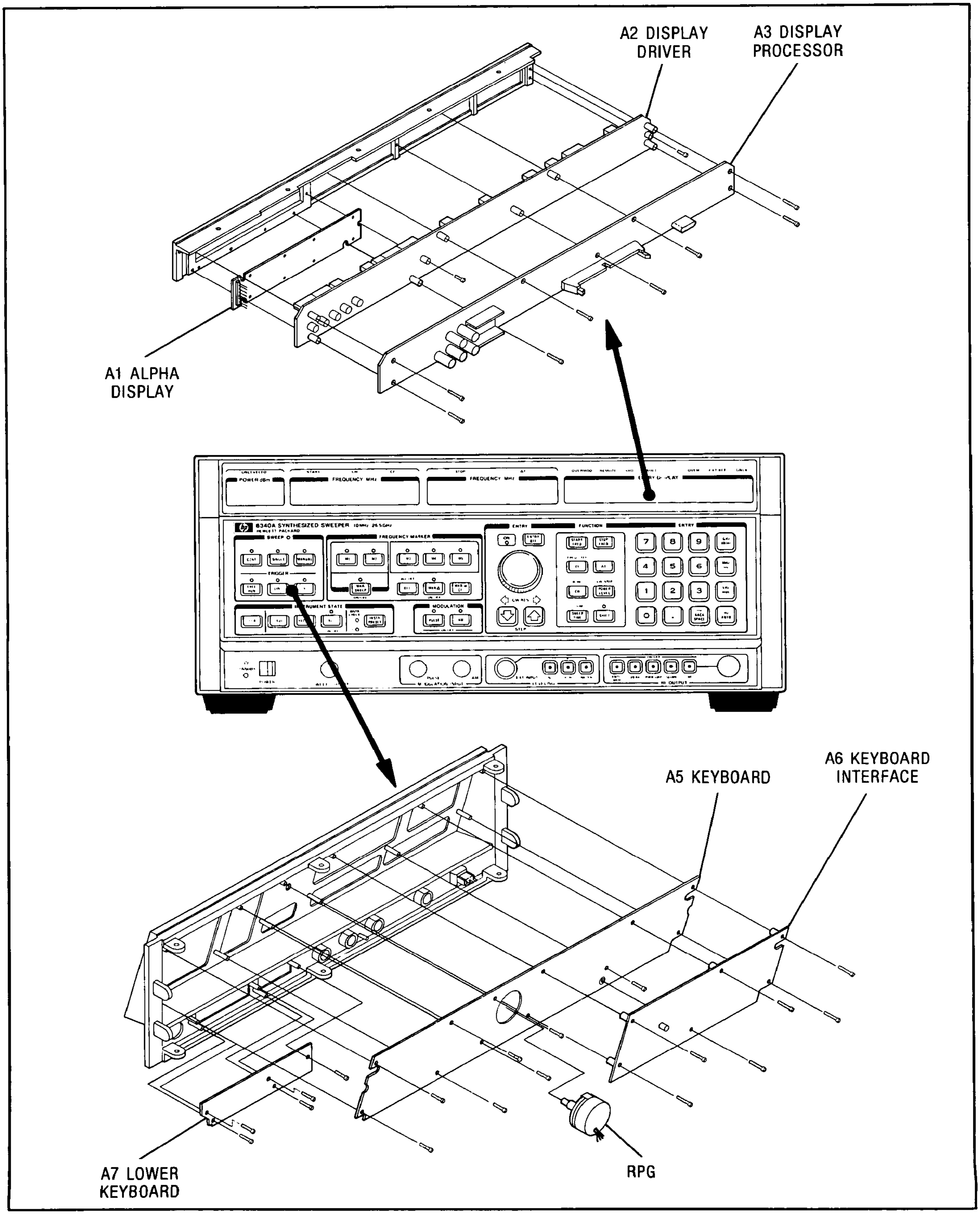


Figure 8H-2. Placement of Front Panel Assemblies

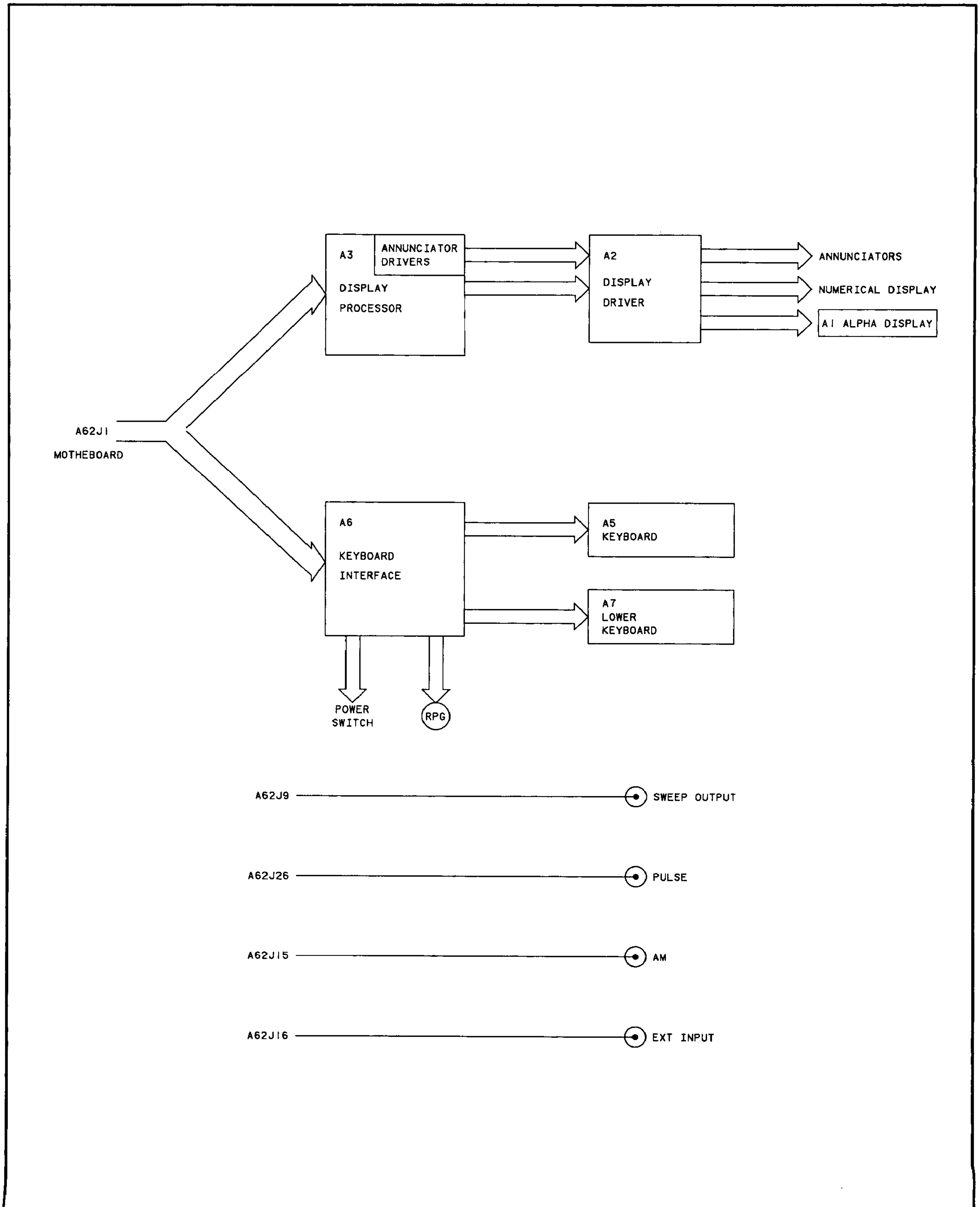


Figure 8H-3. Simplified Block Diagram of Front Panel Assemblies

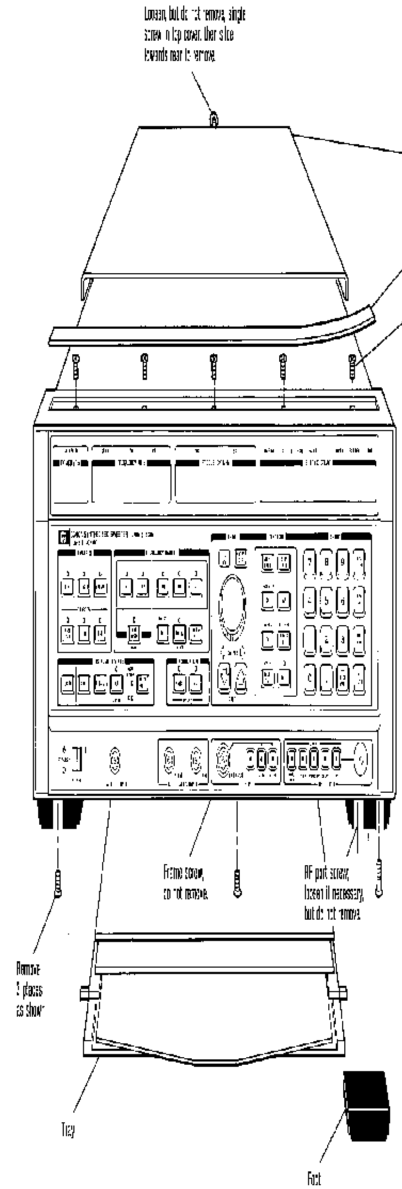


Figure 8H-4. Front Panel Disassembly

1. Disconnect ac power line cord.
2. Remove top cover to facilitate subsequent cable removal.
3. Remove vinyl trim from the top, front edge of instrument by prying a corner loose and gently peeling the trim from the bezel.
4. Remove all five screws that are visible under the trim.

NOTE

It is important that screws of the correct length be used in these five locations. Longer screws protrude through the display casting and damage the display driver board.

5. Remove either front foot (instructions are on the foot) to release the information cards tray. Remove the tray.
6. Five screws will be seen on the lower front frame edge: remove 5, as shown, and loosen a fourth if necessary.

NOTE

The loosened screw centers the RF connector in the front panel opening. Be sure that the RF connector is recentered and secured during re-assembly of the front panel.

7. Gently pry the front panel and display assembly from the frame. It may be necessary to apply pressure from behind against the display assembly.
8. If you intend to remove the entire front panel then you must disconnect the two 50-wire ribbon cables and the four coaxial cables (the coaxial cables that connect the front panel BNC connectors to the motherboard SMB connectors). If you intend to only troubleshoot the display and/or keyboard assemblies then you only need to disconnect the ribbon cable that is attached to the display assembly.
9. Separate the keyboard assembly from the display assembly by removing the three screws between the panel castings.
10. To work on the keyboard, reconnect the ribbon cables and attach the display to the top of the front casting for support.
11. To work on the display, configure the display boards into the service position (Figure 8H-6), reconnect the ribbon cables, lay the display board on the reinstalled top cover, and attach the keyboard to the front panel for support.

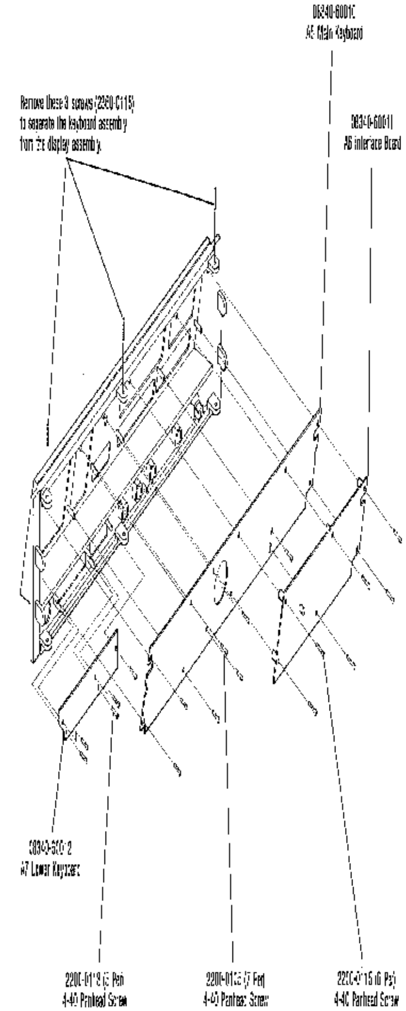


Figure 8H-5. A5, A6, A7 Disassembly

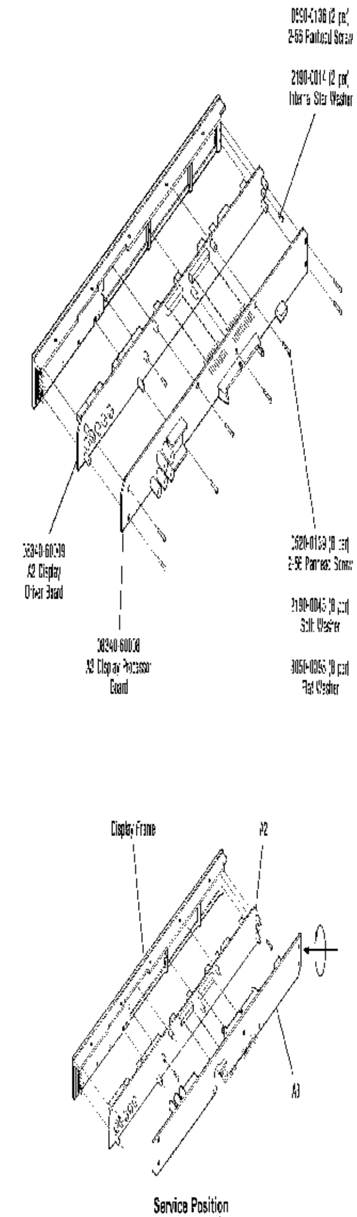


Figure 8H-6. A2, A3 Disassembly

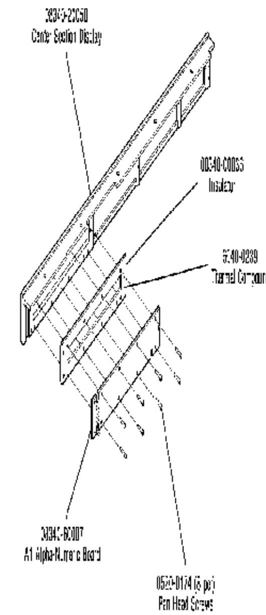


Figure 8H-7. A1 Disassembly

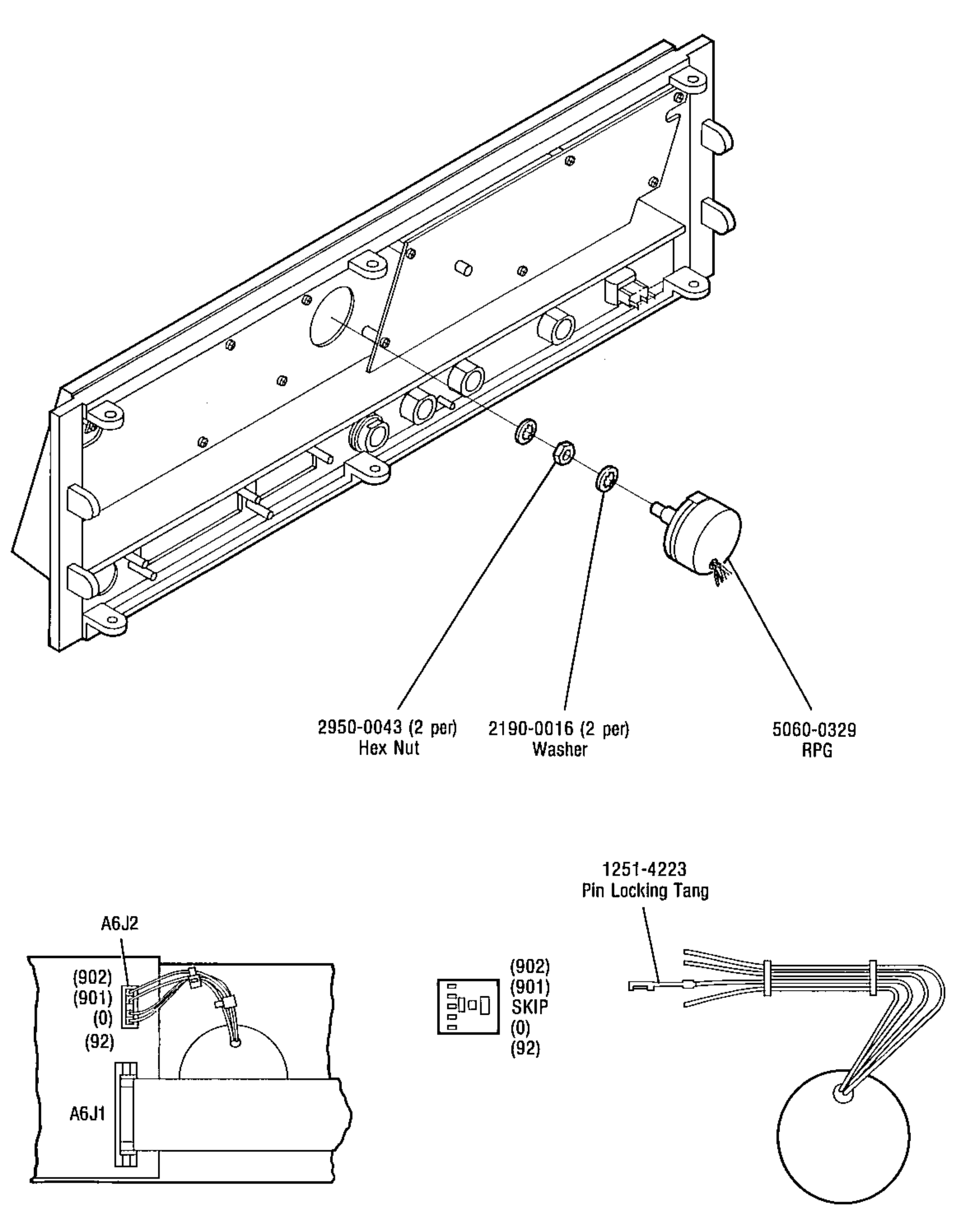


Figure 8H-8. RPG Disassembly

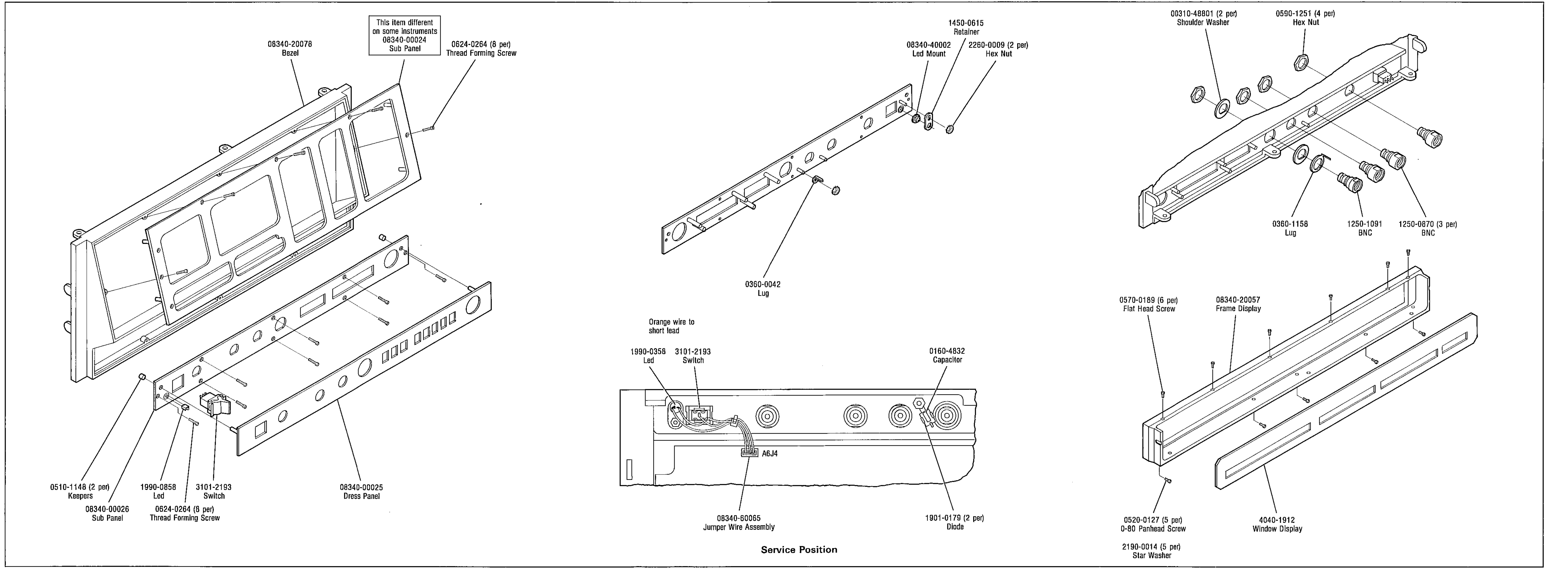


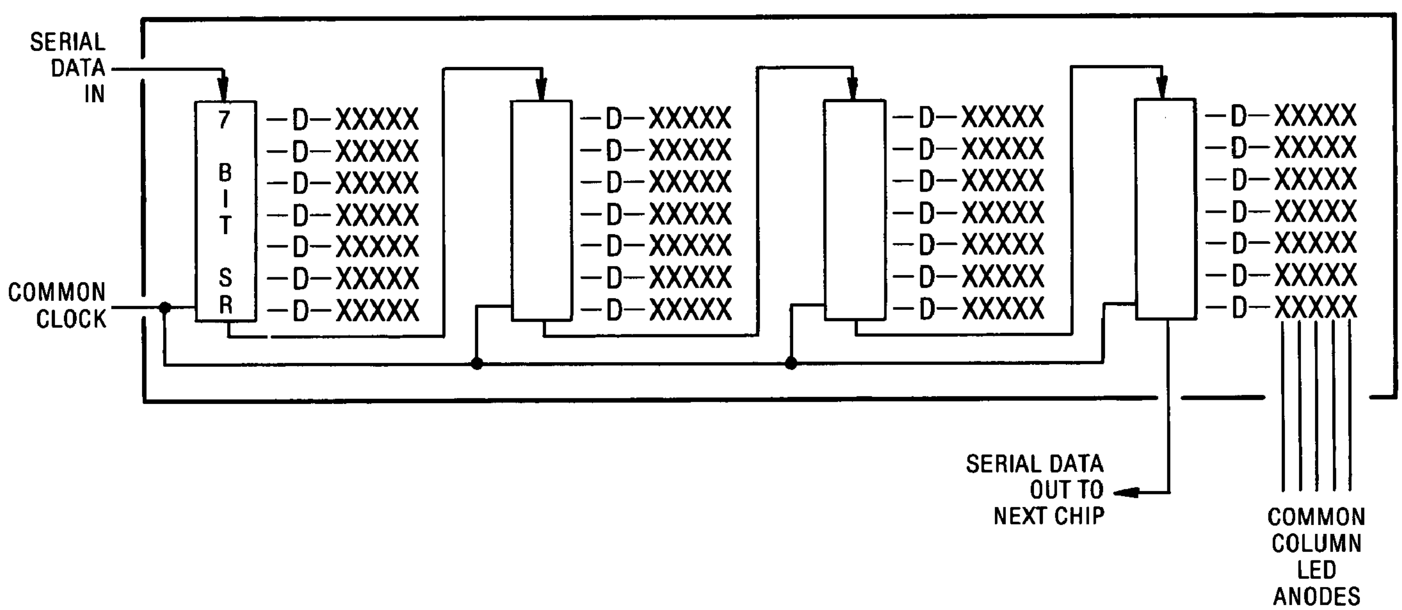
Figure 8H-9. Panels, Switch, and Connectors Disassembly

A1 ALPHA DISPLAY, CIRCUIT DESCRIPTION

An integrated 5X7 dot matrix display is used in the 8340A for display of alphanumeric information. Seven, four-character chips are used for a total of 28 characters. The shift register (SR), drivers (D), and LEDs (X) are arranged as follows:

The 5 LEDs in each row are common to one driver. Each character has 5 columns (columns 1 through 5). The same column in each character is driven by a common column driver (i.e. column 1 in all 28 characters is driven by the same column driver).

The appropriate LEDs in one column of all 28 characters are turned on at one time for about 2.5 ms. The next column is selected and the appropriate LEDs in that column are turned on. The entire process is repeated at about 80 times per second.



When the processor is ready to display a line in the alpha display, the processor fetches the character out of RAM for the last character position of the display. Next, the processor determines which column of the character is being set up (for example, column 5). The processor looks up the bit pattern for the 7 LEDs in the column. The processor outputs these 7 bits, in parallel, to the shift register. The shift register outputs the 7 bits serially to the displays. The processor gets the next to the last character and repeats the above sequence until all 196 bits (7 rows times 28 characters) have been shifted into the displays. Since all 5 LEDs in each row are common to a row driver, if a bit for the particular row is a 1, the cathodes of the LEDs in that row will be pulled LOW. However, only one of the five LEDs is turned on by pulling the appropriate column line HIGH. The above sequence is repeated for each of the five columns and the whole process is repeated at a rate of approximately 80 times per second to ensure a flicker-free display.

The alpha display shift clock is the same alpha display clock generated and controlled on the Display Processor board.

The alpha displays dissipate a lot of power and as a result they must have a substantial heat sink. For this reason the display chips are soldered into the PC board and the PC board is screwed directly to the anodized aluminum bezel assembly. On the PC board, all of the pins to the chips have as much copper connected to them as possible so that the heat will be conducted into the copper on the PC board and then into the bezel. Heat sink compound should be used between the alpha display PC board and the bezel to ensure a low thermal resistance.

A1 ALPHA DISPLAY TROUBLESHOOTING

1. Remove the A1, A2 and A3 boards from the display casting and plug the A1 Board directly into the A2 Board. Take precautions to prevent the A1 Alpha Display from shorting out against the A2 Display Driver.

2. If the Alpha display appears to be working correctly after removing it from the casting, suspect that the anodized insulator has developed a short. If this is the case, clean the casting and the PC board and check for sharp protrusions or foreign particles. Install a new insulator using a non-silicone base thermal compound.

3. If part of the characters are working and some are not, either a signal trace is open or one of the integrated displays is bad. Probe CS1 through CS5, ALPHA CLK, and DATA IN right at the display chip that is not working. If the signals appear at its pins, replace the display. If DATA IN (pin 12) does not appear at the display in question, either this display or the previous display could be at fault.

A2 DISPLAY DRIVER, CIRCUIT DESCRIPTION

NUMERIC SEGMENT DRIVERS A

Each numeric digit is formed by various combinations of seven segments and a decimal point. The anodes of the same segment in each numeric digit are connected in parallel and go to a segment driver. The cathodes of all eight segments within a digit are connected in parallel and go to a digit driver. Therefore, there are eight segment drivers common to all digits plus one digit driver for each of the 31 digits. To display numbers in all display digits, the processor starts at the first digit by clearing the segment driver latch and by turning on the digit driver for the first digit. The display processor then determines from RAM what character should be displayed in this first digit and then sets the appropriate bits of the segment driver latch. Once these bits of the latch are set, the corresponding segment drivers supply current through the segment and out the digit driver. The processor leaves these drivers on for a few tens of milliseconds. At the end of this display time, the segment drivers are all turned off. The shift register/digit driver is immediately shifted to drive the second digit. None of the LED segments of the second digit turn on until the processor determines what character should be displayed and turns on the appropriate segment drivers. This second digit is then displayed for a few tens of milliseconds and so on through all 31 digits until the last digit is displayed and then the whole process is started over. This whole process is repeated about 80 times per second so the eye is not able to perceive the flicker.

The processor selects which numeric segments to turn on by setting the appropriate bits in an 8-bit addressable latch (U9). Processor I/O port P14 through P17 (A3U1 pins 31 through 34) control the address and D input to U9. The address bits (U9 pins 1, 2, and 3) are set to indicate the bit in the latch being changed and the D input (U9 pin 13) is set HIGH or LOW depending on whether you wish to turn on a segment or turn off a segment. The clock line (U9 pin 14) is connected to the LE (Latch Enable) clock signal from A3 block D. Since this clock is essentially the same as the processor LTE (Low Trigger Enable) line, each instruction cycle will transfer the information currently contained on the address and D inputs to the outputs of U9 (U9 pins 4 through 7 and pins 9 through 12).

Each output of U9 is connected through a 1 K ohm resistor to a segment current source and to a 2.2 K ohm resistor connected to the main +5.2V supply.

The segment current sources are formed by two transistors and a resistor (Q11, Q12, and R29 for example). When U9 pin 12 goes HIGH, the upper transistor (Q11) is turned on due to the base current supplied by the 2.2 K ohm resistor and conducts current from the display supply out its emitter and through the resistor (R29). This current increases until the voltage drop across the resistor (R29) equals the VBE drop of the lower transistor. As soon as this current is reached, the lower transistor (Q12) begins to conduct and removes some of the base drive current to the upper transistor (Q11). This process reaches an equilibrium with the lower transistor (Q12) conducting just enough current to remove the excess base current supplied to the base of the upper transistor (Q11). This type of current source is used because it is fairly immune to the voltage variations of the display supply.

When U9 pin 12 goes LOW it conducts all of the current provided by the 2.2 K ohm resistor away from the base of Q11 thus turning off the current source.

Each of the eight segment current sources provides approximately 0.60/16.2 or 37 mA to its particular segment.

NUMERIC DISPLAYS B, C, AND D

The numeric displays consist of two 15 digit and one 5 digit monolithic seven-segment displays (A matched set is available to provide equal illumination). In the 8340A, only 13 of the 15 digits are used in each of the larger displays.

LED ANNUNCIATORS E

Each annunciator is connected in series with a current limiting resistor to +12 volts. The resistor values are selected to make the apparent brightness to the eye the same on all annunciators.

LEVEL SHIFTERS F

In order to meet the input voltage requirements of U4, U5 and U8 power shift registers, level shifters must be used to translate the TTL levels to that required by these ICs.

When the input to the clock level shifter (R7, R8, R9, VR4, and Q6) is not pulled LOW, current is supplied to the base of Q6 through R9 and VR4 and thus causes Q6 to turn on. When Q6 turns on, it pulls one end of R7 down to approximately -5 volts. Each clock input sources 1.8 to 3.5 mA therefore, the current through R7 will be between 5.4 and 10.5 mA making the voltage at the clock inputs (U4, U5 & U8 pin 9) between -3.6 and -2.25 volts. When the input to the clock level shifter is LOW, the base of Q6 is allowed to be pulled down to -5.2 volts thus turning Q6 off and allows the internal pullups of the IC to pull the input HIGH. When the input to one of the start level shifters (R1, R2, and VR1, or R3, R4, and VR2, or R5, R6, and VR3) is not pulled LOW, the start input (U4, U5, and U8 pin 8) will be at approximately +0.6 volts. When the input to one of the start level shifters is pulled low (1.0 volts), the start input will be at approximately -2.2 volts due to the 3.16 volt differential supplied by the zener diode (VR1, VR2, or VR3).

SHIFT REGISTER/NUMERIC DIGIT DRIVER G

The numeric digit drivers (U4, U5, and U8) are power shift registers whose outputs are capable of sinking 250 mA. When the start line (pin 8) is pulsed HIGH, all outputs of the shift register (pins 11 through 20 and 1 through 7) go HIGH. After the application of a start pulse, the first LOW going clock pulse applied to the clock line (pin 9) will cause output U8 (pin 11) to go LOW. Each successive pulse on the clock line (pin 9) shifts this LOW output to the next output line and the previous line goes HIGH. The LOW output shifts through each output line and finally is shifted out of the shift register at which time all outputs will again be HIGH. The outputs of these power shift registers (U4, U5, and U8) are each connected to all the segment cathodes of one digit thus when the output goes LOW it turns on all of the segments in that digit whose segment drivers are activated. The power shift registers have non-standard logic levels for the clock and start inputs. The clock input (pin 9) LOW level is -2.2 volts and has a pull up inside the IC so it can be driven from an open collector transistor. The start input (pin 8) has a HIGH level of +0.5 volts and a LOW level of -0.8 volts.

CONTROL DATA LATCH H

The control data latch (U3) is an open collector addressable D-latch. The address inputs (U3 pins 1, 2, and 3) and the D input (U3 pin 13) are connected to the display processor I/O port P10 through P13 (A3U1 pins 27 through 30). The clock line (U3 pin 14) is connected to the LE signal so each LE cycle the latch will be updated with the current information contained on the I/O port lines. Outputs 4, 5, and 7 (U3 pins 9, 10, and 12) go to the numeric display start pulse level translators. Outputs 0, 1, 2, 3, and 6 (U3 pins 4, 5, 6, 7, and 11) go to Alpha display column drivers 3, 2, 1, 4, and 5 respectively.

ALPHA COLUMN DRIVERS I

The alpha column drivers are formed by Q1 through Q5 and resistor packs U1 and U2. When it is time for the processor to turn on one of the alpha columns, the processor addresses one of the column control lines in the control data latch (U3) LOW which pulls down on the base of one of the column driver transistors (Q1 through Q5) through a 24 ohm resistor. This turns on the transistor which pulls the column line up to the Display Supply.

A2 DISPLAY DRIVER, BLOCK-BY-BLOCK TROUBLESHOOTING

Numeric Segment Drivers (A2 Block A)

ALL NUMERIC DISPLAYS ARE OFF

If all of the segments of all numeric displays are off, first troubleshoot the SHIFT REGISTER/NUMERIC DIGIT DRIVER (A2 Block **G**) and LEVEL SHIFTERS (A2 Block **F**). If no other fault is found, then possibly one of the control signals to A2U9 is faulty.

1. Press **[SHIFT] [FREE RUN]** to run the front panel display diagnostics. Set up the oscilloscope for 50 us/Div.

2. Probe CLR (A2U9 pin 15) with the oscilloscope. You should find LOW going TTL pulses which are 10 to 50 us wide. If this signal is LOW all the time then all numeric displays will remain OFF. If CLR is not correct, troubleshoot the DISPLAY PROCESSOR (A3 Block **D**) or replace A2U9 if U9's input is bad.

3. Probe LE (A2U9 pin 14) with the oscilloscope. Set the oscilloscope to 1 us/Div. You should find LOW going TTL pulses which are 0.36 us wide with a period of 1.36 us. If this signal does not appear, troubleshoot the DISPLAY PROCESSOR (A3 Block **D**).

4. Probe the remaining inputs to U9 (U9 pins 1, 2, 3, and 13). You should find TTL activity. If any of these lines do not have activity or have incorrect voltage levels, troubleshoot the DISPLAY PROCESSOR (A3 Block **D**).

ONE OR MORE NUMERIC DISPLAY SEGMENTS IS ALWAYS OR NEVER ON

If one or more of the numeric display's segments is always on or is never on, the problem most likely lies with the segment current source.

1. Probe the output of U9 which corresponds with the affected segment with the oscilloscope. Set the oscilloscope to 0.5 ms/Div. You should find various patterns of 0.3 ms wide, HIGH going pulses. These pulses will be limited in amplitude to about 3 to 3.5 volts.

2. If the signal at the output of A2U9 is approximately correct, and the segment is on all of the time, it is most likely that the transistor connected to the Display Supply is shorted or a trace from the current sources to the Numeric Displays is open or shorted.

3. If the signal at the output of A2U9 is approximately correct, and the segment is off all of the time, either the transistor connected to the Display Supply is open, the current limiting

transistor is shorted, or a trace from the current sources to the Numeric Displays is open or shorted.

Numeric Displays (A2 Blocks B Through D)

If you have determined that neither the Segment Drivers (A2 Block A) nor the Digit Drivers (A2 Block G) is at fault, replace the Numeric Display Set. This display set is matched for intensity category so be sure to either replace the entire set or else use the same intensity category.

LED Annunciators (A2 Block E)

See troubleshooting of **Annunciator Latch/Driver (A3 Block E)**.

Level Shifters (A2 Block F)

1. Probe NUM CLK (A2TP3) with the oscilloscope. Set the oscilloscope to 1 us/Div. You should find 3 us wide, HIGH going, 3V pulses. If this signal is not present, troubleshoot the DISPLAY PROCESSOR (A3 Block D).

2. If the NUM CLK signal is higher than 3.5V, check the signal levels at the base of Q6. You should find 3 us wide pulses that are 0.6 to 0.8 volts high. If there are no pulses at all at Q6 base, VR4 is open and should be replaced. If the pulses at the base of Q6 are higher than 0.8V, the base of Q6 is open.

3. Probe CLK with the oscilloscope. You should find 3 uS wide, LOW going pulses that go between -3 volts and at least +1.8V. If CLK stays at -3 volts all the time, either Q6 is shorted or R7 is open. If CLK stays at a level near 5 volts all the time, Q6 is open.

4. If you have reason to believe that one of the STRT level shifter circuits is malfunctioning, probe the appropriate signal (LVL START, F1 START, or F2 START) at the cathode of VR1, VR2 or VR3. You should find 3 us wide, HIGH going pulses with levels from 0.7V to approximately 4 volts. If no signal appears, troubleshoot the CONTROL DATA LATCH (A2 Block H).

5. If one of these signals is greater than 4 volts, probe the associated test point (TP4, TP5, or TP7). You should find approximately +- 1.5 volt levels. If the signal at the test point stays at -1.5 volts all the time, it is likely that the zener diode is open. If this signal never goes negative, either the zener is shorted or is in backwards. It is also possible that an input to one of the Numeric Digit Drivers is shorted.

Shift Register/Numeric Digit Driver (A2 Block G)

1. Check for approximately 4.4 to 4.6 volts right at U4 or U5 pin

10 and U8 pin 10. If this voltage is not present, replace CR1 or CR2 as appropriate.

2. Probe the CLK signal at pin 9 of U4, U5, or U8 with the oscilloscope. You should find 3 us wide, LOW going pulses that go between -3 V and at least +1.8V. If these pulses are not present, troubleshoot the Level Shifters (A2 Block D).

3. Probe the STRT signal of the suspected driver at pin 8 of U4, U5, or U8 with the oscilloscope. You should find 3 us wide HIGH going pulses that go between approximately +-1.5V. If these pulses are not present, troubleshoot the Level Shifters (A2 Block D).

4. Probe the outputs of the Digit Drivers (U4, U5 or U6) with the oscilloscope. Set the oscilloscope to 0.1 ms/Div. Since the outputs of the drivers are open collector, connect a 1k ohm resistor between your probe and +5V with small clip leads. This should allow you to observe 400 us wide, LOW going pulses that go between +5V and approximately 0.5V. If this pulse does not appear or if the LOW level is above 0.8 volts, you should replace the driver.

Control Data Latch (A2 Block H)

1. Probe P10 thru P13 signals (A2U3 pins 1, 2, 3, and 13) with the oscilloscope. Set the oscilloscope 0.5 ms/Div. You should find TTL activity. If TTL activity is present, proceed with step 3.

2. Lift the appropriate pin of U3 to determine if the input to U3 is the cause of the problem. If the signal is correct after lifting the pin, replace U3. If the signal is still bad, troubleshoot the DISPLAY PROCESSOR (A3 Block D).

3. Probe LE (A2U3 pin 14) with the oscilloscope. Set the oscilloscope to 1 us/Div. You should find 0.4 us wide, LOW going pulses with a period of 1.4 us. If this signal is not present, follow the same procedure as in step 2.

4. Probe the three STRT lines and you should find 3 us wide, HIGH going pulses. If any of these signals are not present, replace U3.

5. Probe COL 1 through COL5 signals (A2U3 pins 4, 5, 6, 7, and 11) with the oscilloscope. Set the oscilloscope to 0.5 ms/Div. You should find signals which go between 0.5V and 4V. If any of these signals are not present, replace U3.

Alpha Column Drivers (A2 Block I)

1. Probe CS1 through CS5 at the collector of Q1 through Q5 with

the oscilloscope. Set the oscilloscope to 0.5 ms/Div. You should find approximately 1 ms wide, HIGH going pulses of varying amplitudes but at least 2V high. If these signals are present yet one or more alpha display columns are not lighting, check for opens to the A1 board or troubleshoot the A1 Alpha Display.

2. If CS1, CS2, CS3, CS4, or CS5 remain HIGH all the time, connect a 1k ohm resistor between your probe and ground using small clip leads and probe that signal again. If the signal now appears, it is likely that there is an open trace between the transistor and the alpha display chips.

3. If the signal remains HIGH after performing step 2, either the associated transistor is shorted or the input to this block is LOW all the time. Probe the appropriate COL 1 through COL5 signal at U3. If the signal appears at this point, it is likely that the drive transistor is shorted. If no signal appears at U3, troubleshoot the CONTROL DATA LATCH (A2 Block H).

4. If CS1, CS2, CS3, CS4, or CS5 remains LOW all of the time, probe the appropriate COL 1 through COL5 signal at U3. If a signal appears at the output of U3 but the output of the associated driver transistor (Q1 through Q5) remains LOW, a trace is open, one of the resistors in U2 is open, or the drive transistor is open. If no signal appears at U3, troubleshoot the Control Data Latch (A2 Block H).

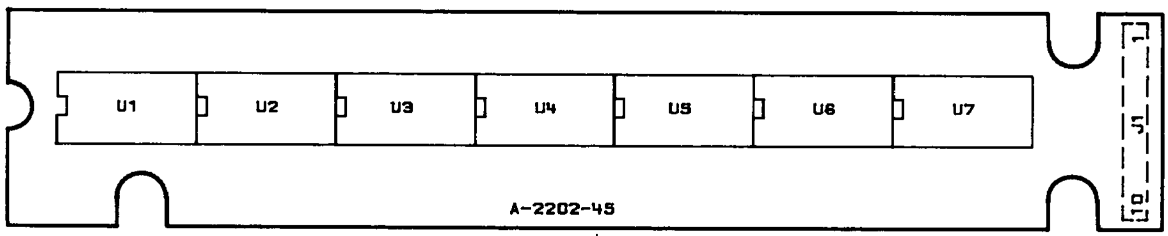


Figure 8H-10. A1 Alpha Display Component Location Diagram

A62J1 PIN I/O

Pin	Mnemonic	A62W1P1	A62W1P2	Levels
1	GND PLANE	PIN 1	PIN 1	0V
2	+12V	PIN 2	PIN 2	+12V
3	DB0	PIN 3	PIN 3	TTL
4	DB1	PIN 4	PIN 4	TTL
5	DB2	PIN 5	PIN 5	TTL
6	DB3	PIN 6	PIN 6	TTL
7	DB4	PIN 7	PIN 7	TTL
8	DB5	PIN 8	PIN 8	TTL
9	DB6	PIN 9	PIN 9	TTL
10	DB7	PIN 10	PIN 10	TTL
11	DB8	PIN 11	PIN 11	TTL
12	DB9	PIN 12	PIN 12	TTL
13	DB10	PIN 13	PIN 13	TTL
14	DB11	PIN 14	PIN 14	TTL
15	DB12	PIN 15	PIN 15	TTL
16	DB13	PIN 16	PIN 16	TTL
17	DB14	PIN 17	PIN 17	TTL
18	DB15	PIN 18	PIN 18	TTL
19	LIPS	PIN 19	PIN 19	TTL (LOW TRUE)
20	LSBY	NOT USED	PIN 20	0V TO +22V
21	GND PLANE	NOT USED	PIN 21	0V
22	HPUP	NOT USED	NOT USED	TTL (HIGH TRUE)
23	ADR0	PIN 23	PIN 23	TTL
24	ADR1	PIN 24	PIN 24	TTL
25	ADR2	PIN 25	PIN 25	TTL
26	ADR3	PIN 26	PIN 26	TTL
27	ADR4	PIN 27	PIN 27	TTL
28	LSTEPUP	NOT USED	PIN 28	TTL (LOW TRUE)
29	GND PLANE	PIN 29	PIN 29	0V
30	+22V	NOT USED	PIN 30	+22V
31	+5.2V	PIN 31	PIN 31	+5.2V
32	+5.2V	PIN 32	PIN 32	+5.2V
33	+5.2V	PIN 33	PIN 33	+5.2V
34	+5.2V	PIN 34	PIN 34	+5.2V
35	+5.2V	PIN 35	PIN 35	+5.2V
36	+5.2V	PIN 36	PIN 36	+5.2V
37	+5.2V	NOT USED	PIN 37	+5.2V
38	GND PLANE	NOT USED	PIN 38	0V
39	GND PLANE	PIN 39	PIN 39	0V
40	GND PLANE	NOT USED	PIN 40	0V
41	GND PLANE	NOT USED	PIN 41	0V
42	−5.2V	PIN 42	PIN 42	−5.2V
43	LSTP	NOT USED	NOT USED	TTL (LOW TRUE)
44	LSPLD	NOT USED	PIN 44	TTL
45	LSRQ	NOT USED	PIN 45	TTL (LOW TRUE)
46	GND PLANE	NOT USED	PIN 46	0V
47	SIOB	NOT USED	PIN 47	TTL (LOW TRUE)
48	GND PLANE	PIN 48	PIN 48	0V
49	ISOA	PIN 49	NOT USED	TTL (LOW TRUE)
50	GND PLANE	PIN 50	PIN 50	0V

Note: Refer to Front Panel Block Diagram and A62 Motherboard Wiring List for signal source and destination information.

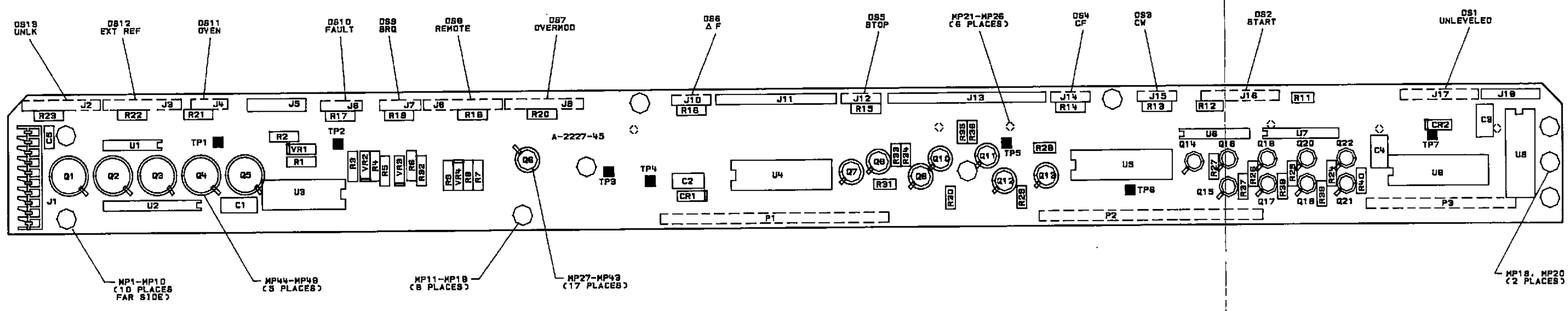


Figure 8H-11. A2 Display Driver, Component Location Diagram

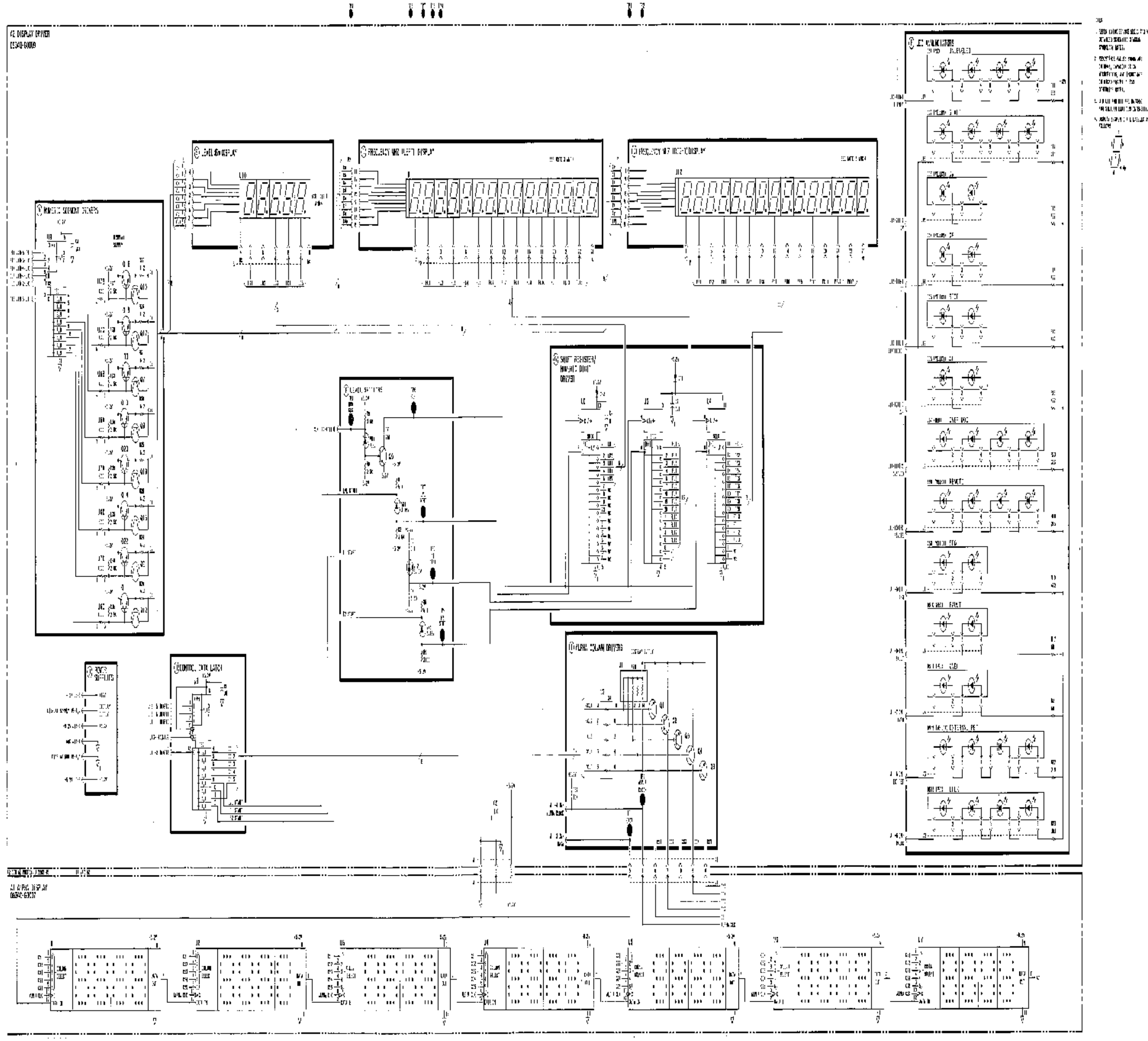


Figure 8H-12. A1 Alpha Display and A2 Display Driver, Schematic Diagram

8-569/8-590

A3 DISPLAY PROCESSOR, CIRCUIT DESCRIPTION

INSTRUMENT BUS INTERFACE B

The Instrument Bus Interface consists of an eight-bit D-latch (U6) and a 3 to 8 line decoder (U10).

The 3 to 8 line decoder (U10) decodes the address information from the instrument address bus and the SIOA signal and generates I/O strobe LEN 5 or LEN 7. LEN 5 (U10 pin 10) latches annunciator control bits (Block E) off the instrument data bus. LEN 7 (U10 pin 7) is the interrupt strobe to the display processor. LEN 7 is also the clock to the eight-bit D-latch (U6 pin 11) which latches the data being sent to the display via the instrument data bus.

The eight-bit D-latch (U6) serves to connect the two asynchronous buses together. The Q outputs of this latch are connected to the displays internal data/address bus. When the display processor is ready to accept the data stored in input latch U6, the read line of the processor (U1 pin 8) goes LOW enabling the D-latch (U6 pin 1). U6 then outputs onto the display data bus.

The Service Request Latch consists of two NAND gates connected as a set/reset latch. U3A has both of its inputs (U3 pins 1 and 2) HIGH so its output (U3 pin 3) will be LOW. U3B has one input (U3 pin 4) connected to the output of U3A (U3 pin 3) which is LOW. The other input (U3 pin 5) is connected to the processor read line (U1 pin 8 Block D) which is HIGH until it reads the data contained in the eight-bit data bus latch (U6). The output of U3B (U3 pin 6) is therefore HIGH which makes the circuit stable in this state until some input changes.

When the instrument processor sends an interrupt to the display, the interrupt line (U10 pin 7) goes LOW and then HIGH 400 nsec later. When this line goes LOW, U3 pin 1 goes LOW causing the output of U3A to go HIGH. This forces U3 pin 4 to go HIGH which causes the output of U3B (U3 pin 6) to go LOW. When this output goes LOW it forces the other input to U3A (U3 pin 2) LOW which makes the circuit stable in this state until some input changes. This output (U3 pin 6) is also connected to the interrupt line of the display processor (U1 pin 6). When this pin goes low, the processor starts an interrupt sequence.

During the interrupt service routine, the display processor takes the read line (U1 pin 8) LOW which is connected to an input to U3B (U3 pin 5) and to the eight-bit data bus latch (U6 pin 1). When this happens, the output of U3B (U3 pin 6) goes HIGH, forcing one input to U3A (U3 pin 2) HIGH. If the other input to U3A is HIGH (U3 pin 1 interrupt strobe) the output of U3A (U3 pin 3) will go LOW which presents a LOW at U3 pin 4 and makes the circuit stable in this state until some input changes and this completes the cycle.

DISPLAY PROCESSOR D

The display processor is an 8049 microcomputer. It contains 128 bytes of RAM and 2K bytes of ROM program memory. This ROM contains all of the microcoded program to control the display processor. This microcomputer contains an eight-bit down counter which uses a prescaled (divided by 32) address latch enable (ALE) signal for its input clock. I/O consists of two 8-bit parallel ports which can be either input or output, and an 8-bit bi-directional bus.

The display uses the 128 bytes of RAM for internal registers, storage for the present characters being displayed in the numeric and alpha displays and for a command-First In First Out register (FIFO).

The instrument processor communicates with the display processor via the lower 8-bits of the 16-bit bidirectional bus; however, the display processor cannot send data back to the instrument processor. The instrument processor outputs command or data information to the display interface latch. The clock to this latch also sets the display service request latch. The display processor immediately takes the information present in the interface latch and places it on the bottom of the FIFO. Commands and data contained on the FIFO are executed sequentially when the display processor has time that is not required to refresh the numeric and alpha displays. This method provides the minimum response time to interrupts from the instrument processor and at the same time always provides flicker free display refreshing.

The oscillator circuit consists of a 10.92 MHz crystal connected to the internal oscillator circuit of the processor (U1 pins 2 and 3). A crystal is used rather than an LC circuit due to variations in oscillator frequency from unit to unit when a LC circuit is used. Refer to manufactures data sheet for a more detailed discussion of the processor.

U3C provides a clock signal (LE) to the two control Addressable Latches on the display driver board (A2). This clock line is required to be HIGH when the reset to these Addressable Latches is LOW so LOW Reset is NANDed with the LTE clock to force the above condition to occur.

ANNUNCIATOR LATCH/DRIVER E

When the annunciator strobe (LEN 5) goes LOW and then HIGH (U5 and U7 pin 9), the information on the instrument data bus is latched into the annunciator data latches. The outputs of these latches drive the inputs of the annunciator drivers (U4 and U8). The annunciators are located on the A2 Display Driver Board. Each annunciator is connected in series with a current limiting resistor to +12 volts. The resistor values were selected to make the apparent brightness to the eye the same on all annunciators.

The HighVoltage drivers (U4 and U8) provide sufficient current sink capability and allow the use of the +12 volt supply for the annunciators.

PRESET CIRCUITRY A

The preset circuitry has two purposes. The first is to allow the instrument preset signal to clear the annunciator LEDs and to reset the display processor. The second is to allow either the instrument preset signal or the display processor to clear the numeric display segment driver data latch.

The LIPS signal comes into the display to a schmitt trigger buffer (U9B pin 5) is inverted twice and appears at U9A pin 3 with polarity unchanged. This buffered LIPS directly clears the annunciator latches (U5 and U7 pin 1 in Block **E**) and directly resets the display processor (U1 pin 4 in Block **D**). This Low-True signal is ORed (U9D pin 12 and 13) with a Low-True signal from I/O Port P25 of the display processor (U1 pin 36). The output of the above gate (U9D pin 11) is inverted (U9C pin 10) to produce the Low-True clear (U9C pin 8) which is sent to the NUMERIC SEGMENT DRIVERS (A2 Block **A**).

ALPHA DISPLAY SHIFT REGISTER G

The alpha displays require row information in serial form. This shift register (U2) has its parallel inputs (U2 pins 3, 4, 5, 6, 12, 13, and 14) connected to the display data/address bus. When the display processor does a write, the write line (U1 pin 10 in Block **D**) goes LOW and forces the parallel load line (U2 pin 1) LOW. At that time, the data on the data bus is loaded into the shift register (U2). This information is then shifted serially to the alphanumeric integrated displays (A1, U1 through U7).

The alpha display clock synchronizes the transfer of serial data from the alpha display shift register (U2) into the serial shift registers contained within the alpha display integrated circuits.

The main sequence synchronization clock (LTE) is ANDed (U3D pin 12 and 13) with I/O Port P27 (U1 pin 38) from the display processor to produce the alpha display clock signal (U3D pin 11). This signal goes to the shift register (U2 pin 2) and to the alphanumeric integrated displays (A1, U1 through U7) and allows the display processor to control the number of bits shifted into the Alpha Display. This method of generating a clock produces the fastest transfer of serial information to the Alpha Displays. It also allows the processor to do other things, once the shift clock has been turned on, until it is time to turn the clock off.

DSA CONNECTOR F

Start, Stop, Clock and Ground are arranged in the same order as on the HP 5005A Signature Analyzer pod. The DSA function is enabled by shorting the ground and DSA Enable lines on the DSA connector (TP5 and TP6) together and forcing the LIPS line LOW (momentarily) by pressing instrument preset or momentarily shorting LIPS to ground on the display.

Two additional pins (TP7 and TP8) are connected to +5.2 volts and U1 pin 7 (processor's External Access EA). When EA is tied to +5.2V it forces the processor to do all instruction fetches from external memory. This function may be useful for troubleshooting address/data bus problems.

DISPLAY SUPPLY C

The peak current required by the displays can be as high as 2 amps. However, the average current required is much less. These current peaks or transients caused by strobing the Alpha and Numeric displays cause spurs on the 8340A RF output.

A constant current source connected to the instrument +5.2 volt supply is provided so that a constant load will be seen by the instrument supplies. The output of this current source is then connected to the LED current source circuits along with a large amount of energy storage (five 220 uF capacitors). The current source provides slightly more than the average amount of current required by the LEDs, and the capacitors provide the additional current required during peak demands.

Q1, Q2, and U11B form the display current source. Q1 and Q2 increase the current capability of the current source. Disregarding U11A for the moment, the emitter of Q1 will be forced to the same voltage as the positive input of U11B by virtue of the voltage feed back through R9. The positive input (U11B pin 5) is fixed at one diode drop below the supply (+5.2VF). R5 therefore, has a constant voltage drop across it and produces the constant current for the display supply. The average current demanded by the displays changes as more or less segments or characters are turned on. In order to keep the current source in regulation during both high and low average current demands, it is necessary to make the current source adjustable. This is accomplished by sensing the voltage at the energy storage capacitors through R11. As this voltage goes down, indicating that the average current is not sufficient, the voltage at U11A pin 1 goes up. This causes an increase in the voltage across R5 and therefore will increase the current to the display supply. The current source should not track the output voltage or respond to variations caused by strobing segments and columns. This would defeat the whole purpose of the current source. To eliminate this problem, U11A is connected as a slow integrator. It responds only to slow variations in the average voltage at the display supply. R12 and R13 set the quiescent operating point of the current source. R11, R3 and C20 set the gain and speed of the integrated voltage feedback loop.

When the current source has been supplying a large amount of current and suddenly the requirement goes down, the current source will try to continue supplying this large current. The voltage at the output will rise until it cannot go any higher and then the current source will go out of regulation. This causes a current transient on the main supply to the display. VR1 and R6 are used to sink this excess current until the integrating feedback has time to reduce the average output current.

POWER SUPPLIES H

The power supply filtering is straight forward except for the choke (L2) in the +5.2 volt supply line. The intention of this choke is to further filter out conducted transients on the 5 volt supply caused by the processor, TTL circuitry, and other display circuitry that could not be connected to the current regulated supply due to the voltage variations of that supply. Spurs related to the display processor running are reduced by approx 15 dB by adding this filter choke.

A3 DISPLAY PROCESSOR TROUBLESHOOTING

REQUIRED EQUIPMENT

* VOM
* Oscilloscope (100 MHz)
* 5005B Signature Analyzer (If DSA troubleshooting is used)
* Logic probe

PREPARATION

1. Measure the power supply voltages on the A3 Display Processor by connecting the VOM common lead to GROUND (TP10) and checking the -5.2V (TP11), +5.2V (TP13) and +12V (TP14) supplies for proper voltages.

2. If the supplies are correct, refer to Figure 8H-4 through 8H-7 and remove the front panel, separate the display assembly from the keyboard and reattach the keyboard to the frame.

3. Remove eight screws from the display assembly holding the A3 Display Processor in place. Turn the Display Processor over and reinsert the other end of P1 through P5 into the same sockets they came out of and install two screws to hold it in place.

4. The resulting position of the two display boards (shown in Figure 8H-7) is called the Service Position and allows most of the following troubleshooting to take place.

5. Place the display into the self-test mode by pressing **[SHIFT] [FREE RUN]**.

SYMPTOMATIC TROUBLESHOOTING

Display RAM Test Fails

1. Replace A3U1

Display Checksum Not Equal To "3A"

1. The display checksum is shown in the ENTRY DISPLAY during the front panel diagnostics. Press **[SHIFT] [FREE RUN]** and determine if the checksum is equal to 3A. If not, replace A3U1.

Numeric And ENTRY Displays Are Dim

1. Check Display Supply voltage (A3P5 pin 1,2) with an oscilloscope. This voltage should be 4.0V with 430 Hz 0.6V p-p ripple. If this voltage is low (< 3.2V), the displays are

likely to be dim and if this voltage is less than about 2.0V the displays will be blank. If this voltage is not correct, troubleshoot the Display Supply (A3 Block **C**).

Both Numeric And ENTRY Displays Are Blank

1. Check LRESET (A3TP12) and CLR (A3P1 pin 1). If either is LOW, troubleshoot PRESET CIRCUITRY (A3 Block **A**).

2. Check the Display Supply voltage (A3P5 pin 1 and 2) with an oscilloscope. This voltage should be 4.0V with 430 Hz 0.6V pk-pk ripple. If this voltage is low (< 3.2V), the displays are likely to be dim and if this voltage is less than about 2.0V the displays will be blank. If this voltage is not correct, troubleshoot the DISPLAY SUPPLY (A3 Block **C**).

3. If both LRESET and CLR are HIGH and the display supply voltage is 4.0V or greater then proceed to **All Numeric Displays Are Blank**, and **ENTRY DISPLAY Is Blank** troubleshooting procedures.

All Numeric Displays Are Blank

1. Connect the oscilloscope to CLK test point (A2TP6). Set it to 0.5 us/div and 1 V/div (0V = center screen). The waveform displayed should be LOW for 2.5 to 3.0 us with levels between +2V and approximately -2.5V. If this signal is not present, troubleshoot the NUM CLK in LEVEL SHIFTERS (A2 Block **F**).

2. Troubleshoot CONTROL DATA LATCH (A2 Block **H**).

3. Troubleshoot NUMERIC SEGMENT DRIVERS (A2 Block **A**).

Entry Display Is Blank

1. Connect oscilloscope to ALPHA CLK (A2TP2). Set the oscilloscope to 0.5 uS/div and 1V/div (0V=Center screen). The waveform displayed should be TTL LOW-going pulses 0.3 uS wide with a period of 1.4 us. If this signal is not present, troubleshoot Alpha Display Clock Control in the ALPHA DISPLAY SHIFT REGISTER Block (A3 Block **G**).

2. Connect oscilloscope to DATA (A2TP1). Set the oscilloscope as above. The waveform display should indicated both HIGH and LOW signal levels approximately 1.4 us wide. If the DATA signal is always LOW, all LEDs in the ENTRY DISPLAY will be off. If this signal is not present, troubleshoot the ALPHA DISPLAY SHIFT REGISTER (A3 Block **G**).

3. Troubleshoot the CONTROL DATA LATCH (A2 Block **H**).

The Same Segment(s) Is Missing In Each Numeric Digit

1. Troubleshoot the NUMERIC SEGMENT DRIVERS (A2 Block **A**).

The Same Column Is Missing In Each ENTRY DISPLAY Character

1. Troubleshoot the ALPHA COLUMN DRIVERS (A2 Block **I**).

2. Troubleshoot the CONTROL DATA LATCH (A2 Block **H**).

One Entire Numeric Display Is Blank

1. Troubleshoot the appropriate STRT signal in the LEVEL SHIFTERS Block (A2 Block **F**).

2. Troubleshoot the appropriate SHIFT REGISTER/NUMERIC DIGIT DRIVER (A2 Block **G**).

The Display Goes Into Self Test When The 8340A Is Turned ON And Does Not Respond To Normal Instrument Functions

1. Troubleshoot the INSTRUMENT BUS INTERFACE (A3 Block **B**).

A3 DISPLAY PROCESSOR BLOCK-BY-BLOCK TROUBLESHOOTING

Preset Circuitry (A3 Block A)

1. Check LRESET (A3TP12) voltage. This should be a TTL HIGH. Now press **[INSTR PRESET]** on the front panel; LRESET should go LOW. If LRESET is correct, proceed to step 6.

2. Probe LIPS at A3U9B pin 5. LIPS should also be HIGH normally and should go LOW when you press **[INSTR PRESET]**. If LIPS is correct, proceed to step 4.

3. Check LIPS at the Instrument end of the ribbon cable and replace the ribbon cable if necessary.

4. Lift A3U9 pin 3 and retest LRESET right at pin 3.

5. If LRESET is still incorrect, replace A3U9. If LRESET is now correct, first suspect A3C21 is shorted. If this capacitor is not shorted look for evidence of a shorted trace associated with this signal. If no shorted trace exists then determine which of the following devices is holding LRESET down:

   A3U5 pin 1
   A3U7 pin 1
   A3U1 pin 4

6. Probe CLR at A3U9C pin 8 or A3P1-1. Set the oscilloscope to 0.2 ms/div and 1 V/Div. The CLR signal should be a continuous series of LOW pulses approximately 1 ms wide and 4 ms apart. Press **[INSTR PRESET]** and CLR should go LOW and remain LOW until the key is released. If both LRESET and CLR are correct, the Preset Circuitry is performing correctly. If CLR is not correct, proceed with step 7.

7. Disconnect the Display Processor board (A3) from the Display Driver board (A2) and repeat step 6. If CLR is now correct, suspect a shorted trace or a shorted input to A2U9 on the A2 Display Driver board.

8. If the CLR signal remains either HIGH or LOW, lift A2U9 pin 8 and check CLR right at the pin. If CLR is now correct, troubleshoot for a short to the CLR signal trace on the A3 Display Processor board.

9. Replace A3U9.

Instrument Bus Interface (A3 Block B)

ANNUNCIATORS ALL STAY ON AFTER **[INSTR PRESET]**

NOTE

If all the annunciators remain lit at power up (similar to holding [INSTR PRESET] in), the instrument processor may not be running. Check the negative power supplies.

1. If the annunciators all stay on after **[INSTR PRESET]**, the Load Strobe (LEN 5) from A3U10 may be bad. To check this, Direct I/O Addressing is used to manually generate the strobe. Press the following key sequence:

   [SHIFT] [GHz] [15] [Hz]
   [SHIFT] [MHz] [0] [Hz]
   [SHIFT] [kHz]

2. Probe LEN5 (A3U10 pin 10) with an oscilloscope while rotating the RPG. Set the oscilloscope to 0.2 us/div and 2 V/div. Rotating the RPG will cause a series of writes to the annunciator's address and there should be LOW going pulses approximately 300 ns wide displayed on the oscilloscope. A logic probe may also be used to detect pulses at this location. If the pulses are present, troubleshoot the Annunciator Latch/Driver (Block **E**).

3. Probe SIOA (A3U10 pin 4) while rotating the RPG. You should again find 300 to 400 ns wide, LOW going pulses. If SIOA is pulsing, proceed to step 5.

4. Probe SIOA on the Motherboard end of the ribbon cable. If SIOA is pulsing, replace the ribbon cable. If SIOA isn't pulsing, troubleshoot the A60 Processor.

5. Check each of the address bits (A0 thru A4 A3U10 pins 5, 2, 3, 6, and 1) for bus activity while the 8340A is sweeping. The lack of activity on any one of these address bits probably indicates that a wire is open in the front panel ribbon cable.

6. Lift A3U10 pin 10 and again check for pulses as in step 2. If pulses now appear at A3U10 pin 10 then check for shorts along LEN5 or troubleshoot the Annunciator Latch/Driver (A3 Block **E**). If after lifting pin 10 pulses still do not appear at pin 10 then replace A3U10.

FRONT PANEL ENTERS DISPLAY SELF TEST MODE AT POWER ON

1. If the Front Panel enters the display self test mode when power is turned on and the main instrument processor is

working, the display processor is probably not receiving interrupts. The interrupt strobe (LEN 7) from A3U10 may be bad. To check this, Direct I/O Addressing is used to manually generate the strobe. Press the following key sequence:

[SHIFT] [GHz] [15] [Hz]
[SHIFT] [MHz] [2] [Hz]
[SHIFT] [kHz]

2. Probe A3U10 pin 7 (LEN 7) with an oscilloscope while rotating the RPG. Set the oscilloscope to 0.2 us/div and 2V/div. Rotating the RPG will cause a series of writes to the display's address. There should be LOW going pulses approximately 300 ns wide displayed on the oscilloscope. A logic probe may also be used to detect pulses at this location. If the pulses are present, proceed to step 7.

3. Probe SIOA (A3U10 pin 4) while rotating the RPG. You should again find 300 to 400 ns wide, LOW going pulses. If SIOA is pulsing, proceed to step 5.

4. Probe SIOA on the Motherboard end of the ribbon cable. If SIOA is pulsing, replace the ribbon cable. If SIOA isn't pulsing, then troubleshoot the A60 Processor.

5. Check each of the address bits (A0 thru A4 A3U10 pins 5, 2, 3, 6, and 1) for bus activity while the 8340A is sweeping. The lack of activity on any one of these address bits probably indicates that a wire is open in the front panel ribbon cable.

6. Lift A3U10 pin 7 and again check for pulses at pin 7 as in step 2. If pulses now appear at A3U10 pin 7 then check for shorts along LEN7 or at the input of U3 or U6. If after lifting pin 7, pulses still do not appear then replace A3U10.

7. Probe LIRQ (A3U3 pin 6). You should expect LOW going pulses between 10 and 25 us wide to appear each time the display is addressed (LEN 7 pulsed). This time varies due to differences in the response time of the display processor to interrupts from the instrument processor. If pulses are present at LIRQ, the Service Request Latch is operating properly.

8. If LIRQ never goes LOW then check for LOW going pulses at A3U3 pin 4 each time the display is written to. If there are no pulses then replace A3U3.

9. Check the level of LREAD signal (A3U3 pin 5). LREAD should be HIGH normally and will go LOW for 700 ns each time the display processor accepts an interupt request.

10. If LREAD stays LOW, this will prevent LIRQ from going LOW. Inspect along the READ signal trace for evidence of a short.

If no short exists then lift A3U6 pin 1 to determine if its input is shorted to ground. If LREAD stays LOW after lifting this pin, then you must suspect that the processor A3U1 is bad and must be replaced.

DISPLAY REMAINS BLANK OR HAS GARBLED MESSAGES

If the display remains BLANK or has garbled messages and numbers in the displays, one or more of the data bits may not be getting to the display processor. To check this you may use Digital Signature Analysis (DSA) or you may do the following manual verification:

1. Set up the 8340A to write to the Display using Direct I/O Addressing. Press

   [SHIFT] [GHz] [15] [Hz]
   [SHIFT] [MHz] [2] [Hz].

2. Turn off the display updating by pressing **[SHIFT] [CONT].**

3. Turn the 8340A POWER switch to the STANDBY position.

4. Connect LRESET (A3TP12) to GROUND (A3TP10).

5. Connect EA (A3TP8) to +12V (A3TP14).

6. Connect READ (A3TP9) to GROUND (A3TP6).

7. Turn the 8340A POWER switch to the ON position.

8. Press the following keys to write a "0" to the Display Interface Latch: **[SHIFT] [kHz] [0] [Hz].**

9. Check each output of the interface latch (A3U6 pins 2, 5, 6, 9, 12, 15, 16, and 19) for being LOW.

10. Press the following keys to write all "1s" to the Display Interface Latch: **[255] [Hz].**

11. Check each output for a HIGH level.

12. If any of the outputs are not HIGH or LOW when they should be, check the ribbon cable for opens or replace A3U6.

Display Supply [A3 Block C]

If the +5.2V power supply is correct yet the Display Supply is not, then you must troubleshoot the Display Supply as follows:

DISPLAY SUPPLY VOLTAGE < 3V

If the Display Supply voltage is below approximately 3 volts, neither the numeric displays nor the entry display will light up with the proper intensity. If the Display Supply is below approximately 2V, all of the LEDs will be off.

1. Measure the output of U11B (pin 7). Under normal conditions, this voltage should be approximately 3.3 volts. If this output (U11B pin 7) is approximately 0.1 to 0.2 volts, it is likely that either Q1 or Q2 is open. Check Vbe on Q1 and then Q2 to help determine which is at fault. If this output (U11B pin 7) is near 5 volts, CR12 may be shorted or U11 is bad.

2. Measure the voltage at U11B pin 5. This voltage should be approximately 4.3 volts (one diode drop below the supply). If this voltage is greater than 4.3V, either CR1 is shorted, R8 is open, or the input to the U11A (pin 5) is damaged.

3. If all of the above is correct, check U11A. If Q1 is saturated or shorted, U11A's output voltage is limited to approximately +5.5V when the Display supply is between 0V to 3.7V. If a voltage outside this range appears, suspect U11A or the associated resistors. If C20 is shorted it will cause the Display supply voltage to be too low.

4. Measure the voltage at U11A pin 3. It should be approximately 4V. If it is not, measure the voltage between U11A pin 2 and pin 3. If the voltage between U11A pins 2 to 3 is not 0V, either R11 is shorted or else U11 is bad. If this voltage is 0V, suspect that either R12 or R13 is bad or is an incorrect value causing the operating point of the current source to be incorrect.

DISPLAY SUPPLY VOLTAGE > 4.2V

If the Display supply average voltage is above approximately 4.2V, the current source is not regulating. If the display supply voltage is above about 4.4V, it is likely that VR1 is open in addition to other problems. Either condition will cause excessive current fluctuations on the +5.2V supply which will be conducted and radiated to sensitive circuits inside the 8340A. This will result in unwanted spurious signals on the output at 80 Hz, 400 Hz, 2.5 kHz and 5 kHz away from the output frequency.

1. Check the collector to emitter voltage of A3Q1. If this voltage is less than about 0.15V, Q1 is likely shorted and should be replaced.

2. Check the collector to emitter voltage of A3Q2. This voltage should be approximately 3.6V. If Vce is less than about 0.08V, Q2 is likely shorted. If Vce is 0.1V to 3.5V, Q2 is being over-driven by U11B. Lift one end of R11 to break the feedback from the Display Supply.

3. Determine if U11A is operating correctly by measuring the voltage at U11A pin 3 and at U11A pin 1. These two voltages should both be very close to being the same and should be approximately 3.9V to 4.0V. If the voltage at U11A pin 3 is not near 4.0V, either R12, R13, or U11 is bad and should be replaced. If the voltage at pin 3 is about 4.0V but the output (pin 1) is not, either a trace is shorted or U11A is bad.

4. If the output of U11A is correct, measure the voltage at U11B pin 5. This voltage should be about 4.2 to 4.3 volts. If this voltage is near ground, CR1 is likely open which will cause the display supply to be saturated.

3. If all measurements up to this point are correct yet the Display supply is still saturated, replace U11.

Display Processor Section (A3 Block D)

If you have reason to suspect that the Display Processor is at fault, start by determining if all of the inputs to the processor are correct.

1. Measure the following points and verify that the corresponding voltages are present.

   A3U1 pin 40 - +5 volts

   LRESET (A3U1 pin 4) - HIGH

   LIRQ (A3U1 pin 5) - HIGH

   EA (A3U1 pin 7) - LOW

   A3U1 pins 5 and 25 - HIGH

2. Probe LTE (A3U1 pin 11) with an oscilloscope. Set the oscilloscope to 1 us/Div. This signal should have a period of approximately 1.4 us and should be LOW for 1 us. If LTE is present, proceed to step 7.

3. Probe the two sides of the crystal (Y1) with the oscilloscope set to 50 ns/Div. You should find a 10.92 MHz, 4V signal on both sides. If the signal is present, proceed to step 6.

4. Check both C1 and C2 to see if either is shorted and replace if necessary. If either C1 or C2 are replaced, repeat step 2.

5. If C1 and C2 are not shorted, replace Y1 and repeat step 2.

6. If LTE is still not present, verify that the trace for LTE is not shorted. If LTE is not shorted, U1 should be replaced.

7. Probe LE (A3U3C pin 8) with the oscilloscope set to 1 us/div. You should find an inverted version of LTE. Press **[INSTR PRESET]** and LE should go HIGH.

If all other signals are correct, the remaining outputs from the processor are best checked using DSA as described in the **DISPLAY ASSEMBLY DSA TROUBLESHOOTING.** However, you can use the internal DSA routine (documented below) to exercise all of the processor outputs in a predictable manner and look at the outputs with a scope.

NOTE

If any of the following signals are not present or are not the correct amplitude (minimum of 4V except for CLK), you should troubleshoot the block that the signal is connected to or replace A3U1 as appropriate.

1. Connect DSA EN (A3TP5) to GND (A3TP4).
2. Turn the POWER switch to STANDBY and then ON again to start DSA mode.
3. Set the oscilloscope to 1 us/Div and trigger off of the appropriate edge of the signal.
4. Probe D0 through D7 (U1 pins 12 through 19). You should find LOW going TTL Level pulses which are 1 to 2 us wide.
5. Probe P10 through P17 (U1 pins 27 through 34). You should find HIGH going TTL Pulses which are 3 to 4 us wide.
6. Probe P25 and P27 (U1 pins 36 and 38). You should find HIGH going TTL pulses which are 3 to 5 us wide.
7. Probe CLK (U1 pin 37). You should find HIGH (1.6V) going pulses which are 3 to 4 us wide. This signal is clamped to 1.6V by the LEVEL SHIFTERS on the A2 Board.
8. Probe START (U1 pin 35) with the oscilloscope. Set the oscilloscope to 10 ms/Div. You should find a signal that is HIGH for approximately 12 ms and LOW for approximately 21 ms.

Annunciator Latch/Driver (A3 Block E)

NOTE

If all of the annunciators stay on after instrument preset yet the rest of the display and the keyboard are correct, first trouble-

shoot the PRESET CIRCUITRY (Block A) and then the INSTRUMENT BUS INTERFACE (Block B).

NOTE

The Annunciator Latch/Driver can be partially troubleshot using DSA as explained in DISPLAY ASSEMBLY DSA TROUBLESHOOTING.

ONE OR MORE ANNUNCIATORS ERRONEOUSLY ON OR OFF

1. If one or more annunciators are ON or OFF when they should not be, verify that the appropriate outputs of A3U5 & U7 are LOW if the associated annunciator is on, and HIGH if the annunciator is OFF. If the output of U5 and U7 are correct, proceed to step 3.

2. Determine if the output of U5 or U7 is bad or if the input to U4 or U8 is shorted. This can be accomplished by lifting the output pin of U5 or U7 and repeating step 1.

3. Verify that the associated output of U4 or U8 is in the correct state (see **NOTE** below). The output of U4 or U8 should be approximately 0.2V if the annunciator is ON, and 6.5 to 9V if the annunciator is off. If the outputs of U4 and U8 are correct, the Annunciator Latch/Driver is operating correctly.

NOTE

Since the outputs of U4 and U8 are open collector outputs, an open trace, open series resistor, or open annunciator will allow the output of U4 or U8 to stay LOW all the time. If you suspect one of the above faults, you should attach a 1K ohm pullup resistor between your probe and the +5 V supply. The levels will then be 0.1 or 5 V if the driver is working correctly.

ONE OR MORE ANNUNCIATORS ARE ERRONEOUSLY OFF

1. If all of the annunciators are off, check the +12V supply on the A2 Display Driver board.

2. If one or several annunciators are off when they should be on and you have already determined that Annunciator Latch/Driver (Block E) is operating correctly, check for +12V right at the annunciator on the A2 Display Driver Board.

3. If +12V does not appear at the annunciator, look for an open trace along the top edge of the A2 board. If +12V is present, replace the annunciator.

DSA Connector (A3 Block F)

The function and use of the DSA (Digital Signature Analysis) Connector is explained in **DISPLAY ASSEMBLY DSA TROUBLESHOOTING**.

Alpha Display Shift Register (A3 Block G)

1. If the Entry display is either BLANK or ALL dots are ON, it is possible that this circuitry is malfunctioning. Press **[SHIFT]** **[FREE RUN]** to run the front panel display diagnostics. Set an oscilloscope up to display TTL levels at 2 us/Div.

2. Probe the display's clock signal (ALPHA CLOCK) at P4-4 with the oscilloscope. You should find a series of seven 0.3 to 0.4 us wide, LOW going pulses. If these pulses are present, proceed to step 5.

3. Probe U3D pin 11 for the pulses described in step 2. If there is still no signal at U3D pin 11 then check LTE (U3D pin 13) for a continuous series of HIGH going pulses 0.36 us wide and a period of 1.36 us. If no signal appears then troubleshoot DISPLAY PROCESSOR (A3 Block **D**).

4. If LTE appears correctly at U3D pin 13 then probe CLK CTL (U3D pin 12). You should find approximately 10 us wide, HIGH going pulses which are used to gate on the clock pulses to the alpha displays. If no signal appears then troubleshoot the DISPLAY PROCESSOR (A3 Block **D**). If both LTE and CLK CTL are correct, replace U3.

5. Probe A3U2 pin 1 with the oscilloscope. You should find approximately 0.8 us wide, LOW going TTL pulses. If there are no pulses then you should troubleshoot the DISPLAY PROCESSOR (A3 Block **D**).

6. Probe DATA (A3U2 pin 9) with the oscilloscope. You should find TTL activity in bursts of seven which correspond in time with the seven clock pulses at P4-4. If this activity is present, then the Alpha Display Shift Register is working.

7. If the activity described in step 6 is not present, lift U2 pin 9 and recheck for activity. If no activity exists after lifting pin 9, replace U2. If activity resumes, check this signal line for shorts on any of the A1, A2 or A3 assemblies. If no shorts exist, troubleshoot the A1 Alpha Display.

A3 DISPLAY PROCESSOR DSA TROUBLESHOOTING

Overview of DSA Options

OPTION 1

The display processor can be forced to repetitively count through its entire address space. A signature analyzer can then be used to determine if the correct signatures appear on D0 through D7, A8 through A10, and +5VF.

OPTION 2

The DSA routine contained in the display processor's memory can be used by enabling the DSA mode and using a signature analyzer to determine if the correct signatures appear on D0 through D7, A8 through A10, the Parallel I/O Ports and many other signal lines. This routine is not able to check the annunciator latches or drivers, the instrument bus interface latches, or any of the signals on the display driver board which have non-TTL levels.

OPTION 3

The main instrument DSA routine can be used to stimulate the annunciator latches, the address decoder and the instrument bus interface latch. A signature analyzer may then be used to determine if the correct signatures appear on these lines.

Freerun DSA (Option 1)

The Freerun DSA mode is selected by connecting EA (A3TP8) to +5.2VF (A3TP7). This forces the processor to do all instruction fetches from external memory. Since there is no external memory and D0 through D7 are pulled up, the front panel processor will fetch FF Hex instruction op codes which does not alter the program counter. After executing this instruction the processor will increment its program counter and do an instruction fetch from the next location and will therefore repetitively count through its entire memory space.

1. Connect EA (A3TP8) to +5.2V (A3TP7) to enable the Freerun DSA mode. Connect the signature analyzer as follows:

   START and **STOP** connected to A10 (A3U1 pin 23), trigger on falling edge.

   CLOCK connected to LE (A3U3 pin 8), trigger on leading edge.

2. Probe the signals listed in the table below with the signature analyzer and verify that the signatures correspond to those given.

Mneumonic	J1 pin #	Signature
D0	11	H62U
D1	10	C21A
D2	9	HA07
D3	8	H0AA
D4	7	P030
D5	6	4442
D6	5	4U2A
D7	4	0772
A8	1	9635
A9	2	1734
A10	3	8P54
+5.2VF	17	7A70

DSA Using The Routine Contained In Display Memory (Option 2)

1. Connect DSA EN (A3TP5) to GND (A3TP6) to enable the internal DSA routine. Connect the signature analyzer as follows:

   START connected to A3TP1, trigger on falling edge.

   STOP connected to A3TP2, trigger on leading edge.

   CLOCK connected to A3TP3, trigger on rising edge.

   GRND connected to A3TP4.

   The +5.2V Signature under these conditions should be H9U2. This indicates that all processor instructions are being executed correctly, the ROM checksum is correct and that the internal RAM is good.

2. Set the **START** polarity to trigger on the leading edge.

3. Set the **STOP** polarity to trigger on the falling edge.

4. Probe the signals listed in the table below with the signature analyzer and verify that the signatures correspond to those given.

Mneumonic	Location	Signature
D0	A3U1 pin 12	CPAC
D1	A3U1 pin 13	20U1
D2	A3U1 pin 14	5P21
D3	A3U1 pin 15	8F24
D4	A3U1 pin 16	FP86
D5	A3U1 pin 17	023P
D6	A3U1 pin 18	185F
D7	A3U1 pin 19	H576
P10	A3U1 pin 27	C606
P11	A3U1 pin 28	06F6
P12	A3U1 pin 29	5868
P13	A3U1 pin 30	39C4
P14	A3U1 pin 31	H2A6
P15	A3U1 pin 32	5FC3
P16	A3U1 pin 33	3U26
P17	A3U1 pin 34	PP24
A8	A3U1 pin 21	4218
A9	A3U1 pin 22	162P
A10	A3U1 pin 23	131U
START	A3U1 pin 35	F81C
P25	A3U1 pin 36	CH4A
NUM CLK	A3U1 pin 37	20PA
CLK CTL	A3U1 pin 38	0H8P
ALPHA CLOCK	A3U3D pin 11	F81C
	A3U9D pin 11	7551
CLR	A3U9C pin 8	CH4A
DATA	A3U2 pin 9	F033
LVL START	A2U3 pin 9	36PH
F1 START	A2U3 pin 10	324H
F2 START	A2U3 pin 12	5746

DSA Using The Instrument's DSA Routine (Option 3)

The 8340A's main processor has incorporated a general purpose DSA routine which exercises all of the I/O addresses. This can be enabled by connecting LSTS test point on the processor to ground.

1. Connect LSTS (A60TP13) to ground. Connect the signature analyzer as follows:

   START connected to HSTM (T1) on the A61 Memory board, trigger on the rising edge

   STOP connected to LSOB (T2) on the A61 Memory board, trigger on the rising edge

   CLOCK connected to LIOSB (A60TP4), trigger on the rising edge

   GRND connected to GND test point on the A61 Memory board.

When the instrument is turned on, the instrument will continually send out signatures to each output address. The information contained on the data bus is latched into the eight bit latch contained on the display processor board when its I/O strobe is addressed. In order to get this latched information onto the internal display data bus, the display processor must be forced to 3-state all of its data/address bus drivers and control line drivers. When this is accomplished, the output enable of the input latch (A3U6 pin 1) can be pulled low which will cause the outputs of A3U6 to drive the internal data/address bus with the bit pattern stored there by the instrument processor. The above can be accomplished by making the following connections on the display processor:

2. Connect LRESET (A3TP12) to GND (A3TP5).

3. Connect EA (A3TP8) to +12VF (A3TP14).

4. Connect LREAD (A3TP9) to GND (A3TP5).

5. Probe the signals listed in the table below with the signature analyzer and verify the signatures correspond to those given.

Mneumonic	Location	Signature
DB0	J2-3	H186
DB1	J2-4	CFPH
DB2	J2-5	H077
DB3	J2-6	0942
DB4	J2-7	CC29
DB5	J2-8	63CP
DB6	J2-9	F77H
DB7	J2-10	2757
ADR0	J2-23	AUCU
ADR1	J2-24	U154
ADR2	J2-25	012F
ADR3	J2-26	8U24
ADR4	J2-27	7UUF
SIOA	J2-49	1714
D0	A3U6 pin 12	5056
D1	A3U6 pin 15	A239
D2	A3U6 pin 9	46P7
D3	A3U6 pin 6	8U5C
D4	A3U6 pin 16	1F22
D5	A3U6 pin 5	73C7
D6	A3U6 pin 19	P76U
D7	A3U6 pin 2	FF4C
LEN 5	A3U10 pin 10	2563
LEN 7	A3U10 pin 7	52CA

6. In order to check the latched information in the annunciator latches (U5 and U7) the three jumpers installed in steps 2, 3, and 4 must be removed. Switch the instrument to STANDBY when removing these jumpers or be sure to remove the jumper between +12V and EA first.

7. Probe the signals listed in the table below with the signature analyzer. Verify that the signatures correspond to those given.

Mneumonic	Location	Signature
CF	A3U5 pin 2	A18U
DELTA F	A3U5 pin 5	9A09
START/STOP	A3U5 pin 7	PH05
CW	A3U5 pin 10	031F
UNLVLD	A3U5 pin 12	HU2P
FAULT	A3U5 pin 15	508P
OVERMOD	A3U7 pin 10	H05A
OVEN	A3U7 pin 12	A0C4
EXT REF	A3U7 pin 15	4169
UNLK	A3U7 pin 2	15HH
SRQ	A3U7 pin 5	U2AH
REMOTE	A3U7 pin 7	3F4F

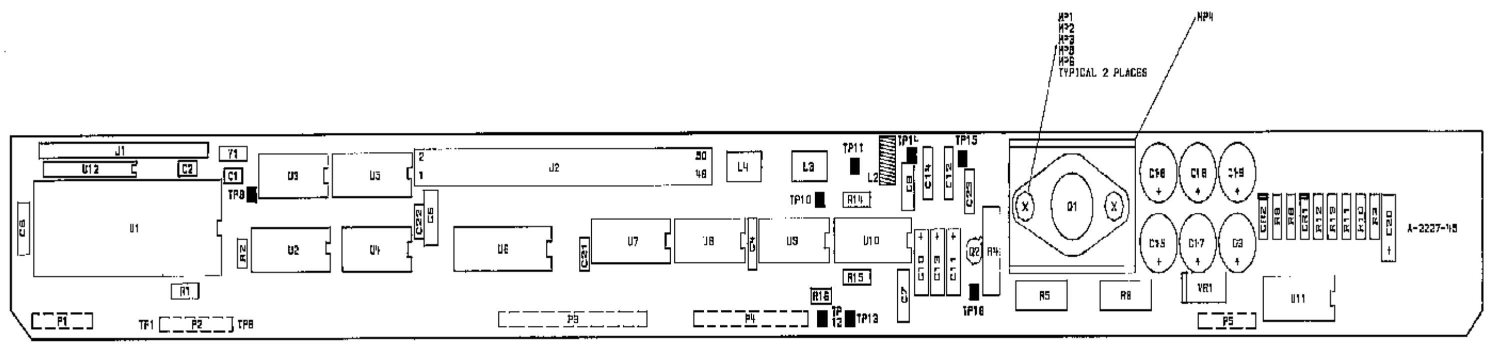


Figure 8H-13. A3 Display Processor, Component Location Diagram

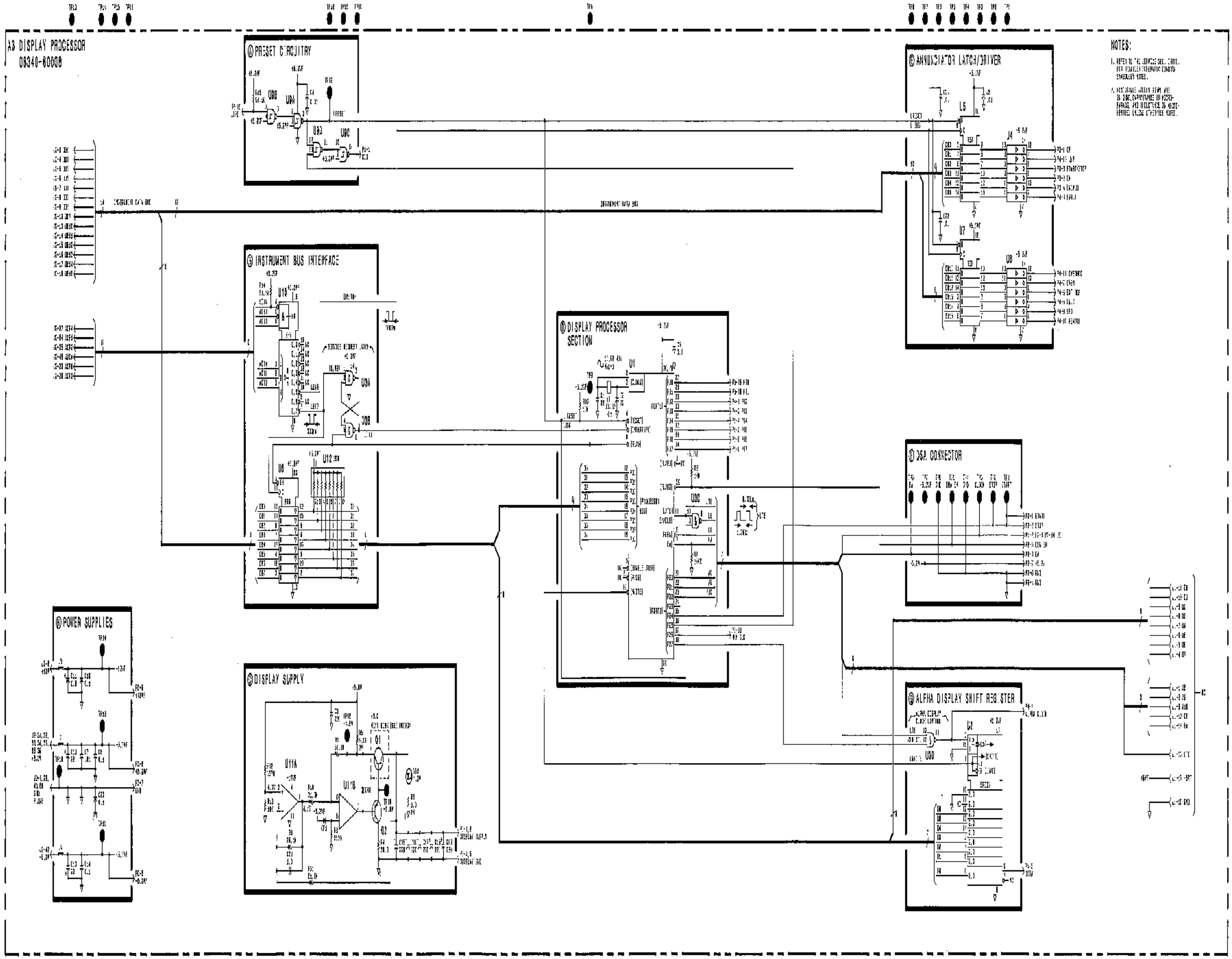


Figure 8H-14. A3 Display Processor, Schematic Diagram

9-6178-61B

A5 KEYBOARD AND A7 LOWER KEYBOARD, CIRCUIT DESCRIPTION

The keyboard section includes the A5 Keyboard Assembly and the A7 Lower Keyboard Assembly. Since both assemblies operate in the same manner, they will be covered together in the circuit descriptions below.

MAIN KEYBOARD B AND LOWER KEYBOARD B

The two keyboards contain 58 keys which have a multi-finger contact structure. Each key shorts one column line and one row line to digital ground.

There is not a general pattern followed for the encoding of the rows and columns, however, it may be necessary to determine what row and column each key translates to during troubleshooting.

ANNUNCIATORS A

The annunciator LED's are driven from latches on the A6 board.

A5 KEYBOARD AND A7 LOWER KEYBOARD TROUBLESHOOTING

ANNUNCIATORS (A5 AND A7 BLOCK A)

1. If one of the front panel LEDs stays on all the time, troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**).

2. If one of the front panel LEDs never comes on, even when **[INSTR PRESET]** is pressed, the cause is most likely a bad LED. To determine if the output of the latch is correct, probe the appropriate output of A6U6, A6U7, A6U16, or A6U17 and press **[INSTR PRESET]**. The voltage at this output should be approximately 0.4V if the latch is working correctly. If the voltage is correct, replace the appropriate LED. If the voltage is incorrect, troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**).

MAIN KEYBOARD (A5 BLOCK B) AND LOWER KEYBOARD (A7 BLOCK B)

1. Determine the ROW number and the COLUMN number of the key which is not working correctly. Probe the appropriate ROW and then the appropriate COLUMN at A6U1 or A6U10. Each signal should go LOW (0V) when the key is pressed.

2. If the row or column signal stays HIGH all of the time, even when the associated key is pressed, check for an open connector between the A5 or A7 keyboard and the A6 controller board. If no open trace or connector is found, replace the key pushbutton.

3. If the row or column signal stays LOW all of the time, even when the associated key is not pressed, measure the resistance of this signal line to ground. If the resistance is 1 ohm or less, either the signal trace must be shorted to ground or the key pushbutton is broken and is shorting the trace to ground. If the resistance is greater than 1 ohm, the associated input to A6U1 or A6U10 is probably shorted. Replace either U1 or U10 as appropriate.

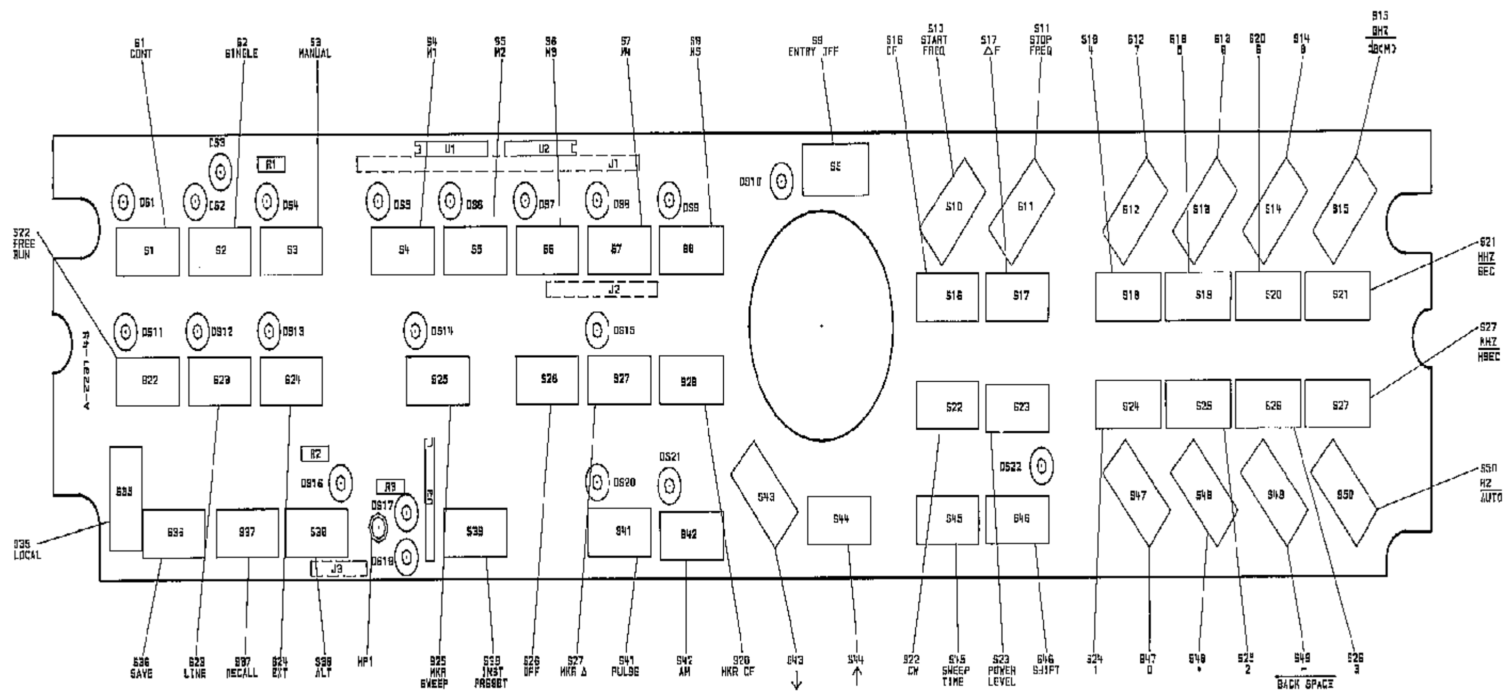


Figure 8H-15. A5 Keyboard, Component Location Diagram

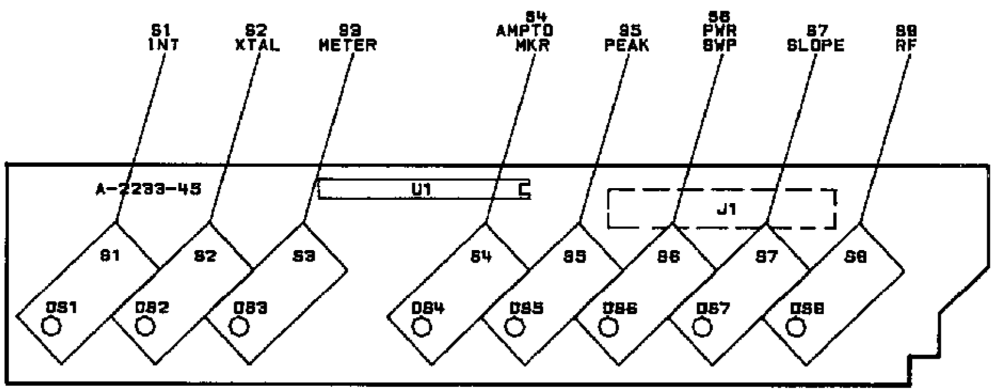
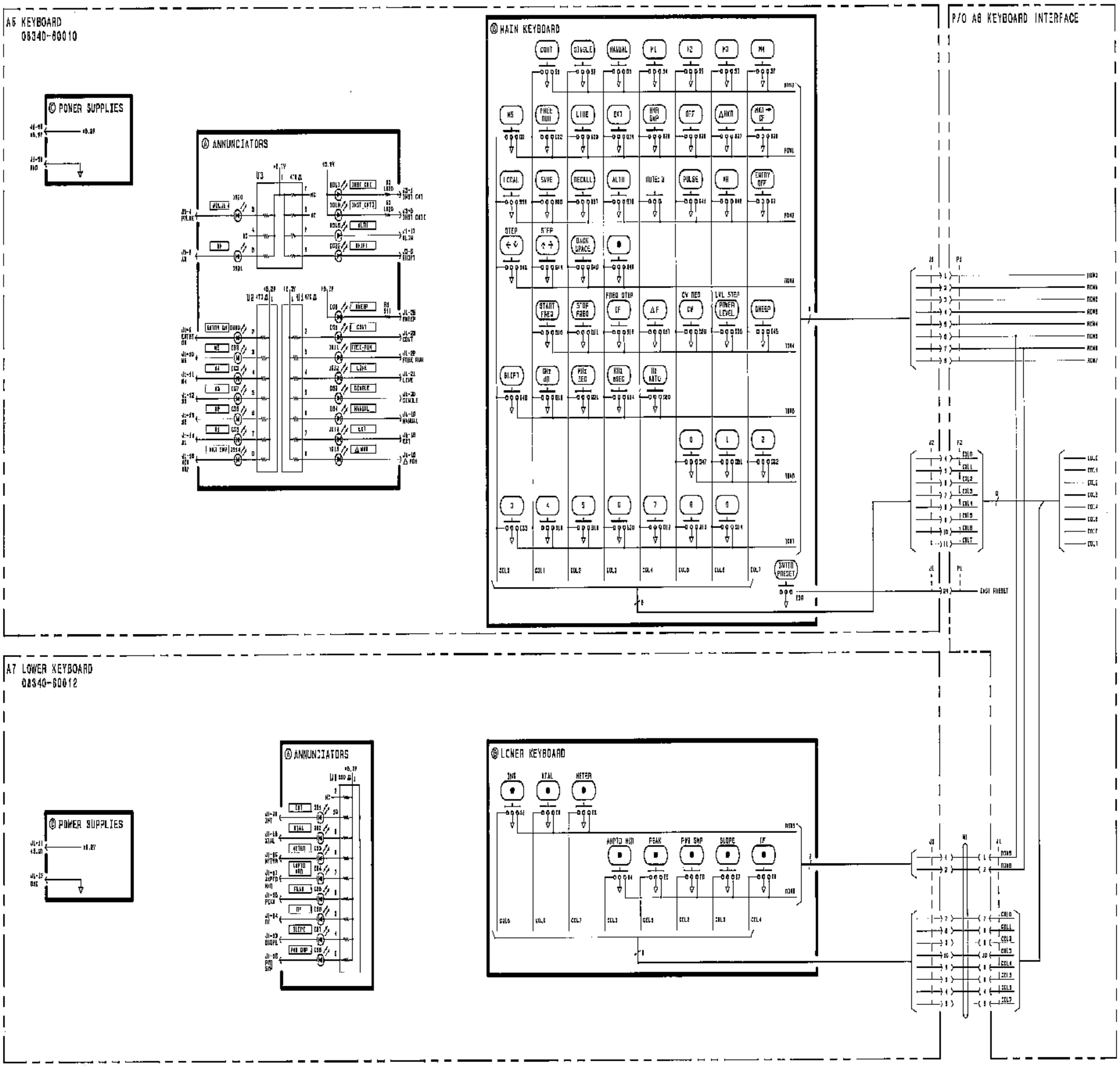


Figure 8H-16. A7 Lower Keyboard, Component Location Diagram



NOTES:

1. REFER TO THE SERVICE SEC. INTRO. SCHEMATIC DIAGRAM NOTES.
2. RESISTANCE VALUES ARE IN OHMS, CAPACITANCE IN MICROFARADS, AND INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.
3. RESERVED FOR FUTURE USE.

Figure 8H-17 A5 Keyboard and A7 Lower Keyboard, Schematic Diagram

A6 KEYBOARD INTERFACE, CIRCUIT DESCRIPTION

KEYBOARD ENCODER/DATA BUFFER A

Two, eight-line to three-line priority encoders (U1 & U10) are used to encode the row and column information. When a key is pressed one row line and one column line is grounded by the key. The row and column is encoded and is presented in Low-True binary form at the outputs (U1 and U10 pins 9, 7, and 6). This information is immediately available at the inputs of U11, the inverting output buffer which converts the above six bits to High-True signals.

Table for Keyboard Encoder U10 & U1

Column or Row selected Low	Output of U10 or U1 PIN 9	7	6
0	1	1	1
1	0	1	1
2	1	0	1
3	0	0	1
4	1	1	0
5	0	1	0
6	1	0	0
7	0	0	0

If more than one key is pressed, the priority encoder only encodes the lowest column and row number.

The encoders can be disabled by a latched control bit. The main instrument processor outputs a HIGH on DB7 (A6U6 pin 3, Block **E**). The processor then outputs address 6, R1: (see U15 pin 10, Block **F**), which latches DB7 to U6 pin 2. This latched bit is sent to U1 pin 5, disabling U1. U1 pin 14 is then HIGH, disabling U10. This control line is used to lockout the keyboard.

If the decoders are not disabled, pressing any key generates a service request (LOW KEY DOWN to Block **C**, HI KEY DN SRQ to Block **I**, and LSRQ to the instrument processor). The processor then outputs address 6, R3: (Block **F**) and reads the encoded key information from U11 (Block **A**).

KEY DOWN TIMER C

The Low-True keydown signal fires a non-retriggerable one-shot (U20 pin 9) which is set for approximately 20 msec pulses. The Q-bar output (U20 pin 12) goes LOW for 20 msec and on its rising edge it clocks a D flip-flop (U19 pin 11) whose D input (U19 pin 12) is connected to the Low-True keydown signal. If a key is still down at this moment, the D flip-flop is reset indicating that a valid keydown has been detected.

When a valid keydown is detected, the Q-bar output (U19 pin 8) goes high and this is the HI KEY DOWN SRQ.

SRQ BUFFER I

The HI KEY DN SRQ signal is NORed (U3 pin 3) with the Hi-True RPG SRQ (U3 pin 2) signal to generate LSRQ (U3 pin 1) to the instrument processor.

The keydown SRQ signal is also present at U11 pin 2 which contains the encoded key information. This bit, when read by the processor during an SRQ service routine, indicates that it was a keydown that generated the service request. U11 inverts this signal so the processor sees a Low-True signal.

Once the instrument processor has read the encoded information, the processor generates a strobe (U15 pin 9 I/O 6,R2: in Block **F**) which sets the SRQ flip-flop (U19 pin 10) indicating that key information has been read by the processor and prepares the key down circuitry for the next keydown signal.

A keyboard lockout signal (U6 pin 2 in Block **E**) is inverted (U8 pin 5 to 6 Block **C**) and if it is LOW it resets the keydown one shot and prevents this one-shot from ever firing.

REPEAT FUNCTION CIRCUITS D

The repeat key function consists of two timing circuits. The first is a 500 msec (U9A) timer which is triggered by the Q output of the keydown flip-flop (U19 pin 9, Block **C**) when a valid keydown has been detected. After 500 msec the rising edge of the Q-bar output of this one-shot (U9 pin 4) clocks a D flip-flop (U4 pin 11). The D input (U4 pin 12) is connected to the Low-True KEY DOWN line from the encoders (U10 pin 14 in Block **A**). If a key is still down 500 msec after a valid key has been detected this flip-flop U4B will be reset activating the repeat function. The Q-bar output of this flip-flop (U4 pin 8) goes high which releases the reset of the second timer (U5 pin 4) and allows it to generate high going pulses at a 5 Hz rate.

The second timer (U5) is a 555 timer. The timing components (R1, R2, CR1, and C8) ensure that high going pulses with a very low duty cycle are generated. The high going output (U5 pin 3) of this timer goes through an inverter (U14 pin 3 to 1) and becomes LOW REPEAT to the RESET of the keydown SRQ flip-flop (U19 pin 13) which has the same effect as pressing the key again. The duration of the reset pulse to this flip-flop (U19B) must be shorter than the fastest time that the main processor can get around to servicing the keydown interrupt or else another keydown SRQ cycle will be immediately started.

KEY UP TIMER (DEBOUNCE) B

The key released timing function prevents key bounce from causing multiple keydown interrupts to the instrument processor. This is accomplished by disabling the keydown circuitry as soon as a valid keydown has been been detected and not re-enabling it until all keys have been up continuously for 50 msec.

As soon as a key is depressed, the REPEAT DISABLE signal (U14B pin 4) goes HIGH when the KEYBOARD LOCKOUT signal (U14B pin 6) is LOW. This REPEAT DISABLE signal is inverted twice (U8 pin 3-4,9-8) and appears at the input of a NOR gate (U14D pin 12). The other input to this NOR gate (U14D pin 11) is connected to the Q output of the keyup one-shot (U9B pin 5) which will go HIGH for 50 msec after the positive transition of the LOW KEY DOWN signal (U9B pin 10). The output of the above NOR gate (U14C pin 13) goes LOW and is inverted (U14C pin 9). The output of the inverter (U14C pin 10) causes the reset line of a D flip-flop (U4A pin 1) to go HIGH which enables this flip-flop. The keydown SRQ line is connected to the clock line (U4A pin 3) so as soon as a valid keydown has been detected, the flip-flop will be set. The Q-bar output (U4A pin 6) goes directly to the enable of the key down one-shot (U20 pin 10 in Block C) which prevents detecting any further key closures until this enable goes HIGH.

When the key is released the Low-True keydown line goes HIGH, firing one-shot U9B (pin 10) for 50 msec which continues to disable the keydown circuitry until it has timed out.

The 0.01 uF cap connected to the output of U8B pin 4 was added to prevent a possible race condition. The input to U14D pin 12 must remain HIGH until the one-shot output going to U14D pin 11 is HIGH and stable. Since the one-shot is fired by the same signal that goes into U14D pin 12, some means of delay had to be implemented. Both digital and analog delay is used to prevent a parametric change from causing a race condition.

At the end of 100 msec, the one-shot output (U9B pin 5) goes LOW which causes the keydown disable flip-flop to be cleared (U4A pin 1) which in turn re-enables the keydown flip-flop (U20B pin 10 in Block C).

RPG COUNTERS DATA BUFFERS G

The rotary pulse generator (RPG) RP1 generates two pulses which are 90 degrees out of phase with each other when the knob is rotated.

Two four bit up/down counters (U13 and U18) count up or down depending on the direction in which the RPG is turned. The two signals from the RPG (which are 90 degrees out of phase) are connected to the up/down input (U13 and U18 pin 1) and to the clock input (U13 and U18 pin 2). If the clock line goes HIGH while the up/down line is still LOW, the counters count down. On the other hand if the RPG is turned in the opposite direction, the up/down line will be HIGH when the clock line goes HIGH and the counters will count up. When the counter counts down below 0, the output is set to all ones and counted down from there.

The outputs of the up/down counters (U13 and U18 pins 13 through 16) are always present at the inputs to the noninverting bus driver from which the instrument processor reads present count.

The up/down counters are cleared by the processor (U13 and U18 pin 8) after the information is read which readies them for the next count period.

A 0.01 uF capacitor is connected to the clock line and the up/down line (C13 and C14) from the RPG (U8 pins 11 and 13) to prevent static discharges from clocking the up/down counters.

RPG COUNT WINDOW TIMER H

The clock line that goes to the up/down counters from the RPG is connected to the clock of a 70 msec one-shot (U20A pin 2). The very first pulse on the RPG clock line fires the one-shot. At the end of 70 msec, the one-shot output (U20A pin 4) clocks a D flip-flop (U19A pin 3). If the RPG is enabled, the D input to this flip-flop (U19A pin 2) will be LOW and the Q-bar output (U19A pin 6) will go HIGH causing the LSRQ (Block I) line to go LOW, indicating a service request to the processor. The Q-bar output (U19A pin 6) also goes to the input of the inverting bus buffer (U11 pin 17 in Block **A**). The output of U11 is read by the processor during the service request routine. A LOW on this line indicates the RPG which needs service.

The RPG SRQ line also goes to the disable count input of the up/down counters (U13 and U18 pin 7 Block **G**) which disables any further counting until the processor has serviced the RPG service request.

After the instrument processor has read the information from the up/down counters, a reset strobe is generated (U15 pin 9, Block **F**) by the processor which sets the RPG SRQ flip-flop and clears the up/down counters and prepares the entire circuit for another cycle.

ANNUNCIATOR LATCHES E

Four 8-bit D-latches (U6, U7, U16, and U17) store LED & control information. 29 bits control all of the various LEDs on the front panel. One bit is an instrument preset lockout (U16 pin 2) which is ANDed with the input from the hardware instrument preset signal. One bit is the lockout for the rest of the keyboard (U6 pin 2) which prevents any keyboard entries. The last bit (U17 pin 9) is unused.

The same bit that turns on the enabled LED also enables the RPG (U19 pin 2 Block **H**). U19 pin 2 is the D input.

The green SWEEP LED is driven by an inverter which is controlled by a NAND gate. This NAND gate forces the LED to be ON when LIPS (Instrument Preset signal) is LOW.

ADDRESS DECODER F

U15 is used to decode four strobes from the five Address lines and the I/O strobe (SIOB). LEN 4 and LEN 4 (U15 pin 11 and 10) are used to clock the LED and control input D-latches (U6, U7, U16, and U17 Block **E**). LEN 6 (U15 pin 9) resets the Key down and RPG service request circuitry. LEN 7 (U15 pin 7) is a read strobe and enables the coded key information, the RPG count information, and the two bits which indicate which circuit requested service onto the bus to be read by the processor.

POWER SWITCH AND STANDBY LED

During STANDBY operation, the POWER switch grounds the LSBY line which activates the fan relay and signals the power supplies to turn off.

The STANDBY LED is connected to the +22 volt supply through a current limiting resistor. The POWER switch grounds the cathode of this LED during standby thus turning on the LED.

A6 KEYBOARD INTERFACE TROUBLESHOOTING

REQUIRED EQUIPMENT

* VOM
* Oscilloscope (100 MHz)
* 5005B Signature Analyzer (If DSA Troubleshooting is used)
* Logic Probe

PREPARATION

1. Refer to Figure 8H-4 and remove the Front Panel Assembly from the instrument.
2. Disconnect the display from the keyboard and reattach the display to the frame.
3. Lay the keyboard down in front of the instrument to allow access to the Keyboard Interface.

SYMPTOMATIC TROUBLESHOOTING

One Or More LED'S Do Not Light When [INSTR PRESET] Is Pressed

1. Troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**) and the Annunciators (A5 and A7 Block **A**).

None Of The Annunciators Light When [INSTR PRESET] Is Pressed

1. Troubleshoot the INSTR PRESET BUFFER (A6 Block **J**).
2. Troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**)

All Of The Annunciators Except SWP Remain On After Power Up or After [INSTR PRESET]

1. Troubleshoot the ADDRESS DECODER (A6 Block **F**).
2. Troubleshoot the INSTR PRESET BUFFER (A6 Block **J**).

Check LED I Or II Remain On After [INSTR PRESET]

1. The instrument processor self test has failed. Refer to the A60 Processor troubleshooting.

Pressing A Key Gives No Response (Display Does Not Change And The Instrument State Does Not Change)

1. Probe KEYBOARD LOCKOUT at A6U6 pin 2 (Block **E**). This signal

should be LOW. If KEYBOARD LOCKOUT (U6 pin 2) is HIGH, troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**).

2. Probe LOW KEY DOWN at U10 pin 14. Press any key and this signal should go LOW. If LOW KEY DOWN does not go LOW, troubleshoot the KEYBOARD ENCODER/DATA BUFFER (A6 Block **A**).

3. Probe HI KEY DN SRQ (A6 TP 3) with an oscilloscope. Set the oscilloscope to 5 ms/Div. This signal should normally be LOW and, when you press a key, go HIGH for a period of time that is equal to the response time of the instrument processor to a SRQ. This will vary between 100 us and 25 ms. If HI KEY DN SRQ is correct, troubleshoot the SRQ BUFFER (A6 Block **I**). If HI KEY DN SRQ is not correct, troubleshoot the KEY DOWN TIMER (A6 Block **C**).

When A Key Is Held Down, The Key Is Not AutomaticallY Repeated

1. Probe REPEAT RESET (U4A pin 5 Block **B**). This signal should go HIGH and stay HIGH as long as a key is depressed. If REPEAT RESET functions correctly, troubleshoot REPEAT FUNCTIONS CIRCUIT (A6 Block **D**). If REPEAT RESET does not function correctly then troubleshoot the KEY UP TIMER (DEBOUNCE) (A6 Block **B**).

Pressing A Key Sometimes Produces Several Of The Same Characters In The Display

1. Probe LOW KEY DISABLE (A6 U20B pin 10, Block **C**). This signal should go LOW and remain LOW until after the key is released. If LOW KEY DISABLE appears to be functioning correctly, troubleshoot the KEY DOWN TIMER (A6 Block **C**). If LOW KEY DISABLE is HIGH all the time, troubleshoot the KEY UP TIMER (A6 Block **B**).

Sometimes Keystrokes Are Missed By The Instrument

1. Troubleshoot the KEY DOWN TIMER (A6 Block **C**).

The 8340A Only Responds To Keystrokes And/Or The RPG When It Is In A Swept Mode And Ignores Them When Not In A Swept Mode

1. Troubleshoot the SRQ BUFFER (A6 Block **I**).

Turning The RPG When There Is An Active Function Produces No Response

1. Press a function key and verify that the ENTRY ON LED lights. If this LED does not light, troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**).

2. If the ENTRY ON LED is lit, probe CLK (A6TP1) with an

oscilloscope. Set the oscilloscope to 5 ms/Div. You should see LOW going pulses as you rotate the RPG and the pulse width should vary with the speed of rotation. If CLK is not correct, troubleshoot the RPG and RPG COUNTERS/DATA BUFFERS (A6 Block G).

3. Probe HI RPG SRQ (A6TP8). You should find HIGH going pulses which vary in width depending on the response time of the instrument processor to a SRQ. These pulses should be between 100 us and 25 ms. If HI RPG SRQ is correct, troubleshoot the SRQ BUFFER (A6 Block I) and the RPG COUNTERS/DATA BUFFERS (A6 Block G). If HI RPG SRQ is not correct, troubleshoot the RPG COUNT WINDOW TIMER (A6 Block H).

Turning The RPG Produces A Change Only In One Direction

1. Troubleshoot the RPG and RPG COUNTERS/DATA BUFFER (A6 Block G).

Turning The RPG Causes Either Very Small Or Very Large Changes In The Active Function In The ENTRY DISPLAY

1. Troubleshoot the RPG COUNT WINDOW TIMER (A6 Block H).

The Instrument Will Not Do An Instrument Preset When The [INSTR PRESET] Key Is Pressed

1. Troubleshoot the INSTR PRESET BUFFER (A6 Block J).

A6 KEYBOARD INTERFACE BLOCK-BY-BLOCK TROUBLESHOOTING

KEYBOARD ENCODER/DATA BUFFER (A6 BLOCK A)

U1, U10, And U11 Troubleshooting

1. Probe KEYBOARD LOCKOUT (U1 pin 5). This signal should be LOW unless the 8340A is in REMOTE mode. If KEYBOARD LOCKOUT is HIGH, troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**).

2. Probe LOW KEY DOWN (U10 pin 14). This signal should be HIGH and go LOW when any key is pressed. If this signal is correct, proceed to step 6.

3. If LOW KEY DOWN stays HIGH even when a key is pressed, check the enable into U10 (U10 pin 5). This signal should also be HIGH and go LOW when any key is pressed. If the enable signal to U10 pin 5 in correct, proceed to step 5.

NOTE

If COL 1 or ROW 3 is found to be functioning incorrectly in steps 4 or 5, L STEPUP may be the cause. Perform the troubleshooting for L STEPUP prior to troubleshooting the Keyboard.

4. If the signal to U10 pin 5 functions incorrectly, either U1 is bad or the appropriate input to U1 is not being pulled LOW by the key row. Probe the appropriate key row input to U1. This signal should be HIGH and go LOW each time the associated key is pressed. If the key row functions correctly, replace U1. If the key row does not function correctly, troubleshoot the Keyboard (A5 and A7 Block **B**).

5. If U10 pin 5 functions correctly, either U10 is bad or the appropriate input to U10 is not being pulled LOW by the key column. Probe the appropriate key column input to U10. This signal should be HIGH and go LOW each time the associated key is pressed. If the key column functions correctly, replace U10. If the key column does not function correctly, troubleshoot the Keyboard (A5 and A7 Block **B**).

6. If all the rest of the circuitry on the A6 board is functioning correctly yet a key stroke or RPG number is not communicated to the instrument, it is possible that the buffer (U11) is not functioning correctly. Probe LEN 7 at U11 pin 1 or 19 with an oscilloscope. Set the oscilloscope to 0.1 us/Div. You should find 300 to 400 ns wide, LOW going pulses each time you press a key or repetitive pulses if you hold a key down. If the pulses are not present, troubleshoot the ADDRESS DECODER (Block **F**).

7. Use LEN 7 to trigger the oscilloscope and probe the outputs of

U11 to see if the output is in the correct state during the output enable pulse. When you probe pin 3, you should find it LOW if a key was pressed. When you probe pin 18, you should find it LOW if the RPG was rotated. The remaining outputs (pins 5, 7, 9, 12, 14, and 16) should be HIGH or LOW depending on the key code of the key being depressed (see the circuit description and schematic).

8. If one or more of the outputs are not correct, probe the corresponding input. Since U11 is an inverting buffer you should find the inverted version of the signals described in step 7. If the levels are correct at the input, replace U11. If the signals are not correct, troubleshoot the device from which the signal came.

LSTEPUP Troubleshooting

1. Probe LSTEPUP at the cathode of CR2 or CR3. LSTEPUP should be HIGH and only go LOW when pin 22 on the rear panel 8410 Interface connector is grounded. If this signal is HIGH and stays HIGH when the input is shorted to ground, check the front panel ribbon cable and rear panel cable assy for an open wire. If LSTEPUP is LOW all the time, proceed to step 3.

2. With the diodes installed, check the voltage at the anode of each diode both with LSTEPUP open and with LSTEPUP shorted to ground. The anodes should be at approximately 5V when LSTEPUP is open and at approximately 0.4V when LSTEPUP is shorted to ground. If the voltage at either anode is 0.2V or less when LSTEPUP is grounded, that diode is likely shorted and should be replaced. If the voltage at either anode remains at 5 V when LSTEPUP is grounded, that diode is open and should be replaced.

3. If LSTEPUP stays LOW all the time, lift the cathodes of the two diodes (CR2 and CR3) out of the PC Board and check the signal LSTEPUP with an ohmmeter to determine if a short to ground exists. If LSTEPUP is not shorted to ground, check CR2 and CR3 for being open as described in step 2.

4. Check COL 1 (U10 pin 3) and ROW 3 (U1 pin 1) for a HIGH when no key is pressed. If either signal is LOW, determine whether the COL or ROW line is shorted or the encoder (U1 or U10) input is shorted.

KEY UP TIMER (A6 BLOCK B)

1. Probe KEYBOARD LOCKOUT. This signal should be LOW unless the 8340A is in REMOTE mode. If this signal is not correct, troubleshoot the ANNUNCIATOR LATCHES (A6 Block E).

2. Probe LOW KEY DOWN with an oscilloscope. Set the oscilloscope to 100 ms/Div. This signal should go LOW each time a key is

pressed and remain LOW until the key is released. If this signal is not correct, troubleshoot the KEYBOARD ENCODER/DATA BUFFER (A6 Block **A**).

3. Connect the trigger of the oscilloscope to LOW KEY DOWN (A6TP6) and trigger on the rising edge. Set the oscilloscope to 10 ms/Div and probe the output of the key up timer (A6TP7). You should find a HIGH going pulse 45 to 55 ms wide each time a key is RELEASED. If this pulse is not present, replace U9B. If the duration of this pulse is not correct, check or replace R7 or C24.

4. Probe LOW KEY DISABLE (A6TP13). This signal should go LOW when HI KEY DN SRQ goes HIGH and should remain LOW for 45 to 55 ms after LOW KEY DOWN goes HIGH. If LOW KEY DISABLE is correct, proceed to step 10.

5. Probe U4A pin 1. This signal should go HIGH when a key is pressed and should remain HIGH for 45 to 55 ms after the key is released. If the signal at U4A pin 1 is not correct, proceed to step 8.

6. Probe HI KEY DN SRQ (A6TP3) with the oscilloscope. Set the oscilloscope to trigger on the LOW going edge of LOW KEY DOWN (A6TP6). You should find a 100 us to 20 ms wide, HIGH going pulse that occurs 15 to 25 ms after the LOW going edge of LOW KEY DOWN. If HI KEY DN SRQ is not correct, troubleshoot the KEY DOWN TIMER (A6 Block **C**).

7. If HI KEY DN SRQ is correct, check U4A pins 2 and 4 to make sure they are pulled HIGH by R11. If these inputs are also correct, replace U4A.

8. Probe A6TP4 (U14D pin 12) with the oscilloscope. Set the oscilloscope to 100 ns/Div and trigger on the HIGH going edge of LOW KEY DOWN. You should find that this signal remains HIGH for a minimum of 100 ns after a key is released. If this signal is LOW all the time, either U8 or U14 is bad.

9. If the signal at A6TP4 is HIGH all the time, probe REPEAT DISABLE (U14B pin 4). REPEAT DISABLE should be an inverted version of LOW KEY DOWN. If REPEAT DISABLE is not correct, replace U14. If REPEAT DISABLE is correct, either U8 is bad or C23 is shorted.

10. If LOW KEY DISABLE is correct, probe REPEAT RESET (U4A pin 5). This signal should go HIGH when HI KEY DN SRQ goes HIGH and remain HIGH for 45 to 55 ms after LOW KEY DOWN goes HIGH.

11. If REPEAT RESET is not correct, either the output of U4A is bad or the input to U9A pin 3 is bad. Lift U4A pin 5, recheck for the correct signal at U4A pin 5, and replace the

appropriate part.

KEY DOWN TIMER (A6 BLOCK C)

1. Probe KEYBOARD LOCKOUT (U8C pin 5). This signal should be LOW unless the 8340A is in REMOTE mode. If this signal is not correct, troubleshoot the ANNUNCIATOR LATCHES (A6 Block E).

2. Probe the output of U8C pin 6. This signal should be an inverted version of KEYBOARD LOCKOUT. If this signal is not correct, replace U8.

3. Probe LOW KEY DISABLE (U20 pin 10). This signal should go LOW when HI KEY DN SRQ goes HIGH and should remain LOW for 45 to 55 ms after LOW KEY DOWN goes HIGH. If this signal is not correct, troubleshoot the KEY UP TIMER (A6 Block B).

4. Probe LOW KEY DOWN with an oscilloscope. Set the oscilloscope to 100 ms/Div. This signal should go LOW each time a key is pressed and remain LOW until the key is released. If this signal is not correct, troubleshoot the KEYBOARD ENCODER/DATA BUFFER (A6 Block A).

5. Connect the trigger of the oscilloscope to LOW KEY DOWN (A6 TP6) and trigger on the falling edge. Set the oscilloscope to 10 ms/Div and probe the output of the Key Down Timer (A6TP14). You should find a 15 to 25 ms wide, LOW going pulse each time a key is pressed. If this pulse is not present, replace U20B. If the duration of this pulse is not correct, check or replace R5 or C17.

6. Probe HI KEY DN SRQ with the oscilloscope. Each time a key is pressed, you should find a 100 us to 20 ms wide, HIGH going pulse which starts at the same time as the output of the Key Down Timer (TP14) goes HIGH. If HI KEY DN SRQ is correct, proceed to step 10.

7. Probe LOW REPEAT (A6TP12). This signal should remain HIGH unless a key is held down for longer than approximately on half second. If LOW REPEAT is not correct, troubleshoot the REPEAT FUNCTION CIRCUITS (A6 Block D).

8. Probe LEN 6 (U19B pin 10) with an oscilloscope. Set the oscilloscope to 0.2 us/Div. You should find a LOW going, 300 to 400 ns wide pulse each time a key is pressed. (This signal may be difficult to find unless a storage scope is used. Refer to ADDRESS DECODER Troubleshooting (A6 Block F) for further information.) If LEN 6 is not correct, troubleshoot the ADDRESS DECODER (A6 Block F).

9. If LEN 6 is correct, either the output of U19B (pin 8) is bad or one of the three destinations of HI KEY DN SRQ is bad.

Determine which part is bad (U11 Block **A**, U4 Block **B**, U19 Block **C**, or U3 Block **I**) and replace the defective part.

10. If HI KEY DN SRQ is correct, probe LOW DEBOUNCED KEY DOWN (U19B pin 9) with the oscilloscope. You should find LOW going, 15 to 25 ms wide pulses starting when the signal at TP14 goes HIGH.

11. If LOW DEBOUNCED KEY DOWN is not correct, either the output of U19B is bad or U9A pin 1 (Block **D**) input is bad. Lift U19 pin 9, recheck for the correct signal at U19 pin 9, and replace the appropriate part.

REPEAT FUNCTION CIRCUITS (A6 BLOCK D)

1. Probe REPEAT RESET (U9A pin 3) with the oscilloscope. Set the oscilloscope 20 ms/Div and trigger off the LOW going edge of LOW KEY DOWN (A6TP6). REPEAT RESET should go HIGH 15 to 25 ms after LOW KEY DOWN goes LOW and should remain HIGH for 45 to 55 ms after LOW KEY DOWN (TP6) goes HIGH. If this is not correct, troubleshoot the Key Up Timer (A6 Block **C**).

2. Probe LOW DEBOUNCED KEY DOWN (U9 pin 1) with the oscilloscope (same settings as step 1). This signal should go LOW 15 to 25 ms after LOW KEY DOWN goes LOW and remain LOW 100 us to 20 ms (depends on how fast the main processor services the HI KEY DN SRQ). If this signal is not correct, troubleshoot the Key Down Timer (A6 Block **C**).

3. Probe REPEAT DISABLE (U4 pin 10) with the oscilloscope (same settings as step 1). This signal should go HIGH when any key is pressed and go LOW as soon as the key is released. If this signal is not correct, troubleshoot the Key Up Timer (A6 Block **B**).

4. Probe U9A pin 4 (A6TP9) with the oscilloscope. Set the oscilloscope to 100 ms/Div and trigger on the HIGH going edge of HI KEY DN SRQ (A6TP3). Press any key and hold it down. This signal should go LOW for approximately 400 ms and then go HIGH for approximately 100 ms. If this signal is not present, replace U9. If the duration of this signal is not correct, check or replace R3 or C7.

5. Probe TP5 (U4 pin 8) with the oscilloscope (same settings as step 4). Press any key and hold it down. TP5 should be LOW and remain LOW for approximately 400 ms. It should then go HIGH and remain HIGH until the key is released. If the signal at TP5 is correct, proceed to step 7.

6. Lift U4B pin 8 and check for the signal described in step 5 right at the pin. If this signal is now correct, check for shorts along the trace or replace U5 if there are no shorts.

If the signal is not correct, replace U4.

7. Probe U5 pin 3 with the oscilloscope. Set the oscilloscope to 50 ms/Div and select rising edge triggering. When you press and hold a key you should find a HIGH going pulse every 100 ms. If this signal appears correct, proceed to step 10.

8. If the signal at U5 pin 3 goes HIGH (when U5 Pin 4 goes HIGH) and remains HIGH until the key is released, C8 is shorted. If the signal is a square wave, CR1 is most likely open.

9. If U5 pin 3 stays either HIGH or LOW, lift U5 pin 3 and recheck the signal right at the pin. If the signal is now correct, check for shorts or replace U14 if no shorts exist. If the signal is still bad, replace U5.

10. Adjust the oscilloscope to 20 us/Div. Verify that these HIGH going pulses are approximately 20 us wide. If these 20 us wide, HIGH going pulses are spaced very close together (< 100 ms), it is very likely that CR1 is shorted.

11. If the signal at U5 pin 3 is correct, probe LOW REPEAT (A6 TP12) with the oscilloscope. Set the oscilloscope to 50 ms/Div and triggering on the LOW going edge of this signal. You should find the inverted version of the signal at U5 pin 3.

12. If LOW REPEAT is not correct, lift U14A pin 1 and recheck the signal right at the pin. If the signal is now correct, check for shorts or replace U19 if no shorts exist. If the signal is still bad, replace U14.

ANNUNCIATOR LATCHES (A6 BLOCK E)

1. Probe ANNUNCIATOR RESET at U6 pin 1. This signal should be HIGH all the time and should go LOW when **[INSTR PRESET]** is pressed. If ANNUNCIATOR RESET is not correct, troubleshoot the INSTR PRESET BUFFER (A6 Block **J**).

2. Probe LEN 5 at U6 pin 11 with the oscilloscope. Set the oscilloscope to 200 ns/Div and trigger on the LOW going edge of this pulse. You should find a LOW going, 300 to 400 ns wide pulse each time you press a key which has a LED associated with it. If this signal is not present, troubleshoot the ADDRESS DECODER (A6 Block **F**).

3. Probe LEN 4 at U16 pin 11 with the oscilloscope. Set the oscilloscope to 200 ns/Div and trigger on the LOW going edge of this pulse. You should find a LOW going, 300 to 400 ns wide pulse each time you press a key which has a LED associated with it. If this signal is not present, troubleshoot the ADDRESS DECODER (A6 Block **F**).

One Or More Of The Front Panel LEDs Never Light

1. Perform steps 1, 2, and 3 at the beginning of the ANNUNCIATOR LATCHES troubleshooting.

2. Check the voltage at the appropriate output of the ANNUNCIATOR LATCHES (U6, U7, U16, or U17). When **[INSTR PRESET]** is pressed the voltage at all of these outputs should be LOW (approximately 0.4V). If the appropriate output is LOW yet the LED is OFF, replace the LED.

3. If the output checked in step 2 does not go LOW, lift the output pin and recheck the voltage right at the pin with **[INSTR PRESET]** pressed. If the signal is now correct, check for shorts either on the A6 board or on the A5 or A7 keyboards. If the signal is still bad, replace the appropriate latch.

One Or More Outputs From The Annunciator Latches Is Not Correct

1. Perform steps 1, 2, and 3 at the beginning of the ANNUNCIATOR LATCHES troubleshooting.

2. If one or more of the outputs from the ANNUNCIATOR LATCHES (U6, U7, U16, and U17) is not correct, enable the INSTRUMENT DSA by connecting the LSTS test point (TP13 on the A60 Processor board) to ground.

3. Verify that suspected latch output is not working. Set the oscilloscope to 100 us/Div and probe the output. If the output is working, you should find TTL activity (< 0.4V for LOW and > 3.5V for HIGH).

4. Probe the appropriate data bus input for this section of the latch with the oscilloscope. Set the oscilloscope to 10 us/Div and triggering on the LOW going edge of this signal. You should find a series of low going pulses, 2 to 4 us wide. The LOW level should be very near 0V an the HIGH level should be very near +5V. If the signal is correct, proceed to step 6.

5. Check this same data bus line at the Motherboard end of the front panel ribbon cable. If the signal appears at the Motherboard correctly, repair or replace the ribbon cable. If no signal appears at the Motherboard, refer to the A60 Processor troubleshooting.

6. Lift the appropriate output pin of the latch and check the signal right at the pin as described in step 4. If the signal is still not correct, replace the latch.

7. If the signal is correct with the pin lifted, check along the signal trace for shorts. In the case of the control signals, troubleshoot the following:

RPG COUNT WINDOW TIMER (A6 Block **H**) if the ENTRY ON signal (U6 pin 19) is bad.

KEY UP TIMER (A6 Block **B**), KEYBOARD ENCODER/DATA BUFFER (A6 Block **A**) or KEY DOWN TIMER (A6 Block **C**) if the KEYBOARD LOCKOUT signal (U6 pin 2) is bad.

INSTR PRESET BUFFER (A6 Block **J**) if INSTR PRESET LOCKOUT signal (U16 pin 2) is bad.

Front Panel SWEEP LED Not Operating Correctly

1. With the 8340A sweeping, probe LSPLD (U2D pin 13) with the oscilloscope. Set the oscilloscope to approximately the same ms/Div as the sweep time of the 8340A. You should find both HIGH and LOW TTL levels with the LOW level corresponding to the times when the sweep LED should be ON. If LSPLD is correct, proceed to step 4.

2. Measure LSPLD at the Motherboard end of the ribbon cable. If LSPLD is present at the Motherboard, the ribbon cable is likely open and should be replaced.

3. If no signal appears at the Motherboard then disconnect the 50 pin ribbon Cable from the A6 Keyboard Interface and recheck for this signal. If there still is no signal at the Motherboard, troubleshoot this signal on the A58 Sweep Generator. If the signal is present, check for shorts along this signal path on the A6 board and replace U2 if no shorts are found.

4. Probe U2D pin 11. You should find an inverted version of LSPLD. If the signal does not appear at pin 11, check for shorts and then replace U2 if there are no shorts.

5. Check the signal at U2 pin 8. It should be the same as LSPLD. If the signal at U2 pin 8 is correct yet the SWEEP LED is not flashing, replace the green SWEEP LED. If the signal at U2 pin 8 is not correct, check for shorts along the signal path of the A5 Keyboard as well as the A6 board and then replace U2 if no shorts are found.

ADDRESS DECODER (A6 BLOCK F)

1. Measure the voltage between the ground pin (U15 pin 8) and chassis ground. If the measured voltage is not 0V, repair or replace the front panel ribbon cable.

2. Place the 8340A into the DSA mode by grounding the LSTS test point on the A60 Processor board. Probe A0 thru A4 and SIOB (U15 pins 1 through 6) with the oscilloscope. Set the oscilloscope to 2 us/Div and triggering on the LOW going edge. You should find bus activity (both HIGH and LOW levels) on every line. If the signals are present, proceed to step 5.

3. Measure the signal(s) that is not present at the Motherboard end of the ribbon cable. If the signal is present at the Motherboard, the ribbon cable is most likely open and should be replaced.

4. If no signal appears at the Motherboard, disconnect the 50 pin ribbon cable from the A6 Keyboard Interface and recheck for the signal. If there still is no signal at the Motherboard,

troubleshoot the signal on the A60 Processor board. If the signal is present, check for shorts along the signal path on the A6 board and replace U15 if no shorts are found.

5. If all of the inputs to U15 are correct, probe LEN 4 through LEN7 (U15 pins 7, 9, 10, and 11) with the oscilloscope. Set the oscilloscope to 200 ns/Div. You should find 200 to 400 ns wide, LOW going pulses. If LEN 4 through LEN 7 are correct, the ADDRESS DECODER is operating properly.

6. If any of these signals is not correct, lift the appropriate pin of U15 and check the signal right at the pin. If the signal is now correct, troubleshoot the blocks which are connected to the signal. If the signal is still not correct, replace U15.

RPG COUNTERS/DATA BUFFERS (A6 BLOCK G)

1. Probe CLK (A6TP1) with the oscilloscope. Set the oscilloscope to 10 ms/Div. You should find a repetitive TTL signal when you rotate the RPG. If the signal is present, proceed to step 3.

2. Remove the 902 (white/black/red) wire from the RPG connector and check CLK right at the wire. If the signal is not present, replace the RPG. If the signal is present, check C25 for being shorted. If C25 is not shorted, replace U8.

3. Probe the output of the U8E (pin 10). The inverted version of CLK should be present. If the signal is correct, proceed to step 5.

4. If the signal is not present at U8E pin 10 output, either U8 is bad or one of the inputs driven by this signal is preventing the signal from changing. Lift U8 pin 10 and check the signal right at this pin. If the signal still is not correct, replace U8. If the signal is correct, inspect for shorts along this signal trace. If no shorts exist, determine which of the destinations is the problem.

5. Probe UP/DOWN (A6TP2) with the oscilloscope. Set the oscilloscope to 10 ms/div. You should find a repetitive TTL signal when the RPG is rotated. If the signal is present, proceed to step 7.

6. Remove the 901 (white/black/brown) wire from the RPG connector and check the signal right at the wire. If the signal still is not present, replace the RPG. If the signal is present, check if C26 is shorted. Replace U8 if C26 is not shorted.

7. Probe the output of U8E (pin 12). The inverted version of UP/DOWN should be present. If the signal is correct, proceed to step 9.

8. If the signal is not present at U8E pin 12, either U8 is bad or one of the inputs driven by this signal is preventing the signal from changing. Lift U8 pin 12 and check the signal right at this pin. If the signal still is not correct, replace U8. If the signal is correct, inspect for shorts along this signal trace. If no shorts exist, determine which of the destinations is the problem.

9. Probe LEN6 at U13 or U18 pin 8 and LEN7 at U12 pin 1 or 19 with the oscilloscope. Set the oscilloscope to 200 ns/Div and trigger on the LOW going edge. You should find 200 to 400 ns wide, LOW going pulses each time the RPG is rotated. If these pulses are not present, troubleshoot the ADDRESS DECODER (A6 Block **F**).

10. Probe HI RPG SRQ at U13 or U18 pin 7 with the oscilloscope. Set the oscilloscope to 20 ms/division. HI RPG SRQ should be LOW and goes HIGH for 100 us to 20 ms each time the RPG is rotated. If this signal is not correct, troubleshoot the RPG COUNT WINDOW TIMER (A6 Block **H**).

11. Probe the outputs of U13 and U18 (pins 13 through 16 and pin 19) with the oscilloscope. Set the oscilloscope to 20 ms/Div and trigger on the HIGH going edge. Each time you rotate the RPG (very slowly counter clockwise) you should find a series of pulses on these pins. If pulses do not appear at an output, either U13 or U18 is bad or the input to the bus buffer (U12) is bad.

12. Probe each output of U12 (pins 3, 5, 7, 9, 12, 14, 16, and 18) with the oscilloscope. Set the oscilloscope to 200 ns/Div and trigger on the LOW going edge of LEN7 (U12 pin 1 or 19). Rotate the RPG slowly in both directions and verify that both HIGH and LOW levels are present at each output of U12 during the first 200 to 400 ns after the trigger. If one or more of the outputs does not exhibit both HIGH an LOW states during this time window yet the corresponding input to U12 does, U12 is bad.

13. If all of these outputs are correct but you still suspect that the main processor is not getting the data, verify that these signals are getting through the front panel ribbon cable by probing right at the Motherboard with the oscilloscope. Set the oscilloscope the same as in step 12. Note that if one of these data lines is open, several of the LEDs on the front panel will also be incorrect.

RPG COUNT WINDOW TIMER (A6 BLOCK H)

1. Probe LEN6 at U13 or U18 pin 8 (Block **G**) and LEN7 at U12 pin 1 or 19 (Block **G**) with the oscilloscope. Set the oscilloscope to 200 ns/Div and trigger on the LOW going edge. You should find

200 to 400 ns wide, LOW going pulses each time the RPG is rotated. If these pulses are not present, troubleshoot the ADDRESS DECODER (A6 Block **F**).

2. Probe ENTRY ON at U19A pin 2. This signal should be LOW if an active function is displayed in the entry display. Press **[START FREQ]** and this signal should go LOW. If this signal does not go LOW, troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**).

3. Probe CLK (U20 pin 2) with the oscilloscope. Set the oscilloscope to 10 ms/Div. You should find a repetitive TTL signal when the RPG is rotated. If CLK is not correct, troubleshoot the RPG COUNTERS/DATA BUFFER (A6 Block **G**).

4. Connect the trigger of the oscilloscope to CLK (A6TP1) and trigger on the falling edge. Probe the output of the RPG COUNT WINDOW TIMER (A6TP15) with the oscilloscope. You should find a LOW going pulse 65 to 75 ms wide each time the RPG is rotated. If this pulse is not present, replace U20. If the duration of this pulse is not correct, check or replace R6 or C22.

5. Probe HI RPG SRQ with the oscilloscope. Each time the RPG is rotated you should find a 100 us to 20 ms wide, HIGH going pulse which goes HIGH at the same time as the output of the RPG COUNT WINDOW TIMER (TP15) goes HIGH.

6. If HI RPG SRQ is not correct, lift U19 pin 6 and recheck the signal. Press **[INSTR PRESET]** and the signal should go LOW. Rotate the RPG and verify that HI RPG SRQ pulses HIGH (if the 8340A is sweeping) or goes HIGH and stays HIGH (if the 8340A is not sweeping). If the signal is correct at U19 pin 6, either there is a short along this trace or one of the inputs connected to HI RPG SRQ is bad and is preventing it from changing levels. If the signal at U19 pin 6 is not correct, replace U19.

SRQ BUFFER (A6 BLOCK I)

1. Probe LSRQ (U3A pin 1) with the oscilloscope. Set the oscilloscope 100 us/Div and trigger on the LOW going edge. Press **[CW]** on the 8340A and rotate the RPG. You should find a 100 us wide, LOW going pulse each time the RPG is rotated. If this signal is correct, proceed to step 4.

2. Probe HI RPG SRQ (TP8) with the oscilloscope. Set the oscilloscope to trigger on the HIGH going edge. Each time the RPG is rotated, you should find a 100 us wide, HIGH going pulse. If this signal is correct, replace U3.

3. If HI RPG SRQ is not correct, lift U3A pin 2 and recheck HI RPG SRQ at TP8. Rotate the RPG and verify that this signal goes HIGH and stays HIGH. Press ENTRY OFF and verify that HI RPG SRQ

returns LOW when you rotate the RPG. If HI RPG SRQ is now correct, replace U3. If the signal is still bad at TP8, troubleshoot the RPG COUNT WINDOW TIMER (A6 Block **H**).

4. Press any key and you should find a 100 us wide, LOW going pulse on LSRQ when the key is pressed.

5. If LSRQ is not correct, probe HI KEY DN SRQ (TP3) with the oscilloscope. Set the oscilloscope to trigger on the HIGH going edge. Each time a key is pressed, you should find a 100 us wide HIGH going pulse. If HI KEY DN SRQ is correct, replace U3.

6. If HI KEY DN SRQ is not correct, lift U3A pin 3 and recheck HI KEY DN SRQ at TP3. Press any key and verify that this signal goes HIGH and stays HIGH. Press **[INSTR PRESET]** and verify that HI KEY DN SRQ returns LOW. If the signal is correct, replace U3. If the signal is incorrect, troubleshoot the KEY DOWN TIMER (A6 Block **C**).

INSTR PRESET BUFFER (A6 BLOCK J)

1. Probe INSTR PR LOCKOUT (U3D pin 12). This signal should be LOW unless the instrument is in REMOTE mode. If this signal is HIGH, troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**).

2. Probe INSTR PRESET (U3D pin 11). This signal should be HIGH and go LOW when the **[INSTR PRESET]** key is pressed. If this signal is correct, proceed to step 6.

3. If INSTR PRESET stays HIGH all the time, check for an open circuit on both the A5 and the A6 boards. You can manually ground this signal at A6P1 pin 24 to verify that the signal at U3D pin 11 goes LOW at the same time. This will cut the problem in half.

4. If INSTR PRESET stays LOW all the time, lift one side of C1 and recheck the level of INSTR PRESET. If this corrects the problem, replace C1.

5. If INSTR PRESET still stays LOW, detach the A6 board from the A5 keyboard. If INSTR PRESET is now correct, remove the INSTR PRESET key switch from the A5 keyboard and check for shorts. If no shorts exist, replace the key switch.

6. If INSTR PRESET is correct, probe U3D pin 13. The signal at this pin should be LOW and should go HIGH when INSTR PRESET goes LOW. If the signal is not correct, check for shorts along the trace and then replace U3 if no shorts exist.

7. Probe LIPS (U3C pin 10). LIPS should be HIGH and go LOW when **[INSTR PRESET]** is pressed. If LIPS is correct, proceed to step 10.

8. If LIPS is LOW all the time, disconnect the front panel ribbon cable from the A6 Keyboard Interface board and probe LIPS on the Motherboard. If LIPS is still LOW, troubleshoot the A52 Positive Regulator board or the A61 Memory board.

9. If LIPS is correct, reconnect the A6 board and lift U3C pin 10. If LIPS is correct after lifting U3C pin 10, replace U3. If LIPS is not correct, check for shorts along the signal trace and then replace U8 if no shorts are exist.

10. Probe U8A pin 2. The signal on this pin should be LOW and go HIGH when **[INSTR PRESET]** is pressed. If the signal is correct, proceed to step 12.

11. Lift U8 pin 2 and recheck the signal at the pin. If the signal is correct, check for shorts along the signal trace and replace U2 if no shorts exist. If the signal is still not correct, replace U8.

12. If the signal at U8 pin 2 is correct, probe ANNUNCIATOR RESET at U2 pin 3. This signal should be HIGH and go LOW when **[INSTR PRESET]** is pressed. If ANNUNCIATOR RESET is not correct, lift U2 pin 3 and recheck right at the pin. If this signal is bad right at the pin, replace U2. If this signal is good with the pin lifted, check for shorts along the signal trace and if no shorts exist, troubleshoot the ANNUNCIATOR LATCHES (A6 Block **E**) to determine which latch input is bad.

A6 KEYBOARD INTERFACE DSA TROUBLESHOOTING

A limited amount of DSA is available on the Keyboard Interface. All of the latched LED Bits and Control Bits as well as the Strobes can be tested for correct operation by using the following main instrument DSA routine and a Signature Analyzer.

1. Ground the LSTS test point on the A60 Processor board and then turn the instrument to STANDBY and then ON. Connect Signature Analyzer as follows:

   START connected to T1 on the A61 Memory board, trigger on the rising edge.

   STOP connected to T2 on the A61 Memory board, trigger on the rising edge.

   CLOCK connected to LIOSB (A60TP4), trigger on the rising edge.

   GRND connected to chassis ground or ground pin.

2. Probe the signals listed in the table below and verify that the signatures match those given.

Mnemonic	Location	Signature
DB0	A6J3-3	H186
DB1	A6J3-4	CFPH
DB2	A6J3-5	H077
DB3	A6J3-6	0942
DB4	A6J3-7	CC29
DB5	A6J3-8	63CP
DB6	A6J3-9	F77H
DB7	A6J3-10	2757
DB8	A6J3-11	P702
DB9	A6J3-12	67A8
DB10	A6J3-13	FU51
DB11	A6J3-14	9PA2
DB12	A6J3-15	3H44
DB13	A6J3-16	37FH
DB14	A6J3-17	CF15
DB15	A6J3-18	H186
ADR0	A6J3-23	AUCU
ADR1	A6J3-24	U154
ADR2	A6J3-25	012F
ADR3	A6J3-26	8U24
ADR4	A6J3-27	7UUF

SIOB	A6J3-47	3704
LEN 4	A6U15 pin 11	P769
LEN 5	A6U15 pin 10	U034
LEN 6	A6U15 pin 9	FAFP
MKR SWP	A6U6 pin 12	8H01
M1	A6U6 pin 9	2156
M2	A6U6 pin 15	79U9
M3	A6U6 pin 6	F8A6
M4	A6U6 pin 16	AA19
M5	A6U6 pin 5	H973
ENTRY ON	A6U6 pin 19	AP4U
KEYBOARD LOCKOUT	A6U6 pin 2	7C63
ALTN	A6U7 pin 19	FH92
EXT	A6 U7 pin 2	A070
SINGLE	A6U7 pin 16	5F49
MAN	A6U7 pin 5	C892
FREE	A6U7 pin 15	7124
LINE	A6U7 pin 6	F5C5
CONT	A6U7 pin 12	C03U
DELTA MRKR	A6U7 pin 9	5C2A
PEAK	A6U16 pin 12	CC23
XTAL	A6U16 pin 9	0UFP
AMPTD MRKR	A6U16 pin 15	6614
PWR SWP	A6U16 pin 6	C5A1
INT	A6U16 pin 16	12FC
RF	A6U16 pin 5	10PH
EXT	A6U16 pin 19	H7A5
INST PR LOCKOUT	A6U16 pin 2	20CH
AM	A6U17 pin 19	38U3
SLOPE	A6U17 pin 2	086U
PULSE	A6U17 pin 16	P6A0
INST CK I	A6U17 pin 5	FH41
INST CK II	A6U17 pin 15	9A82
FM	A6U17 pin 6	CAU3
SHIFT	A6U17 pin 12	0F6P
	A6U17 pin 9	6155

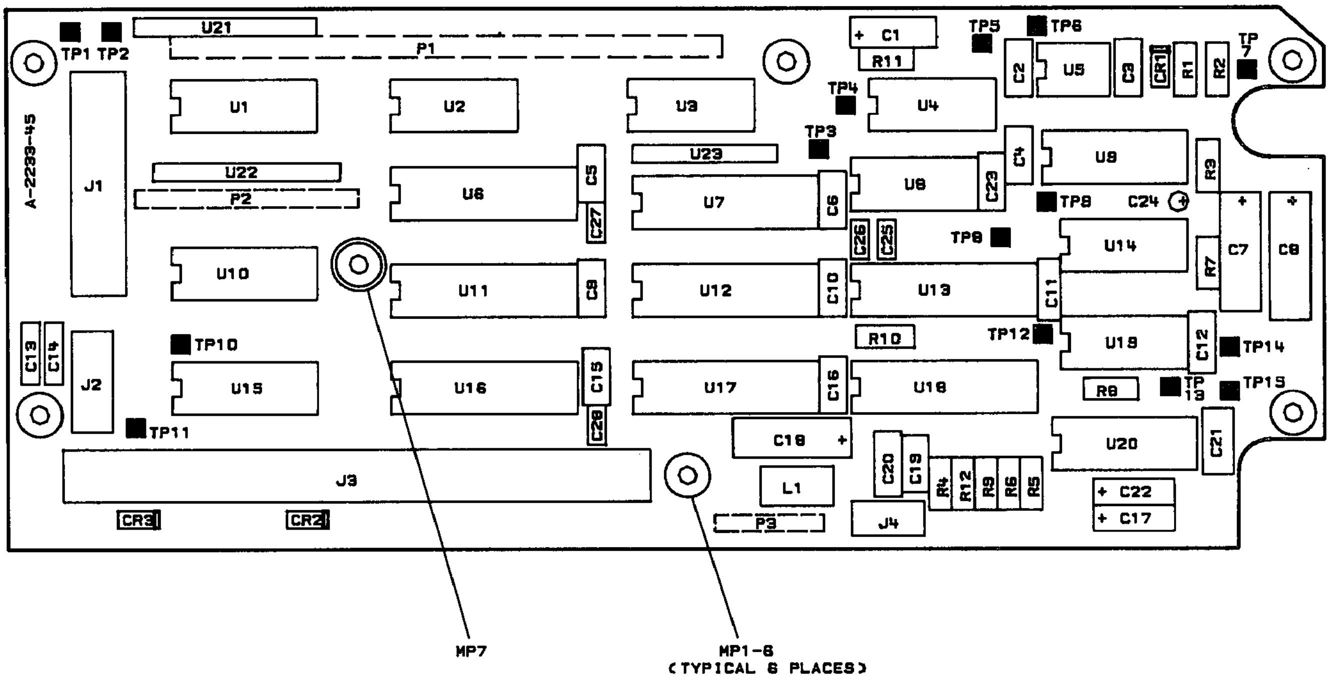


Figure 8H-18. A6 Keyboard Interface, Component Location Diagram

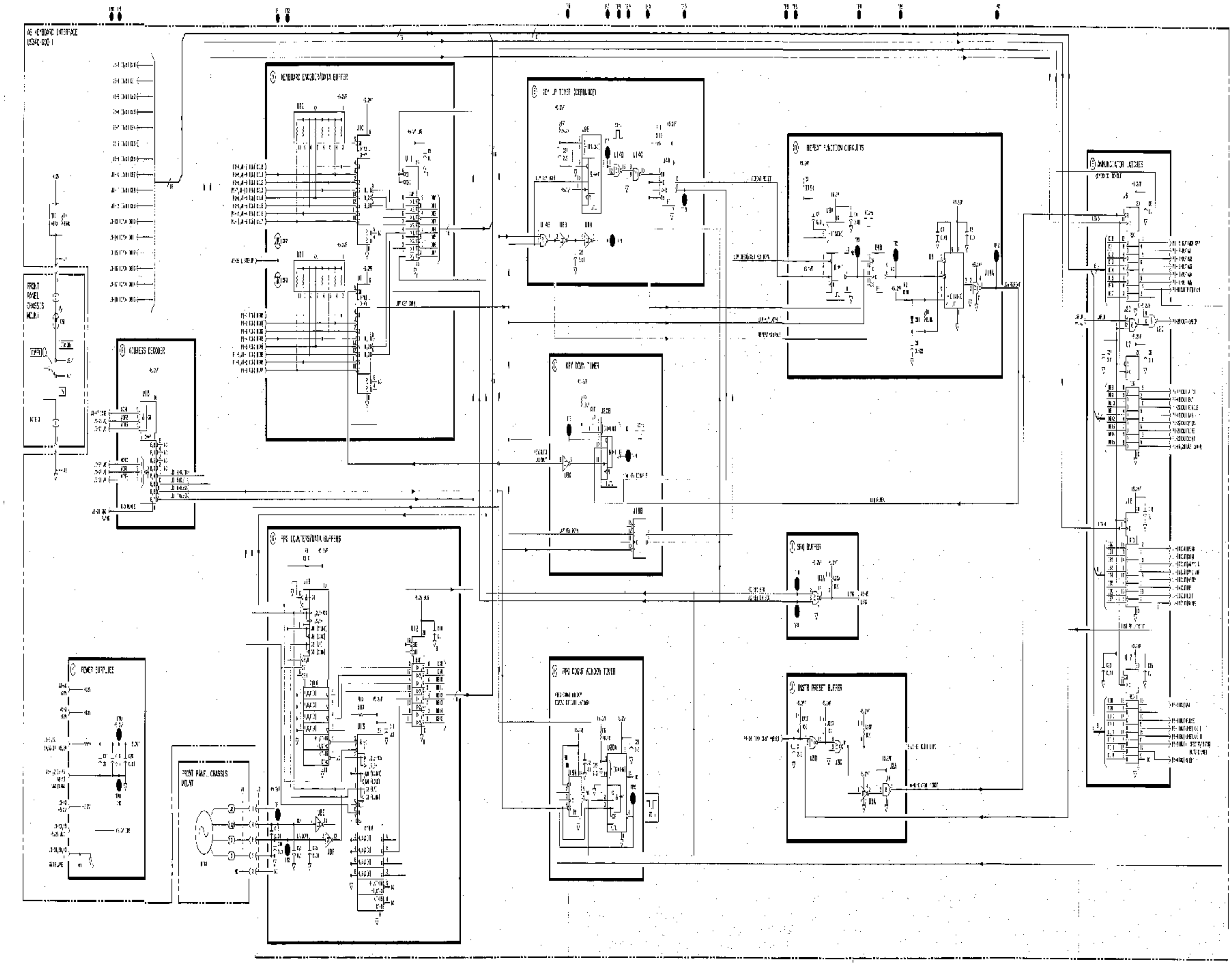


Figure 8H-19. A6 Keyboard Interface Schematic Diagram

8-6578-658

REAR PANEL
THEORY OF OPERATION

INTRODUCTION

This Rear-Panel description provides information on the connectors and components located on the HP 8340A Rear Panel. Figure 8H-25, Rear Panel Features, located near the end of this section, shows the components mounted on the Rear Panel.

DESCRIPTION

The assemblies and components mounted on the 8340A Rear Panel perform many different functions which may be divided into the following groups:

- HP-IB - Provides a digital interface by which the 8340A can communicate with other HP-IB-equipped instruments or controllers.
- SWEEP-RELATED INTERFACE LINES - These are signals such as MUTE, PEN LIFT, NEG BLANK, Z-AXIS BLANK/MKRS, EXT TRIGGER INPUT, and STOP SWP IN/OUT. These signals allow the 8340A to interface with external devices such as X-Y recorders or network analyzers. The external device can then determine what state the 8340A sweep is in (sweep in progress, retrace, sweep stopped for band switch, etc). External devices may stop the 8340A sweep with the **STOP SWP IN/OUT**. When the 8340A is in External Trigger mode, the **EXT TRIGGER INPUT** allows an external device to initiate sweeps.
- FREQUENCY STANDARD - The **INT** and **EXT** connectors, in conjuction with the **FREQUENCY STANDARD** switch, allows selection of either the internal or the external frequency standard. The standard is used as a master timebase for the 8340A.
- RF OUTPUTS - All instruments are equipped with **AUX OUTPUT**. Option 004 and 005 instruments have the **RF OUTPUT** connector mounted on the Rear Panel.
- DEDICATED INTERFACE CONNECTORS - Provide interfacing with the HP 8410B/C and the HP 8755C Network Analyzers.
- FAN - Provides instrument cooling.
- LINE MODULE - Holds main line fuse and the line voltage selector printed circuit board. This module also suppresses line transients.

BLOCK DIAGRAM

Figure 8H-20, Rear Panel Block Diagram, shows all Rear Panel connectors, the source or destination of the associated signals, and any other assemblies these signals go through.

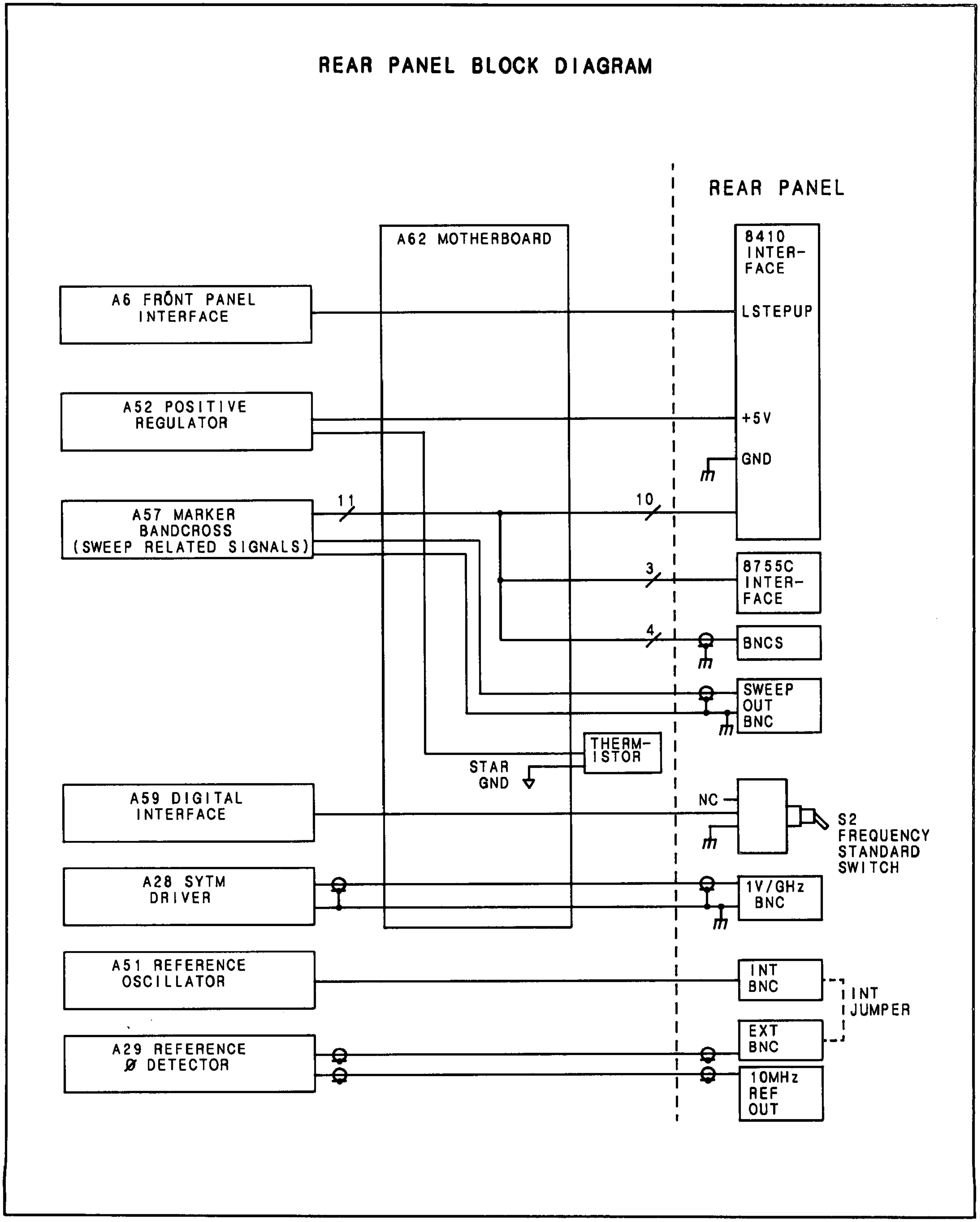


Figure 8H-20. Rear Panel Block Diagram (1 of 2)

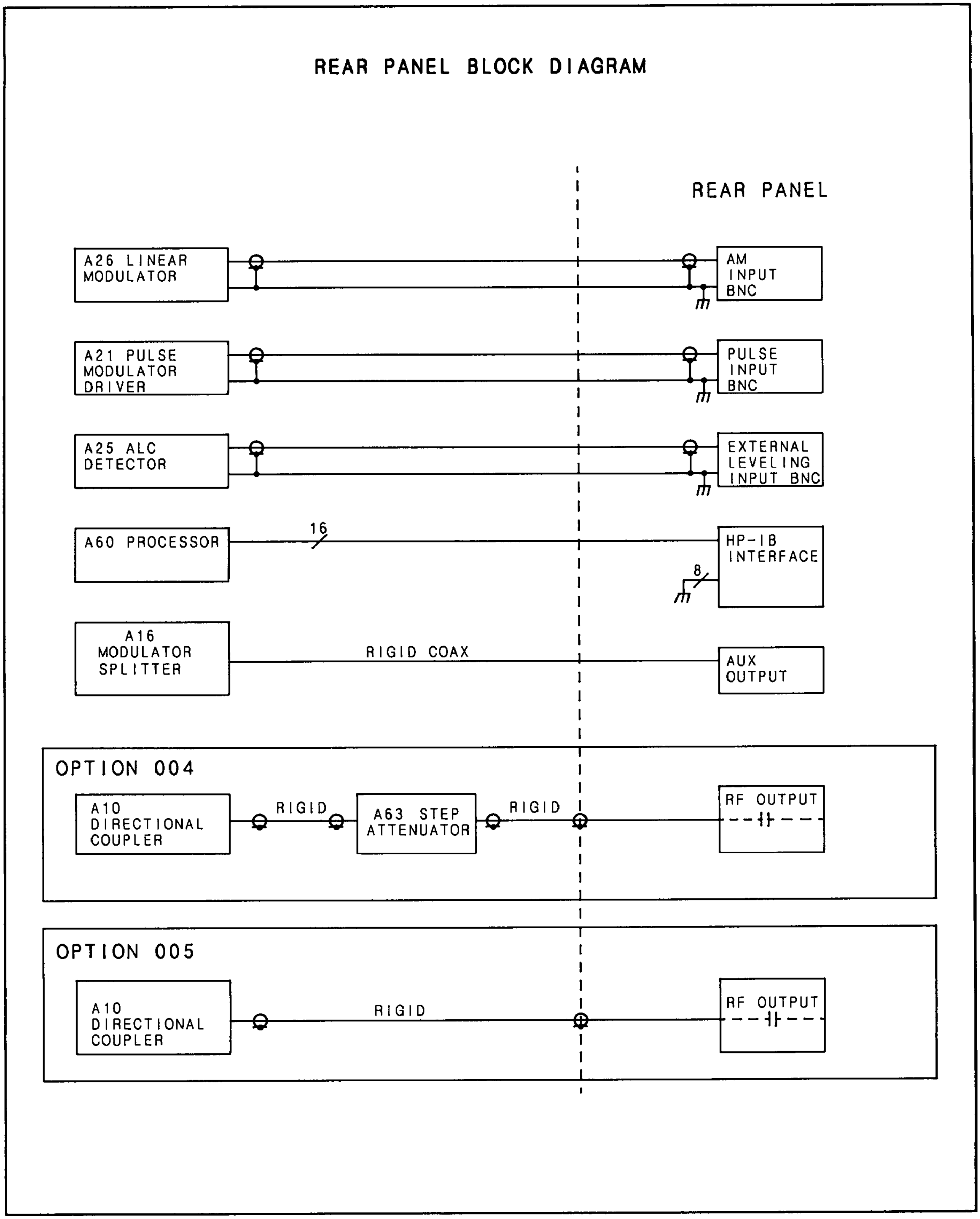


Figure 8H-20. Rear Panel Block Diagram (2 of 2)

REAR PANEL
TROUBLESHOOTING TO ASSEMBLY LEVEL

REAR PANEL CONNECTORS

Refer to Figure 8H-26 to determine the source/destination assembly that generates or receives the signal in question, and which assembly(ies) and/or cable(s) it propagates through. Refer to the "**REAR PANEL INDIVIDUAL ASSEMBLIES**" descriptions for a functional description of each Rear Panel connector.

FAN

Fan troubleshooting information is provided in the "**POWER SUPPLY - FAN**" functional group.

LINE MODULE

Line module troubleshooting information is provided in the "**POWER SUPPLIES -FAN**" functional group.

MECHANICAL ASSEMBLIES

Refer to Section VI, parts list.

REAR PANEL
INDIVIDUAL ASSEMBLIES

LINE MODULE

Description

The line module performs several functions. The main line fuse protects the instrument from line voltage surges, incorrect line voltage, or internal damage due to a short in the line module, transformer, motherboard, or a rectifier board. The line module also suppresses power line transients. The line voltage selector printed circuit board allows the user to easily configure the 8340A for operation at different line voltages. The selected voltage is visible through the clear plastic window next to the line fuse (see Figure 8J-1 in the "**POWER SUPPLIES - FAN**" functional group).

Line Module Troubleshooting

Refer to "**LINE MODULE TROUBLESHOOTING**" in the "**POWER SUPPLIES - FAN TROUBLESHOOTING TO ASSEMBLY LEVEL**" section for troubleshooting information.

LINE MODULE REPLACEMENT

Refer to Figure 8J-5. Transformer - Line Module - Fan Replacement in the "**POWER SUPPLIES - FAN**" functional group for replacement procedures.

RF CONNECTORS

AUX OUTPUT 2.3 - 7 GHz J19

This is a type-N female connector that nominally provides a -3 dBm RF output from the HP 8340A's fundamental YIG oscillator. Impedance of this connector is nominally 50 Ohms.

RF OUTPUT J20

This precision APC-3.5 male connector replaces the standard Front Panel RF output connector in Option 004 and Option 005 instruments. Option 004 has a Rear Panel RF output with attenuator, and Option 005 has a Rear Panel RF output without the attenuator. The specifications for each option are listed in Table 1-1 (Section I of this manual). Output impedance is nominally 50 Ohms. The RF OUTPUT connector has a capacitor built into it. This capacitor is in series with the RF OUTPUT and protects the instrument from DC potentials. The maximum dc voltage that may be applied to the RF connector is 50 Vdc.

Considerable care must be used when working with APC-3.5 connectors. Do not deform the connector by excessive tightening force, and do not allow the connector to become corroded, scratched, or dirty. If cleaning is necessary, use a firm, lint free brush only. Do not use any cleaning solvents since they can chemically damage the plastic bead that supports the center conductor. If this connector is mechanically degraded, high frequency losses will occur.

REAR PANEL BNC CONNECTORS

1V/GHz (19V MAX) J6

This BNC connector has an output voltage that is proportional to the RF output frequency, with a ratio of 1 volt per GHz frequency. The maximum specified output voltage is 19V. Above 19 GHz this output levels off at approximately 20V. Accuracy is 1V/GHz ±1% ±2mV with a load impedance ≥ 4 kohms. (Note: This output is current limited. Loads less than 4 kohms will cause the circuit to current limit at high frequency. An output voltage ratio of 0.5 volts/GHz can be achieved by clipping two jumpers on the A28 SYTM board (see the RF Section functional group). This allows a proportional output for the entire 10 MHz to 26.5 GHz frequency span of the HP 8340A.

SWEEP OUTPUT J7

The output voltage range for this connector is 0 to +10 Vdc. When the HP 8340A is sweeping, the **SWEEP OUTPUT** is 0 Vdc at the beginning of the sweep and +10 Vdc at the end of the sweep, regardless of sweep width. In CW mode, the **SWEEP OUTPUT** is always at 0 volts. In MANUAL mode, the **SWEEP OUTPUT** ranges from 0 Vdc at the 10 MHz minimum frequency, to 10 Vdc at the 26.5 GHz maximum frequency, with proportional voltages at the frequencies between these points.

10 MHz REF OUTPUT J8

This output provides a 10 MHz signal at approximately 0 dBm, derived from the internal frequency standard of the HP 8340A. This can be the master time base reference output for a network of instruments.

INT J9/EXT J10 (SWITCH & BNC CONNECTORS)

These items allow the user to select either the internal (INT) 10 MHz crystal oscillator frequency standard, or an external (EXT) frequency standard to be used as the master timebase for the HP 8340A. To select the internal standard, place the switch in the **INT** position and connect a jumper cable between the **INT** and **EXT** BNC connectors (the **INT** BNC is now outputting 10 MHz at approximately +3 dBm). To use an external standard, disconnect the jumper, change the switch to **EXT**, and connect the external source to the **EXT** BNC connector. The external source must be either 5 MHz ±50 Hz, or 10 MHz ±100 Hz, and provide 1 to +10 dBm into the 50 Ohm BNC connector. When the switch is in the **EXT** position, the internal standard is turned off and the amber **EXT**

REF annunciator lights above the Front Panel **ENTRY DISPLAY.**

EXTERNAL TRIGGER INPUT J11

This input triggers the start of a sweep. Trigger signal must be >2 volts (10V maximum), and wider that 0.5 microseconds. Nominal input impedance is 2 KOhms.

MUTE OUTPUT J12

This output provides an active LOW, TTL signal which causes external X-Y recorders or instruments to pause while the HP 8340A crosses a frequency band switchpoint. The X-Y recorder Operating Guide, located at the end of Section III, explains the interaction of recorders with the HP 8340A.

PENLIFT OUTPUT J13

OPERATION WITH X-Y RECORDERS

PENLIFT disables an X-Y recorder's ability to lower its pen during sweep retrace. If **[SHIFT] [LINE]** is pressed on the Front Panel, PENLIFT will also disable the pen during forward sweep band switchpoints. Because of X-Y recorder limitations PENLIFT will always disable the X-Y recorder's pen at sweep times under 5 seconds.

PENLIFT enables pen operation by providing a current path to ground for the X-Y recorder's pen solenoid. The voltage at the PENLIFT output in this state will be approximately 0 Vdc. Circuit impedance in this state is approximately 0.5 Ohms (Q3 on).

PENLIFT disables pen operation by not providing a current path to ground for the X-Y recorder's pen solenoid. The voltage on the PENLIFT output will be equal to the X-Y recorder's pen solenoid supply voltage. Circuit impedance in this state is very high (Q3 open). A 56.2 volt zener diode protects the PENLIFT circuit from excessively high X-Y recorder solenoid voltages. A57CR10 protects the circuit from negative voltages on the input.

OPERATION WITH TTL LOADS

The PENLIFT output will be at TTL levels if connected to TTL devices.

NEG BLANKING J14

This output provides a negative rectangular pulse (approximately -5 volts into 2 KOhms) during sweep retrace and forward sweep band switchpoints.

Z-AXIS BLANK/MKRS J15

This output supplies a positive rectangular pulse (approximately +5 volts into 2 KOhms) during sweep retrace and forward sweep band switchpoints. This output also supplies a -5 volt pulse when the RF output is coincident with a marker frequency.

STOP SWP IN/OUT J16

When this line is grounded, forward sweeping is stopped. The sweep will resume when this input is released from ground. If this input is grounded during retrace, the retrace will continue but the next sweep will not begin until **STOP SWP IN/OUT** is released from ground. This line is also an output, a TTL LOW indicates that the sweep has been stopped by the 8340A.

NOTE

For troubleshooting information, refer to Figure 8H-26, Rear Panel Assembly, Schematic Diagram located at the end of this section. More information concerning the operational parameters of these BNC signals may be found in Section III of this manual.

8410 INTERFACE J18

The HP 8340A Synthesized Sweeper interfaces with the HP 8410B/C Network Analyzer by means of the Source Control Cable (HP Part Number 08410-60146 CD9). This interface permits multi-octave operation of the 8410B/C with the 8340A. This connector has pins that duplicate several Rear Panel functions, including **EXT TRIGGER INPUT, MUTE OUTPUT, PENLIFT OUTPUT, NEG BLANK,** and **Z-AXIS BLANK/MKRS.** There is also a pin input (LSTEPUP) for a switch closure to execute the **UP** key function, which is used to increment the active Front Panel control function. Figure 8H-21 contains a visual representation of the 8410 Interface Cable.

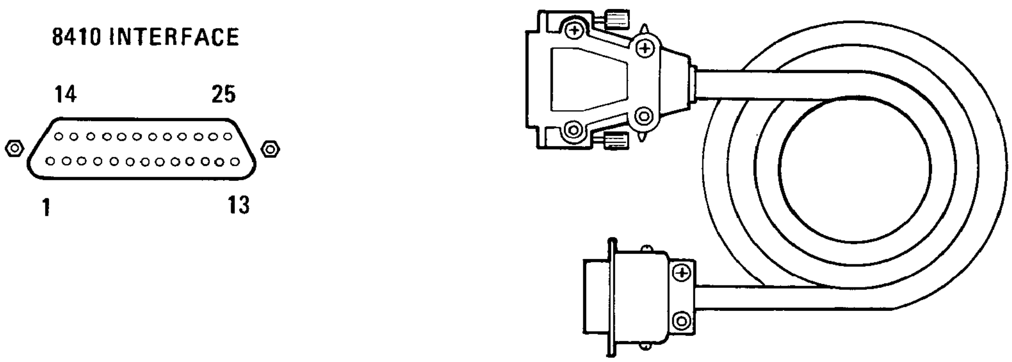
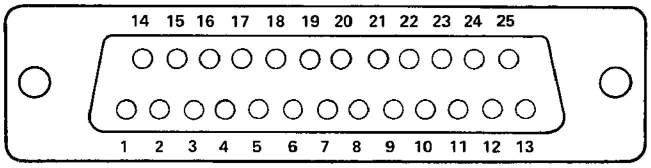


Figure 8H-21. 8410 Interface and Cable

The pin configuration of the 8410B/C INTERFACE and descriptions of all related signals are located in Figure 8H-22.

8410C INTERFACE CONNECTOR J18
(As seen from rear panel)



J18 Pin	Mnemonic	Levels	Input/Output	Signal Source/ Destination	A62J31 Pin	J18W46 Wire Color Code
1						
2	Z-AXIS BLANK	+5V, −5V*	OUTPUT	A57P1-99	2, 16	2
3						
4	LALTSEL	TTL (LOW TRUE)	OUTPUT	A57P1-59	10, 24	0
5	LSSP (LSTOP SWEEP)	TTL (LOW TRUE)	I/O	A57P1-107	5, 19	5
6	+5.2V			A52P1-17, 18, 41, 42	3	3
7						
8						
9	$\overline{\text{MUTE}}$	TTL (LOW TRUE)	INPUT	A57P1-61	8, 22	4
10	EXT TRIG	EXT SOURCE INPUT LEVEL	INPUT	A57P1-106	4, 18	6
11	PEN LIFT	SEE TEXT	OUTPUT	A57P1-108	6, 20	8
12						
13						
14	NEG BLANK	0V, −5V*	OUTPUT	A57P1-41	1, 15	1
15						
16	LRETRACE	TTL (LOW TRUE)	OUTPUT	A57P1-58	11, 25	9 - 0
17	LALTEN	TTL (LOW TRUE)	OUTPUT	A57P1-60	9, 23	9
18						
19	GND			STOP SWEEP BNC GND LUG		9 - 0 - 7
20						
21						
22	LSTEPUP	TTL (LOW TRUE)	INPUT	A62J1-28	14	9 - 0 - 8
23						
24	8410 TRIG	TTL (LOW TRUE)	OUTPUT	A57P1-62	7	7
25						

*See text

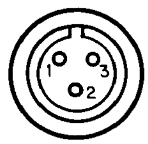
Figure 8H-22. 8410 INTERFACE Connector J18

8755C ALT SWP INTERFACE J17

The HP 8340A can sequence alternate sweeps in the HP 8755C Scalar Network Analyzer with Interface Cable 8120-3174 CD8. Figure 8H-23 shows the pin configuration and complete description of the 8755C ALT SWP INTERFACE signals.

ALTERNATE SWEEP INTERFACE CONNECTOR J17

8755C
ALT SWP.
INTERFACE



(viewed from rear of instrument)

Pin	Mnemonic	Description	Level	Wire Color Code	A62J31 Pin	Source
1	LALTEN	LOW to Externally Enable ALT SWP Mode in HP 8755C	TTL OUTPUT	9 - 1 - 5	23	A57P1-60
2	LALTSEL	Channel Select (HIGH =Channel 1, LOW =Channel 2)	TTL OUTPUT	9 - 1- 6	24	A57P1-59
3	LRETRACE	LOW During Retrace	TTL OUTPUT	9 - 1 - 7	25	A57P1-58

Figure 8H-23. HP 8755C ALT SWP INTERFACE J17

HP-IB INTERFACE CONNECTOR J21

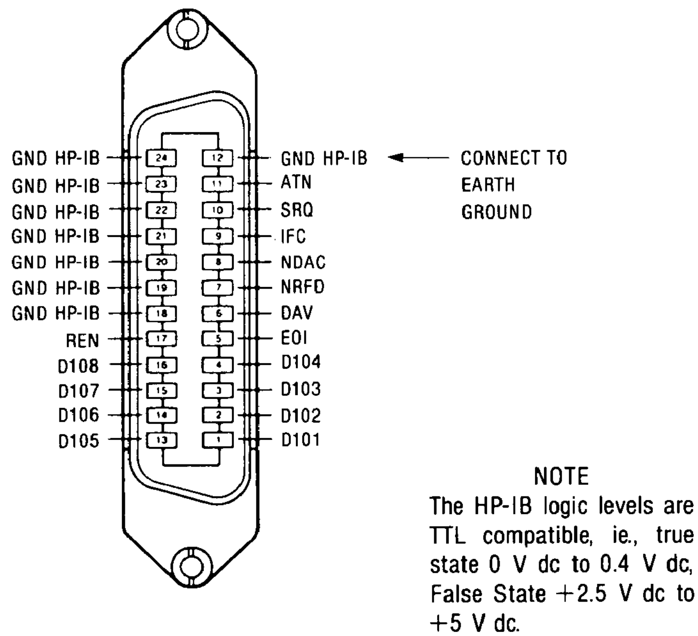
The HP-IB interface allows the HP 8340A to communicate with another instrument or device on the HP-IB bus.

The 8340A's HP-IB may be checked for proper operation by performing the **"HP-IB OPERATION VERIFICATION PROCEDURE"**, located in the **"MANUAL PERFORMANCE TEST PROCEDURES"**, Section IV.

Refer to Figure 8H-24, HP-IB Connector, for further information.

For more information concerning HP-IB operation, refer to the remote programming information in Section III.

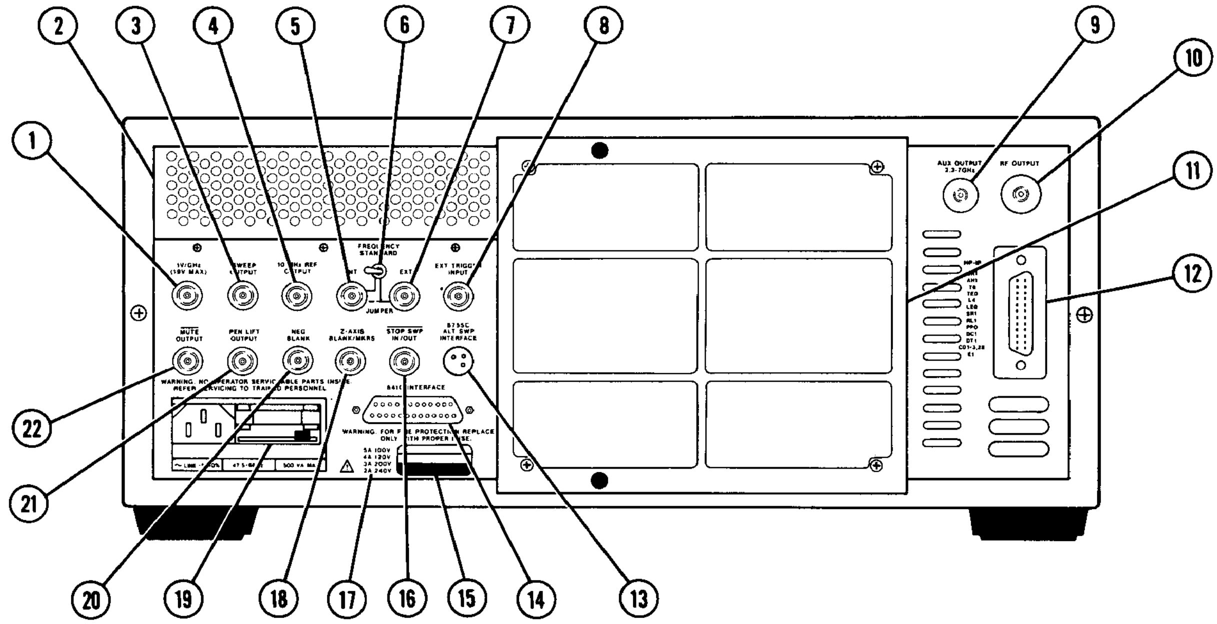
HP-IB troubleshooting information may be found in the **"CONTROLLER"** functional group in this manual.



MNEMONICS TABLE

Mnemonic	Description
ATN	LOW = Attention control line
DAV	LOW = Data Valid control line
DIO1 through 8	LOW = Data Input/Output lines
EOI	LOW = End Or Identify control line
IFC	LOW = Interface Clear control line
NDAC	LOW = Data Not Accepted control line
NRFD	LOW = Not Ready For Data control line
REN	LOW = Remote Enable control line
SRQ	LOW = Service Request control line

Figure 8H-24. HP-IB Connector J21



1. 1V/GHz J6
2. HEAT SINK (P/O A62 Motherboard)
3. SWEEP OUTPUT J7
4. 10MHz REF OUTPUT J8
5. FREQUENCY STANDARD INT J9
6. FREQUENCY STANDARD SWITCH
7. FREQUENCY STANDARD EXT J10
8. EXT TRIGGER INPUT J7 – J11
9. AUX OUTPUT 2.3 – 7 GHz J19
10. RF OUTPUT J20 (Option 004 and 005 only)
11. FAN (B1)
12. HP-IB J21
13. 8755C ALT SWP INTERFACE J17
14. 8410 INTERFACE J18
15. SERIAL TAG
16. $\overline{\text{STOP SWP}}$ IN/OUT J16
17. FUSE RATING GUIDE
18. Z-AXIS BLANK/MKRS J15
19. LINE MODULE
20. NEG BLANKING J14
21. PEN LIFT OUTPUT J13
22. $\overline{\text{MUTE}}$ OUTPUT J12

Figure 8H-25. Rear Panel Features

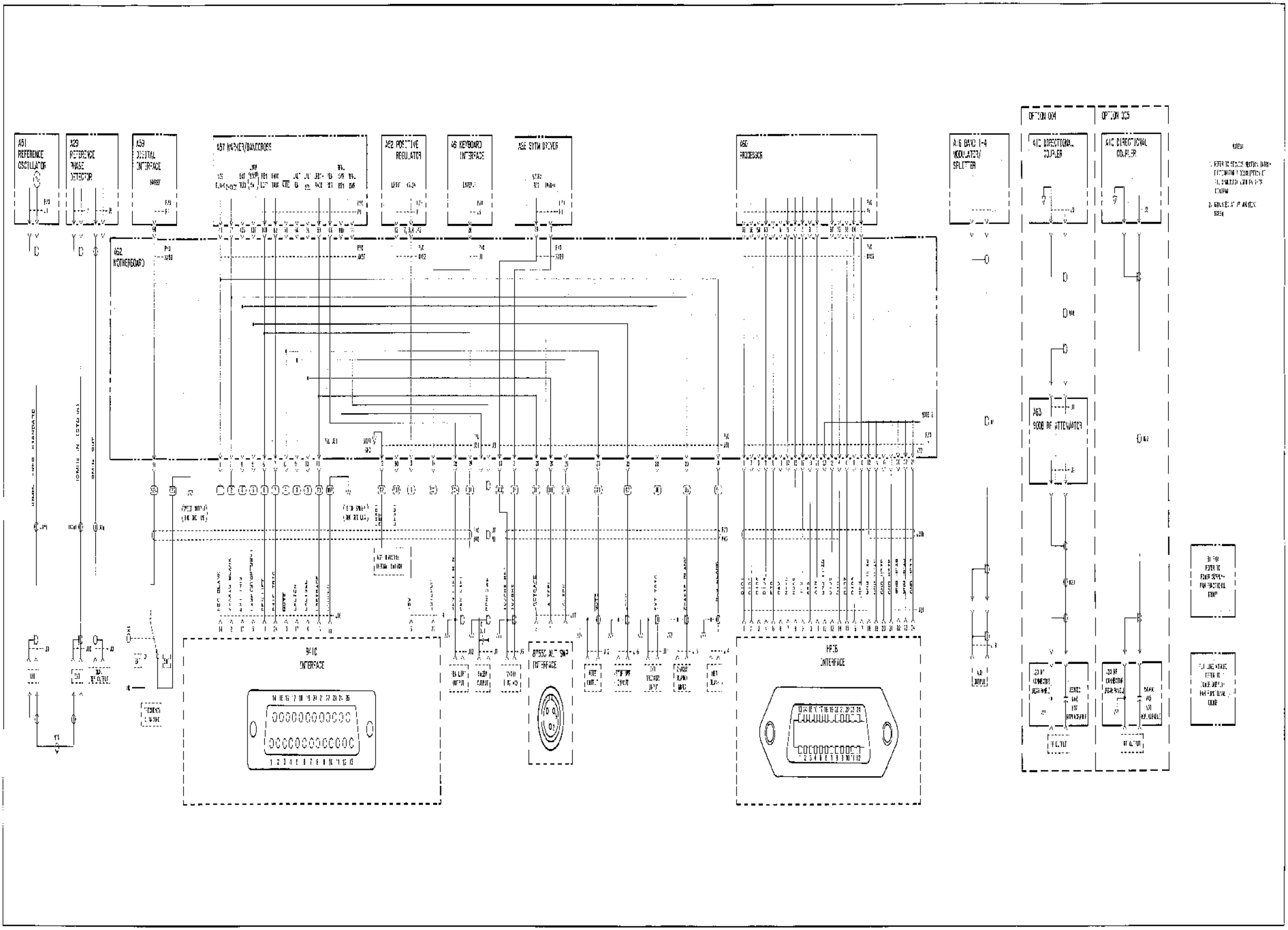
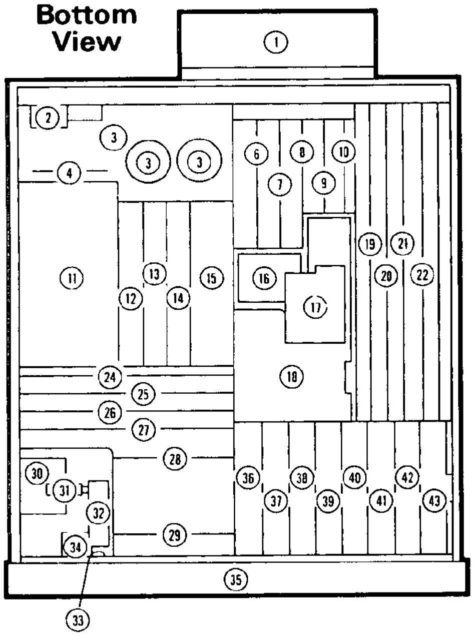


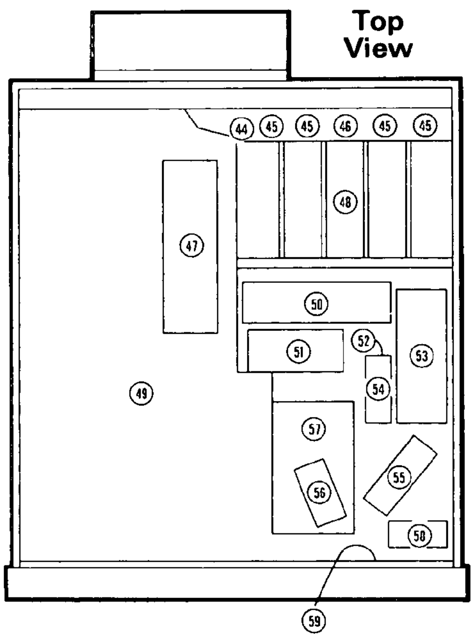
Figure 8H-26. Rear Panel Assembly Schematic Diagram

REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



Top View



Assy./Ref. Des.	Description	Location	Ref.-M/N Loops	20-30 Loops	Swp. Gen.-YO Loop	Motherboard	Controller	Front/Rear Panel	RF Section	Power Supplies
			Volume 3						Volume 4	
A1	Alpha Display	32						●		
A2	Display Driver	33						●		
A3	Display Processor	34						●		
A4	Not Assigned	-								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	[illegible]							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	31							●	
A12	Band 0 Splitter/Detector	54							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	[illegible]							●	
A18	Band 0 Power Amplifier	55							●	
		[illegible]							●	
A19	Capacitor Assembly	[illegible]								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	28							●	
A25	ALC Detector	27							●	
A26	Linear Modulator	26							●	
A27	Level Control	25							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	15	●							
A33	M/N Output	[illegible]	●							
A34	Reference-M/N Motherboard	5	●							
A35	Rectifier	4								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	40		●						
A41	PLL2 Phase Detector	41		●						
A42	PLL2 Divider	42		●						
A43	PLL2 Discriminator	43		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	[illegible]			●					
A49	YO Loop Phase/Detector	[illegible]			●					
A50	YO Loop Interconnect	17			●					
A51	Reference Oscillator	[illegible]	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	10								●
A57	Marker/Bandcross	19					●			
A58	Sweep Generator	20			●					
A59	Digital Interface	21					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	58							●	
AT2	15 dB Attenuator	48			●					
B1	Fan Assembly	[illegible]								●
A62C1-3	Power Supply Filter Capacitors	3								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

RF SECTION (POWER LEVEL CONTROL) I

RF SECTION
INTRODUCTION

This section provides descriptions and block diagrams for the RF and microcircuit sections. Descriptions for ALC Loop assemblies, SYTM-Related assemblies, and pulse modulation-related assemblies are also supplied.

LIST OF ASSEMBLIES COVERED

The following assemblies are described in this functional group. Some assemblies (microcircuits) are not field repairable. These are described only with a drawing of the assembly and a schematic drawing, Figure 8I-42, RF Section Schematic Diagram.

- A8 3.7 GHz Oscillator
- A9 Band 0 Pulse Modulator
- A10 Directional Coupler
- A11 Band 1-4 Detector
- A12 Band 0 Splitter/Detector
- A13 SYTM (Switched YIG-Tuned Multiplier)
- A14 Band 1-4 Power Amplifier
- A15 Band 0 Low Pass Filter
- A16 Band 1-4 Modulator/Splitter
- A17 Band 0 Mixer
- A18 Band 0 Power Amplifier
- A20 RF Section Filter
- A63 RF Attenuator/J5 RF OUTPUT Connector
- AT1 Peripheral Mode Isolator
- A21 Pulse Modulator Driver
- A24 Attenuator Driver/SRD Bias
- A25 ALC Detector
- A26 Linear Modulator
- A27 Level Control
- A28 SYTM Driver/A47 Sense Resistor Assembly (SYTM Circuit)

RF SECTION
THEORY OF OPERATION

INTRODUCTION:

This section provides an overall description of the RF Section as well as a brief description of the following:

- Microcircuit Assemblies
- ALC Loop Assemblies
- SYTM-Related Assemblies
- Pulse Modulation-Related Assemblies

This section also contains a Simplified Block Diagram and an RF Section Schematic Diagram for the A8 - A18, A20, A63 and AT1 assemblies.

RF SECTION, OVERALL DESCRIPTION

The RF Section contains the microcircuits and printed circuit boards that produce, amplify, and control the RF output. A brief discussion about the function of the microcircuits will be covered first, followed by the Automatic Leveling Loop and Pulse Modulation operation. The last three paragraphs will cover the Switched YIG Tuned Multiplier (SYTM) and its associated assemblies. Figure 8I-1 contains an RF functional group simplified functional block diagram.

RF power generated by the YIG Oscillator in the YO Loop is delivered to the Mod/Splitter in the RF Section. The Mod/Splitter couples off a portion of this signal to provide an auxilary output at the rear panel of the 8340A. The RF is split again to provide RF to the Band 1-4 Power Amplifier and swept LO to the Band 0 Mixer.

Band 0 (.01-2.3 GHz) is produced by mixing a high power swept LO signal with a fixed RF signal. This RF signal is generated by the 3.7 GHz oscillator and passes through a linear modulator, the pulse modulator, and low pass filter before reaching the mixer. The output frequency of the mixer is the difference between the LO and the RF frequencies [F(IF)=F(LO)-F(RF)]. So by sweeping the LO from 3.71 to 6.0 GHz the IF sweeps from 0.01 to 2.3 GHz. The IF is amplified by the Band 0 Power Amplifier and enters the Band 0 Splitter/Detector where a small portion of the signal is split off and detected for leveling. The leveled RF then enters the SYTM. The SYTM provides a straight through path for the RF from the Band 0 Splitter/Detector when Band 0 is activated. After the SYTM the signal passes through the Directional Coupler, which performs no funcion in Band 0, and the Step Attenuator before reaching the instrument output connector.

Bands 1 through 4 (2.3-26.5 GHz) are obtained by feeding the RF output from the Mod/Splitter through the Band 1-4 Power Amp. The SYTM generates harmonics from the high level output of the Power Amp to produce Bands 2-4. The SYTM contains a bandpass filter that is tuned to the desired RF output frequency. As a result the SYTM passes the desired RF output frequency and rejects the unwanted harmonic related signals. The Directional Coupler couples off part of the RF output from the SYTM to the Band 1-4 Detector for leveling in Bands 1-4. The Step Attenuator is used in all bands when low power output levels are needed.

Leveling is accomplished through the automatic level control circuit (ALC). The ALC uses feedback to hold the RF output constant throughout the entire frequency range of the 8340A. When internally leveled and operating in Bands 1-4, voltage from the

Band 1-4 Detector is fed through a log amplifier and summed with a correction level that closely approximates the variations of the RF attenuator and RF cables. The corrected detector level is then fed through the sample/hold and is routed on to the Linear Modulator Driver Board. Here the corrected detector voltage is summed with the reference voltage at the input of the integrator. If the corrected detector voltage is not equal to the reference voltage the integrator output voltage will change. The integrator output drives an exponential driver that feeds current to the linear modulator in the Mod/Splitter. This changes the RF output level, and hence the detected voltage from the Band 1-4 Detector. The integrator voltage will continue to change until the corrected detector voltage cancels the reference voltage. Leveling in Band 0 uses the same ALC by switching in the Band 0 Splitter/Detector in place of the Band 1-4 detector. The modulator drive is also switched to the A9 Band 1-4 Modulator in the 3.7 GHz oscillator.

Pulse modulation in the 8340A requires special drive circuitry and modulators to achieve narrow pulse widths. The pulse modulator for Bands 1-4 is located in the Mod/Splitter and the pulse modulator for Band 0 is located just after the 3.7 GHz oscillator. The pulse modulator drive circuitry coordinates the ALC operation with the pulse signal. When the pulse input is driven low to turn off the RF the ALC is signaled to sample and hold the current RF level. During the time the pulse input is held low the output is attenuated by more than 80 dB. When the pulse input is returned to its normal high level the ALC releases the hold circuits and the instrument returns to the RF level it had before the RF was turned off.

The SYTM contains a step recovery diode (SRD) which generates the harmonics for Bands 2-4. The ability of the SRD to generate harmonics is effected by power level, frequency and DC bias. For maximum conversion efficiency the SRD bias is varied with power level and frequency. In Band 1 (2.3-7.0 GHz) the SRD is biased on to allow the fundamental to pass through. The SYTM also contains a YIG-tuned bandpass filter that can be tuned over Bands 1-4 (2.3 to 26.5 GHz frequency range) by changing the magnetic field. The passband of the filter must track closely the YO frequency, or some harmonic of it, to cover Bands 1-4. The SYTM Driver compensates for nonlinearities in the tuning magnet, past magnetic history, and magnetic delay. The Pin Switch in the SYTM allows the Band 0 signal to be switched off when Bands 1-4 is selected. Bias for this switch is generated on the Attenuator Driver/SRD Bias Board.

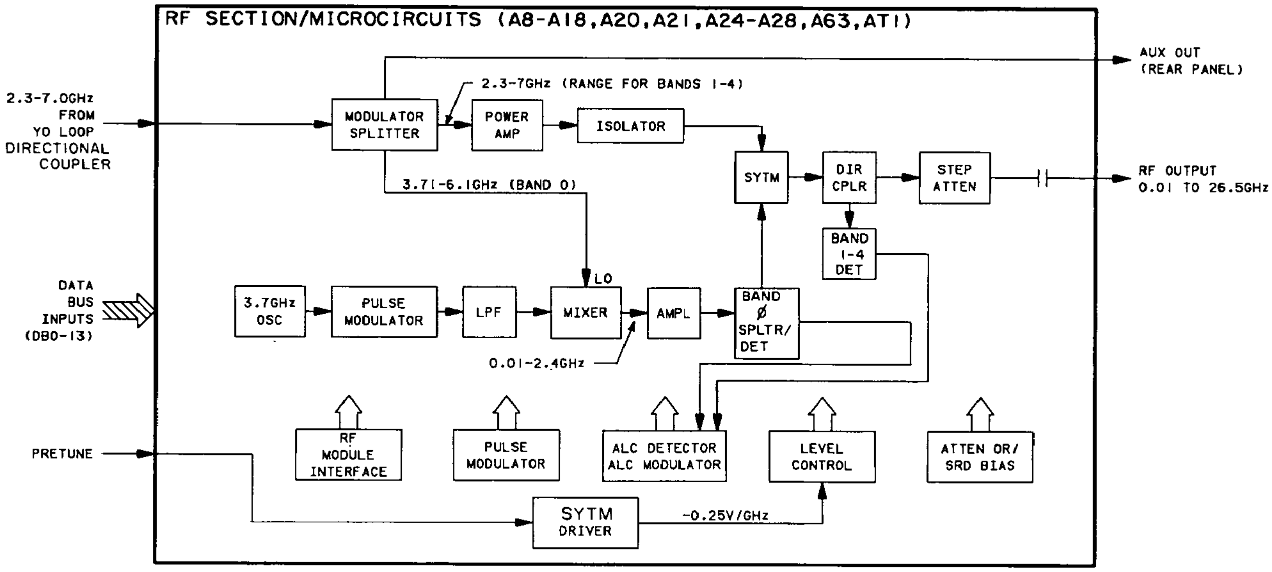


Figure 8I-1. RF Functional Group, Simplified Block Diagram

MICROCIRCUIT ASSEMBLIES

Introduction

The RF section includes all but two of the high frequency microcircuits, with their bias boards, that produce the RF output. The A44 YIG Oscillator (YO) and the A45 Directional Coupler are discussed in the YO LOOP Section. The components in this section include A8 through A18A1, AT1, and A63. The connections between microcircuits and other assemblies are shown on the troubleshooting block diagram.

A16 Band 1-4 Modulator/Splitter

Refer to Figure 8I-18, "A16 Band 1-4 Modulation/Splitter, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A16 Modulator/Splitter divides the YO output into three paths. Band 0 output provides LO drive (+9 to +16 dBm) for the Band 0 Mixer. The output for Bands 1-4 delivers +9 to +16 dBm to the Band 1-4 Amp. And the third output port provides approximately 0 dBm to the Aux Output.

The Modulator/Splitter uses three PIN diode modulators. The Pulse Mod input drives the PIN diode pulse modulator full on or full off, and provides an RF on/off ratio of greater than 80 dB for pulse operation in Bands 1 through 4. The MOD HI input drives the linear modulator and provides amplitude control for Bands 1 through 4 and is used for amplitude leveling. The third modulator (located after the splitter) is used as a PIN switch and blocks the RF from entering the Band 1-4 section while Band 0 is activated.

The A16A1 Mod/Splitter Bias Board provides the required voltages for the 2 FET buffer stages. Adjustment resistors G1 and G2 are set at the factory for best harmonic performance.

A17 Band 0 Mixer

Refer to Figure 8I-19, "A17 Band 0 Mixer, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A17 Mixer mixes a fixed 3.7 GHz signal with the swept 3.71 to 6.0 GHz YO output, producing the 0.01 to 2.3 GHz RF output in Band 0. Unwanted mixing products are minimized by a 3.7 GHz directional filter located before the single balanced mixer and a 2.75 GHz low pass filter at the output. The swept YO output, after passing through the A16 Modulator/Splitter, acts as the Local Oscillator signal for the mixer. Conversion loss of the assembly is high due mainly to the 3.7 GHz filter. Loss is approximately 9 dB at 1

GHz.

A8 3.7 GHz Oscillator

Refer to Figure 8I-10, "A8 3.7 GHz Oscillator, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A8 3.7 GHz Oscillator provides a fixed 3.70 GHz RF output. The A8A1 Oscillator Microcircuit and A8A2 Oscillator Bias Board are located inside the A8 3.7 GHz Oscillator housing. This source is phased locked to the 100 MHz internal standard. A linear modulator is located at the output of the oscillator and provides amplitude control from nominally +1 dBm to -70 dBm.

The A8A2 3.7 GHz Oscillator Bias Board provides the necessary circuitry to amplify the 100 MHz input signal and phase lock the 3.7 GHz signal to it. A lock signal is generated when the oscillator is phase locked to the 100 MHz. The +20V and -10V microcircuit Bias Voltages are also delivered through the Bias Board.

A9 Band 0 Pulse Modulator

Refer to Figure 8I-11, "A9 Band 0 Pulse Modulator, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A9 Pulse Modulator is a shunt PIN diode modulator and provides an on/off ratio greater than 80 dB in Band 0.

A15 Band 0 Low Pass Filter

Refer to Figure 8I-17, "A15 Band 0 Low Pass Filter", and Figure 8I-42, "RF Section Schematic Diagram". The A15 Low Pass Filter greatly attenuates the harmonics from the 3.7 GHz Oscillator and hence minimizes unwanted mixing products produced in the A17 Band 0 Mixer.

A18 Band 0 Power Amplifier

Refer to Figure 8I-20, "A18 Band 0 Power Amplifier, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A17 Band 0 Power Amplifier is a bipolar amplifier and provides approximately 40 dB of gain with 20 dBm output power from 0.01 to 2.3 GHz. At 20 dBm, harmonic output is less than -25 dBc.

The A18A1 Band 0 Power Ampifier Bias Board provides the various bias currents for the Band 0 Amplifier. It is matched and attached at the factory, has no adjustments or replaceable parts, and cannot be replaced separately as an assembly. The +20V and -10V lines provide power. When the RF is OFF or the 8340A is operating in Bands 1-4, the -10 volt bias is removed, shutting down the amplifier.

A12 Band 0 Splitter/Detector

Refer to Figure 8I-14, "A12 Band 0 Splitter/Detector, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A12 Band 0 Splitter/Detector samples and detects the RF amplitude for Band 0 leveling. The device consists of a resistive power splitter and a Schottky diode detector. The Splitter stage has very good port matching characteristics. The detector stage produces a positive output proportional to the RF power. LDET BW input switches in additional filtering for leveling below 400 MHz. A thermistor (mounted inside the splitter/detector package) is used to compensate for detector temperature variations.

A14 Band 1-4 Power Amplifier

Refer to Figure 8I-16, "A14 Band 1-4 Power Amplifier, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A14 Band 1-4 Power Amplifier is a GaAs FET amplifier that covers the 2.3 to 7.0 GHz frequency range. The amplifier provides approximately 26 dBm output power. The small signal gain is typically 25 dB but at maximum leveled output the amplifier can be 10 dB into compression.

A notch filter with its center frequency at 7.0 GHz is used to reduce harmonics out of the amplifier. This filter is switched in when the amplifier is operating below 4.5 GHz. Above 4.5 GHz the filter is switched out to allow maximum YO output power. The switching circuitry is on the A14A1 bias assembly and is controlled by the YO 1.4 Volts/GHz signal.

The A14A1 Bias Board assembly contains several factory adjusted gate bias potentiometers. These are set at the factory for optimum output power and minimum harmonics. The drain supply to the first two stages is removed when the RF is off or the 8340A is operating in Band 0.

AT1 Peripheral Mode Isolator

Refer to Figure 8I-23, "AT1 Peripheral Mode Isolator, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". AT1 Isolator provides 20 dB of isolation and has less than 1 dB of insertion loss. AT1 improves the match to the Switched YTM.

A13 SYTM (Switched YIG-Tuned Multiplier)

Refer to Figure 8I-15, "A13 SYTM, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A13 SYTM (Switched YIG-Tuned Multiplier) uses a PIN diode switch to turn the Band 0 signal off when Band 1-4 is selected. For Band 0, the SYTM provides a straight through path for the 0.01 to 2.3 GHz RF from the A12 Band 0 Splitter/Detector. Insertion loss for Band 0 is typically less than 0.5 dB.

For Bands 1 through 4, the RF input from the AT1 Isolator is fed to the SYTM. This RF input is applied through an impedance matching circuit to a Step Recovery Diode (SRD) which has an output that is rich in harmonics. The SRD BIAS applied to the diode is changed for each band to optimize the generation of the harmonic used for that band (Band 1 = Fundamental, Band 2 = Second Harmonic, Band 3 = Third Harmonic, Band 4 = Fourth Harmonic). The YIG Tuned Filter is a tunable bandpass filter which is tuned to the RF output frequency by the SYTM Coil drive-current supplied by the A28 SYTM Driver.

The filter's bandpass frequency is determined by a small YIG sphere with a resonant frequency that depends on the surrounding magnetic field strength. The magnetic field is established by an opposing pair of electromagnet coils. Changing the current through the coils changes the magnetic field strength, and hence the bandpass frequency.

A10 Directional Coupler

Refer to Figure 8I-12, "A10 Directional Coupler, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A10 Directional Coupler has a -16 dB coupling coefficient. The reverse-coupled port is terminated. The coupled output is sent to the All Band 1-4 Detector for leveling in Bands 1 through 4. Although the Band 0 output (0.01-2.3 GHZ) must pass through the A10 directional Coupler, it plays no part in Band 0 leveling. The insertion loss is less than 1.3 dB at 26.5 GHz.

All Band 1-4 Detector

Refer to Figure 8I-13, "All Band 1-4 Detector, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The All Band 1-4 Detector detects the RF amplitude for leveling in Bands 1-4. It produces a positive output proportional to the RF power in the same way as the Band 0 Detector.

A63 RF Attenuator/J5 RF OUTPUT Connector

Refer to Figure 8I-22, "A63 90 dB Programmable RF Attenuator, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The RF Attenuator provides 90 dB of attenuation in 10 dB steps. Combined with the range of the ALC loop, this yields a maximum power range of +20 to -110 dBm. The Step Attenuator functions as four fixed attenuators, with 10, 20, and two 30 dB attenuators. Latching relays close contacts which either insert these attenuators in the RF path or bypass them. The control and drive circuitry for the attenuator is located on the A24 Attenuator Driver/SRD bias Board. The insertion loss, with 0 dB attenuation selected is less than 2.8 dB at 26.5 GHz.

The J5 RF Output Connector is a APC-3.5 male RF connector with a series 1000 pF (non-replaceable) capacitor to provide DC blocking. The maximum dc voltage allowed across this capacitor is 50 volts.

ALC LOOP ASSEMBLIES

Description

The ALC Loop is a feedback control system which monitors RF power and maintains that power at a set level. The point at which the power is monitored may be inside the instrument (internal leveling), or the user may choose to monitor power at some point in his test setup (external leveling). A voltage derived from the power sensor (internal crystal detector, external crystal detector, or external power meter) is compared to a reference voltage at the loop summing point (Figure 8I-2, "Leveling Loop, Simplified Block Diagram"). If the resulting currents at the summing node do not cancel, the loop integrator output voltage will change. This voltage controls the modulator which varies the RF output power. The power will thus change until the voltage representing RF power cancels the reference, at which point the integrator output stops changing and the power remains constant. The feedback loop reduces the current into the integrator to zero. For any given reference voltage there is one detector output voltage which causes zero integrator current. Thus, the loop is controlling detector output voltage.

The detector output voltage is a function of RF power into the detector, but it also varies with temperature and RF frequency. Thus, forcing the detector output voltage to some particular level does not guarantee that the RF power will remain constant as the temperature or frequency changes.

A 16 dB directional coupler is used to sample the RF output power. Its coupled arm produces a signal 16 dB smaller than the level of the outgoing RF power. Any RF power coming into the instrument from the outside is ideally not coupled to the coupled arm at all. The detector is connected to the coupled arm. The 16 dB coupling factor is not perfectly flat (constant as a function of RF frequency), and the coupler does couple some reverse power into the detector. There is a 10 dB step attenuator (max 90 dB) between the coupler and front panel output connector, which is not flat either. Thus, as the leveling loop holds the detector output voltage constant, the RF output power will vary with frequency due to the flatness of the detector, coupler, attenuator, and RF hardware. If plotted on a graph, this variation can be approximated with several straight line segments to within ±1 dB. Straight line variations can be compensated out by making the reference voltage change as a function of frequency. This is essentially what is done using the "level correction" voltage produced on the A27 Level Control board. The temperature characteristics of the detector are corrected by temperature compensation circuits on the A25 ALC Detector board.

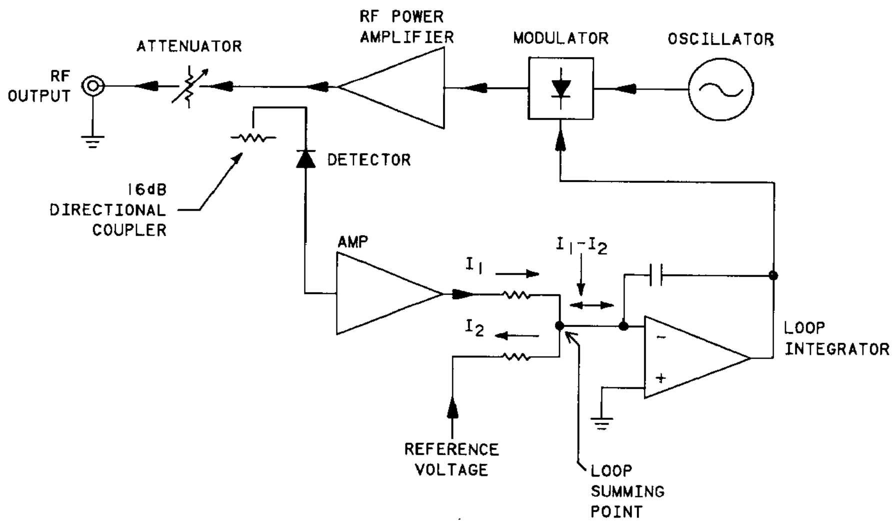


Figure 8I-2. Leveling Loop, Simplified Block Diagram

The normal range of power at the output of the coupler is from 0 dBm to -10 dBm. The attenuator is used to get lower powers. For instance, -56 dBm is achieved with 50 dB attenuation and the ALC loop set to -6 dBm. The loop is not normally set to less than -10 dBm for noise and drift reasons (the detector output is approximately 1 mV for -10 dBm RF output). The maximum attenuation is 90 dB. To get from -100 dBm to -110 dBm, the ALC is run from -10 dBm to -20 dBm. For powers greater than 0 dBm, the ALC Loop is run at the desired power. At some frequencies, the 8340A is capable of producing +20 dBm, the maximum power the ALC can be set to. To get +20 dBm output, the power amplifier is driven into saturation by about 10 dB. Thus, to reduce its output 30 dB (to -10 dBm), the amplifier input must be reduced 40 dB. This is done by the modulators which consist of PIN diodes shunting a transmission line. Another 20 dB of range is needed to provide 90% AM capability. The modulator has over 80 dB range, and is 60 dB down with less than 10 mA drive.

The attenuation of the modulator is a very non-linear function of drive current. If plotted on log-log paper, however, the plot is straight over the high current end of its range. If fed from a current source which is offset by about 1 mA, as shown in Figure 8I-3, "Modulator Characteristics", the plot of attenuation in dB vs. log I is quite straight over its entire range. Since the bandwidth and stability of the ALC Loop are a function of the gain and frequency response of each element in the loop, it is desirable that these parameters not change with operating conditions such as RF frequency and power level. Although not at all linear, the modulator characteristic described above lends itself to the construction of a constant gain ALC Loop. Let the output current from the current source circuit be an exponential function of some control voltage, as with the bipolar transistor in Figure 8I-3, "Modulator Characteristics". Then if the control voltage corresponding to each current is written along the current axis on the chart, one recognizes a characteristic whereby attenuation in dB's is linear with control voltage. In this case, the slope is -1 dB/mV. This sensitivity will be the same anywhere downstream of the modulator. For example, the output of the coupled arm of the coupler will vary -1 dB/mV. This sensitivity will be independent of variable RF losses (frequency response of components), and oscillator power. Furthermore, this scheme handles any non-linear element which can be described by;

$$V_{out} = (V_{in})^N$$

such as a properly biased harmonic frequency multiplier. The sensitivity simply is multiplied by the scalar N, remaining constant over all amplitudes.

The remaining non-linear element in the loop is the crystal detector. The ALC Loop operates from -20 dBm to +20 dBm. The detector is connected to a 16 dB coupler, so it is driven by signals ranging from -36 dBm to +4 dBm. Below -15 dBm, the detector is in its "square law" region where its output voltage is given by:

$$V_{det} = K_2 * V^2_{RF}$$

K2 is temperature dependent. At +4 dBm, the detector is almost into the linear region where

$$V_{det} = K_1 * V_{RF}$$

K1 is not temperature dependent. Between -15 dBm and +10 dBm, the detector exhibits a smooth transition between the asymtotes described by the above formulas (Figure 8I-4, "Detector Characteristics"). Let the detector output be processed by a log converter described by:

$$V_{LOG} = (kT/q) * \ln (V_{DET}/10 \text{ mV})$$

V log is plotted next to Vdet in Figure 8I-4, "Detector Characteristics". Note that when the detector is in its square law region, V log changes 6 mV for each 1 dB change in RF, independent of RF level. In the linear region, the change is 3 mV/dB. A special log converter has been designed which smoothly changes its slope from:

At low levels: $(kT/q) * \ln (V_{det}/10 \text{ mV})$

to

At high levels: $2(kT/q) * \ln (V_{det}/10 \text{ mV})$.

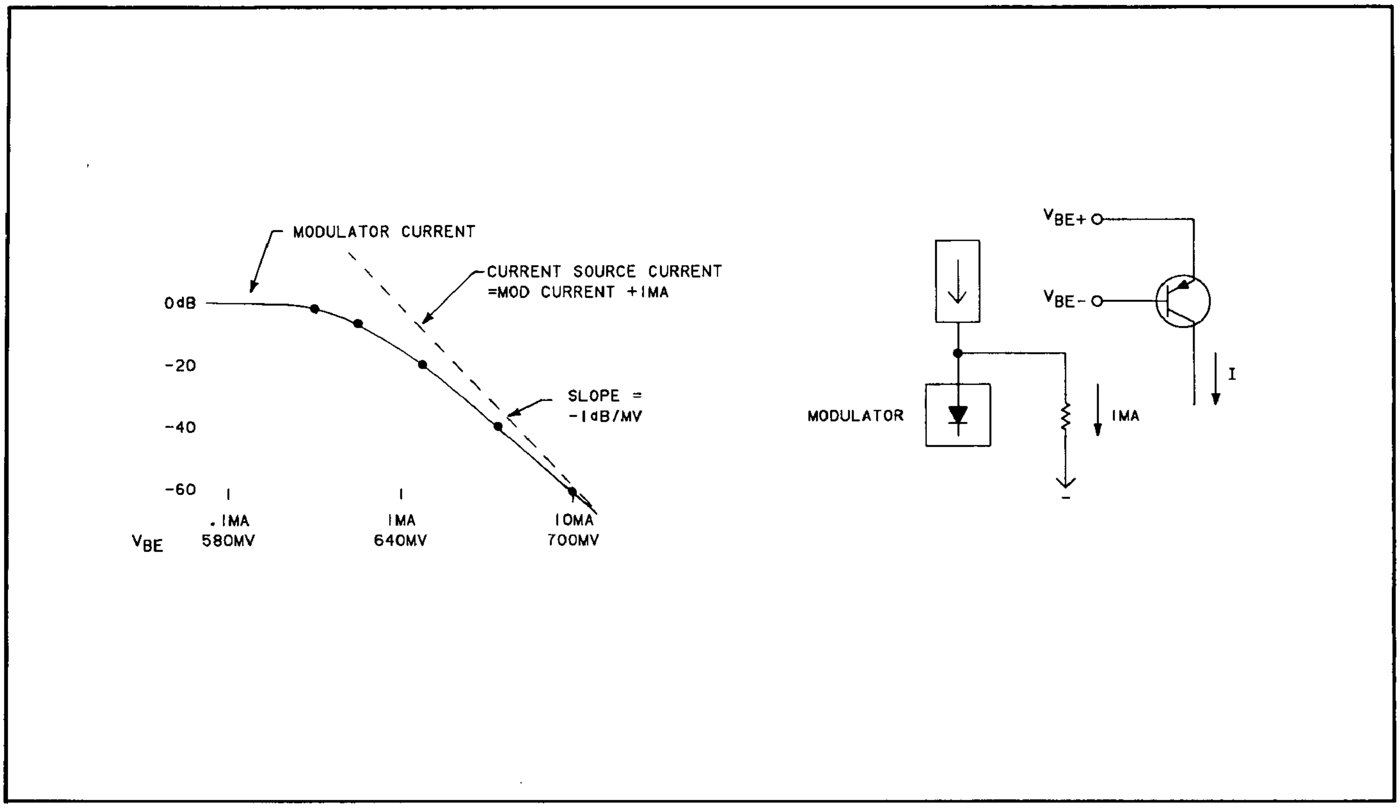


Figure 8I-3. Modulator Characteristics

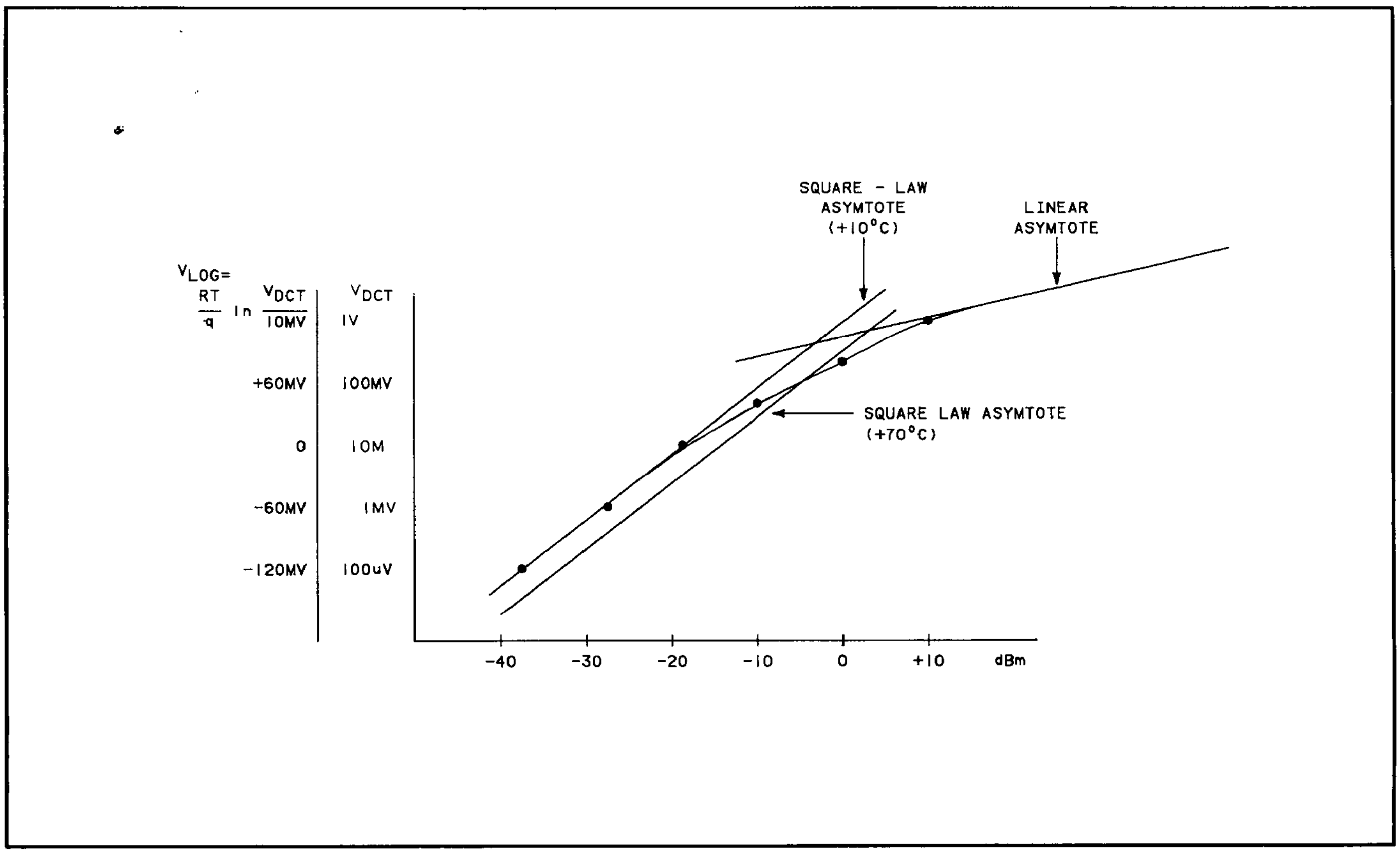


Figure 8I-4. Detector Characteristics

The transition matches that of the detector, and the circuit contains temperature compensation of the square law asymtote. The output of this logger is a constant 6 mV/dB, independent of RF level and detector temperature. The logger itself is temperature dependent due to the kT/q term. This variation is compensated by making the ALC reference voltage vary with temperature.

The combination of exponential modulator drive and dual-slope logger completely cancels (ideally) the gain variations of the RF hardware. In this example, a 1 mV change in modulator drive always produces a 6 mV change out of the logger. Since the rest of the circuitry in the loop is linear, a constant gain loop is realized. Actually, since all is not perfect, the gain varies ± 3 dB over frequency and 40 dB of power level. The actual modulator driver has a sensitivity of -.03 dB/mV to reduce noise sensitivity.

Figure 8I-5, "ALC Loop, Detailed Block Diagram", is a detailed block diagram of the ALC Loop without the RF hardware. The 8340A has two RF signal generation paths, one producing 0.01 - 2.3 GHz (Band 0), the other producing 2.3 - 26.5 GHz (Band 1-4). Each path has its own modulator and crystal detector. The dual slope logger has FET switches at its input to select the appropriate detector. The thermistor used for the detector temperature compensation is physically located inside the Band 0 Detector housing. This is mounted directly to the Band 1-4 Directional Coupler to which the Band 1-4 Detector is connected. Thus, the thermistor thermally tracks both detectors. The Band 0 Detector is designed to have the same temperature drift as the Band 1-4 detector.

The x5 amplifier following the logger has several functions. It has a high input impedance to prevent loading the logging elements. It boosts the signal to a high enough level so that noise, drift, and sample/hold offsets are not a problem. It is capable of driving the Sample and Hold capacitor which follows. It provides a point to add the level correction signal.

The level correction signal compensates for the frequency response of the RF hardware. If the instrument is sweeping frequency and the modulator is continually adjusted to keep the output power constant, the detector output voltage will not be constant due, to unflatness in the attenuator, coupler, detector, and connecting hardware. The level correction signal is made to approximate this unflatness with three straight line segments. This signal gets added to the detector voltage so that the output of the x5 amp is flat with frequency. This voltage is now an accurate representation of the actual front panel output power and is used to drive the front panel level meter as well as close the feedback loop. The level correction signal could have been added at several other places in the loop but was done here for the benefit of the level meter. The level meter is read by the Test Analog-to-Digital Converter (ADC) on the A27 assembly. The output of the Test ADC is a digital representation of the actual Front Panel Output Power. The processor converts this into the appropriate display value for the Front Panel POWER dBm display.

During normal operation the instrument processor does not monitor the Test ADC output. The POWER dBm display is then a duplication of the ENTRY DISPLAY. During AM modulation, External leveling or when an unleveled condition occurs, the POWER dBm display indication is a function of the Test ADC output.

Following the x5 amplifier is a sample/hold circuit which is there primarily for pulse modulation. The 8340A provides internally leveled pulse modulation for pulse widths as narrow as 100 nanoseconds. Since the ALC Loop has a loop bandwidth of 100 KHz (rise time approximately 4 usec), the loop cannot be expected to generate shorter pulse widths. In pulse mode the linear modulator is held at a fixed level and another modulator (the pulse modulator) turns the RF ON and OFF with 10 nsec rise and fall times. The ALC circuitry must measure the detector voltage when the pulse is ON and use this information to control the linear modulator. The detector Sample and Hold gate is closed when the RF is ON, open when it is OFF. (The signal controlling the Sample and Hold gate is delayed to account for propagation delays through the logger and amplifier.) The Sample and Hold serves to stretch narrow pulses, holding their amplitude during the 10 usec that the integration gate is closed. It also provides a steady voltage to the level meter during pulse operation as well as during RF blanking.

The level meter signal is amplified by a factor of 6.6, to 200 mV/dB. The output of this amplifier is +5.0V at -25 dBm, -5.0V at +25 dBm. This voltage goes to an A-to-D converter on the A27 Level Control board. The attenuator setting is digitally subtracted from the A-to-D output and the result displayed on the front panel power dBm display. When internally leveled and AM is OFF, the POWER dBm display simply displays the number in the ENTRY DISPLAY. The level A-to-D circuitry is used whenever the actual output power may be expected to differ from the level entry. These conditions are:

- Unleveled light ON (instrument cannot put out as much power as is requested. The meter displays the actual output.)

- AM ON (User may put DC into AM input, changing output power.) The x6.6 amplifier contains a 5Hz, active low pass filter, preventing the level meter from flickering for AM rates above 20 Hz.

- External leveling selected. (Actual output is a function of the user's detector, coupler, RF hardware, etc.)

The output voltage of the logger has a temperature dependence due to its kT/q term. Thus, for constant RF power, the logger output voltage is directly proportional to absolute temperature. (This effect is separate from the detector's temperature drift which is compensated by the thermistor.) To maintain the accuracy of the level meter, the gain of the x6.6 amplifier is made to vary inversely with absolute temperature. This is accomplished by using an input resistor with a temperature coefficient of +3400 ppm/degrees C. For the same reason, the ALC reference voltage must be made to increase with temperature at +3400 ppm/degree C so that with constant output power, the logger voltage will track the reference. As long as they track over temperature, the loop will not try to change the power. To accomplish this, the reference voltage from the A27 Level Control board is routed through an inverting amplifier on the A25 ALC Detector board whose gain is proportional to absolute temperature. The output of this amplifier goes to the A26 Linear Modulator board where it is fed to the loop summing point. Placing the temperature compensating amplifier on the detector board improves thermal tracking with the logger.

The remaining circuitry on the detector board is for external leveling. The 8340A may use either positive or negative polarity external detectors. The external input goes to an "Absolute Value" circuit which inverts positive inputs but not negative ones. The output of the absolute value circuit drives the external logger. This logger has no special compensation for detector T.C. or square law deviation. Its own inherent temperature drift is compensated by the drifting reference voltage, as for internal leveling. The logger output is amplified by a factor of 5 to 30 mV/dB.

A25 FET switches select either the output of the internal or external circuits to send to the A26 Linear Modulator board. When external meter leveling is selected, a crossover network is used to help stabilize the loop. Frequencies from DC to about 0.7 Hz may pass from the external input to the modulator board. Above 0.7 Hz, the external input is rolled off, and the loop is closed through the internal detector. In this way, the loop stability is maintained with a wide variety of meter bandwidths.

The external AM input goes to the AM logger on the A26 Linear Modulator board. The output of the logger is amplified by a factor of 10 to 30 mV/dB. This signal is summed into the loop at the same point as the reference, causing the loop to change the RF output power accordingly. Since the detector logger has shaped the detector voltage to be linear in terms of decibels, the AM input provides very linear control.

The logged detector voltage, temperature compensated reference voltage, marker signal, and logged AM input are all summed together at the loop summing point. That point feeds the input of an integrator through a FET switch (integrate/hold gate). That switch is normally closed. If it is opened, as between pulses during pulse modulation, the input to the integrator is zero, causing its output to remain constant, thus holding the modulator drive at a constant level. The integrator controls the bandwidth of the leveling loop. The integrator gain is proportional to 1/FC, causing gain crossover to occur at F = 130 kHz for C = 1000 pF, and F = 6 kHz for C = 0.023 uF. The capacitor is selected by a FET switch. The loop is normally in its low bandwidth state, being switched to high bandwidth if sweep times are <5 sec, if AM is ON with pulse mode OFF, or if "shift AM" is ON with pulse mode ON.

The integrator output drives an exponential current source

$$I_{out} = I_{in} \times e^{I_{in}/0.1mA}$$

For Iout above 1mA (normal operation), this is a close approximation to an exponential. An exponential modulator drive helps keep loop gain constant as the power level is changed. The input to the current source is controlled by 5 loop gain adjustments selected according to the RF band in use (Bands 0 through 4). The YTM transfer function increases loop gain on its multiplying bands so separate adjustments are necessary. At the output of the current source, an appropriate offset current is subtracted, biasing the current source for a straight line modulator characteristic. The output current is sent to either the Band 0 or Bands 1 through 4 modulator by a pair of FET switches.

When the integrator output is at 0 volts, the modulator will be close to full output. When the loop gain is properly set, the modulator output will decrease at the rate of approximately 30 dB/volt. If increased output power is needed, the integrator moves positive. If more power is needed than the instrument can provide, the integrator will go more positive than the "full on" voltage. At this point, the feedback loop is open, and the integrator will try to saturate in a positive direction. A clamp circuit is activated at approximately +.7V, which dumps current into the integrator input preventing the output from going more positive. Preventing the integrator from saturating greatly speeds recovery time. When the integrator output moves above +.2V, a comparator is tripped which lights the front panel UNLEVELED annunciator. The overmod comparator trips for voltages more negative than -3.5V (OVERMOD annunciator), and another clamp is activated at -3.7V.

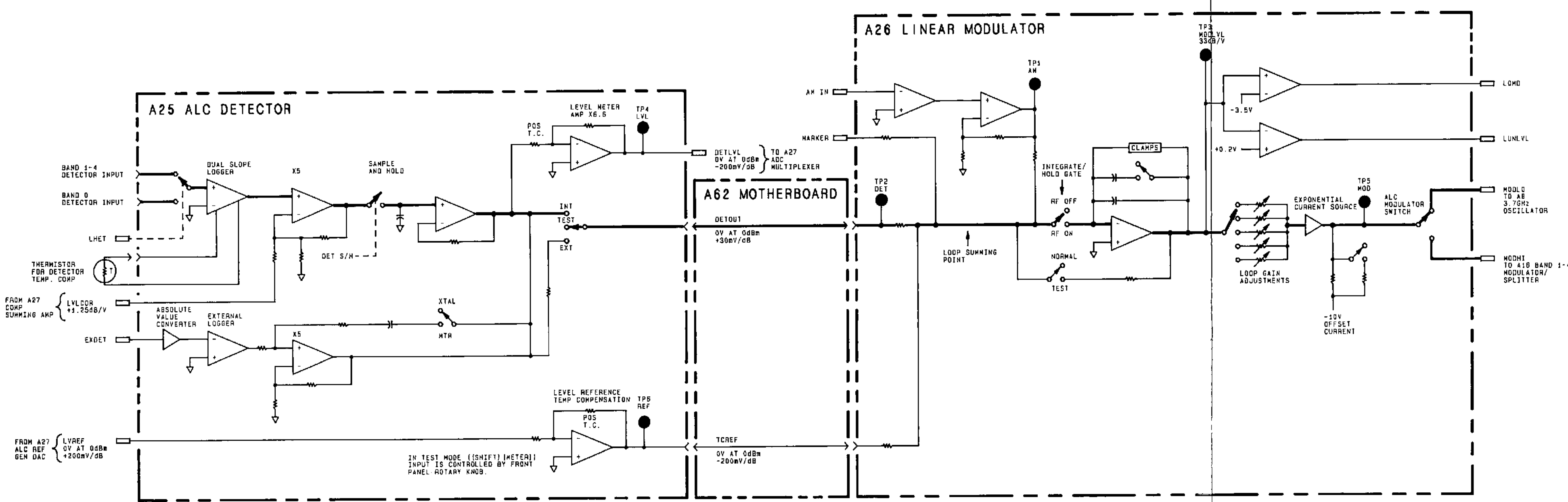


Figure 8I-5. ALC Loop, Detailed Block Diagram

When RF is turned OFF during RF blanking, both the pulse modulator and linear modulator are shut down. The linear modulator is used to provide a controlled RF turn-on with no overshoot. This does not happen during pulse modulation because the RF is not OFF long enough (10 msec. max) for the Sample and Hold circuits to drift. Also, during external leveling, a slow detector would cause turn-on overshoot if the RF were not brought up slowly. The RF ON/OFF control (HRFON) is fed to the clamp circuits in such a way as to force the integrator output to -3.0V. Note that this will not trip either comparator. When RF is turned ON, the voltage rises at the charge rate of the integrator. If external power meter leveling is selected, a capacitor is switched into the RF ON/OFF circuit slowing the turn-on to two seconds.

ALC Loop Troubleshooting

For troubleshooting purposes, the ALC Loop may be broken and a signal injected to be traced around the loop. When this mode is activated by pressing **[SHIFT] [METER]**, the FET switches will be switched to break the connection from the A25 ALC Detector board to the A26 Linear Modulator board (See Figure 8I-37, "A26 ALC Modulator, Schematic Diagram", Block **B**). A resistor (A26R17) is switched across the integrator capacitor on the A26 Linear Modulator assembly converting this stage to an inverting amplifier. Thus, the integrator output may be controlled via the reference DAC. The signal may then be traced from there to the modulator driver, RF output, detector output, logger output, x5 amp, through the Sample and Hold, level amp, and to the A-to-D driving the level meter. By putting a detector on the RF output, the external leveling circuits may be checked. The AM signal path is the only one left unchecked.

To enter the test mode, press **[INSTR PRESET]**, **[CW]**, and **[SHIFT] [METER]**. The UNLEVELED annunciator should be ON. The POWER dBm display should indicate the approximate RF output power. The ENTRY DISPLAY should indicate "ATN: -00, MOD: 0.0 dB". The modulators are being controlled by the voltage at A26TP3 (MODLVL). This voltage is programmed by the ALC Reference Generator DAC on the A27 Level Control assembly. The DAC can be controlled using the RPG. Rotate the RPG CCW and note that the ENTRY DISPLAY MOD level changes. Continue turning the RPG CCW until the Power dBm display begins to change. The absolute MOD level indication is not important, however, a further decrease in MOD level should generate a corresponding decrease in the Power dBm display and the RF output power (i.e., 10 dB MOD level change should generate 10 dB ±3dB power change). A defective circuit can be isolated by tracing the voltage from A26TP3 to the modulators or by tracing the RF path from the YO to the Level Meter Amplifier on the A25 ALC Detector assembly. The AM signal path must be checked separately.

SYTM RELATED ASSEMBLIES

Introduction

The two boards that directly provide control circuitry for the SYTM are the A28 SYTM Driver and the A24 Attenuator Driver/SRD Bias Board.

A28 SYTM Driver

The SYTM passband must track the appropriate harmonic of YO frequency to an accuracy on the order of 0.1% without the benefit of feedback. The main function of the A28 SYTM Driver is to tune the center of the SYTM passband to the correct frequency for Bands 1-4 by varying the magnetic field through the YIG sphere. The magnetic field is proportional to the current through the SYTM coil with a sensitivity on the order of 15 mA/GHz. The current is generated from the PRETUNE signal (-2.5 V/GHz YO frequency) from the A54 YO Pretune DAC/Delay Compensation Board and the latched band information from the A27 Level Control Board. In order to adequately track the correct harmonic of YO frequency, the SYTM Driver contains circuitry that adds corrections to the SYTM tuning current accounting for the effects of the nonlinear tuning curve, past magnetic history, and magnetic delay.

NONLINEAR TUNING CURVE COMPENSATION

The circuitry on the SYTM Driver contains three breakpoint adjustments to correct for the nonlinearities in the SYTM tuning curve. Two of the breakpoints are fixed in frequency but variable in magnitude of effect. The third breakpoint is variable over a limited range of frequency operation as well as in magnitude of effect.

PAST MAGNETIC HISTORY COMPENSATION

A series of kick pulses are summed into the SYTM tuning current at appropriate times to minimize the effects of past magnetic history. The kick pulses drive the SYTM magnetic field both above and below the normal tuning range.

MAGNETIC DELAY COMPENSATION

The SYTM magnet doesn't repsond fast enough to track the correct frequency when the current drive is changed rapidly. This presents an increasingly severe delay problem as the 8340A sweep rate is increased. To compensate for the slow response of the

SYTM, the delay compensation current is added to the SYTM tuning current that is a function of sweep rate and change in frequency from the start of sweep.

A24 Attenuator Driver/SRD Bias Board

Three SYTM functions are controlled by the A24 Attenuator Driver/SRD Bias Board. These are Step Recovery Diode bias, PIN Switch driver, and YIG sphere temperature control.

STEP RECOVERY DIODE BIAS

In Band 1 the step recovery diode (SRD) is forward biased with a negative voltage. The conversion efficiency of the SYTM in Bands 2, 3, and 4 is related to the DC bias voltage on the SRD. The proper biasing of the step recovery diode is also necessary to avoid squegging. To maintain optimum SRD bias for Bands 2, 3, and 4 the bias voltage is generated as a function of both frequency and power level. The variation of the SRD bias voltage with frequency is derived from BPRETUNE (a voltage from the A28 SYTM Driver that is proportional to the YO frequency). The SRD bias is adjusted for power level correction using SRD bias control from the A26 Linear Modulator Board (a voltage corresponding to the modulator voltage).

PIN SWITCH

In Band 0 the Band 0 RF input is allowed to pass unattenuated through the SYTM and the YIG sphere is tuned by the A28 SYTM Driver to a fixed non-interfering frequency. In Bands 1-4 the SYTM Driver provides a tuning current as previously described while the Band 0 RF input port to the SYTM is grounded to keep it from interfering with the desired Band 1-4 RF output. The process of selectively grounding the Band 0 RF signal is facilitated by the PIN Diode Switch in the SYTM. The PIN Diode Switch driver is located on the Attenuator Driver/SRD Bias Board.

YIG SPHERE TEMPERATURE CONTROL

The YIG sphere temperature control is required because the SYTM passband will drift if the temperature varies. The SYTM sphere temperature is held constant using heater resistors and a thermistor located on the SYTM substrate and the heater drive circuitry located on the Attenuator Driver/SRD Bias Board.

SYTM Peaking

SYTM Peaking is a function designed to tune the SYTM such that the RF signal (YO frequency or multiple of the YO frequency) is in the center of the SYTM 1 dB passband insuring that maximum RF power is available.

The peaking routine is stored in ROM and can be accessed manually by pressing the front panel PEAK button or remotely by a "RP1" instruction. An "RP0" instruction will remotely turn OFF the peaking function. The peaking routine when accessed in this manner will execute only if the 8340A is in CW or MANUAL mode and if the RF is ON.

By manually pressing SHIFT AMPT MKR or remotely programming "SH AK", the peaking function will execute immediately even if not in the CW or MANUAL mode; however, only a fine search around the most recent slope DAC (A28U24) setting will be done. Since the SYTM passband is not tuned to track the output frequency in Band 0 (heterodyne band) the peaking routine will not execute if Band 0 is selected.

The ALC detector monitors the RF output level. The detected level is routed to the A25 ALC Detector Board. The DETOUT output (A25P1 Pin 32) is fed to the A26 ALC Modulator (A26P1 Pin 10). The MOD LVL (A26P1 Pin 32) is then fed to the A27 Level Control Board (A27P1 Pin 61) where it becomes one input to the ADC Input Multiplexer. The peak routine programs the ADC Multiplexer to route the MOD LVL voltage to the Test ADC. By monitoring the Test ADC output while tuning the SYTM the program can find the peak RF signal level.

The SYTM is tuned by varying the slope DAC setting. When the peak function is activated on the front panel, the 8340A will do a full peak (i.e.,coarse and fine search) if in CW or MANUAL. If the peak function is left ON, the 8340A will repeak every 7 minutes doing only a fine search around the most recent slope DAC setting. If the CW or MANUAL frequency is changed while peaking is ON using the RPG a fine search around the most recent slope DAC setting will be done; however, if the CW or MANUAL frequency is changed using the step keys or numerical entry keys, a full peak will be done.

The MOD LVL voltage is offset and scaled so that the 10 volt input range of the ADC covers MOD LVL voltages between -3.53 V to +2.47 V. The input range is equivalent to about 6 mV/bit. The sensitivity of the MOD LVL line is around 20 to 50 mV/dB so the ADC has a sensitivity of about 0.2 dB/bit.

The SYTM passband has a second narrower peak that is located 200-300 MHz lower in frequency than the desired peak. The coarse search routine starts at the top of the passband and searches for a peak in 15 MHz steps. Once a peak is found the coarse search continues for another 150 MHz to verify that the correct peak is found and stops before the second peak is reached. 15 MHz was chosen for the step size because the minimum 1 dB bandwidth is 24 MHz so at least one of the steps will fall within 1 dB of the peak. Once the coarse search peak is located, the processor takes a reading of the modulator level to be used as a reference for the -1 dB points. The level control DAC (A27U14) is then stepped down 1 dB which causes the modulator level to drop 1 dB (since the ALC loop must generate the 1 dB change). The processor then uses the -1 dB reference and steps the slope DAC up until the modulator level is equal to or less than the -1 dB reference level. The slope DAC is then stepped down from the peak until the same reference threshold is reached. If the slope DAC goes out of range before the -1 dB reference level is reached, the routine searches the other side of the passband to the same modulator threshold present when the slope DAC reached the end of its range. The slope DAC is then set to the midpoint of the two values it had when the reference level was reached and the original power is restored. The setting for the slope DAC can be accessed by doing an IO read from subchannel 10.

Peaking is done at the current ALC power level because the SYTM passband may vary with power level. In the fundamental band, the YIG sphere in the SYTM may squeg if too much power is applied. To prevent this from interfering with peaking, the maximum ALC power setting (in the fundamental band only) is 0 dBm during the coarse search and +10 dBm for the fine search. Once the peaking is completed, the original power is restored.

When the instrument goes unleveled, the current driving the ALC modulator is turned off to give maximum available power. However, the MODLVL line has a soft clamp that still gives an indication of the detected power out of the SYTM with a sensitivity of 30 mV/dB. The absolute voltage level shifts by about 1 volt when the instrument goes unleveled but the incremental level remains valid. The absolute level shift poses no problem to the peaking routine since the peaking routine uses incremental changes.

SYTM tracking is accomplished by pressing **[SHIFT] [PEAK]** on the front panel or by remotely programming "SH RP" over the HP-IB bus. SYTM tracking updates calibration constants 9 through 12 and 50 through 52 to the best value for the SYTM tracking in each band. Each band is tracked independently of the other bands. To track a band, a single band sweep is set up and the sweep is stopped at several points across the band that each sweep is peaked. The number stored in the calibration constant represents the least squares fit to the slope DAC numbers returned from the peaking routine with the lowest power point receiving a double weighting. If the least squares number is out of the range of the slope DAC, the fault light is turned ON with the TRK indicator flashing when **[SHIFT] [MANUAL]** is pressed. In Band 1, the SYTM is peaked at 2.3 GHz and at one GHz steps from 3 GHz to 7 GHz. In Band 2 the SYTM is peaked at 6.9 GHz and at one GHz steps from 7.5 to 13.5 GHz. In Band 3, the SYTM is peaked at 13.4 GHz and at one GHz steps from 14 GHz to 20 GHz. In Band 4, the SYTM is peaked at 19.8 GHz and at one GHz steps from 20.5 GHz to 26.5 GHz.

SYTM PEAKING TROUBLESHOOTING

If the FAULT annunciator comes ON the function that caused a fault can be determined by pressing the **[SHIFT]** key and then the **[MANUAL SWEEP]** key. If the peak indicator is flashing, it means that the peaking routine failed to find a peak within the range of the SYTM slope DAC. This can be caused by several different problems: the SYTM driver may not be shifting the passband, there may not be enough power out of the SYTM for proper ALC operation, the ALC modulator or the ADC might be defective. Looking at the CMP test point on the A28 SYTM Driver board will give an indication of how the slope DAC is varying slope compensation. This trace can be compared with the A-to-D IN test point on the A27 Level Control board to see if the A-to-D input is within reasonable limits. If the voltage on the A-to-D input doesn't trace out a passband as the slope DAC is varied, check the MODLVL test point on the A26 Linear Modulator board. The A-to-D IN test point should be a scaled version of the voltage at the MODLVL test point. If the fault is due to peaking, the fault light may be cleared by pressing the **[INSTR PRESET]** key or by turning the line power OFF and ON.

PULSE MODULATION ASSEMBLIES

Pulse modulation in the 8430 is produced by the A21 Pulse Modulator Driver Board driving one of the two pulse modulators in the instrument. The "Pulse Modulation Input" on the front panel of the 8340A is a TTL compatible input. A LOW signal on this input turns the RF OFF and a HIGH TTL signal turns the RF ON. With no connection, the Pulse Modulation Input is internally pulled up to a TTL HIGH level.

When a LOW signal is present on the pulse Modulation Input the A21 Pulse Modulator Driver PC Board delivers 20 mA to one of two pulse modulators. An output multiplexer on the A21 Driver Board directs the 20 mA modulator current to the A9 Band 0 Pulse Modulator when the 8340A is in Band 0 or the pulse modulator in the A16 Mod/Splitter when operating in Bands 1 through 4.

The leveled pulse modulation capability of the 8340A requires timing signals to be sent to the ALC assemblies. The timing signals coordinate the leveling operation with the pulse operation. Three timing signals are generated on the A21 Pulse Modulator Driver Board when a pulse is initiated. These are the Sample/Hold timing, the Analog to Digital Converter (ADC) timing, and the Integrator timing.

The Sample/Hold timing signal controls the sample/hold gate on the A25 Detector Board. This signal is adjusted to close the gate (sample) when the RF pulse is ON and open the gate (hold) when the RF is OFF. The Sample/Hold output voltage represents the peak RF amplitude.

The ADC timing enables the analog-to-digital converter on the A27 Level Control Board to monitor the output of the Sample/Hold. The ADC is enabled when the RF is ON, and for 1 msec after the RF is turned OFF. After 1 msec, droop renders the Sample/Hold voltage inaccurate.

The Integrator timing controls the Integrate and Hold gate on the A26 Modulator Board. This gate is closed when the RF is ON and stable. To speed response time for narrow pulses the gate is held closed for a minimum of 10 usec. In fast response mode **[SHIFT] [AM]** the gate is held closed for a minimum of 1 usec. The Sample/Hold maintains a valid integrator input after the pulse is turned OFF.

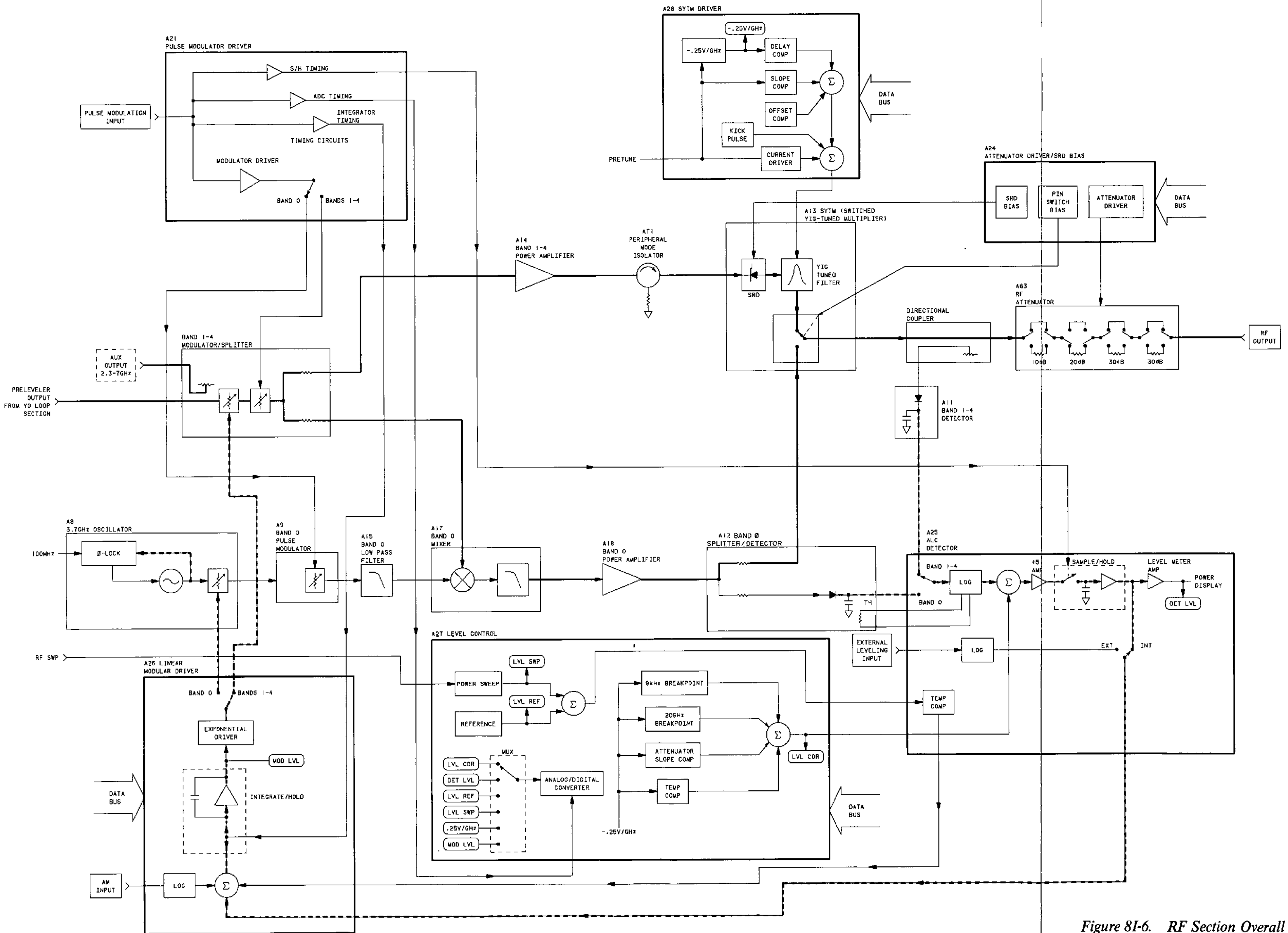


Figure 8I-6. RF Section Overall Block Diagram

TROUBLESHOOTING TO ASSEMBLY LEVEL

For ALC problems, refer to ALC Troubleshooting under ALC Loop Assemblies. For SYTM problems, refer to SYTM Troubleshooting under SYTM Related Assemblies.

For a troubleshooting block diagram, refer to Figure 8I-42, "RF Section Schematic Diagram", at the end of the RF Section documentation.

For other RF associated problems, refer to the **"OVERALL TROUBLESHOOTING PROCEDURE"** located in the **"SERVICE INTRODUCTION"** (beginning of Section 8).

REPAIR PROCEDURES

INTRODUCTION

This section contains: information on the Module Exchange Program; complete removal/installation procedures for all RF assemblies.

WARNING

Read all warnings and cautions in the "REPAIR PROCEDURES" chapter in the "SERVICE INTRODUCTION". The "SERVICE INTRODUCTION" is located in the beginning of Section VIII.

MODULE EXCHANGE PROGRAM

The A8 through A18, A63, and AT1 assemblies are not field repairable. Of these, the A8, A9, A13, A14, A16, A17, and A18 assemblies are available at a reduced cost through the module exchange program. This instrument may be repaired by replacing a defective module with a restored - exchanged module. To support the module repair concept, Hewlett-Packard has set up a module exchange program.

The procedure for using the module exchange program is given in Figure 8I-7, "Module Exchange Procedure". When you locate the defective module, order a replacement module through the nearest Hewlett-Packard sales office. The restored exchange module will be sent immediately, directly from a customer service replacement parts center. When you receive the exchange module, return the defective module in the same special carton in which the exchange module was received. DO NOT return a defective module to Hewlett-Packard until you receive the exchange module.

If you are not going to return the defective module to Hewlett-Packard, or if you are ordering a module for spare parts stock, etc., order a new module using the new module part number listed in Table 6-3.

The Hewlett-Packard module exchange program allows you to obtain a fully tested and quaranteed restored - exchange module at a reduced price. (The reduced price is contingent upon return of the defective module to Hewlett-Packard.) Assemblies available for module exchange are listed in Table 6-1.

The module exchange program described here is a fast, efficient, economical method of keeping your Hewlett-Packard instrument in service.

Locate defective module using troubleshooting procedures and service sheets in this manual.

Is a replacement module on hand?

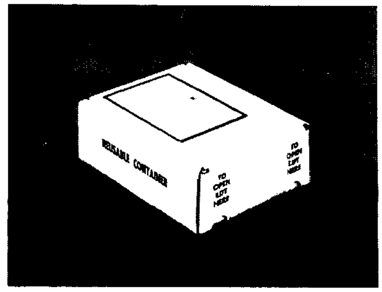
YES:

- Install the replacement module. Keep the defective module for return to HP.
- Order restored-exchange module from HP. Refer to the Replaceable Parts Section for part numbers.
- Put restored-exchange module in spares stock.
- Return defective module to HP.

NO:

- Order restored-exchange module from HP. Refer to the Replaceable Parts Section for part numbers.
- Swap replacement module and defective module.
- Return defective module to HP.

A.



Restored-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.

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

Figure 8I-7. Module Exchange Procedure

RF ASSEMBLIES REMOVAL AND INSTALLATION PROCEDURES

Equipment Required	HP Part Number
Large Pozidriv	8710-0900
Small Pozidriv	8710-0899
5/16 Wrench	8720-0015
Offset Pozidriv (A16 assembly only)	8710-0949
1/4 inch Nut Driver (A8 and A9 assy's only). . . .	8720-0002
5/16 Special Wrench (A8 and A15 assy's only) . . .	08555-20097
7/32 Wrench (A15 assembly only)	8710-0534

Introduction

The following procedures can be divided into two main categories: The first category is made up of the assemblies that require only the removal of attached cables or wires and the appropriate mounting hardware. The second category consists of assemblies that require the opening of a hinged "RF Deck" in order to access either the whole assembly or part of the mounting hardware.

NOTE

Before performing any of the following procedures it is necessary to: Remove the top, bottom, and perforated (right hand) side covers. Place the instrument on its left side (as viewed from the front).

A8 3.7 GHz Oscillator Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location", for related assemblies, cables, and mounting hardware location.

Remove all cables and wires from both the A8 and A9 assemblies:

Remove W10 from the instrument. To accomplish this it may be necessary to place a special 5/16 inch "slotted box end wrench" (HP Part Number 08555-20097) on A15J2 to keep the A15 assembly from turning when W10 is removed from A15J1. A standard 5/16 inch wrench is used to remove W10 From A15J1. Remove W10 from the A9 assembly and set aside.

Remove W25 from A62J10 (item 1). Remove the five screws (item 2) that hold on the combined A8 and A9 assemblies to the RF Deck. Remove one screw (item 3) that holds the A8 casting to the A62 Motherboard. Note that this screw (item 3) is longer than the five other screws (item 2).

Carefully remove the A8/A9 assembly from the instrument. Remove W9 completely. When loosening W9 from A9J1 be careful not to damage the -10V terminal on the A8 assembly with the wrench. Use a 1/4 inch nut driver to separate the A8 assembly from the A9 assembly by removing the four nuts located in the corners of A9 assembly.

To re-install the new A8 assembly reverse the above procedure. When re-installing W10, completely tighten one end before starting the other.

A9 Band 0 Pulse Mod Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location", for related assemblies, cables and mounting hardware location.

Remove all cables from the A9 assembly.

Remove W10 from the instrument. To accomplish this it may be necessary to place a special 5/16 inch "slotted box end wrench" (HP Part Number 08555-20097) on A15J2 to keep the A15 assembly from turning when W10 is removed from A15J1. A standard 5/16 inch wrench is used to remove W10 From A15J1. Remove W10 from the A9 assembly and set aside.

Disconnect W9 from the A9 assembly by first loosening W9's A8J1 connector. When removing W9's A9J1 connector be careful not to damage the -10V terminal on the A8 assembly.

To install a new A9 assembly reverse the above procedure.

A10 Directional Coupler/A12 Band 0 Detector Replacement Procedure

CAUTION

A10J1, A10J2, and A10J3 are precision APC 3.5 mm connectors. The cables and A11 Band 1-4 Detector assembly that connect to them use SMA connectors. Extreme care should be taken when disconnecting or connecting an SMA cable from a mating 3.5 mm connector. The SMA cable center conductor must align with the 3.5 mm connector center conductor. If there is any axial force on the cable when disconnecting the SMA fitting, the 3.5 mm connector center conductor may be

damaged, necessitating the replacement of the A10 Directional coupler. Remove any axial force on the cable by first disconnecting the end of the cable that does not mate with a 3.5 mm connector or by removing the mounting screws of the device having 3.5 mm connectors. Perform both safeguards where possible. The A10J2 - A11J1 connection is not as critical because the A11J1 connector has a captured nut. This nut does not allow axial force on the APC 3.5 mm center conductor until well after the SMA center conductor is disengaged.

To remove the A12 assembly, perform step A. To remove the A10 assembly, perform both step A and B.

A. Refer to Figure 8I-8, View C (top of instrument). W13 is shown on the right-hand side of the figure. Disconnect W13 from the A18 assembly. Now look at Figure 8I-8, View B, which shows a portion of the bottom of the instrument. Disconnect W14 and W26 from the A12 assembly. Use a small Pozidriv to remove the two screws that hold on the A12 assembly (Item 13). Carefully remove the A12 assembly, with W13 still attached. If the A12 assembly must be removed, disconnect W13 and de-solder the three wires attached to it. Reverse the above procedure for re-installing the new A12 assembly.

B. Refer to Figure 8H-4, "Front Panel Disassembly", in the **FRONT PANEL - REAR PANEL** functional group. Remove the front panel according to the instructions given in steps 1 though 7. It is not necessary to remove the ribbon cables.

Remove the two screws (item 6) that hold in the A10/A12 assembly mounting bracket.

Remove the A11 Band 1-4 Detector assembly from A10J2.

Remove the W16 cable from the A13 SYTM assembly. Carefully remove the other end of W16 from the precision 3.5 mm A10J1 connector. Carefully remove the cable from the A10J3 connector (near the front panel). Use extreme care to avoid axial force on the cable.

Pull the A10/A12 mounting bracket out far enough to access the screws that hold the A10 assembly in place. Remove the screws that hold the A10 assembly.

To reinstall the new assembly, reverse the above procedure. The cable going to A10J3 is accessible through the front of the instrument (with the front panel removed).

Reassemble the front panel.

A13 Band 0-4 SYTM Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location", and Figure 8I-9, "A13, A16, A18, and AT1 Assembly, Cable, Mounting Hardware Location".

Open the hinged RF Deck assembly by following the "HINGED RF DECK ACCESS PROCEDURE". This procedure is located just after these disassembly procedures.

NOTE:

When removing the ribbon cable from A13A1 (See Below), be sure to note its proper orientation. Putting this cable on backwards causes all power supplies to shut down.

Remove W8 from AT1J2. Remove the ribbon connector (W33) from A13A1J1 by gently prying it up with a small, flat tool. Be careful to note the original orientation of this ribbon connector. Re-installing it backwards will cause all of the power supplies to shut down. Do not pull it off by hand as this may result in badly bent pins. Disconnect W8 from A13J1 and remove it completely from the instrument. Be careful not to bend the small terminals on the A13A1 PC Board with the wrench.

Completely remove W14 connecting A13J2 to A12J2.

While holding the A13 assembly, remove the two screws (item 8) shown in Figure 8I-9.

The A13 assembly is now free. When replacing it apply a thin but continuous layer of thermal compound (HP Part Number 6040-0454 CD0) to each side of the A13MP1 aluminum spacer that goes between the SYTM and the RF Deck.

CAUTION

Use only oil based thermal compound. The use of silicone based thermal compound

may cause serious reliability problems. Silicone based oil migrates to pass element sockets, switch contacts, or printed circuit board edge connectors. The compound then tends to raise contact resistance or electrically isolate the contacts. Silicone based thermal compounds disperse into the air and deposit themselves anywhere in the instrument. Applying this material to a warm component (e.g. a heat sink or pass element) increases the rate of dispersion.

AT1 Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location", View D, for related assemblies, cables, and mounting hardware location. Refer to the "HINGED RF DECK ACCESS PROCEDURE".

Remove W7 and W8 from the AT1 assembly.

Remove the four screws shown in Figure 8I-8, View D. When removing the last screw, hold the AT1 assembly. Make sure W7 and W8 are clear of AT1J1 and AT1J2 when removing the AT1 assembly.

To replace, reverse the above procedure.

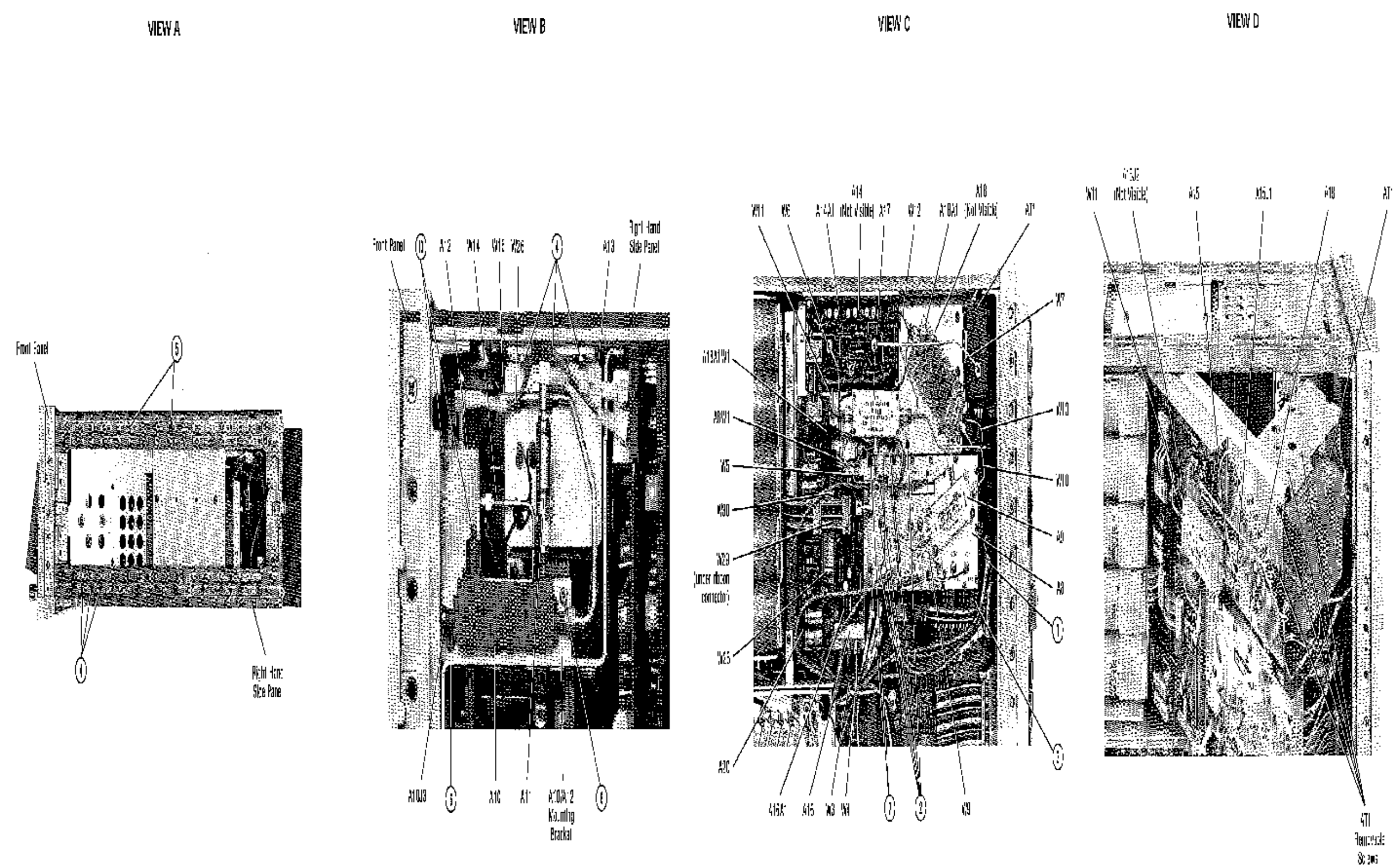
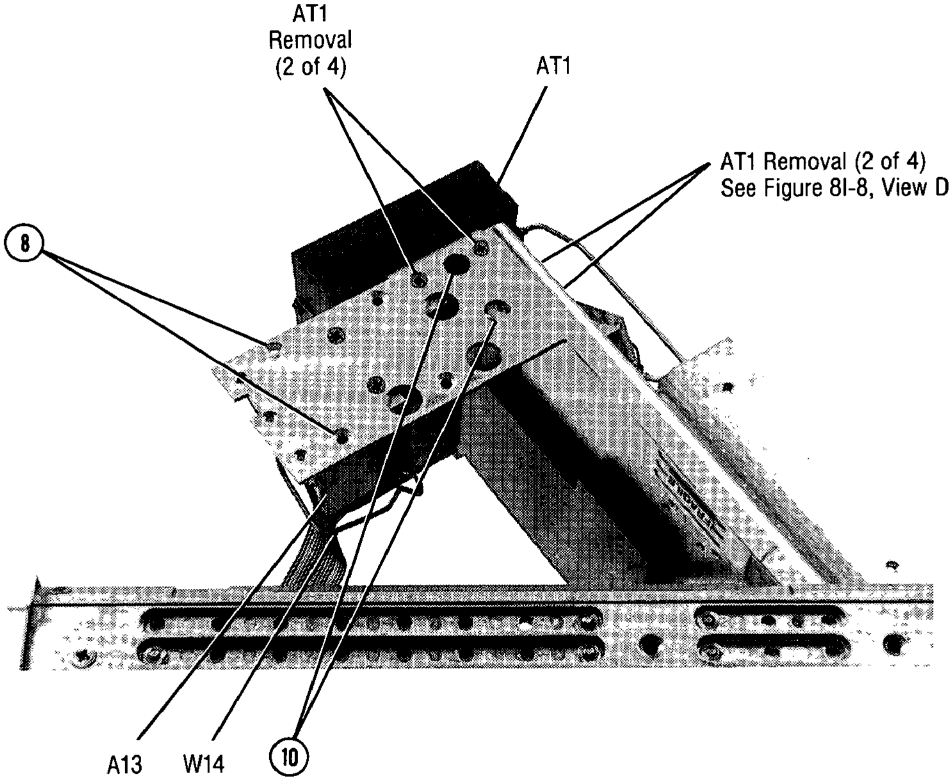


Figure 5I-8. RF Assemblies, Cables, Mounting Hardware Location

VIEW A



VIEW B

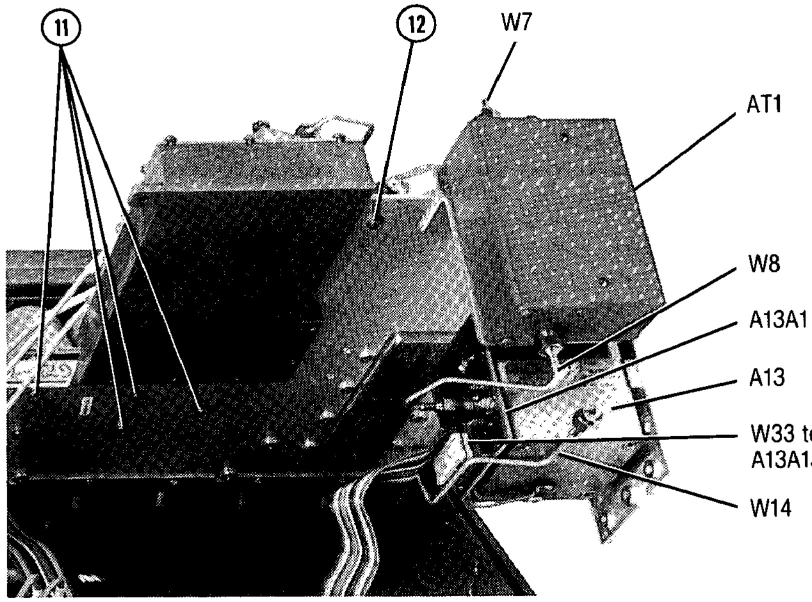


Figure 8I-9. A13, A13A1, A16, A18, and AT1, Asssemblies, Cables, and Mounting Hardware Location

A14/A14A1 Band 1-4 Power Amplifier Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location".

Remove the ribbon cable going to A14A1. Completely remove W7 from the instrument.

Remove W6 by first disconnecting it from A14. To disconnect W6 from A16, five-conductor A8W1 must be disconnected. Completely remove W6 from the instrument.

Remove the eight screws that hold the composite A14-A14A1 assembly together.

To install the new A14-A14A1 assembly, reverse the above procedure. When reconnecting the ribbon connector, be extremely careful not to bend the pins.

A15 Band 0 Low Pass Filter Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location".

Follow the procedure for the removal of the A20 assembly.

Remove the W10 connector from the A15 assembly.

Slide the A15 assembly to the left until the portion with flat sides is accessible. Remove W11 from A15 by placing a 5/16 inch wrench on the W11 connector and a 7/32 inch wrench on A15's flat section.

The A15 assembly may now be removed.

To replace the A15 assembly, reverse the above procedure.

NOTE

When tightening W10 to A15 do not tighten so hard that W10 is stressed.

A16 Band 0-4 Modulator/Splitter Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location", and Figure 8I-9, "A13, A16, A18, A18A2, and AT1 Assembly, Cable, Mounting Hardware Location".

Disconnect the ribbon connector from A16A1.

Remove the 5 contact A8W1 and 2 contact A18A1W1 connectors from the A20 assembly.

Disconnect W5, W6, W28, and W29 from the A16 assembly.

Perform the "HINGED RF DECK ACCESS PROCEDURE".

Using an offset posidrive, remove the five A16 mounting screws on the back of the RF Deck. Refer to item 11, Figure 8I-9, View B.

Pull the A16 assembly out far enough to access cables W28 and W29. Remove these cables by gently and carefully prying them upward with a small, flat implement.

The entire A16/A16A1 assembly is now free. Transfer the cable (W30) that interconnects A16 and A16A1 to the new A16/A16A1 assy. and reverse the above procedure to re-install.

A17 Band 0 Mixer Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location".

(1.) Remove the four screws located in each corner.

(2.) Disconnect the 3 cables going to the A17 assembly.

(3.) The A17 assembly is now free.

A18/A18A1 Band 0 Power Amplifier/Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location".

Perform the "HINGED RF DECK ACCESS PROCEDURE".

Remove the two screws (item 12) on the back of the RF Deck that hold this assembly in place.

Remove the cables that go to the A18 assembly.

The A18/A18A1 assembly is now free.

A20 RF Section Filter Replacement Procedure

Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location".

Remove all connectors from the P.C. Board. One of the ribbon connectors goes to the A16A1 assembly as well as the A20 assembly and must also be removed from there.

Remove the four screws that hold the P.C. Board in place. (These are on the top of the board, one in each corner.) Remove A8W1 and A18A1W1. The A20 assembly is now free.

When reconnecting the ribbon cable to the A20 and A16A1 P.C. Boards, be extremely careful not to bend the pins.

A63 RF Attenuator Replacement Procedure

Refer to Figure 8H-4, "Front Panel Disassembly", in the **FRONT PANEL - REAR PANEL** functional group. Remove the front panel according to the instructions given in steps 1 through 7. It is not necessary to remove the ribbon cables.

Remove the two cables going to the A63 assembly. Remove the two screws that hold the A63 mounting bracket in place. Remove the two screws that hold the A63 assembly to its mounting bracket.

HINGED RF DECK ACCESS PROCEDURE

It is necessary to perform the following procedure to replace any of the following assemblies:

A13 Band 0-4 SYTM
A16 Mod Splitter
A18 Band 0 Power Amplifier
AT1 Band 1-4 Peripheral Mode Isolator

1. Remove the top, bottom, and perforated side covers. Place the instrument on its left side (as viewed from the front).

   Refer to Figure 8I-8, "RF Assemblies, Cables, Mounting Hardware Location".

CAUTION

A10J1 A10J2 and A10J3 are precision APC 3.5 mm connectors. The cables and A11 Band 1-4 Detector assembly that connect to them use SMA connectors. Extreme care should be taken when disconnecting or connecting an SMA cable from a mating 3.5 mm connector. The SMA cable center conductor must align with the 3.5 mm connector center conductor. If there is any axial force on the cable when disconnecting the SMA fitting, the 3.5 mm connector center conductor may be damaged, necessitating the replacement of the A10 Directional coupler. Remove any axial force on the cable by first disconnecting the end of the cable that does not mate with a 3.5 mm connector or by removing the mounting screws of the device having 3.5 mm connectors. Perform both safeguards where possible. The A10J2 - A11J1 connection is not as critical because the A11J1 connector has a captured nut. This nut does not allow axial force on the APC 3.5 mm center conductor until well after the SMA center conductor is disengaged.

Bottom of Instrument

2. Remove W15 from the A12 assembly. Disconnect W16 from the A13 Band 0-4 SYTM. Carefully disconnect the other side of W16 from the A10 assembly and completely remove W16 from the instrument. Use extreme care to avoid axial force on the W16 to A10J1 connection.

3. Remove three side panel screws (item 4) that hold the A13 assembly to the side rail.

4. Remove two side panel screws (item 5) that hold the RF Deck to the side rail.

Top of Instrument

5. Remove W3 and W4 from the A16 assembly.

6. Remove two screws (item 7) from the RF Deck (See View C).

7. Remove one screw (item 3) that holds the A8 casting to the A62 Motherboard.

Both Top and Bottom of Instrument

8. While holding W15 clear of A12J1 (Top), pull the A8 casting away from the instrument (Bottom). The RF Deck will swing open.

CAUTION

To avoid crushing A20 components mounted near the RF Deck hinge, do not open the RF deck to more than a 45 degree angle from its original position.

Removing the cable going to the A8 assembly "100 MHz 0 dBm INPUT" will allow the RF Deck to open farther.

INDIVIDUAL ASSEMBLY
SERVICE SECTION

A8 Through A18, A63, and AT1 are not field repairable. Refer to the Module Exchange Program section of the "**RF SECTION REPAIR PROCEDURE.**"

A8 3.7 GHz OSCILLATOR

Introduction

Refer to Figure 8I-10, "A8 3.7 GHz Oscillator, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The A8 3.7 GHz Oscillator Assembly provides a clean, stable 3.7 GHz signal against which a swept 3.71 to 6.10 GHz signal is mixed in order to generate Band 0 frequencies of 10 MHz to 2.4 GHz. This heterodyne scheme is used in the 8340A because the YO is not capable of generating frequencies below 2 GHz. In order to maintain the same frequency accuracy as Bands 1-4, the 3.7 GHz Oscillator is phase-locked to a 100 MHz instrument reference. Also provided within the A8 assembly are a phase lock detector and indicator and a linear modulator (for Band 0 ALC control).

The overall functions of the 3.7 GHz Oscillator can be divided into two major parts. A microcircuit assembly contains an oscillator, sampler, and modulator. A printed circuit board assembly contains a 100 MHz amplifier, a phase lock amplifier, and a phase lock indicator.

The oscillator consists of a bistable pair of bipolar transistors and a microstrip resonator, tuned with a varactor diode. The tuning range of the oscillator is nominally 3.685 to 3.715 GHz. Outputs from this oscillator are sent to a sampler and through a modulator and a bandpass filter to the SMA output port.

The modulator is a shunt reflective PIN modulator providing at least 60 dB of modulation at 20 milliamps bias current.

The sampler consists of a balanced pair of Schottky diodes driven by a step recovery diode. Its purpose is to provide a sampled (at 100 MHz) version of the 3.7 GHz signal to the phase locked loop.

One of two amplifiers on the printed circuit board is a narrow-band 100 MHz-tuned amplifier whose purpose is to drive the step recovery diode (of the sampler circuit). This amplifier is designed to raise the 100 MHz input signal level from 0 dBm to approximately 10 dBm to drive the step recovery diode.

The 100 MHz amplifier consists of two gain stages and a matching circuit for the step recovery diode.

This first stage of the amplifier involves Q1, operating in a class A configuration. R3 provides a stable dc bias. Capacitor C2 provides emitter bypass. C1 and L1 form a band pass input. C1 also provides a dc block. Base bias is through resistor R1, while collector bias is provided by L2.

Capacitor C3 acts as a supply bias. To ensure overall amplifier stability, C3 must provide good bypass at frequencies down to 100 kHz. At under 100 kHz, the amplifier gain is small enough so that stability is insured.

Interstage matching is accomplished by C4, C5, and L3. C5 also serves as a dc block. C4 is adjustable so that a good match can always be obtained.

The second stage amplifier is Q2, which is operated in a class B configuration to provide reasonable output power with low dc input power. Base bias is through a ground wire with two ferrite beads (E2 and E3) to provide high RF impedance. Collector bias is through R4 and L4, with supply bypass capacitor C6. R4 serves to lower dissipation in Q2 and as a low pass filter (along with C6) to enhance supply isolation.

Capacitor C7 is a dc block, while C8, L5 and R5 form a drive circuit for the step recovery diode. C8 and L5 provide a good match for the step recovery diode at 100 MHz, while R5 provides a good match at lower frequencies, as well as providing step recovery diode bias. Resistor R5 is necessary to prevent diode squegging.

Phase Lock Amplifier

The phase lock amplifier provides two major functions. First, it forms a phase-locked loop together with the microcircuit, tuned oscillator, and mixer. This loop keeps the oscillator output at 3.7 GHz. Second, when the loop is not locked, the amplifier provides a search oscillation that sweeps the VCO over a wide enough range to allow the loop to lock to the 37th harmonic of the 100 MHz input.

An RC network composed of R6-8, C9 and C10 combines and filters the two outputs from the microcircuit sampler. Potentiometer R8 provides an adjustment to compensate for unequal outputs from the two sampler ports, allowing the loop to close (with 0 Vdc at Q3A base). In the absence of signals from the sampler (i.e., microcircuit removed or defective), R9 provides bias for Q3A base. This allows a search oscillation to occur and keeps the amplifier from latching up in an unwanted mode.

Transistors Q3A and Q3B are a matched differential pair which form the amplifier inputs. Bias is provided by R10, R12, and R13. High frequency gain is set by R11. Output from the first amplifier is fed differentially to transistors Q4 and Q5, another differential pair. Tuning voltage output is taken single-ended from the collector of Q4.

The second amplifier bias is provided by the matched pair of Q6A and Q6B. Since the bases and emitters of Q6 are tied together, current through each must to be equal.

Resistors R19 and R20 lower the voltage drop across Q6 and thus, lessen power dissipation in Q6. R20 also limits the maximum current flow in Q6. Gain shaping for the overall amplifier is provided by R14-17. A feedback path including R21 and C14 causes the amplifier to oscillate at approximately 30 Hz whenever the loop is open (unlocked). This is the search oscillation required for signal acquisition.

Lock Indicator

The lock indicator senses when the phase lock loop is not locked. The out of lock condition is one where the tuning voltage is greater than 0 Vdc or less than -35 Vdc (regardless of whether the voltage is constant or due to search oscillation.

Timer U1 is set up as a monostabe multivibrator. Whenever the oscillator tune line is greater than 0 Vdc, transistor Q7 turns on. This makes U1 input pin 2 LOW and causes a pulse output on pin 3. If the voltage stays HIGH, pin 3 stays HIGH. Whenever the tune line goes below -35 Vdc, Q8 turns on and U1 pin 3 goes HIGH.

The output pulse width is approximately the period of the search oscillation (approx. 30 msec). During search oscillation, U1 pin 3 will continuously be HIGH.

When the tuning voltage stays between 0 and -35 Vdc, U1 pin 3 stays LOW. The search oscillator is a linear oscillator, therefore, the tuning voltage should always go to 0 or -35 Vdc unless the loop is locked.

The output can source at least 30 mA of current and can be used to directly drive an LED indicator.

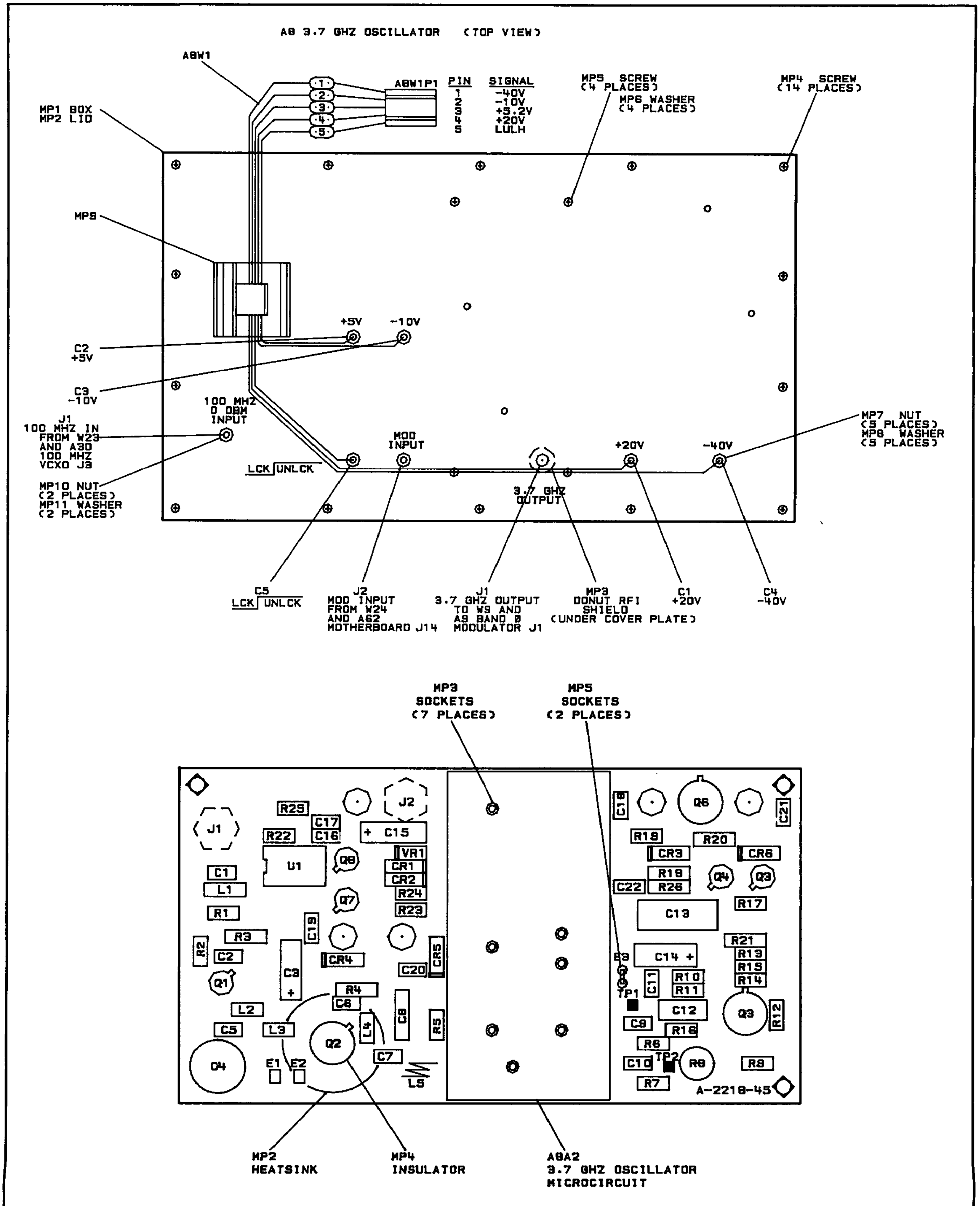


Figure 8I-10. A8 3.7 GHz Oscillator, Component Location Diagram

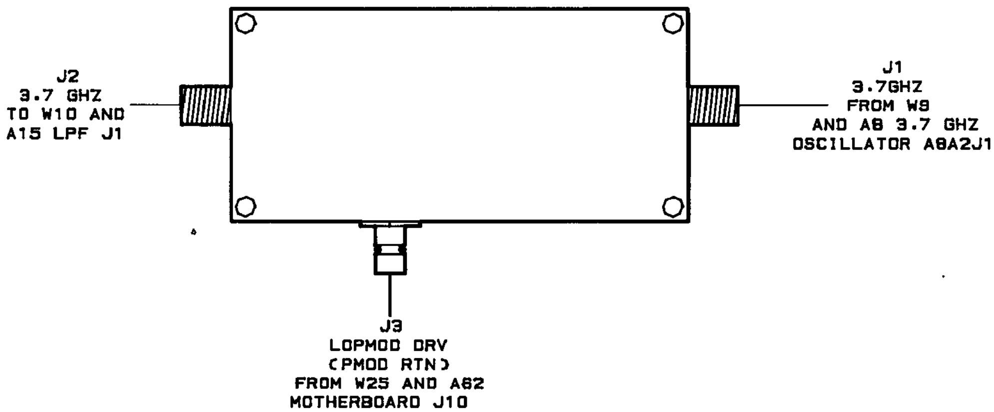


Figure 8I-11. A9 Band 0 Pulse Modulator, Component Location Diagram

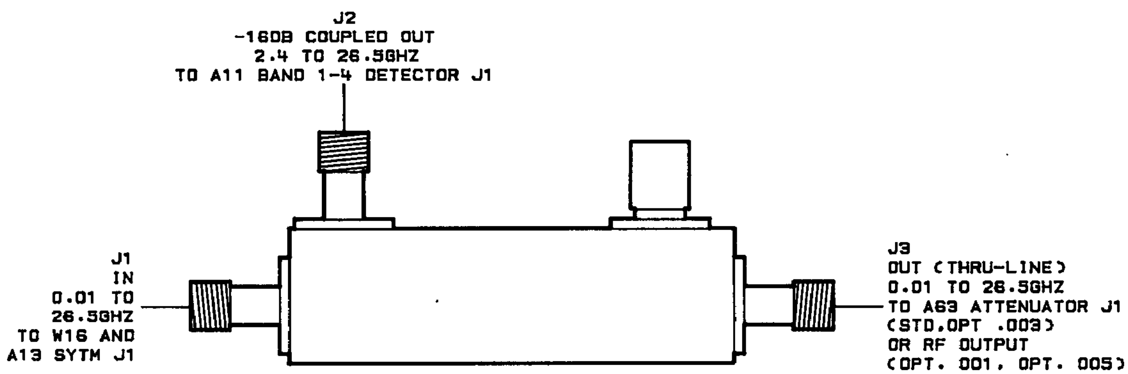


Figure 8I-12. A10 Directional Coupler, Component Location Diagram

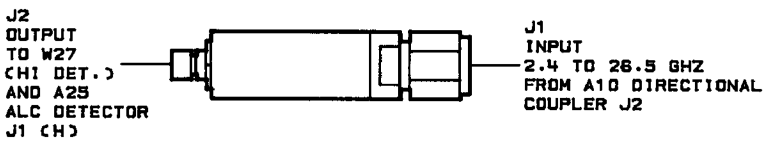


Figure 8I-13. A11 Band 1-4 Detector, Component Location Diagram

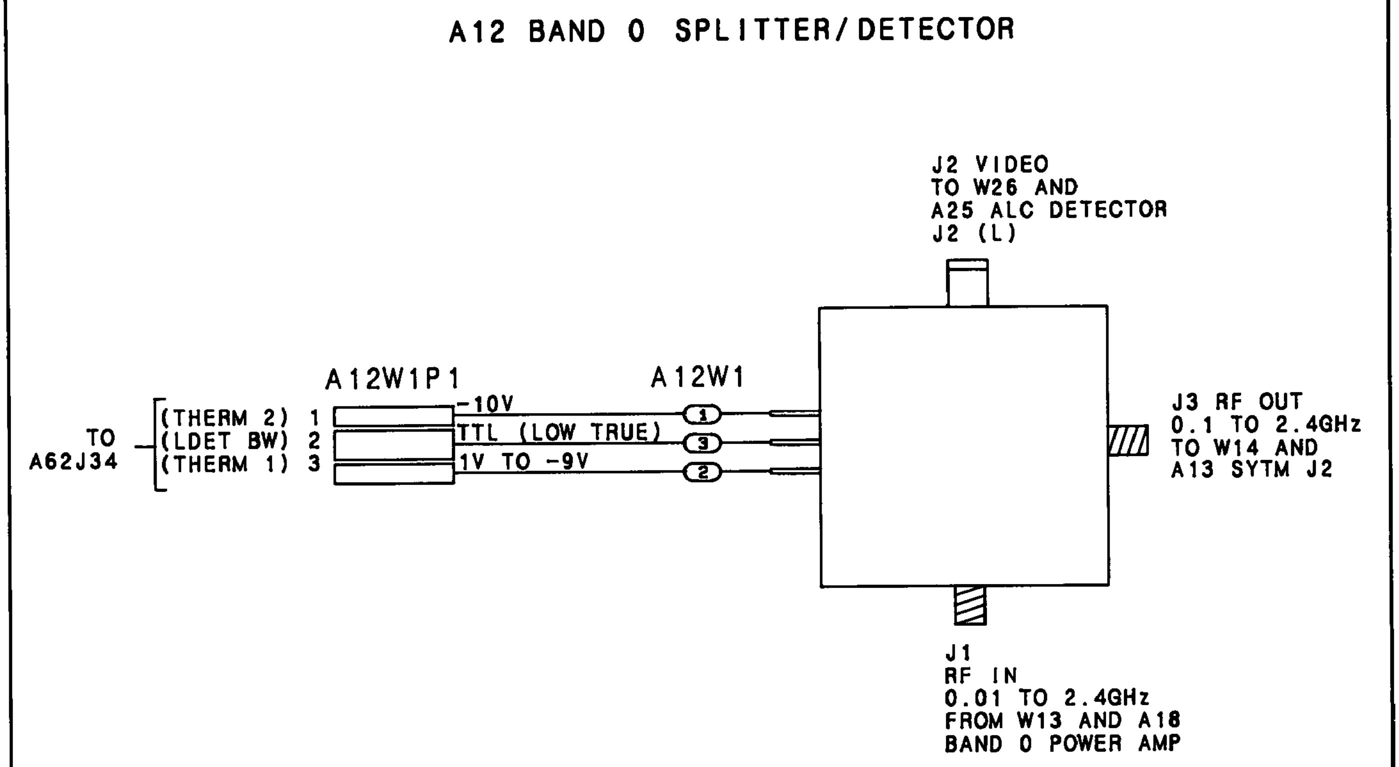


Figure 8I-14. A12 Band 0 Splitter Detector

A62J34 TO A12W1P1 PIN I/O

Pin	Mnemonic	A12W1P1	Levels
1	THERM 2	PIN 1	−10V
2	LDETBW	PIN 2	TTL (LOW TRUE)
3	THERM 1	PIN 3	1V TO −8V

Note: Refer to RF Section Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

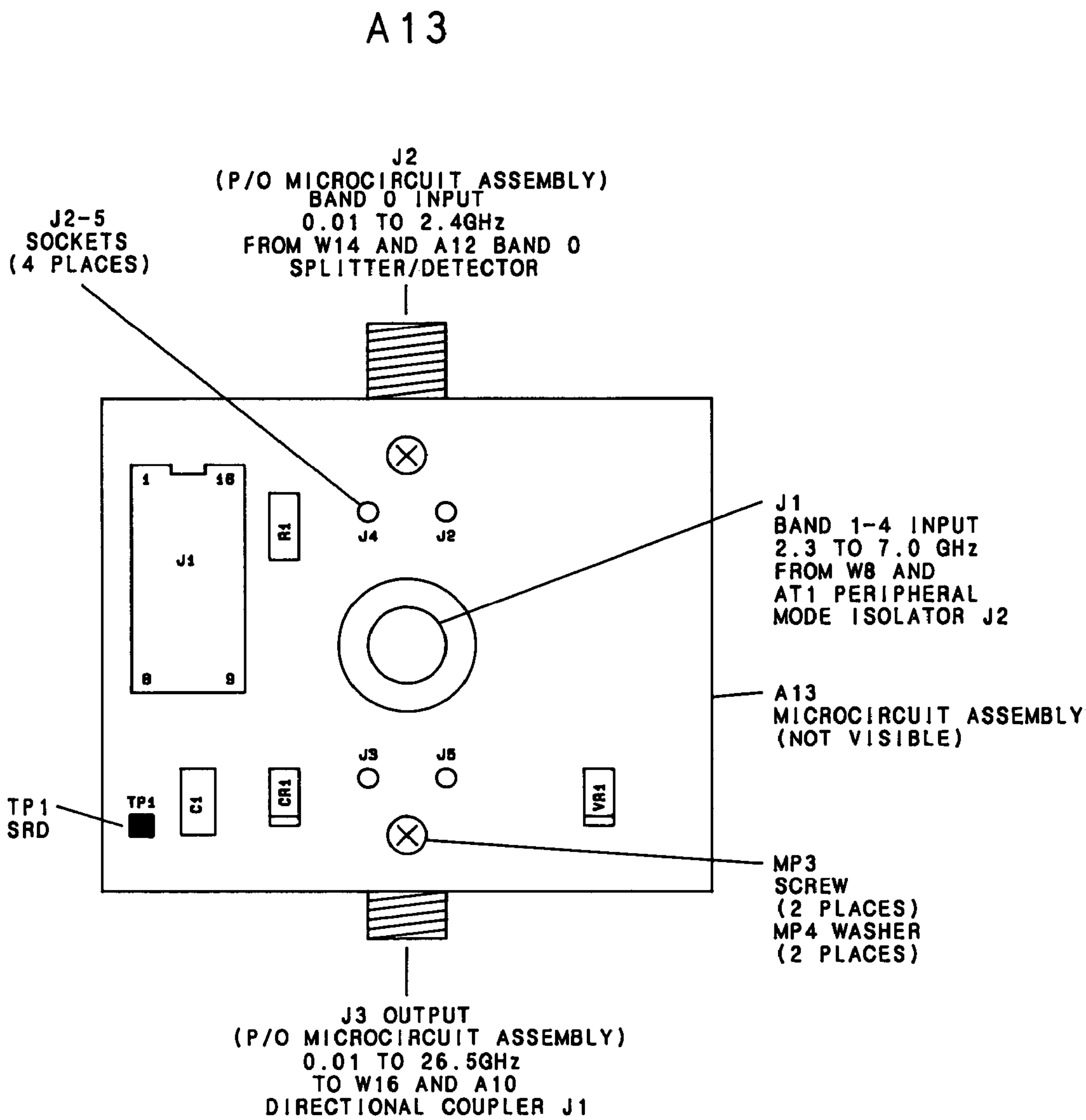


Figure 8I-15. A13 SYTM, Component Location Diagram

A62J18 TO A13A1J1 PIN I/O

Pin	Mnemonic	A13A1J1	Levels
1			
2	SRD BIAS	PIN 2	−10V/THRU 2000 OHMS TO +5V
3			
4	SYTM COIL −	PIN 4	−40V TO −25V
5			
6	+20V	NOT USED	+20V
7	−10V	NOT USED	−10V
8	SYTM HTR	PIN 8	0V TO +20V
9	SYTMTHRM	PIN 9	APPROX. −5V
10	PINBIAS	PIN 10	−4V TO +12V
11			
12	STYM-COIL −	PIN 12	−40V
13	SYTM GND	NOT USED	0V
14	SYTM GND	PIN 14	0V
15	SYTM GND	PIN 15	0V
16			

Note: Refer to RF Section Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

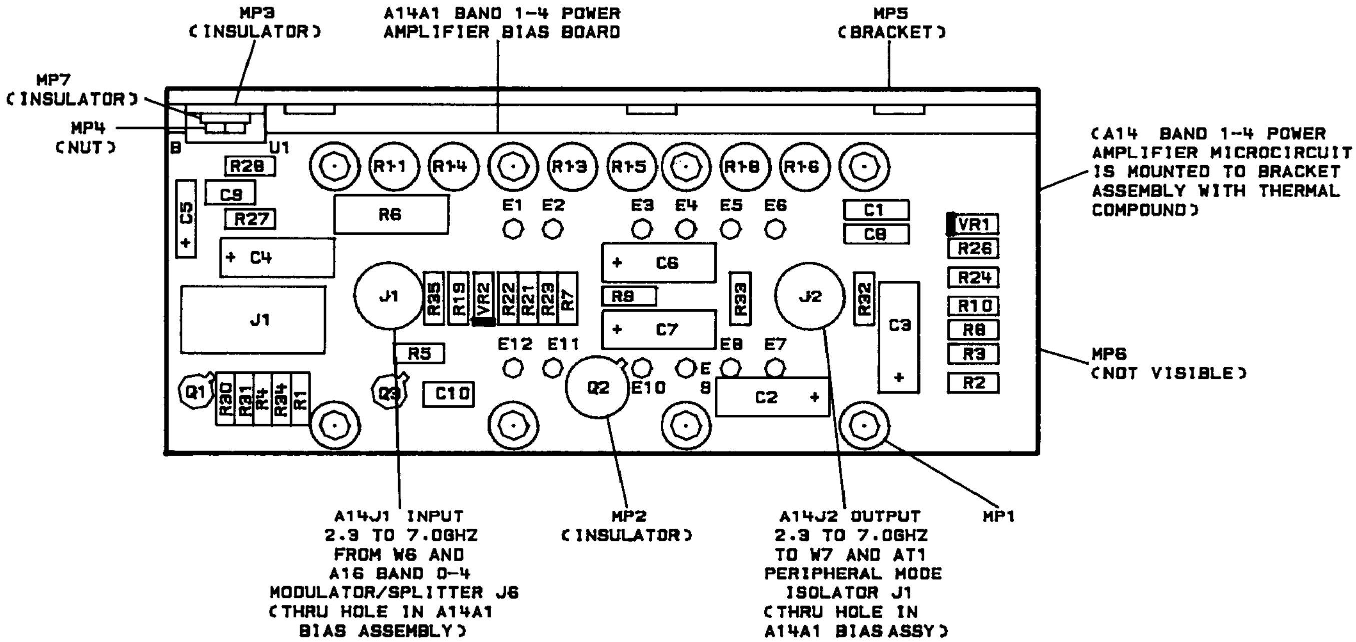


Figure 8I-16. A14A1 Band 1-4 Power Amplifier Bias Assembly Component Location Diagram

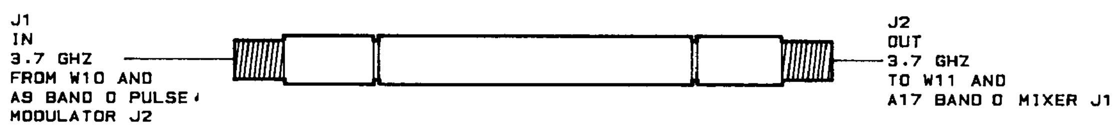


Figure 8I-17. A15 Band 0 Low Pass Filter

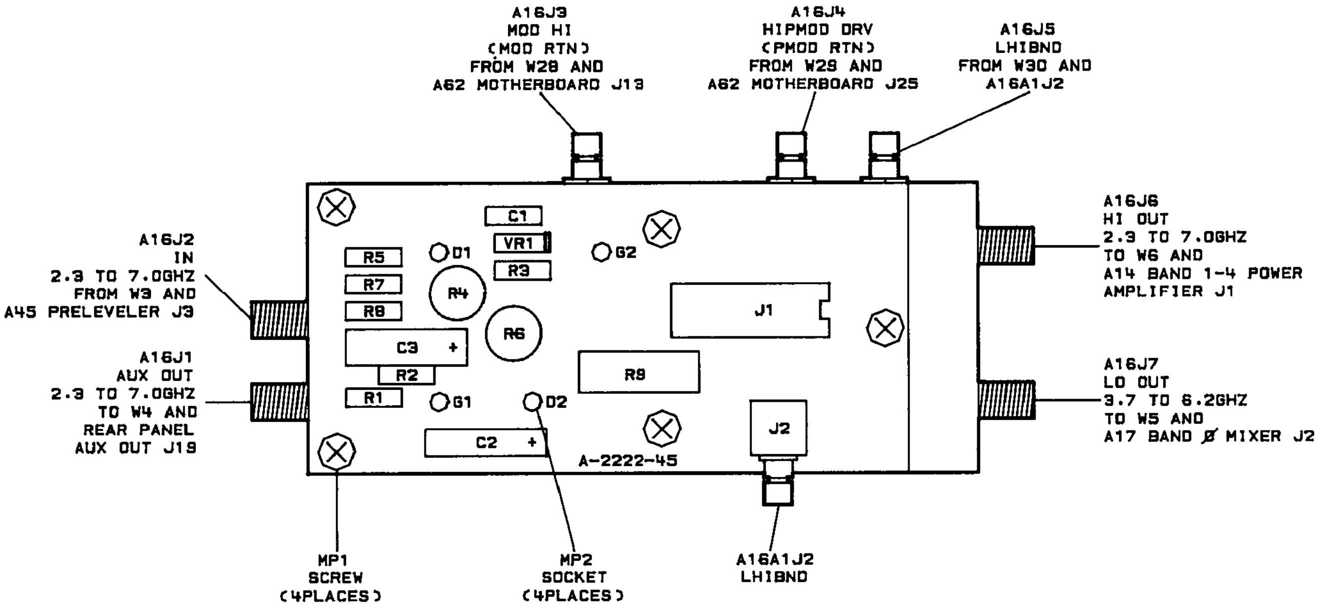


Figure 8I-18. A16 Band 1—4 Modulation/Splitter, Component Location Diagram

A62J19 TO A16A1P3 AND A20P2 PIN I/O

Pin	Mnemonic	A62W31P2	A62W31P3	A16A1J1	A20J1	Levels
1	GND PLANE	PIN 1	PIN 1	PIN 1	PIN 1	0V
2	+20V	PIN 2	NOT USED	NOT USED	PIN 2	+20V
3	+5.2V	PIN 3	PIN 3	PIN 3	PIN 3	+5.2V
4	−5.2V	PIN 4	PIN 4	PIN 4	PIN 4	−5.2V
5	−10V	PIN 5	NOT USED	NOT USED	PIN 5	−10V
6	−40V/−40V SENSE (−)	PIN 6	NOT USED	NOT USED	PIN 6	−40V
7	LHET	PIN 7	NOT USED	NOT USED	PIN 7	TTL (LOW TRUE)
8	LHET	PIN 8	NOT USED	NOT USED	PIN 8	TTL (LOW TRUE)
9	GND PLANE	PIN 9	PIN 9	PIN 9	PIN 9	0V
10	+20V	PIN 10	NOT USED	NOT USED	PIN 10	+20V
11	+5.2V	PIN 11	PIN 11	PIN 11	PIN 11	+5.2V
12	−5.2V	PIN 12	PIN 12	PIN 12	PIN 12	−5.2V
13	−10V	PIN 13	NOT USED	NOT USED	PIN 13	−10V
14	−.25V/GHZ	NOT USED	NOT USED	NOT USED	NOT USED	−.25V/GHZ
15	LHIBND	NOT USED	PIN 15	PIN 15	NOT USED	TTL (LOW TRUE)
16	HULH	PIN 16	NOT USED	NOT USED	PIN 16	TTL (HIGH TRUE)

Note: Refer to RF Section Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

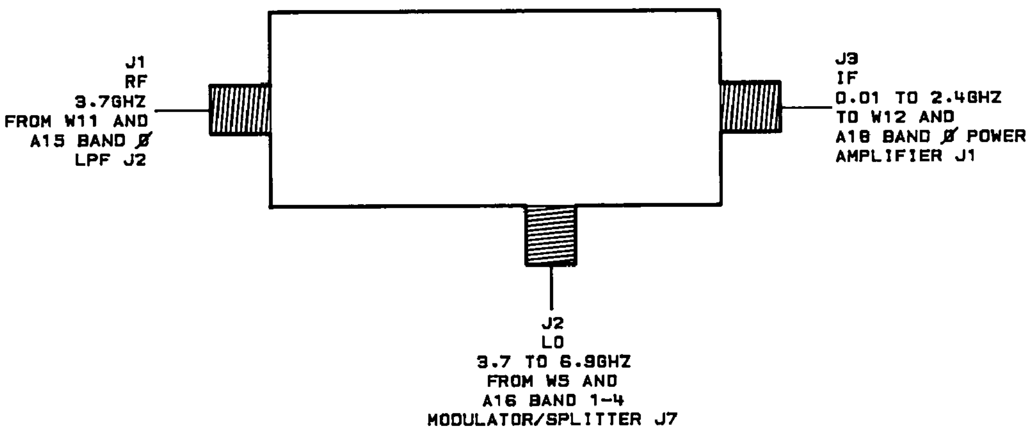


Figure 8I-19. A17 Band 0 Mixer, Component Location Diagram

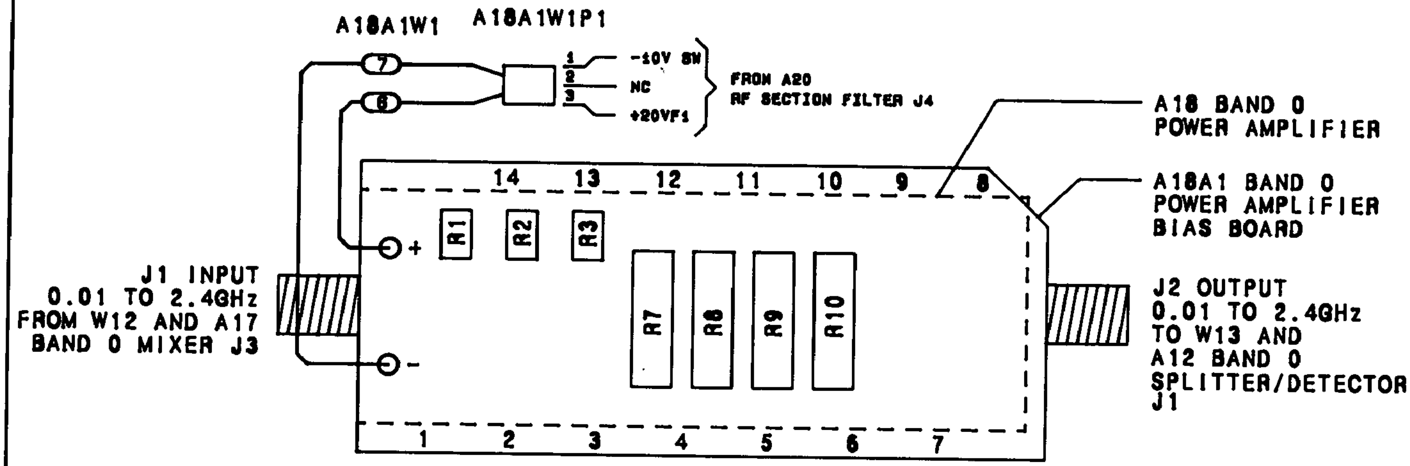


Figure 8I-20. A18 Band 0 Power Amplifier, Component Location Diagram

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Figure 8I-21. Left Intentionally Blank

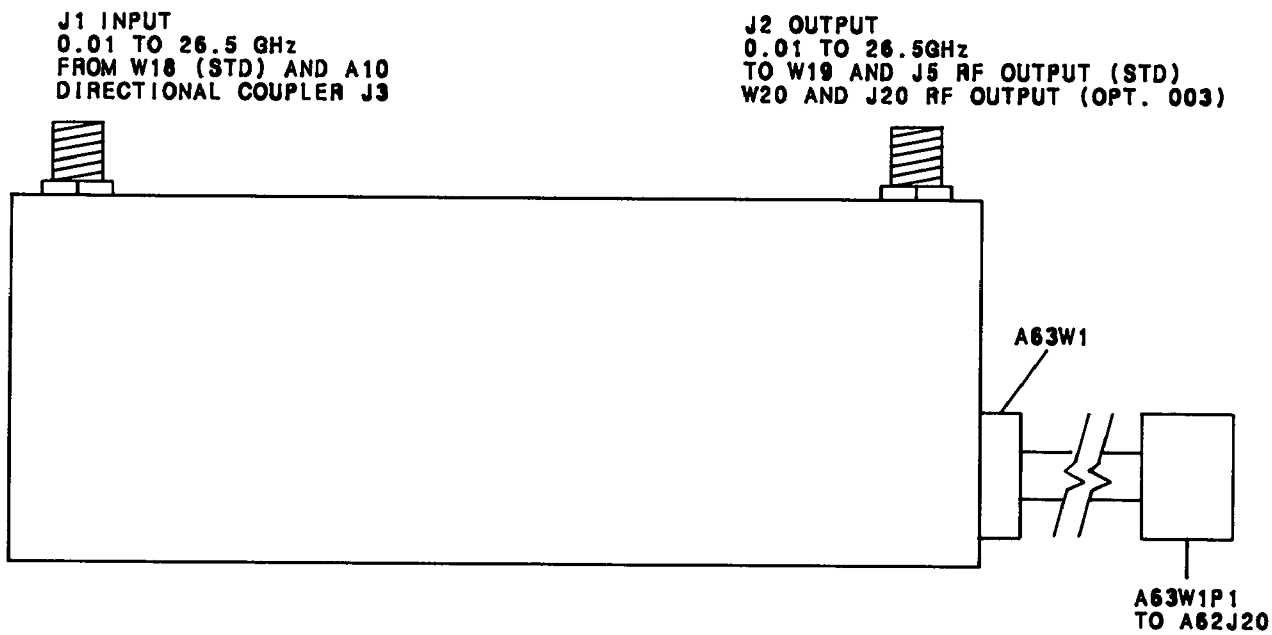


Figure 8I-22. A63 90 dB Programmable RF Attenuator, Component Location Diagram

A62J20 TO A63W1P1 PIN I/O

Pin	Mnemonic	A63W1P1	Levels
1			
2	ATNAT1	PIN 2	OPEN COLLECTOR
3	ATNTH2	PIN 3	OPEN COLLECTOR
4	ATNTH4	PIN 4	OPEN COLLECTOR
5	ATNAT3	PIN 5	OPEN COLLECTOR
6	ATN COIL +	PIN 6	+5V
7			
8			
9	ATNAT2	PIN 9	OPEN COLLECTOR
10	ATNAT4	PIN 10	OPEN COLLECTOR
11	ATNTH3	PIN 11	OPEN COLLECTOR
12			
13	ATNTH1	PIN 13	OPEN COLLECTOR
14	LATTN	PIN 14	TTL (LOW TRUE)

Note: Refer to RF Section Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

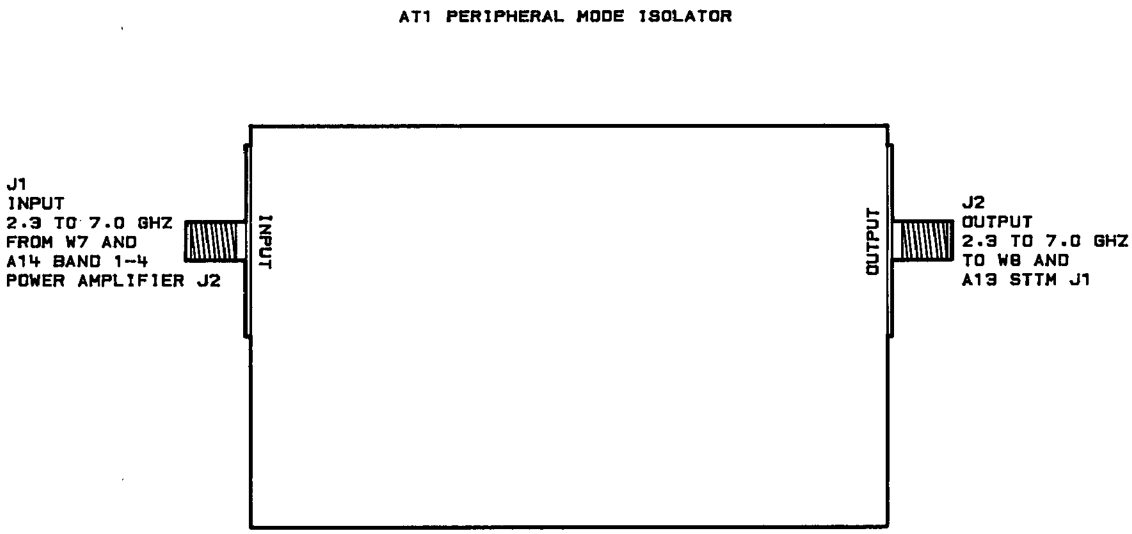


Figure 8I-23. AT1 Peripheral Mode Isolator, Component Location Diagram

A20 RF SECTION FILTER, CIRCUIT DESCRIPTION

Introduction

The RF Section Filter consists of the following major sections:

- Power Amplifier Supply Filters
- Band 0 Amplifier Switch.

Power Amplifier Supply Filters

Refer to Figure 8I-24, "A20 RF Section Filter, Component Location Diagram", and Figure 8I-42, "RF Section Schematic Diagram". The Band 1-4 Amplifier draws a substantial amount of current from the +5.2V and -10V supplies when operated at full power. During Pulse operation the input signal to the Power Amp is turned off and on at the pulse rate. This causes large surge currents in the supply lines which, if unfiltered, would cause the voltages to fluctuate at the pulse rate. (This occurs because the pulse rate is normally at a higher frequency than the power supply bandwidths.) These voltage fluctuations would affect the YO Phase Lock circuitry and the main YO Coil Driver circuitry causing large sidebands on the output carrier at the pulse frequency. To minimize this effect, a two stage LC filter is used in both the +5.2V and -10V supply lines going to the Band 1-4 Amplifier.

The sidebands would be of little consequence in the (pulsed) front panel output. They would be apparent, however, at the rear panel YO AUX output (producing 50-60 dBc sidebands) when the front panel output is being pulsed.

Band 0 Amplifier Switch

The Band 0 Amplifier Switch turns off the -10V supply to the Band 0 Amp when the instrument is not operating in Band 0.

When the LHET signal is LOW (indicating that the instrument is operating in Band 0 [Heterodyne Band]), Q1 is turned on by the voltage divider formed by R2 and R3. The collector of Q1 is pulled up to ground, and thus Q2 is biased on via the voltage divider formed by R4 and R5. Q2 saturates, and its collector is pulled down to -10V, turning on the Band 0 Amplifier. When LHET is HIGH, Q1 and Q2 are biased off, turning off the Band 0 Amplifier. The -10V input to this switch is derived from the filtered -10V supply that is also used by the Band 1-4 Amplifier.

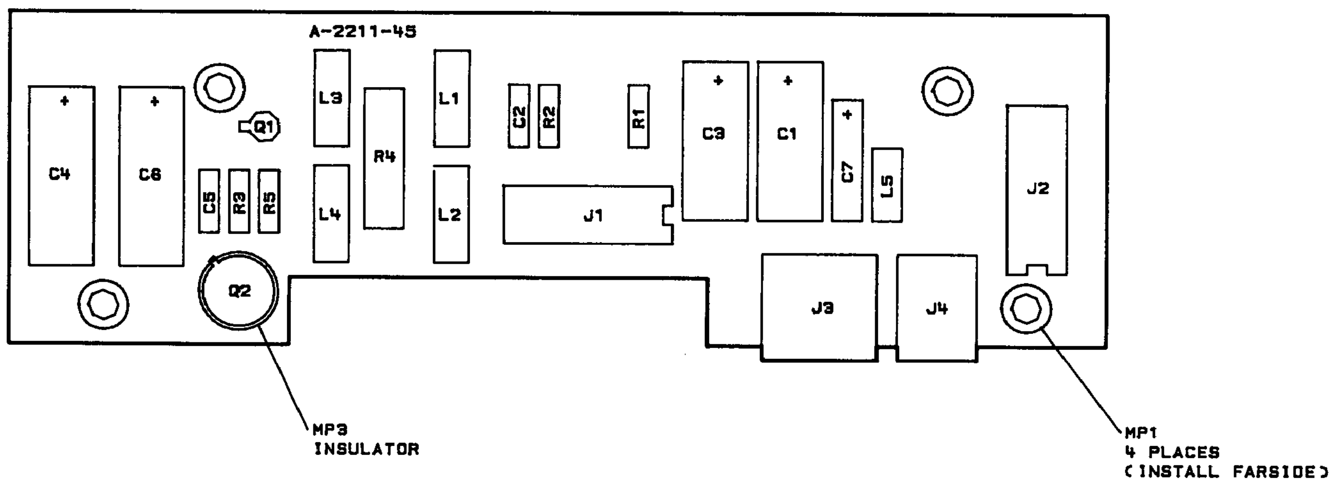


Figure 8I-24. A20 RF Section Filter, Component Location Diagram

A62J19 TO A16A1P3 AND A20P2 PIN I/O

Pin	Mnemonic	A62W31P2	A62W31P3	A16A1J1	A20J1	Levels
1	GND PLANE	PIN 1	PIN 1	PIN 1	PIN 1	0V
2	+20V	PIN 2	NOT USED	NOT USED	PIN 2	+20V
3	+5.2V	PIN 3	PIN 3	PIN 3	PIN 3	+5.2V
4	−5.2V	PIN 4	PIN 4	PIN 4	PIN 4	−5.2V
5	−10V	PIN 5	NOT USED	NOT USED	PIN 5	−10V
6	−40V/−40V SENSE (−)	PIN 6	NOT USED	NOT USED	PIN 6	−40V
7	LHET	PIN 7	NOT USED	NOT USED	PIN 7	TTL (LOW TRUE)
8	LHET	PIN 8	NOT USED	NOT USED	PIN 8	TTL (LOW TRUE)
9	GND PLANE	PIN 9	PIN 9	PIN 9	PIN 9	0V
10	+20V	PIN 10	NOT USED	NOT USED	PIN 10	+20V
11	+5.2V	PIN 11	PIN 11	PIN 11	PIN 11	+5.2V
12	−5.2V	PIN 12	PIN 12	PIN 12	PIN 12	−5.2V
13	−10V	PIN 13	NOT USED	NOT USED	PIN 13	−10V
14	−.25V/GHZ	NOT USED	NOT USED	NOT USED	NOT USED	−.25V/GHZ
15	LHIBND	NOT USED	PIN 15	PIN 15	NOT USED	TTL (LOW TRUE)
16	HULH	PIN 16	NOT USED	NOT USED	PIN 16	TTL (HIGH TRUE)

Note: Refer to RF Section Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

A21 PULSE MODULATOR, CIRCUIT DESCRIPTION

Introduction

The A21 Pulse Modulator assembly controls the pulse modulation functions for the 8340A. The front panel BNC "PULSE MODULATION INPUT" is the main control signal. The A21 Pulse Modulator then drives the PIN switch RF modulators in the A9 (for Band 0) or A16 (for Band 1-4) microcircuits. In addition, timing circuits send control signals to key elements of the ALC loop to coordinate the leveling function with the pulse modulation.Refer to Figure 8I-26, "A21 Pulse Modulator Driver, Schematic Diagram".

Input Buffer and Control Logic A

The input buffer (Q7 circuit) buffers the "PULSE MODUATION INPUT" (TTL compatible; HIGH = RF ON; LOW = RF OFF), and protects Q7 from higher input voltages. Two control lines gate the pulse input. HPLSEN gates the buffered pulses (HIGH = Enabled; LOW = Disabled). HRFON overrides the pulse input, causing the RF to be turned OFF (HIGH = RF ON; LOW = RF OFF). TP5 is the assembly's primary gated control line (HIGH = RF OFF; LOW = RF ON).

With no input signal CR1 is forward biased, Q7 is on and U1C pin 10 is LOW. During the LOW state of an input signal, CR1 is turned off, Q7 is off and U1C pin 10 is HIGH. The output of U1C (pin 8) will not go LOW unless HPLSEN is HIGH. If either input to U1B is LOW the RF is turned OFF.

The input impedance is established by R14. If necessary R14 can be changed to 51.1 ohms to provide a 50 ohm input impedance. If this is done, however, an open-circuit input will no longer be pulled HIGH. Thus, if pulse modulation is activated with open-circuit input, the RF will go OFF.

Modulator Driver B

The Modulator Driver provides the current and voltage bias for the RF pulse modulators, controlled by TP5. Differential current switch Q2 and Q3 control the bias for the drivers Q5 and Q8. With TP5 HIGH (HIGH = RF OFF), Q2 is off and Q3 is on, sourcing current through CR4 and CR5. This turns Q5 on, sourcing 20mA through R11 to bias the PIN diode modulator on, turning the RF OFF. With TP5 LOW (LOW = RF ON), Q2 is on and Q3 is off. Now the drivers are biased through CR8, CR3, CR4, CR6, and R10 to -10VF. This turns Q8 on, back-biasing the PIN diodes and turning the RF ON. C3 and C4 AC-couple the transition current spikes from the modulators back to the A21 assembly.

Output Multiplexer C

The Output Multiplexer selects one RF modulator to receive the pulse modulation control. With LHET LOW (LOW = Band 0), U3D and U3C turn Q12 on and Q11 off, selecting A9 (Band 0) to pulse modulate. With LHET HIGH (HIGH = Band 1-4), Q12 is off and Q11 is on, pulse modulating A16 (Band 1-4). U3B biases A16 off when HRFON is LOW (LOW = RF OFF) when the front panel "RF" is OFF and during retrace.

ADC Timing D

The ADC Timing enables the ADC (A27) to monitor the detected power level when either the RF is ON or up to 1 millisecond after the RF has been turned OFF. This is to prevent the "POWER dBm" display from showing an invalid power level if the RF has been turned OFF for over 1 millisecond (ALC Sample/Hold droop). With TP5 LOW (RF on), TP3 is forced HIGH to enable the ADC. When TP5 goes HIGH, one-shot U2B is triggered to output a 1 millisecond LOW pulse, holding the ADC enabled. If the RF is not turned ON again within 1 millisecond, U2B returns HIGH, forcing TP3 LOW to disable the ADC.

Integrator Timing E

The Integrator Timing controls timing to gate the integrator input of the main ALC amp (A26), ensuring that the integrator responds to RF power level error signals only when the RF level detected is ON and stable. When TP5 goes LOW (RF ON), U1A output is forced HIGH. The following LOW-pass filter section delays the transition by 1 microsecond. When TP2 goes HIGH, the integrator (A26) is enabled. When TP5 goes HIGH again (RF OFF), U1A output goes LOW to put the integrator circuits into hold. One-shot U2A is triggered when TP5 goes LOW, outputting a LOW pulse to U1A. This determines the minimum time that TP2 is HIGH (integrate) for each RF pulse with very narrow pulse widths. The one-shot time period depends on the ALC loop bandwidth and is controlled by HLBW. With HLBW HIGH, the minimum sample time is 1 microsecond; with HLBW LOW, the minimum sample time is 10 microseconds.

Sample/Hold Timing F

The Sample and Hold Timing controls timing of sample/hold gate in detector circuits (A25) during pulse modulation. The key timing element is C13. The time delay constant is independent and adjustable for both RF ON and RF OFF. The voltage on C13 is detected by Schmitt trigger Q6/Q9. The squarewave output is then delayed from the pulse at TP5, with both leading and trailing edges delayed by independent and adjustable time periods.

The circuit functions as follows: Presume C13 to be charged. When TP5 goes LOW (RF ON), Q1 turns off, and C13 discharges through R24, R23, R22, and R21. R21 adjusts the "ON DELAY" (discharge). When the voltage on C13 reaches the lower threshold, +1.2V, Q6/Q9 fires and TP1 goes HIGH to sample. When TP5 goes back HIGH (RF OFF), Q1 turns on, and charges C13 through R23 and R24. R23 is adjustable and controls the "OFF DELAY" (charge). When the voltage on C13 reaches the upper threshold, +1.5V, Q6/Q9 fire and TP1 goes LOW to hold. If C13 is not fully discharged before TP5 goes HIGH again, the rising edge of TP5 will turn on Q4 very briefly through C12 to fully discharge C13. This ensures that the "OFF DELAY" is independent of pulse width.

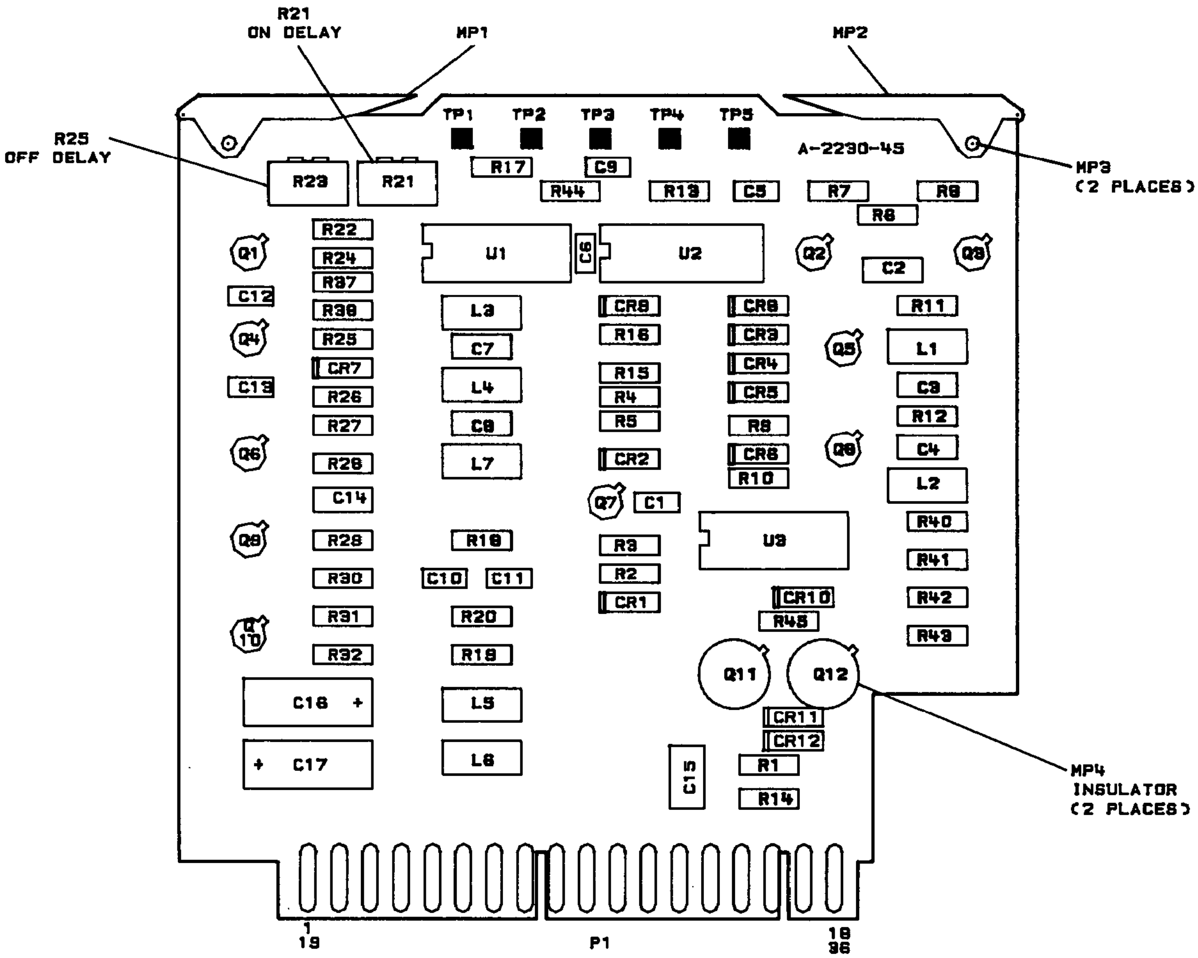


Figure 8I-25. A21 Pulse Modulator Driver, Component Location Diagram

A21 Pulse Modulator Driver P1 Pin I/O

A21

Pin	Mnemonic	Levels	Source	Destination
1 19	HADCEN	TTL (HIGH TRUE)	D	XA27P1-8
2 20	LMODHLD	TTL	E	XA26P1-1
3 21	DET S/H + DET S/H −	+4.5V/+3.5V +3.5V/+4.5V	F F	XA25P1-2 XA25P1-24
4 22	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*G *G
5 23	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*G *G
6 24	HLBW	TTL (HIGH TRUE)	XA26P1-33	XA26P1-33
7 25	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*G *G
8 26	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*G *G
9 27	HPLSEN HRFON	TTL (HIGH TRUE) TTL (HIGH TRUE)	XA26P1-2 XA57P1-105	*A *A C
10 28				
11 29	 LHET	 TTL (LOW TRUE)	 XA27P1-20	 *C
12 30				
13 31				
14 32				
15 33				
16 34	LOPMOD DRV	CURRENT SOURCE	C	A62J10-SMC CENTER
17 35	PLS IN RTN PMOD RTN	0V 0V	* B	*A *A
18 36	PLS IN HIPMOD DRV	TTL CURRENT TO PIN DIODE	A62J26-SMC CENTER C	A A62J25-SMC CENTER

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

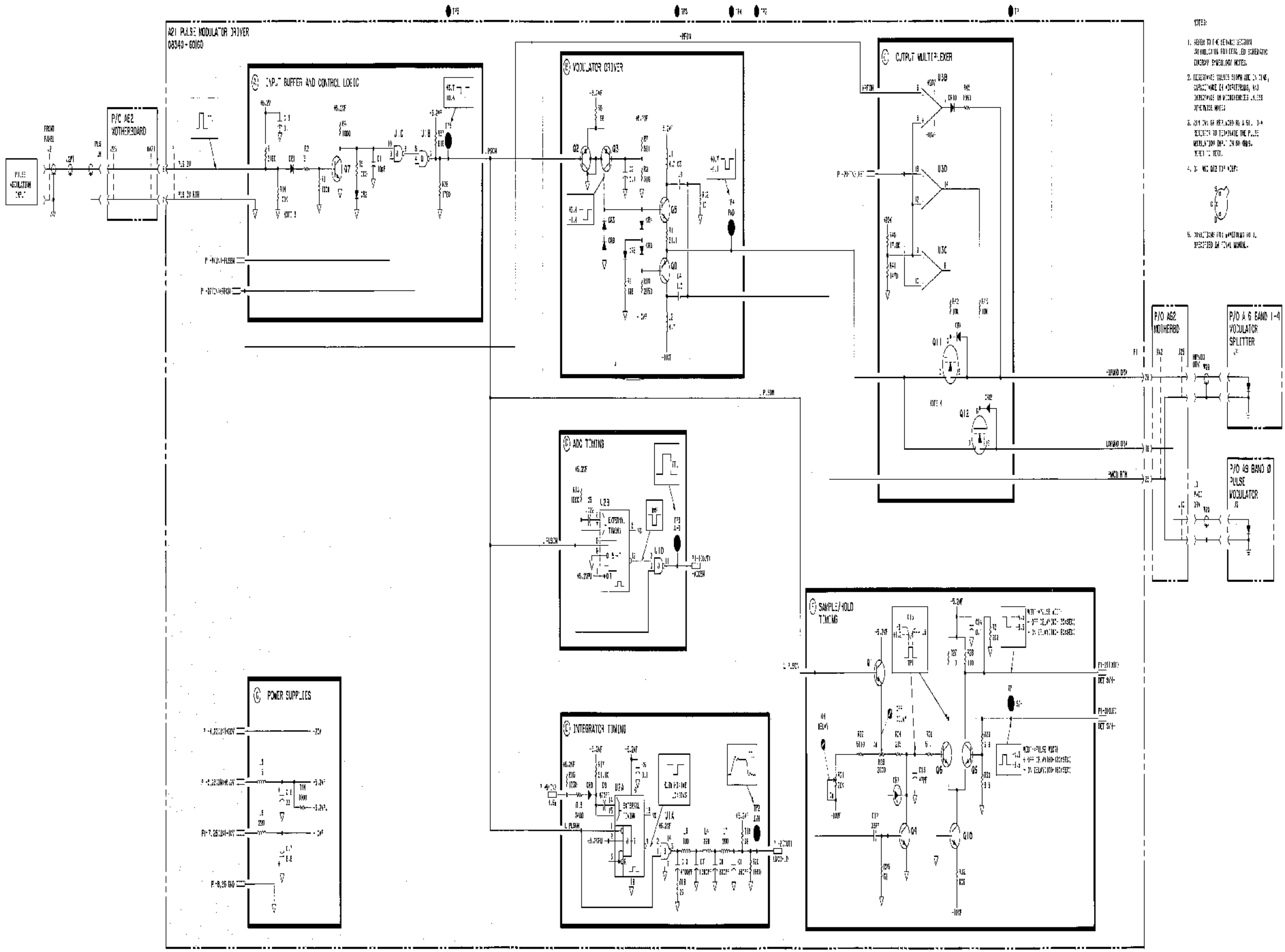


Figure 8I-26. A21 Pulse Modulator Driver, Schematic Diagram

A24 ATTENUATOR DRIVER/SRD BIAS, CIRCUIT DESCRIPTION

Introduction

Refer to Figure 8I-28, "A24 Attenuator Driver/SRD Bias, Schematic Diagram".

The A24 assembly has two primary functions. One is to control the 90 dB RF step attenuator. The other is to supply the correct bias voltage to the Step Recovery Diode (SRD) in the A13 Switched YIG-Tuned Multiplier (SYTM). The optimum bias voltage is a function of both RF power level and frequency, and also depends upon the frequency band being used. In addition, a simple circuit provides the correct bias for the PIN Diode switch in the A13 SYTM to select Band 0 or Band 1-4.

Frequency Ramp Generator A

The Frequency Ramp Generator provides two frequency-tracking ramp voltages for the frequency-dependent element of the SRD bias circuits. A 1.4V/GHZ signal is generated on the A28 assembly and sent to the Frequency Ramp Generator through A24P1-6. U1A amplifies and offsets this ramp to produce a descending ramp at TP4. This ramp is again offset and inverted to produce an ascending ramp at TP5. These two opposing ramps are each attenuated through variable resistors and then summed together to form a new ramp in Block **B**.

Modulator Voltage Clamp B

This circuit generates a voltage dependent on RF power level. Optimum SRD bias depends heavily upon RF power level to the A13 SYTM. SRD BIAS CONT from A26 supplies this information for the SRD bias adjustments. However, when the ALC loop goes unleveled, the SRD BIAS CONT line moves abruptly positive and no longer represents RF power level. The Modulator Voltage Clamp adds two frequency-dependent voltage ramps to this signal. The offsets are adjusted such that when the SRD BIAS control jumps positive, the base-emitter junctions of Q1, Q2, and Q3 (Block **D**) become reverse-biased, breaking the connection between SRD BIAS control and the SRD BIAS.

Band Decoder C

The Band Decoder provides control signals based upon the frequency band being used. HLB0, HLB1, and HLB2 are encoded with the current band. They are decoded by U5 into five distinct control lines (TP6 through TP10). Three of these control open-collector comparators to drive FETs which control SRD bias. Two of the comparator outputs are in the SRD Bias Amplifier to select reverse-bias in Band 0, forward-bias in Band 1, and the freqency- and power-dependent bias in Bands 2, 3, and 4.

SRD Bias Adjustments D

The SRD Bias Adjustments circuitry provides the frequency and power-dependent bias adjustments for the SRD in Bands 2-4. Three identical circuits, each with three adjustments, sum together a synthesized control signal. Only one of these three circuits is used at a time, dependent upon the band being used, as switched by the FETs. In each section, two adjustments add currents proportional with frequency to Block **D**'s output current; a third adjustment subtracts current proportional to the RF power level through a transistor controlled by the Modulator Voltage Clamp circuit (Block **B**).

Exponential Generator E

The Exponential Generator shapes the current generated by the SRD Bias Adjustments circuitry to produce an exponentially shaped current output. Dual transistor Q7 is responsible for the relationship of collector current being an exponential function of base-emitter voltage. The use of a positive temperature coefficient resistor as well as a dual transistor helps cancel out thermal effects. The resulting output is a current sink which is an exponential function of the current input.

SRD Bias Amplifier F

The SRD Bias Amplifier converts the exponential current to a voltage that is fed to the SRD; it also establishes bias for special cases of Band 0 and Band 1. U3 converts the current sunk by the Exponential Converter to a voltage. The MIN adjustment determines the minimum bias voltage (about -0.5V) for very low power levels when the input current is zero. In the special case of Band 0, the L0 line is pulled LOW, sinking current through R34 and forcing the voltage at TP12 to about +7V. This reverse biases the SRD, attenuating the Band 1-4 RF path. In Band 1, the L1 line is pulled LOW, turning off Q8 and pulling about 5 milliamps through R35. This forward biases the SRD and allows the fundamental frequency to pass through the SYTM easily while minimizing harmonics. In Bands 2-4, Q8 is turned on and the exponential bias shaping previously discussed is used to bias the SRD.

PIN Diode Bias G

When Band 0 is selected, the PIN diode in the SYTM is reverse-biased, thus allowing the Band 0 signal to pass through the coupling loop to the output of the SYTM. When Band 1-4 is selected, the PIN diode in the SYTM is turned on, grounding one side of the output coupling loop. This is necessary for efficient coupling from the YIG sphere and helps attenuate any stray signals in the Band 0 path. Comparator U12B controls the bias applied to the cathode of the PIN diode in the A13 SYTM. The PIN diode is biased off (TP11 +12V HIGH) when Band 0 is selected and biased on (TP11 -10V LOW) when Band 1-4 is selected.

Read Status Output Buffer H

Several status lines are provided in the RF section which may be used to communicate information back to the instrument processor. Most of these lines are not used at present but may be used to provide information to the processor about the operating condition of PC boards in the RF section. This output buffer (U14) is a six bit tri-state buffer which is enabled by the RSTAT strobe (15,R3:) from the Address Decoder on the A24 assembly. The enable line has a pullup to prevent this buffer from being enabled when the A27 Level Control board is removed.

Attenuator Control Latch I

The Attenuator Control Latch (U5) is a 74LS175 latch which has both inverting and non-inverting outputs for each of four latched inputs. Data bits 10 through 13 are latched from the instrument data bus when the WLEVEL strobe (10,R1:) goes low, then high. A pull-up is provided on the WLEVEL strobe to prevent inadvertent writes if the A27 Level Control board (source of the strobe) is removed. Each data bit latched is used to control one of four attenuator sections. The non-inverting output of each bit is used to activate the driver which removes the attenuator card and inserts the through card for that section. The inverting output is used to activate the driver which removes the through card and inserts the attenuator card. The required inputs (DB 10 through DB 13) to select each attenuation (0 to 90 dB) is shown in a table on the A24 schematic.

Attenuator Coil Drivers J

The A63 Attenuator contains four attenuator cards (10 dB, 20 dB, 30 dB, 30 dB) and four through cards. Each section can switch in an attenuator card or a through card depending upon the total attenuation desired. These sections are switched in by latching solenoids. Once the actuator reaches full travel, the solenoid coil is de-energized by opening contacts internal to the attenuator. Each coil draws 300 milliamps for approximately 8 milliseconds until the internal contacts open the coil circuit. Since each attenuator card requires two solenoids, there are a total of eight separate coils that must be driven at various times, depending upon the section switched and whether a through card or attenuator card is being inserted.

The coil drivers (U8, U9, U10, and U11) are 75451B peripheral positive-AND drivers. These devices are capable of driving 300 milliamps with a saturation voltage of less than 0.7 volts which is sufficient to drive the 5 volt coils of the attenuator. These drivers do not have diode protection to prevent damage from inductive kick back by the coils. For this reason a TID 125 array of diodes (U13) is connected to provide diode clamping to both ground and to +5.2 volts.

Since the peak current that must be provided to the attenuator and drivers is quite large, a separately filtered power source is provided for this circuitry via L5, C10 and C11 (Block L). The above filtering will prevent current transients from disturbing other functions on this P.C. board.

SYTM Heater Control K

In order to provide a reasonably constant temperature for the A13 SYTM, a heater (resistor) and a thermistor are installed inside the A13 SYTM.

The A13 SYTM uses the internal thermistor to provide a voltage that changes as the temperature inside changes. This voltage (SYTMTHRM) is sent to the A24 Assembly SYTM Heater Control where it is compared to a reference voltage and amplified by op-amp (A24U4). The inverting input of this op-amp is referenced to -5 volts to set the operating point of the amplifier. The -5 volts is obtained from the divider formed by R50 and R51.

As the temperature inside the A13 SYTM rises, the thermistor resistance decreases, causing the voltage at A24TP2 to increase. A24R48 is the input resistor to the op-amp. When the voltage at A24TP2 increases, the voltage at the op-amp output (U4 pin 6) increases, decreasing the current to the base of Q9. This decreases the amount of current provided to the A13 SYTM heater, and thus decreases the temperature. Feedback is provided around this circuit by A24R49 and A24C13. This feedback allows a very large gain at dc and sets a gain of 30 at frequencies above a few hundredths of a Hertz.

The reverse of the above occurs if the temperature inside the A13 SYTM decreases. This circuit is designed to maintain the temperature of the YIG sphere at approximately 85 degrees centigrade, independent of the ambient temperature.

Power Supply L

An LC filter circuit is used on each power supply line. The component values for these filters were chosen to form a low Q circuit to reduce any chance of resonances.

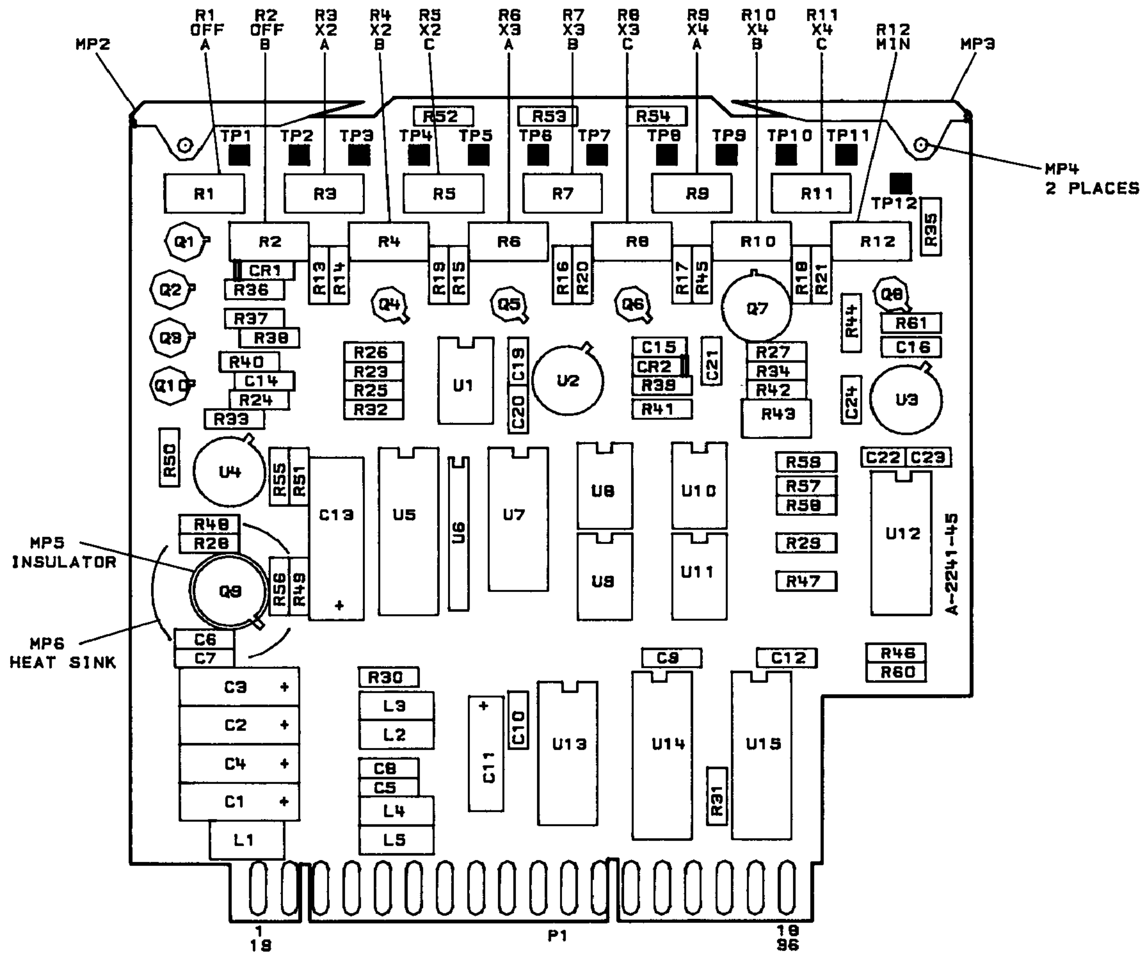


Figure 8I-27. A24 Attenuator Driver/SRD Bias, Component Location Diagram

A24 Attenuator Driver/SRD Bias P1 Pin I/O

A24

Pin	Mnemonic	Levels	Source	Destination
1 19	+20V SYTMHTR	+20V 0 TO +20V	XA52P1-16, 40 K	*L A62J18 PIN 8
2 20	SYTMTHRM HLB0	APPROX. −5V TTL (HIGH TRUE)	A62J18-9 XA27P1-46	K *C
3 21	+5.2V HLB1	+5.2V TTL (HIGH TRUE)	XA52P1-17, 18, 41, 42 XA27P1-16	*L *C
4 22	STAT10 HLB2	TTL (LOW TRUE) TTL (HIGH TRUE)	XA23P1-22 XA27P1-47	H *C
5 23	−10V RSTAT	−10V TTL (LOW TRUE)	XA53P1-12, 13, 31, 32 XA27P1-45	*L *H
6 24	1.4V/GHZ PIN BIAS	+1.4V/GHZ −4V TO +12V	XA28P1-7 G	*A A62J18 PIN 10
7 25	ATN COIL + SRD BIAS	+5V −10V THRU 2K TO +5V	L F	A62J20 PIN 6 A62J18 PIN 2
8 26	GND GND PLANE	0V 0V	A62 STAR GND INSTRUMENT GND	*L *L
9 27	ATNTH4 ATNAT4	OPEN COLLECTOR OPEN COLLECTOR	J J	A62J20 PIN 4 A62J20 PIN 10
10 28	ATNTH3 ATNAT3	OPEN COLLECTOR OPEN COLLECTOR	J J	A62J20 PIN 11 A62J20 PIN 5
11 29	ATNTH2 ATNAT2	OPEN COLLECTOR OPEN COLLECTOR	J J	A62J20 PIN 3 A62J20 PIN 9
12 30	ATNTH1 ATNAT1	OPEN COLLECTOR OPEN COLLECTOR	J J	A62J20 PIN 13 A62J20 PIN 2
13 31	SRD BIAS CONT HENDKICK	0 TO −5V (LEVELED) TTL (HIGH TRUE)	XA26P1-18 XA28P1-18	B H
14 32	DB9 DB11	TTL TTL	*H *H	* *I
15 33	DB10 WLEVEL	TTL TTL (LOW TRUE)	*H XA27P1-12	*I I
16 34	DB12 DB13	TTL TTL	*H *H	*I *I
17 35	SYTM GND	0V	A62J18-13, 14, 15	*L
18 36	RGND	0V	STAR GND POINT	*L

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

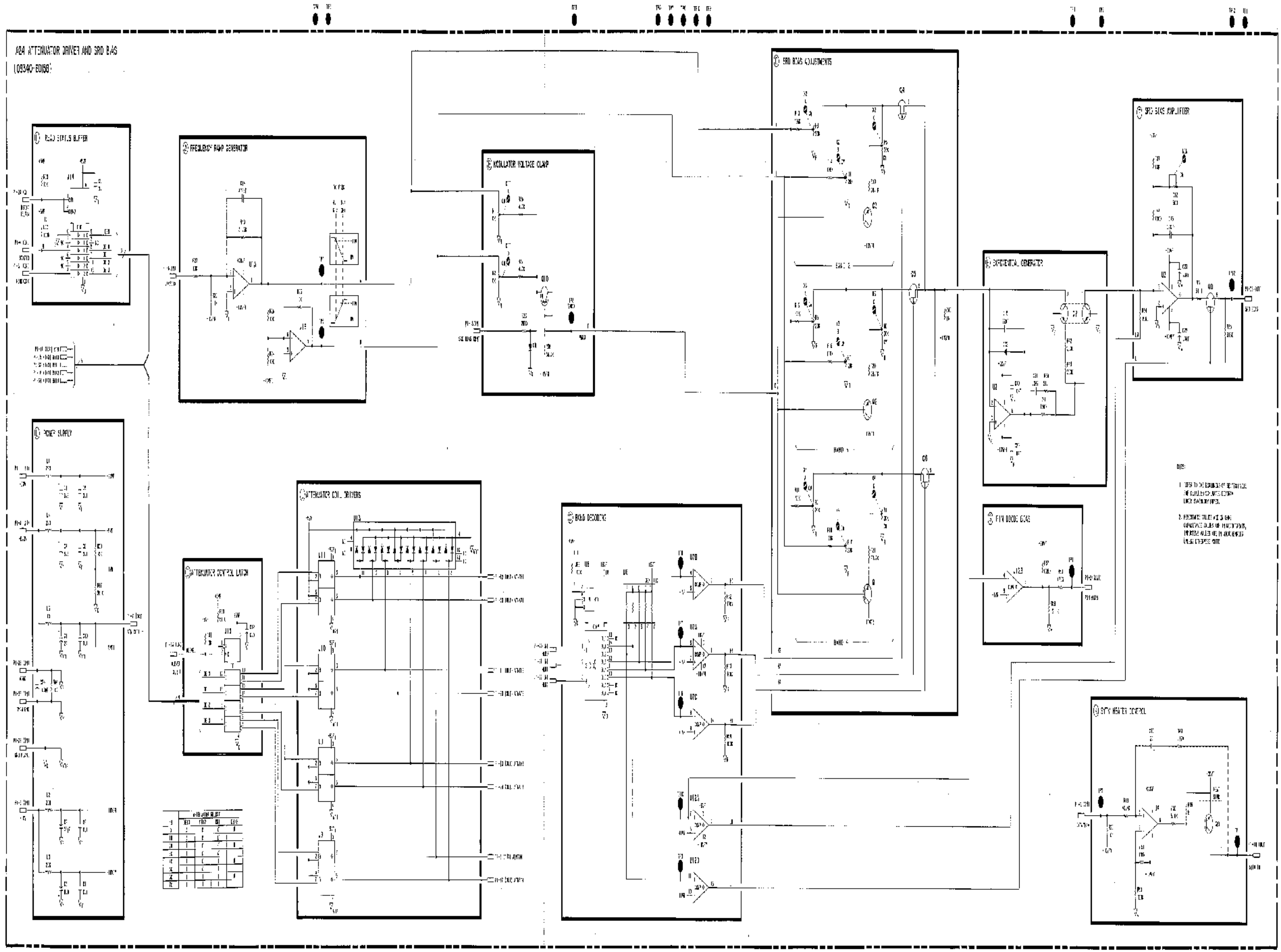


Figure 8F-28. A24 Attenuator Driver/SRD Bias, Schematic Diagram

A25 ALC DETECTOR, CIRCUIT DESCRIPTION

Introduction

Refer to Figure 8I-32, "A25 ALC Detector, Schematic Diagram".

The A25 ALC Detector assembly processes the voltage from either internal or external detectors, producing an output voltage proportional to the RF power level. This output voltage is then compared to a reference level voltage on the A26 Linear Modulator Assembly, and the resulting error is used to drive the RF modulators to control the RF leveling loop. Two "log converters"; one for the internal detectors, another for external detectors or power meters, convert the detected RF voltage to a signal proportional to RF power in dBm. In addition, an amplifier buffers this proportional signal and sends it to an analog-to-digital converter on the A27 Level Control board. This ADC converts the signal into digital information for the "POWER dBm" display. The reference level voltage is temperature-compensated on this assembly.

Internal Detector Log Converter A

The Internal Detector Log Converter receives the detected RF voltage and outputs a signal proportional to RF power level in dBm.

Crystal detectors characteristically exhibit two distinct regions of operation. At low power levels (less than 0 dBm), the detectors are in their square-law region. The detected output voltage then varies with the square of the RF voltage. At high power levels (more than +10 dBm), the detected output voltage varies linearly with the RF voltage. The log function converts the detected RF voltage into a DC voltage proportional to RF power, but to track the detectors accurately through both regions requires halving the gain at low power levels. Alternately, the gain can be doubled at high power levels. The Log Converter is a dual-slope design that accomplishes this with a smooth transition between square-law and linear regions.

Figure 8I-29, "Simplified Single-slope Log Converter Diagram", illustrates a simplied single-slope log converter. The log function is accomplished by Q6A using the transistor characteristic that collector current is the exponential of base-to-emitter voltage. U1 amplifies the detector voltage, driving the emitter of Q6A until the collector current sensed through R21 equals the input voltage. Q6A's emitter voltage is then the log of the input voltage, which passes through Q6B (wired as a diode) to the output.

To make a dual-slope Log Converter, a second pair of transistors with bias current sources is added, as in Figure 8I-30, "Simplified Dual-slope Converter Diagram". Bias currents Ib1 and Ib2 are constant and nearly equal. Q6A and Q6B still carry the logging current Iin;

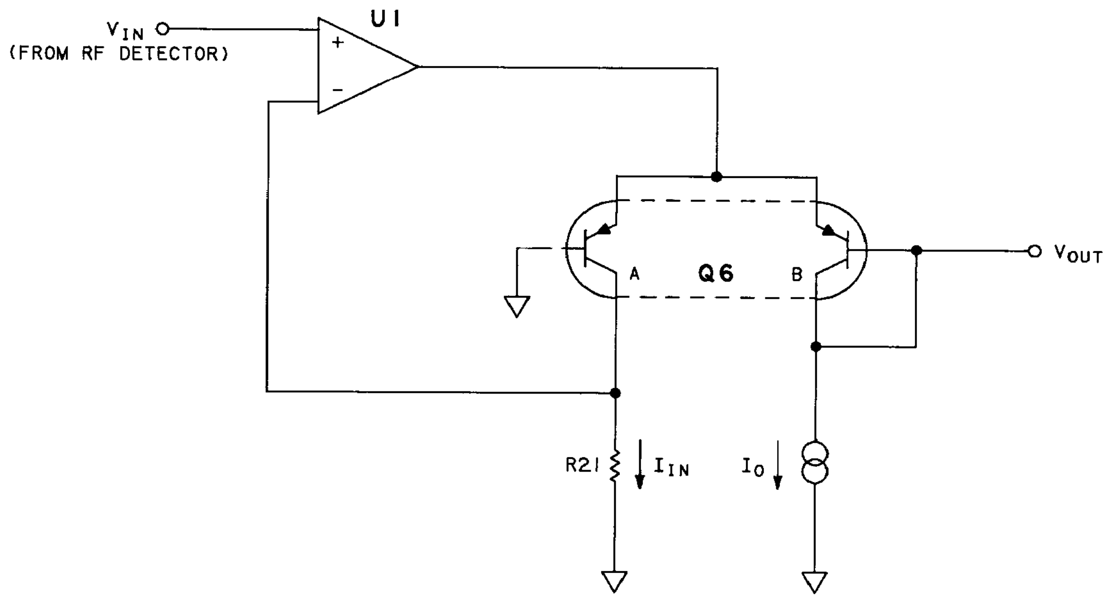


Figure 8I-29. Simplified Single-slope Log Converter Diagram

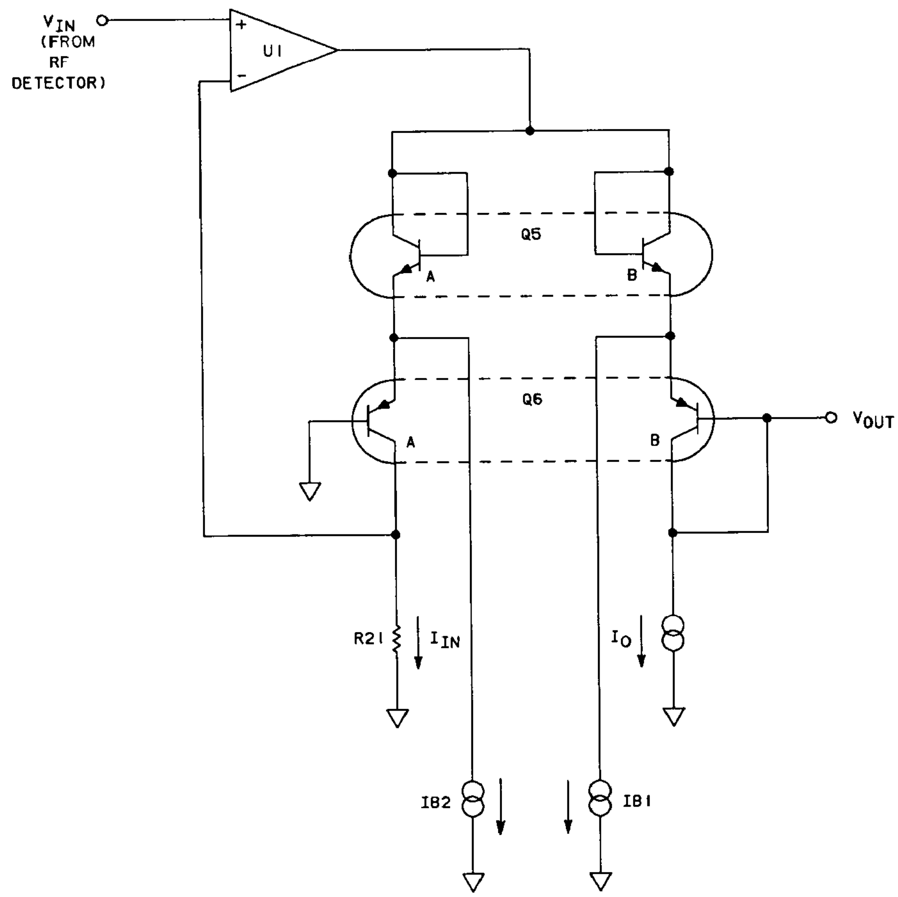


Figure 8I-30. Simplified Dual-slope Converter Diagram however, Q5A and Q5B now carry Ib1 and Ib2 as well. For low power levels (square-law region), assume Iin is much less than Ib1 and Io is much less than Ib2. (Iin = Vin/R21) Then Q5A and Q5B are carrying essentially identical currents, and their base-to-emitter voltages are identical. In effect, then, the emitter of Q6A is at the same voltage as the emitter of Q6B, and the circuit acts like the single-slope logger of Figure 8I-29, "Simplified Single-slope Log Converter Diagram". For high power levels (linear region), Iin is much greater than Ib1. Now Q5A and Q6A both carry the same current Iin (Ib1 can be ignored), and the base voltage of Q5A varies twice as much as the emitter of Q6A (both base-to-emitter junctions contribute to the logging function). Thus, the gain of the logger is doubled when the detectors are in their linear regions, and the Log Converter outputs a voltage proportional to RF power in dBm over a wide range of power levels encompassing both square-law and linear regions.

Internal Detector Log Converter **A**: Q1 and Q2 select the A12 Band 0 Detector or A11 Band 1-4 Detector when appropriate. U2D and U2C, through R33 "L-20" and R34 "H-20", add minute offsets in Band 0 and Band 1-4 respectively to adjust low RF power levels. U1 and Q3 form a low drift, high gain DC amplifier to drive the logger. Q12, Q13, Q14, and Q15 form a high-speed differential AC amplifier to improve the loggers high-frequency response. Q4 sums the DC Amplifier and AC Amplifier to drive current through the logger. Q7 biases Q4. The logger consists of Q5 and Q6, and functions like the simplified dual-slope logger described in Figure 8I-30, "Simplified Dual-slope Converter Diagram". R24 is added to compensate for bulk resistance in Q5A and Q6A at high currents. Q8 and Q9 provide the adjustable bias currents Ib1 and Ib2, respectively. U2B and U2A turn on the logger bias for Band 0 and Band 1-4 respectively. R38 ("L+10") and R108 ("LOFS") adjust the bias for Band 0. R39 ("H+10") adjust the Band 1-4 bias. A thermistor mounted inside A12 Band 0 Detector changes the bias current Ib1 to improve temperature tracking. Q16A provides the bias current Io. Q16B serves to clamp the logger's negative excursions when pulse modulation turns the RF OFF. The clamp voltage is approximately -0.12 Vdc, but varies slightly with changes in power level, reference power level, and temperature to minimize recovery time. Q16B is normally non-conducting.

X5 Amplifier B

Q17, Q18, Q19, and Q23 form a discrete differential amplifier to buffer the Log Converter's high-impedance output. In addition, the LVLCOR (level correction) signal from the A27 Level Control Assembly is summed together with the detected voltage.

Sample/Hold C

The Sample/Hold circuit stores the detected RF level when the RF power is off during pulse modulation. Sampling switch Q25, holding capacitor

C25, and buffer U8 are the key elements. Sampling switch Q25 is controlled by the A21 Pulse Modulator assembly through drivers Q30 and Q31. When Q25 goes open ("Hold" mode), some charge on C25 is lost through gate capacitance. C24 injects a charge into C25 to compensate for this charge loss, adjustable by R58 "BAL". The charge lost through Q25 during switching depends on the gate voltage excursion, which in turn depends on the sample/hold input voltage. Q24 monitors the output voltage and adjusts the excursions of Q25's gate so that the charge lost during switching is independent of power level. During bandswitching, the logger may produce negative transients large enough to accidentally turn on Q25; CR4 and CR5 clamp these excursions. Note that R61 will keep Q25 on if the A21 Pulse Modulator Assembly is removed.

Level Meter Amplifier D

Q20 and U4B buffer and filter the sample/hold voltage level. The amplifier has a voltage gain of approximately 6.6, and a low-pass filter cutoff frequency of only 5 Hz. Temperature sensitive resistors R64 and R66 track the gain drift of the logger. U5B buffers the signal to be read by the ADC on the A27 Level Control assembly. The microprocessor can then monitor the RF power level and display it on the front panel POWER dBm display.

External Log Converter E

If the RF power level is monitored externally though the "LEVELING EXT INPUT", the External Detector Log Converter provides the logging function similar to the log converter in Block **A**. U10 and U6 form an "absolute value converter" to permit both positive and negative detectors to be used. U10 is a non-inverting amplifier with gain of 2.2, so when the "EXT INPUT" is positive, U10 pin 6 goes positive. U6 pin 6 will then go negative, turning CR9 on and configuring U6 like an inverting amplifier to drive the logger through R86. When the "EXT INPUT" is negative, U10 pin 6 goes negative, causing U6 pin 6 to go positive and turn CR9 off. Thus, U6 is effectively removed from the circuit, and U10 drives the logger through R81, R85, and R86 directly. Resistor values are used to make the current to the logger the same for both positive and negative voltages. R80 "EX-" adjusts the voltage offset of U10; R84 "EX+" adjusts the voltage offset of U6.

CR6 prevents large differential voltages from occurring across U6's inputs when it is open-loop (negative ext. inputs). Large differential inputs will turn on U6's internal protection diodes, loading the junction of R81-R85.

U7 and Q22 form an inverting log converter. U7 drives the emitters of Q22A until the collector current equals the input current. (The input current may be driven by either U10 or U6.) Q22B is wired like a diode, and passes the base-to-emitter voltage out. Q21B provides bias current for Q22B. Q21A will clamp the logger's negative excursions to approximately -0.3 Vdc, and is normally turned off. R88 compensates for bulk resistance in Q22A at high logger currents.

Note that when external detectors are used, the Sample/Hold is not effective during pulse modulation. Furthermore, the front panel POWER dBm display will continue to display the internally detected power level (instrument output power), not the externally detected power level.

Function Switches and External Detector Frequency Compensation F

U3 buffers the External Detector Log Converter, with a DC voltage gain of approximately 10. Open-collector drivers U9 and FET swtiches Q27 and Q28 select the internal or external detector signal, as appropriate, for use on the A26 Linear Modulator assembly. Q29 adjusts the frequency compensation for external meter leveling. The U9 open-collector FET drivers pull down to -10 Vdc to turn the FETs off, and float HIGH to turn the FETs on. Refer to Table 8I-1 for a function select truth table.

Level Reference Temperature Compensation G

To compensate for gain drift in the log converters, the reference voltage is made to change with temperature. This is accomplished by inverting amplifier U4A which has a temperature-dependent feedback resistor R101. The temperature-compensated reference voltage (TCREF) goes to the A26 Linear Modulator board where it is summed with AM and marker inputs, then compared to the output of the A25 ALC Detector board.

Power Supply H

LC filtering removes noise from the +20VF and -10VF lines for use on the A25 ALC Detector Assembly. Additional RC filtering keeps +20VL and -10VL extra clean for use in the internal logger. The +1.5VF is the TTL reference voltage for the comparators.

Table 8I-1. Function Select Truth Table

Leveling Mode		Q27	Q28	Q29
Internal		ON	OFF	OFF
External	Crystal Detector	OFF	ON	OFF
	Power Meter	OFF	ON	ON
Unleveled (Shift Meter)		OFF	OFF	OFF

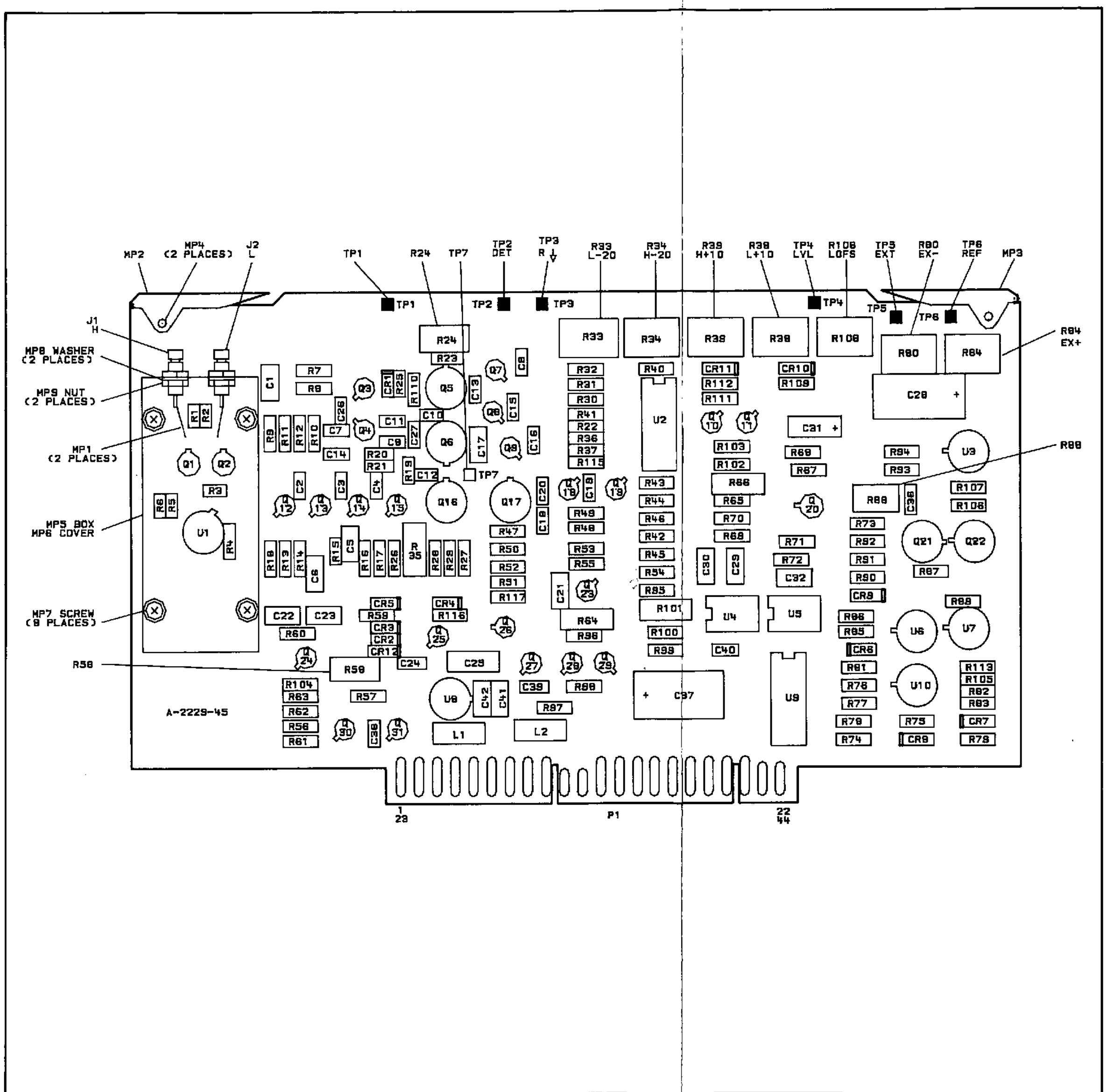


Figure 8-31. A25 ALC Detector, Component Location Diagram

A25 ALC Detector P1 Pin I/O

A25

Pin	Mnemonic	Levels	Source	Destination
1 23				
2 24	DET S/H + DET S/H −	+4.5/+3.5V +3.5/+4.5V	XA21P1-3 XA21P1-21	C C
3 25	HPLSEN	TTL (HIGH TRUE)	XA26P1-2	*NOT USED
4 26	THERM 1 THERM 2	−1V TO −8V −10V	A62J34-3 A62J34-1	A A
5 27	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*H *H
6 28	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*NOT USED *NOT USED
7 29	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*H *H
8 30				
9 31	GND GND	0V 0V	A62 STAR GND A62 STAR GND	* *
10 32	GND DETOUT	0V −30mV/dB, 0V = 0dBm	A62 STAR GND F	* XA26P1-10
11 33	 DETLVL	 −200mV/dB, 0V = 0dBm	 D	 XA27P1-29
12 34	RGND RGND	0V 0V	STAR GND POINT STAR GND POINT	*H *H
13 35	LVLREF TCREF	0.2V/dB, 0V = 0dBm −200mV/dB, 0V = 0dBm	XA27P1-30 G	G XA26P1-12
14 36	LVLCOR HMTR	+1.25dB/VOLT, 0V = 0dB TTL (HIGH TRUE)	B XA26P1-13	XA27P1-62 A F
15 37	 LHET	 TTL (LOW TRUE)	 XA27P1-20	 *A
16 38				
17 39	 LDETBW	 TTL (LOW TRUE)	 XA26P1-9	 *NOT USED
18 40				
19 41				
20 42	 HINT	 TTL (HIGH TRUE)	 XA26P1-42	 F
21 43	 EXDETR	 0V	 *	 E
22 44	 EXDET	 0.5mV − 2V	 A62J16 SMC CENTER	 E

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

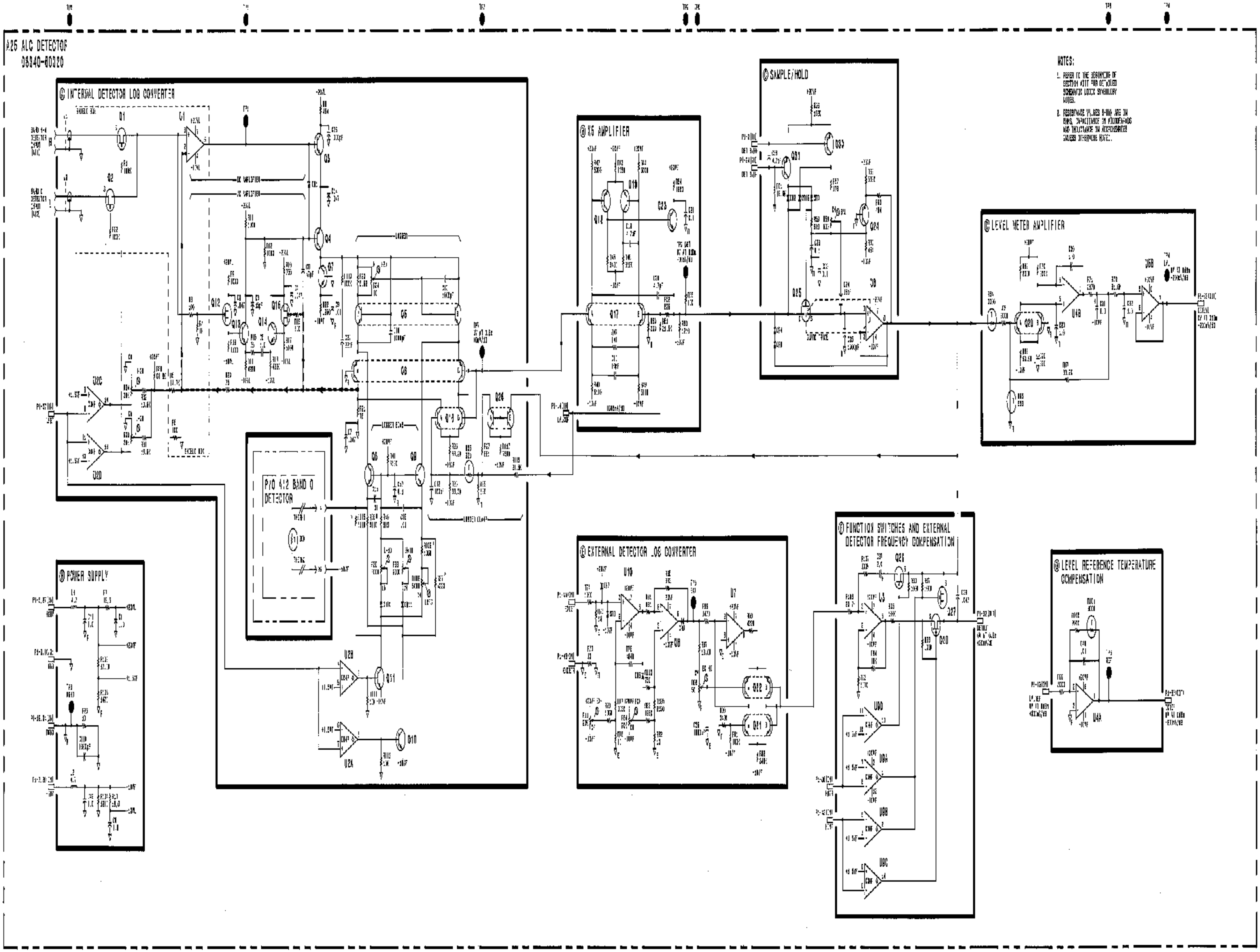


Figure 8A-12. A25 ALC Detector, Schematic Diagram

8-763/8-764

A26 LINEAR MODULATOR, CIRCUIT DESCRIPTION

Introduction

The A26 Linear Modulator assembly compares the detected RF power level against the level reference voltage, and drives the RF modulators to correct any errors. This closes the ALC loop and levels the RF power. The amplitude modulation (AM) input is logged and added to the level reference on this assembly.

AM Log Converter A

U12 buffers the front panel "AM MODULATION INPUT" with approximately unity gain. U1 and Q24 form the log converter. (See Figure 8I-33, "External AM Log Converter, Simplified Diagram", and Figure 8I-34, "HLBW Algorithm".) U12 drives a current through R23 to U1; a constant bias current Ib (through R26) establishes the operating point of the logger. U1's output will drive the emitter of Q24A until its collector current equals the total input current. The base-to-emitter voltage is then logarithmically related to the input voltage. This voltage is sensed through Q24B to the output. U2 buffers the log converter's high output impedance, and has a voltage gain of about 10. FETs Q23 and Q1 switch out the log converter when AM is not selected.

ALC Loop Integrator B

The ALC loop summing node is at the source of FET Q16. At this point, the detected RF power level voltage (DETOUT) is summed with the reference power level voltage (TCREF). When the loop is closed and leveled, these signals should be equal and opposite, thus perfectly cancelling. If they do not cancel, the error current is integrated by U8 and changes the RF modulation level to correct the power level. The marker pulses (HMRKR) and logged external AM (if enabled) are also added to the summing node.

U8 is the main ALC amplifier, forming an integrator with capacitor C6 (ALC Loop BW = 100kHz). C15 is switched in parallel with C6 by FET Q20 in any externally leveled mode (ALC Loop BW = 20kHz). Under a variety of conditions, C7 is also connected in parallel with C6 (ALC Loop BW = 7 kHz; see Figure 8I-34, "HLBW Algorithm"). Q17 clamps the negative voltage excursions of U8 to about -3.9 V when the loop goes unleveled. Likewise, Q18 clamps the positive excursions to about +0.5 V. U11B and Q25 alter the bias on these clamps when HRFON goes LOW to turn the RF power off, clamping the MODLVL voltage at about -3.0V. When external power meter leveling is selected, FET switch Q30 is closed to put C23 across Q25's control line. This makes the "turn-on" time at bandswitches or beginning of sweep very slow and avoids ALC overshoot due to slow power meter response times. (Leveled ALC Loop BW is not affected.) Q10 is normally off, but can be turned on to shunt R17 across the integrating capacitors C6, C7, and C15. This makes U8 an inverting amplifier instead of an integrator for the open-loop mode. Q10 also parallels R3 with R58, doubling the reference sensitivity to achieve a wide control range when open-loop.

Overmodulation/Unleveled Detectors C

The MODLVL voltage will remain within certain bounds when the RF power is leveled. If MODLVL exceeds these bounds, comparators detect the condition and send the information to the microprocessor. Q27 and U14 detect excessive amplitude modulation. When MODLVL falls below about -3.6 V, Q27 turns on, trips U14, and sends LOMD to A27 for the microprocessor to read. Likewise, Q26 and U13 detect the MODLVL when the RF modulators are no longer attenuating and the RF power is unleveled. If MODLVL rises above about +0.2 V, Q26 will turn on and trigger U13 to send LUNLVL to A27. Both functions are disabled by Q28.

Jumper W1 allows instruments with a serial prefix of 2320A and above to be immune to a problem where the UNLEVELED annunciator may go ON briefly after the end of sweep. This problem occurs because the YO and the SYTM may not track after end-of-sweep. If they do not, the power to the leveling detector may decrease. The ALC loop will try to compensate for the decrease in power and generate an UNLEVELED condition.

W1 must be in position B for instruments with a serial prefix of 2320A or higher. This position allows HSP (HIGH SWEEP) to turn on Q28, directly disabling the OVERMODULATION/UNLEVELED circuitry at end-of-sweep.

W1 must be in position A for instruments with a serial prefix of 2319A or before. This is because HSP does not go to the A26 assembly in these units. Instead, the processor turns on Q28 to disable OVERMODULATION/UNLEVELED via COMPEN. The problem occurs because during sweep the processor is disabled (to reduce system noise). When the processor activates at end of sweep, it receives a service request (LSRQ). After determining the cause of the service request from A59 Block I, the processor programs COMPEN to disable the OVERMODULATION/UNLEVELED Detectors. By the time the processor has done all this, however, an UNLEVELED condition may have already occurred. This problem only affects the Maximum Leveled Power Test in Section IV, PERFORMANCE TESTS. Actual instrument Performance is not affected.

ALC Modulator Switch D

FET swtiches Q21 and Q22 select either the Band 0 (P/O A8) or Band 1-4 (P/O A16) RF modulators to be driven by the Modulator Driver. In Band 0, U4PW14 goes LOW, causing U11D pin 14 to go to ground to turn Q21 ON. At the same time, U11C pin 8 goes HIGH to turn Q22 OFF. Note that U11C also turns the HIGH band switch (P/O A16) off in Band 0. (Refer to the Figure 8I-42, RF Section Schematic Diagram.) In Bands 1-4, the situation is reversed: Q21 is off, and Q22 is on. R62 sinks a fixed current from the exponential current mirror in Band 0, as described above. In Band 1, R61 sinks this current; in Bands 2-4, R60 in parallel with R61 sinks the bias current. In bands 1-4, Q31 and R56 source 25 mA to the Band 0 Pulse Modulator to help reduce 3.7 GHz spurious outputs.

ALC Loop Function Switch Drivers E

U15 latches digital information from the microprocessor to control the major ALC functions. Many of U15's outputs are used on other boards in the ALC loop. HMTR and HINT determine the primary leveling mode. These two lines, with decoders U10C and U10B, drive comparators to control the Main ALC Amplifier. See Table 8I-2 for their functions. The other lines and comparators control functions for loop bandwidth, enable amplitude modulation, and enable the OVERMODULATION/UNLEVELED comparators. U9C controls the A12 Band 0 Detector bandwidth.

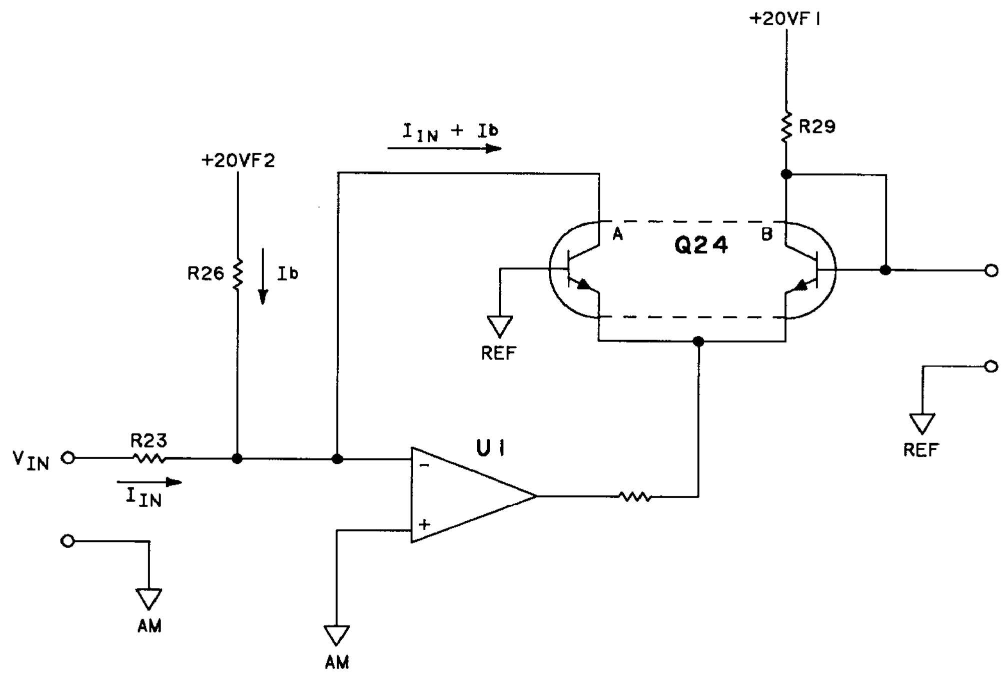
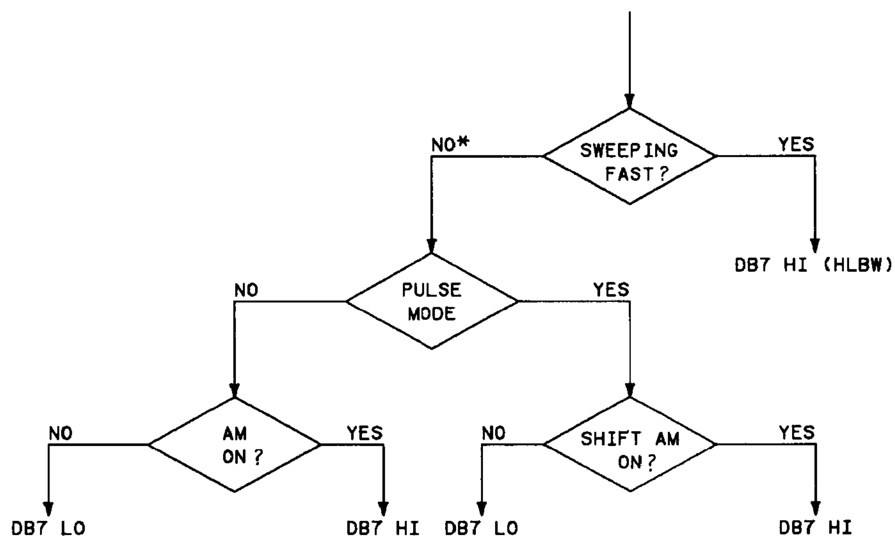


Figure 8I-33. External AM Log Converter, Simplified Diagram



FAST SWEEP: <5 SEC

*INCLUDES MANUAL & CW

SHIFT AM ACTIVATES AM

TURNING AM OFF DE-ACTIVATES SHIFT AM

Figure 8I-34. HLBW Algorithm

Table 8I-2. HMTR and HINT Functions

HMTR	HINT	
	Low = 0	**High = 1**
High = 1	External Power Leveling	"Open-Loop"
Low = 0	External Crystal Leveling	Internal Leveling

Band Switch Drivers F

U4 decodes the band information from HLB0, HLB1, and HLB2. Each output goes LOW for the selected band, causing the output of each respective comparator to go HIGH for the selected band. U10A senses the Band 0 and Band 1 lines, but actually drives U11A pin 1 HIGH during Bands 2-4 to alter the modulator bias for the multiplying bands.

ALC Modulator Driver G

The ALC loop gain is adjustable for each band separately. Q2, Q3, Q4, Q5, and Q6 select the MODLVL to pass through an adjustment for Band 0 through 4 respectively. U7 buffers this voltage for Bands 2-4 and sends it to the A24 assembly for use in biasing the Step Recovery Diode in the A13 SYTM. Each of the five adjustments drives the emitter of Q15B one at a time. Q15B forms a common-base current summing node. Q7 and Q8 form an "exponential current mirror" to drive current through the RF modulators.

The exponential function is desirable to linearize the RF modulators' attenuation characteristics. (See Figure 8I-35, "Modulator Characteristic".) The RF attenuation of the modulator is a very non-linear function of drive current. If plotted on log-log paper, however, the plot is straight over the high current end of its range. Therefore, converting the MODLVL voltage to an exponential current would best fit the modulators' characteristics at high attenuation levels. To track the modulator curve better at low attenuation, simply subtracting a fixed current from the exponential current mirror's output will "bend" the modulation curve on log-log paper. This gives the desired result; RF attenuation in dB is proportional to the MODLVL voltage. In Bands 2-4, non linearities in the power transfer characteristics of the A13 SYTM require additional modulator drive shaping.

R54 and Q15A bias Q15B's emitter at about 0.0V. Q15B is a common-base current summing node. Q15's collector current is the same as the emitter current. Q8, with R85 and R55, form an exponential current mirror; current through Q8A causes a voltage drop across R85 and R55. This causes Q8B's base-to-emitter voltage to change linearly, causing Q8B's collector current to change exponentially. Q7 is added in a Darlington configuration to buffer Q8B. R86, R87, R88 "MO" (Modulator Offset), and R44 provide a bias current to the exponentiator input (Q15 emitter) so that when "mod level" (TP3) is at 0 volts, the exponentiator will be outputting some current. This current equals the current being shunted from the modulators by R61 and R62. Q14 increases the bias in bands 2 - 4, compensating for the increased shunt current through Q29 and R60 in those bands.

Power Supply H

The power supply filtering consists of ordinary LC filters. R80 and R81 generate the +1.5VF reference voltage for TTL comparators.

Slow Rise Time Pulse Driver I

Fast rise time pulse modulation produces a very broad spectrum of RF Harmonics, resulting in errors with some measurements. For this reason, the 8340A has a pulse modulation mode implemented through the linear modulator. This mode produces pulses with approximately 2 usec rise and fall times. The mode is activated by pressing **[SH] [PULSE]**, and hooking the pulse input to the AM jack. The pulse input requirements are: -6V = off, > -2V = on. This works with the +-6V modulator drive produced by the 8755C or 8756A.

When **[SHIFT] [PULSE]** has been pressed, the front panel AM light comes on and the AM signal (U9 pin 13) goes low, disabling normal AM circuitry. HSRT goes high, forcing U3 pin 1 low, thereby enabling the Q32/Q9 comparator circuit. When the AM input voltage is more positive than -3V, Q32 is on and Q9 is off. When the AM input voltage becomes more negative than -3V, the base of Q32 is pulled negative through CR3, causing the comparator to switch states and turn Q9 on. This pulls current through CR9, CR10, and CR14.

With no current through CR14 (AM input more positive than -3V) the network R95-R98, L7, and CR13 does nothing because it is connected from ground to a point at ground potential (emitter of Q15, located in Block **G**). When the AM input is more negative than -3V and Q9 is on, current is drawn through CR14, L7, R96, R95, and the emitter of Q15. Removing current from the emitter of Q15 causes increased current to the linear modulator, causing the RF power to drop by at least 40 dB. L7 slows this transition producing the 2 usec fall time.

When the AM input is more positive than -3V the comparator changes states, leaving Q9 off. This change in current through L7 causes an inductive kick which forward biases CR13. This positive pulse through R95 into Q15's emitter speeds the turn-on of the modulator, which would otherwise have a long rise time due to its long carrier life.

When the AM input goes more negative than -3V (to shut off the RF), it is necessary to open the integration gate Q16, thereby holding the MODLVL voltage at a constant value. When Q9 conducts, some of its collector current goes through CR10 and CR9 to the base of Q12, opening the integration gate. When the input goes positive, the inductive kick from L7 back biases CR10. C36 discharges slowly, delaying the closing of the integration gate. This assures that the RF has reached the proper level.

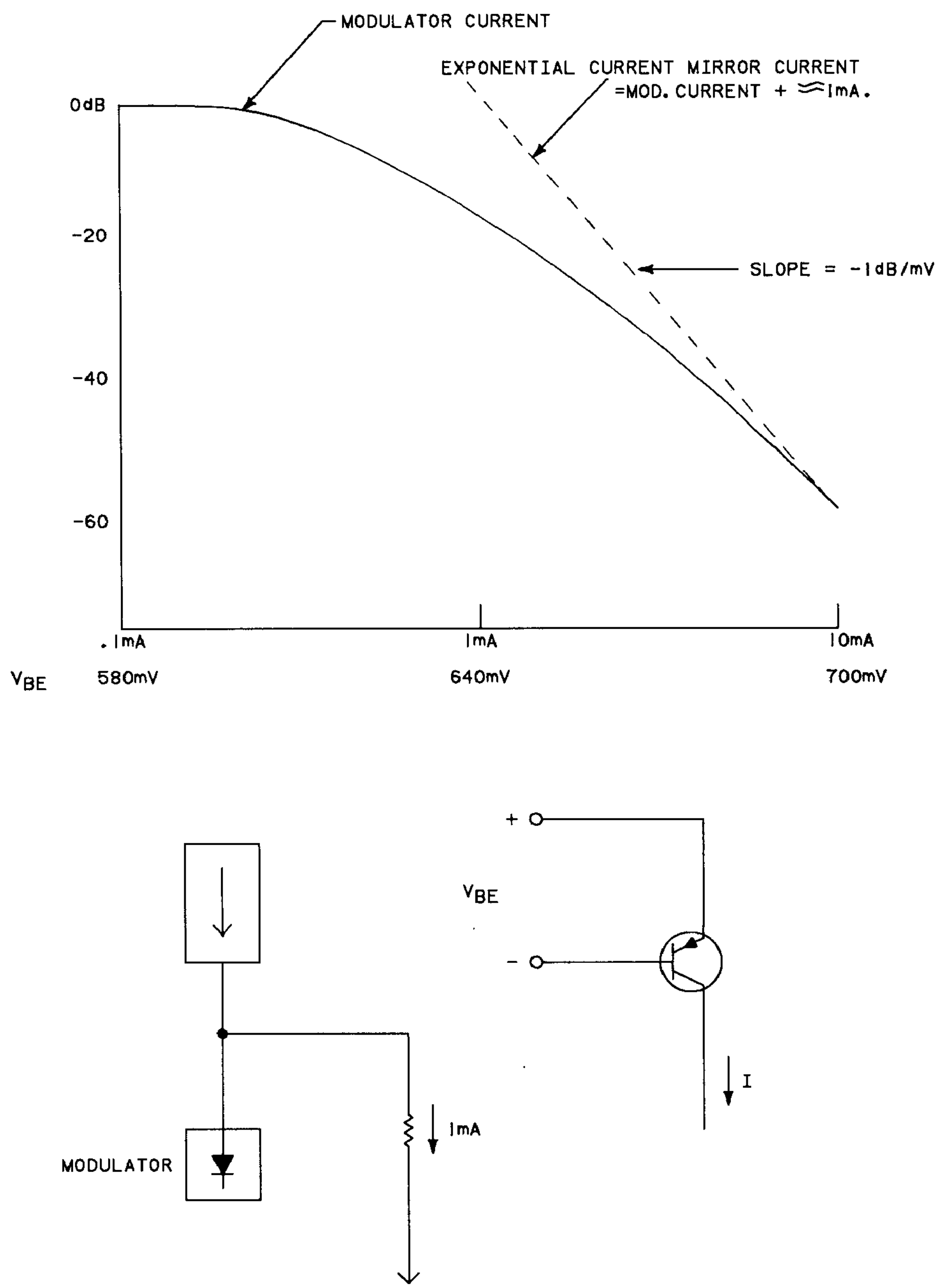


Figure 8I-35. Modulator Characteristic

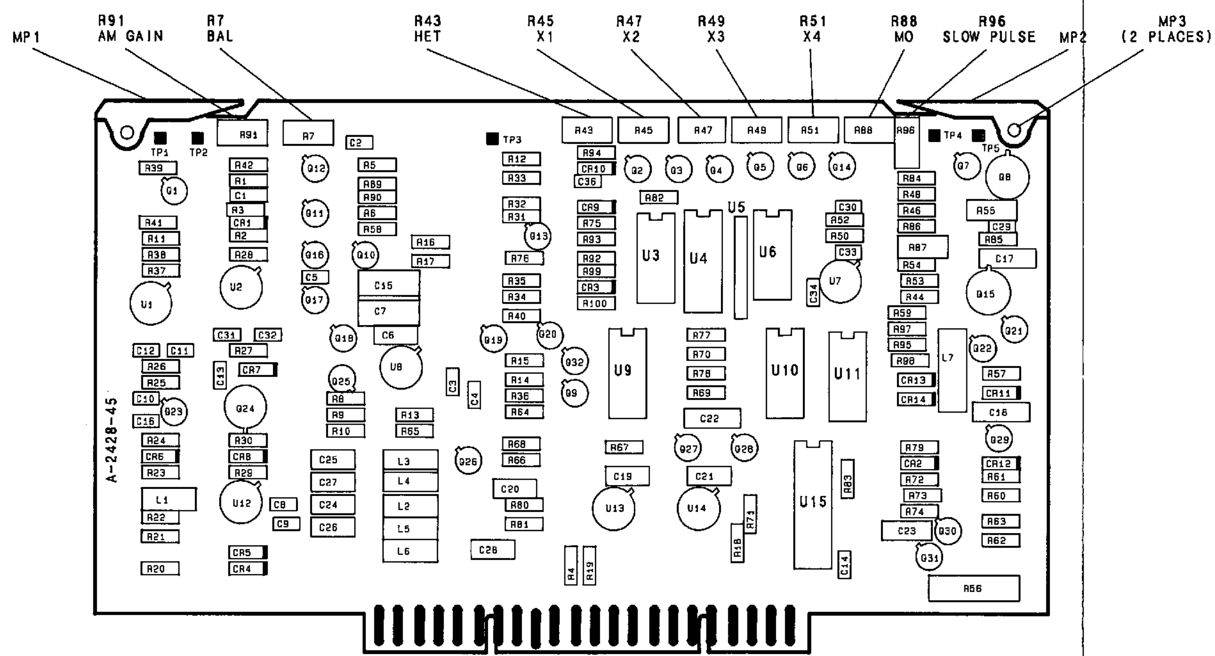


Figure 8I-36. A26 ALC Modular Component Location Diagram

A26 Linear Modulator P1 Pin I/O

A26

Pin	Mnemonic	Levels	Source	Destination
1 23	LMODHLD LHIBND	TTL TTL (LOW TRUE)	XA21P1-2 D	B A62J19 PIN 15
2 24	HPLSEN HRFON	TTL (HIGH TRUE) TTL (HIGH TRUE)	E XA57P1-105	* *B
3 25	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*H *H
4 26	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*H *H
5 27	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*H *H
6 28	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*H *H
7 29	HSP HLB0	TTL (HIGH TRUE) TTL (HIGH TRUE)	XA57P1-13 XA27P1-46	* *F
8 30	LOMD HLB1	TTL (LOW TRUE) TTL (HIGH TRUE)	C XA27P1-16	XA27P1-48 *F
9 31	LDETBW HLB2	TTL (LOW TRUE) TTL (HIGH TRUE)	E XA27P1-47	*XA25P1-39 *F
10 32	DETOUT MODLVL	−30mV/dB, 0V = 0dBm 0V TO −3V (LEVELED)	XA25P1-32 B	B XA27P1-61
11 33	RGND HLBW	0V TTL (HIGH TRUE)	STAR GND POINT E	*H XA21P1-6
12 34	TCREF RGND	−200mV/dB, 0V = 0dBm 0V	XA25P1-35 STAR GND POINT	B *H
13 35	HMTR DB11	TTL (HIGH TRUE) TTL	E *	XA25P1-36 *E
14 36	LHET LUNLVL	TTL (LOW TRUE) TTL (LOW TRUE)	XA27P1-20 C	*NOT USED XA27P1-52
15 37	DB0 DB1	TTL TTL	XA60P1-20 XA60P1-76	*E *E
16 38	DB2 DB3	TTL TTL	XA60P1-21 XA60P1-77	*E *E
17 39	DB4 DB6	TTL TTL	XA60P1-22 XA60P1-78	*E *E
18 40	SRD BIAS CONT DB7	0 TO −5V (LEVELED) TTL	G XA60P1-79	XA24P1-13 *E
19 41	AM IN AM RTN	±1V MAXIMUM 0V	A62J15-SMC CENTER *	A A
20 42	MODHI HINT	CURRENT SOURCE TTL (HIGH TRUE)	D E	A62J13-SMC CENTER XA25P1-42
21 43	MOD RTN HMRKR	0V TTL (HIGH TRUE)	D XA57P1-2, 12	A62J13-SMC SHIELD B
22 44	MODLO WMOD	CURRENT SOURCE TTL (LOW TRUE)	D XA27P1-59	A62J14-SMC CENTER *E

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

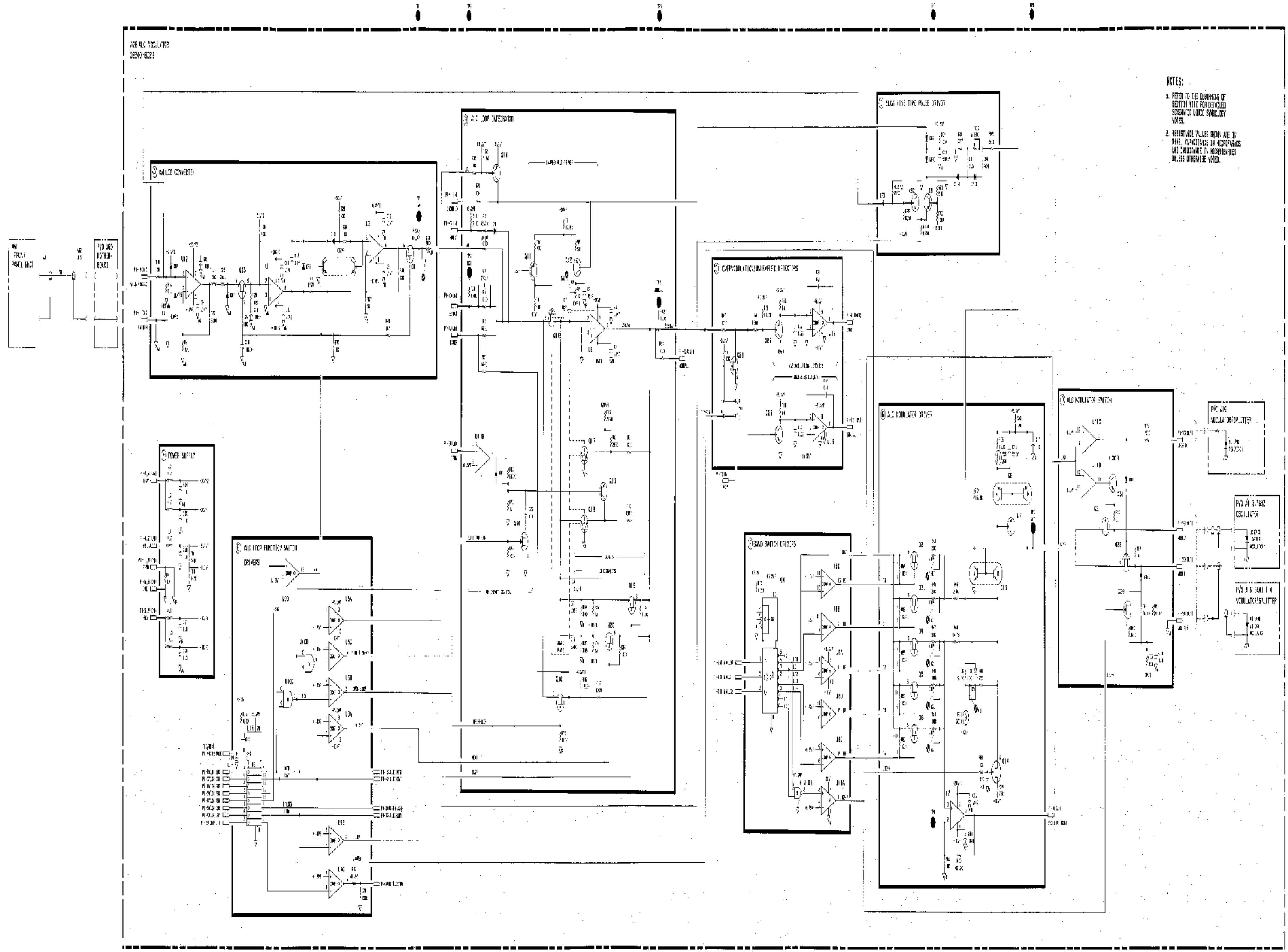


Figure 8I-37. A36 ALC Modulator, Schematic Diagram

S-7993-60C

A27 LEVEL CONTROL ASSEMBLY, CIRCUIT DESCRIPTION

Introduction

The A27 Level Control board performs the following functions:

- Flatness Compensation - provides error compensation to the ALC as a function of frequency.
- Power Sweep Control - uses the RF Sweep to generate a processor-controlled power level sweep.
- ALC Reference Generator - controls the reference voltage for the A26 Linear Modulator's Level Control Circuits.
- Test ADC - (Analog-to-Digital Converter) monitors any one of several dc levels (modulation level, sweep voltage, ALC level, etc.) via an analog multiplexer. The ADC sends a digital equivalent of the chosen dc voltage to the instrument processor.

Band Switch Control A

A 74LS175 latch (U28) is used to latch data bits 0,1 & 2 off of the data bus when WBAND strobe (U27 pin 13 Block **B**) goes LOW and then HIGH. These latched data bits produce the encoded latched band information HLB0 (U28 pin 2), HLB1 (U28 pin 7) and HLB2 (U28 pin 10).

LHET is decoded by using a NAND gate as a dual negative input OR gate (U26B). The inverting outputs of latch (U28) HLB1-not (U28 pin 6) and HLB2-not (U28 pin 11) go to this NAND gate and cause its output (LHET U26 pin 6) to go HIGH when either input (U26 pin 4 or 5) goes LOW.

Address Decoding B

The I/O strobe decoding consists of two 74LS138 3 line to eight line decoders (U20 & U27) and one NAND gate (U26A) connected as an inverter. These two decoders decode address lines A0 through A4 and SIOA I/O strobe to produce input and output strobes for the RF section of the instrument.

20 GHz Breakpoint Slope Compensation C

The 20 GHz breakpoint is used to compensate for directional coupler forward losses and coupler detector coupling losses which occur beyond 20 to 23 GHz.

The breakpoint circuit is exactly the same as the 9 GHz breakpoint except the breakpoint will occur when the voltage on the V/GHz line is -10.0(R6/R7+R8).

The output of this breakpoint circuit is connected to the V referance input of a NE5018 DAC (U10 pin 14). This DAC is exactly as described for the attenuator slope compensation DAC or 9 GHz Breakpoint DAC.

9 GHz Breakpoint Slope Compensation D

At about 9 GHz the detector's specifications indicate that it could have either increasing or decreasing output versus frequency. Since the detector's specifications indicates that either situation could occur from unit to unit, a bipolar breakpoint was placed at approximately 9 GHz.

When creating a correction to the level reference voltage to compensate for detector losses, the following must be considered: If the output of the detector decreases for any reason, the ALC circuitry will increase the output power to force the detector output to be the same. So to compensate for detector losses we must create a correction that decreases the level reference.

The location of the breakpoint (the frequency at which the correction begins to occur) is controlled by an amplifier with diode feedback paths. An op-amp (U4B) has a diode (CR3) in series with its output (U4B pin 7) so whenever its output voltage is less than zero volts the diode will be reverse biased. Furthermore, a diode clamp (CR2) clamps its output (pin 7) to be no more negative than one diode drop. When its output (pin 7) is positive, the series diode (CR3) is forward biased, the diode clamp (CR2) is reverse biased and the op-amp is now in a standard inverting gain configuration with a 10K feedback resistor (R5). The V/GHz line (-0.25 V/GHz) and an offset are summed into the inverting input of the op-amp (U4B pin 6). The offset resistor (R3 + R4) is connected to the +10.00 volt precision reference. The input resistor (R2) is connected to the V/GHz line. As long as the current provided by the offset resistor (R3 +R4) is greater than the current sunk by the input resistor (R2), the output of this circuit will remain at 0 volts. As soon as the current sunk by the input resistor is greater than that provided by the offset resistor, the output of the circuit will begin to increase at a rate of +0.25 V/GHz since the amplifier has a gain of 1. The breakpoint will occur when the voltage on the V/GHz line equals 10.0 V(R2/R3+R4). The offset resistor is a fixed resistor in series with a pot so the point at which the breakpoint occures can be adjusted over some range.

The output of this breakpoint circuit is connected to the V reference input of a NE5018 DAC (U9 pin 14). This DAC is exactly the same as the attenuator slope DAC. When the digital input is 0 the output is -V reference, when the digital input is 128 the output will be 0 volts and when the digital input is 255 the output will be +(127/128) * V reference.

Attenuator Slope Compensation E

Attenuator slope compensation is used to increase or decrease the level reference voltage as a function of frequency. When this reference is increasing, it causes the leveling circuitry to increase the output power as a function of frequency to compensate for power losses in the attenuator or cabling between the detector coupler and the output of the 8340A.

In Band 0 this slope compensation is used to compensate for the frequency response of the Band 0 detector. Since the Band 0 detector can have either a positive or negative slope versus frequency response, it was necessary to make this compensation circuit bipolar.

The rate at which the output power increases is determined by the number written into the attenuator slope compensation DAC (U8). This number may be different for each RF attenuator step if their frequency characteristics are different.

The frequency reference for this circuit is the V/GHz line which comes from the A28 SYTM driver board. The voltage on the V/GHz line is -0.25 volts per GHz. V/GHz is derived from the pretune voltage.

The V/GHz line goes into an inverting amplifier (U5B pin 6) which has a gain of -(10/12.1). This gain block is necessary since the reference voltage required at the DAC (U8 pin 14) must be positive.

The Signetics NE5018 DAC is used for all three compensation DACs (U8, U9, and U10). It contains input latches and an output buffer. Inside this DAC, the reference voltage is converted into a reference current.

Digital data is latched off of the data bus when the Latch Enable signal (U8 pin 10) goes LOW. This latched data controls the current switches inside the DAC to produce a current that is proportional to the Reference voltage and the latched digital information. This current is then fed into a current-to-voltage conversion stage and appears at the output (U8 pin 18) as a voltage which is proportional to the voltage on the VREF input (pin 14) and the digital information.

The diode (CR1) connected to the summing node of the DAC (U8 pin

20) prevents the summing node from droping more than a diode drop below ground and therefore improves the DACs settling time.

A capacitor (C10) is connected in parallel with the internal feedback resistor (U8 pins 18 and 20) provides high frequency stabilization under all conditions. Another capacitor (C9) is connected between the summing node and the amplifier compensation pins (U8 pins 20 and 21) and is required to make the output amplifier as fast as possible while still remaining stable.

Cable Slope Compensation F

The Cable Loss TC Compensation is accomplished by summing a modified form of the V/GHZ voltage into the summing amp (U5A pin 2). R70 and R71 form a voltage divider which decreases the temperature compensation for front panel output options where the cable length is short. The amount of compensation at 25 degrees C is approximately 0.0027 dB/GHz. In the rear panel options where the cable length is long, R71 is removed and R70 is shorted to provide 0.0052 dB/GHz compensation at 25 degrees C. Since RT1's resistance decreases as its temperature increases, the amount of compensation increases with temperature.

Compensation Summing Amplifier G

The summing amplifier (U5A) sums four compensation terms together with the correct polarity and gain.

The Attenuator Slope Compensation is summed into the inverting input (U5A pin 2). This signal has a gain of -2.5. The NE5018 DACs have a voltage gain of 2 so the overall gain from input (R58 in Block E) to output (U5A pin 1) is = -4.13. One GHz Change in frequency will produce -0.25 volts change of the V/GHz line and 1.033 volts change at the output (U5A pin 1). The sensitivity of the LVLCOR output (U5A pin 1) is 1.25 dB/V so the above 1.033 volts represents a change in power of 1.033 V(1.25 dB/V)=1.29 dB. The above was assuming that the DAC was set at full range (input = 255). If we now want to know the effect that one bit change of the DAC has on the output we divide by the number of bits (256). The resulting sensitivity of the Attenuator Compensation DAC is (1.29 dB/GHz)/256 bits=0.00504 dB/GHz/Bit which is approximately 0.005 dB/GHz/Bit.

The 9 GHz Slope Compensation is summed into the inverting input (U5A pin 2) with a gain of -1.0. The overall gain is 2.0. One GHz change in frequency will produce 0.50 V change at the output. The resulting sensitivity of the 9 GHz Slope Compensation is [0.50 V/GHz(1.25 dB/V)]/256 Bits=0.0025 dB/GHz/Bit.

The 20 GHz Slope Compensation is summed into the inverting input

(U5A pin 2) with a gain of -2.0. The overall gain is 8.0. One GHz change in frequency will produce 2.0 V change at the output. The resulting sensitivity of the 20 GHz Slope Compensation is [2.0 V/GHz(1.25 dB/V)]/256 Bits=0.01 dB/GHz/Bit.

Cable losses after the ALC detector must be accounted for by increasing the compensation voltage as a function of frequency. This cable loss increases with increasing temperature; therefore a temperature-dependent frequency compensation must be summed in.

ALC Reference Generator H

A CMOS 10-bit multiplying DAC (U14) is used to control the reference voltage for the Level Control circuits.

The temperature accuracy of the entire leveling system cannot be any better than the reference voltage. Therefore an AD581L 10.00V precision reference (Q1 in Block S) is used for the reference into the level DAC. The T.C. of this device is less than 5 ppm. The +20 volt supply is used as the input voltage (Q1 pin 1) to minimize the load on the +15 V supply that is created on this board.

From this 10.00 volt reference, the level DAC (U14 pin 15) creates a current that is a function of the 10-bit digital input. Each LSB represents 1/1024th of the reference current. The current created above is a differential current between I1 (U14 pin 1) and I2 (U14 pin 2). Internal to the CMOS DAC (U14) there is a feedback resistor connected between I1 and RFB feedback (U14 pin 16). This resistor's value tracks the T.C. of the current produced by the DAC.

I1 is connected to the inverting input of the output op-amp (U17 pin 2). I2 is connected to the non-inverting input of this op-amp (U17 pin 3) and to reference ground. The feedback resistor (U14 pin 6) is connected to the output of the op-amp (U17 pin 6).

If we consider the op-amp ideal, then the voltage at I1 must be zero; furthermore, the input current to the op-amp must be zero. The current sourced by the DAC must go somewhere and therefore the op-amp produces a voltage at its output that is exactly sufficient to sink this I1 current through the feedback resistor. This produces a voltage drop that is proportional to Rfeedback. A larger digital value increases I1 in proportion, and the voltage at the output of the op-amp (U17 pin 6) must become more negative to sink the appropriate amount of current through Rfeedback.

From the above we can conclude that the voltage produced at the output will be negative and will be between 0 volts and

(1023/1024) * Vref.

A schottky diode (CR8) is placed accross the I1 and I2 pins of the DAC. This prevents the voltage at these pins from exceeding the supply voltage during turn-on which would cause latch-up.

The digital inputs to this DAC are latched off of the instrument data bus by two 74LS174 6-bit latches (U13 & U16). The clock for these latches is the WLEVEL strobe (U27 pin 14 in Block **B**). The outputs of these latches are pulled up to the 5 volt supply with 1K ohm resistors. These pullups reduce the magnitude of digital noise feeding through the latches by pulling each output up hard to the supply.

Power Sweep Generator I

The level sweep DAC provides the power sweep function by sweeping the level reference as a function of the sweep ramp. This feature may also be used by the customer to compensate for line length external to the 8340A.

The operation of the level sweep DAC (U24) circuitry is exactly the same as the level DAC (U14) except that its reference voltage (U24 pin 15) is the RF Sweep ramp. This input linearly varies between 0 and +10 volts as the frequency sweeps between the start and stop frequency. The RF Sweep ramp is clamped to ground and VDD by two schottky diodes to prevent any latch-up problems. The operation of output op-amp (U31) and the input latches (U23 & U30) is the same as the equivalent circuitry in the ALC REFERENCE GENERATOR, Block **H**.

Fail Test LED K

The Fail Test LED is used to indicate that an error condition has been detected on the level control board during self test using the ADC to check the major functional blocks on the board. This LED is turned on and off by the processor.

ADC Control Latch L

A 74LS174 (U29) is used to latch six control signals off the data bus when the WADCC strobe (U29 pin 9) goes LOW. These signals are LOW CNVERT ALWAYS (U29 pin 2), LOW DON'T CNVERT (U29 pin 15), LOW AMUX0-2 (U29 pins 5, 12 & 7) and HIGH SRQ DISABLE (U29 pin 10).

ADC Clock/Control M

The clock for the ADC is generated by a schmidt trigger input NAND gate with RC feedback. The clock frequency is not critical and can vary by as much as 2:1 without causing any problems. This clock is controlled by several digital signals (U6B pins 10,12 & 13). Assume that one of the clock control signals is LOW thus disabling the clock and causing the output (U6B pin 8) to be HIGH. When the output of this circuit is HIGH, the feedback input (U6B pin 9) will also be HIGH after a period of time. If the clock circuit is enabled by all of the clock control signals going HIGH, the clock output (U6B pin 8) will immediately go LOW. The feedback input (U6B pin 9) will begin to head towards 0 volts at a rate determined by the RC time constant formed by R21 and C32. As soon as this voltage reaches the trigger threshold of the NAND gate, the clock output will go HIGH. The feedback input will head towards Vout at a rate determined by the RC time constant. As soon as this voltage reaches the trigger threshold of the NAND gate the clock output will again go LOW and the cycle will be repeated until one of the control lines (U6B pins 10,12 or 13) is pulled LOW.

Clock control enable U6B pin 10 is connected to LA-D SRQ so that the clock circuit is disabled whenever the ADC is being read. When the conversion is complete, the rising edge of the ADC clock (U6B pin 8) clocks the up/down counter (U1 pin 2 Block **Q**) which causes its RCO signal (U1 pin 15) to go HIGH. This clocks the conversion complete flip/flop (U21A pin 3 in Block **Q**) causing SRQ (U21A pin 5) to go LOW. The ADC clock must be disabled before the next falling edge of the clock to eliminate any partial clock pulses. Clock control enable U6B pin 13 is driven by the latched control line LOW DON'T CONVERT (U29 pin 15 in Block **L**). This signal allows the instrument processor to prevent the ADC clock from running when it is not being used. Clock control enable U6B pin 12 is driven by the output of a NAND gate (U26B pin 11) used as a dual negative input OR gate.

If either U26B input goes LOW, the clock circuit will be enabled. The first input (U26B pin 13) goes to L CNVERT ALWAYS. Any time this line is LOW, the clock will be enabled to run. The other input (U26B pin 12) is driven by a four input NAND gate (U6A pin 6). If LOW CNVERT ALWAYS is HIGH then the clock will be disabled when either input to U6A is LOW. The first input (U6A pins 1&2) are connected to the output of the conversion latch (U21B pin 9). The clock will be stopped when the conversion complete latch is reset which occurs at the end of a conversion cycle. The other inputs to this gate (U6A pins 4&5) are connected to HADCEN (XA27P1 pin 8) which goes to the ALC circuitry and is HIGH only when a valid voltage representing the detected output power is present on the DETLVL line (XA27P1 pin 29). HADCEN has a pullup resistor (R59) so the ADC will function normally if the ALC board is removed.

ADC Input Multiplexer N

The purpose of the ADC input multiplexer is to allow the processor to select which analog input line the ADC will convert to Digital information for use by the processor.

As discussed under Block L, AMUX0,1,2 are latched off the instrument data bus and determine which channel is selected. The output of the MUX (U25 pin 8) is connected to the summing node of an op amp. The buffer amp allows each channel to have a different gain and offset.

Channel 0 (U25 pin 4) is bipolar with a gain of 1 which will yield a full scale input range of ±5.0 volts. Channel 0 is the DET LVL input from the Detector board and is corrected to accurately represent the actual output power of the 8340A when this voltage is valid. The scale factor of this voltage is -0.2 V/dB or ± 25 dB fullscale.

Channels 1 through 5 (U25 pins 5,6,7,12 & 11) are voltages that can be used by the processor to determine if major portions of the instrument are functioning correctly. Resistors R61 through R64 are used to sum an offset current into the buffer amplifier (U18A pin 2) to offset its output (U18A pin 1) to -5 volts. This allows the measured voltage to vary from 0 to -10 volts while the ADC sees -5 to +5 volts. Channel 6 (U25 pin 10) is scaled to allow -3.53 to +2.47 volts input. MOD LVL is connected to this input. If the SYTM is peaked by the processor so that more power is available, this voltage will change proportionately and if less power is available this voltage will change in the opposite direction. This input is required to provide feedback to the instrument processor for the auto-peaking and auto-tracking functions.

Channel 7 (U25 pin 9) will allow ±5 volt signals and is connected to TP 16 on the Level Control board. This input is used during testing of the ADC.

Test ADC O

The TEST ADC is essentially an internal voltmeter that measures the voltage of a pre-selected line and converts it into digital information. The processor reads the output of the TEST ADC, thus monitoring the voltage of the selected line. One example of how this circuit is used follows:

The 8340A normally places the user-selected power level in the Front Panel "ENTRY" an POWER dBm" displays. Under the conditions listed below the selected power level may not be the same as the actual power output.

- When the RF power output is unleveled.
- When the instrument is in the External Leveling mode.
- When AM is engaged (a dc voltage on the AM input will cause a change in the actual RF output power).

When any of the above conditions occur the TEST ADC monitors the DETLVL INPUT from the ALC circuitry and converts it into digital information. The processor reads this information and converts it into an equivalent power level in dBm. This value is displayed in the Front Panel "POWER dBm" display.

The Tracking Analog-to-Digital Converter (U11) contains a D-to-A converter and reference amplifier, an up/down counter, a window comparitor to control the up/down counter and data latches to store conversion data. A precision resistor (R17) is connected to the precision 10.00 V reference and to the converters Iref and Ref Amp + terminals (U11 pins 5 & 9). The Iref terminal connected to the reference current resistor (R17) is held at ground by the reference amplifiers input (U11 pin 5). The reference current is simply Vref/R17=1 mA. This reference current is multiplied by four in the DAC and then is divided appropriately according to the digital output of the internal 10-bit up/down counter. Iout of the DAC (U11 pin 10) is a current going into the A/D converter (U11 pin 11) and is summed into a 1 Kohm resistor along with an offset current of 2 mA through R18 (10.00V/R18) and the input current determined by R43 (Vin/ 2.5 Kohm). This summing node is connected to the comparitor input (U11 pin 11) which compares this voltage to reference ground. Since this summing node is held at ground (via digital feedback), the algebraic sum of the currents entering and leaving this node must equal zero. If the currents entering this node are slightly greater than the currents leaving the node the internal window comparitor will signal the up/down counter to count up. This will in turn increase the current sinking output of the DAC (Iout U11 pin 10) until it sinks just enough extra current to compensate for the excess current entering the node. The reverse is also true. The window comparitor, up/down counter, and DAC will compensate for a deficiency of current at the summing node by decreasing the amount of current sunk by Iout. The digital value contained in the up/down counter, when the currents at the summing node are in equilibrium, is the digital representation of the current entering the node through R43. The offset current summed into the summing node through R18 forces the digital value to the DAC (and digital ouputs) to be mid range when no current is flowing in the input resistor (R43). This allows a bi-polar input voltage at R43 so that both positive and negative voltages can be digitized. The input voltage range at R43 is -5V to +5V. A -5 volt level will yield a digital value of 0; 0 volts will yield 512; and +5 (511/512) will yield 1023.

The digital outputs of the internal up/down counter go into transparent latched output buffers. Whenever the Data Hold line (U11 pin 28) is HIGH, the digital information appears at the outputs (U11 pins 18 through 27). If the Data Hold line is brought LOW, the information present at the DAC and up/down counters at that instant will be frozen in the output latch/buffers. Since the outputs are always enabled, the digital information appears directly at the inputs to two 74LS367 bus buffers (U12 & U15). When the main processor is ready for the ADC data it causes the RLEVEL strobe to go LOW which enables the outputs of these bus buffers (U12 & U15 pins 1 & 15) and places the ADC data on the instrument data bus to be read by the instrument processor. This RLEVEL strobe is also connected to the Data Hold on the ADC (U11 pin 28) so that the information in the ADC latches cannot be changed while it is being read. The ADC requires that the Data Hold line cannot be brought LOW for 150 nS after the rising edge of the ADC clock to allow for settling of the counter outputs. Due to the asyncronous nature of the ADC clock and the RLEVEL strobe, the above restriction means that the ADC clock cannot be allowed to run while the ADC is being read.

ATTENUATOR INSTALLED SENSING

A pulled up line that is grounded by the installation of the attenuator is connected to the input of DB 10 of the ADC data output buffers (U15 pin 10). This bit will be read any time the processor does a read level operation. This information is used to determine if the attenuator is installed only if the calibration data has been damaged and the default values must be used.

ADC Window Comparitor P

Since the ADC clock must not run when the voltage into the ADC is not changing, an external window comparitor (in addition to the window comparitor that resides inside the Test ADC) senses when the ADC clock should be turned on, allowing the ADC to function. The summing node of the current DAC inside the Test ADC and the input current through R43 is sensed by the widow comparitor circuit. Whenever the input current does not match the current output from the ADC, an offset voltage proportional to the error between the DAC current and the input current exists. Both the internal window comparitor and the external window comparitor sense this voltage. The external comparitor is set to trigger when this voltage exceeds approximately ±1 LSB of the ADC. This window comparitor then starts a conversion. In this way the ADC clock can be turned off until the input voltage changes by more than approximately 2 LSB maximum.

U7 is an OP-07, a very low offset op-amp, which has been connected to provide a gain of approximately 19-20. Its purpose is to provide a larger voltage, representing one LSB to the comparitors. In order to provide a significant increase in resolution, U7 must have an input offset voltage which is much lower than the comparitor's.

The filter formed by R46 and C38 prevents transients or noise generated by the clock circuit from triggering the comparitors when the voltage is within the window.

U2 and U3 form the window comparitor. R47 and R48 set U2 output HIGH until the (-) input (U2 pin 3) exceeds 75 mV. R49 and R60 set U3 output HIGH (U3 pin 7) until the + input (U3 pin 2 is less than -75 mV. C39 and C40 provide noise filtering. Both U2 and U3 are open collector output comparitors so R50 is provided to pull up this signal to 5 volts. This open collector line is called LOW Outside Window (TP 5).

Conversion Complete Timer/SRQ Latch Q

The function of the conversion-complete timer is to allow the clock to run for 8 clock pulses after the widow comparitor has signaled that the ADC has converted the input voltage to within ±1 LSB of the actual value. This will allow the ADC sufficient time to convert the input voltage down to within ±0.5 LSB before its clock is stopped. (Assuming the input voltage is not changing.)

The output of the window comparitor (L OUTSIDE WINDOW) is inverted by U26C which drives LOW Enable of a LS169 counter (U1 pin 7). This counter is enabled to count up when the voltage being converted is inside the window. After 8 counts the carry out (U1 pin 15) goes LOW which does a parallel load (U1 pin 9) and clocks both the ADC clock control flip-flop (U21B in Block **M**) and the SRQ latch (U21A). The D input to the ADC clock control flip-flop (U21B in Block **M**) is grounded so it is reset which turns the clock off.

The D input to the SRQ flip-flop (U29A in Block **Q**) goes to H SRQ DISABLE (U29 pin 10 in Block **L**). If H SRQ DISABLE is LOW then U21A (Block **Q**) will be reset. The output of latch U21A goes to U22 in Block **R** to be read by the instrument processor and to a SRQ delay circuit. This SRQ circuit will allow only one ADC SRQ every 100 mS to limit the amount of main processor time devoted to servicing the ADC. LA-D SRQ also goes to U6B pin 10 (in Block **M**) which disables the ADC clock until the SRQ is cleared by the RLEVEL strobe.

In the delay circuit, Q2 will be conducting any time the ADC is not requesting service. As soon as ADC SRQ goes low, Q2 will be turned off and C53 will be charged up through R42. When C53 is sufficiently charged, the voltage at U19A pin 2 will cause its output (LCHNG) to go low. This signals the processor that a change has occurred. As soon as the processor reads the ADC, the SRQ flip-flop will be set so its output (U21A pin 5) will go HIGH, Q2 will turn on and pull the input to U19A LOW and therefore its output will go back HIGH. R40 provides base drive current for Q2 since the output current of U21 would not be sufficient. R39 limits the discharge current of C53 when Q2 turns on.

The Change Detectors U19B and U19D are designed to output a LOW going pulse onto the LCHNG line to the digital interface board to indicate that a change has occurred on the Unleveled or Overmod inputs to the Level Control board.

The inputs (LUNLVL and LOMD) also go to an output buffer (U22 pins 4 & 12 Block **R**) which can be read by the processor to determine what signal has changed state.

Assume that LUNLVL is HIGH initially; therefore both inputs to the LS266 open collector exclusive nor gate U19B will be HIGH. An exclusive nor gates output will go LOW when its inputs are at different logic levels, therefore for the above conditions its output will be HIGH. When LUNLVL goes LOW, one input (U19B pin 6) immediately goes LOW while the other (U19B pin 6) remains above the trigger threshold due to the limited discharge rate of C41 through R54. The output (U19B pin 4) will be LOW during this time. After some period of time, both inputs will be LOW. When LUNLVL goes HIGH, one input (U19B pin 6) will immediately go

HIGH, while the other input (U19B pin 5) will remain below the trigger threshold for some period of time due to the charge rate of C41 through R53 & 54. The output of the gate (U19B pin 4) will be LOW until the trigger threshold is reached.

The values of R54 and R52 were chosen so when LUNLVL or LOMD are LOW both inputs to U19 will be below the trigger threshold with worst case input currents to the gate. R53 and R51 then have been chosen so that the voltage divider formed with R52 and R53 will be above the trigger threshold under worst case conditions.

Status Buffer R

There are several bits of information about functions on the Level Control board that must be communicated back to the instrument processor and several ADC control lines that must be asserted by the instrument processor.

A 74LS367 bus buffer (U22 Block **R**) is used to put several bits of information onto the data bus when the RSTAT strobe is pulled LOW (U20 pin 7 in Block **B**). Four signals are communicated to the processor. They are LA-DSRQ (U22 pin 14 in Block **R**), LUNLVL (U22 pin 4), LOMD (U22 pin 12) and LOW BD INSTALLED (U22 pin 2).

Power Supplies S

Standard power supply filtering is provided for the +20V, +5V, -5V, -10V and -15V supplies. Low Q filters were used to help prevent resonances. A +15 V supply is provided using a 3 terminal adjustable regulator (Q3). In addition to all of the above supplies, a low current +10V supply is provided for the CMOS 7520 DACs U8, U9, and U10. The reliability of these CMOS DACs should increase as the voltage stress is decreased as far as practical. This 10V supply is tied to the +5.2 V supply to prevent the digital inputs to the DACs from being greater than the VDD supply when the instrument is turned on.

R57 is used to remove dc currents from the Reference Ground. These currents are injected by the DACs and other resistors connected to this ground.

Q1 is an AD581L 10.00V precision reference. This voltage (+10VR) is used as the reference voltage for the level DAC (U14 Block **H**) and to produce precision offsets (Block **C**, **D**, and **T**). The +20 volt supply is used as the input voltage (Q1 pin 1) to minimize the load on the +15V regulator (Q3).

Reference-Level Summing Amplifier T

The output from the Level DAC and the Level Sweep DAC are summed together at unity gain by the summing op-amp (U18B). The +10.00 reference is also summed into this op-amp with a gain of 0.5 to provide a negative 5 volts offset at the level reference output (U18B pin 7). The output can be adjusted between approximately -5.12 and +5.11 volts by the main Level DAC. This voltage represents a change in output power of +25.55 dBm to -25.60 dBm and represents a slope of approximately -0.2 volts/dB. This is approximately because the exact slope and offset of the level reference is corrected in software by the instrument controller.

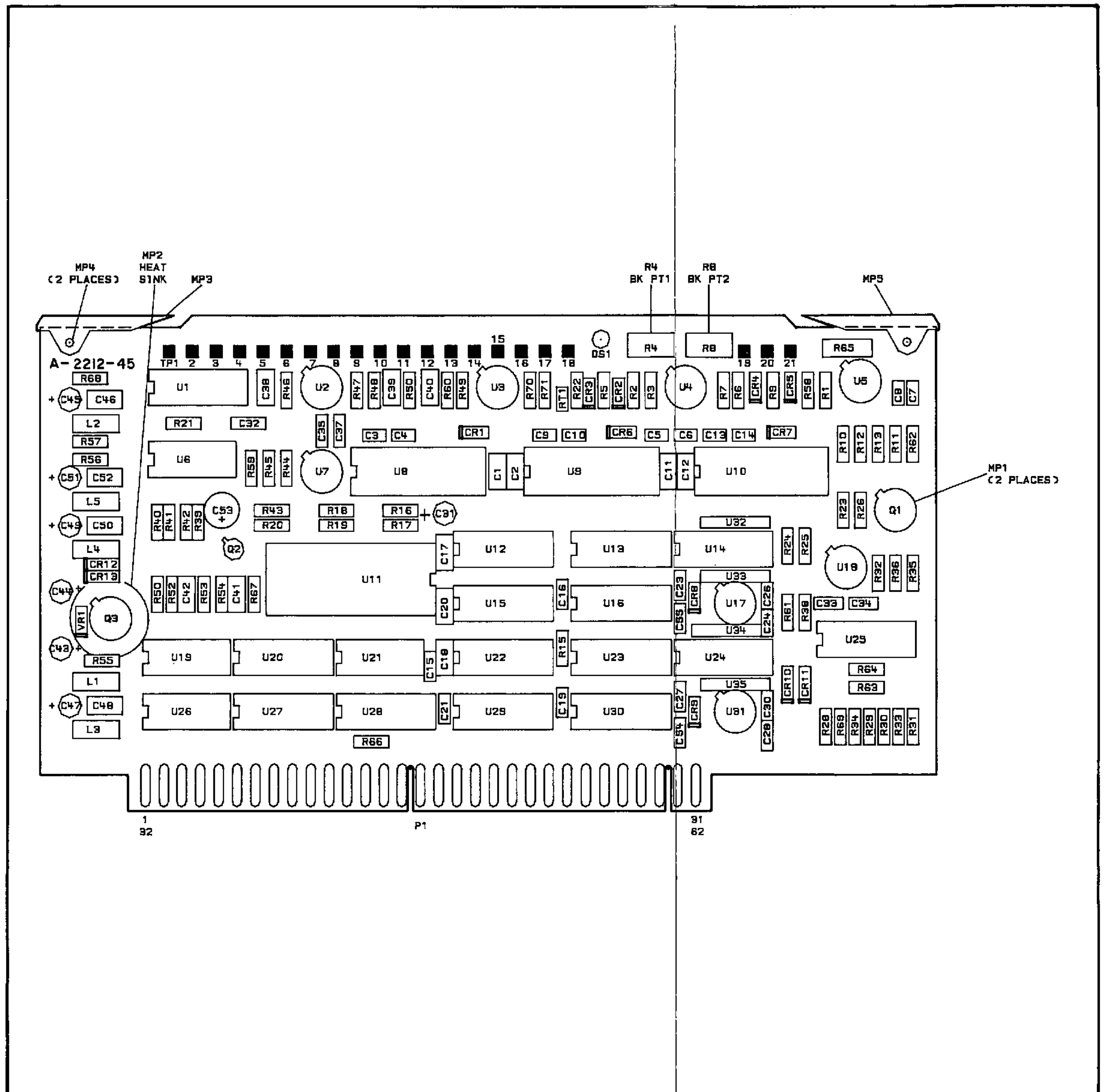


Figure 81-38. A27 Level Control, Component Location Diagram

A27 Control P1 I/O (1 of 2)

A27

Pin	Mnemonic	Levels	Source	Destination
1 32	−5.2V −5.2V	−5.2V −5.2V	XA53P1-18, 36 XA53P1-18, 36	*S *S
2 33	+20V +20V	+20V +20V	XA52P1-16, 40 XA52P1-16, 40	*S *S
3 34	+5.2V +5.2V	+5.2V +5.2V	XA52P1-17, 18, 41, 42 XA52P1-17, 18, 41, 42	*S *S
4 35	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*S *S
5 36	−15V −15V	−15V −15V	XA56P1-15, 30 XA56P1-15, 30	*S *S
6 37	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*S *S
7 38	GND PLANE GND PLANE	0V 0V	IN GROUND IN GROUND	*S *S
8 39	HADCEN LATTN	TTL (HIGH TRUE) TTL (LOW TRUE)	XA21P1-1 A62J20-14	M O
9 40	ADR0 ADR1	TTL TTL	XA60P1-17 XA60P1-73	*B *B
10 41	ADR2 ADR3	TTL TTL	XA60P1-18 XA60P1-74	*B *B
11 42	ADR4 SIOA	TTL TTL (LOW TRUE)	XA60P1-19 XA60P1-15	*B *B
12 43	WLEVEL WBAND	TTL (LOW TRUE) TTL (LOW TRUE)	B B	XA24P1-33 XA28P1-29
13 44	 WYTMSLP	 TTL (LOW TRUE)	 B	 XA28P1-30
14 45	WYTMCTL RSTAT	TTL (LOW TRUE) TTL (LOW TRUE)	B B	XA28P1-8 *
15 46	W11R2 HLB0	TTL (LOW TRUE) TTL (HIGH TRUE)	B A	XA23P1-15 *
16 47	HLB1 HLB2	TTL (HIGH TRUE) TTL (HIGH TRUE)	A A	* *

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

A27 Control P1 I/O (2 of 2)

A27

Pin	Mnemonic	Levels	Source	Destination
17 48	RFSWP LOMD	10V/SWEEP TTL (LOW TRUE)	XA57P1-42 XA26P1-8	I Q R
18 49	RGND RGND	0V 0V	STAR GND POINT STAR GND POINT	*S *S
19 50	GND PLANE GND PLANE	0V 0V	INSTRUMENT GROUND INSTRUMENT GROUND	*S *S
20 51	LHET −.25V/GHZ	TTL (LOW TRUE) −.25V/GHZ	A XA28P1-40	* *
21 52	LCHNG LUNLVL	TTL (LOW TRUE) TTL (LOW TRUE)	* XA26P1-36	Q Q R
22 53	DB0 DB1	TTL TTL	*XA60P1-20 *XA60P1-76	*L *L
23 54	DB2 DB3	TTL TTL	*XA60P1-21 *XA60P1-77	*L *L
24 55	DB4 DB5	TTL TTL	*XA60P1-22 *XA60P1-78	*L *L
25 56	DB6 DB7	TTL TTL	*XA60P1-23 *XA60P1-79	*L *L
26 57	DB8 DB9	TTL TTL	*XA60P1-24 *XA60P1-80	*L *L
27 58	DB10 DB11	TTL TTL	*XA60P1-25 *XA60P1-81	*L *L
28 59	RGND WMOD	0V TTL (LOW TRUE)	STAR GND POINT B	*S *
29 60	DETLVL RGND	−0.2V/dB, 0V = 0dB 0V	XA25P1-33 STAR GND POINT	N *S
30 61	LVLREF MODLVL	0.2V/dB, 0V = 0dB 0 TO −3V LEVELED	T XA26P1-32	XA25P1-13 N
31 62	BVSWP LVLCOR	10V SWEEP 1.25 dB/V, 0V = 0dB	XA58P1-40 G	N XA25P1-14

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

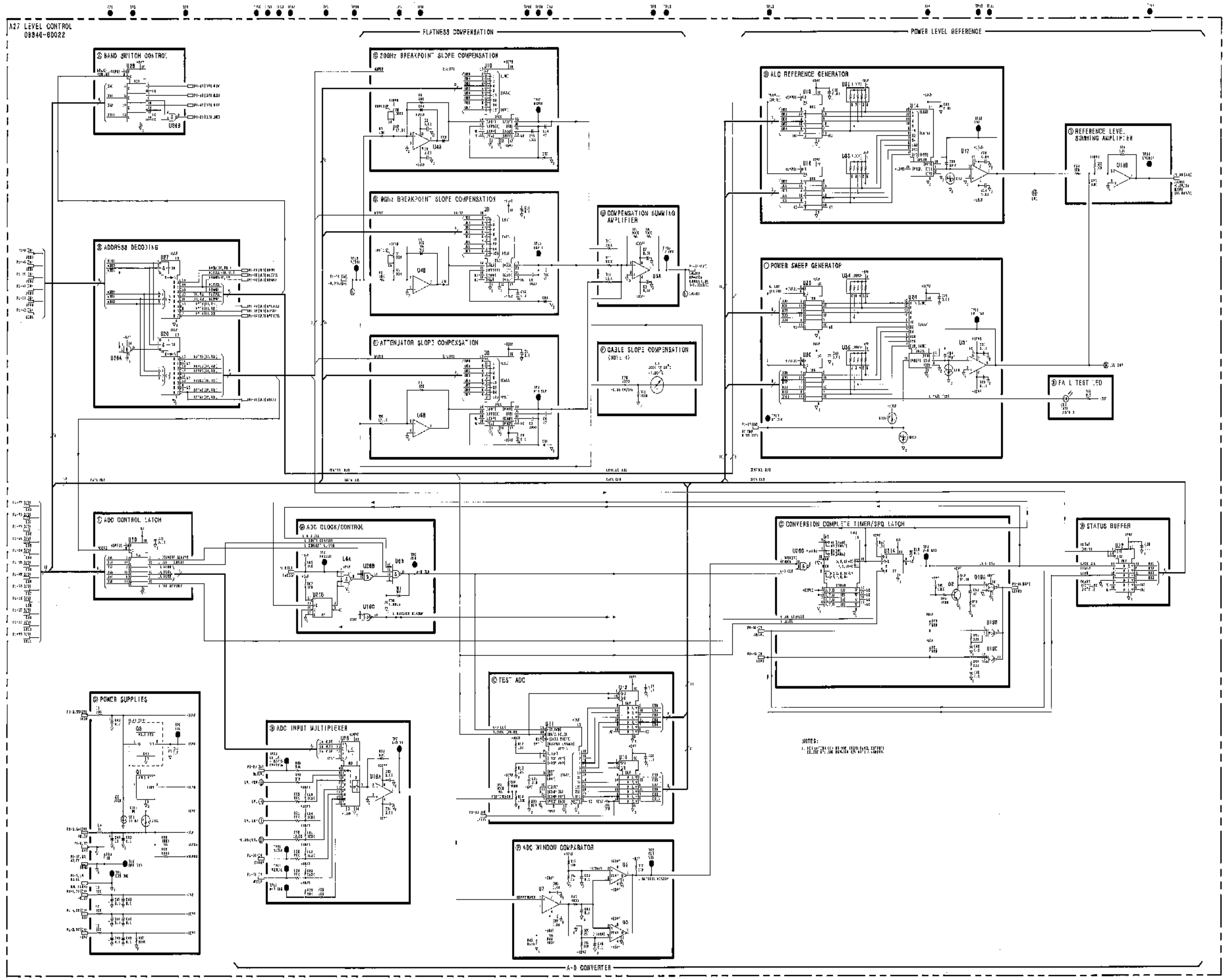


Figure 8-39. A27 Level Control Schematic Diagram

A28 SYTM DRIVER, CIRCUIT DESCRIPTION

Introduction

Refer to Figure 8A-41, "A28 SYTM Driver, Schematic Diagram".

The SYTM driver provides the correct amount of current to the SYTM coil for tuning the SYTM frequency under all conditions. Since the SYTM uses an open-loop tracking scheme, all differences in tracking conditions must be compensated for by the SYTM driver without the benefit of feedback. The SYTM driver also provides the rest of the instrument with voltages that are proportional to frequency (-0.25 V/GHz, +1.0/+0.5 V/GHz, +1.4 v/GHz).

Offset Compensation [A]

The offset compensation circuitry adds a correction current independent of frequency. The offset, adjusted by R1, affects the entire operating range of the SYTM and has a range of ±200 MHz. A separate offset adjusted by R113 is active only in band 1 (switched by Q4) and has a range of -125 to +75 MHz that is superimposed on the setting of R1.

Delay Compensation [B]

The SYTM magnet responds to any change in coil current, by setting up eddy currents to oppose the change. During a sweep, while the input current is ramping, the eddy currents set up a magnetic field that partially cancels the magnetic field required to tune the SYTM passband. A compensation current is added to the current driving the SYTM in order to offset the effects of the eddy currents. Since the eddy currents take time to set up, the start of the compensation ramp needs to be rounded. Although the transient response of the eddy currents do not follow an exponential function, using a low-pass filter on the delay compensation adequately accounts for the transient response.

The delay DAC (U3) gives the instrument processor control over the gain of the delay correction. When the processor writes to IO address 10,R2: a strobe (WBAND) is generated on the A27 Level Control Board. WBAND comes onto the SYTM driver through P1 Pin 29. When WBAND is pulsed, U14 latches the information on bits 3 through 10 of the Data Bus. The latched bits form the binary input to the delay DAC (U3). The reference input to the delay DAC is the sum of inputs. When Q10 is closed the voltage across C13 is self-adjusting to give 0V output from U5A. When Q10 is opened, the output of U5A is proportional to the -0.25 V/GHz line, offset by the voltage across C13. When the instrument is sweeping, this generates a ramp that is referenced to the frequency at the time Q10 was opened. Q10 is open when HSP (P1 Pin 26) is HIGH. The output voltage at U5A is summed into U2A through R7 (DYS) for the delay compensation. The offset is adjusted through R6 (DYO) and summed into U2A as well. If the 8340A is sweeping 19.8 GHz to 26.5 GHz and if R6 (DYO) and R7 (DYS) are both turned fully counter-clockwise, then the output of U2A pin 1 will ramp up to about +12.7 V. R55 converts the output of U2A into the reference current (Iref) for the delay DAC (U3). Iref causes an equal current to flow from a series of binary weighted switches in U3. The binary switches are driven by the latched bits from U14. The internal binary weighted switches source the current from U3 pin 4 when the latched bits corresponding to the switches are HIGH. When the latched bits are LOW the current is sourced from U3 Pin 2. Thus when all of the latched bits are HIGH U3 Pin 4 will sink a current equal to Iref and U3 Pin 2 will not sink any current. When all of the bits are LOW U4 Pin 2 will sink a current equal to Iref and U3 Pin 4 will not sink any current. The amount of current sunk by U3 Pin 4 (I1) and U3 Pin 2 (I2) will vary between the two extremes in proportion to the latched binary code with the sum of I1 and I2 equal to Iref. The voltage present at U2C pin 8 is equal to I1*2K. In terms of the input current this becomes Iref*N*2K where N is the ratio of the binary input to the full scale binary input to the DAC. Q9 switches the delay compensation into the compensation summing amplifier at appropriate times. Q9 conducts when HSP (P1 Pin 26) is HIGH. Since HSP is also HIGH in CW the delay DAC (U3) is programmed to 0 by the processor because no delay compensation is required in CW operation. R46, R47 and C26 form a low-pass filter that rounds the first part of the delay compensation waveform.

Slope Compensation [C]

The slope compensation circuits generate a correction current proportional to frequency. The slope DAC (U4) provides microprocessor control over the slope correction and enables the 8340A to do the required self-peaking (see Block H description). When the processor writes to I/O address 11:R1 a strobe (WYTMSLP) is generated on the A27 Level Control Board. WYTMSLP comes onto the SYTM driver through P1 Pin 30 and causes U15 to latch the binary input for U4. The reference input for U4 is the PRETUNE signal that has been scaled and inverted by U2B to give +1.4 V/GHz +- 1%. This voltage is also output from P1 Pin 7 and is used for the ramp bias of the step recovery diode in the SYTM. The voltage present at U2D Pin 14 is equal to the combined effects of I1 (current sunk by U4 pin 4) and I2 (current sunk by U4 pin 2). The two current effects can be considered independently and then added for the final result. To consider the effects separately, set one equal to zero and look at the effects of the other. No current will flow through R57 due to I1 so the voltage at U2D Pin 14 due to I1 will be equal to -2K*I1. No current will flow through R58 due to I2 so the voltage at pin 14 due to I2 will be

2K*I2. The voltage at U2D Pin 14 due to both currents will be 2K*(I2-I1). I1+I2=Iref and I1=N*Iref (where N is the ratio of the binary input to the full scale binary input to the DAC). This gives a final result for the output voltage of U2D pin 14 to be (PRETUNE*4/8.9±1.3%)*(1-2*N). The output voltage of U2D pin 14 can vary by as much as ±8V which is summed into the compensation amplifier in Block **G** through R56. The output voltage on pins 2 and 4 of U4 can vary between -8V and 0V which is within the output voltage compliance of U4 (-8V and +21V). The DAC provides ±4% slope adjustment in band 1, ±2% in band 2, ±1.3% in band 3 and ±1% in band 4.

Since bits 0 through 2 are ignored when the data is latched into U15 from the data bus the binary pattern present at the input of the delay DAC increments once for every eight increments of the data on the Data Bus. Whenever the RPG is connected to U4 it will take eight pulses of the RPG to change the DAC by one bit. This will reduce the sensitivity of the RPG.

In addition to the correction provided by the slope DAC, three breakpoints are provided to correct for the non-linearities of the SYTM magnet. R20, R21, R22, R18 and R17 form a voltage divider used in conjunction with CR1 and CR2 to set fixed frequency breakpoints at 13.7 GHz (±2%) and 20 GHz (±2%). R2 and R3 vary the effect of the breakpoints adding as much as 3.1% and 3.2% respectively. R4, R5 and CR3 form a breakpoint that can be varied in frequency (anywhere above 23.2 GHz) as well as adjusted to add as much as 4.0% to the slope. All percentage increases in slope are referenced to the frequency where the breakpoint begins to take effect.

Programmable Voltage Divider [D]

The Pretune line comes to the SYTM driver board on P1 Pin 22. It is a voltage proportional to YO frequency and is adjusted to give -2.5 v/GHz with an accuracy of ±6.5mV ±7uV/C ±25ppm/C.

The programmable voltage divider uses a precision resistor array (U21) to attenuate the PRETUNE voltage giving a voltage that is proportional to SYTM frequency. The overall accuracy depends on the accuracy of the PRETUNE line as well as that of the resistor array. Hence, the specifications for the resistor array are important to the accuracy of the -0.25 V/GHz and +1.0/+0.5 V/GHz lines as well as to the tuning of the SYTM. The array consists of eight 2.5K resistors with a 5% absolute tolerance, 0.01% tracking tolerance relative to R1 (giving a worst case tolerance of 0.02% for any resistor ratio). The array also has a 2ppm/C tracking temperature coefficient between any two resistors.

The latched band information (P1 Pins 31, 32, and 33 in Block I) is used as the input for a 3 by 8 decoder (U16). The outputs of the decoder are input into comparators (U19) that drive the gates of FETs to switch the appropriate node of the voltage divider.

-0.25V/GHz [E]

The -0.25 V/GHz line is the most widely used signal on the SYTM driver board. During Band 1-4 it is a buffered version of the voltage out of the programmable voltage divider. U6 has a low offset voltage (1.6 mV max over 0 deg. C.-70 deg. C.) and keeps the output within 1.6 mV (6.4 MHz) of the input signal. During Band 0, (Q11 closed and Q18 open) the instrument frequency is equal to the YO frequency offset by 3.7 GHz. The -0.25 V/GHz line uses the PRETUNE voltage, scales it down to -0.25 v/GHz and adds an offset voltage that equals 0.25 v/GHz*3.7 GHz or 0.925V. This signal is generated using the +10V reference, offset R68, R69, and R70, and PRETUNE. When the Band 0 signal is adjusted at 10 MHz by trimming the +10V reference with R85 (Block **K**) the -0.25 V/GHz line will be accurate within 10 MHz of the ideal value at 2.2 GHz.

Q11 and Q18 switch between the Band 0 and Band 1-4 conditions. A sample and hold circuit (Q5 and U5B) is used to remove the discontinuities that are present due to changing the band number and PRETUNE at different times.

Q6 is capable of sourcing 2 mA and sinking 40 mA. The normal load requires sourcing 0.5 mA and sinking 7 mA. R65 limits the amount of output current to protect Q6 in the event the output is shorted. R27 along with the +20V supply provide the sourcing capability. C16 is required to stabilize the loop during the sample mode. The holding capacitor (C14) is a mylar capacitor with an insulation resistance of 15,000 megohms. U5B has a maximum input bias current of 8 nA over 0 deg. C. to 70 deg. C. (100 pA @ 25 deg. C.). Q5 has a maximum drain cutoff current of 0.1 nA at 25 deg. centigrade. The maximum droop is 260 mV/sec. A normal holding interval is about 5 msec resulting in a maximum droop of 1.3 mV during the holding interval. This value drops substantially at instrument temperatures lower than 70 deg. C. The maximum droop at room temperature is 20 mV/sec or 0.1 mV during a holding interval of 5 msec. When the circuit is in the hold mode (Q5 open) R32 and diodes CR4 and CR5 keep U6 from saturation and making the output of U6 a buffered version of the input to U6. The output of U6 is used as a pullup voltage for the comparators driving the FET's in blocks **D** (programmable voltage divider) and **E** (-0.25 V/GHz). The output of U6 also drives the guard trace described in Block **H** description (current driver).

Without the clamping provided in the hold mode, the input diode protection internal to U6 would shunt current from the input disturbing the desired SYTM tuning. Because U6 doesn't saturate, the transition from hold to sample occurs with a minimal perturbation. R33 attenuates the amplitude of the hold-to-sample perturbation. R30 adds a zero to the transfer function that eliminates the ringing of the perturbation.

+1.0/+0.5 V/GHz [F]

This block provides a voltage proportional to instrument frequency that is sent to the rear panel. The standard configuration has a sensitivity of +1.0 v/GHz. This limits at around +19V (+20V supply tolerance and 0.4V saturation across Q7). The +1.0 v/GHz sensitivity was necessary to interface with 8410B/C Series Network Analyzer. The limit of +19V doesn't matter in this case because the 8410B/C only covers up to 18.6 GHz. For applications involving the entire frequency range, 2 jumpers (W1 and W2) on the SYTM driver board can be cut to change the sensitivity to +0.5 v/GHz. Q8 and R37 provide a current source that limits around +19.7 volts. The current is on the order of 1.2 mA (not exact because the transistor parameters of each half will differ due to the difference in their power dissipation). This current in conjunction with R41 will give about a +5 volt offset from the output of U10. This removes the effect of op amp limiting which happens as low as +17V for U10. C19 insures that the 0 dB gain crossover for the loop has a slope of --6 dB/octave. Q7 is a dual NPN transistor, one side Q7B is used as a drive transistor for the output, the other side is used in conjunction with R38 to limit the output current to 7.8 mA. CR6 and CR7 protect the circuitry from voltages that may inadvertently be applied to the output. R73 and the -10V supply provide pull-down capabilities for the output. R75, R40 and R39 cause the output to be referenced to ground potential at the rear panel. R42, R43, C20 and C21 are used for high frequency noise rejection of the power supplies.

Compensation Summing Amplifier [G]

The currents that are generated by the slope, offset and delay compensation circuitry are amplified by a factor of 25 by U1 and injected into the collector of the drive transistor A47Q2. The R13 is effectively in parallel across the sense resistors on the A47 assembly with an additional current equal to the voltage at the emitter of Q1 divided by R13. Q1 is used to buffer the output of U1 allowing the amplifier to have a higher output voltage capability. R11 and the -10 volt supply provide a sink capability. The compensation summing amplifier U1 is able to pull the passband of the SYTM over the range of -220 MHz to +625 MHz. Q3 is a P-channel FET used to switch the compensation out during kick pulses (see Block **J** description). Q2, R116 and R117 drive the gate of Q3 to +20 volts to turn it off and to 0 volts to turn it on.

Current Driver [H]

When considering the errors of the current driver, only the temperature effects need be considered since the steady-state errors are adjusted out when the instrument is calibrated. The temperature errors indicate the need for a self-peaking routine for the 8340A. The 1 dB passband is on the order of 25-30 MHz in band 4 (assuming the instrument is calibrated to center the tracking in the middle of the passband), the errors that could result from a temperature drift would cause power losses greater than any tolerable level.

The sensitivity of the input node of the current driver is 4 MHz/mV. The impedance of the line can be as much as 2.6K ohms. In order to keep the errors due to leakage currents less than 1 MHz, the leakage currents must be kept below 100 nA. When leakage currents exist at frequencies greater than 1 MHz, potential problems could exist. To avoid the problems, guard traces are placed around the sensitive traces. The guard traces are driven by a buffered version of the same voltage.

A triple darlington configuration (Q26, Q27, and drive transistor A47Q2) is used to remove the effects of the variation of the beta of the drive transistor due to temperature. With this configuration, the base current into the OP-07 (U22) is less than 15uA so any variations in this current due to temperature would influence the tracking by less than 1 MHz. R110 and R100 are used to keep a small amount of current flowing through Q26 and Q27.

Q22 keeps U22 from saturating during the kick pulses. Q21 and Q25 are used in the generation of the kick pulses and are discussed in the Block J description.

Due to the inductance of the SYTM coil, a voltage spike is generated when the current ramp is reset. The zener diode, VR2 prevents this voltage kick from exceeding the breakdown voltage for the transistors by controlling the maximum allowed rate of change of current from the driver. CR10 protects the base-emitter junction of Q26 from large voltages that could cause a breakdown. CR11 is a low capacitance diode that is placed in series with VR2 to reduce the effect of the zener diode's junction capacitance. R111 is added to eliminate the ringing that would otherwise be present at retrace. There is also a zener diode protection circuit on the SYTM bias board. This circuit clamps the inductive voltage at a higher voltage (about 140V) than the one on the driver board (about 125V). The primary purpose for this circuit is to protect the drive transistor located on the sense resistor assembly (A47) in the event that the SYTM driver board is pulled out while the instrument is under power. The breakdown voltage of the drive transistor is 400V. Q26 and Q27 have breakdown voltages of 160V so the clamping circuit on the bias board would also protect them if the clamping circuit on the driver board fails. Due to the method employed by the clamping circuit on the SYTM driver, the sense resistors always give an indication of the amount of current flowing through the coil. This voltage is used by the kick pulse comparators to sense the amount of current in the coil. If the clamping circuit on the driver board fails, there would be no negative (in frequency) kick pulse and the delay compensation wouldn't be as effective. However the rest of the circuit would work because the clamping circuit on the SYTM bias board would protect the transistors.

C39, C40, and R101 are used to match the frequency response of the SYTM coil to the frequency response of the YO coil. The sweep output on the front and rear panels is also matched.

During a bandswitch the -0.25 V/GHz voltage is more accurate for holding the SYTM at the desired current than is the normal attenuated PRETUNE voltage (see Block H). At these times the -0.25 V/GHz line is gated by Q12 to override the attenuated PRETUNE voltage to hold the SYTM and avoid the undesired kick pulses that would be present due to the discontinuities on the attenuated PRETUNE line. When the instrument is in the Band 0 the SYTM magnet is tuned to about 4 GHz to keep the YIG sphere from interferring with the output. Tuning the SYTM to 4 GHz is accomplished by closing Q17. R109, Q21, and Q25 will be discussed in the Block J description (kick pulses).

Digital Control [I]

The following digital control signals are used on the SYTM driver board:

HSP: (P1 Pin 26) A signal from the A59 Digital Interface board that is HIGH when the instrument is sweeping and LOW at bandcrossings and retrace. HSP is used to generate the DELAY and DLY RES signals which control Q10 and Q9 in Block **B**.

WBAND: (P1 Pin 29) (10:R2) Block **B** - A strobe from the A27 Level Control board used by U14 to latch data from the Data Bus for U3 (delay DAC).

WYTMSLP: (P1 Pin 30) (11:R1) Block **C** - A strobe from the A27 Control board used by U15 to latch data from the data bus for U4 (slope DAC).

WYTMCTL: (P1 Pin 8) (11:R3) Block **I** - A strobe from the A27 Level Control board used by U13 to latch S/H from Data Bit 3, SYTMSEL from Data Bit 4, KICK TRIGGER from Data Bit 5.

KICK TRIGGER: (U13 Pin 7 Block **I**) Initiates the SYTM kick pulse in Block **J** when set momentarily HIGH. KICK TRIGGER is a pulse that is about 20 usec wide.

SYTMSEL: (U17B Pin 1) controls the gate signal for Q12 in Block **H**.

S/H (DB3), LYTMKICK, and LYOKICK (P1 Pin 41) are used by U12A (Block **I**) to generate the sample signal which controls Q5 in Block **E**.

HLB0: (P1 Pin 31), HLB1 (P1 Pin 32) and HLB2 (P1 Pin 33) give latched band information decoded by U16 to control Q13, Q14, Q15, and Q16 in Block **D**, to generate the HET signal which controls Q17 in Block **H**, and to generate the Band 0 and Band 1-4 signals which control Q11 and Q18 in Block **E**.

HENDKICK: (U12B Pin 6 Block **I**) A signal that is HIGH when both the SYTM and YO kick pulses are off and it is routed to the A24 Attenuator Driver board to be read by the processor. If HENDKICK remains LOW for more than 90 msec the processor ignores it and activates the fault light indicating a KICK error.

U17, U18, and U19 are open collector quad comparators used to drive all of the FET switches on the board (except Q3, Q21 and Q25). The inputs to the FETs are TTL level signals. The outputs are pulled to -15V for LOW output and pulled up to the level set by the pull-up resistor connected to the individual comparators. R93 and R94 set the switching threshold of 1.3V for the comparators.

Kick Pulses [J]

In order to set up a uniform past history for each sweep and to force the SYTM to settle faster, a sequence of kick pulses is used at the end of each sweep with a start frequency less than 22.5 GHz. Sweeps with start frequencies greater than 22.5 GHz are not kicked. When kicked, the STYM is kicked positive in frequency until a predetermined current is reached, then the SYTM is kicked negative in frequency until a second predetermined current is reached, it then is allowed to settle from that point. The kick pulses minimize the differences between the various sweep conditions (continuous, line, external, single, and alternate). They are not needed at bandcrossings because the SYTM's past history at bandcrossings is similar to that provided by the kick pulses.

When Q21 and Q25 in Block **H** are both open, the base current to the triple darlington is removed and the drive current decays to zero. This results in a negative (frequency) kick pulse. With Q25 open and Q21 closed the driver saturates and the current heads towards its maximum steady-state value giving a positive kick pulse. R133 and CR4 will cause Q25 to be open whenever Q21 is closed. This is accomplished by allowing the output of U7 enable U23 whenever U7 is LOW.

The frequency to which the SYTM is tuned is proportional to the current through the SYTM coil. The current through the coil is sensed by measuring the voltage on the sense resistor (at P1 Pin 44). This voltage is compared with adjustable preset levels by the two comparators (U7, U23) that drive Q21 and Q25.

It is necessary to deactivate the comparators when kick pulses are not desired so they don't interfere with the normal tuning of the SYTM. LM311's were chosen for the comparators because of the strobe pin that allows them to be deactivated. The deactivated state of the comparators will have a HIGH output. Normal operation of the current driver requires Q25 to be an N-channel FET (normally on) and Q21 to be a P-channel FET (normally off). The outputs of the comparators are used in the control of the strobe. The comparators are deactivated when 3 to 5 mA of current is drawn out of pin 6. Hence, U23 is deactivated when Q24A is turned on. Likewise, U7 is deactivated when Q19A is turned on. Q19B and Q24B are used as current mirrors with the necessary gain to insure that Q19A and Q24A have 3 to 5 mA in the off state. R114 and R82 set the current ratio between Q19A and Q19B. R115 and R108 set the ratio between Q24A and Q24B.

Q21 is turned off when the gate voltage is more positive than -11V. When the comparator is in the HIGH state R81 pulls the comparator output up to +5.2V. R83 feeds this level into the base of Q19A to latch the comparator into the HIGH state. In order for the comparator to become active Q19A must be turned off. This is accomplished by pulling the base voltage down below 0.6V. When the kick pulse is desired, Q20 is momentarily turned on which pulls the voltage down at the base of Q19A turning Q19A off and thus activating the comparator. If the voltage on the sense resistor is more positive than the voltage set by R10, the output of comparator U7 will go LOW (-15V) turning Q21 on and keeping Q19A OFF. CR8 keeps the output of U7 from pulling the base of Q19A below -0.4V. The comparator remains in this state until the voltage on the sense resistor reaches the threshold set by R10. The output of the comparator then switches to +5.2V turning Q21 off and Q19A on. This latches the comparator into the HIGH state until Q20 is again pulsed on.

Q25 is turned off when the gate voltage goes to -15V and turned on when the voltage is pulled up to the level of Q25's source voltage. U23 has an open collector output so the gate of Q25 is pulled up to the same voltage as the source by R103 in Block **H**. Again the the output of the comparator (U23) is used to latch itself into its HIGH state. In order to activate U23, Q24A must be turned off. This is accomplished when Q23 is pulsed on or whenever the output of U7 is LOW. The comparator then switches to its active mode if the voltage sensed at the sense resistor is more negative than the level set by R9. The output of the comparator goes to -15V which turns Q25 off. CR9 keeps Q22 from pulling the base of Q24A below -0.4V. U23 latches itself in its HIGH state in the same way U7 latches itself. R126 provides hysteresis around U7 while R128 and R134 provide hysteresis around U23. The hysteresis around each comparator ensures that the comparators will deactivate themselves once the appropriate conditions are met. CR12 keeps the output of U23 from disturbing the SYTM tuning when U23 is deactivated.

Thus, when a kick pulse trigger (KICK T) is sent by the microprocessor (by setting the common point of R107 and R104 to a HIGH TTL logic level) both comparators are activated and Q25 is turned off while Q21 is turned on (R9 and R10 are adjusted to levels out of the normal SYTM operating range). Q21 remains on causing the current to the coil to increase until the threshold set by R10 is reached. U7 then turns Q21 off and latches in this state. The coil current then decreases until the threshold set by R9 is reached. U23 then turns Q25 on and latches in this state. Both comparators remain in their latched state until another trigger pulse is sent. U23 is in it's active mode during both kick pulses. LYTMKICK is a TTL level signal that is LOW when Q24A is off indicating when the kick pulses are active. LYTMKICK (offset by a diode drop) is also used to switch out the compensation during the kick pulses (see Block **G** description). If the compensation were left in it would be able to interfere with the current sense level to the extent that the negative kick pulse wouldn't shut off.

Voltage Reference [K]

The +10 VREF and -10 VREF are generated for cases where accurate supply voltages are needed. The +10V reference is adjusted by R85 to null the offset error in Band 0 of the +1.0/+0.5 V/GHz lines (see Block **F** description). It has a maximum temperature drift of 25 ppm/C. R84 is used to reduce the loading on the +10V reference (U5). U13, R86, R87 and R88 form a voltage inverter creating a -10V reference supply.

Power Supplies [L]

The power supplies coming to the board are: the +20V supply (P1 Pins 1,23), the +5.2V supply (P1 Pins 2,24), the -10V supply (P1 Pins 3,25), the -15V supply (P1 Pin 4) and the -40V supply (P1 Pins 5,27). All supplies coming onto the board (except the -40V supply) are filtered by low-pass filters consisting of a 4.7uH inductor in series with the supply followed by a 1 uF capacitor shunting across the supply to power ground. The -40V supply is used as a reference voltage in Block **H** (current driver) and is not shown in Block **L** of the schematic.

U11 regulates the +20V supply and provides a +15V supply to the rest of the board.

TROUBLESHOOTING PROCEDURE

NOTE:

Perform the following tests shown in Roman numerals. If one of the steps fail, perform the associated substeps shown in uppercase alpha characters. If one of the steps in uppercase alpha characters fail, perform the associated substeps shown in numeric characters.

I. Check the voltages on the power supplies. P1 Pins 1,23 should be +20V ±0.2V, P1 Pins 2,24 should be +5.2V ±0.05V, P1 Pins 3,25 should be -10V ±0.1V, P1 Pin 4 should be -15V ±0.2V, P1 Pins 5,27 should be -40V ±0.7V, U9 Pin 6 should about +10V adjustable by R85 and U10 pin 6 should be the negative of U9 Pin 6 ±1.3 mV.

II. Set 8340A to CW 10MHz and adjust R85 (Block **K**) until the voltage out of the +1.0 V/GHz rear panel connector reads 10 mV ±1.5 mV.

  A. If +1.0 V/GHz line won't adjust to 10 mV at 10 MHz, then check U9 pin 6. Output should vary around +10V as R85 is varied.

  B. Check the -0.25 V/GHz line, R85 should be able to adjust it to 2.5 mV ±0.05 mV. If OK then check P1 Pin 17, it should read 10 mV ±1.5 mV when adjusted by R85. If it is correct at P1 Pin 17 then the rear panel BNC isn't connected to the +1.0 V/GHz line.

    1. R41 (Block **F**) should have about 5V across it.

    2. U8 (Block **F**) shouldn't be saturated.

    3. R38 should have less than 0.4V across it. If R38 has 0.4V or more, check the +1.0 V/GHz line for an output short.

  C. Check PRETUNE line at P1 Pin 22. It should read -9.25V ±5 mV.

    1. Pull out A28 SYTM driver board (Refer to Repair Procedures in the beginning of the RF functional group) and verify that the PRETUNE line is valid on the A54 YO Pretune board (TP3).

Troubleshoot or adjust as necessary. Refer to the Sweep Generator - YO Loop functional group.

D. The gate of Q11 should have the same voltage as U6 pin 6 and the gate of Q18 should be about -15V.

1. U16 Pin 13 (Block I) should be LOW. U16 Pins 12, 11, and 10 should be HIGH.

   a. U16 pins 1 and 3 should be LOW. U16 Pin 2 should be HIGH.

      If not, pull out SYTM driver board and verify the latched band information on the A27 Level Control board; otherwise replace U16.

E. The gate of Q5 should have the same voltage as measured at U6 pin 6.

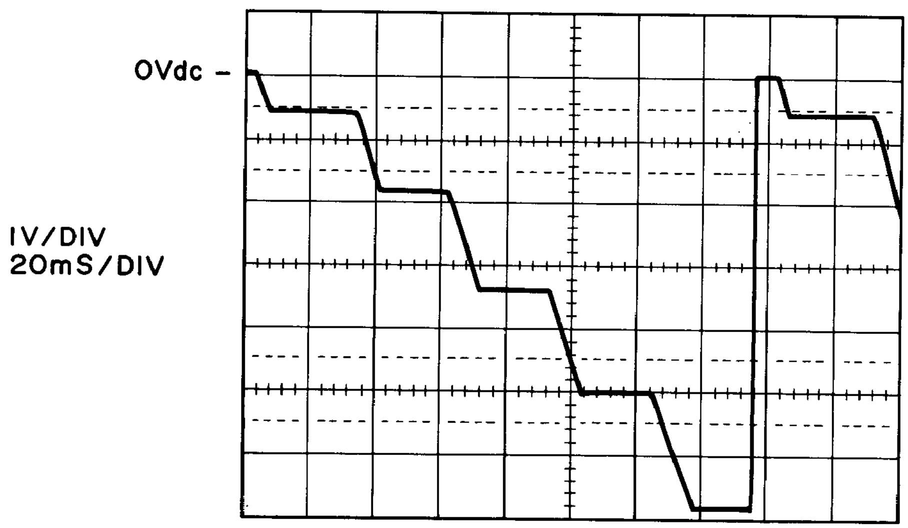
1. U12 Pin 1 should be LOW, it is an input to a three input and gate whose output U12 Pin 12 should also be LOW.

   a. If U12 Pin 1 (Block I) isn't LOW check latch U13 for correct operation by using the signature analyzer test described in the troubleshooting section of the A60 Processor Assembly. I/O channel 11 subchannel 3 is the address of the strobe used with U13. This test may also be done by entering **[SHIFT]** **[GHz]** **[1]** **[1]** **[Hz]**, **[SHIFT]** **[MHz]** **[3]** **[Hz]**, **[SHIFT]** **[KHz]** **[8]** **[Hz]**. U13 Pin 2 should be HIGH. Then enter **[6]** **[5]** **[5]** **[2]** **[7]** **[Hz]**. U13 Pin 2 should now be LOW. If either condition fails, it indicates a problem with either the Data Bus or U13.

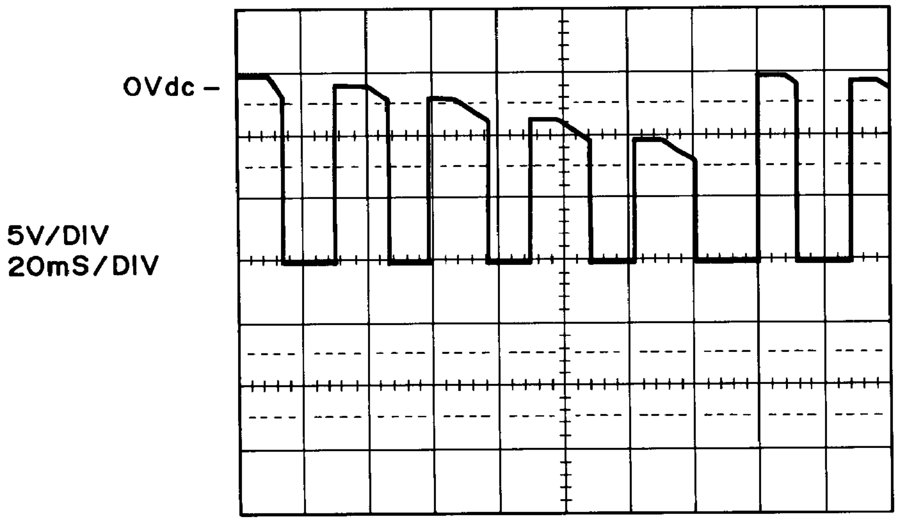
III. Connect voltmeter rear panel to +1.0 V/GHz BNC. It should vary with the instrument frequency up to at least 19V. Check test point A28 TP4 labeled V/GHz to verify correct operation. The voltage at TP4 should read -0.25 v/GHz times the instrument frequency. The voltage readings should be within the following limits at room temperature:

Frequency	-0.25 V/GHz	+1.0 V/GHz
2.2 GHz	± 5 mV	±25 mV
5 GHz	± 5 mV	±25 mV
10 GHz	± 5 mV	±35 mV
15 GHz	± 5 mV	±55 mV
18 GHz	± 5 mV	±60 mV
22 GHz	±10 mV	
26 GHz	±10 mV	

Check the waveform at TP4 (V/GHz) during a full-band sweep. There should be no discontinuities during a bandswitch. It should look like:



A. Check the voltage at the gate of Q5 during the sweep, it should have the the following waveform:



B. Check PRETUNE line at P1 Pin 22. It should read -2.5 v/GHz (relative to YO frequency).

1. Pull out A28 SYTM driver board and verify that the PRETUNE line is valid on the A54 YO Pretune board (TP3). Troubleshoot or align where necessary.

C. In CW operation, the gate of Q12 (Block **H**) should be at -15V. In band 0, Q11 should be at the same level as U6 pin 6 while Q13, Q14, Q15, Q16 and Q18 should be at -15V. In band 1, Q15 and Q18 should be at the same level as U6 pin 6 while Q11, Q13, Q14 and Q16 should be at -15V. In band 2, Q16 and Q18 should be at the same level as U6 pin 6 while Q11, Q13, Q14 and Q15 should be at -15V. In band 3, Q13 and Q18 should be at the same level as U6 pin 6 while Q11, Q14, Q15 and Q16 are at -15V. In band 4, Q14 and Q18 should be at the same level as U6 pin 6 while Q11, Q13, Q15 and Q16 are at -15V.

1. Check latched band information on U16 (Block I) Pins 1, 2 and 3 (P1 Pins 31, 32 and 33). Pin 1 should be HIGH in bands 0, 2 and 4 and LOW in bands 1 and 3. Pin 2 should be HIGH in bands 1 and 2 and LOW in the other bands. Pin 3 should be HIGH in bands 3 and 4 and LOW in the other bands.

2. Pull out SYTM driver board and verify the latched band information on the A27 Level Control board.

3. Verify U16, all outputs should be HIGH except for pin 14 in band 0, pin 13 in band 1, pin 12 in band 2, pin 11 in band 3 and pin 10 in band 4.

D. Check U22 (Block H) to see if it is saturated. If saturated the voltages on pins 2 and 3 will differ. Since U22 has internal input diode protection, current will shunt along the input path through the programmable voltage divider causing an error voltage to be added to the V/GHz lines.

1. Measure the voltage at A28TP5 labeled "SRS" to determine the current flowing through the SYTM coil. If the voltage is around 8V or more, the SYTM output current drive is saturated. Check for collector to emitter shorts in Q26, Q27 and the drive transistor A47Q2 on the sense resistor bracket. If the drive transistor is shorted the same voltage that appeared on the "SRS" test point should appear on A62XA28 Pin 20 with the A28 SYTM driver removed. Also verify that the gate of Q21 is at +5V in CW operation.

2. If the output of U22 is against the negative supply rail check to make sure that Q25 is conducting during CW operation.

   a. Measure the base-emitter voltages of Q26, Q27 and the drive transistor. Replace the transistors that have abnormal base-emitter voltages. Normal base-emitter voltages should be about -0.6V.

E. Check U6 (Block **E**), U5B and Q6 if still having problems with the -0.25 V/GHz line.

IV. Look at the waveform at TP5 labeled "SRS" during a sweep. R9 (Block **J**) should adjust the height of the low frequency kick pulse (about 0V), R10 should adjust the depth of the high frequency kick pulse (about 0V), and R8 (Block **H**) should adjust the overall amplitude of the waveform.

A. Check the emitters of Q24A and Q19A to verify that the pulse trigger is reaching that point.

   1. If no kick pulses are present check pin 7 of U13 (Block **I**) for a positive trigger pulse.

B. Check the inputs and ouputs of U23 and U7 to see if they become active at all.

C. If only a positive kick pulse is present, check P1 Pin 42 (SYTM COIL+). The voltage should drop to -125V ±7V. If it drops to about -140V it means that the diode on the SYTM bias board is clamping the coil voltage. Check VR2 and CR11 in Block **H**. If it drops less, the zener diode on the SYTM bias board may be breaking down at too low a voltage.

V. Look at TP1 "CMP" (Block **G**) and verify that R1 (Block **A**), R2, R3, R4 and R5 (Block **C**) can affect output at 26.5 GHz. Verify that U4 (Block **C**) and R1 (Block **A**) can both increase and decrease the compensation.

VI. Look at the voltage across C26 (TP2 Block **B**) during sweep. It should look like a ramp with an offset. The knee should be rounded. This waveform should restart at each bandcrossing. The overall amplitude should vary with sweep time. R6 (DVO) should vary the height of the knee and R7 (DVS Block **B**) should vary the slope of the ramp.

A. If there is no signal check Q9, it should be gated by HSP via U18 pin 14. Check U2 pin 10 and U2A pin 1.

B. If there is no slope, or if the slope doesn't reset at bandcrossings, check Q10 (gated by HSP via U18 pin 1). Also check U5A pin 1.

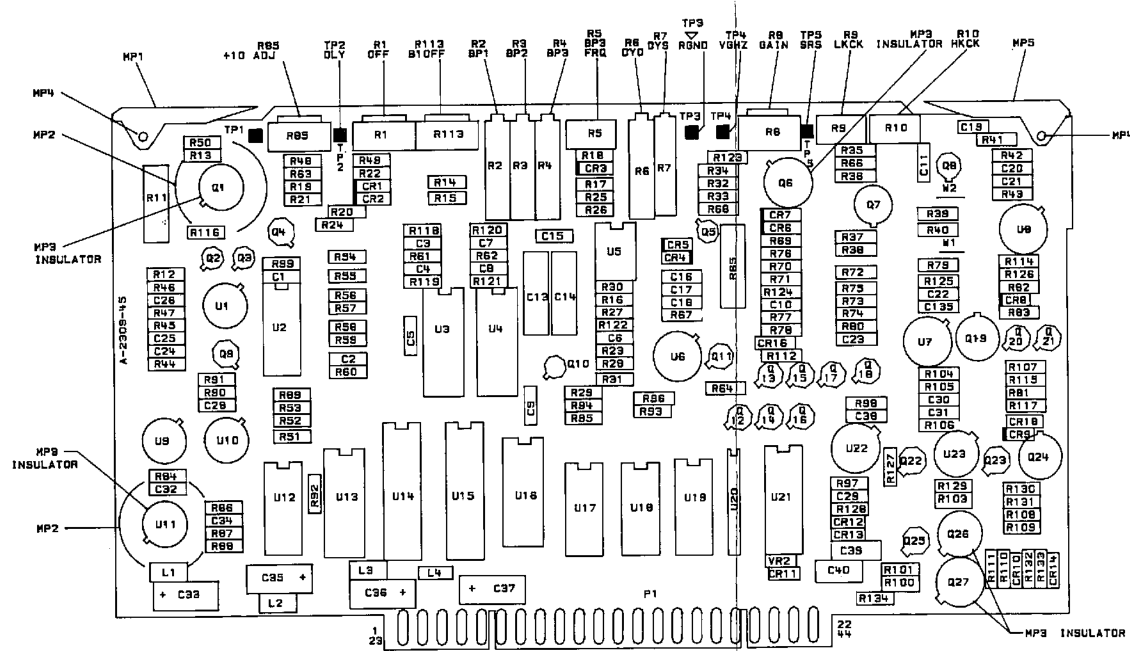


Figure 8-40. A28 SYTM Driver, Component Location Diagram

A28 SYTM Driver P1 Pin I/O

A28

Pin	Mnemonic	Levels	Source	Destination
1	+20V	+20V	XA52P1-16, 40	*L
23	+20V	+20V	XA52P1-16, 40	*L
2	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*L
24	+5.2V	+5.2V	XA52P1-17, 18, 41, 42	*L
3	−10V	−10V	XA53P1-12, 13, 31, 32	*L
25	−10V	−10V	XA53P1-12, 13, 31, 32	*L
4	−15V	−15V	XA56P1-15, 30	*L
26	HSP	TTL (HIGH TRUE)	XA57P1-13	*I
5	SYTM COIL −/−40V	−40V/−40V	A62J18-12/XA53P1-11, 30	H
27	SYTM COIL −/−40V	−40V/−40V	A62J18-12/XA53P1-11, 30	H
6	GND	0V	A62 STAR GND	*L
28	GND	0V	A62 STAR GND	*L
7	1.4V/GHZ	+1.4V/GHZ	C	XA24P1-6
29	WBAND	TTL (LOW TRUE)	XA27P1-43	B
8	WYTMCTL	TTL (LOW TRUE)	XA27P1-14	I
30	WYTMSLP	TTL (LOW TRUE)	XA27P1-44	C
9				
31	HLB0	TTL (HIGH TRUE)	XA27P1-46	*I
10	RSTAT	TTL (LOW TRUE)	XA27P1-45	NOT USED
32	HLB1	TTL (HIGH TRUE)	XA27P1-16	*I
11	DB0	TTL	*XA60P1-20	*NOT USED
33	HLB2	TTL (HIGH TRUE)	XA27P1-47	*I
12	DB2	TTL	*XA60P1-21	*NOT USED
34	DB1	TTL	*XA60P1-76	*NOT USED
13	DB4	TTL	*XA60P1-22	*B C I
35	DB3	TTL	*XA60P1-77	*B C I
14	DB6	TTL	*XA60P1-23	*B C
36	DB5	TTL	*XA60P1-78	*B C I
15	DB8	TTL	*XA60P1-24	*B C
37	DB7	TTL	*XA60P1-79	*B C
16	DB10	TTL	*XA60P1-25	*B C
38	DB9	TTL	*XA60P1-80	*B C
17	+1.0V/GHZ	1.0V/GHZ	F	A62J31-27
39	+1.0V/GHZ RTN	0V	F	A62J31-13
18	HENDKICK	TTL (HIGH TRUE)	I	XA24P1-31
40	−.25V/GHZ	−.25V/GHZ	E	*B C F H
19	SYTMDB	−22V TO −39V	H	A62J32-2
41	YOKICK	TTL (HIGH TRUE)	XA54P1-21	I
20	SYTMDC	−.6V TO −6V	H	A62J32-4
42	SYTM COIL +	−40V TO −25V	H	*
21	RGND	0V	STAR GND POINT	*L
43	RGND	0V	STAR GND POINT	*L
22	PRETUNE	−2.5V/GHZ 0V ≃ 2 GHZ	XA54P1-24	*C D E
44	SYTMRES	−.9V LOW BAND CW	H	J A62J32-5

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

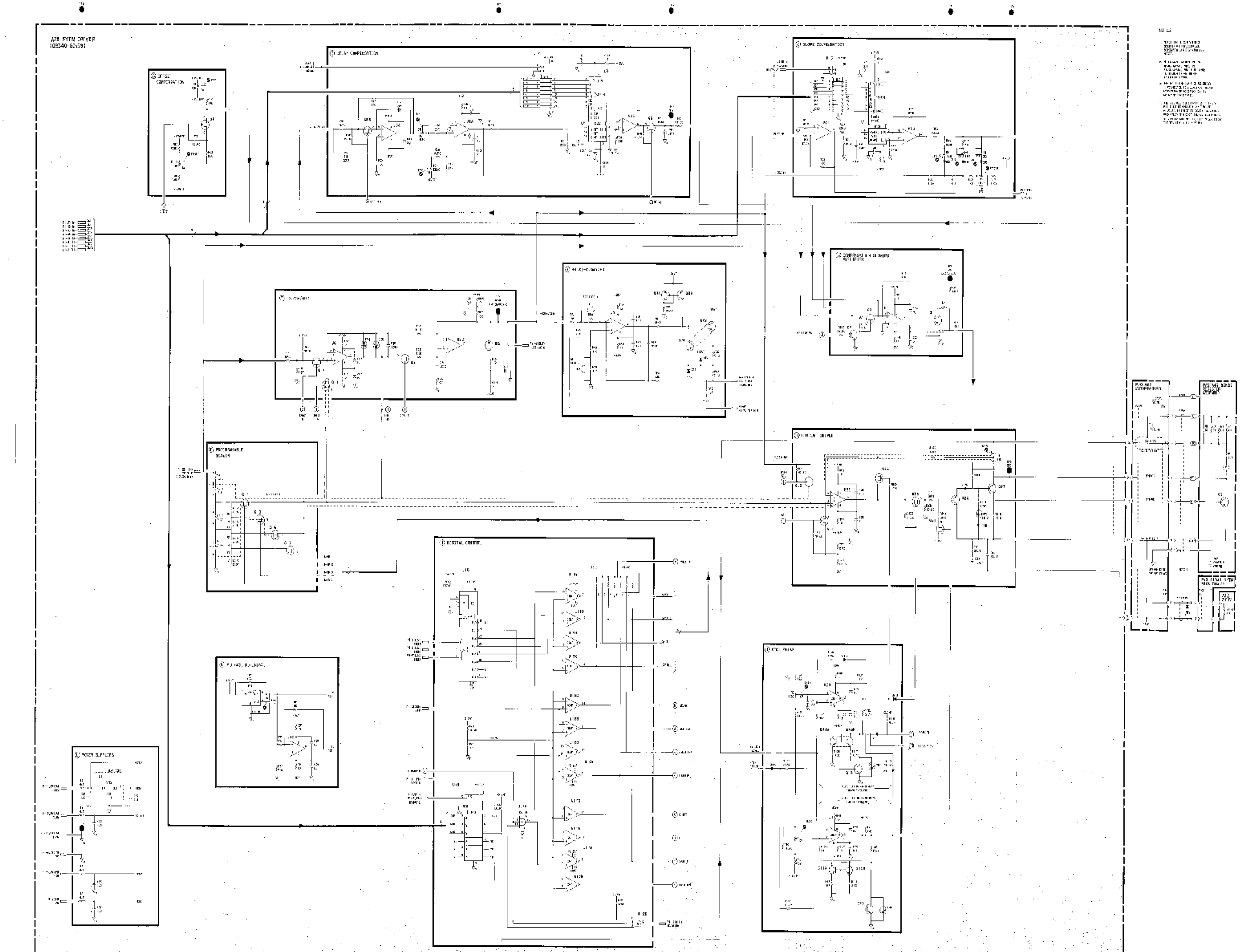


Figure 8-41. A28 SYTM Driver, Schematic Diagram

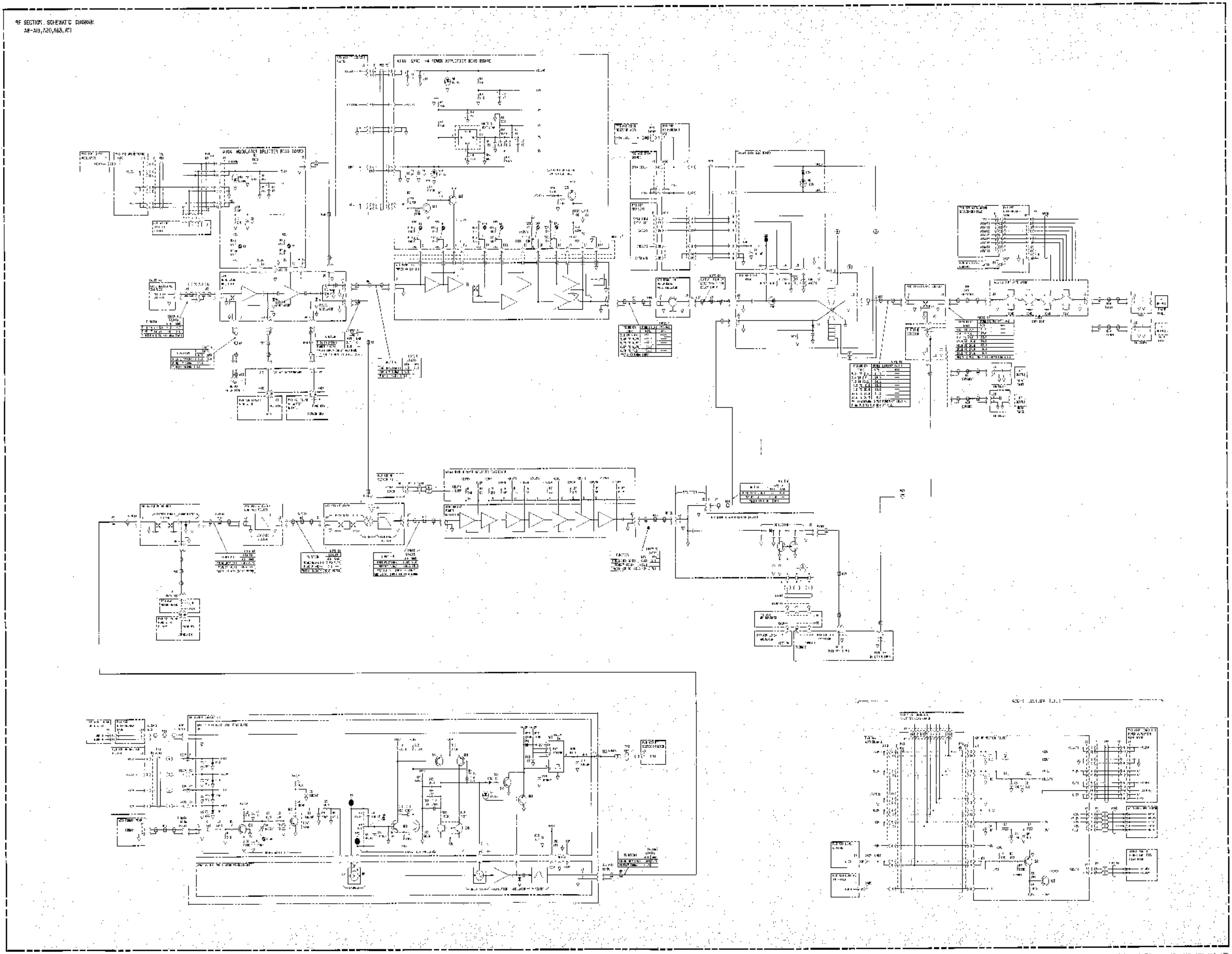
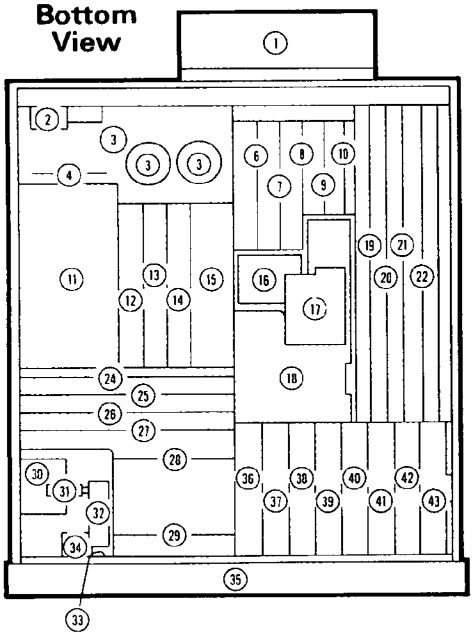


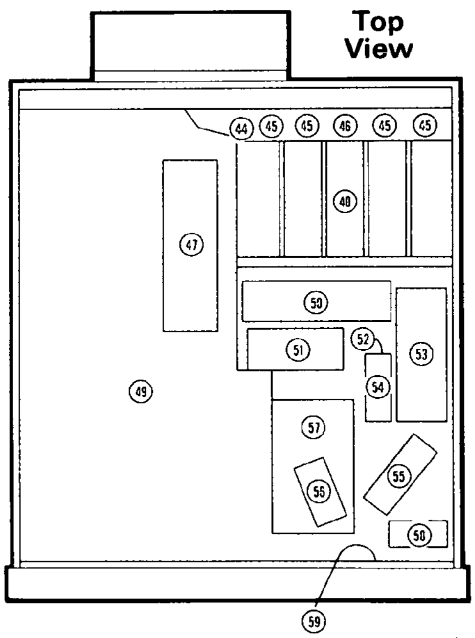
Figure 8-42. RF Section Schematic Diagram; A8 - A18, A20, A63, A71
8-845/8-346

REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



Top View



Assy./Ref. Des.	Description	Location	Ref.-M/N Loops (Volume 3)	20-30 Loops (Volume 3)	Swp. Gen.-YO Loop (Volume 3)	Motherboard (Volume 3)	Controller (Volume 3)	Front/Rear Panel (Volume 3)	RF Section (Volume 4)	Power Supplies (Volume 4)
A1	Alpha Display	33						●		
A2	Display Driver	[illegible]						●		
A3	Display Processor	33						●		
A4	Not Assigned	-								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	55							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	[illegible]							●	
A12	Band 0 Splitter/Detector	31							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	[illegible]							●	
A18	Band 0 Power Amplifier	[illegible]							●	
		[illegible]							●	
A19	Capacitor Assembly	[illegible]								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	[illegible]							●	
A25	ALC Detector	[illegible]							●	
A26	Linear Modulator	[illegible]							●	
A27	Level Control	[illegible]							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	[illegible]	●							
A33	M/N Output	[illegible]	●							
A34	Reference-M/N Motherboard	5	●							
A35	Rectifier	[illegible]								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	[illegible]		●						
A41	PLL2 Phase Detector	[illegible]		●						
A42	PLL2 Divider	[illegible]		●						
A43	PLL2 Discriminator	[illegible]		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	[illegible]			●					
A49	YO Loop Phase/Detector	[illegible]			●					
A50	YO Loop Interconnect	[illegible]			●					
A51	Reference Oscillator	[illegible]	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	[illegible]								●
A57	Marker/Bandcross	[illegible]					●			
A58	Sweep Generator	[illegible]			●					
A59	Digital Interface	[illegible]					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	[illegible]							●	
AT2	15 dB Attenuator	[illegible]			●					
B1	Fan Assembly	1								●
A62C1-3	Power Supply Filter Capacitors	3								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

POWER SUPPLIES — FAN J

INTRODUCTION

This **POWER SUPPLIES - FAN** section provides information and instructions for troubleshooting, repairing, or replacing the 8340A Power Supply, transformer, line filter module, or fan assemblies. Information includes circuit descriptions, troubleshooting procedures, block diagrams, schematics, and component location diagrams for each printed circuit board assembly.

The **POWER SUPPLIES - FAN** functional group is made up of the following sections:

- **THEORY OF OPERATION**

  This section provides a general description of how the 8340A power supplies and rectifiers operate, which assemblies they are on, and how the power supplies are interdependent. A simplified block diagram also shows this information. This section also describes ac mains requirements, line module operation, microprocessor protection and supply failure monitoring circuitry.

- **POWER SUPPLY - TROUBLESHOOTING TO ASSEMBLY LEVEL**

  This section explains how to determine which power supply or rectifier assembly is causing the line fuse to blow or power supplies to fail. Because of the interdependency of many of the power supplies, several power supplies may be down when a single supply is causing the problem. In order to quickly find which assembly has failed, Figure 8J-3, a troubleshooting to assembly level flow chart, and Figure 8J-4, block diagram have been provided. This section also provides line module troubleshooting information.

- **REPAIR PROCEDURES**

  Specific information pertaining to personal and instrument safety are presented in this section. Replacement procedures for the transformer, line module, and fan assemblies are also presented.

- **INDIVIDUAL ASSEMBLY SERVICE SECTIONS**

  - **A19 CAPACITOR ASSEMBLY - A35 RECTIFIER ASSEMBLY - TRANSFORMER - FAN Service Section**

    This section contains the following information: circuit descriptions, troubleshooting and repair procedures for the A19 and A35 assemblies. The circuit descriptions for each assembly are given first, then both troubleshooting guides. These are followed by the fan troubleshooting procedure. The A19 and A35 Repair procedures are located near the end of the section followed by the component location and schematic diagrams for each assembly.

- **A52 POSITIVE REGULATOR Service Section**

  Contains the circuit description, troubleshooting, and repair procedures for the A52 Positive Regulator assembly. The component and schematic diagrams are at the end of the section.

- **A53 NEGATIVE REGULATOR/A56 -15V REGULATOR Service Section**

  Contains the circuit descriptions for both assemblies followed by each troubleshooting and repair procedure. Component and schematic diagrams are at the end of the section.

POWER SUPPLIES - FAN
THEORY OF OPERATION

INTRODUCTION

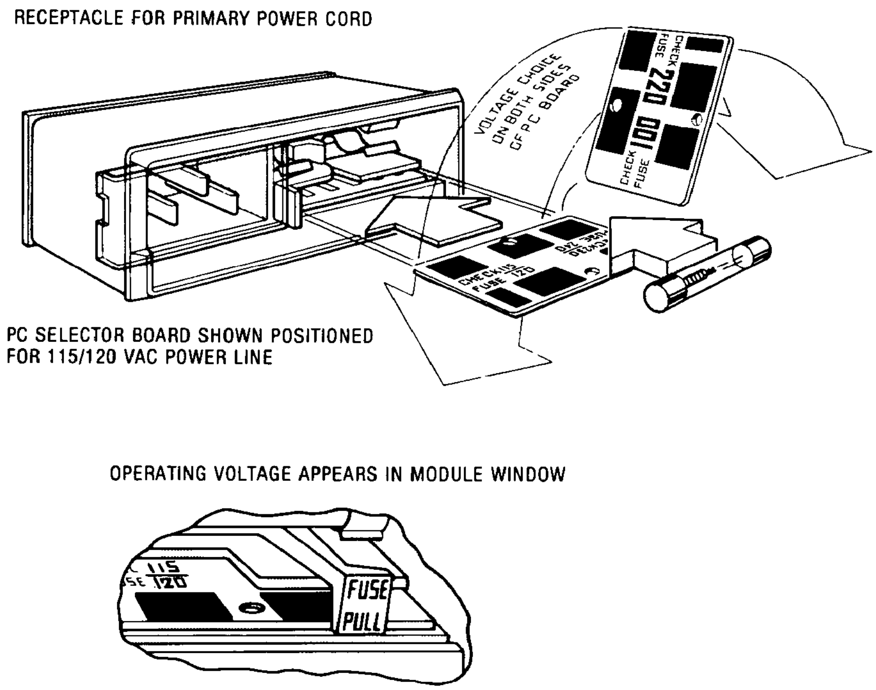
This section supplies the operator with a general knowledge of how the 8340A rectifier and regulators operate and interact with one onother. This section also specifies the ac mains voltages and frequencies the 8340A is designed to accept and describes the operation of the line module, A60 Microprocessor protection circuitry, and supply failure monitoring circuits.

AC MAINS REQUIREMENTS

The 8340A (not Option 003) can be operated at an ac mains voltage of 100, 120, 200, or 240 Vac (+10% -10%) at 47.5 to 66 Hz. Instruments equipped as Option 003 operate at 100 or 120 Vac (+10% -10%) at 360 to 440 Hz. The line filter module configures the primary inputs to the power transformer for the appropriate operating voltage. The cooling fan operates from the primary input to the power transformer. A different fan is required for 400 Hz (Option 003) operation. The four secondary windings provide unrectified voltages for the +22, +20, +5, -10, and -40 volt rectifiers.

LINE MODULE

The line module performs several functions. The main line fuse protects the instrument from line voltage surges, incorrect line voltage applied, internal damage due to a short in the line module, transformer, motherboard, or a rectifier board. The line module suppresses power line transients. The line voltage selector printed circuit board allows the user to easily configure the 8340A for operation at different line voltages. The selected voltage is visible through the clear plastic window (see Figure 8J-1), next to the line fuse.



SELECTION OF OPERATING VOLTAGE

1. SLIDE OPEN POWER MODULE COVER DOOR AND PULL FUSE-PULL LEVER TO LEFT TO REMOVE FUSE.
2. PULL OUT VOLTAGE-SELECTOR PC BOARD. POSITION PC BOARD SO THAT VOLTAGE NEAREST ACTUAL LINE VOLTAGE LEVEL WILL APPEAR IN MODULE WINDOW. PUSH BOARD BACK INTO ITS SLOT.
3. PUSH FUSE-PULL LEVER INTO ITS NORMAL RIGHT-HAND POSITION.
4. CHECK FUSE TO MAKE SURE IT IS OF CORRECT RATING AND TYPE FOR INPUT AC LINE VOLTAGE. FUSE RATINGS FOR DIFFERENT LINE VOLTAGES ARE INDICATED BELOW POWER MODULE.
5. INSERT CORRECT FUSE IN FUSEHOLDER.

Figure 8J-1. Line Module

POWER SUPPLY OPERATION

The 8340A is equipped with the following power supply assemblies: The A19 Capacitor Assembly, the A35 Rectifier Assembly, the A52 Positive Regulator Assembly, the A53 Negative Regulator Assembly, the A56 -15V Regulator Assembly, and several A62 Motherboard mounted components.

NOTE

The components mounted on the A62 Motherboard include series pass elements for the majority of the instrument power supplies.

- A19 CAPACITOR ASSEMBLY provides +20V unregulated and -10V unregulated.
- A35 RECTIFIER ASSEMBLY provides -40V unregulated, +5v unregulated, and +22V regulated.
- A52 POSITIVE REGULATOR provides +20V regulated, +12V regulated, and +5.2V regulated. This assembly also supplies REFERENCE OSCILLATOR SUPPLY, which is the +20V supply switched on or off by HIGH INTERNAL 10 MHz STANDARD ENABLE (HSTD).

- A53 NEGATIVE REGULATOR provides -5.2V regulated, -10V regulated and -40V regulated.
- A56 -15V REGULATOR uses the -40V regulated output to develop a -15V supply.

The 20 volt secondary is rectified and used by both the +20V and +22V regulators. The +22V supply is used for functions that require power when the instrument is in STANDBY mode (e.g. the oven for the 10 MHz standard, standby relay, and memory backup).

The +20V is used throughout the rest of the instrument. +20V is used to power the REFERENCE OSCILLATOR SUPPLY, the +12V supply, and also provides a reference voltage for the +5.2, -10, and -40 volt supplies. The -10V and -40V supplies power the -5.2V and -15V supplies, respectively. None of the instrument power supplies (except the +22V supply) will operate if the +20V supply fails. The +20V supply is energized with a "start-up" current source until it reaches the voltage required to power the precision +10V reference. This +10V reference serves as a voltage reference for the +20V supply. If the instrument is turned off, or if the temperature threshold of the thermal switch is exceeded, the +20V supply is shut down and all other supplies (except the +22V supply) stop functioning (all other supplies are either directly or indirectly dependent on +20V). The REFERENCE OSCILLATOR SUPPLY is provided so the internal 10 MHz reference oscillator can be turned off when an external 10 MHz reference is used.

The 5V secondary output is rectified and regulated to generate the +5.2V regulated supply.

The 10V secondary and 40V secondary outputs are rectified and regulated to power the -10V and -40V supplies. Regulation in these two supplies is accomplished by placing the series pass element in the rectifier ground return path. The return current is regulated to hold the voltage of the supply at the appropriate level.

MICROPROCESSOR PROTECTION CIRCUITRY

The +12V supply is powered by the +20V supply and is not allowed to operate until the +5.2V and -5.2V supplies are present. This circuit protects 08340-60018 processors from excessive power dissipation caused by a 5.2V supply failure. The 08340-60018 was used only in instruments with a serial prefix number of 2447A and below. Newer version(s) of this assembly do not require this protection circuit.

SUPPLY FAILURE MONITORING CIRCUITRY

HIGH POWER UP (HPUP) indicates whether or not all of the instrument power supply voltages are in the correct operating range. If the supplies are out of tolerance, HPUP will be low and LIPS (LOW INSTRUMENT PRESET) will be pulled low. Pulling LIPS low causes the A60 Microprocessor to reset, protects the instruments memory, resets the A3 Display Microprocessor and turns on all of the front panel LED's. LIPS can also be pulled low by pressing the front panel Instrument Preset button.

SIMPLIFIED BLOCK DIAGRAM

Figure 8J-2, Simplified Block Diagram, provides an overview of power supply assemblies and how they interrelate.

WARNING

Although the +22V REGULATOR is the only operational supply in STANDBY mode, all rectifiers are operational and the filter capacitors are fully charged. With the instrument connected to ac mains, there are voltages present at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

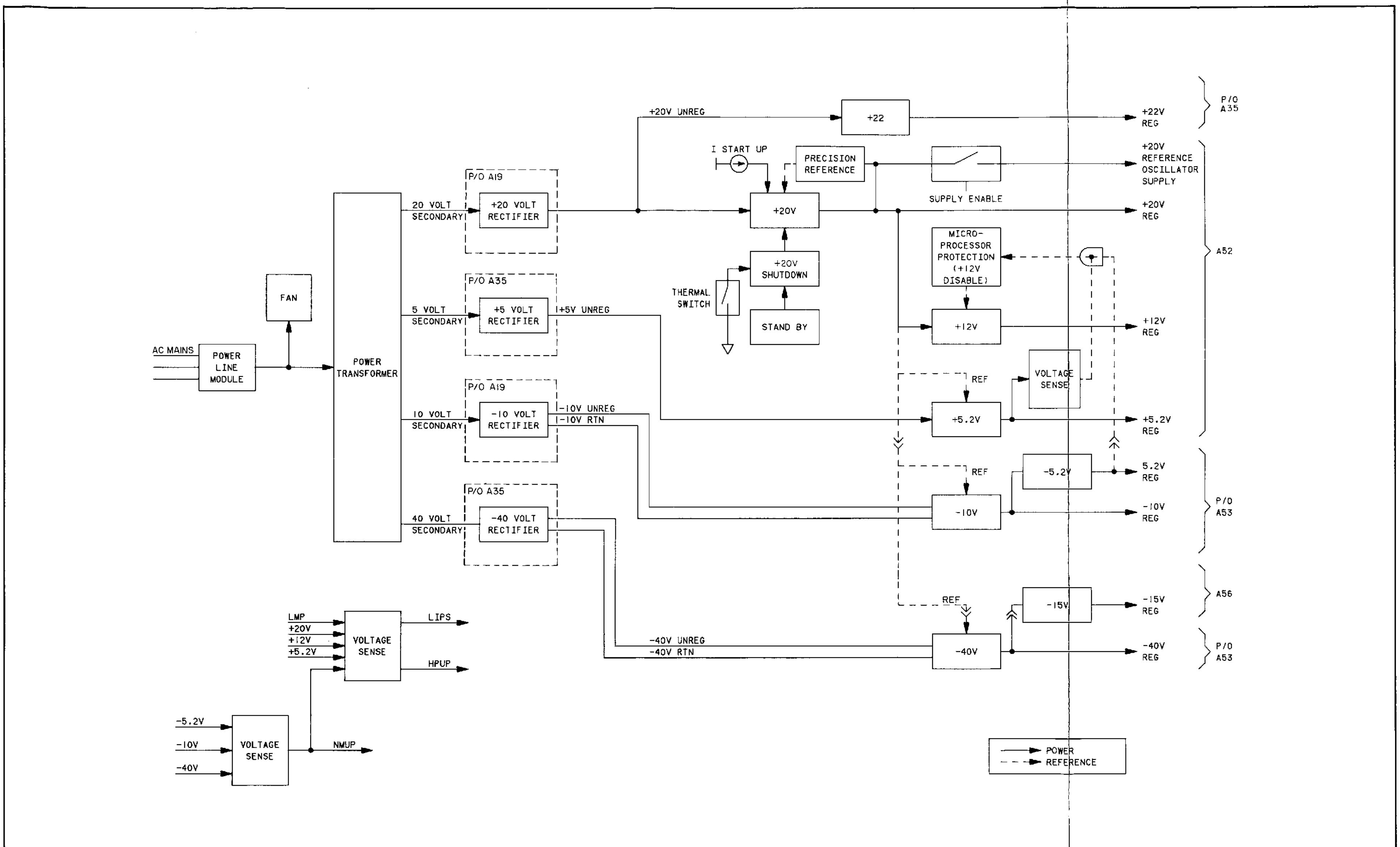


Figure 8J-2. Simplified Block Diagram

POWER SUPPLIES - FAN
TROUBLESHOOTING TO ASSEMBLY LEVEL

INTRODUCTION

This section contains information necessary to determine which rectifier or regulator assembly to troubleshoot if the instrument is blowing line fuses, if the line module is bad, or if more than one power supply is down, which supply is actually causing the problem. If more than one regulator is not operating, refer to the flowchart below.

WARNING

When connected to ac mains, there are voltages at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

WARNING

If the A19 POWER-ON SAFETY INDICATOR LED is on there are voltages present inside the instrument (the A62 Motherboard, the A35 and A19 Rectifier Assemblies, line filter module/transformer wiring, etc.) that can cause personal injury or even death.

CAUTION

The assemblies mentioned below contain static sensitive components. Troubleshoot these assemblies only at a work station that is equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to ground of no less than 1 Megohms and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and statutes. When handling a printed circuit board, always hold it by the edges. Never touch the finger contacts.

INSTRUMENT BLOWS LINE FUSE

Initial checks:

Make sure that the line voltage selector printed circuit board is installed in the line filter module (FL1) with the proper voltage selected. Make sure ac mains voltage is nominal. Check to see if the proper value fuse is installed for the line voltage selected.

Regulator Checks

Remove ac mains and wait for the A19 POWER-ON SAFETY INDICATOR to go out. Remove the A52 Regulator Assembly. Reconnect ac mains and turn the instrument on. If the fuse blows repeat the above procedure and remove the A53 Assembly, A35 Assembly, and A19 assembly, one at a time, until the instrument stops blowing fuses. If the fuse still blows after removing all of these assemblies, suspect the A62 Motherboard, a transformer to motherboard wiring error, an FL1 wiring error, or the transformer itself.

If the line fuse stops blowing after the removing one of the above assemblies, troubleshoot that assembly. Refer to the appropriate service section.

LINE MODULE TROUBLESHOOTING

Refer to Figure 8J-8, A19 Capacitor Assembly, A35 Rectifier Assembly, Transformer, Fan, Schematic Diagram.

Make sure the main line fuse is good. Be sure to install the correct fuse for the selected line voltage (refer to the Fuse Rating Guide, located on the rear panel near the line module).

Refer to Figure 8J-5, Transformer - Line Module - Fan Replacement. Perform steps 1 and 2 of the **"Line Filter Module Replacement"** procedure. Reconnect ac mains, if the line voltage selector printed circuit board is set to 120 or 240 Vac, measure across output pins C and E. Likewise measure across output pins D and F. The voltage across each of these should be equal to the line voltage. If no voltage is present, replace the line module.

If the line voltage selector printed circuit board is set to 100 or 220 Vac, measure across output pins A and F. The voltage across these pins should be equal to the line voltage. If no voltage is present, replace the line module.

MULTIPLE/SINGLE SUPPLY FAILURES

Many of the 8340A power supplies are dependent on one another.

The +22V supply is the only one that is completely indendent of any other supplies. Furthermore, no other supply relies on it. The +20V supply also requires no other supplies to operate. However, all other supplies (except the +22V supply) depend either directly or indirectly on the +20V supply. There are other supply interrelationships as well. The +12V supply requires both the +5.2V and -5.2V supplies to operate (this was once needed to protect the A60 Microprocessor). The -5.2V and -15V supplies are powered directly by the -10V and -40V supplies, respectively.

In order to determine which rectifier or regulator is at fault when multiple supplies are down, or to determine if a single supply failure is being caused by the rectifier or regulator, refer to Figure 8J-3, Power Supply-Troubleshooting to Assembly Level, Flowchart. All supply interrelationships have been taken into account in this flowchart.

To determine which assembly is at fault, begin with the "START" position on the flowchart. Follow the flowchart instructions until a "TROUBLESHOOT" box is reached.

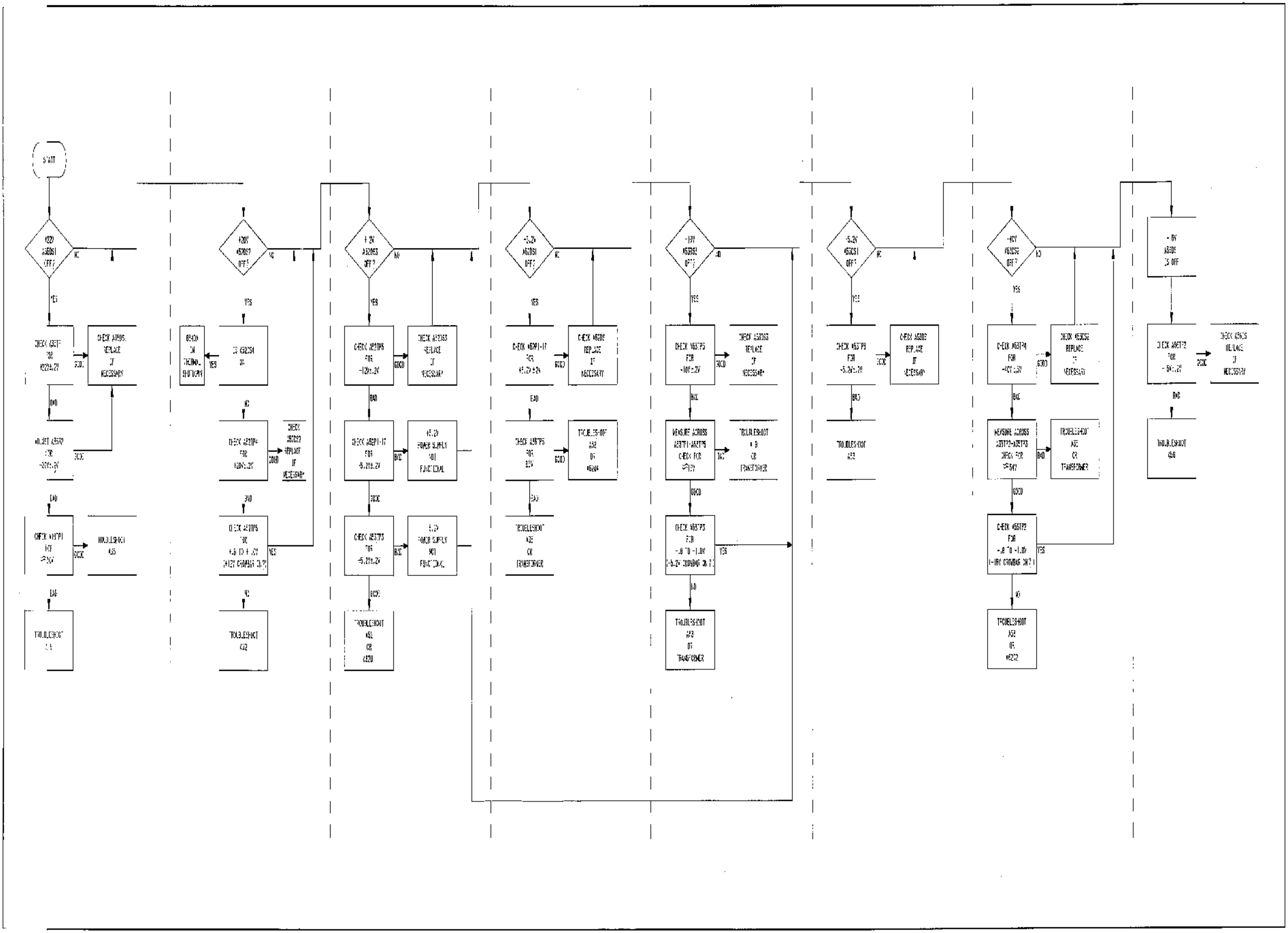


Figure 8J-3. Power Supply — Troubleshooting to Assembly Level, Flow Chart

A62J30 TO B1W1P1 PIN I/O

Pin	Mnemonic	B1W1P1	Levels
1 2	FAN 2	PIN 1	110 VAC
3	FAN 1	PIN 3	110 VAC

Note: Refer to A19 Capacitor Assembly, A35 Rectifier, and Line Power Circuits Schematic Diagram and A62 Motherboard Wiring List for signal source and destination information.

NOTES 1. REFER TO FIGURE 8-XX FOR A DESCRIPTION OF THE SYMBOLOGY USED ON THIS DIAGRAM.

2. REFER TO A62 MOTHERBOARD PIN LIST FOR COMPLETE SOURCE/DESTINATION INFORMATION.

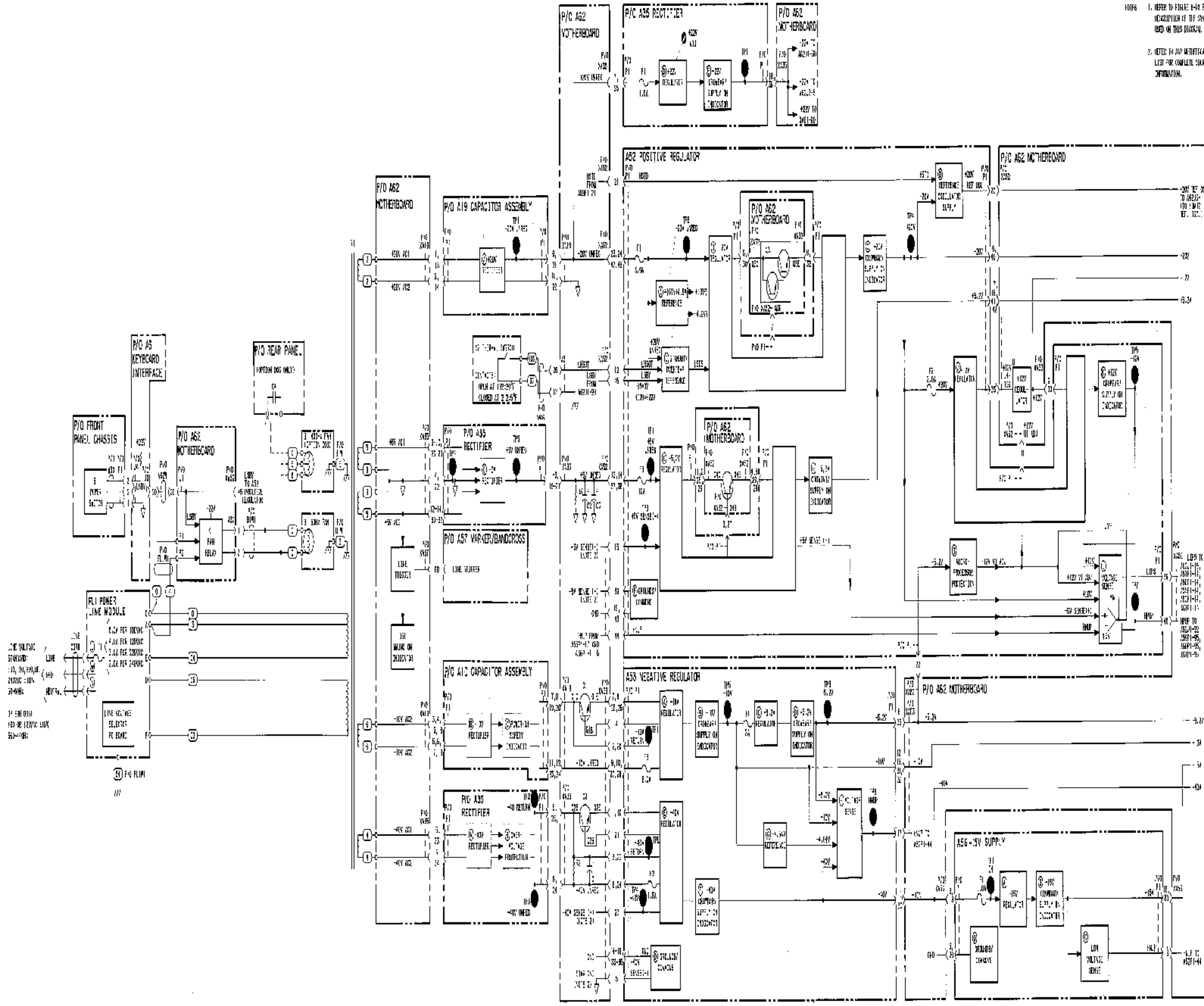


Figure 8-4. Power Supply – Troubleshooting Block Diagram

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POWER SUPPLIES — FAN
REPAIR PROCEDURES

INTRODUCTION

This section contains information and/or procedures for the following:

- **SAFETY INSTRUCTIONS**
- **TRANSFORMER REPLACEMENT**
- **LINE FILTER MODULE REPLACEMENT**
- **FAN REPLACEMENT**

SAFETY INSTRUCTIONS

Read the "**SAFETY CONSIDERATIONS**" section located near the front of Volume 3. this is extremely important. The "**SAFETY CONSIDERATIONS**" section contains information vital to personal safety.

WARNING

When connected to ac mains, there are voltages at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

WARNING

If the A19 POWER-ON SAFETY INDICATOR LED is on there are voltages present inside the instrument (the A62 Motherboard, the A35 and A19 Rectifier Assemblies, Line Module/transformer wiring, etc.) that can cause personal injury or even death.

CAUTION

In the following procedures handling assemblies that contain static sensitive components is necessary. Handle any printed circuit board by the edges and never touch finger contacts. Execute these procedures only at a work station that is equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to ground of no less than 1 Megohms and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and statutes.

CAUTION

Do not re-install the A19 Capacitor, A35 Rectifier, A52 Positive Regulator or A53 Negative Regulator assemblies unless ac mains has been disconnected from the instrument. Failure to observe this precaution will likely result in non-repairable damage to these assemblies.

TRANSFORMER REPLACEMENT

Recommended Special Equipment

Screwdriver, Posidriv Offset HP Part Number 8710-0949 CD1.

Removal Procedure

Refer to Figure 8J-5, Transformer-Line Module-Fan Replacement, located after the Line Module replacement procedure.

1. Disconnect the instrument from ac mains. Remove instrument top and bottom covers. The screws that hold them in place are accessible through holes in the fan housing. Remove the side panel on the transformer side of the instrument. Wait for the A19 POWER-ON SAFETY INDICATOR to go out before proceeding.

2. Remove the A19 CAPACITOR Assembly:
   a. Remove two flange screws **1**.
   b. Remove two side panel screws **2**.

3. Disconnect transformer wires from A62 Motherboard:
   a. Remove the seven screws **3** that connect the transformer secondary wires to the A62 Motherboard.
   b. Remove wire clamp screw **4** from side panel.
   c. Remove the two screws **5** that hold the blue transformer secondary wires to the bottom of the A62 Motherboard.

4. Mechanically disconnect the rear panel Assembly **6**.
   a. Invert the instrument and remove three rear panel screws **7** located on the bottom of the instrument. When these screws are removed the A35 Rectifier protective cover will come off.
   b. Remove three rear panel screws **8** located on the rear panel itself.
   c. Reach into the side of the instrument and push the rear panel out. Pull the rear panel out and away from the fan housing.

5. Desolder all transformer primary wires from Line Module, FL1.

6. Remove the four 1/4 in. screws, **9a**, and the four 3/8 in. screws, **9b**, from the side panel.

CAUTION

On some instruments with a serial prefix number of 2305A or below, the four 9a screws are too long (3/8 in). Ensure that the four 9a screws are 1/4 in. long, if

not, replace with 1/4 in. screws (HP Part Number 2360-0193). This is necessary to avoid shorting the transformer windings.

7. Remove the last two screws as follows:
   a. Remove the cables from A25J1 and A25J2.
   b. Remove the A24, A25, A26, A27, and A28 Assemblies.
   c. Remove two transformer screws, located on the side of the transformer enclosure closest to the front panel (made accessible by removing A24 through A28), with offset posidriv.
   d. Turn the instrument on its side and remove the transformer by carefully pulling out one end a little, then the other. Proceed in this way until the transformer is out.
   e. Remove the metal plate from the side of the transformer and place it on the new transformer.

New transformer Installation

1. To install the new transformer reverse steps 1 through 7 above.

NOTE

Do not allow the transformer secondary wires touch adjacent A62 Motherboard lugs when reversing step 3a. Also, make sure that the white transformer secondary wire pair is reattached to the A62 Motherboard lug labeled (9). Do not attach it to the taller unmarked lug nearby.

NOTE

Make sure the blue transformer secondary wires are all the way inside the plastic clamp when reversing step 3b. If plastic clamp hardware is mounted in the wrong side panel hole, the A19 Assembly will not go back into place.

NOTE

Reinstall the A19 CAPACITOR Assembly as follows: Lift the two grey cables out of the way, lower the A19 assembly flange end first until the finger contact end drops into place. Then lift up slightly on the flange end and push down on the finger connector side until the fingers are fully seated.

LINE MODULE REPLACEMENT

Removal Procedure

Refer to Figure 8J-5, Transformer-Line Module-Fan Replacement, located after this procedure.

1. Disconnect the instrument from ac mains. Remove instrument top and bottom covers. The screws that hold them in place are accessible through holes in the fan housing. Remove the instrument side panel on the Line Module side. Wait for the A19 POWER-ON SAFETY INDICATOR to go out before proceeding.

2. Mechanically disconnect the rear panel Assembly **6**.
   a. Invert the instrument and remove three rear panel screws **7** located on the bottom of the instrument. When these screws are removed the A35 Rectifier protective cover will come off.
   b. Remove three rear panel screws **8** located on the rear panel itself.
   c. Reach into the side of the instrument and push the rear panel out. Pull the rear panel out and away from the fan housing.

3. Desolder all wires. When soldering the wires on the replacement Line Module refer to Figure 8J-8. A19 Capacitor Assembly, A35 Rectifier, Schematic Diagram for wiring information.

New Line Module Installation

Reverse steps 1 through 3 above.

FAN REPLACEMENT PROCEDURE

Fan Removal

Refer to Figure 8J-5, Transformer-Line Module-Fan Replacement.

1. Disconnect the instrument from ac mains. Remove instrument top and bottom covers. Wait for the A19 POWER-ON SAFETY INDICATOR to go out before proceeding.

2. Remove two screws **12** from the rear panel frame (top of instrument).

3. Remove three screws **13** from the rear panel frame (bottom of instrument).

4. Remove the A35 protective cover **10**, A35 RECTIFIER Assembly, and the nearby capacitor cover **11**.

5. When the A35 Assembly is removed the fan cable may be disconnected from J30.

6. Remove four screws from each side of the fan housing. These screws must be discarded and replaced with new screws (HP Part Number 2200-60055, CD7).

7. Remove four screws that hold the fan filter assembly to the front of the fan.

8. Remove the two screws now accessible on the front of the fan housing. These screws must be discarded and replaced with new screws (HP Part Number 2200-60055, CD7).

9. Separate the fan housing.

10. Remove the two screws that hold the fan to the base plate. Note carefully the position of the two washers located between the fan and the base plate. Be careful to place these washers properly when reassebling the fan assembly or the fan may be permanently warped.

Fan Housing Assembly

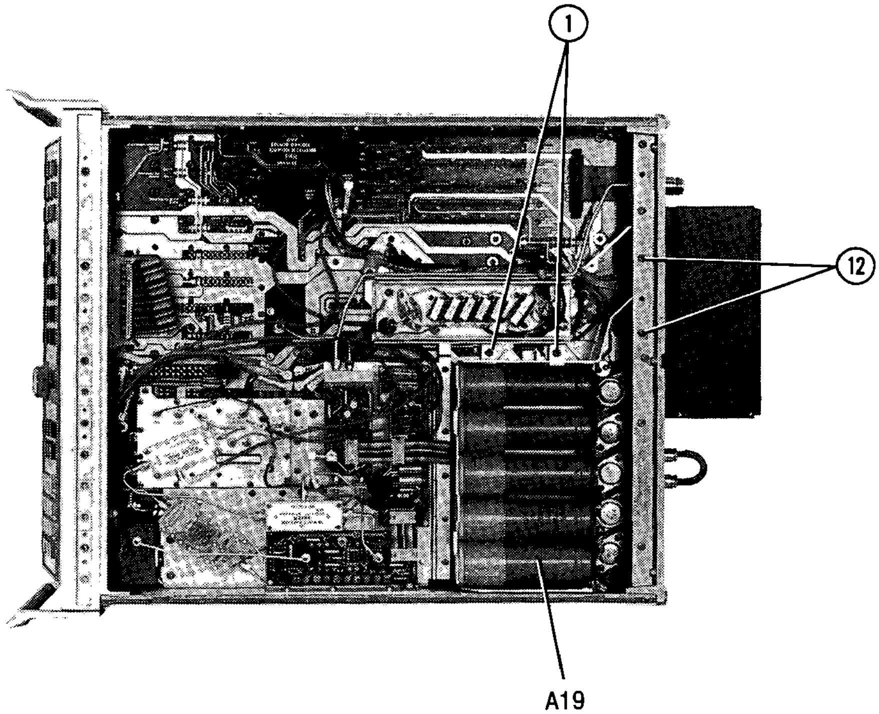
To reassemble the fan housing reverse steps 1 through 10 above.

NOTE

The fan housing top (HP Part Number 08340-00012) and fan housing bottom (HP

Part Number 08340-00013) are the two parts that connect directly to the fan base plate. If instruments with a serial prefix number of 2303 or lower must have either the fan housing top or fan housing bottom replaced, both parts must be replaced.

TOP VIEW



TOP VIEW

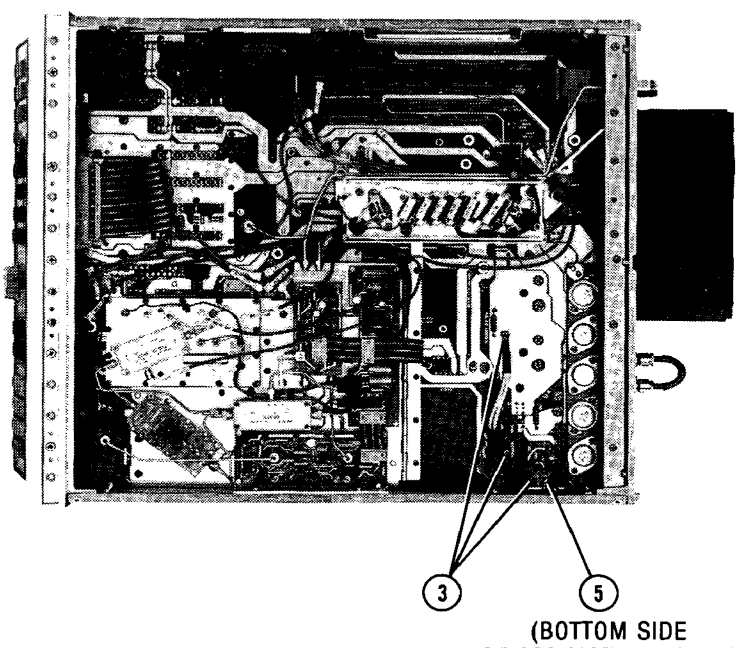
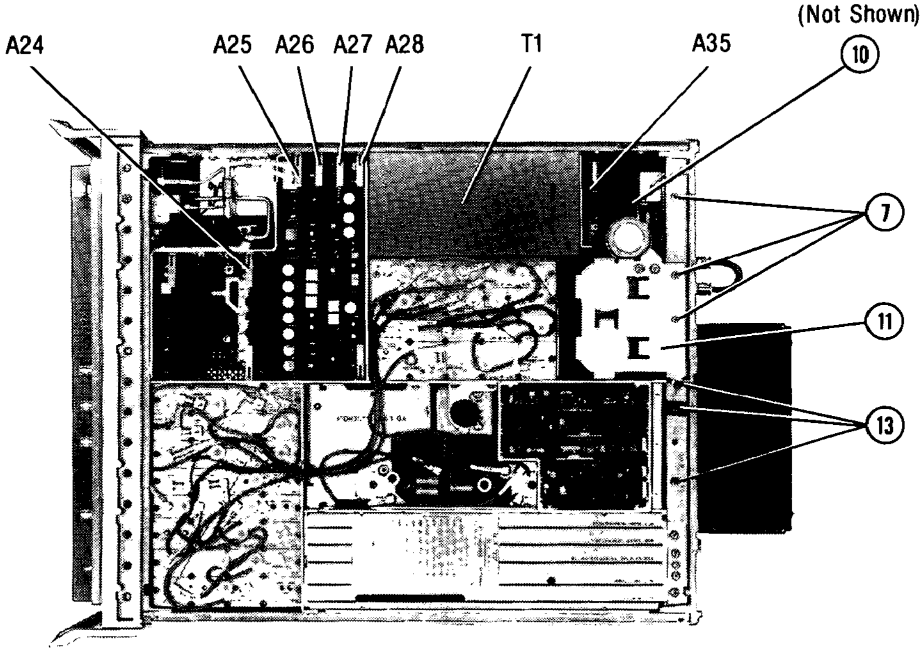


Figure 8J-5. Transformer-Line Module-Fan Replacement (1 of 2)

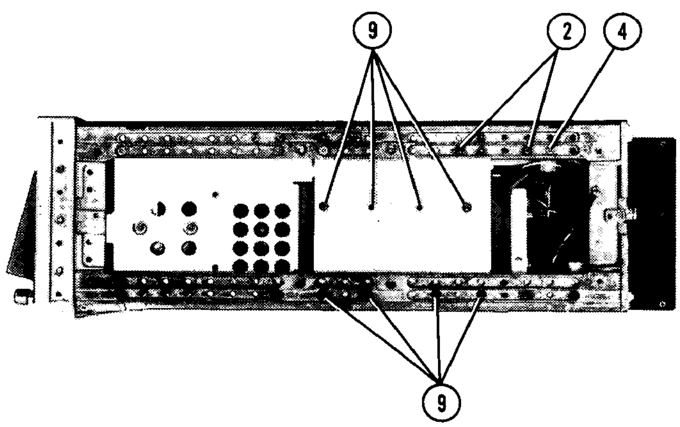
BOTTOM VIEW



NOTE

The fan starting capacitor for Option 003 (400 Hz operation) is located under capacitor cover (Item 11).

SIDE VIEW



REAR VIEW

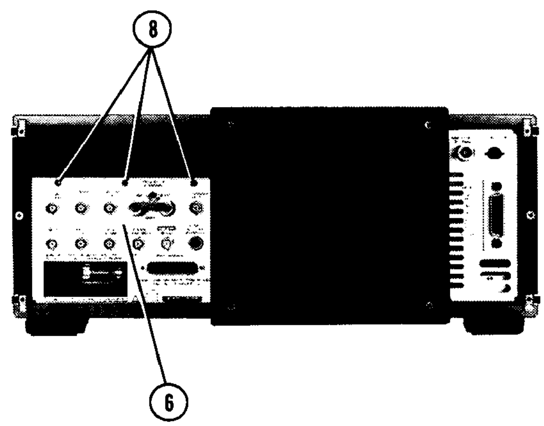


Figure 8J-5. Transformer-Line Module-Fan Replacement (2 of 2)

A19 CAPACITOR ASSEMBLY - A35 RECTIFIER ASSEMBLY TRANSFORMER - FAN

INTRODUCTION

The power supply includes the following:

- The A19 CAPACITOR Assembly.
- The A35 RECTIFIER Assembly.
- The A52 Positive Regulator Assembly.
- The A53 Negative Regulator Assembly.
- The A56 -15V Regulator Assembly.
- Several A62 Motherboard components.

Figure 8J-2 is a simplified block diagram of the power supplies. The +12V, +5.2V, -10V, and -40V power supplies are dependent upon the +20V supply. The -5.2V and -15V supplies are dependent upon the -10V and -40V supplies, respectively.

The function of the power supplies is to produce the voltages required for the 8340A. The circuit also generates the power-up flag HPUP (HIGH POWER UP). This flag is used by the microprocessor and several other circuits to control instrument activity and to ensure proper initialization.

PRIMARY POWER

Primary power is supplied to the primary of T1 through line filter module FL1, which includes a line voltage selector printed circuit board. C1 filters noise. The voltage selector board is positioned to provide correct power connections to T1 for operation with line voltages of 100 Vac, 120 Vac, 220 Vac, or 240 Vac. Refer to Section II, Installation, for complete instructions on the correct installation of the line voltage selection printed circuit board.

STANDBY MODE

With ac mains connected and the front panel LINE switch in STANDBY, the following occurs. Power is supplied to the rectifiers on the A19 CAPACITOR and A35 RECTIFIER Assemblies. The +22V REGULATOR, located on the A35 RECTIFIER Assembly, is powered by the output of the +20V RECTIFIER (+20V UNREG). The anode of DS1 (front panel STANDBY LED) is grounded, lighting DS1. A62K1 switches (closes) into STANDBY (fan B1 remains OFF) and LOW STANDBY (LSBY) disables the +20V REGULATOR. A62CR2 is placed across the coil of the A62K1 relay to remove the inductive kickback that would occur when the 8340 is switched from STANDBY to ON. The A62K1 relay is connected so that power is normally supplied to the fan (B1). Switching to STANDBY grounds A62K1 pin 1 and energizes the relay, removing power from the fan (B1). When the +20V supply is disabled, all other supplies (except the +22V supply) are disabled. Other LEDs that are ON are A62DS1 (MAINS-ON indicator), A19DS1 (POWER-ON SAFETY INDICATOR) and A35DS1 (+22V supply operational indicator).

WARNING

Although the +22V REGULATOR is the only operational supply, ac mains are present, the rectifiers are fully operational and the filter capacitors are fully charged.

When the LINE switch is moved from STANDBY to ON, A62K1 pin 1 is disconnected from ground, allowing power to go to the fan (B1). Simultaneously, LSBY goes from 0V to +22V which allows the +20V supply and other supplies to become operational.

A19 CAPACITOR ASSEMBLY, CIRCUIT DESCRIPTION

Introduction

The A19 CAPACITOR Assembly contains the full-wave bridge rectifiers and line filters for the +20V, and the -10V power supplies. Also located on the board is a POWER-ON SAFETY INDICATOR for the safety of the service technician. If the POWER-ON SAFETY INDICATOR is illuminated (See "**POWER-ON SAFETY INDICATOR Circuit C**", below), there will be hazardous voltages present directly beneath the A19 assembly on the A62 Motherboard.

All components referenced below are on the A19 Assembly unless otherwise noted.

+20V RECTIFIER Circuit A

The +20V full-wave bridge rectifier consists of CR1 through CR4. C3 and C10 form a high frequency filter that suppresses conducted line emissions by attenuating diode reverse recovery transients. C1 decreases the high frequency currents on the +20V UNREG line. C5 and C6 are the main filter capacitors; R1 and R4 form a bleeder resistor.

-10V RECTIFIER Circuit B

The -10V full-wave bridge rectifier includes CR5 through CR8; these are schottky barrier power rectifiers and are used here to increase the efficiency of the low voltage power supplies. C4 is a high frequency filter to suppress conducted line emissions. C7, C8, and C9 are the line filter capacitors and R2 is a bleeder resistor. C2 decreases the high frequency currents on the -10V UNREG line.

POWER-ON SAFETY INDICATOR Circuit C

The POWER-ON LED (DS1) should be ON whenever the unregulated supply filter capacitors still store enough energy to present a potential safety hazard. Since the 8340A has no ON/OFF line power switch, if ac mains are connected, the unregulated supplies and +22V regulated supply are active.

A35 RECTIFIER ASSEMBLY, CIRCUIT DESCRIPTION

Introduction

The A35 Rectifier Assembly consists of the following:

- **-40V RECTIFIER** Circuit.
- **OVERVOLTAGE PROTECTION** Circuit.
- **+5V RECTIFIER** Circuit.
- **+22V REGULATOR** Circuit.

All components referenced below are on the A35 Assembly unless otherwise noted.

-40V RECTIFIER Circuit A

The -40V RECTIFIER consists of CR1 through CR4. C1 is the high frequency filter that decreases conducted line emissions. C5 decreases the high frequency currents on the -40V UNREG line.

OVERVOLTAGE PROTECTION Circuit B

The OVERVOLTAGE PROTECTION circuitry is a simple crowbar circuit that is fired in the event that the line voltage selector printed circuit board is set to a low line voltage and the instrument is mistakenly plugged into a high voltage outlet. VR1 starts to conduct as the voltage across it reaches 82.5V, biasing crowbar SCR Q1 on and shorting the 40V transformer winding during each positive half-cycle of the ac mains. This blows the main fuse in the line module.

+5V RECTIFIER Circuit C

The +5V RECTIFIER is arranged in a full-wave, center-tapped configuration for efficiency (e.g. only one rectifier in series with the load at any time, as opposed to two for a bridge configuration). Power rectifier U1 is a single-chip dual schottky barrier rectifier in a TO-3 package. C2 and C3 are the high frequency filters that decrease conducted line emissions. C7 decreases the high frequency currents on the +5V UNREG line.

+22V REGULATOR Circuit D

The +22V REGULATOR consists of U2 (a three terminal adjustable regulator), the adjustment circuitry (R1, R2, and R3), and ripple rejection capacitors C8 and C10. CR7 prevents C8 and C10 from discharging into U2 if the input to U2 is shorted or when line power is removed. CR5 and CR6 protect the +22V loads from damage due to reverse polarity power supply voltages in the event of some instrument fault. For example, without CR5 and CR6 a direct short between the +22V and -10V power supplies occured, the -10V supply would overpower the +22V standby supply and reverse its polarity.

NOTE

This supply is continuously active as long as the instrument is connected to ac mains.

+22V CROWBAR/SUPPLY-ON INDICATOR Circuit E

In the event of an overvoltage condition on the +22V regulated output, VR2 will conduct, biasing crowbar SCR Q2 on and shorting the +22V supply to ground. This protects the instrument +22V loads from damage due to an overvoltage condition. C9 filters transients to prevent premature firing of Q2. The POWER-ON SAFETY INDICATOR consists of DS1, R4, and VR3. DS1 will begin to light when the regulator supply voltage reaches +17V.

+22V Supply Tolerance

The tolerance of the +22V supply is +22V ±5% (1.1V).

P/O A62 MOTHERBOARD ASSEMBLY CIRCUIT DESCRIPTION

The A62 Motherboard distributes all secondary ac and unregulated dc power to those printed circuit boards requiring these voltages. The MAINS-ON indicator (consisting of DS1, R1, and CR1) is active whenever the instrument is plugged into the ac mains. It's function is to warn the service technician that hazardous voltages are present on the Motherboard in the power supply area. (The same circuit is used to generate the 60 Hz LINE TRIGGER signal for the internal sweep circuitry). If DS1 fails to light when ac mains are connected, suspect a DS1 failure. A failure of DS1 should not cause failure of the LINE TRIGGER function.

The instrument power supply heat sink is located on the rear panel. It is the primary cooling system for the +20, +12, +5.2, -10, and -40 Volt power supply series pass elements. Figure 8J-14. Power Supplies Major Assembly Location Diagram, illustrates the placement and identity of these series pass elements on the A63 Motherboard/Heatsink.

A19 CAPACITOR ASSEMBLY, TROUBLESHOOTING

WARNING

When connected to ac mains, there are voltages at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

WARNING

If the A19 POWER-ON SAFETY INDICATOR LED is on there are voltages present inside the instrument (the A62 Motherboard, the A35 and A19 Rectifier Assemblies, line filter module/transformer wiring, etc.) that can cause personal injury or even death.

CAUTION

Do not remove the crowbar and operate the supply without it. This could cause severe damage to the instrument if the supply is faulty and the crowbar has engaged to protect the instrument.

CAUTION

The A19 Assembly contains static sensitive components. Troubleshoot this assembly only at a work station that is equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to ground of no less than 1 Megohms and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and statutes. When handling a printed circuit board, always hold it by the edges. Never touch the finger contacts.

Introduction

When POWER-ON SAFETY INDICATOR LED DS1 is on, it is warning the service technician that hazardous voltages exist on the A62

Motherboard, beneath the A19 CAPACITOR Assembly. Wait for this LED to go out before removing the A19 Capacitor Assembly to place it on an extender board. This extender board is designed assuming the instrument is on its left side (ON/STANDBY switch down, output connector up), with the A19 Capacitor Assembly resting on the side rail.

Main Line Fuse Blows

If the instrument blows the line fuse, refer to the "**INSTRUMENT BLOWS LINE FUSE**" section of the "**POWER SUPPLY - TROUBLESHOOTING TO ASSEMBLY LEVEL**" functional group. If the tests contained in the above functional group indicate that this assembly is at fault, proceed as follows:

Remove aluminum electrolytic capacitors C5 through C9. If the problem dissappears, one of these capacitors is shorted. Use a process of elimination to discover which capacitor is defective. If the problem persists, try to isolate the cause to one of the two rectifier circuits as follows: The transformer secondary windings that power the rectifiers first go to the A62 Motherboard where they are attached with screws. Remove ac mains from the instrument, wait for the POWER-ON SAFETY INDICATOR to go out. Remove the A19 Assemby (to make the screws accessable) and remove one of the red secondary wires that power the +20V RECTIFIER (be careful to isolate the exposed wire from all other circuits on the motherboard). Reinstall the A19 Assembly and reconnect ac mains. Repeat this procedure to disconnect the -10V secondary if necessary. If either rectifier circuit is at fault, suspect a shorted component. If the problem persists, suspect an A62 Motherboard short.

+20V Rectifier Output Voltage Incorrect

Make sure the instrument is in STANDBY and ac mains are nominal (120V in the 120V line option, etc.). Ensure that the line voltage selector printed circuit board is installed properly. Measure A19TP1 (or directly across C5 or C6) for +35V. If the voltage is low disconnect ac mains and wait for the POWER-ON SAFETY INDICATOR to go out. Remove the A35 and A52 assemblies. Connect ac mains and measure TP1 again. If the voltage at TP1 is now approximately +35VDC, proceed as follows: While observing all safety precautions mentioned above, reinstall A35 and A52 one at a time to determine which one is at fault. Refer to the appropriate troubleshooting guide.

If the problem persists after the A35 and A52 are both removed, suspect an open rectifier diode. If these are funtional, suspect the transformer.

-10V RECTIFIER Output Voltage Incorrect

Troubleshooting is similar to the "**+20V RECTIFIER Output Voltage Incorrect**" troubleshooting section, above. Check for +18VDC directly across C7, C8, or C9. Any "**+20V RECTIFIER Output Voltage Incorrect**" instructions that pertain to the A35 and A52 assemblies pertain to the A53 assembly when troubleshooting the -10V RECTIFIER. If DS1 is out, but the -10V UNREG voltage level appears correct, check DS1 and R3.

A35 RECTIFIER ASSEMBLY, TROUBLESHOOTING

WARNING

When connected to ac mains, there are voltages at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

WARNING

If the A19 POWER-ON SAFETY INDICATOR LED is on there are voltages present inside the instrument (the A62 Motherboard, the A35 and A19 Rectifier Assemblies, line filter module/transformer wiring, etc.) that can cause personal injury or even death.

CAUTION

The A35 Assembly contains static sensitive components. Troubleshoot this assembly only at a work station that is equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to ground of no less than 1 Megohms and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and statutes. When handling a printed circuit board, always hold it by the edges. Never touch the finger contacts.

CAUTION

Do not remove the crowbar and operate the supply without it. This could cause severe damage to the instrument if the supply is faulty and the crowbar has engaged to protect the instrument.

Since the A35 Rectifier Assembly contains three separate and isolated power circuits, each circuit can be considered separately.

-40V RECTIFIER Troubleshooting

The -40V RECTIFIER is straightforward, and troubleshooting follows the same logic as pointed out in troubleshooting the A19 Capacitor Assembly. When a crowbar SCR fails, it will usually short. If the instrument blows line fuses and the problem is traced to the A35 Rectifier Assembly, check Q1 for a short (this could also be due to a shorted VR1). If the overvoltage protection circuit does not work, it is probably due to an open VR1.

+5V RECTIFIER Troubleshooting

The +5V RECTIFIER has only two diodes which are both in one TO-3 package. If this unregulated supply malfunctions, check the diodes for open or shorted condition failures.

+22V REGULATOR Troubleshooting

The +22V REGULATOR source is the +20V UNREG line. the A19 Capacitor Assembly must therefore be present to test this regulator. The tolerance of this supply is +22V ±5% (1.1V).

SUPPLY/LOAD FAILURE DETERMINATION

Disconnect the instrument from ac mains. After the POWER-ON SAFETY INDICATOR goes out remove the A35 Assembly and place it on an extender board. Apply thin, colored, non-conductive tape to the extender board +22V output pins (use of colored tape is recommended because transparent tape may be forgotten and left on the extender board, causing unnecessary troubleshooting). Do not apply tape to A35 printed circuit board fingers. Re-install the A35 Assembly and connect ac mains to the instrument. If the power supply now operates properly suspect a short on one of the instrument assemblies that use +22V. Refer to Table 8J-11, Power Supply Destination Chart at the end of the **"POWER SUPPLY - FAN"** functional group, for a list of these assemblies. After removing tape from extender board fingers clean fingers according to the following instructions:

CAUTION

Cleaning P.C. Board fingers by any other method than the one described below may cause serious reliability problems. NEVER clean fingers with any kind of eraser. NEVER use tap water in the cleaning solution described below. Tap water contains chlorine. Chloride contamination from tap water, salt (from skin contact),

or any other source may cause serious reliability problems. Always wear a ground strap when handling any 8340 internal component or assembly.

Printed Circuit Board Finger Cleaning Procedure

Mix one part deionized water with two parts isopropyl alcohol. Apply this solution to a clean, lint free, cloth (HP Part Number 9310-0039 CD3). Rub the fingers carefully and then dry with a clean part of the cloth.

Refer to the appropriate section below:

- +22V Load Failure
- +22V Power Supply Failure

+22V Load Failure

If the problem is load related repeat the above procedure for safe removal of the A35 Assembly, remove the tape from the extender board's +22V output pins, clean the fingers as described above, and reinstall the A35 assembly. It will be necessary to remove each assembly that uses +22V, one at a time, to determine which one is faulty. Likewise remove any cables listed that carry the affected supply. Refer to Table 8J-11, Power Supply Destination Chart, located at the end of the "**POWER SUPPLY - FAN**" functional group, for a list of these assemblies. Always remove ac mains and wait for the POWER-ON SAFETY INDICATOR to go out before removing or installing any assembly or cable.

+22V Power Supply Failure

If the power supply output does not return to normal after the extender board +22V output pins are taped off, refer to the appropriate sections below:

- +22V output voltage approximately .8V to 1.0V.
- +22V output voltage approximately 0V.
- +22V output voltage incorrect. Tolerance is +22V $\pm$5% (1.1V).

+22V output voltage approximately .8V to 1.0V.

Crowbar circuit verification - If the output voltage is approximately .8V to 1.0V the crowbar circuit is engaged. Connect the instrument to an auto-transformer set for 0V output. While monitoring the supply output voltage slowly increase the auto-transformer output voltage. If the crowbar fires before the supply output reaches +22V suspect A35VR2.

Regulator verification - If the power supply output reaches +22V stop increasing auto-transformer voltage. Measure the voltage across pin 1 and the case of U2 (regulator). If the voltage is not approximately 1.25V suspect U2. Measure the voltage from the input and the output of U2. If there is little or no voltage U2 is probably shorted.

+22V output voltage approximately 0V.

Initial checks - Ensure that ac mains voltage is nominal and that the line voltage selector PC Board is installed properly in the line filter module, FL1. Make sure the proper fuse value is installed. If the above is correct and the power supply input fuse (F1) is blown, suspect regulator A35U2.

Regulator verification - Measure across pin 1 and the case of U2. If the voltage is not approximately 1.25V suspect U2.

Measure the +20V UNREG (P1-7). If this voltage is less than approximately +30V, troubleshoot the +20V Rectifier. Refer to the A19 troubleshooting guide.

Examine the +22V supply for burnt or discolored components. Suspect a shorted capacitor, diode, or crowbar SCR if the above mentioned procedures to not isolate the problem.

+22V output voltage incorrect. Tolerance is +22V ±5% (1.1V).

Ensure that ac mains voltage is nominal and that the line voltage selector PC Board is installed with the proper line voltage selected.

Measure the +20V UNREG input with respect to ground. If the voltage is less than approximately +30V troubleshoot the +20V Rectifier. Refer to the A19 Troubleshooting Guide.

Measure the output voltage with an HP 1740A or similar Oscilloscope. Make sure the supply is not oscillating.

If the output is approximately 1.25V C10 is probably shorted.

FAN TROUBLESHOOTING PROCEDURES

WARNING

When connected to ac mains, there are voltages at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

WARNING

If the A19 POWER-ON SAFETY INDICATOR LED is on there are voltages present inside the instrument (the A62 Motherboard, the A35 and A19 Rectifier Assemblies, line filter module/transformer wiring, etc.) that can cause personal injury or even death.

Fan Inoperative/Slow

Make sure ac mains are nominal and that the line voltage selector PC Board in the line filter module is set to the correct voltage. Disconnect ac mains from the instrument. Remove the instruments top and bottom covers. The screws that hold them in place are accessible through holes in the fan housing. Wait for A19 POWER-ON SAFETY INDICATOR to go out. Remove the A35 RECTIFIER Assembly. Disconnect the fan power cord from A62J30 (located under the A35 Assembly). Connect ac mains, turn the Line switch on, and measure the voltage at A62J30. Make sure the voltage is approximately 120V. If it is not troubleshoot the K1 relay or the line filter module. If the voltage is correct disassemble the fan housing assembly as follows:

Disconnect ac mains. Turn the instrument on its side and Remove the four screws on each side of the fan housing. These screws must be discarded and replaced with new screws (HP Part Number 2200-60055, CD7). Remove the four screws that hold on the fan filter assembly. Remove the two screws now accessible on the front of the fan housing. The latter two screws must be discarded and replaced with new screws (HP Part Number 2200-60055, CD7). Separate fan housing.

Reconnect the fan power cord to A62J30. Remove the access plate on the fan where the power cord is attached. Connect ac mains and turn the Line switch on. Measure the voltage across the power terminals. If the voltage is not approximately 120V suspect the fan power cable. It the voltage is correct, suspect the starting capacitor (on Option 400 units only), or the fan itself. Refer to the "**FAN REPLACEMENT PROCEDURE**" in the "**REPAIR PROCEDURES**" section for complete fan replacement instructions.

A19 REPAIR PROCEDURES

CAUTION

Never short a capacitor with a screwdriver or similar tool.

Capacitor Replacement

When installing a replacement electrolytic capacitor, make sure the capacitor's pressure relief valve is directly over the hole in the PC Board. This ensures that capacitor polarity is correct.

A35 REPAIR PROCEDURES

See all warnings and cautions mentioned above in the "**A19 REPAIR PROCEDURES**" section.

CAUTION

The thermal connection between the voltage regulator A35U2, the full wave rectifier A35U1, and the A35 heat sink is the dominant factor in the two device's long term reliability. Be sure to properly apply thermal compound (HP Part Number 6040-0454 CD0) when installing or replacing either of these parts.

CAUTION

Use only oil based thermal compound. The use of silicone based thermal compound may cause serious reliability problems. Silicone based oil migrates to pass element sockets, switch contacts, or printed circuit board edge connectors. The compound then tends to raise contact resistance or electrically isolate the contacts. Silicone based thermal compounds disperse into the air and deposit themselves anywhere in the instrument. Applying this material to a warm component (e.g. a heat sink or pass element) increases the rate of dispersion.

Thermal Compound Application

When installing or replacing a pass transistor or voltage regulator make sure thermal compound is applied as described below:

Apply a thin coating of thermal compound (HP Part Number 6040-0454 CD0) to both sides of the insulating washer. The coating should be just thick enough to provide a thin but continuous layer of compound from component-to-washer and washer-to-heat sink. An excessive amount of heat sink compound impairs its ability to transfer heat. The pass element mounting screws should be tightened with seven inch-pounds of force. Tightening with less force diminishes the heat transfer capability of the thermal compound. Tightening with greater force may damage the mounting hardware.

TRANSFORMER REPLACEMENT PROCEDURE

For transformer replacement instructions refer to "**TRANSFORMER REPLACEMENT**" in the "**REPAIR PROCEDURES**" section of this functional group.

FAN REPLACEMENT PROCEDURE

Refer to the "**FAN REPLACEMENT PROCEDURE**" in the "**REPAIR PROCEDURES**" section of this functional group.

Table 8J-1. A35 Rectifier, Regulated Supply Limit

Power Supply	DMM Probe	Ground	Limit
+22V	A35TP1	A35TP4	+20.90V to +23.10V

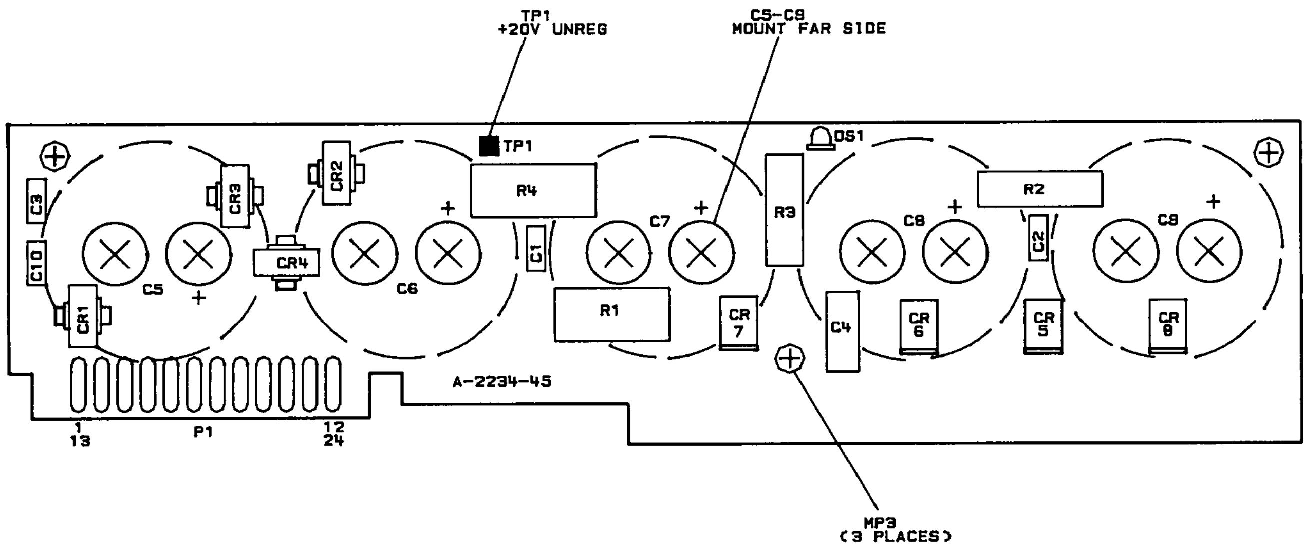


Figure 8J-6. A19 Capacitor Assembly, Component Location Diagram

A19 Capacitor Assembly P1 Pin I/O

A19

Pin	Mnemonic	Levels	Source	Destination
1	+20V AC1	+20 VAC	A62 LUG (2)	*A
13	+20V AC1	+20 VAC	A62 LUG (2)	*A
2	+20V AC2	+20 VAC	A62 LUG (2)	*A
14	+20V AC2	+20 VAC	A62 LUG (2)	*A
3	−10V AC1	−10 VAC	A62 LUG (6)	*B
15	−10V AC1	−10 VAC	A62 LUG (6)	*B
4	−10V AC1	−10 VAC	A62 LUG (6)	*B
16	−10V AC1	−10 VAC	A62 LUG (6)	*B
5	−10V AC2	−10 VAC	A62 LUG (6)	*B
17	−10V AC2	−10 VAC	A62 LUG (6)	*B
6	−10V AC2	−10 VAC	A62 LUG (6)	*B
18	−10V AC2	−10 VAC	A62 LUG (6)	*B
7	−10V RETURN	+6.4V AT 13.3 GHZ	XA53P1-2, 20	B C
19	−10V RETURN	+6.4V AT 13.3 GHZ	XA53P1-2, 20	B C
8	−10V RETURN	+6.4V AT 13.3 GHZ	XA53P1-2, 20	B C
20	−10V RETURN	+6.4V AT 13.3 GHZ	XA53P1-2, 20	B C
9	+20V UNREG	+31.2V	XA35P1-7, 25	*A
21	+20V UNREG	+31.2V	XA35P1-7, 25	*A
10	GND	0V	A62 STAR GND	*A
22	GND	0V	A62 STAR GND	*A
11	−10V UNREG	−10V	B C	XA53P1-27, 28
23	−10V UNREG	−10V	B C	XA53P1-27, 28
12	−10V UNREG	−10V	B C	XA53P1-27, 28
24	−10V UNREG	−10V	B C	XA53P1-27, 28

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

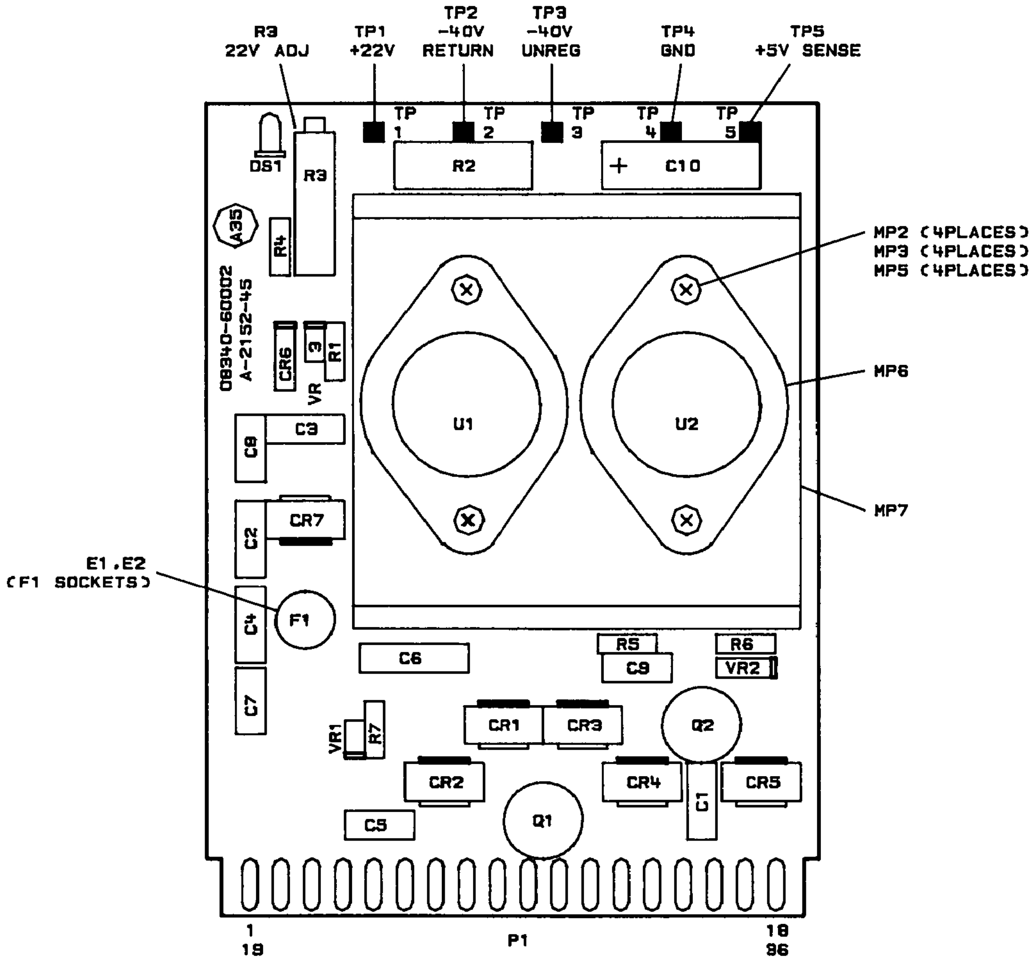


Figure 8J-7. A35 Rectifier, Component Location Diagram

A35 Rectifier P1 Pin I/O

A35

Pin	Mnemonic	Levels	Source	Destination
1 19	+5V UNREG +5V UNREG	+7 TO +9V +7 TO +9V	C C	* *
2 20	+5V UNREG +5V UNREG	+7 TO +9V +7 TO +9V	C C	* *
3 21	+5V UNREG +5V UNREG	+7 TO +9V +7 TO +9V	C C	* *
4 22	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*C *C
5 23				
6 24	−40V UNREG −40V UNREG	−40V −40V	A B A B	* *
7 25	+20V UNREG +20V UNREG	+31.2V +31.2V	D D	* *
8 26	+5V AC1 +5V AC1	7V AC 7V AC	A62 LUG (5) A62 LUG (5)	*C *C
9 27	+5V AC1 +5V AC1	7V AC 7V AC	A62 LUG (5) A62 LUG (5)	*C *C
10 28	+5V AC1 +5V AC1	7V AC 7V AC	A62 LUG (5) A62 LUG (5)	*C *C
11 29				
12 30	+5V AC2 +5V AC2	7V AC 7V AC	A62 LUG (5) A62 LUG (5)	*C *C
13 31	+5V AC2 +5V AC2	7V AC 7V AC	A62 LUG (5) A62 LUG (5)	*C *C
14 32	+5V AC2 +5V AC2	7V AC 7V AC	A62 LUG (5) A62 LUG (5)	*C *C
15 33	−40V AC1 −40V AC1	−40V AC −40V AC	A62 LUG (4) A62 LUG (4)	*A *A
16 34	−40V AC2 −40V AC2	−40V AC −40V AC	A62 LUG (4) A62 LUG (4)	*A *A
17 35				
18 36	+22V +22V	22V 22V	D E D E	* *

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

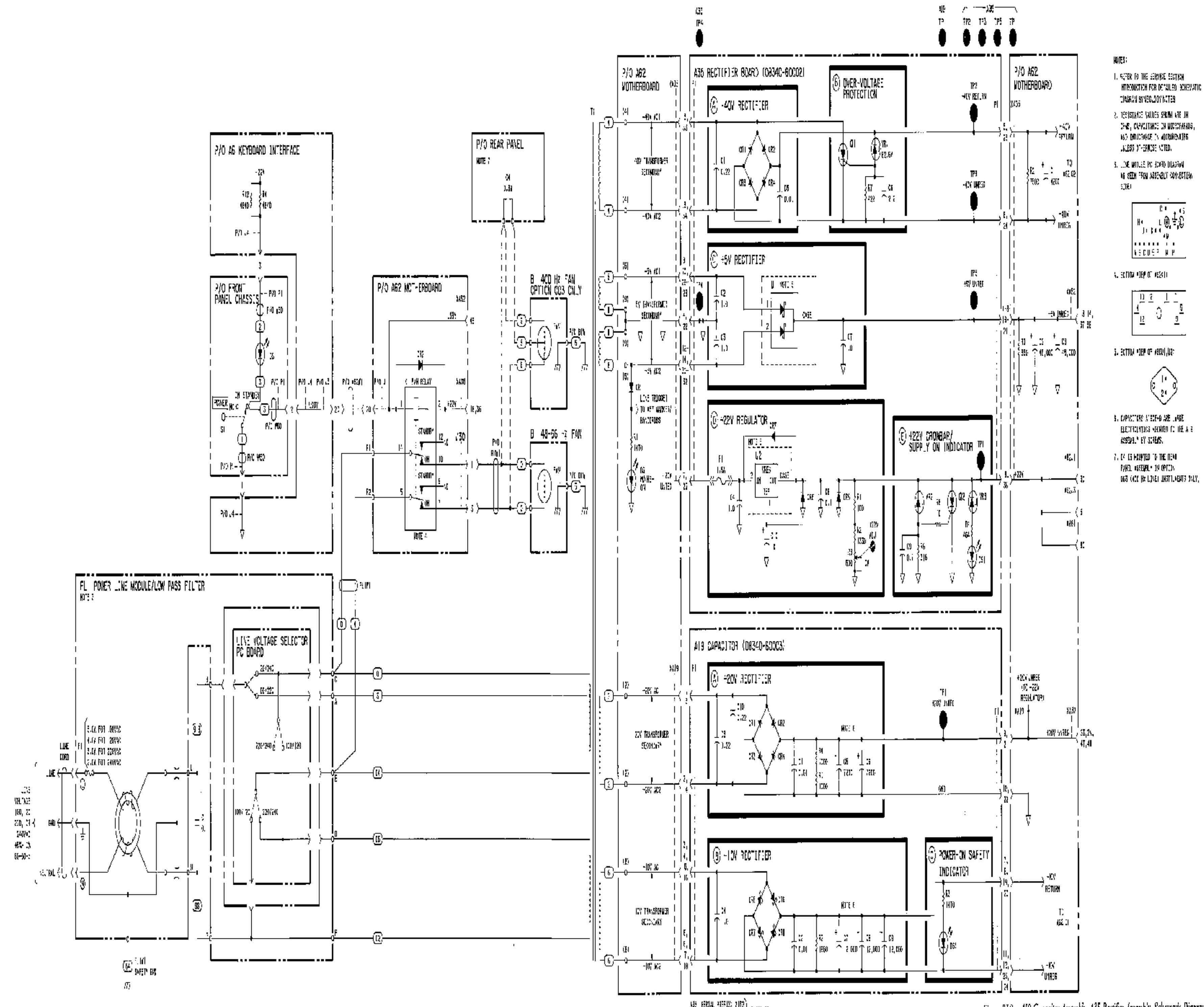


Figure 8J-8. A19 Capacitor Assembly, A15 Rectifier Assembly, Schematic Diagram

A52 POSITIVE REGULATOR

INTRODUCTION

This service section pertains to the following assemblies:

- The A52 Assembly.
- Parts of the A62 Motherboard Assembly.

A52 POSITIVE REGULATOR CIRCUIT DESCRIPTION

Introduction

The A52 Positive Regulator contains circuitry for the +20V supply, the +12V supply, the +5.2V, voltage accuracy sensing circuitry for these supplies, and ON/STANDBY and SHUTDOWN functions. The +20V supply is a self-starting regulator having a precision reference to accurately set the output potential. With the exception of the independent +22V standby supply (described in the A35 theory of operation), all supplies are slaved to the +20V output. The +12V, +5.2V, -10V and -40V supplies are directly slaved while the -5.2V and -15V supplies are indirectly slaved (refer to Figure 8J-2, Simplified Block Diagram).

NOTE

The +20V and +5.2V supplies are critical, low noise supplies with a specified periodic and random deviation (PARD) less than 100 microvolts peak. The +12V supply is non-critical with a specified PARD less than 5mV peak.

All components referenced below are on the A52 Assembly unless otherwise noted.

+10V/+4.9V REFERENCE Circuit A

The zener regulator VR5 creates a stable +10V reference (+10VR) for use in the +20V REGULATOR (Block **B**), Standby/Overtemperature Shutdown (Block **E**), and voltage sense circuitry on the A52 Positive Regulator Assembly. VR5 bias is supplied through R26 by +20V UNREG. The accuracy and stability of VR5 is not critical; however, a large error in the voltage across VR5 can cause problems with the power Up/Down circuitry. If +10VR is incorrect, check for excessive supply loading. Trouble is indicated if the value of +10V REF changes significantly as the LINE switch is cycled. The +4.9V reference (+4.9VR) is generated by divider network R39 and R40. This signal is used as a reference for the comparators in the STANDBY/OVERTEMP SHUTDOWN (Block **E**) and VOLTAGE SENSE (Block **L**) circuits on the A52 Positive Regulator Assembly.

+20V REGULATOR Circuit B

The +20V REGULATOR is the master regulator for the 8340A power supply system. Except for the +22V standby supply (which is ON continuously), all instrument supplies are dependent on the +20V supply. The +12V supply and the REFERENCE OSCILLATOR SUPPLY are powered directly from the +20V regulator. The +5.2V, -10V, and the -40V supplies use the +20V supply as a reference (see Figure 8J-2). The -5.2V and -15V supplies are powered by the -10V and -40V supplies respectively, and are functionally dependent on the +20V supply.

The +20V startup current source is composed of Q12, Q13, and Q14. Q12 and R14, driven from the Internal +10V REFERENCE (Block **A**) form a 6mA (nominal) current sink. C19 damps out Q12 oscillations due to excessive line length. Q13 and Q14 are connected as a Wilson current mirror with local feedback (R6 and R7) to ensure current sharing. Output current from the collector of Q14 is 6mA.

In standby, the output of U4D pin 13 (Standby/Overtemp Shutdown) is LOW, and current from Q14 is shorted to ground. When the instrument is ON, both U4D pin 13 and U4C pin 14 are open (they have open collector outputs) and current from Q14 is delivered to the base of the darlington pass transistor A62Q3, acting as an emitter follower. This causes the +20V output to begin increasing.

When +20V output exceeds +10V, precision +10.00V reference U2 goes into regulation, and U1 begins to function. TP3, aside from allowing a check of U2, provides a very accurate +10.00V reference for instrument troubleshooting.

The DC feedback loop (error correction circuit) receives the +20V output through voltage divider R13 and R15 and compares it to the output of U2 by U1. The voltage generated on the output of U1 (pin 6) is fed through CR5 and R11 to the base of emitter follower pass transistor A62Q3, completing the loop. Due to the placement of CR5, U1 cannot source current to A62Q3. U1 therefore, sinks base current as +20V out exceeds 20 Volts, acting as negative feedback to regulate the output voltage.

R16 and C5 form a noise filter to clean up broadband noise on integrated reference voltage source U2. They also slow down the startup transient, acting as a "soft-start" circuit. C4 (in conjunction with R13), C3, R12 and C2, R10 and C1, R18 and C6, are loop frequency compensation components.

R1 and R2 form the current sense resistor for the foldback current limit circuit consisting of R82, R8, CR4, R9, and Q8. As the current from A62Q3 (Darlington pass transistors) exceeds 2.4 Amps, the voltage at the emitter of Q8 decreases sufficiently to turn Q8 on. This allows current to flow through Q8, sinking base current from A62Q3, and reducing the current from A62Q3. R8, R9, and CR4 sets the voltage at which Q8 turns on. CR10 protects instrument loads from reverse polarity power in the event of a short between the +20V output and some negative polarity power supply. R82 prevents Q8 from sinking all of the base current when the instrument (+20V supply) is turned on.

Foldback current limit is used on all critical supplies for several reasons. First, a high current supply (such as the +5.2V supply capable of delivering 10 Amps) is easily capable of damaging a printed circuit board if a short develops. Foldback current limit reduces this output current capability of the supply as its output voltage drops (as in driving a dead short). A second and equally important consideration is power dissipation in the pass transistor for a critical supply. The purpose of the foldback circuit is to have power dissipation less with the supply shorted, than with the supply in normal operation. Table 8J-2 lists the maximum output current capability of each supply, and short circuit output current in foldback.

Table 8J-2. Power Supply Output Current Capability

SUPPLY	MAXIMUM OUT	SHORT CIRCUIT CURRENT
+20	2.4A	< .5 A
+12	1.8A	NO FOLDBacK (>2A)
+5	10 A	< 3 A
-5	1.8A	NO FOLDBacK (>2A)
-10	6.0A	< 3 A
-15	1.8A	NO FOLDBacK (>2A)
-40	1.7A	< .5 A

+20V CROWBAR/SUPPLY ON INDICATOR Circuit C

VR1 and R20 monitor the +20V regulator output. When this voltage exceeds approximately 23V, the drop across R20 is large enough to bias crowbar SCR Q1 ON and short the supply output to ground. This circuit is useful for protecting instrument loads in many fault conditions. C21 prevents very short transients from firing SCR Q1.

Yellow LED DS2, mounted close to TP4, and current limit resistor R21 give a visual indication of the status of the +20V power supply. By observing this indicator along with the indicators for the other supplies, the status of all the instrument power supplies can be easily determined.

+20V Supply Tolerance

The tolerance of the +20V supply is +20V $\pm$5% (1.0V).

REFERENCE OSCILLATOR SUPPLY Circuit D

When HIGH INTERNAL 10 MHz STANDARD ENABLE (HSTD) is set HIGH by the microprocessor, Q4 conducts, turning series switch Q5 ON. This brings the +20V Reference Oscillator Supply output up to power the A51 10 MHz Reference Oscillator.

STANDBY/OVERTEMP SHUTDOWN Circuit E

In STANDBY mode LSBY is pulled LOW by the front panel ON/STANDBY switch. This drives U4D pin 13 (the open collector output of quad comparator U4, Standby/Overtemp Shutdown Block **E**) LOW which in turn, through CR7, pulls the base of chassis mounted +20V pass transistor Q3 to ground. The +20V supply is shut down, along with all other supplies that are slaved to it. Also, CR13 pulls the CLK input to D-type flip flop U5B LOW (U5 is a positive edge triggered CMOS D-type flip flop).

When the ON/STANDBY switch is flipped to the ON position, LSBY rises to +22V, reverse biasing CR6. The voltage across C9 rises exponentially toward 5V. When it passes 4.9V, U4D pin 13 goes HIGH (open) and the base of chassis mounted Q3 is released. The +20V supply starts itself. CR13 now causes the CLK input to U5B to go HIGH (but not to exceed the 10V Vcc). This transition clocks a zero into the flip flop (due to the D input, which is tied low), resetting any overtemperature condition that may have occured. During initial power-up, C10 and R53 reset U5B to ensure that the instrument is always in operational status (with overtemp flag cleared) when initially energized.

The main heat sink temperature sensor is a normally open bi-metallic switch that closes when the heat sink reaches 100 degrees C. The sensor is tied from LOW HEAT SINK OVERTEMPERATURE SENSOR (LHSOT) to ground. A switch closure pulls LHSOT LOW and forces U4A pin 1 HIGH, which in turn sets flip flop U5B Q output (pin 13) HIGH. This forces U4B output (pin 2) HIGH and turns ON red overtemp indicator LED DS4. U5B Q NOT output (pin 12) goes LOW forcing U4C pin 14 LOW which in turn pulls the base of A62Q3 to ground, shutting all instrument power supplies down except the

+22V supply. U5B has now latched this overtemp condition, and subsequent removal of LHSOT (as when the heat sink cools back down) does not cause the instrument to restart. The only way to clear this overtemp condition is to turn the ON/STANDBY switch to STANDBY, and then back to ON.

This overtemp protocol was specifically chosen for several reasons. First of all, a fault condition that allows the main heat sink to reach 100 degrees C indicates that a failure has probably occurred (e.g. the fan has stopped, etc.). To ensure that the operator is aware of a potentially hazardous condition it takes specific operator intervention before the instrument will restart. Because the over temperature detector latches when overtemp is detected, the 8340A will not cycle ON and OFF repetedly if there is a condition that causes overheating. This improves instrument reliability by eliminating cycling at excessively high temperatures.

GROUNDS and COMMONS F

Ground distribution is very critical on this board to achieve the PARD (Periodic and Random Deviation) specification for the +20V and +5.2V regulators. Right at the edge connector fingers power ground (plain ground), sense ground (ground 1), and +20V ground (ground 2) are separated. This is to isolate power ground currents from sensitive circuitry in the regulators. The sense ground for the +5.2V supply (ground 3) is taken from +5.2V sense (-), P1-39.

+5.2V REGULATOR Circuit G

+20V provides the reference voltage, and powers the loop error correction amplifier U3. R67 and R68 drop +20 Volts to 4.0 Volts. C14 is a noise filter, and also acts as a "soft-start" element (it slows down the power supply turn-on transient). +5.2V out is sensed remotely on the A62 Motherboard at the main 5V power distribution point. +5.2V SENSE(+) comes back onto the board, into voltage divider R65, R66, and is compared to the generated 4V reference by error amp U3. The output voltage of U3 is fed to emitter follower Q7, then to darlington driver Q10, and then to the transistor, A62Q4. The +5.2V SENSE(-) comes from the central ground distribution point (STAR ground) on the A62 Motherboard to provide ground reference (ground 3).

Loop frequency compensation is provided by C13 (in parallel with R65) C16, R63, R64 and C12. R69 and C15 lower output impedance and provide a minimum load capacitance. Foldback current limit operates in essentially the same manner as in the +20V supply. The current sense resistor is the parallel combination of R3, R4, and R5. Foldback is accomplished with pre-bias from R61 and R62, and Q6 is the active element. R83 prevents Q6 from sinking all of the base current to Q7 when the +5.2V supply is active.

+5.2V CROWBAR/PROTECTION Circuit H

When +5.2V OUT exceeds approximately 6.2V, VR3 conducts, biasing crowbar SCR Q11 on and shorting the +5.2V output to ground. This protects load circuits from an overvoltage condition. C20 prevents very short transients from firing SCR Q11. CR12 protects against reverse polarity applied to the load due to some instrument fault, and yellow LED, DS1, provides a visual indication of the operational status of the +5.2V supply.

+5.2V Supply Tolerance

The tolerance of the +5.2V supply is +5.2V +-5% (0.26V).

MICROPROCESSOR PROTECTION Circuit I

VR4 senses the -5.2V supply. If the -5.2V supply level is more positive than -4.5V, Q3 is turned ON. This shorts the adjustment terminal of A62U1 (the +12V regulator in +12V REGULATOR Block **E**) to ground, pulling +12V output down to +1.3V. This circuit prevents the 08340-60018 version microprocessor from being damaged by excessive power dissipation. If repairs have been done to either the +12V or -5V supplies, it is critical that the operation of this circuit be checked prior to turning the instrument ON with a 08340-60018 microprocessor board installed.

+12V REGULATOR Circuit J

A62U1 is an adjustable three-terminal regulator. Output voltage is adjusted by the selection of the feedback resistors R29, R30 and A62R14. R30 and A62R14 are fixed values while R29 is a factory select. Through proper selection of R29, compensation for variations in regulator characteristics is obtained. The nominal value of R29 is 3.83K and is appropriate for most of the regulators. However, it may be necessary to substitute an alternate value. Increasing R29 increases the +12V output. A62R14 is mounted on the A62 Motherboard in parallel to R29 to ensure that the regulator has a ground reference path before its feedback is connected (as in accidentally inserting the A52 Positive Regulator Assembly with the power ON).

Input capacitor A62C7 is required for stability of the regulator. A62C6 is a noise filter and increases the ripple rejection of the regulator and lowers its output impedance. A62CR3 is required to protect the regulator from damage due to charge stored on A62C6 in the event of a short from the +12V output to ground. CR11 protects the +12V power supply's loads from reverse polarity power in the event of a short between +12V and some negatine power supply. R31 and C17 reduce the output impedance of the supply, and provide a minimum capacitive load to guarantee stability regardless of load configuration.

+12V CROWBAR/POWER ON INDICATOR Circuit K

When +12V OUT exceeds approximately 13.5 Volts, VR2 conducts, providing gate current for crowbar SCR Q2, biasing it on and shorting the supply output to ground. This protects load circuits from damage due to the overvoltage condition. C22 prevents very short transients from firing SCR Q2. Yellow LED, DS3 gives a visual indication of the status of the +12V power supply. It will begin to light when the output of A62U1 is approximately +7.6V.

+12V Supply Tolerance

The tolerance of the +12V supply is +12V ±5% (0.6V).

VOLTAGE SENSE Circuit L

U6A, U6D, and U6B sense the level of the +5.2V, +12V and +20V power supplies. When one of these supplies goes out of regulation its comparator output goes LOW, shorting delay capacitor C8 to ground. This forces HPUP (HIGH POWER UP) LOW, pulling LIPS (LOW INSTRUMENT PRESET) LOW. CR9, CR14 and CR15 are provided to easily isolate which supply caused the low voltage indication.

The cathode of CR8, HIGH NEGATIVE UP (HNUP) is connected to the A53 Negative Regulator and the A56 -15V Supply boards. This line is pulled LOW in the event any of these supplies go out of regulation.

When all supplies come into regulation, C8 is released and its voltage increases as it is charged by R49. After some 300mS its level passes VREF at 4.9 volts and U6C pin 14 goes LOW. This sets HPUP (via Q16) and LIPS (via Q15) HIGH. These signals are used by the processor (and several other circuits) to control instrument activity and to ensure proper initialization.

A52 POSITIVE REGULATOR, TROUBLESHOOTING

WARNING

When connected to ac mains, there are voltages at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

CAUTION

Do not remove the crowbar and operate the supply without it. This could cause severe damage to the instrument if the supply is faulty and the crowbar has engaged to protect the instrument.

WARNING

If the A19 POWER-ON SAFETY INDICATOR LED is on there are voltages present inside the instrument (the A62 Motherboard, the A35 and A19 Rectifier Assemblies, line filter module/transformer wiring, etc.) that can cause personal injury or even death.

CAUTION

The A52 Assembly contains static sensitive components. Troubleshoot this assembly only at a work station that is equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to ground of no less than 1 Megohms and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and statutes. When handling a printed circuit board always hold it by the edges. Never touch the finger contacts.

+20V REGULATOR Troubleshooting

If all supplies appear to be down, the first priority is to troubleshoot the +20V Regulator (Block B). If this supply is down the rest of the instrument supplies, except the +22V supply, will be shut down.

If more than one supply has failed, and the +20V supply is not one of them, refer to the "**POWER SUPPLY TO ASSEMBLY LEVEL**" Flow Chart.

The +20V supply tolerance is +20V ±5% (1.0V).

SUPPLY/LOAD FAILURE DETERMINATION

Disconnect the instrument from ac mains. After the POWER-ON SAFETY INDICATOR goes out remove the A52 Assembly and place it on an extender board. Apply thin, colored, non-conductive tape to the extender board +20V output pins (use of a colored tape is recommended because transparent tape may be forgotten and left on the extender board, causing unnecessary troubleshooting). Do not apply tape to A52 printed circuit board edge fingers. Re-install the A52 Assembly and connect ac mains to the instrument. If the power supply now operates properly suspect a short on one of the instrument assemblies that use +20V. After removing tape from extender board fingers clean fingers according to the following instructions:

CAUTION

Cleaning P.C. Board fingers by any other method than the one described below may cause serious reliability problems. NEVER clean fingers with any kind of eraser. NEVER use tap water in the cleaning solution described below. Tap water contains chlorine. Chloride contamination from tap water, salt (from skin contact), or any other source may cause serious reliability problems. Always wear a ground strap when handling any internal 8340 component or assembly. Always hold printed circuit boards by the edges.

Printed Circuit Board Finger Cleaning Procedure

Mix one part deionized water with two parts isopropyl alcohol. Apply this solution to a clean, lint free, cloth (HP Part Number 9310-0039 CD3). Rub the fingers carefully and then dry with a clean part of the cloth.

- +20V Load Failure
- +20V Power Supply Failure

+20V Load Failure

If the problem is load related repeat the above procedure for safe removal of the A52 Assembly, remove the tape from the extender board's +20V output pins, clean the extender boards fingers as described above, and re-install the A52 Assembly. It will be necessary to remove each assembly that uses +20V, one at a time, to determine which one is faulty. Likewise remove any cables listed that carry the affected supply. Refer to Table 8J-11, Power Supply Destination Chart at the end of the "**POWER SUPPLY - FAN**" functional group, for a list of these assemblies. Always remove ac mains and wait for the POWER-ON SAFETY INDICATOR to go out before removing or installing any assembly or cable.

+20V Power Supply Failure

If the power supply output does not return to normal after the extender board +20V output pins are taped off, refer to the appropriate section below:

- +20V output voltage approximately .8V to 1.0V.
- +20V output voltage approximately 0V.
- +20V output voltage incorrect. Tolerance is +20V ±5% (1.0V).

+20V output voltage approximately .8V to 1.0V.

Crowbar circuit verification - If the output voltage is approximately .8V to 1.0V the crowbar circuit is engaged. Connect the instrument to an auto-transformer set for 0V output. While monitoring the supply output voltage slowly increase the auto-transformer output voltage. If the crowbar fires before the supply output reaches +20V suspect VR1.

Regulator and error amp verification - If the power supply output reaches +20V stop increasing auto-transformer voltage. Verify a 6 mA current flow through Q14 (measure .6V across R7). If the voltage across R7 is wrong check for 6 mA through Q13 (.6V across R6). Check the current through Q12, it should also be 6ma. Check for +10V at the base of Q12. If Q12, Q13, and Q14 are operating correctly check the operation of precision +10V reference device U2 and operational amplifier U1.

Check the voltage across CR7 (Block E). If the voltage is .6V the base current of A62Q3 is being drawn away by U4D.

Check U4D (Block E) input pins. Pin 11 should be approximately +20V and pin 10 should be +4.9V. If these are correct suspect a U4 failure. It is possible that a failure of U4C (Block E) is drawing A62Q3 base current. However this can only be verified by changing U4.

Measure the voltage across the base (P1-7) and the emitter (P1-8) of darlington transistor A62Q3. If the voltage is not approximately 1.25V suspect A62Q3. Measure the voltage between the collector and the emitter of A62Q3. If there is little or no voltage A62Q3 is probably shorted.

+20V output voltage approximately 0V.

Initial checks - Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed properly in the line filter module, FL1. Make sure the proper fuse value is installed. If the above is correct and the power supply input fuse (F1) is blown, suspect darlington transistor A62Q3.

Measure the +20V UNREG (P1-23) with respect to ground. If this voltage is less than approximately +30V, troubleshoot the +20V Rectifier. Refer to the A19 troubleshooting guide.

Regulator verification - Measure across the base (P1-7) and emitter (P1-32) of A62Q3. If the voltage is not approximately 1.25V suspect A62Q3.

Current limit checks - Check for .6V across the emitter - base junction of Q8. This condition indicates that the current foldback circuit is engaged and that it is shutting down the pass transistor A62Q3.

Measure Q8 emitter to collector. If the voltage is approximately .2V or less, Q8 may be shorted.

Examine the +20V supply for burnt or discolored components.

Suspect a shorted capacitor, diode, or crowbar SCR if the above mentioned procedures to not isolate the problem.

+20V output voltage incorrect. Tolerance is +20V ±5% (1.0V).

Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed with the proper line voltage selected. Measure the +20V UNREG input with respect to ground. If the voltage is less than Approximately +30V troubleshoot the +20V Rectifier. Refer to the A19 Troubleshooting Guide.

Measure the output voltage with an HP 1740A or similar Oscilloscope to make sure the supply is not oscillating. If the supply is oscillating check the precision 10V reference for oscillations. Check loop frequency compensation capacitors C1, C2, C4, and C5.

Check the voltage output of the precision reference U2 and the values of divider resistors R13 and R15. Make sure the feedback path to U1 is not open.

Check C4 and C5 by removing them from the circuit. C4 and C5 are likely to cause supply noise or temperature instability if bad (current leakage). The voltage at pin 2 of U1 must be 1/2 of the supply output voltage.

+12V REGULATOR Troubleshooting

The +12V supply tolerance is +12V ±5% (0.6V). If the +12V regulator is down, remember that this supply comes up only when the +5.2V and -5.2V supplies are both operating properly. If the A53 Negative Regulator board is not installed, the +12V supply will not function. The best way to tell which circuit caused the shutdown is to measure the base of Q3 in the MICROPROCESSOR PROTECTION circuit (Block I). If it is turned ON (.6V or greater), then VR4 is open or the -5.2V supply is down. If it is OFF, then U6B pin 1 in Voltage Sense (Block L) has caused the problem. Trace backwards to find out why.

Determine if the +12V supply has failed or is being forced into current limit by a short elsewhere in the instrument. Refer to "SUPPLY/LOAD FAILURE DETERMINATION" in the above +20V troubleshooting section. If the problem is load related, troubleshooting is similar to the +20V "Load Failure" section. If the +12V supply is at fault, proceed as follows:

+12V Power Supply Failure

If the power supply output does not return to normal after the extender board +12V output pins are taped off, refer to the appropriate section below:

NOTE

After repairing the +12V supply make sure its output is +12.00V ±.6V. Change factory select resistor R29 if necessary. Increasing R29 Increases the +12V output.

- +12V output voltage approximately .8V to 1.0V.
- +12V output voltage approximately 0V.
- +12V output voltage incorrect. Tolerance is +12V ±5% (0.6V).

+12V output voltage approximately .8V to 1.0V.

Crowbar circuit verification - If the output voltage is approximately .8V to 1.0V the crowbar circuit is engaged. Connect the instrument to a auto-transformer set for 0V output. While monitoring the supply output voltage slowly increase the auto-transformer output voltage. If the crowbar fires before the supply output reaches +12V suspect VR2.

Regulator verification - If the power supply output reaches +12V stop increasing auto-transformer voltage. Measure the voltage across pin 1 and the case of A62U1 (regulator). If the voltage is not approximately 1.25V suspect A62U1. Measure the voltage from the input and the output of A62U1. If there is little or no voltage A62U1 is probably shorted.

+12V output voltage approximately 0V.

Initial checks - Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed properly in the line filter module, FL1. Make sure the proper fuse value is installed.

If the above is correct and the power supply input fuse (F2) is blown, suspect regulator A62U1.

Measure the +20V REGULATOR output (TP4). If this voltage is incorrect, troubleshoot the +20V power supply. Refer to the "**+20V REGULATOR Troubleshooting**" section, above.

Regulator verification - Measure across pin 1 and the case of A62U1. If the voltage is not approximately 1.25V suspect A62U1.

Examine the +12V supply for burnt or discolored components. Suspect a shorted capacitor, diode, or crowbar SCR if the above mentioned procedures to not isolate the problem.

+12V output voltage incorrect. Tolerance is +12V ±5% (0.6V).

Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed with the proper line voltage selected.

Measure the +20V REGULATOR output (TP4). If the voltage is incorrect, troubleshoot the +20V power supply. Refer to the "**+20V REGULATOR Troubleshooting**" section, above.

Measure the +12V output voltage with an HP 1740A or similar Oscilloscope to make sure the supply is not oscillating.

If the output is approximately 1.25V either A62C6 or A62C7 are probably shorted.

CAUTION

After repairing the +12V supply the operation of the MICROPROCESSOR PROTECTION Circuit must be checked prior to turning the instrument on with the A60 Microprocessor board in the instrument.

REFERENCE OSCILLATOR SUPPLY Troubleshooting

If the +20V switched supply does not come up (or will not shut down), check driver Q4 and pass element Q5 in Reference Oscillator Supply (Block D).

Ensure that the INTERNAL 10 MHz STANDARD ENABLE (HSTD) signal is getting to the board properly.

+5.2V REGULATOR Troubleshooting

The +5.2V supply tolerance is +5.2V $\pm$5% (0.26V). The +5.2V supply and the +20V supply are similar in design. Therefore, troubleshooting techniques are similar. Refer to the +20V "SUPPLY/LOAD FAILURE DETERMINATION" section, above, to determine if the failure is caused by a supply failure or a shorted assembly elsewhere in the 8340A. Refer to the +20V "Load Failure" section if the cause is load related. If the supply has failed, proceed as follows:

+5.2V Power Supply Failure

If the power supply output does not return to normal after the extender board +5.2V output pins are taped off, refer to the appropriate sections below:

- +5.2V output voltage approximately .8V to 1.0V.

- +5.2V output voltage approximately 0V.
- +5.2V output voltage incorrect. Tolerance is +5.2V ±5% (0.26V).

+5.2V output voltage approximately .8V to 1.0V.

Crowbar circuit verification - If the output voltage is approximately .8V to 1.0V the crowbar circuit is engaged. Connect the instrument to an auto-transformer set for 0V output. While monitoring the supply output voltage slowly increase the auto-transformer output voltage. If the crowbar fires before the supply output reaches +5.2V suspect VR3.

Regulator and error amp verification - If the power supply output reaches +5.2V stop increasing auto-transformer voltage. Check the operation of transistors Q7, Q10, and A62Q4. The emitter-base voltage across each of these transistors should be approximately .6v. Check for emitter-collector shorts. Measure the voltage across the collector and emitter of A62Q4. If there is little or no voltage A62Q4 is probably shorted.

+5.2V output voltage approximately 0V.

Initial checks - Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed properly in the line filter module, FL1. Make sure the proper fuse value is installed. If the above is correct and the power supply input fuse (F3) is blown, suspect transistor A62Q4.

Measure the +5V UNREG (P1-13). If this voltage is less than approximately +9.5V, troubleshoot the +5V Rectifier. Refer to the A35 troubleshooting guide.

Regulator verification - Check transistors Q7, Q10, and A62Q4 for proper operation. The base-emitter voltage across each of these transistors should be approximately .6V.

Current limit checks - Check for .6V across the emitter-base junction of Q6. This condition indicates that the current foldback circuit is engaged and that it is shutting down the pass transistor A62Q4. Measure Q6 emitter to collector. If the voltage is approximately .2V or less, Q6 may be shorted.

Examine the +5.2V supply for burnt or discolored components. Suspect a shorted capacitor, diode, or crowbar SCR if the above mentioned procedures to not isolate the problem.

+5.2V output voltage incorrect. Tolerance is +5.2V ±5% (0.26V).

Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed with the proper line voltage selected.

Measure the +5V UNREG. If the voltage is less than Approximately +9.5V troubleshoot the +5V Rectifier. Refer to the A35 Troubleshooting Guide.

Measure the output voltage with an HP 1740A or similar Oscilloscope to make sure the supply is not oscillating. Check frequency compensation capacitors C12, C13, and C16.

Check the values of divider resistors R66 and R67.

Make sure the feedback path to U3 is not open. Check C13 and C14 by removing them from the circuit.

C13 and C14 are likely to cause supply noise or temperature instability if bad (current leakage).

A52 REPAIR PROCEDURE

CAUTION

The thermal connection between the voltage regulator A35U2 and the main heat sink is the dominant factor in its long term reliability. Be sure to properly apply thermal compound (HP Part Number 6040-0454 CD0) when installing or replacing this part.

CAUTION

Use only oil based thermal compound. The use of silicone based thermal compound may cause reliability problems. Silicone based oil migrates to pass element sockets, switch contacts, or printed circuit board finger contacts. The compound then tends to raise contact resistance or electrically isolate the contacts. Silicone based thermal compounds disperse into the air and deposit themselves anywhere in the instrument. Applying this material to a warm component (e.g. a heat sink or series pass element) increases the rate of dispersion.

Thermal Compound Application

When installing or replacing a pass transistor or voltage regulator make sure thermal compound is applied as described below:

Apply a thin coating of thermal compound (HP Part Number 6040-0454 CD0) to both sides of the insulating washer. The coating should be just thick enough to provide a thin but continuous layer of compound from component-to-washer and washer-to-heat sink. An excessive amount of heat sink compound impairs its ability to transfer heat. The pass element mounting screws should be tightened with seven inch-pounds of force. Tightening with less force diminishes the heat transfer capability of the thermal compound. Tightening with greater force may damage the mounting hardware.

Table 8J-3. A52 Positive Regulator, Regulated Supply Limits

Power Supply	DMM Probe	Ground	Limits
+20V	A52TP4	A52P1-19	+19.00V to +21.00V
+12V	A52TP5	A52P1-19	+11.4V to +12.6V
+5.2V	A52P1-17	A52P1-19	+4.94V to +5.46V

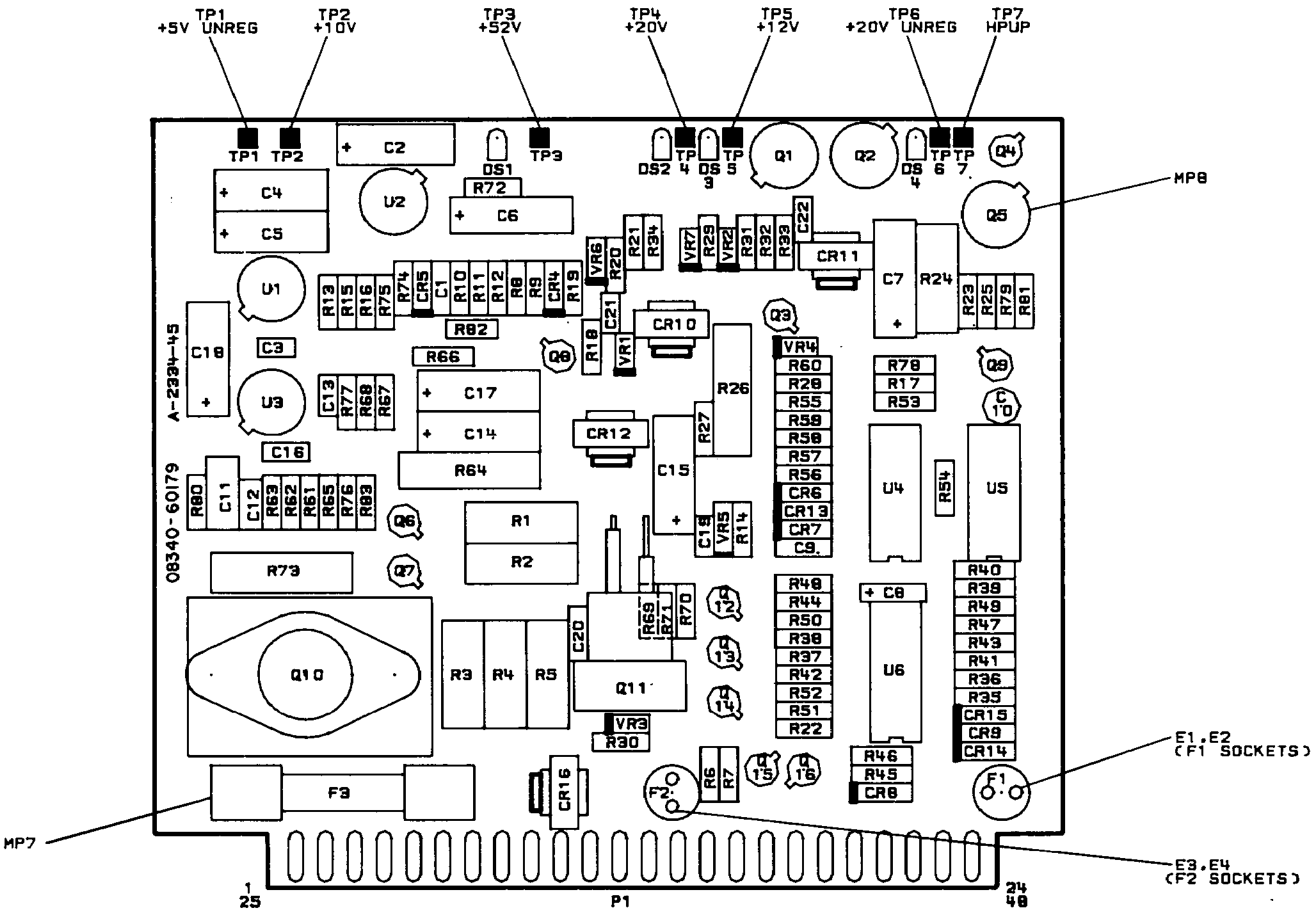


Figure 8J-9. A52 Positive Regulator, Component Location Diagram

A52 Positive Regulator P1 Pin I/O

Pin	Mnemonic	Levels	Source	Destination
1 25	Q4C Q4C		A62Q4-COLLECTOR A62Q4-COLLECTOR	G G
2 26	Q4C Q4C		A62Q4-COLLECTOR A62Q4-COLLECTOR	G G
3 27	Q4B Q4B		A62Q4-BASE A62Q4-BASE	G G
4 28	Q4E Q4E		A62Q4-EMITTER A62Q4-EMITTER	G G
5 29	Q4E Q4E		A62Q4-EMITTER A62Q4-EMITTER	G G
6 30	Q3C Q3C		A62Q3-COLLECTOR A62Q3-COLLECTOR	A B E A B E
7 31	Q3B		A62Q3-BASE	B B
8 32	Q3E Q3E		A62Q3-EMITTER A62Q3-EMITTER	B B
9 33	+12V +12V	+12V +12V	J K J K	*L *L
10 34	+12V UI ADJ	+10.5V	J	*I L
11 35	+12V UNREG +12V UNREG	+20V +20V	J J	*J *J
12 36	LHSOT LIPS	TTL (LOW TRUE) TTL (LOW TRUE)	A62J31-26 *L	E *
13 37	+5V UNREG +5V UNREG	+7 TO +9V +7 TO +9V	XA35P1-1-3, 19-21 XA35P1-1-3, 19-21	*G *G
14 38	+5V UNREG +5V UNREG	+7 TO +9V +7 TO +9V	XA35P1-1-3, 19-21 XA35P1-1-3, 19-21	*G *G
15 39	+5V SENSE (+) +5V SENSE (−)	+5.2V 0V	G F	L F
16 40	+20V +20V	+20V +20V	B C B C	*D J L *D J L
17 41	+5.2V +5.2V	+5.2V +5.2V	G H G H	* *
18 42	+5.2V +5.2V	+5.2V +5.2V	G H G H	* *
19 43	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*F *F
20 44	+20V REF OSC HNUP	0V/+20V TTL (HIGH TRUE)	D XA53P1-17; XA56P1-1, 16	A62J3-1 *L
21 45	HSTD LSBY	TTL (HIGH TRUE) 0V TO +22V	XA59P1-66 A62J1-20	D E
22 46	−5.2V HPUP	−5.2V TTL (HIGH TRUE)	XA53P1-18, 36 L	*I *
23 47	+20V UNREG +20V UNREG	+31.2V +31.2V	XA35P1-7, 25 XA35P1-7, 25	*A *A
24 48	+20V UNREG +20V UNREG	+31.2V +31.2V	XA35P1-7, 25 XA35P1-7, 25	*A *A

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

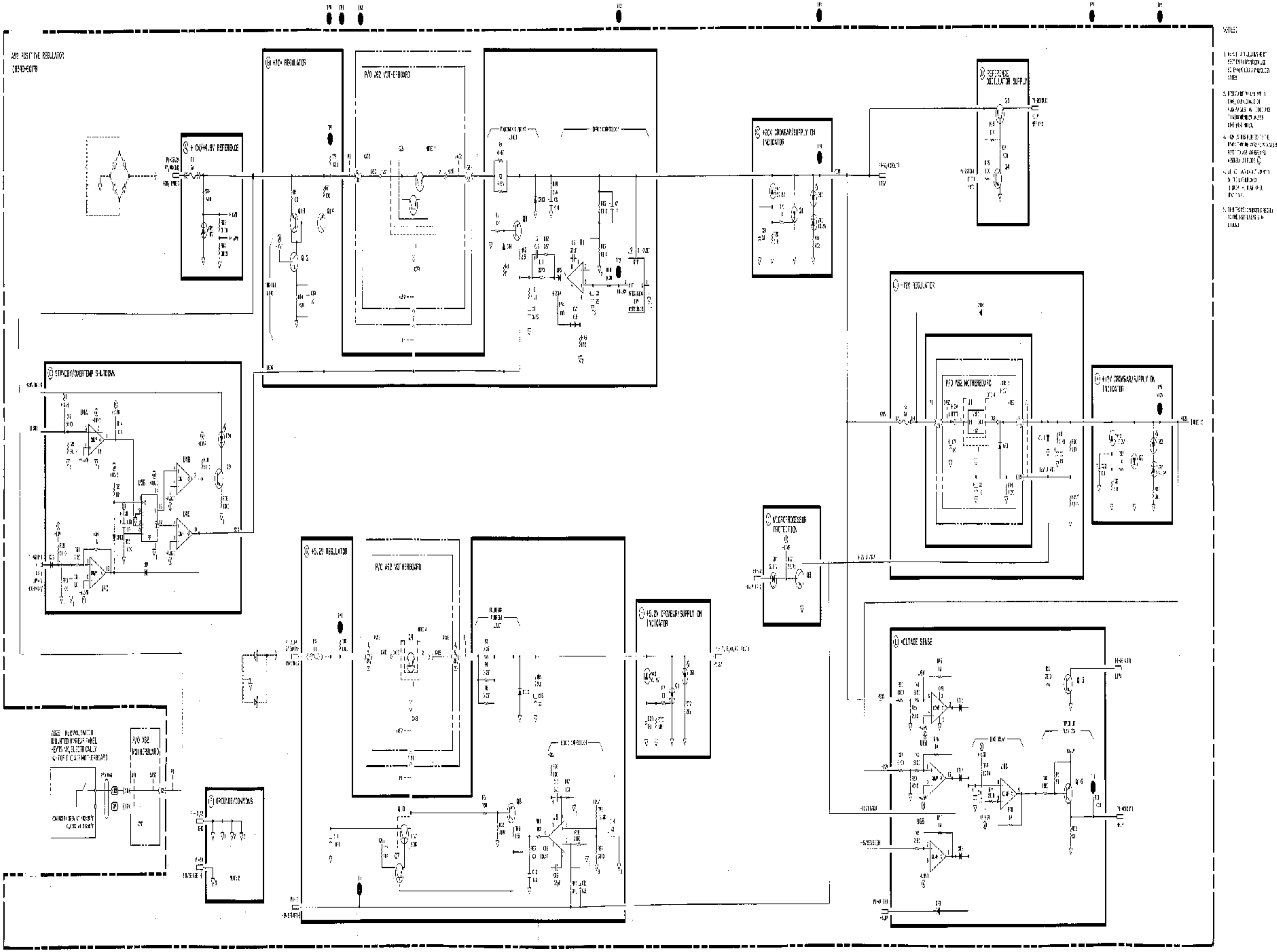


Figure 5J-10. A52 Positive Regulator, Schematic Diagram

A53 NEGATIVE REGULATOR/A56 -15V REGULATOR

INTRODUCTION

This service section pertains to the following assemblies:

- The A53 Negative Regulator Assembly.
- The A56 -15V Regulator Assembly.
- Parts of the A62 Motherboard Assembly.

A53 NEGATIVE REGULATOR, CIRCUIT DESCRIPTION

Introduction

The A53 assembly contains all circuitry for the -10V, -5.2V, and -40V power supplies, as well as voltage sensing circuitry to flag the A52 Positive Regulator board should one of these supplies go out of tolerance.

NOTE

The -10V and -40V supplies are critical, low-noise supplies. They are limited to a Periodic and Random Deviation (PARD) less than 100 microvolts peak. The -5.2V supply is primarily a digital (ECL) supply, and has a PARD specification of 5mV.

-10V REGULATOR Circuit A

+20 VREF (P1 pin 29) comes onto the board from the A52 Positive Regulator. It is used as a reference through voltage divider chain R8, R9, and R10, and it powers up error amp U4. C5 is the "soft-start" element (it slows down the -10V supply turn-on transient). CR6 protects the input stage of U5 during startup. The DC feedback loop is completed through R7, CR5, and darlington driver A62Q1. This power supply differs from many others in that the return side of the supply is regulated and the unregulated side is common to the output. A62Q1 regulates the voltage difference between the -10V RETURN and ground. The amplitude of the -10V RETURN is regulated as necessary so that the -10V UNREG line is always -10V with respect to ground. This allows the use of an NPN pass transistor used as an emitter follower rather than in the common emitter configuration, which is more sensitive to supply loading.

C1, C4, R6, and C3 are frequency compensation components. C6 provides a minimum load capacitance and lower output impedance. Foldback current limiting is used here as on the +5.2 and +20V supplies. The parallel combination of R1, R2, and R3 forms the current sense resistor.

The voltage at the base of Q4 is set by the voltage divider formed by R4 and R5. The voltage at the R4 end of the divider is set by the voltage drop across the current sense resistors (R1 - R3). The voltage at the R5 end of the divider is set by the output voltage of the supply. When the voltage at the base of Q4 reaches Vbe (threshold), Q4 will begin to conduct and will remove some portion of the base current being supplied to Q1 by U4. When the output voltage of the supply is low (during turn on or short circuit) a relatively small sense resistor (R1 - R3) current will bring Q4's base voltage above threshold. Q4 will turn on limiting the current supplied to Q1.

When the output of the supply is negative (-10V) the base of Q4 will be biased more negative and it will require a larger sense resistor current to bias the base of Q4 above threshold.

CR4 partially compensates for the base-emitter voltage of A62Q1. R55 provides sufficient current to bias CR4 in its linear region. CR7 in protects load circuits from reverse polarity power should a short develop between the -10V output and a high current positive supply.

-10V CROWBAR/SUPPLY ON INDICATOR Circuit B

Should -10V OUT exceed approximately 11V, VR1 will conduct, biasing crowbar SCR Q6 on and shorting the supply output to ground. This protects load circuits from an overvoltage condition. C15 prevents very fast transients from firing Q6. Yellow LED DS3 provides a visual indication of the -10V supply operational status.

-10V Supply Tolerance

The -10V supply tolerance is -10V $\pm$5% (0.5V).

-5.2V REGULATOR Circuit C

U1 is a monolithic three-terminal adjustable negative regulator. The adjustment terminal is nominally 1.25V above the output terminal.

C14 increases ripple rejection for U1. CR15 provides a discharge path for C14 when Vout is shorted to ground. C8 is required by the regulator for stability, and C7 is required to reduce the apparent electrical length of the supply input leads. R15 lowers the power dissipation in U1 by reducing its operating junction temperature. CR8 is provided to protect load circuits from damage due to reverse polarity power caused by an instrument failure.

-5.2V CROWBAR/SUPPLY ON INDICATOR Circuit D

When -5.2V OUT exceeds approximately 6.2 volts, VR2 conducts, biasing crowbar SCR Q1 on and shorting the -5.2V supply to ground. Yellow LED DS1 provides a visual indication of the operational status of the supply.

-5.2V Supply Tolerance

The -5.2V supply tolerance is -5.2V +-5% (0.26V).

CAUTION

After repairing the -5V supply the operation of the MICROPROCESSOR PROTECTION Circuit (located on the A52 Positive Regulator Assembly) must be checked prior to turning the instrument on with a 08340-60018 Processor board in the instrument.

-40V REGULATOR Circuit E

This circuit is similar in operation to the -10V REGULATOR in that the -40V RETURN line is regulated, not the -40V UNREG line. See the "**-10V REGULATOR Circuit A**" description, above. +20V REF provides reference (through divider R27, R28, R29) for the regulator, and powers error amplifier U3. VR4 limits the negative supply to U3 at -10V. C12 is the "soft-start" element, slowing down the power supply turn-on transient. CR11 protects the input stage of U3 during startup. The forward path is completed through R26, CR10, darlington driver Q3, and pass transistor A62Q2. CR9 protects the base-collector junction of Q3 during startup. (When the supply is beginning to energize, A62Q2 has a low collector current and a beta (gain) of less than one. The collector-base junction of Q3 could be forward biased and become susceptible to failure from excessive current flow.) Current limit operation is similar to the -10V current limit. R22 is the current sense resistor, Q2 is the active element, and R23/R24 provide Q2 bias.

Feedback is completed off the board using remote sense at the main -40V distribution point on the A62 Motherboard. -40V SENSE comes back onto the board to complete the loop. Ground reference (Ground 2) connects to main ground on the board at the edge finger to reduce the perturbations in the supply due to noise currents in the ground trace on the board. R31 and C13 provide a minimum load capacitance. CR12 protects load circuits from damage due to reverse polarity supply power caused by an instrument failure.

-40V CROWBAR/SUPPLY ON INDICATOR Circuit F

When -40V OUT exceeds appproximately 44.2 volts, VR3 conducts, biasing crowbar SCR Q5 on and shorting the -40V supply to ground. This protects load circuits from an overvoltage condition. C16 prevents very fast transients from firing Q5. Yellow LED DS2 provides a visual indication of supply operational status.

-40V Supply Tolerance

The -40V supply tolerance is -40V $\pm$5% (2.0V).

VOLTAGE SENSE Circuit H

VR5, in the -4.64V REFERENCE (Block G), provides a -4.64V reference to compare with each supply output. Should any supply be out of regulation (low output), the corresponding comparator output will go LOW, forcing U2D pin 13 HIGH. This turns Q7 on which pulls HIGH NEGATIVE UP (HNUP) LOW (the logic level on HNUP is: HIGH = +20V, LOW = +.2V).

U2A monitors the -5.2V supply, U2B monitors the -10V supply, and U2C monitors the -40V supply. The input common mode range of U2 includes its negative supply (U2A pin 12, connected to -10V). However, if Vin goes more negative than U2A pin 12, the device will be damaged. In the event of a crowbar (or short to ground) on the -10V supply, U2 pin 12 is pulled up to ground. The -40V supply, however, is still up, and can source sufficient current to damage U2. Clamp diode CR14 and current limit resistor R51 prevent this problem from occuring. U2C pin 8 follows the -10V supply at U2 pin 12 when it is shorted. Diodes CR1, CR2, and CR3 isolate the outputs of U2A, U2B and U2C. This will allow checking each supply independently for low output.

GROUNDS and COMMONS I

This block depicts the critical power and signal ground distribution system implemented on the board. Caution has been used in the distibution of loads, and in isolating critical ground paths from non-critical or high current ground paths.

A56 -15V SUPPLY, CIRCUIT DESCRIPTION

The A56 board contains the -15V REGULATOR and VOLTAGE SENSE circuitry to flag the A52 Positive Regulator if an out of tolerance condition in the supply occurs.

-15V REGULATOR Circuit A

U1 is a monolithic three-terminal adjustable negative regulator. It is designed to maintain a constant -1.25V difference between the OUT terminal and the ADJ terminal.

C2 improves the ripple rejection of U1, and CR1 provides a discharge path for C2 in the event of a short from -15V OUT to ground. C3 is required to compensate for the effective line length in the input circuit due to R1 and R6. R1 and R6 will reduce the power dissipation in U1 during crowbar. CR2 protects against an inadvertant short between -15V OUT and a high current positive supply (CR2 clamps -15V OUT at approximately +0.8V, protecting load curcuits from damage).

-15V CROWBAR/SUPPLY ON INDICATOR Circuit B

When V OUT exceeds approximately 17.8 Volts, VR1 conducts, biasing crowbar SCR Q1 on and shorting the -15V supply to ground. This protects instrument load circuits from an overvoltage condition. Yellow LED DS1 gives a visual indication of the supply status.

-15V Supply Tolerance

The -15V supply tolerance is -15V $\pm$5% (0.75V).

LOW VOLTAGE SENSE Circuit C

When -15V OUT exceeds 12.1V, Q2 turns OFF and HIGH NEGATIVE UP (HNUP) goes HIGH. HNUP is used on the A52 Positive Regulator board to monitor the -15V output and determine if it is within tolerance.

A53 NEGATIVE REGULATOR, TROUBLESHOOTING

WARNING

When connected to ac mains, there are voltages at points inside the instrument that can cause personal injury or even death. Any servicing of this instrument with protective covers removed should be performed only by trained personnel who are aware of the hazard involved.

CAUTION

Do not remove the crowbar and operate the supply without it. This could cause severe damage to the instrument if the supply is faulty and the crowbar has engaged to protect the instrument.

WARNING

If the A19 POWER-ON SAFETY INDICATOR LED is on there are voltages present inside the instrument (the A62 Motherboard, the A35 and A19 Rectifier Assemblies, line filter module/transformer wiring, etc.) that can cause personal injury or even death.

CAUTION

The A53 Assembly contains static sensitive components. Troubleshoot this assembly only at a work station that is equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to ground of no less than 1 Megohms and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and statutes. When handling a printed circuit board, always hold it by the edges. Never touch the finger contacts.

Operation and troubleshooting of the negative regulators are virtually the same as their positive counterparts.

If more than one supply has failed, refer to the "**POWER SUPPLY**

TROUBLESHOOTING TO ASSEMBLY LEVEL" Flowchart.

-10V REGULATOR Troubleshooting

The -10V supply tolerance is -10V ±5% (0.5V). Make sure the -10V supply (crowbar, etc) is not pulling the -10V supply down. Remove the -5.2V fuse, F1, and check to see if the -10V supply operates properly. If the -10V supply is still not functional, proceed as follows:

SUPPLY/LOAD FAILURE DETERMINATION

Disconnect the instrument from ac mains. After the POWER-ON SAFETY INDICATOR goes out remove the A53 Assembly and place it on an extender board. Apply thin, colored, non-conductive tape to the extender board -10V output pins (use of transparent tape is not recommended because it may be forgotten and left on the extender board, causing unnecessary troubleshooting). Re-install the A53 Assembly and connect ac mains to the instrument. If the power supply now operates properly suspect a short on one of the instrument assemblies that use -10V. Refer to Table 8J-11, Power Supply Destination Chart at the end of the "**POWER SUPPLY - FAN**" functional group, for a list of these assemblies. After removing tape from extender board fingers clean fingers according to the following instructions:

CAUTION

Cleaning P.C. Board fingers by any other method than the one described below may cause serious reliability problems. NEVER clean fingers with any kind of eraser. NEVER use tap water in the cleaning solution described below. Tap water contains chlorine. Chloride contamination from tap water, salt (from skin contact), or any other source may cause serious reliability problems. Always wear a ground strap when handling any internal 8340 component or assembly. Always hold a printed circuit board by the edges.

Printed Circuit Board Finger Cleaning Procedure

Mix one part deionized water with two parts isopropyl alcohol. Apply this solution to a clean, lint free, cloth (HP Part Number 9310-0039 CD3). Rub the fingers vigorously and then dry with a clean part of the cloth.

Refer to the appropriate section below:

- -10V Load Failure
- -10V Power Supply Failure

-10V Load Failure

If the problem is load related repeat the above procedure for safe removal of the A53 Assembly, remove the tape from the extender board -10V output pins, clean the fingers as described above, and reinstall the A53 assembly. It will be necessary to remove each assembly that uses -10V, one at a time, to determine which one is faulty. Likewise remove any cables listed that carry the affected supply. Refer to Table 8J-11, Power Supply Destination Chart at the end of the **"POWER SUPPLY - FAN"** functional group, for a list of these assemblies. Always remove ac mains and wait for the POWER-ON SAFETY INDICATOR to go out before removing or installing any assembly or cable.

-10V Power Supply Failure

If the power supply output does not return to normal after the extender board -10V output pins are taped off, refer to the appropriate section below:

- -10V output voltage approximately -.8V to -1.0V.
- -10V output voltage approximately 0V to +.7V.
- -10V output voltage incorrect. Tolerance is -10V ±5% (0.5V).

-10V output voltage approximately -.8V to -1.0V.

Crowbar circuit verification - If the output voltage is approximately -.8V to -1.0V the crowbar circuit is engaged. Connect the instrument to an auto-transformer set for 0V output. While monitoring the supply output voltage slowly increase the auto-transformer output voltage. If the crowbar fires before the supply output reaches -10V suspect VR1.

Regulator and error amp verification - If the power supply output reaches -10V stop increasing auto-transformer voltage. Check the operation of transistor Q4 and A62Q1. The emitter-base voltage across A62Q1 should be approximately 1.2v. Check for emitter-collector shorts. The emitter-base voltage across Q4 should be .35 to .5 volts, which indicates that the transistor is biased off.

-10V output voltage approximately 0V to +.7V.

Initial checks - Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed properly in the line filter module, FL1. Make sure the proper fuse value is installed. If the above is correct and the power supply input fuse (F3) is blown, suspect transistor A62Q1.

Measure the -10V RETURN (P1-2) with respect to the -10V UNREG (P1-9). If this voltage is less than approximately -16V, troubleshoot the -10V Rectifier. Refer to the A19 troubleshooting guide.

Regulator verification - Check transistor Q4, and A62Q1 for proper operation. The base-emitter voltage across A62Q1 should be approximately 1.2V. The base-emitter voltage across Q4 should be .35 to .5 volts, which indicates that the transistor is biased off.

Current limit checks - Check for .6V across the emitter-base junction of Q4. This condition indicates that the current foldback circuit is engaged and that it is shutting down pass transistor A62Q1. Measure Q4 emitter to collector. If the voltage is approximately .2V or less, Q4 may be shorted.

Examine the -10V supply for burnt or discolored components. Suspect a shorted capacitor, diode, or crowbar SCR if the above mentioned procedures do not isolate the problem.

-10V output voltage incorrect. Tolerance is -10V ±5% (0.5V).

Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed with the proper line voltage selected.

Measure the -10V RETURN (P1-2) with respect to the -10V UNREG (P1-9). If the voltage is less than Approximately -16V troubleshoot the -10V Rectifier. Refer to the A19 Troubleshooting Guide.

Measure the output voltage with an HP 1740A or similar Oscilloscope to make sure the supply is not oscillating.

Check the values of divider resistors R8, R9, and R10. Make sure the feedback path to U4 is not open. Check C5 by removing it from the circuit. C5 is likely to cause supply noise or temperature instability if bad (current leakage)..

-40V REGULATOR Troubleshooting

The -40V supply tolerance is -40V ±5% (2.0V). The -40V REGULATOR circuit is very similar to the -10V REGULATOR circuit. Therefore, troubleshooting techniques are very similar. Refer to the "**-10V REGULATOR Troubleshooting**" section, above. The major difference between the two supplies is that the -10V supply uses a darlington series pass element for supply regulation whereas the -40V supply uses a descrete transistor. When checking for proper A62Q2 operation measure its base-emitter voltage. If this voltage is not approximately .6V to .7V, suspect A62Q2.

-5.2V REGULATOR Troubleshooting

The -5.2V supply tolerance is -5.2V ±5% (0.26V). Determine if the -5.2V supply has failed or is being forced into current limit by a short elsewhere in the instrument. Refer to "SUPPLY/LOAD FAILURE DETERMINATION" in the above -10V troubleshooting section. If the problem is load related, troubleshooting is similar to the -10V "Load Failure" section. If the -5.2V supply is at fault, proceed as follows:

-5.2V Power Supply Failure

If the power supply output does not return to normal after the extender board -5.2V output pins are taped off, refer to the appropriate sections below:

- -5.2V output voltage approximately -.8V to -1.0V.
- -5.2V output voltage approximately 0V.
- -5.2V output voltage incorrect. Tolerance is -5.2V ±5% (0.26V).

-5.2V output voltage approximately -.8V to -1.0V.

Crowbar circuit verification - If the output voltage is approximately -.8V to -1.0V the crowbar circuit is engaged. Connect the instrument to an auto-transformer set for 0V output. While monitoring the supply output voltage slowly increase the auto-transformer output voltage. If the crowbar fires before the supply output reaches -5.2V suspect VR2.

Regulator verification - If the power supply output reaches -5.2V stop increasing auto-transformer voltage. Measure the voltage across pin 1 and the case of U1 (regulator). If the voltage is not approximately 1.25V suspect U1. Measure the voltage from the input and the output of U1. If there is little or no voltage U1 is probably shorted.

-5.2V output voltage approximately 0V.

Initial checks - Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed properly in the line filter module, FL1. Make sure the proper fuse value is installed.

If the above is correct and the power supply input fuse (F1) is blown, suspect regulator U1.

Measure the -10V REGULATOR output (TP5). If this voltage is incorrect, troubleshoot the -10V power supply. Refer to the "**-10V REGULATOR Troubleshooting**" section, above.

Regulator verification - Measure across pin 1 and the case of U1. If the voltage is not approximately 1.25V suspect U1.

Examine the -5.2V supply for burnt or discolored components. Suspect a shorted capacitor, diode, or crowbar SCR if the above mentioned procedures to not isolate the problem.

-5.2V output voltage incorrect. Tolerance is -5.2V ±5% (0.26V).

Ensure that ac mains voltage is nominal and that the line voltage selector printed circuit board is installed with the proper line voltage selected.

Measure the -10V REGULATOR output (TP5). If the voltage is incorrect, troubleshoot the -10V power supply. Refer to the "**-10V REGULATOR Troubleshooting**" section, above.

Measure the -5.2V output voltage with an HP 1740A or similar Oscilloscope to make sure the supply is not oscillating. If the output is approximately 1.25V C14 is probably shorted.

A56 -15V SUPPLY, TROUBLESHOOTING

CAUTION

The A56 Assembly contains static sensitive components. Troubleshoot this assembly only at a work station that is equipped with an anti-static surface. Any persons working on this instrument should wear a grounding strap that provides a path to ground of no less than 1 Megohms and no more than 2.5 Megohms. All anti-static safeguards must conform to state and federal safety standards and

statutes. When handling a printed circuit board, always hold it by the edges. Never touch the finger contacts.

The -15V supply is very similar to the -5.2V supply. Therefore, troubleshooting techniques are also similar. Refer to the "**-5.2V REGULATOR Troubleshooting**" section, above. The -15V supply tolerance is -15V ±5% (0.75V).

A53/A56 REPAIR PROCEDURE

CAUTION

The thermal connection between the pass transistors/voltage regulators and the main heat sink is the dominant factor in their long term reliability. Be sure to properly apply thermal compound (HP Part Number 6040-0454 CD0) when installing or replacing these parts.

CAUTION

Use only oil based thermal compound. The use of silicone based thermal compound may cause serious reliability problems. Silicone based oil migrates to pass element sockets, switch contacts, or printed circuit board edge connectors. The compound then tends to raise contact resistance or electrically isolate the contacts. Silicone based thermal compounds disperse into the air and deposit themselves anywhere in the instrument. Applying this material to a warm component (e.g. a heat sink or pass element) increases the rate of dispersion.

Thermal Compound Application

When installing or replacing a pass transistor or voltage regulator make sure thermal compound is applied as described below:

Apply a thin coating of thermal compound (HP Part Number 6040-0454 CD0) to both sides of the insulating washer. The coating should be just thick enough to provide a thin but continuous layer of compound from component-to-washer and washer-to-heat sink. An excessive amount of heat sink compound impairs its ability to transfer heat. The pass element mounting screws should be tightened with seven inch-pounds of force. Tightening with less force diminishes the heat transfer capability of the thermal compound. Tightening with greater force may damage the mounting hardware.

Table 8J-4. A53 Negative Regulator, Regulated Supply Limits

Power Supply	DMM Probe	Ground	Limits
-40V	A53TP4	A53P1-14	-42.00V to -38.00V
-10V	A53TP5	A53P1-14	-10.5V to -9.5V
-5.2V	A53TP3	A53P1-14	-5.46V to -4.94V

Table 8J-5. A56 −15V Supply, Regulated Supply Limit

Power Supply	DMM Probe	Ground	Limit
-15V	A56TP2	A56P1-5	-15.75V to -14.25V

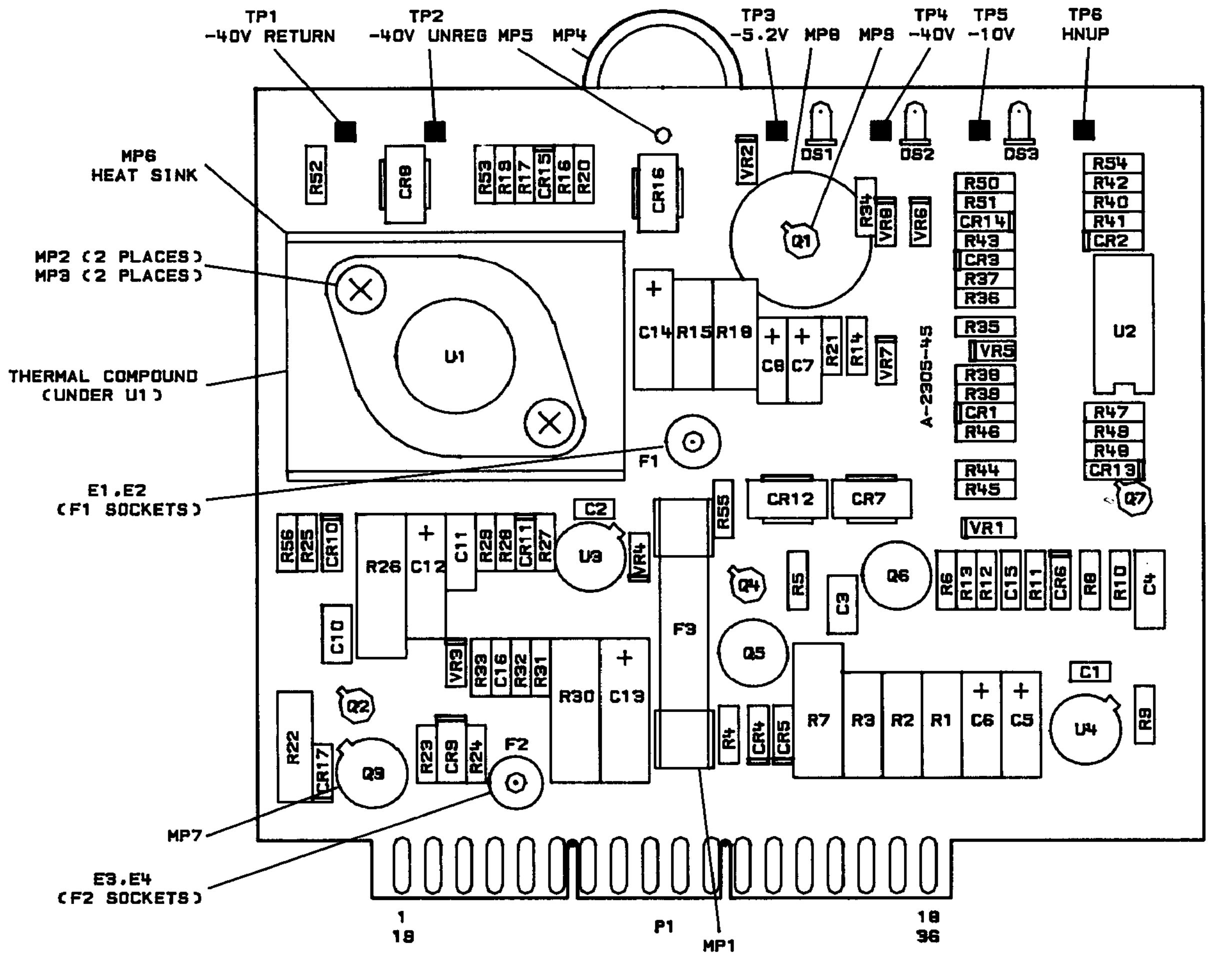


Figure 8J-11. A53 Negative Regulator, Component Location Diagram

A53 Negative Regulator P1 Pin I/O

A53

Pin	Mnemonic	Levels	Source	Destination
1	Q2E		A62Q2-EMITTER	E
19	Q2E		A62Q2-EMITTER	E
2	−10V RETURN	+6.4V AT 13.3 GHZ	A62Q1-COLLECTOR	XA19P1-7, 8, 19, 20 A
20	−10V RETURN	+6.4V AT 13.3 GHZ	A62Q1-COLLECTOR	XA19P1-7, 8, 19, 20 A
3	−40V RETURN	12.7 AT 13.3 GHZ	A62Q2-COLLECTOR	*E
21	Q2B		A62Q2-BASE	E
4	Q1B		A62Q1-BASE	A
22	−40V RETURN	12.7V AT 13.3 GHZ	A62Q2-COLLECTOR	*E
5	−40V SENSE (+)	0V	D	*E
23	−40V SENSE (−)	−40V	E	*
6	−40V UNREG	−40V	XA35P1-6, 24	*E
24	−40V UNREG	−40V	XA35P1-6, 24	*E
7	Q1E		A62Q1-EMITTER	A
25	Q1E		A62Q1-EMITTER	A
8	Q1E		A62Q1-EMITTER	A
26	Q1E		A62Q1-EMITTER	A
9	−10V UNREG	−10V	XA19P1-11, 12, 23, 24	A
27	−10V UNREG	−10V	XA19P1-11, 12, 23, 24	A
10	−10V UNREG	−10V	XA19P1-11, 12, 23, 24	A
28	−10V UNREG	−10V	XA19P1-11, 12, 23, 24	A
11	−40V	−40V	E F	*H
29	+20V	+20V	XA52P1-16, 40	*A E H
12	−10V	−10V	A B	*C G H
30	−40V	−40V	E F	*H
13	−10V	−10V	A B	*C G H
31	−10V	−10V	A B	*C G H
14	GND	0V	A62 STAR GND	*D
32	−10V	−10V	A B	*C G H
15	GND	0V	A62 STAR GND	*D
33	GND	0V	A62 STAR GND	*D
16	GND	0V	A62 STAR GND	*D
34	GND	0V	A62 STAR GND	*D
17	HNUP	TTL (HIGH TRUE)	*H	*
35	GND	0V	A62 STAR GND	*D
18	−5.2V	−5.2V	C D	*H
36	−5.2V	−5.2V	C D	*H

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

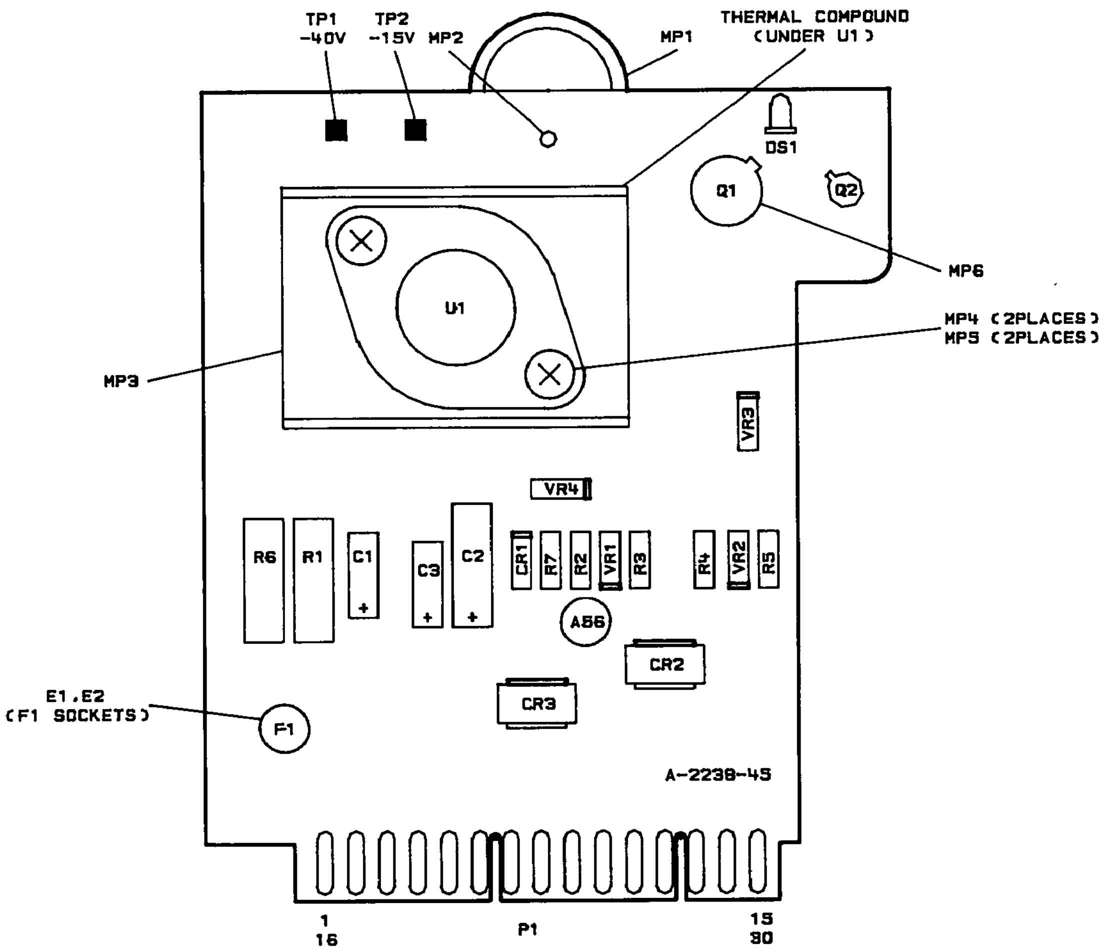


Figure 8J-12. A56 −15V Regulator, Component Location Diagram

A56 −15V Regulator P1 Pin I/O

A56

Pin	Mnemonic	Levels	Source	Destination
1 16	HNUP HNUP	TTL (HIGH TRUE) TTL (HIGH TRUE)	*C *C	* *
2 17				
3 18	−40V/−40V SENSE(−) −40V/−40V SENSE(−)	−40V −40V	XA53P1-11, 30/XA53P1-23 XA53P1-11, 30/XA53P1-23	*A *A
4 19	−10V −10V	−10V −10V	XA53P1-12, 13, 31, 32 XA53P1-12, 13, 31, 32	*NOT USED *NOT USED
5 20	GND GND	0V 0V	A62 STAR GND A62 STAR GND	*D *D
6 21				
7 22				
8 23				
9 24				
10 25				
11 26				
12 27				
13 28				
14 29				
14 30	−15V −15V	−15V −15V	A B A B	*C *C

A single letter in the source or destination column refers to a function block on this assembly schematic.

An asterick (*) denotes multiple sources or destinations; refer to the A62 Motherboard Wiring List for a complete representation of signal sources and destinations.

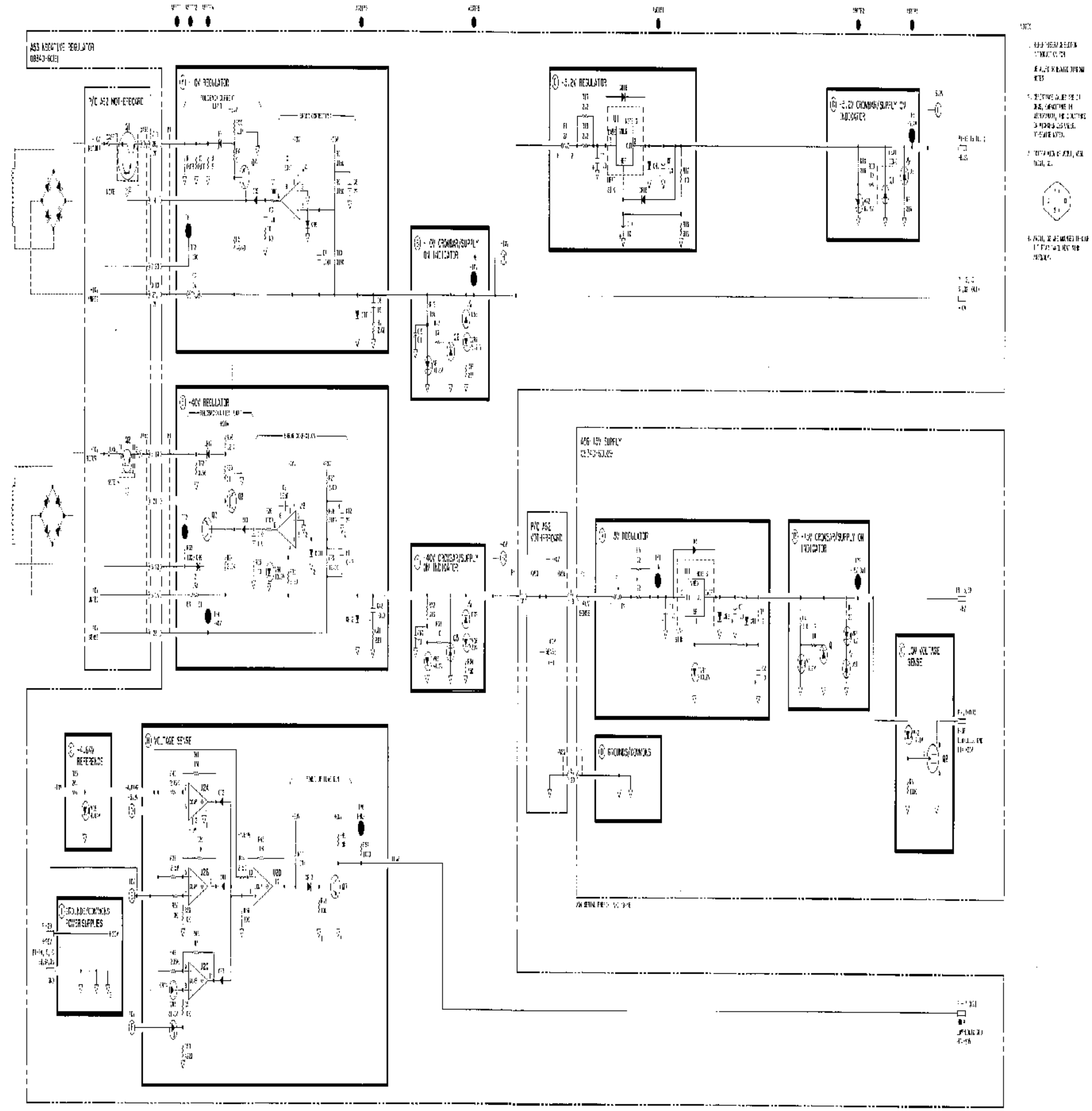


Figure 8J-13. A53 Negative Regulator and A56 −15V Regulator, Schematic Diagram

8-935/8-940

Table 8J-6. Power Supply Destination Chart

Assembly	Power Supply	Destination Assemblies/Connectors
A19	+20V UNREG	A35, A52
	−10V UNREG	A53
A35	−40V UNREG	A53
	+5V UNREG	A52, A62J1,A62J31
	+22V	A61, A62J1, A62J3
A52	+20V	A21 through A28, A34, A36, A38, A40 through A43, A53 through A55, A57 through A61
	+5.2V	A21 through A28, A34, A36, A37, A39 through A43, A54, A55, A57 through A60, A62J2, A62J19
	+12V	A23, A57 through A61, A62J1
A53	−10V	A21 through A28, A34, A36, A38 through A43, A54, A55, A57 through A61, A62J2, A62J18, A62J19
	−40V	A22, A23, A28, A34, A40, A54, A55, A56, A62J2, A62J19
	−5.2V	A23, A27, A34, A52, A57 through A61, A62J1, A62J2, A62J19
A56	−15V	A27, A28, A54, A57 through A61

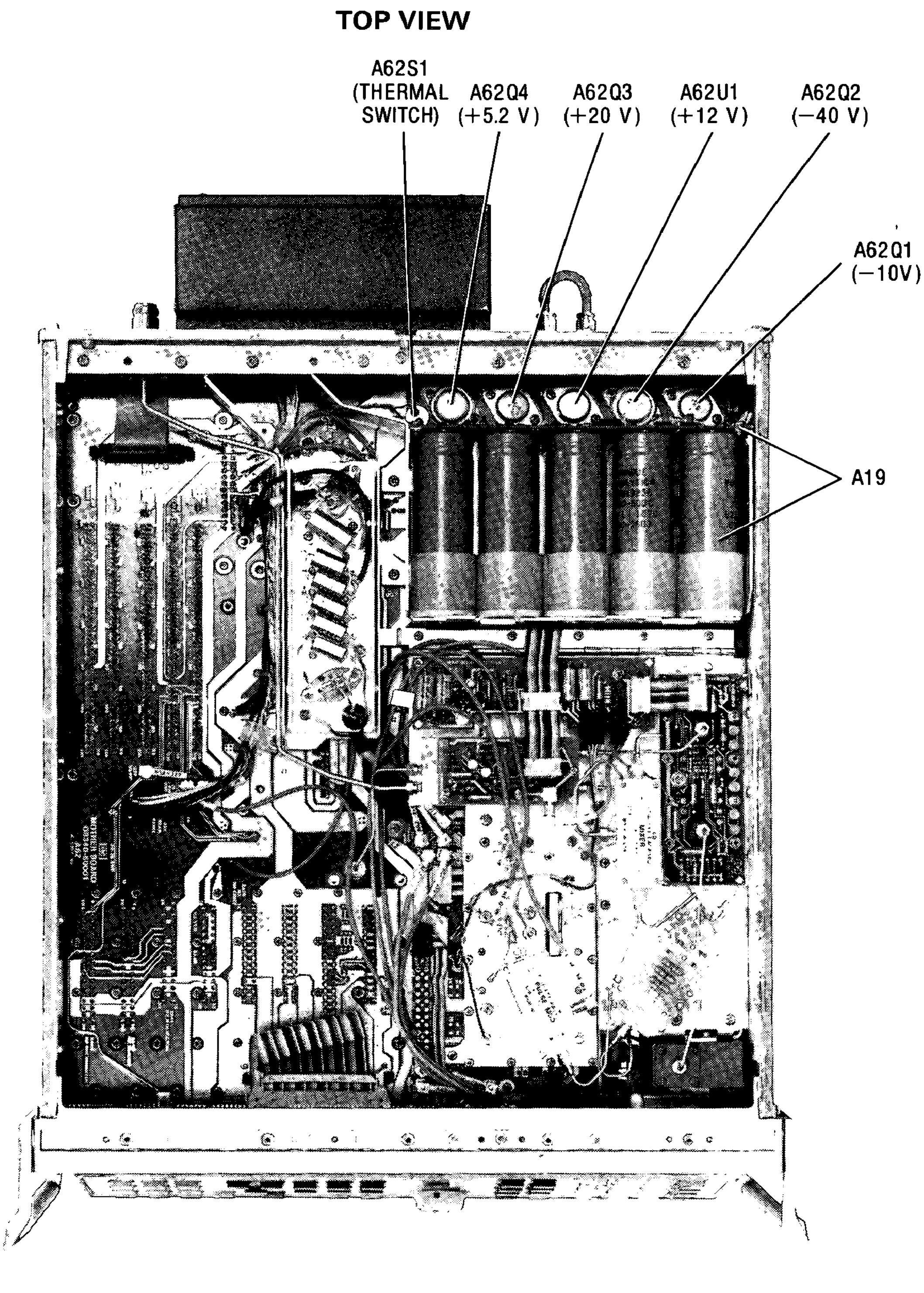


Figure 8J-14. Power Supply Major Assemblies Location Diagram (1 of 2)

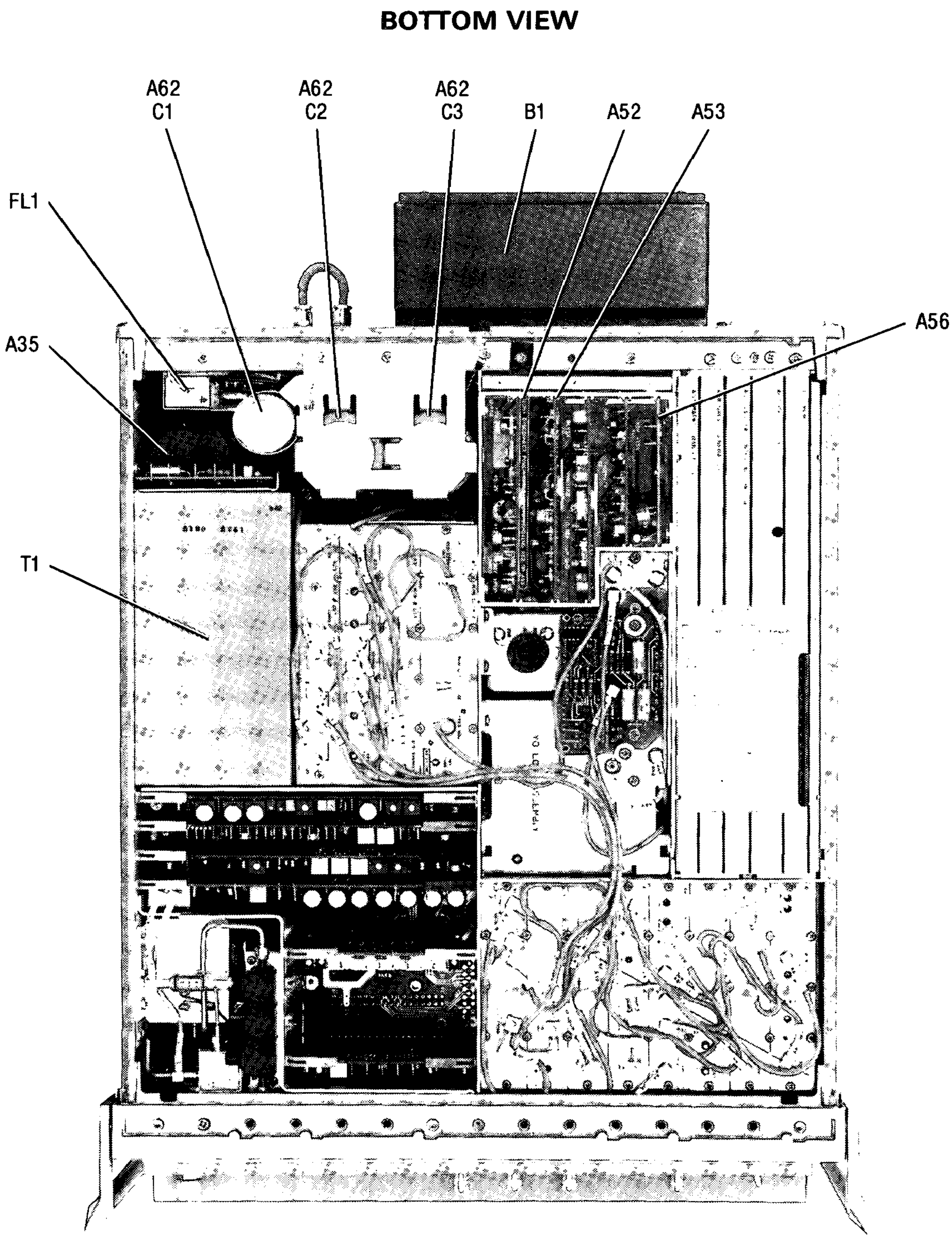


Figure 8J-14. Power Supply Major Assemblies Location Diagram (2 of 2)

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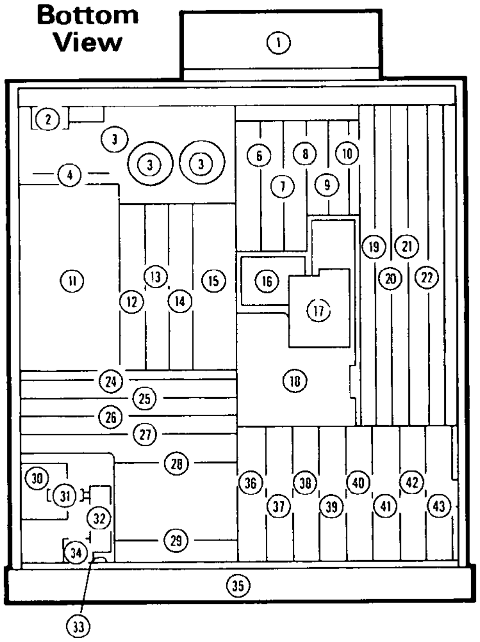
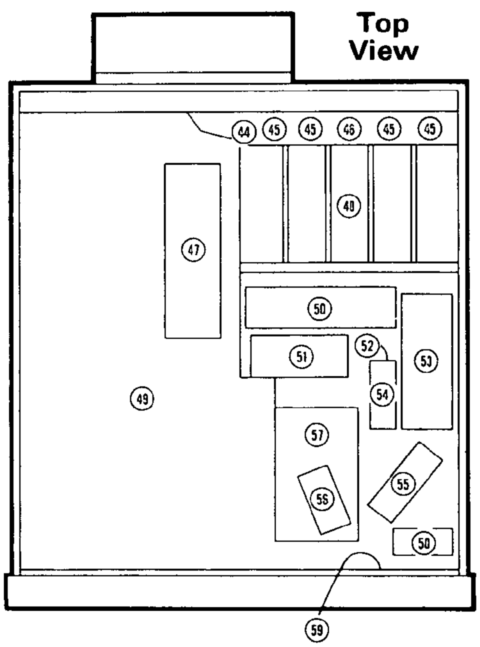
REFERENCE GUIDE TO SERVICE DOCUMENTATION

Bottom View



Top View



Assy./Ref. Des.	Description	Location	Ref.-M/N Loops	20-30 Loops	Swp. Gen.-YO Loop	Motherboard	Controller	Front/Rear Panel	RF Section	Power Supplies
			Volume 3						Volume 4	
A1	Alpha Display	33						●		
A2	Display Driver	33						●		
A3	Display Processor	33						●		
A4	Not Assigned	-								
A5	Keyboard	35						●		
A6	Keyboard Interface	35						●		
A7	Lower Keyboard	35						●		
A8	3.7 GHz Oscillator	57							●	
A9	Band 0 Pulse Modulator	56							●	
A10	Directional Coupler	32							●	
A11	Band 1-4 Detector	31							●	
A12	Band 0 Splitter/Detector	31							●	
A13	SYTM (Switched YIG Tuned Multiplier)	30							●	
A14	Band 1-4 Power Amplifier	53							●	
A15	Band 0 Low Pass Filter	52							●	
A16	Band 1-4 Modulator/Splitter	51							●	
A17	Band 0 Mixer	54							●	
A18	Band 0 Power Amplifier	55							●	
		60							●	
A19	Capacitor Assembly	48								●
A20	RF Section Filter	50							●	
A21	Pulse Modulator Driver	29							●	
A22	Not Assigned	-								
A23	Not Assigned	-								
A24	Attenuator Driver/SRD Bias	28							●	
A25	ALC Detector	27							●	
A26	Linear Modulator	26							●	
A27	Level Control	25							●	
A28	SYTM Driver	24							●	
A29	Reference Phase Detector	12	●							
A30	100 MHz VCXO (Voltage Controlled Crystal Osc.)	13	●							
A31	M/N Phase Detector	14	●							
A32	M/N VCO (Voltage Controlled Osc.)	15	●							
A33	M/N Output	15	●							
A34	Reference-M/N Motherboard	5	●							
A35	Rectifier	[illegible]								●
A36	PLL1 VCO (Voltage Controlled Osc.)	36		●						
A37	PLL1 Divider	37		●						
A38	PLL1 IF	38		●						
A39	PLL3 Upconverter	39		●						
A40	PLL2 VCO (Voltage Controlled Osc.)	40		●						
A41	PLL2 Phase Detector	41		●						
A42	PLL2 Divider	42		●						
A43	PLL2 Discriminator	43		●						
A44	YIG Oscillator (YO)	18			●					
A45	Directional Coupler	18			●					
A46	7 GHz Low Pass Filter	18			●					
A47	Sense Resistor Assembly (YO circuit)	47			●					
	(SYTM circuit)	47							●	
A48	YO Loop Sampler	15			●					
A49	YO Loop Phase/Detector	15			●					
A50	YO Loop Interconnect	17			●					
A51	Reference Oscillator	16	●							
A52	Positive Regulator	6								●
A53	Negative Regulator	7								●
A54	YO Pretune/Delay Compensation	8			●					
A55	YO Driver	9			●					
A56	−15V Regulator	10								●
A57	Marker/Bandcross	19					●			
A58	Sweep Generator	20			●					
A59	Digital Interface	21					●			
A60	Processor	22					●			
A61	Not Assigned	23					●			
A62	Motherboard	49				●				
A63	90 dB RF Attenuator	59							●	
AT1	Peripheral Mode Isolator	53							●	
AT2	15 dB Attenuator	16			●					
B1	Fan Assembly	1								●
A62C1-3	Power Supply Filter Capacitors	3								●
FL1	AC Line Module	2								●
A62Q1-4	Power Supply Regulating Transistors	45								●
A62S1	Power Supply Thermal Switch	44								●
T1	Power Supply Transformer	11								●
A62U1	Power Supply Regulator	46								●

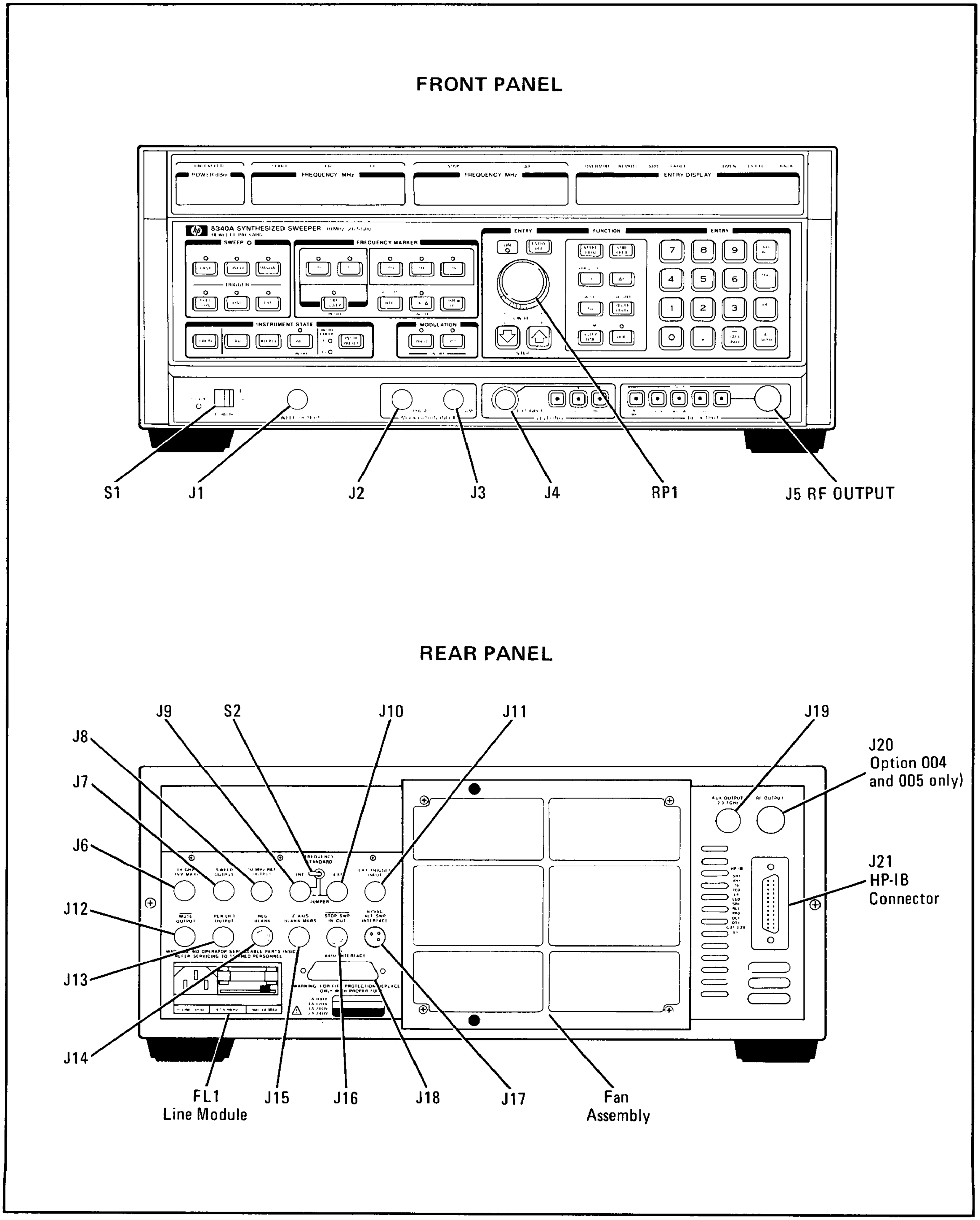


Figure 8K-1. Front and Rear Panels

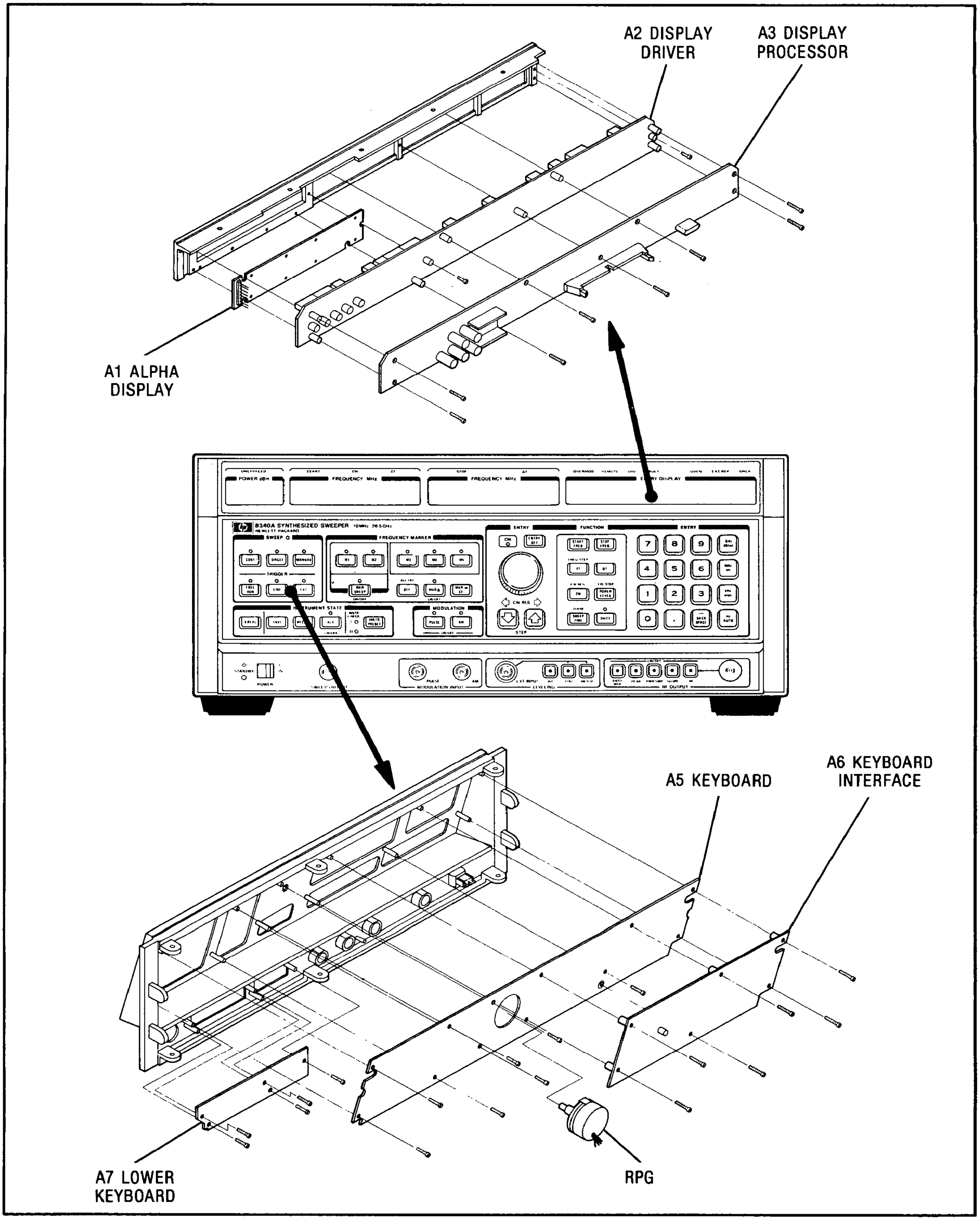


Figure 8K-2. Front Panel Assemblies

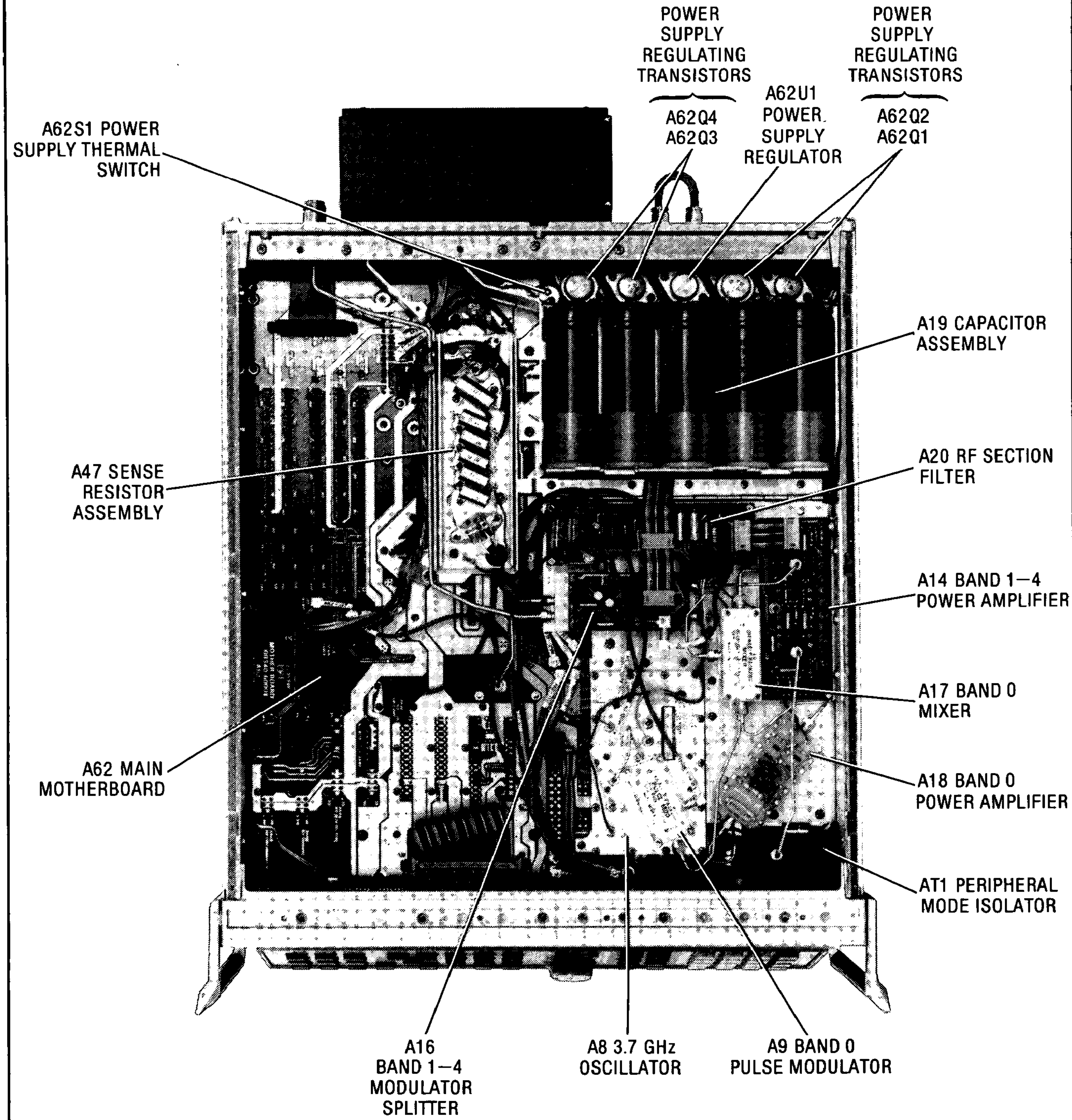


Figure 8K-3. 8340A - Top View (1 of 3)

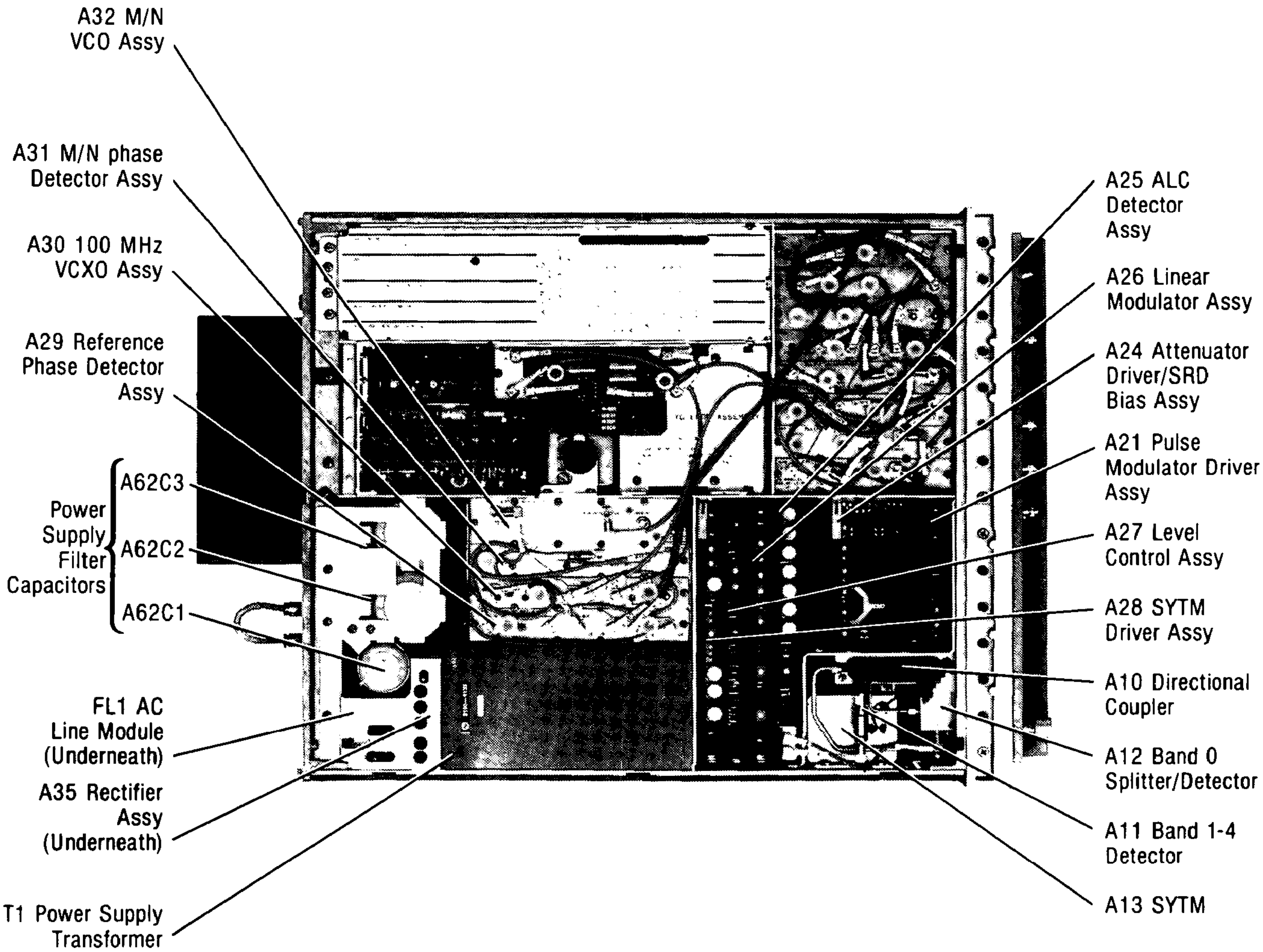


Figure 8K-3. 8340A - Bottom View (2 of 3)

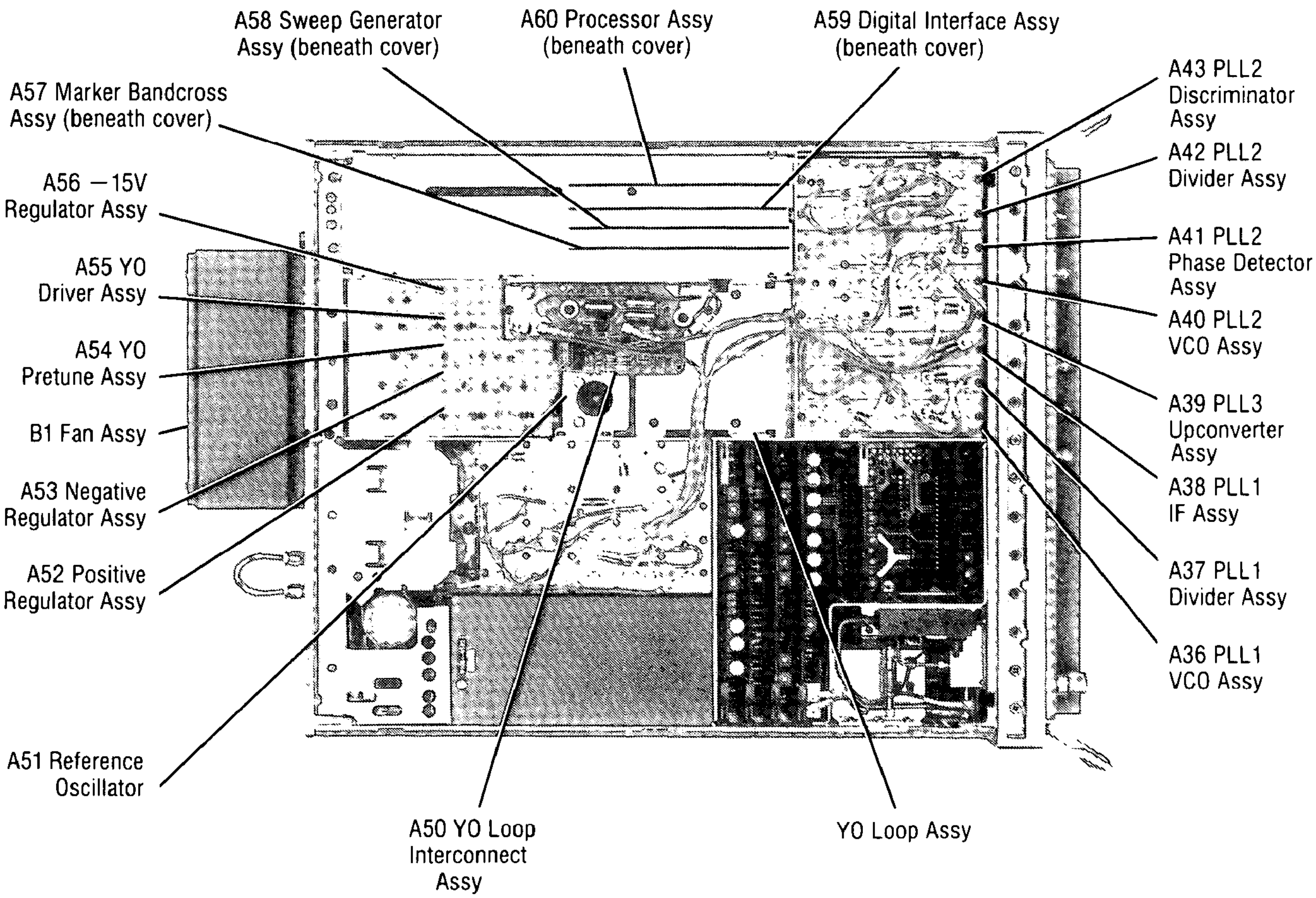
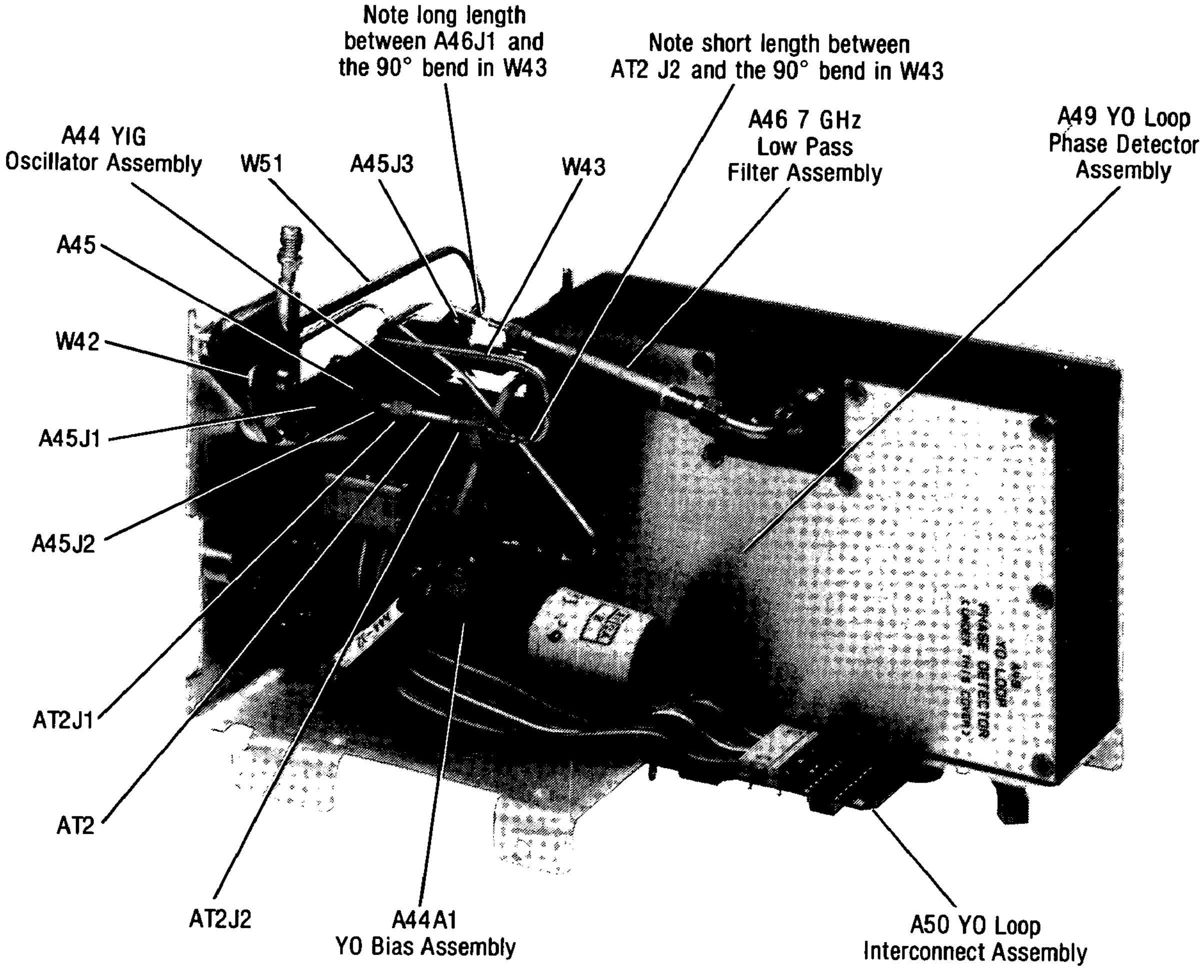


Figure 8K-3. 8340A - Bottom View (3 of 3)



CAUTION: W51 Must be disengaged from W3 before removing the YO Loop from the instrument or damage to these cables will result. Refer to Figure 8I-8, View C, in the RF Section (Volume 4).

Figure 8K-4. YO Loop Assembly (1 of 3)

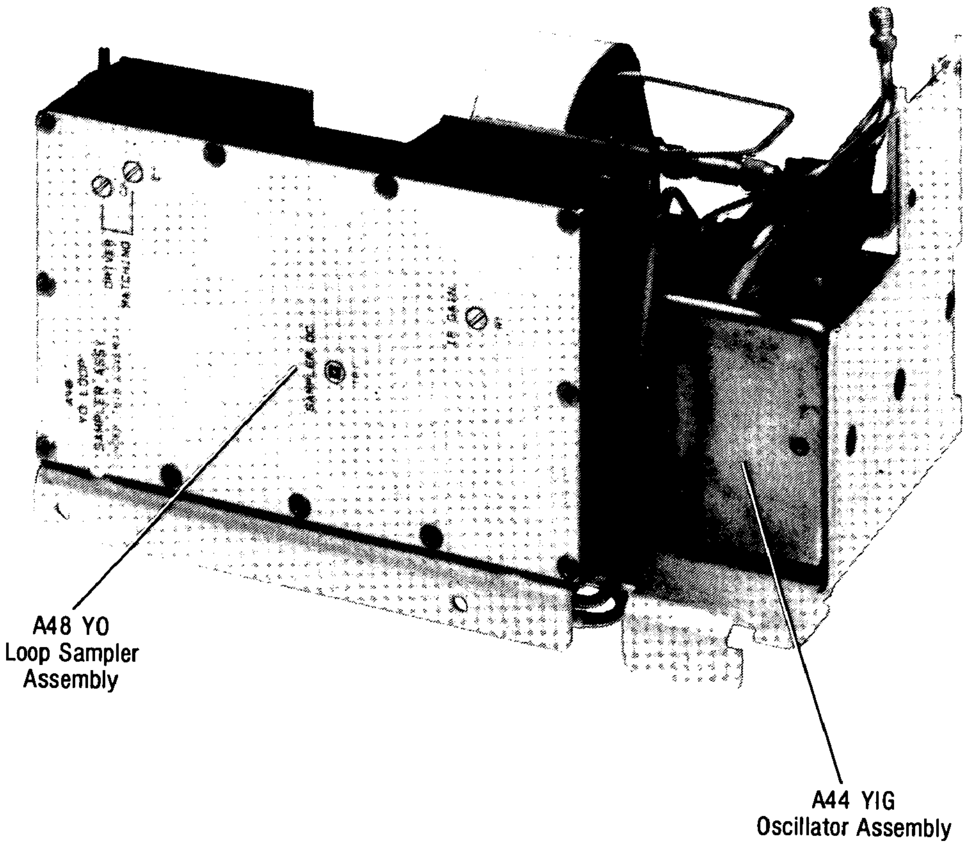


Figure 8K-4. YO Loop Assembly (2 of 3)

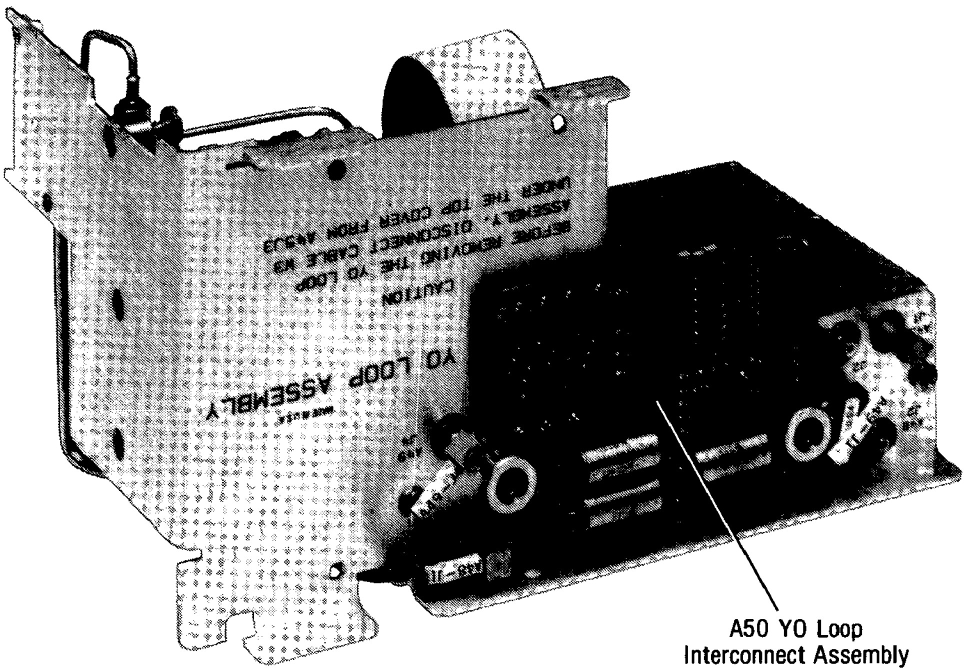


Figure 8K-4. YO Loop Assembly (3 of 3)

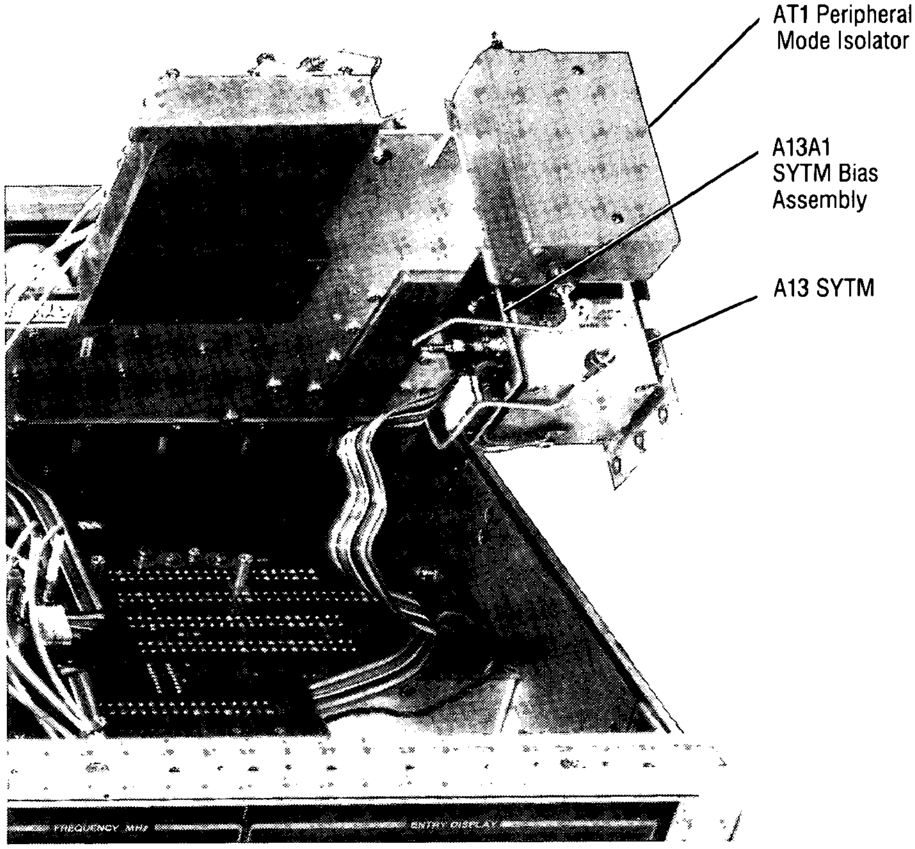


Figure 8K-5. RF Section Swing Out