Errata

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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.

About this Manual

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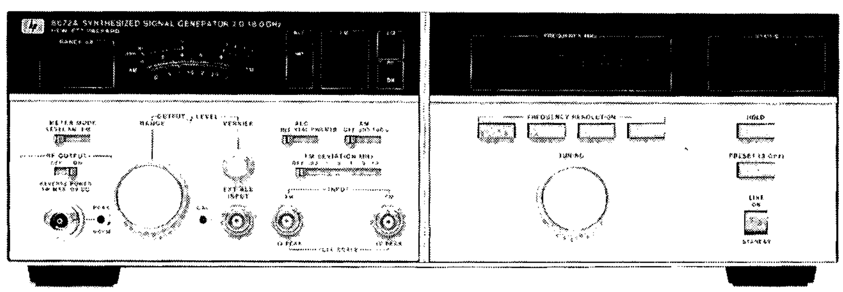
Agilent Technologies

SERVICE MANUAL

HP 8672A

SYNTHESIZED SIGNAL GENERATOR

2.0 - 18.0 GHz



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HEWLETT PACKARD

Service Manual

HP 8672A Synthesized Signal Generator

2.0 – 18.0 GHz

SERIAL NUMBERS

Attached to the rear panel of the instrument is a serial number plate. The serial number is in the form: 0000A00000. The first four digits and the letter are the serial number prefix. The last five digits are the suffix. The prefix is the same for identical instruments; it changes only when a configuration change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument.

This manual applies to instruments with serial numbers prefixed 2747A, ~~2823A,~~ 2930A, 2933A, and 2934A.

For information on instruments with serial numbers prefixed 2708A and below, refer to the earlier *HP 8672A Operating and Service Manual*, HP part number 08672-90086.

HEWLETT PACKARD

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Microfiche Part No. 08672-90120

1501 Page Mill Road, Palo Alto California
Printed in USA

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CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, (NIST), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

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For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

HP 8672A

Herstellerbescheinigung

Hiermit wird bescheinigt, dass dieses Gerät/System in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkenstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/System angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zusatzinformation für Mess- und Testgeräte:

Werden Mess- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Messaufbauten verwendet so ist vom betreiber sicherzustellen dass die Funk-Entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

Manufacturer's Declaration

This is to certify that this product meets the radio frequency interference requirements of Directive FTZ 1046/1984. The German Bundespost has been notified that this equipment was put into circulation and has been granted the right to check the product type for compliance with these requirements.

Note: If test and measurement equipment is operated with unshielded cables and/or used for measurements on open setups, the user must ensure that under these operating conditions, the radio frequency interference limits are met at the border of his premises.

Safety Considerations

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal).

Before Applying Power

Verify that the product is set to match the available line voltage and the correct fuse is installed.

Safety Earth Ground

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.

Warning

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. (Grounding one conductor of a two conductor outlet is not sufficient protection.) In addition, verify that a common ground exists between the unit under test and this instrument prior to energizing either unit.

Whenever it is likely that the 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 (for voltage reduction) make sure the common terminal is connected to neutral (that is, the grounded side of the mains supply).

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

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

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.

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 (see Table of Contents for page references).

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.

5

Adjustments

Introduction

This section contains adjustments and checks that assure peak performance of the Signal Generator. This instrument should be readjusted after repair to assure performance. Allow a one hour warm-up prior to performing the adjustments. If the mains power cable is removed and reinstalled during an adjustment, be sure that the OVEN COLD status annunciator is off before proceeding with the adjustment.

The order in which the adjustments are made is critical. Prior to making any adjustments, refer to the paragraph entitled "Related Adjustments".

Determining the adjustments to be performed after a component failure and subsequent repair or a performance test failure is important. This will help keep the adjustment time to a minimum. After repair and/or adjustment, performance tests are usually required to verify proper performance. Refer to the paragraph entitled "Related Adjustments".

Safety Considerations

This section contains information, cautions and warnings which must be followed to protect yourself, and to avoid damage to the equipment.

Warnings

Maintenance described in this section is performed with power supplied to the instrument and with protective covers removed. Maintenance should be performed only by service trained personnel who are aware of the hazard involved (for example, fire and electrical shock). Where maintenance can be performed without power applied, the power should be removed.

A pin-to-pin voltage difference of 60 Vdc may be found on many of the Signal Generator's circuit board connectors. If a circuit board is placed on an extender board, the possibility of coming in contact with 60 Vdc is greatly increased. The voltage could cause personal injury if contacted.

Equipment Required

Each adjustment procedure contains a list of required test equipment and accessories. The test equipment is identified by callouts in the test setup diagrams included with each procedure.

If substitutions must be made for the specified test equipment, refer to Table 1-3 of the Operating Manual for the critical specifications. It is important that the test equipment meet the critical specifications listed in the table if the Signal Generator is to meet its performance requirements.

The HP 11712A Support Kit is an accessory item available from Hewlett-Packard for use in servicing the Signal Generator.

Factory Selected Components

Factory selected components are identified on the schematics and parts list by an asterisk (*) that follows the reference designator. The nominal value of the component is shown. The manual change sheets will provide updated information pertaining to selected components. Table 5-1 lists the reference designator, the service sheet where the component is shown, the normal value range, and the criteria used for selecting a particular value.

Related Adjustments

If all the adjustments are to be performed, they should be done in order of appearance in this manual.

In the event of a performance test or component failure, it must be determined if an individual adjustment procedure should be performed or if the instrument should be repaired. Tables 5-2 and 5-3 indicate the required action in either case.

After the instrument is repaired or adjusted, "Performance Tests" in Section IV of the Operating Manual must be performed to verify proper operation of the Signal Generator. Tables 5-2 and 5-3 can also be used as a guideline when repairing or adjusting the instrument.

Table 5-1. Factory Selected Components

Reference Designator	Service Sheet	Range of Values	Basis of Selection
A3A1A2C8 A3A1A2L4	2 2	0 — 12.0 pF 0.22 — 0.68 μH	Centers the frequency adjustment range of A3A1A2C4 around 100 MHz. Refer to the "100 MHz VCXO Adjustment" procedure in this chapter.
A3A1A2R67, R68 and R69	2	Refer to table in "100 MHz VCXO Adjustment"	Required change in attenuation necessary for a −10 dBm output level of the 400 MHz signal. Refer to the "100 MHz VCXO Adjustment" procedure in this chapter.
A3A1A5L2	5	39 — 68 nH	Selected to adjust the gain of the mixer amplifier to eliminate spurious signals at 9 and 10 kHz offset from the fundamental signal.
A3A1A5R42	5	21.5 — 31.6 kΩ	Selected to adjust the TUNE voltage for the low frequency end of the M/N VCO tuning range (355 - 395 MHz). Verify that the 400 MHz signal to A3A1A3 is −12 dBm ± 1 dB and the 20 MHz signal to A3A1A3 is >−1 dB. Set the Signal Generator to 2060 MHz and disconnect the 400 MHz input. Measure the voltage at A3A1A4TP1. It should be 0 to −1 Vdc (typically − 0.95 Vdc). If the voltage is less than −1 Vdc (e.g., −1.2 Vdc), decrease the value of A3A1A5R42 to bring the voltage into specification. Choose resistor values ranging from 21.5 to 31.6 kΩ.
A3A7C48	13	3.9 — 5.6 pF	Selected for frequency response on the 100 kHz and lower FM deviation ranges. Use the FM Frequency Response Test Setup (test oscillator and spectrum analyzer only). Set the test oscillator's controls so that the spectrum analyzer's display of the first FM sidebands are 30 dB down from carrier at 1 MHz. At 3.16 MHz the sidebands should be 40 dB down; at 10 MHz, 50 dB down. If the response is peaking, insert a smaller value capacitor. If the response is rolling off, insert a larger value capacitor.
A3A7R61, R65, and R75	13	R61: 1620 or 1960Ω R75: 1780 or 2150Ω R65: 3.16 — 11.0 kΩ	Normal values for sensitivity of 10 MHz — pk/Vrms from front panel; R61, 1960Ω; R75, 1960Ω; R65, 4640Ω. If sensitivity is low, change R75 to 2150Ω R65 to 3830Ω. If sensitivity is high, change R61 to 1620Ω; R75 to 1780Ω; R65 to 9090Ω. Measure the dc voltage on the emitter of Q5. If more negative than −8 Vdc, reduce the value of R65; if more positive than −0.5 Vdc, increase the value of R65.
A3A9A4R20	12	348Ω — 1.21 kΩ	YTO Assembly. Sets YTO Phase-Locked Loop gain crossover to 20 ± 2 kHz. Refer to "YTO Phase Detector Adjustment" in this chapter.
A3A9A5C10	11	20 — 22 pF	Sampler Assembly. Centers the YTO phase detector sampler response. Refer to "YTO Sampler Adjustment" in this chapter.
A3A9A5C22	11	120 — 150 pF	Selected for proper IF gain. Perform "YTO Sampler Adjustment" in this chapter.

Table 5-2. Performance Test Failure and Required Action

Performance Test Failure (Section IV)	Adjustment or Repair (Table 5-3)	Repeat Performance Test(s) (Section IV)
Frequency Range and Resolution	Check phase-locked loops. See service sheets BD2, BD3 and BD4.	Frequency Range and Resolution
Frequency Switching Time	Repair or adjust the phase-locked loop or the remote programming circuit boards A2A7 and A2A9.	Frequency Switching Time, Frequency Range and Resolution
Output Level, High Level Accuracy and Flatness	Perform Flatness and ALC adjustment. Check output attenuator. See service sheets BD5 and BD6.	Output Level, High Level Accuracy and Flatness
Low Level Accuracy	Check attenuator and level control assembly. See service sheets BD5 and BD6.	Low Level Accuracy, Output Level, High Level Accuracy and Flatness
Output Level Switching Time	Repair the level control assembly or replace the output attenuator.	Output Level Switching Time
Harmonics, Subharmonics, and Multiples	Perform YTM, ALC and Flatness adjustments. Check the YTM. See service sheet BD5.	Harmonics, Subharmonics, and Multiples. Output Level, High Level Accuracy and Flatness.
Non-Harmonically Related Spurious Signals	This problem can occur anywhere in the instrument. Isolate the defective component and make adjustments as required (see table 5-3).	Non-Harmonically Related Spurious Signals
Power Line Related Spurious Signals	Refer to Section VIII, Power Supply Schematics, service sheets 33 through 35.	Power Line Related Spurious Signals
Single-Sideband Phase Noise	Check phase-locked loops. See service sheets BD2, BD3, and BD4.	Single-Sideband Phase Noise. Frequency Range and Resolution. All FM tests.
External FM Accuracy and Meter Accuracy or FM Frequency Response	FM Driver Adjustments, FM Adjustments	All FM tests
FM Harmonic and Non-Harmonic Distortion	First perform FM Driver Adjustments; then, if necessary, repair FM Driver or FM Input Circuits (see table 5-3).	All FM tests.
Residual FM	Check FM Driver for hum, noise or ground loops. Check the YTO Loop for "solid" phase lock.	Single-Sideband Phase Noise Ratio
Incidental FM	Repair AM, YTM, or ALC circuits (see table 5-3).	Related to Repair
AM Distortion	Repairof AM or ALC circuits required.[1] Adjustment (if any) related to repair.	Related to Repair
External AM Accuracy and Meter Accuracy	For incorrect meter accuracy, perform the AM Meter Adjustment; for incorrect input accuracy, troubleshoot the AM and ALC circuits.	External AM Accuracy and Meter Accuracy

Table 5-2. Performance Test Failure and Required Action (continued)

Performance Test Failure (Section IV)	Adjustment or Repair (Table 5-3)	Repeat Performance Test(s) (Section IV)
AM Bandwidth	AM Bandwidth Adjustment	AM Bandwidth
Incidental AM	Repair or adjust the YTM and ALC circuits (see table 5-3).	Output Level, High Level Accuracy and Flatness. Harmonics, Sub-Harmonics, and Multiples. Incidental AM.
Internal Time Base Aging Rate	Replace A3A8 or repair power supply.	Internal Time Base Aging Rate

NOTES

Some obscure performance failures (power levels, phase noise, etc.) can be caused by failure of phase-locked loops. Therefore, Frequency Range and Resolution tests should be performed before troubleshooting other failures.

If the output frequency is incorrect or any of the phase-lock loops are unlocked, make the appropriate adjustments and (if necessary) refer to Section VIII for repair information. After adjustment or repair, check for the incorrect frequency and verify that the phase-locked loops are locked. Perform the single-sideband phase noise test.

1. Excessive AM distortion (clipping) in the +10 dBm OUTPUT LEVEL RANGE may occur. Reducing the output level by setting the range to 0 dBm or turning the VERNIER counterclockwise should reduce the AM distortion to an acceptable level.

Table 5-3. Post Repair Adjustments

Repaired Assembly	Adjustments (Chapter 5)
A1AT1 Programmable Attenuator	ALC, and Flatness
A1A3 YTM Assembly	YTM, Power Clamp, ALC, and Flatness
A1A5, A6, A7, A8 YTM and ALC Circuits	YTM, ALC, AM Bandwidth, and Flatness
A1A6 External Leveling Circuits Only	External Leveling
A1A9 Metering Assembly	AM Meter and FM
A1A12 Power Amplifier	YTM, ALC, Flatness, and Power Clamp
A1DC1 — Directional Coupler	Flatness and ALC
A2A3, A2A4, A2A5 — LFS Phase-Locked Loop Circuits	20/30 MHz Divider Bias 160 — 140 MHz VCO Pretune
A3A2, A3A3, A3A4 — Power Supplies	Power Supply
A3A1A1, A3A1A2 — Time Base Reference	100 MHz VCXO
A3A1A3, A3A1A4, A3A1A5 — M/N Phase-Locked Loop Circuits	M/N VCO
A3A5 — DAC Assembly A3A6 — YTO Driver Assembly	YTO Pretune Digital-to-Analog Converter YTO Driver
A3A7 — YTO/FM Driver Assembly	YTO Pretune Digital-to-Analog Converter YTO Driver YTO Sampler YTO Phase Detector FM Driver FM
A3A8 — 10 MHz Reference Oscillator Assembly	10 MHz Reference Oscillator
A3A9A3 — 2.0 to 6.2 GHz YTO Assembly	YTO Pretune Digital-to-Analog Converter YTO Driver YTO Sampler YTO Phase Detector FM Driver FM YTO Loop Offset and Overmodulation
A3A9A4 — YTO Phase Detector Assembly	YTO Phase Detector YTO Loop Offset and FM Overmodulation
A3A9A5 — YTO Sampler Assembly	YTO Sampler

Power Supply Adjustments

Reference Service Sheets 33 — 35

Description This procedure adjusts the +22 volt and +20 volt power supplies to their required tolerance. The remaining supply voltages (+11V, +5.2V, −5.2V, −10V, and −40V) are checked.

Equipment Digital Voltmeter (DVM) .... HP 3455A or HP 3456A

Procedure

1. Set the Signal Generator's rear panel FREQ STANDARD INT/EXT switch to INT.
2. Connect the DVM input to A3A12TP1 on the Rectifier Assembly.
3. Adjust +22 ADJ (A3A12R2) for a DVM reading of +22.00 ±0.02 Vdc.
4. Connect the DVM input to A3A3TP5 on the Positive Regulator Assembly.
5. Set +20 ADJ (A3A3R50) for a DVM reading of +20.000 ±0.002 Vdc.
6. Check the power supplies shown in the following table. All voltages should be within tolerance.

Power Supply	Test Point	Power Supply Voltage (Vdc) Min.	Max.
+11 Vdc	A3A3TP6	+9.9	+12.1
+5.2 Vdc	A3A3TP2	+5.1	+5.3
−5.2 Vdc	A3A4TP5	−5.1	−5.3
−10 Vdc	A3A4TP4	−9.8	−10.2
−40 Vdc	A3A4TP1	−39.00	−40.60

10 MHz Reference Oscillator Adjustment

Reference Service Sheet 1

Description This procedure adjusts the frequency of the internal reference oscillator using an external frequency standard.

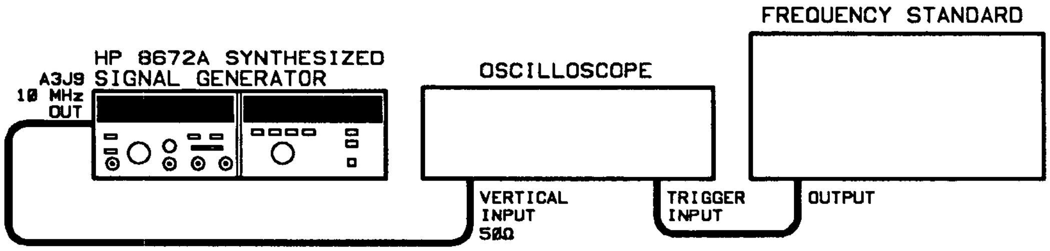


Figure 5-1. 10 MHz Reference Oscillator Adjustment Test Setup

Equipment

Frequency Standard .... HP 5065A
Oscilloscope .... HP 1980B

Note Be sure the Signal Generator has had one hour to warm up before performing the adjustment. Verify that the OVEN COLD and ϕ UNLOCKED status annunciators are off. If necessary, refer to the troubleshooting information in chapter 8.

Procedure

1. Set the Signal Generator's rear panel FREQ STANDARD INT/EXT switch to the INT position.
2. Connect the equipment as shown in figure 5-1. Set the vertical input of the oscilloscope for 50Ω input impedance.
3. Set the FREQ adjustment (on the A3A8 10 MHz Reference Oscillator Assembly) so the signal, as observed on the oscilloscope display, is not drifting.
4. Verify that in 10 seconds the display drifts less than 360°. A drift of 360° in 10 seconds corresponds to an adjustment accuracy of 1 $\times 10^{-8}$. Adjustment accuracy is not specified for this instrument; the numbers shown are what can typically be obtained.

100 MHz VCXO Adjustment

Reference Service Sheet 2

Description The frequency and tuning range output of the 100 MHz Voltage Controlled Crystal Oscillator (VCXO) is centered around 100 MHz. The output is set as close as practical to 100 MHz. The 400 MHz multiplied signal is adjusted for maximum output and minimum spurious signal output. An attenuator is selected to provide a 400 MHz output of −10 dBm.

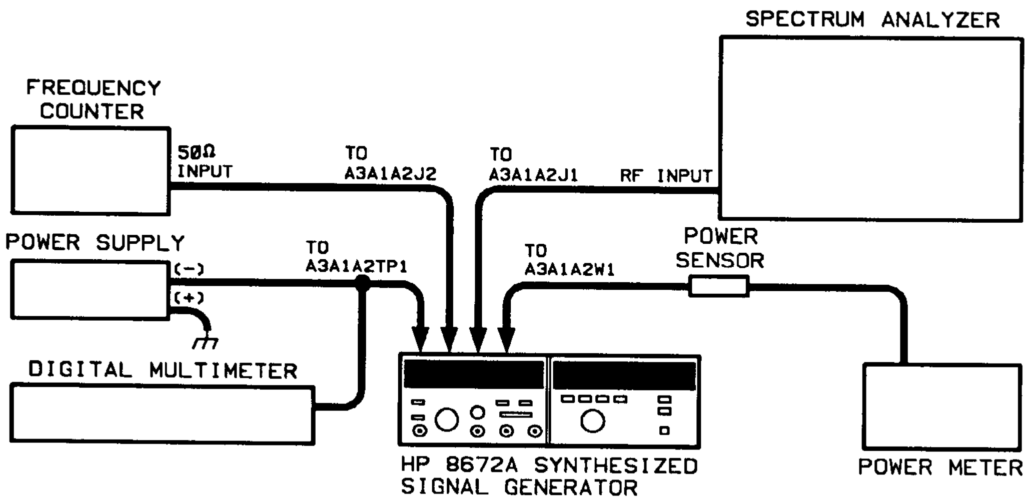


Figure 5-2. 100 MHz VCXO Adjustment Test Setup

Equipment

Frequency Counter	HP 5340A or HP 5343A
Spectrum Analyzer	HP 8566B
Power Supply	HP 6200B
Power Meter	HP 436A
Power Sensor	HP 8481A
Digital Voltmeter (DVM)	HP 3455A or HP 3456A

Procedure

1. Connect the frequency counter to A3A1A2J2 in place of the termination and connect the spectrum analyzer to A3A1A2J1 in place of the gray-orange-white cable, as shown in figure 5-2.
2. Set the output of the power supply to −8.00 ±0.01 Vdc. Connect the positive lead to ground and the negative lead to A3A1A2TP1, 100 MHz TUNE.
3. Tune A3A1A2C4, 100 MHz, for the maximum 100 MHz signal level as viewed on the spectrum analyzer display.
4. Tune A3A1A2C4 to increase the frequency (and decrease the amplitude) until the oscillation stops on the high frequency side; then tune A3A1A2C4 to start the oscillation. Continue

to decrease the frequency until the oscillation stops. If the VCXO does not stop oscillating at the high end, decrease the value of A3A1A2C8 by 1 pF from its present value. If it does not stop at the low end, increase the value of A3A1A2C8 by 1 pF. If a change is necessary, repeat this step. If a value of A3A1A2C8 cannot be found within the range of 0 to 12 pF, change A3A1A2L4 (the range of values for A3A1A2L4 is listed in step 7), then repeat this step.

5. Adjust A3A1A2C4 to obtain the maximum signal level as viewed on the spectrum analyzer display. Slowly tune to a higher frequency until the power drops by 1 dB. Record ΔF_1, that is, how far the frequency of the 1 dB point is above 100 MHz. Use the frequency counter to make the measurement to 10 Hz resolution.

   _____________ΔF_1

6. Tune to a lower frequency until the power is decreased 1 dB on the other side of the peak. Record ΔF_2, that is, how far the frequency of the 1 dB point is below 100 MHz.

   _____________ΔF_2

7. The VCXO centering about 100 MHz is correct if $0.5 \leq \frac{1}{2} \leq 2$.

   If the ratio is less than 0.5, decrease A3A1A2L4 one value to increase the center frequency. If the ratio is greater than 2, increase A3A1A2L4 one value to decrease the center frequency. Refer to the following table for the inductor values.

A3A1A2L4 Inductor Values

Value	HP Part Number
0.68 μH	9140-0141
0.56 μH	9100-2256
0.47 μH	9100-2255
0.39 μH	9100-2254
0.33 μH	9100-0368
0.27 μH	9100-2252
0.22 μH	9100-2251

8. If the inductor value is changed, repeat steps 3 through 7.
9. Adjust A3A1A2C4 to obtain a VCXO output of 100 MHz ±100 Hz.
10. Disconnect the spectrum analyzer from A3A1A2J1 and reconnect the gray-orange-white cable.
11. Disconnect the 400 MHz Output cable (gray-red-white cable) from A3A1A3J1 and connect the cable to the spectrum analyzer. Set the spectrum analyzer's controls for a center

frequency of 500 MHz, frequency span per division 100 MHz, and vertical sensitivity per division 10 dB log. Adjust the 400 MHz A3A1A2C3, C2, and C1 adjustments in that order to obtain the maximum 400 MHz signal with the lowest harmonic levels possible.

12. Check the various harmonics of the 100 MHz signal relative to the 400 MHz harmonic level. The 200 and 800 MHz harmonics should be greater than 25 dB down; 100, 300, 500, 600, 700, and 900 MHz harmonics should be greater than 35 dB down. If necessary, repeat steps 11 and 12.
13. Disconnect the spectrum analyzer from the gray-red-white cable and connect the cable to the power meter.
14. Check the power meter reading. The power should be −10 to −13 dBm. If the power is incorrect, select the values of A3A1A2R67, R68, and R69 from the Attenuator Resistor Values Table to obtain the proper power level. The attenuation should always be 3 dB or greater.

Attenuator Resistor Values

Attenuation (dB)	Resistors (ohms) R67	R68	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

15. If the amount of attenuation is changed, recheck the harmonic levels.
16. Set the Signal Generator's LINE switch to STANDBY. Disconnect all test equipment except the DVM and reconnect all instrument cables.
17. Set the Signal Generator's LINE switch to ON. Verify that the dc voltage at A3A1A2TP1 is −8 ±1 Vdc. If the voltage is out of tolerance, repeat step 9 or check the 10 MHz Reference Adjustment.
18. Connect the frequency counter to the Signal Generator's RF OUTPUT connector.
19. Verify that the counter reading is within 1 kHz of the Signal Generator's FREQUENCY MHz display at 2000 and 6199 MHz.

M/N VCO Adjustment

Reference Service Sheet 4

Description The M/N Phase-Locked Loop frequency is set to track the VCO tuning voltage across the frequency range. The M/N VCO output level is checked to ensure an adequate RF output level across the VCO tuning range.

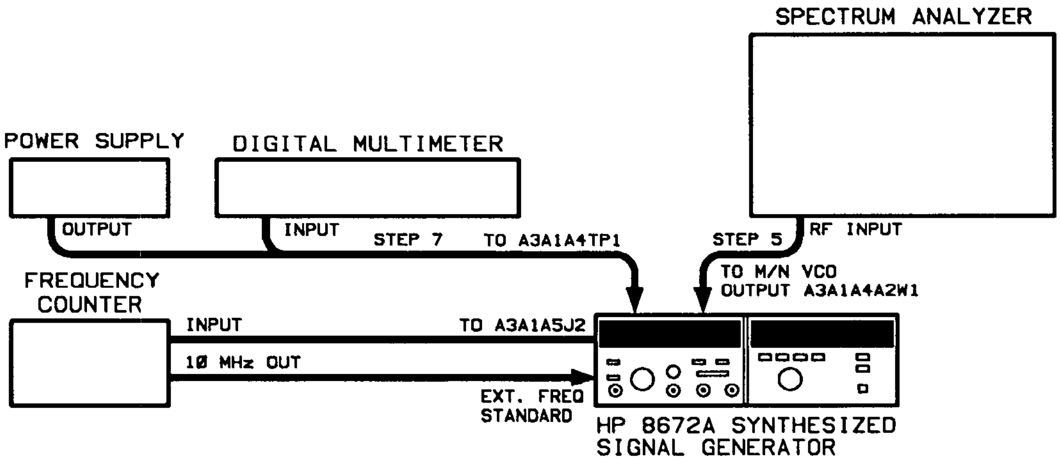


Figure 5-3. M/N VCO Adjustment Test Setup

Equipment

Digital Voltmeter (DVM)	HP 3455A or HP 3456A
Frequency Counter	HP 5340A or HP 5343A
Spectrum Analyzer	HP 8566B
Power Supply	HP 6200B

Procedure

1. On the Signal Generator, press PRESET (3 GHz) and set the frequency to 6090.000 MHz. Set the FREQ STANDARD INT/EXT on the rear panel to EXT.
2. Connect the equipment as shown in figure 5-3.
3. Verify that the M/N output frequency is 197.419 MHz ±1 kHz.

Warning **Because this circuit board is being placed on an extender board, the possibility of coming in contact with 60 Vdc is greatly increased. The voltage could cause personal injury if contacted.**

4. Set the LINE switch to STANDBY and disconnect the mains power cable. Remove the A3A1A4/A5 Assembly and place it on an extender board.
5. Connect the spectrum analyzer input to the M/N VCO output A3A1A4A2W1 (white coax).

Caution

Do not apply a positive voltage to A3A1A4TP1. A positive voltage will forward bias the VCO tuning diodes and may destroy them.

6. Connect the mains power cable and set the LINE switch to ON.
7. Set the power supply for −35.0 ±0.5 Vdc. Connect the positive output of the power supply to ground and connect the negative output to A3A1A4TP1 TUNE.
8. Release the locknut for the PWR adjustment, A3A1A4A1C5. Adjust A3A1A4A1C5 for an output level of 0 ±2 dBm. Tighten the locknut.

Note

The adjustment screws for A3A1A4A1C1 and C5 are held in place by locknuts. After making the adjustment, tighten the locknuts and recheck the frequency and level.

9. Slowly reduce the dc voltage at A3A1A4TP1, TUNE, while monitoring the VCO output power on the spectrum analyzer. The output power should be greater than −2 dBm between 395 MHz (−35 Vdc) and 355 MHz (−2.3 Vdc).
10. Reconnect A3A1A4A2W1 (white coax) to A3A1A5J3.
11. Connect the spectrum analyzer to A3A1A5J1 and adjust it for a center frequency of 375 MHz with a span width of 50 MHz.
12. Slowly adjust the dc voltage at A3A1A4TP1, TUNE, while monitoring the VCO output power on the spectrum analyzer. The output power should be +3 dBm ±6 dBm between 395 MHz (−35 Vdc) and 355 MHz (−2.3 Vdc).
13. If the output power is greater than +10 dBm or less than −3 dBm, service is required. Refer to the troubleshooting procedure in service sheet 4, chapter 8.
14. If component replacement is necessary, repeat step 12 after repairs have been made.
15. Remove the power supply connection to A3A1A4TP1.
16. Set the LINE switch to STANDBY and disconnect the mains power cable. Remove A3A1A4/A5 from the extender board and reinstall the assembly in the Signal Generator.
17. Connect the mains power cable and set the LINE switch to ON. Verify that the frequency is still at 6090.000 MHz.
18. Set FREQ ADJ A3A1A4A1C1 for a voltage level of −35.0 ±0.5 Vdc, measured at A3A1A4TP1.
19. Tune the Signal Generator frequency to 2100.000 MHz. Verify that the M/N output frequency is 177.500 MHz and the tuning voltage is −2.4 ±0.7 Vdc.

20. Disconnect all test equipment from the Signal Generator and reconnect all internal instrument cables.
21. Connect the frequency counter to the Signal Generator's RF OUTPUT connector.
22. Verify that the counter reading is within 1 kHz of the Signal Generator's FREQUENCY MHz display at 2000 and 6199 MHz.

20/30 MHz Divider Bias Adjustment

Reference Service Sheet 6

Description A substitute VCO feedback signal, derived from an external RF signal source, is monitored with an oscilloscope. The RF signal level is slowly reduced and the CLK BIAS ADJ is set to obtain a stable clock signal. The RF input is reduced to the minimum level that provides a stable signal.

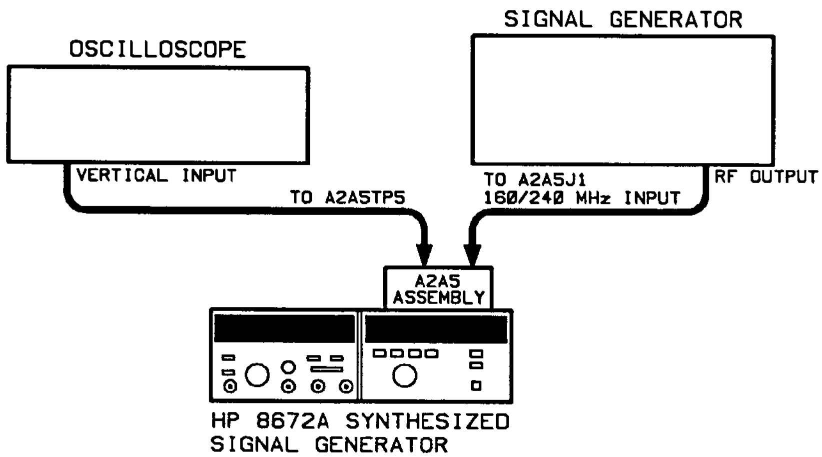


Figure 5-4. 20/30 MHz Divider Bias Adjustment Test Setup

Equipment

Oscilloscope .... HP 1980B
Signal Generator .... HP 8640B or 8340A

Procedure

1. Set the LINE switch to STANDBY and remove the mains power cable.
2. Remove the screws that hold the A2A5 20/30 MHz Divider Assembly in place.

Warning

Because this circuit board is being placed on an extender board, the possibility of coming in contact with 60 Vdc is greatly increased. The voltage could cause personal injury if contacted.

3. Remove the A2A5 Assembly, place it on an extender board, and reinstall the assembly.
4. Reconnect the mains power cable and set the LINE switch to ON.
5. Set the controls of the signal generator for continuous wave output of −5 dBm at 240 MHz.

6. Remove the red cable A2W2 from the 160/240 MHz INPUT, A2A5J1.
7. Connect the equipment as shown in figure 5-4.
8. Center A2A5R4 (CLK BIAS ADJ).
9. Observe the 14 — 24 MHz clock signal on the oscilloscope display.
10. Adjust A2A5R4 to obtain a stable clock frequency on the oscilloscope display.
11. Reduce the output level of the signal generator while readjusting A2A5R4 to obtain a stable clock at the lowest possible local oscillator signal display.
12. Verify that a stable clock signal is obtained with an input signal of −10 dBm or less.
13. Disconnect the test equipment. Set the Signal Generator to STANDBY and disconnect the mains power cable. Reinstall A2A5 in its cavity. Reconnect cable A2W2 to A2A5J1 and reconnect the mains power cable.

160 — 240 MHz VCO Pretune Adjustment

Reference Service Sheet 8

Description This procedure sets the low and high frequency limits of the 160 — 240 MHz oscillator by moving the oscillator coil closer to or farther from the circuit board.

Note This procedure need be performed only if major repair has been done to the 160 — 240 MHz oscillator.

Equipment Frequency Counter .... HP 5340A or HP 5343A

Procedure

1. Set the LINE switch to STANDBY and remove the mains power cable.
2. Remove the screws that hold the A2A3 VCO assembly in place.

Warning **Because this circuit board is being placed on an extender board, the possibility of coming in contact with 60 Vdc is greatly increased. The voltage could cause personal injury if contacted.**

3. Remove the A2A3 assembly, place it on an extender board, and reinstall the assembly.
4. Remove the green cable A3W14 that is connected to the 20/30 MHz OUTPUT A2A3J1. Connect the frequency counter to A2A3J1.
5. Reconnect the mains power cable and set the LINE switch to ON.
6. Set A2A3S1 (FREQ TEST SWITCH) to the TEST HIGH FREQ position. The frequency should be greater than 30.5 MHz.
7. If the frequency is less than 30.4 MHz, move the oscillator coil closer to the circuit board. The oscillator cover must be removed before adjusting the coil. Unsolder the four corners of the oscillator cover before removing it. Next, unsolder the oscillator coil leads, move the coil closer to the circuit board, and resolder the coil leads. Clip excess oscillator lead length on the circuit side of board if necessary.

Note The oscillator coil is normally mounted parallel to the circuit board with the bottom threads approximately 1.3 mm (0.050 inch) above the board.

8. Replace the oscillator cover by temporarily soldering one corner of the cover and recheck the frequency.
9. Set A2A3S1 to the TEST LOW FREQ position. Verify a frequency reading of less than 19.5 MHz. If necessary, set the LINE switch to STANDBY, remove the cover, reset the coil, replace the cover, and repeat steps 6 through 9.
10. Set A2A3S1 to the NORMAL position.
11. Replace the oscillator cover permanently by soldering all four corners. Do not solder the entire perimeter of the oscillator cover. The cover is for frequency stability, not for RFI leakage.
12. Set the LINE switch to STANDBY and remove the mains power cable. Reinstall A2A3 in its cavity and reconnect the green cable to A2A3J1. Reconnect the mains power cable.

YTO Pretune Digital-To-Analog Converter Adjustments

Reference Service Sheet 9

Description This adjustment sets the analog output voltage with respect to the digital frequency tuning data.

Equipment Digital Voltmeter (DVM) . . . . HP 3455A or HP 3456A

Procedure

1. Set Signal Generator controls as follows:

RF Switch	ON
ALC Mode Switch	INT
Frequency	6198 MHz

2. Press the HOLD key.
3. Connect the DVM ground lead to the reference ground, A3A6TP5. (The ground lead remains connected here for the rest of the procedure).
4. Check the voltage of the Reference Voltage Buffer at A3A5TP4. Verify that the voltage is −6.300 ±0.063 Vdc. Make repairs if necessary.
5. Connect the DVM to the YTO Pretune Output, A3A5TP5.
6. Connect test points A3A5TP1 and A3A5TP2 together with an alligator clip.
7. Adjust A3A5R15 (OFFSET) to obtain a DVM reading of +6.00mV ±0.02 mVdc.
8. Remove the alligator clip from testpoints A3A5TP1 and A3A5TP2.
9. Adjust A3A5R8 (GAIN) to obtain a voltage of −18.594 ±0.001 Vdc.
10. Tune the Signal Generator to 3066.000 MHz. Verify that the voltage at A3A5TP5 is −9.193 ±0.003 Vdc.
11. Tune the Signal Generator to 4049.000 MHz. Verify that the voltage at A3A5TP5 is −12.145 ±0.03 Vdc.
12. Disconnect the DVM from the Signal Generator.

YTO Driver Adjustment

Reference Service Sheet 10

Description The fundamental output of the Signal Generator is set to the maximum and minimum frequencies and the YTO driver's gain and offset currents are set to give specified YTO output frequencies.

Equipment Frequency Counter .... HP 5340A or HP 5343A

Note All boards must be installed in the instrument before these adjustments are made.

Procedure

1. On the Signal Generator, press PRESET (3 GHz) and set the output level to −10 dBm.
2. Connect the frequency counter to the Signal Generator's RF OUTPUT connector.
3. Connect A3A6TP5 (GND) to A3A7TP2 (TUN VOLT) with a clip-on jumper wire. (This grounds the feedback voltage and opens the YTO Phase-Locked Loop.)
4. Tune the Signal Generator to 2000.000 MHz. Adjust A3A6R34, 2 GHz, to obtain 2000.0 ±0.1 MHz on the frequency counter. Wait until the drift is minimal (approximately 30 seconds) before making this adjustment.
5. Tune the Signal Generator to 6199.000 MHz. Adjust A3A6R25, which is labeled 6.199 GHz, to obtain 6199.0 ±0.1 MHz on the frequency counter. Wait until the drift is minimal (approximately 30 seconds) before making this adjustment.
6. Repeat steps 4 and 5 until the required tolerance is obtained at both frequencies.
7. Disconnect A3A6TP5 from A3A7TP2.
8. Verify that the counter reading is within ±1 kHz of the Signal Generator's FREQUENCY MHz display at 2.0 and 6.199 GHz.

YTO Sampler Adjustment

Reference Service Sheet 11
Service Sheet A

Description The sampler is driven by a sweep oscillator and the sweep output is used to sweep the oscilloscope. The sampler driver circuit is adjusted for maximum amplitude and flatness over the range of the M/N loop. The sampler's IF preamplifier is adjusted for correct level and the frequency response is checked.

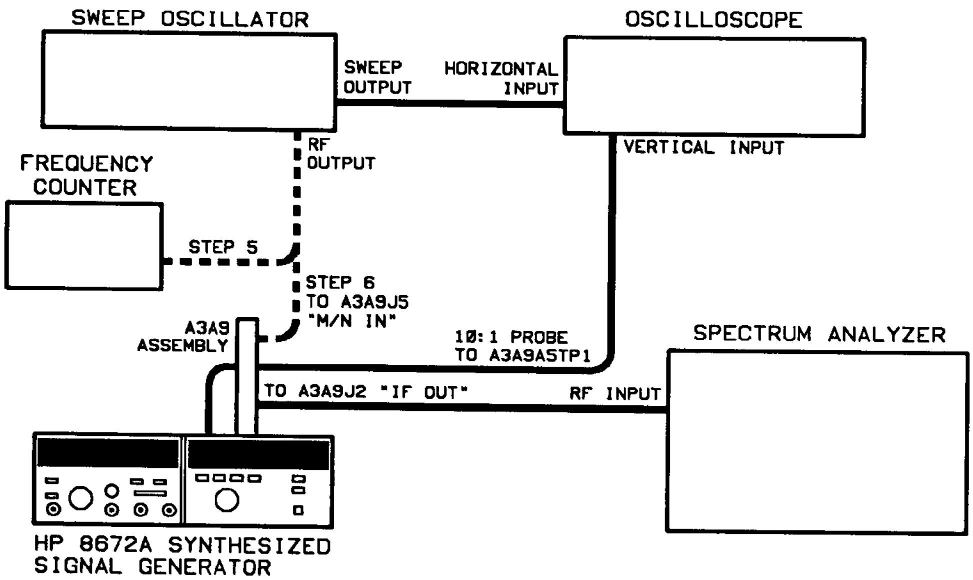


Figure 5-5. YTO Loop Sampler Adjustment Test Setup

Equipment

Oscilloscope	HP 1980B
Sweep Oscillator	HP 86222B/8620C or HP 8340A
Spectrum Analyzer	HP 8566B
Frequency Counter	HP 5340A or HP 5343A
50Ω Termination	HP 909A Opt. 012

Note An HP 8481A Power Sensor can be used in place of the 50Ω termination.

Procedure

1. Set the Signal Generator's LINE switch to STANDBY and disconnect the mains power cable.
2. Place the A3A9 Assembly into the service position (refer to service sheet A for disassembly procedures).
3. Remove the right side cover of A3A9.
4. Connect a 50Ω termination to the A3A9A1 Directional Coupler output, which normally connects to A1W1.
5. Set the sweep oscillator's controls for a leveled output of 0 dBm, center frequency of 187.5 ±1.0 MHz (measured by frequency counter) and a sweep span of 200 MHz (±100 MHz).
6. Connect the equipment as shown in figure 5-5. Connect the Signal Generator's mains power cord and set the LINE switch to ON.
7. Connect the sweep oscillator's RF output to the M/N LOOP SIGNAL connector, A3A9J5, in place of the white-orange cable.
8. Adjust A3A9A5C1 and C2 (with an insulated adjustment tool) to get an oscilloscope display similar to figure 5-6. Tune for maximum negative voltage and flatness over the center two divisions. The minimum change from the reference level to the maximum negative voltage should be 0.5 volts. (*Troubleshooting Note:* If the minimum change is out of tolerance, A3A9A5Q3 and Q8 may have low gain, the YTO feedback signal feeding the RF port of the mixer may be low, or the sampler may be bad.)

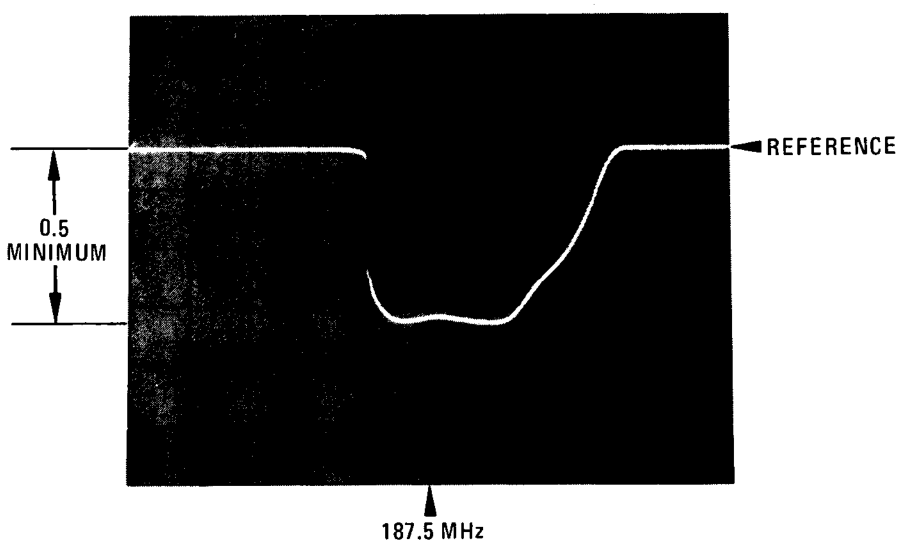


Figure 5-6. YTO Sampler Frequency Response

9. Short A3A7TP2 to ground to open the YTO Phase-Locked Loop.

10. Tune to 2100 MHz and disconnect the gray cable from the phase detector output, A3A9J6. Remove the oscilloscope probe from A3A9A5TP1.
11. Connect the spectrum analyzer's input directly to IF OUT, A3A9J2.
12. Set the sweep oscillator's controls for a center frequency of 177.5 ±1.0 MHz and set the sweep width to 10 MHz.
13. Connect the sweep oscillator's output to the M/N LOOP SIGNAL input A3A9J5.
14. Set the spectrum analyzer's controls for a 0 to 100 MHz frequency span. Set the other controls to display the IF signal. The fundamental, second and third harmonics should be visible at 30, 60, and 90 MHz. Tune the sweep oscillator slightly to align the signals on the display.
15. Adjust the A3A9A5R1, IF GAIN, so that the displayed IF signal at 30 MHz is +0 ±1 dBm. If the level is too low, or if the levels in the following step are not within the levels given, select a new value for C22. Values should be within the range of 120 to 150 pF, and 130 is usually the best value.
16. Slowly tune the sweep oscillator's center frequency from 174 to 181 MHz and observe the fundamental's output level. Verify that the allowable level variation is not exceeded and that the power does not drop below the stated level over the frequency range:
    a. from 6 to 20 MHz, −3 dBm minimum,
    b. from 20 to 30 MHz, +1 to +4 dBm,
    c. from 30 to 70 MHz, −10 dBm minimum.
17. Return the Signal Generator to normal operation as follows:
    a. Disconnect all test equipment.
    b. Reconnect the gray cable to A3A9J6 and the white-orange cable to A3A9J5.
    c. Reverse the instructions in step 4, 3, 2, and 1.
18. Connect the frequency counter to the Signal Generator's RF OUTPUT connector.
19. Verify that the counter reading is within 1 kHz of the Signal Generator's FREQUENCY MHz display at 2000.0 and 6199.0 MHz.

YTO Loop Offset and FM Overmodulation Adjustment

Reference Service Sheet 12

Description To operate the YTO loop phase detector in the linear region, the loop offset adjustment is set so that the foldover at the peak of the phase detector output signal just begins. To set the FM overmodulation threshold, the FM overmodulation adjustment is set to a position that just lights the front panel FM OVERMOD status annunciator.

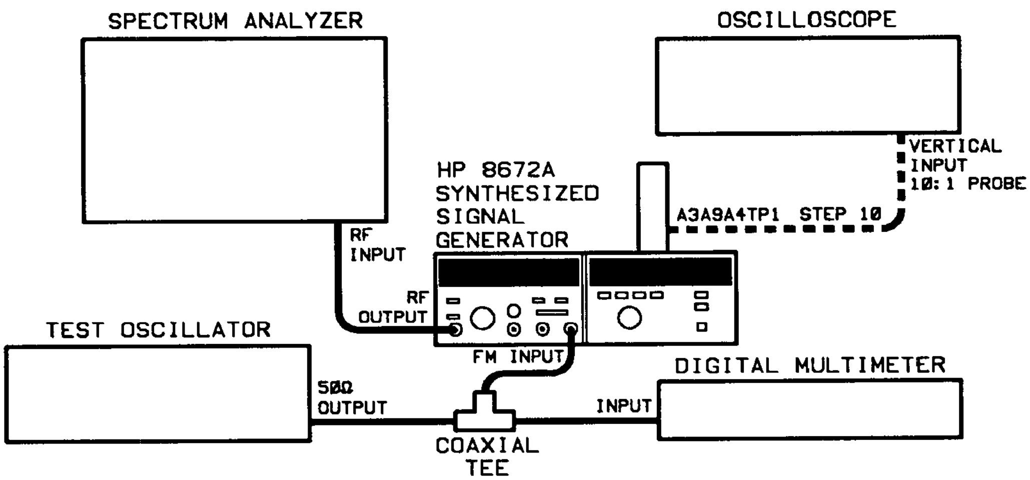


Figure 5-7. YTO Loop Offset and FM Overmodulation Adjustment Test Setup

Equipment

Oscilloscope	HP 1980B
Spectrum Analyzer	HP 8566B
Test Oscillator	HP 8116A
Digital Voltmeter (DVM)	HP 3455A or HP 3456A

Procedure

1. Set the Signal Generator's LINE switch to STANDBY and disconnect the mains power cord.
2. Place the A3A9 Assembly into the service position. (Refer to chapter 8, disassembly procedures.)
3. Remove the A3A9A4 cover.
4. Connect the equipment as shown in figure 5-7. Connect the Signal Generator's mains power cord and set the LINE switch to ON.
5. On the Signal Generator, press PRESET (3 GHz). Set the FM DEVIATION switch to 10 MHz.
6. Tune the test oscillator to 100 kHz.
7. Adjust the spectrum analyzer's controls to display the carrier and the 100 kHz sidebands.

8. Adjust the test oscillator's output level for the first carrier null as observed on the spectrum analyzer's display. Record the test oscillator's output level as measured with the voltmeter.

____________Vrms (V_1)

9. Divide the measured value by 2.4. Readjust the test oscillator's output level to the computed level, V_2.

$V_1/2.4 =$ ____________(V_2)

10. Connect the oscilloscope to A3A9A4TP1 through a divide-by-ten probe. Adjust the oscilloscope's controls to view the 100 kHz signal.

11. Set the YTO loop offset adjustment A3A9A4R53, OFST, so the sinusoidal waveform just begins to fold over. See figure 5-8.

Note There may be two settings of A3A9A4R53 that give the proper offset. Use the position closer to the center of the adjustment range.

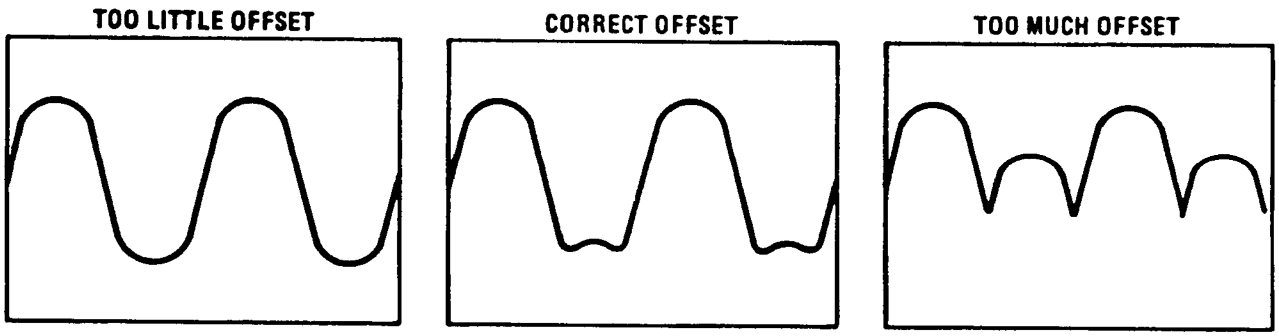


Figure 5-8. YTO Loop Offset Adjustment Waveforms

12. Disconnect the oscilloscope probe.

13. Adjust the test oscillator's output level for the second carrier null as observed on the spectrum analyzer's display. Record the test oscillator's output level.

____________Vrms (V_3)

14. Multiply the measured value by 1.18. Readjust the test oscillator's output level to the computed level, V_4.

$V_3 \times 1.18 =$ ____________(V_4)

15. Set the FM overmodulation adjustment A3A9A4R30, OMOD, to the fully clockwise position. Slowly rotate the adjustment counterclockwise until the front panel FM OVERMOD status annunciator just turns on.
16. Return the Signal Generator to normal operation by reversing the instructions in steps 4, 3, 2, and 1.

YTO Phase Detector Adjustments

Reference Service Sheet 12

Description This procedure measures and adjusts the gain crossover frequency of the YTO Phase-Locked Loop using a low frequency spectrum analyzer and tracking generator.

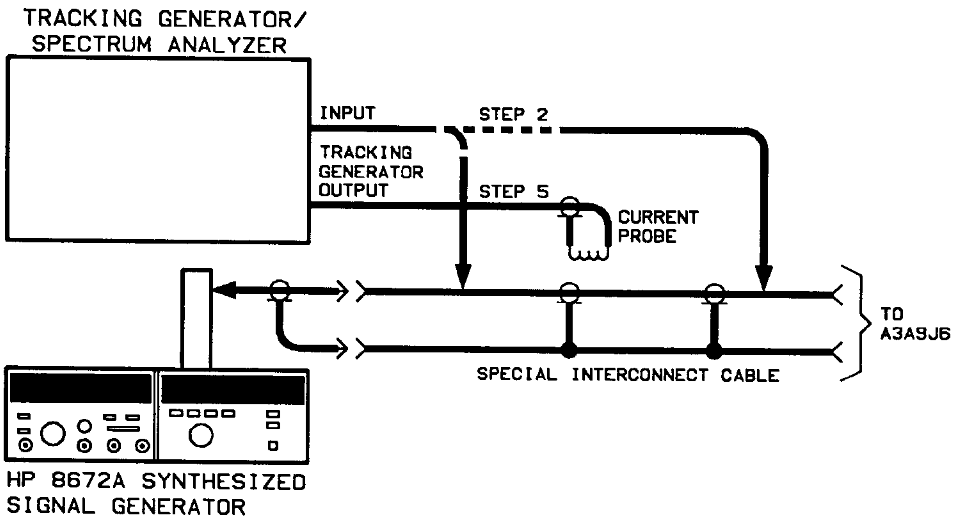


Figure 5-9. YTO Phase Detector Adjustment Test Setup

Equipment

Spectrum Analyzer	HP 8556A/8552B/141T (with tracking generator)
Current Probe	HP 1110B
Special Interconnect Cable	(See figure 5-10)

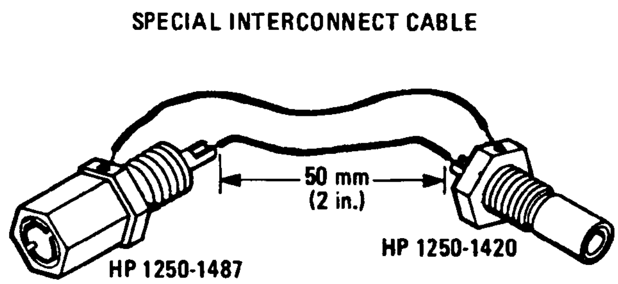


Figure 5-10. Special Interconnect Cable

Procedure

1. Set the Signal Generator's RF OUTPUT switch to ON.
2. Connect the equipment as shown in figure 5-9. The special interconnect cable is inserted between A3W16 (gray cable) and A3A9J6 (YTO TUNE 1).

Note

When clipping the current probe around the special cable's center conductor, do not allow the metal surface to come in contact with the center conductor connection of the SMA connectors.

3. Set the spectrum analyzer to scan from 0 to 50 kHz, vertical sensitivity per division to 2 dB, scan mode to single, and set the display's variable persistence to maximum.
4. Press the single sweep key on the spectrum analyzer.
5. Move the spectrum analyzer's input to the cable side (A3W16) of the special cable.
6. Press the single sweep key. Check that the gain-crossover frequency is 20 ±2 kHz. If the gain-crossover frequency is not correct, A3A9A4R20 must be changed to set the correct frequency; otherwise, this adjustment is complete. See figure 5-11.

18 ____________ 22 kHz

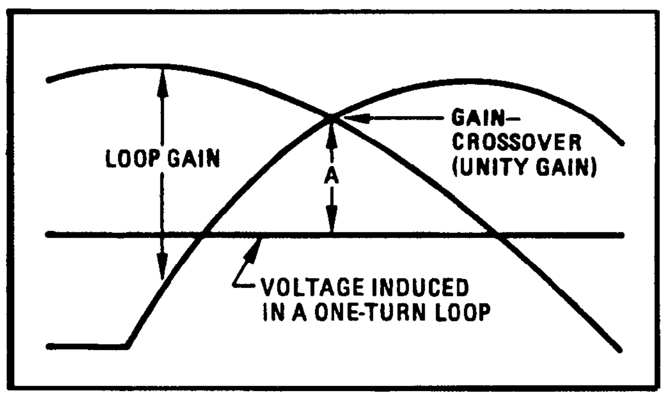


Figure 5-11.
Spectrum Analyzer Display of Phase Locked Loop Gain

7. If A3A9A4R20 must be changed, perform the following steps:
   a. Set the LINE switch to STANDBY.
   b. Disconnect the mains power cord.
   c. Place the A3A9 Assembly in the test position. (Refer to chapter 8, disassembly procedures.)
   d. Remove the A3A9A4 cover.
   e. Select the value of R20 using the following formula:

$$R2 = R1\left(\frac{F1}{20\ kHz}\right)$$

where

R2 = required value for R20
R1 = present value of R20
F1 = measured frequency

for example, if R1 = 619Ω and F1 = 25 kHz then

$$R2 = 619\left(\frac{25\ kHz}{20\ kHz}\right)$$

R2 = 773Ω or 750Ω (closest value)

8. Install R20, reconnect the mains power cord and set the LINE switch to ON. Recheck the gain-crossover frequency.

Note

The other loop parameters, phase margin and loop gain, may be checked if the loop does not operate correctly. Loop gain is checked at 1 kHz and should be approximately 40 dB. Phase margin is checked by disconnecting the input to the ac probe, shorting the input, and pressing the single sweep pushbutton. Phase margin should be approximately 45° and is calculated by the following expression:

$$\theta = \cos^{-1}\left(1 - \frac{10^{\left(\frac{A}{10}\right)}}{2}\right)$$

where θ = phase margin and A = ratio (in dB) of the induced voltage to the gain-crossover. (Gain-crossover is the reference, therefore the ratio is negative.)

9. Return the Signal Generator to normal operation as follows:

   a. Set the LINE switch to STBY.
   b. Disconnect the mains power cord.
   c. Install the A3A9A4 cover.
   d. Return the A3A9 Assembly to its normal position.
   e. Install the top and bottom covers.

FM Driver Adjustments

Reference Service Sheet 13

Description The dc offset of the FM integrator amplifier is set as close to zero volts as possible. Any FM signal present on the error signal line of the YTO phase lock loop is nulled at both high and low FM driver sensitivities.

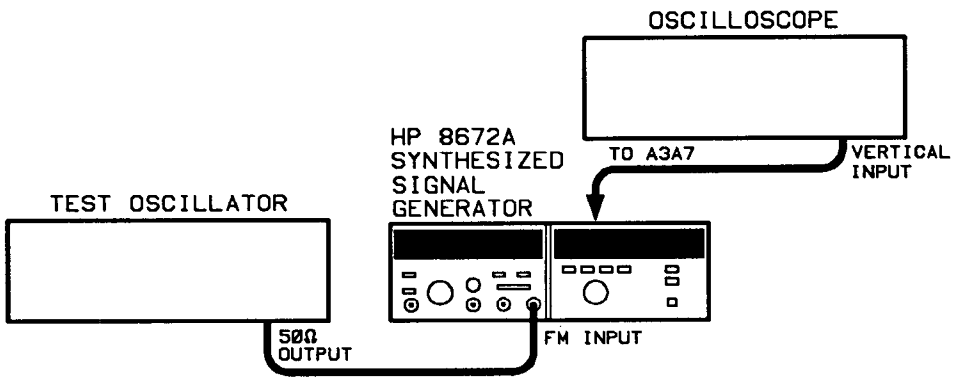


Figure 5-12. FM Driver Adjustment Test Setup

Equipment

Oscilloscope .... HP 1980B
Test Oscillator .... HP 8116A

Procedure

1. Set FM DEVIATION to 0.1 MHz.
2. Connect the oscilloscope to A3A7TP3.
3. Set A3A7R28, OFST (offset adjust), for 0.0 ±0.1 Vdc.
4. Set FM DEVIATION to 10 MHz.
5. Verify a voltage level of 0 ±2 Vdc at A3A7TP3.
6. If the RF OUTPUT switch is off, set it to ON.
7. Set the test oscillator controls for an output of 1.5 mVrms at 5 kHz.
8. Connect the oscilloscope to A3A7TP2, tune voltage. Connect the test oscillator output to the FM INPUT connector. The signal displayed by the oscilloscope will generally be less than 20 mV peak-to-peak.
9. Set A3A7R40, GAIN, to null any FM signal present at A3A7TP2.
10. Set FM DEVIATION to 0.1 MHz and test oscillator output level to 0.15 Vrms.
11. Set A3A7R46, −40 GN (−40 Gain), to null any FM signal present at A3A7TP2.

YTM Adjustment

Reference Service Sheets 15 and 16

Description The 12.4 volt reference is adjusted. A low frequency signal is applied to the tuning coil of the YTM (YIG Tuned Multiplier) to sweep the filter through its response curve. The tuning coil drive is adjusted to obtain maximum RF output from the YTM by centering the filter response about the RF output signal. The tuning coil adjustments are repeated to optimize the filter's tracking over the 2 to 18 GHz frequency range. The SRD (Step Recovery Diode) bias for the YTM is adjusted.

Equipment

Digital Voltmeter (DVM) .... HP 3455A or HP 3456A
Oscilloscope .... HP 1980B
Power Meter .... HP 436A
Power Sensor .... HP 8481A
Step Attenuator .... HP 8495A Opt. 002
Test Oscillator .... HP 8116A

Procedure

+12.4 Volt Reference

1. Set the Signal Generator as follows:

LINE switch	ON
RF OUTPUT	ON
ALC	XTAL
LEVEL RANGE	+10 dB
VERNIER	fully clockwise
Frequency	2000.000 MHz
PEAK/NORM control	NORM
CAL control	fully clockwise
AM	OFF
FM	OFF

2. Allow the instrument 30 minutes to warm up with these instrument settings.
3. Connect the DVM to the +12.4V test point on A1A8. Connect the ground lead to the GND test point on A1A8.
4. Adjust A1A8R64, +12.4V, for +12.400 ± 0.005 Vdc.

Band 1 Adjustment (2.0 to 6.199 GHz)

5. Connect the DVM to the +C.S. test point on A1A8.
6. Adjust A1A8R46, BD1 LO, for +8.0 ± 0.2 Vdc.
7. Center A1A7R31, BIAS, and A1A7R29, PWR.
8. Disconnect A1W1 from directions coupler output at A3A9A1J1 (see service sheet B, "Top View Assembly Locations"). Connect

a step attenuator between A3A9A1J1 and A1W1. Connect the remaining equipment as shown in figure 5-13.

The locally fabricated "test coupler" consists of the resistor and two capacitors shown in the figure.

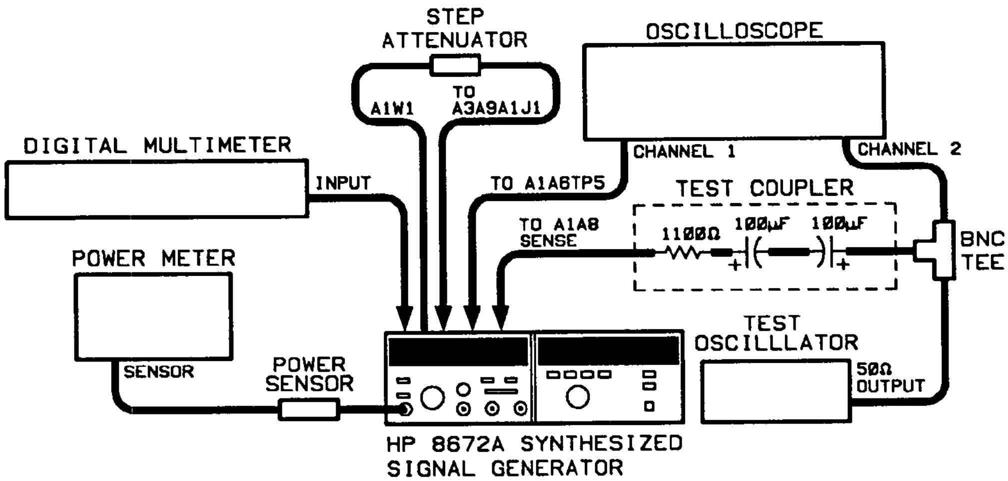


Figure 5-13. YTM Adjustment Test Setup

9. Set the test oscillator output for 60 Hz at 900 mV peak to peak as indicated by the oscilloscope.
10. Set the oscilloscope to 1 vs. 2 mode and adjust channel 2 sensitivity for a ten division horizontal sweep. Set channel 1 sensitivity to approximately 30 mV per division.
11. Remove the blue cable from A2A12 RF amplifier assembly. Removing the cable disables the power clamp for this adjustment.
12. Set the step attenuator for 10 dB attenuation. In the following steps, if the oscilloscope display shows an erratic passband res ponse (squegging), set the attenuator for a higher attenuation. Attenuator settings of 10 to 20 dB should be sufficient to stop squegging for Band 1 frequencies. Increasing the attenuation reduces the power at the input of the YTM and also reduces the sensitivity of the displayed signal. Therefore, keep the attenuator set for as low an attenuation as necessary to stop squegging.
13. Adjust A1A8R46, BD1 LO, at 2 GHz to center the peak of the YTM response as shown in figure 5-14. The display may show a retrace pattern due to hysteresis in the YTM circuitry. The center of the filter passband is halfway between the peaks of the two displayed signals.

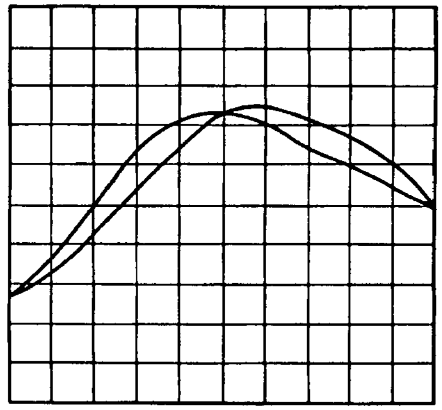


Figure 5-14. Optimum Centered YTM Response

14. Tune to 6 GHz and adjust A1A8R20, BD1 HI, to center the filter response.
15. Tune from 2 to 6 GHz using 1 MHz tuning resolution while observing the oscilloscope display. The peak of the filter passband should remain within ±5 divisions of the center of the display and should remain reasonably centered.

    Readjust the step attenuator as required to maintain a smooth curve. If necessary, repeat steps 13 through 15 until the response remains reasonably well centered. The last adjustment should be at 6 GHz.

Band 2 Adjustment (6.2 to 12.399 GHz)

16. Set the step attenuator to 0 dB attenuation. The attenuator should be set to 0 dB for frequencies above 6.2 GHz.
17. Tune to 6.5 GHz and adjust A1A8R47, BD2 LO, to center the response.
18. Tune to 11.5 GHz and adjust A1A8R16, BD2 HI, to center the response.
19. Tune from 6.2 to 12.3 GHz using 1 MHz tuning resolution. The peak of the response should remain within ±5 divisions of the center of the display and should remain reasonably centered.

    Readjust the step attenuator if necessary to maintain a smooth curve. If necessary, repeat steps 17 through 19 until the response remains reasonably well centered. The last adjustment should be at 11.5 GHz.

Band 3 Adjustment (12.4 to 18.599 GHz)

20. Tune to 13 GHz and adjust A1A8R41, BD3 LO, to center the response 2.5 divisions to the right of center. The response should be as shown in figure 5-15.

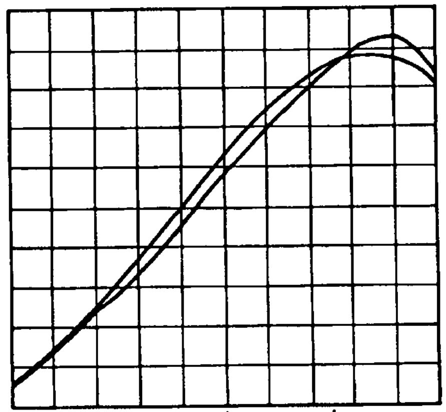


Figure 5-15. Optimum Offset YTM Response

21. Tune to 16 GHz and adjust A1A8R11, BD3-16, to center the response 2.5 divisions to the right of center.
22. Tune to 18 GHz and wait 10 minutes for the YTM to temperature stabilize. The stabilization is required to minimize the effect of filter drift during the next adjustments.
23. Tune to 17 GHz and adjust A1A8R17, BD3-17, to center the peak of the response.
24. Tune to 18 GHz and adjust A1A8R23, BD3-18, to center the peak of the response.
25. Tune to 18.599 GHz and adjust A1A8R32, BD3-18.6, to center the peak of the response.
26. Tune from 12.4 to 16 GHz using 1 MHz tuning resolution. The peak of the response should always remain at least 4 divisions from the left edge of the display.

    If necessary, repeat steps 20 and 21 to obtain the desired response. The last adjustment should be made at 16 GHz.
27. Tune from 16 to 18 GHz using 1 MHz tuning resolution. The peak of the response should remain within ±5 divisions of center and remain reasonably centered.

    If necessary, repeat steps 23 and 24 to obtain the desired response. The last adjustment should be made at 18 GHz.
28. Tune from 18 to 18.599 GHz using 1 MHz tuning resolution. The peak of the response should remain within ±5 divisions of center and reasonably centered.

    If necessary, repeat steps 24 and 25 to obtain the desired response. The last adjustment should be made at 18.599 GHz.

SRD Bias Adjustment

29. Disconnect the signal from A1A8 SENSE test point and disconnect the oscilloscope.
30. Connect the power meter to the Signal Generator's output.
31. Tune to 11.5 GHz and set A1A7R29, PWR, fully counterclockwise.
32. Reconnect the blue cable to A1A12 RF Amplifier assembly. Set the Signal Generator's ALC switch to INT and set the range to 0 dB.
33. Set the VERNIER for a −10 dBm reading on the power meter. Adjust A1A6R12, INT OS, if necessary, to bring the power level within ±3 dB of −10 dBm.
34. Connect the DVM positive lead to A1A5TP6. Connect the ground lead to A1A7 GND test point. Adjust A1A7R31, BIAS, to maximize the DVM reading.
35. Verify that the voltage at A1A7 BIAS test point is −0.5 ±0.2 Vdc. If the voltage is not correct, service is required.
36. Disconnect the test equipment and perform the Power Clamp, ALC and Flatness adjustments.

Power Clamp Adjustment

Reference Service Sheet 14

Description The power clamp circuit is adjusted to obtain the maximum power available without squegging. Squegging is a spurious oscillation that occurs in the YTM (YIG Tuned Multiplier) at high power levels. The input power to the YTM must be limited for frequencies between 2.0 and 6.2 GHz to prevent erratic power variations due to squegging.

Equipment

Power Meter .... HP 436A
Power Sensor .... HP 8481A

Procedure

1. Connect the power meter and sensor to the Signal Generator.
2. Set the Signal Generator's frequency to 5 GHz. Set the Signal Generator RANGE to 0 dB and the ALC switch to XTAL. Set the RF OUTPUT switch to OFF.
3. Set A1A5R76, PWR CLAMP, fully clockwise. This sets the power clamp for minimum power level.
4. Set the RF OUTPUT switch to ON. Adjust A1A5R76, PWR CLAMP, slowly counter-clockwise to +12 dBm on the power meter. If the level drops suddenly by several dB, set the RF OUTPUT switch to OFF and rotate A1A5R76, PWR CLAMP, clockwise slightly to reduce the clamp level. Set the RF OUTPUT switch to ON and continue with step 5.
5. Tune the Signal Generator from 2.0 to 6.1 GHz using 100 MHz steps. The power level should not change more than ±1 dB from the level set in step 4. If a sudden drop in output level occurs, set the Signal Generator to the frequency at which this drop occurs and proceed to step 6. If the power does not vary more than ±1 dBm, go to step 7.
6. Turn the RF switch OFF and rotate the PWR CLAMP clockwise. Turn the RF switch ON and rotate the PWR CLAMP counterclockwise to obtain the maximum power available at the frequency where the power drop occurred. Repeat step 5.
7. Reduce the clamp level by 0.5 dB to ensure best stability with time.

ALC Adjustments

Description

The ALC (Automatic Level Control) circuitry offsets are adjusted for proper operation. The meter is calibrated to indicate output level. The +10 dB (Overrange) range circuitry is calibrated, and the absolute ALC level with respect to the vernier voltage is calibrated.

Equipment

Digital Voltmeter (DVM) .... HP 3455A or HP 3456A
Power Meter .... HP 436A
Power Sensor .... HP 8481A

Procedure

ALC Offsets

1. Connect the power meter and sensor to the Signal Generator.
2. Set the Signal Generator's frequency to 4 GHz. Set the power meter CAL factor for 4 GHz.
3. Set the Signal Generator RANGE to 0 dB and the ALC switch to INT. Adjust the VERNIER for a power meter reading of −4 dBm.
4. Connect the DVM to A1A5TP4. Connect the ground lead to the A1A5 GND test point. Verify that the UNLVL annunciator is not lighted. Adjust A1A5R7, OS, for a DVM reading of 130.0 ±0.5 mVdc.
5. Adjust the Signal Generator's VERNIER control for a power meter reading of 0.0 ±0.5 dBm. Set the RF OUTPUT switch to OFF.
6. Connect the DVM to A1A6TP5. Connect the ground lead to the A1A6 GND (not GND2) test point. Adjust A1A6R12, INT OS, for a DVM indication of 0.00 ±0.01 mVdc.

Level Meter

7. Set the OUTPUT LEVEL RANGE to 0 dB and set the RF OUTPUT switch to ON. Connect the DVM to the A1A10 DAC test point. Connect the ground lead to the A1A10 REF GND test point. Adjust the VERNIER for a DVM indication of −6.50 ±0.05 Vdc. −6.50 Vdc corresponds to an ALC reference voltage for −10 dBm.
8. Adjust A1A10R31, GAIN, (near REF GND), for a front panel meter reading of −10 dBm.
9. Adjust the VERNIER for a DVM reading of −1.50 ±0.05 Vdc (corresponding to 0 dBm).
10. Adjust A1A5R69, MET CAL, for a front panel meter reading of 0.0 dBm.

11. Repeat steps 7 through 10 until there is less than 0.1 dB change at the last adjustment.

Overrange

12. Set the power meter to read dB relative (dB REL). This adjustment will set the −10 dBm VERNIER setting in the +10 dB RANGE equal to the 0 dBm VERNIER setting on the 0 dB RANGE.
13. Set the OUTPUT LEVEL RANGE to +10 dB. Adjust the Signal Generator's VERNIER control for a DVM indication of −6.50 ±0.05 Vdc (−10 dBm).
14. Adjust A1A6R36, OVERRANGE, for a power meter reading of 0.00 ±0.01 dB.

ALC Absolute Level

15. Set the power meter to read absolute power (dBm). Set the OUTPUT LEVEL RANGE to 0 dB and adjust the VERNIER for a DVM reading of −3.00 ±0.05 Vdc. −3 Vdc corresponds to an ALC reference voltage for −3 dBm.

    Adjust A1A6R33, −3, for a power meter reading of −3.0 ±0.1 dBm.
16. Adjust the Signal Generator's VERNIER control for a DVM reading of −6.50 ±0.05 Vdc (−10 dBm reference).

    Adjust A1A6R39, −10, for a power meter reading of −10.0 ±0.1 dBm.
17. Set the OUTPUT LEVEL RANGE to +10 dB. Adjust the Signal Generator's VERNIER control for a DVM reading of −2.50 ±0.05 Vdc (−2 dBm reference).

    Adjust A1A6R28, +8, for a power meter reading of +8.0 ±0.1 dBm.
18. Repeat steps 15 through 17 until less than 0.1 dB improvement can be made.
19. Disconnect the DVM from the Signal Generator and perform the Flatness Adjustment.

Flatness Adjustment

Reference Service Sheet 16

Description The Flatness Adjustment reduces power variations due to output cable, attenuator, crystal detector, and directional coupler variations.

Equipment

Digital Voltmeter (DVM) .... HP 3455A or HP 3456A
Power Meter .... HP 436A
Power Sensor .... HP 8481A

Procedure

1. Connect the power meter and sensor to the Signal Generator.
2. Set the Signal Generator's frequency to 4 GHz.

Note After each frequency change, make sure the power meter CAL factor is adjusted for the new frequency.

3. Set the OUTPUT LEVEL RANGE to 0 dB and the ALC switch to INT.

   Adjust the Signal Generator's VERNIER control for a front panel meter reading of 0 dBm.
4. Set the power meter to read dB relative (dB REL).
5. Set the Signal Generator's frequency to 10 GHz. Adjust A1A7R18, SLOPE 10 GHz, for a power meter reading of 0 dB.
6. Set the Signal Generator's frequency to 18 GHz. Adjust A1A7R4, SLOPE 18 GHz, for a power meter reading of 0 dB.
7. Set the Signal Generator's frequency to 17 GHz. Adjust A1A7R4, SLOPE 18 GHz, for the best overall output power accuracy between 17 and 18 GHz.

External Leveling Adjustment

Reference Service Sheet 17

Description The external ALC (Automatic Level Control) amplifier is adjusted for zero offset. The +10 dB range is calibrated for external leveling modes.

Equipment

Digital Voltmeter (DVM)	HP 3455A or HP 3456A
Power Meter	HP 436A
Power Sensor	HP 8481A
50Ω Termination	HP 11593A

Procedure

1. Set the Signal Generator's frequency to 4 GHz. Connect a 50 ohm load to the Signal Generator's EXT ALC input connector.
2. Connect the DVM between A1A6TP6 and A1A6TP8 (GND 2). Adjust A1A6R15, EXT OS, for a reading of 0.0 ±0.1 mVdc. Disconnect the 50 ohm load and the DVM.
3. Connect the power meter and sensor to the Signal Generator as shown in figure 5-16.

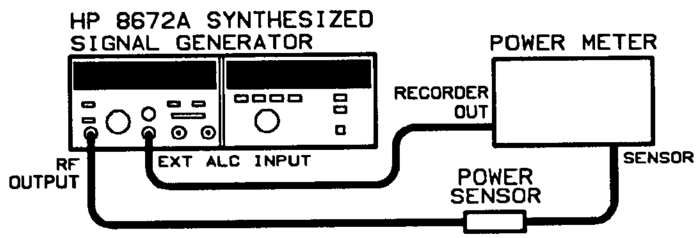


Figure 5-16. External Leveling Adjustment Test Setup

4. Set the Signal Generator's frequency to 4 GHz. Adjust the CAL factor on the power meter for 4 GHz.
5. Set the OUTPUT LEVEL RANGE to 0 dB and the ALC switch to INT. Adjust the Signal Generator's VERNIER control for a power meter reading of −5 ±1 dBm. Press the range hold key on the power meter.
6. Connect the DVM to A1A10 DAC test point and A1A10 REF GND. Set the Signal Generator's ALC switch to PWR MTR.
7. Set the OUTPUT LEVEL RANGE to 0 dB. Adjust the Signal Generator's VERNIER control for a DVM reading of −1.50 ±0.05 Vdc. Adjust the Signal Generator's front panel CAL control for a power meter reading of −10.0 ±0.1 dBm.

8. Set the OUTPUT LEVEL RANGE to +10 dBm. Adjust A1A6R38, EXT GAIN, for a power meter reading of 0.0 ±0.1 dBm.
9. Repeat steps 7 and 8 until there is less than 0.1 dB change at the last adjustment.
10. Disconnect the power meter from the Signal Generator.

AM Bandwidth Adjustment

Reference Service Sheet 14 and 17

Description This procedure sets the bandwidth of the AM circuitry. A reference level is set on the spectrum analyzer. The maximum specified AM drive frequency is set for each frequency band. The Signal Generator is tuned across the band to determine worst-case AM sensitivity. The sensitivity is adjusted for each band to match the previously set reference level.

Equipment

Spectrum Analyzer .... HP 3580A
Test Oscillator .... HP 8116A

Procedure

1. Connect the equipment as shown in fgure 5-17.

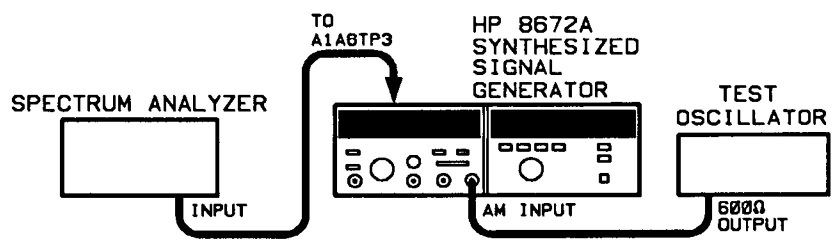


Figure 5-17. AM Bandwidth Adjustment Test Setup

2. Set the Signal Generator as follows:

FREQUENCY	2000 MHz
OUTPUT LEVEL RANGE	−110 dB
OUTPUT LEVEL VERNIER	0 dBm
AM Switch	100%
METER MODE Switch	AM

3. Tune the test oscillator to 10 kHz with an output amplitude of 0.5 Vrms.
4. Connect the spectrum analyzer's input to A1A6TP3.
5. Adjust the spectrum analyzer to view the 10 kHz signal using the 2 dB log per division scale.

Note Do not be concerned about the high harmonic content observed on the spectrum analyzer display.

6. Using the vertical sensitivity controls of the spectrum analyzer, set the peak of the 10 kHz signal to the center horizontal

graticule line. This establishes a reference level for the modulation signal.

Note

Do not disturb the spectrum analyzer's vertical sensitivity controls or the test oscillator's amplitude controls for the remainder of this test.

7. Tune the test oscillator to 200 kHz.
8. Adjust the spectrum analyzer to display the 200 kHz signal.
9. Tune the Signal Generator from 2000 to the 6199 MHz in 1 MHz steps while observing the 200 kHz signal on the spectrum analyzer display. Note the frequency at which maximum amplitude of the displayed signal occurs.
10. Tune the Signal Generator frequency to the maximum amplitude point.
11. Adjust A1A5R23 (GAIN ×1) for a displayed signal level equal to the 10 kHz reference.
12. Tune the Signal Generator from 6200 to 12 399 MHz in 1 MHz steps while observing the 200 kHz signal on the spectrum analyzer display. Note the frequency at which maximum amplitude of the displayed signal occurs.
13. Tune the Signal Generator frequency to the maximum amplitude point.
14. Adjust A1A5R21 (GAIN ×2) for a displayed signal level equal to the 10 kHz reference.
15. Tune the Signal Generator from 12 400 to 18 000 MHz in 1 MHz steps while observing the 200 kHz signal on the spectrum analyzer display. Note the frequency at which maximum amplitude of the displayed signal occurs.
16. Tune the Signal Generator frequency to the maximum amplitude point.
17. Adjust A1A5R17 (GAIN ×3) for a displayed signal level equal to the 10 kHz reference.

AM Meter Adjustment

Reference Service Sheet 21

Description The output of the Signal Generator is amplitude modulated. The depth of the modulation is detected and displayed on the measuring receiver. This reading is used as a reference point to adjust the AM meter circuitry for accurate indication of AM depth.

Equipment

Local Oscillator	HP 8340A
Measuring Receiver	HP 8902A
Test Oscillator	HP 8116A
Double Balanced Mixer	RHG DMS1-18

Procedure

1. Connect the equipment as shown in Figure 5-18.

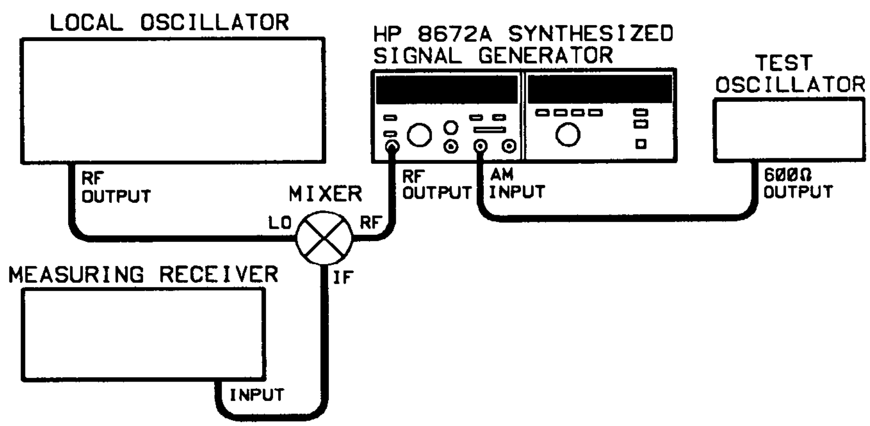


Figure 5-18. AM Meter Adjustment Test Setup

2. Set the Signal Generator as follows:

FREQUENCY	3000 MHz
OUTPUT LEVEL RANGE	0 dB
OUTPUT LEVEL VERNIER	0 dBm
ALC Mode	INT
AM Switch	100%
METER MODE Switch	AM

3. Set the measuring receiver as follows:

MEASUREMENT	AM
DETECTOR	Peak +
HP FILTER	50 Hz
LP FILTER	15 kHz
Measurement Frequency	63 MHz

4. Tune the local oscillator to 3063 MHz with an output amplitude of +8 dBm.

5. Tune the test oscillator to 10 kHz.
6. Adjust the test oscillator's output amplitude for a reading of 50% AM on the measuring receiver display.
7. Adjust A1A9R69 (AM MTR) to obtain a Signal Generator front panel meter reading of 50% AM depth.

AM Meter Adjustment — Alternate Procedure

Reference Service Sheet 21

Description The Signal Generator's RF output is mixed with the output of the local oscillator. The resultant IF signal is connected to the oscilloscope's vertical input. The test oscillator's output is used to drive the AM circuitry in the Signal Generator and the horizontal amplifiers in the oscilloscope. The resultant oscilloscope display is a trapezoidal waveform from which the AM depth is easily calculated.

Equipment

Local Oscillator	HP 8340A
Oscilloscope	HP 1980B
Test Oscillator	HP 8116A
Double Balanced Mixer	RHG DMS1-18

Procedure

1. Connect the equipment as shown in Figure 5-19.

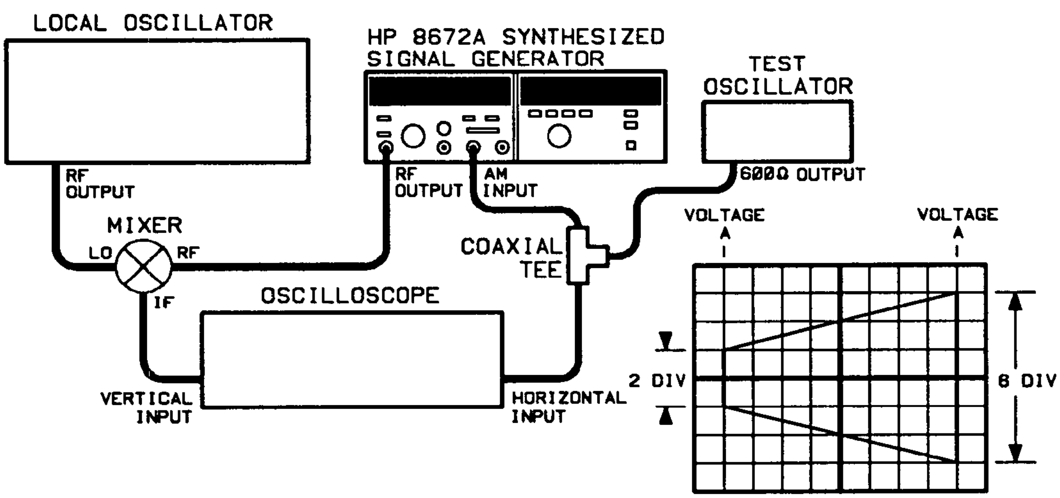


Figure 5-19. Alternate AM Meter Adjustment Test Setup

2. Set the Signal Generator as follows:

FREQUENCY	3000 MHz
OUTPUT LEVEL RANGE	−20 dB
OUTPUT LEVEL VERNIER	0 dBm
ALC Switch	INT
AM Switch	100%
METER MODE Switch	AM

3. Tune the local oscillator to 3010 MHz with an output amplitude of +8 dBm.

4. Tune the test oscillator to 10 kHz with an output amplitude of 0.35 Vrms.
5. Adjust the oscilloscope's controls to display the trapezoidal modulation signal as shown in figure 5-19.
6. Adjust the test oscillator's output voltage so that voltage A is 2 divisions in amplitude and voltage B is six divisions in amplitude.
7. Adjust A1A9R69 (AM MTR) to obtain a Signal Generator front panel meter reading of 50% AM depth.

FM Adjustments

Reference Service Sheet 21

Description This procedure sets the FM meter accuracy and the FM OVERMOD annunciator trigger point. The external modulation drive signal is set to a level which will cause full scale FM deviation. The Signal Generator's meter drive circuitry is set to display this deviation on the front panel meter. The modulation drive signal is then set to a level which will cause FM overmodulation. The Signal Generator's FM overmodulation control is adjusted to cause the OVERMOD annunciator to be illuminated.

Equipment

Local Oscillator	HP 8340A
Measuring Receiver	HP 8902A
Test Oscillator	HP 8116A
Double Balanced Mixer	RHG DMS1-18

Procedure

1. Connect the equipment as shown in Figure 5-20.

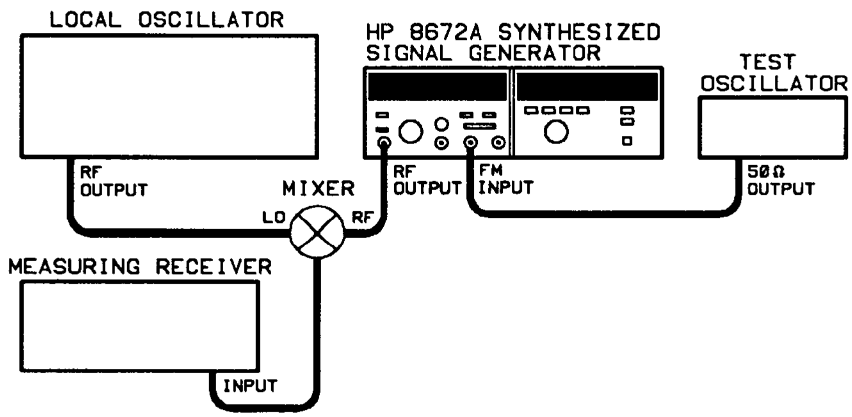


Figure 5-20. FM Adjustments Test Setup

2. Set the Signal Generator as follows:

FREQUENCY	3000 MHz
OUTPUT LEVEL RANGE	−10 dB
OUTPUT LEVEL VERNIER	0 dBm
ALC Switch	INT
FM DEVIATION Switch	0.3 MHz
METER MODE Switch	AM

3. Tune the local oscillator to 3063 MHz with an output amplitude of +8 dBm.

4. Set the measuring receiver as follows:

MEASUREMENT	FM
DETECTOR	Peak +
HP FILTER	50 Hz
LP FILTER	15 kHz
Measurement Frequency	63 MHz

5. Tune the test oscillator to 100 kHz.
6. Adjust A1A9R34 (FM OMOD) fully clockwise.
7. Adjust the test oscillator's output amplitude to 0.707 Vrms.
8. Adjust A1A9R37 (FM GAIN) to 300 kHz peak FM deviation as displayed on the measuring receiver.
9. Adjust A1A9R21 (FM MTR) for 300 kHz peak FM deviation as shown on the Signal Generator's front panel meter.
10. Adjust the test oscillator's output amplitude to 0.7425 Vrms.
11. Slowly adjust A1A9R34 (FM OMOD) until the front panel FM OVERMOD annunciator lights.
12. Reduce the test oscillator's output amplitude to 0.707 Vrms. Verify that the FM OVERMOD annunciator is off.

6

Replaceable Parts

Introduction

This section contains information for ordering parts. Table 6-1 lists part numbers for restored assemblies. Table 6-2 lists abbreviations used in the parts list and throughout the manual. Table 6-3 lists all replaceable parts in reference designation order. Table 6-4 contains the names and addresses that correspond to the manufacturer's code numbers.

Restored Assemblies

Table 6-1 lists restored assemblies for the instrument that may be purchased on an exchange basis, thus affording a considerable cost saving. 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.

Abbreviations

Table 6-2 lists abbreviations used in the parts list, schematics, and throughout the manual. Standard abbreviations may be in upper or lower-case letters. However, the replaceable parts list is a computer printout using only upper-case letters. Thus, abbreviations in the replaceable parts list are in upper-case letters only.

Replaceable Parts List

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

a. Electrical assemblies and their components in alphanumeric order by reference designation.

b. Chassis-mounted, or non-assembly, parts in alphanumeric order by reference designation.

The information given for each part consists of the following:

a. Reference designation

b. Hewlett-Packard part number

c. Part number check digit (CD)

d. Total quantity (Qty) used in the instrument

e. Part description

f. Five-digit code that represents a typical manufacturer

g. Manufacturer's part number

The total quantity for each part is given, at the first appearance of the part number in each major assembly.

Factory Selected Parts (*)

Parts marked with an asterisk are factory selected parts. (That is, they are selected in test.) The value shown in the parts list is a nominal value only. Refer to table 5-1, "Factory Selected Components", for instructions on selecting the actual value for replacement.

Parts List for Older Configurations

The parts list applies directly to instruments with serial number prefixes as described on the title page and in the preface. Parts information for instruments with older configurations is described there as well.

Parts List Updating

Instruments made after the publication of this manual may have parts different from those shown in the replaceable parts list. The *Manual Update* will provide information for the new parts as well as the serial number prefixes of the new instruments. The *Manual Update* will also correct errors in the parts list.

Ordering Information

When ordering a part listed in the replaceable parts list, include the Hewlett-Packard part number, the check digit, and the quantity required.

Address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

Note

Within the U.S.A., it is more expedient to order directly from the HP Parts Center in Mountain View, California. Ask your nearest HP office for information and forms for the "Direct Mail" Order System.

Parts Identification

Most mechanical parts are identified in figures 6-1 through 6-16. These figures are located at the end of the replaceable parts list. Most electrical parts are shown in figures associated with the schematic diagrams in chapter 8.

To identify a part not shown in chapters 6 or 8, or in the *Manual Updates* supplement, contact the parts identification section of your nearest Hewlett-Packard service center. Be prepared to identify the instrument by model and serial number, and to describe the part by type, function, and location within the instrument.

Recommended Spares List

Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard prepares a "Recommended Spares" list for this instrument. The contents of the list are based on failure reports and repair data. Quantities given are for one year of parts support. A complimentary copy of the "Recommended Spares" list may be requested from your nearest Hewlett-Packard office.

When stocking parts to support more than one Signal Generator or a variety of Hewlett-Packard instruments, it may be more economical to work from one consolidated list rather than simply adding together stocking quantities from the individual instrument lists. Hewlett-Packard will prepare consolidated "Recommended Spares" lists for any number or combination of instruments. Contact your nearest Hewlett-Packard office for details.

Table 6-1. Part Numbers for Exchange Assemblies

Reference Designation	Description	Part Number* Exchange Assy	New Assy
A1A3	YTM Assembly	5086-6151	5086-7151
A1A12	Power Amplifier Assembly	08672-69005	08672-67005
A1AT1	Programmed Attenuator Assembly	08672-60111	08672-60114
A3A1A4	M/N VCO Assembly	86701-60071	86701-60029

*When ordering extra assemblies for spare parts stock, use new assembly part number only. Exchange orders require return of the defective part.

Table 6-1. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A .... assembly
AT ...... attenuator; isolator; termination
B .... fan; motor
BT .... battery
C .... capacitor
CP .... coupler
CR .... diode; diode thyristor; varactor
DC .... directional coupler
DL .... delay line
DS .... annunciator; signaling device (audible or visual); lamp; LED
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 ..... transistor; SCR; triode thyristor
R .... resistor
RT .... thermistor
S .... switch
T .... transformer
TB .... terminal board
TC .... thermocouple
TP .... test point
U .... integrated circuit; microcircuit
V .... electron tube
VR .... voltage regulator; breakdown diode
W ... cable; transmission path; wire
X .... socket
Y crystal unit (piezoelectric or quartz)
Z .. tuned cavity; tuned circuit

ABBREVIATIONS

A .... ampere
ac .... alternating current
ACCESS .... accessory
ADJ .... adjustment
A/D .... analog-to-digital
AF .... audio frequency
AFC .... automatic frequency control
AGC .. automatic gain control
AL .... aluminum
ALC .. automatic level control
AM .... amplitude modulation
AMPL .... amplifier
APC . automatic phase control
ASSY .... assembly
AUX .... auxiliary
avg .... average
AWG ... American wire gauge
BAL .... balance
BCD ... binary coded decimal
BD .... board
BE CU ..... beryllium copper
BFO . beat frequency oscillator
BH .... binder head
BKDN .... breakdown
BP .... bandpass
BPF .... bandpass filter
BRS .... brass
BWO backward-wave oscillator
CAL .... calibrate
ccw .... counterclockwise
CER .... ceramic
CHAN .... channel
cm .... centimeter
CMO ..... cabinet mount only
COAX .... coaxial
COEF .... coefficient
COM .... common
COMP .... composition
COMPL .... complete
CONN .... connector
CP .... cadmium plate
CRT .... cathode-ray tube
CTL complementary transistor logic
CW .... continuous wave
cw .... clockwise
cm .... centimetre
D/A .... digital-to-analog
dB .... decibel
dBm decibel referred to 1 mW
dc .... direct current
deg ...... degree (temperature interval or difference)
... ° ... degree (plane angle)
°C degree Celsius (centigrade)
°F .... degree Fahrenheit
°K .... degree Kelvin
DEPC ...... deposited carbon
DET .... detector
diam .... diameter
DIA .. diameter (used in Parts List)
DIFF AMPL ...... differential amplifier
div .... division
DPDT .... double-pole, double-throw
DR .... drive
DSB .... double sideband
DTL .... diode transistor logic
DVM .... digital voltmeter
ECL .... emitter coupled logic
EMF ..... electromotive force
EDP electronic data processing
ELECT .... electrolytic
ENCAP .... encapsulated
EXT .... external
F .... farad
FET .... field-effect transistor
F/F .... flip-flop
FH .... flat head
FIL H .... fillister head
FM .... frequency modulation
FP .... front panel
FREQ .... frequency
FXD .... fixed
g .... gram
GE .... germanium
GHz .... gigahertz
GL .... glass
GRD .... ground(ed)
H .... henry
h .... hour
HET .... heterodyne
HEX .... hexagonal
HD .... head
HDW .... hardware
HF .... high frequency
HG .... mercury
HI .... high
HP .... Hewlett-Packard
HPF .... high-pass filter
HR .. hour (used in Parts List)
HV .... high voltage
Hz .... Hertz
IC .... integrated circuit
ID .... inside diameter
IF .... intermediate frequency
IMPG .... impregnated
in .... inch
INCD .... inncandescent
INCL .... include(s)
INP .... input
INS .... insulation
INT .... internal
kg .... kilogram
kHz .... kilohertz
kΩ .... kilohm
kV .... kilovolt
lb .... pound
LC .... inductance-capacitance
LED ..... light-emitting diode
LF .... low frequency
LG .... long
LH .... left hand
LIM .... limit
LIN linear taper (used in Parts List)
lin .... linear
LK WASH .... lock washer
LO .... low; local oscillator
LOG .. logarithmic taper (used in Parts List)
log .... logrithm(ic)
LPF .... low pass filter
LV .... low voltage
m .... metre (distance)
mA .... millampere
MAX .... maximum
MΩ .... megohm
MEG meg (10^6) (used in Parts List)
MET FLM .... metal film
MET OX ...... metallic oxide
MF .... medium frequency; microfarad (used in Parts List)
MFR .... manufacturer
mg .... milligram
MHz .... megahertz
mH .... millihenry
mho .... mho
MIN .... minimum
min .... minute (time)
... ′ ... minute (plane angle)
MINAT .... miniature
mm .... millimetre
MOD .... modulator
MOM .... momentary
MOS .... metal-oxide semiconductor
ms .... millisecond
MTG .... mounting
MTR meter (indicating device)
mV .... millivolt
mVac .... millivolt, ac
mVdc .... millivolt, dc
mVpk .... millivolt, peak
mVp-p . millivolt, peak-to-peak
mVrms .... millivolt, rms
mW .... milliwatt
MUX .... multiplex
MY .... mylar
μA .... microampere
μF .... microfarad
μH .... microhenry
μmho .... micromho
μs .... microsecond
μV .... microvolt
μVac .... microvolt, ac
μVdc .... microvolt, dc
μVpk .... microvolt, peak
μVp-p microvolt, peak-to-peak
μVrms .... microvolt, rms
μW .... microwatt

NOTE

All abbreviations in the Parts List appear in uppercase.

Table 6-2. Reference Designations and Abbreviations (2 of 2)

ABBREVIATIONS (cont'd)

nA .... nanoampere
NC .... no connection
N/C .... normally closed
NE .... neon
NEG .... negative
nF .... nanofarad
NI PL .... nickel plate
N/O .... normally open
NOM .... nominal
NORM .... normal
NPN negative-positive-negative
NPO .... negative-positive
zero .... (zero temperature coefficient)
NRFR .. not recommended for field replacement
NSR .... not separately replaceable
ns .... nanosecond
nW .... nanowatt
OBD .... order by description
OD .... outside diameter
OH .... oval head
OP AMPL .... operational amplifier
OPT .... option
OSC .... oscillator
OX .... oxide
oz .... ounce
Ω .... ohm
P ... peak (used in Parts List)
PAM .... pulse-amplitude modulation
PC .... printed circuit
PCM .. pulse-code modulation; pulse-count modulation
PDM .... pulse-duration modulation
pF .... picofarad
PH BRZ .... phosphor bronze
PHL .... Phillips
PIN .... positive-intrinsic-negative
PIV ..... peak inverse voltage
pk .... peak
PL .... phase lock
PLO ..... phase lock oscillator
PM .... phase modulation
PNP positive-negative-positive
P/O .... part of
POLY .... polystyrene
PORC .... porcelain
POS positive; position(s) (used in Parts List)
POSN .... position
POT .... potentiometer
p-p .... peak-to-peak
PP peak-to-peak (used in Parts List)
PPM .... pulse-position modulation
PREAMPL ...... preamplifier
PRF pulse-repetition frequency
PRR .... pulse repetition rate
ps .... picosecond
PT .... point
PTM .. pulse-time modulation
PWM . pulse-width modulation
PWV ... peak working voltage
RC .... resistance-capacitance
RECT .... rectifier
REF .... reference
REG .... regulated
REPL .... replaceable
RF .... radio frequency
RFI .... radio frequency interference
RH ... round head; right hand
RLC ... resistance-inductance-capacitance
RMO .... rack mount only
rms .... root-mean-square
RND .... round
RAM .. random-access memory
ROM ...... read-only memory
R&P .... rack and panel
RWV . reverse working voltage
S .... scattering parameter
s .... second (time)
... " ... second (plane angle)
S-B .... slow-blow (fuse) (used in Parts List)
SCR silicon controlled rectifier; screw
SE .... selenium
SECT .... sections
SEMICON ..... semiconductor
SHF .... super-high frequency
SI .... silicon
SIL .... silver
SL .... slide
SNR ..... signal-to-noise ratio
SPDT .... single-pole, double-throw
SPG .... spring
SR .... split ring
SPST single-pole, single-throw
SSB .... single sideband
SST .... stainless steel
STL .... steel
SQ .... square
SWR ..... standing-wave ratio
SYNC .... synchronize
T ..... timed (slow-blow fuse)
TA .... tantalum
TC temperature compensating
TD .... time delay
TERM .... terminal
TFT ...... thin-film transistor
TGL .... toggle
THD .... thread
THRU .... through
TI .... titanium
TOL .... tolerance
TRIM .... trimmer
TSTR .... transistor
TTL transistor-transistor logic
TV .... television
TVI .... television interference
TWT .... traveling wave tube
U .... micro (10^{-6}) (used in Parts List)
UF . microfarad (used in Parts List)
UHF .... ultra-high frequency
UNREG .... unregulated
V .... volt
VA .... voltampere
Vac .... volts, ac
VAR .... variable
VCO .... voltage-controlled oscillator
Vdc .... volts, dc
VDCW ..... volts, dc, working (used in Parts List)
V(F) .... volts, filtered
VFO ...... variable-frequency oscillator
VHF ..... very-high frequency
Vpk .... volts, peak
Vp-p ..... volts, peak-to-peak
Vrms .... volts, rms
VSWR . voltage standing-wave ratio
VTO . voltage-tuned oscillator
VTVM vacuum-tube voltmeter
V(X) .... volts, switched
W .... watt
W/ .... with
WIV .. working inverse voltage
WW .... wirewound
W/O .... without
YIG ...... yttrium-iron-garnet
Z_o ... characteristic impedance

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

NOTE

All abbreviations in the Parts List appear in uppercase.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A1	08672-60210	4	1	FRONT PANEL BD AY	28480	08672-60210
				(~~DOES NOT~~ INCLUDE A1DS1, A1DS2, A1DS3)		
A1A1C1	0180-0229	7	3	CAP-FXD 33UF -10 +10TA0 OHM	56289	150D336X9010B2
A1A1C2	0180-0229	7		CAP-FXD 33UF -10 +10TA0 OHM	56289	150D336X9010B2
A1A1C3	0160-5910	1	1	CAP-FXD 0.47UF -20 +80Y5V	06383	MA14Y5V1H474Z
A1A1C4	0180-0229	7		CAP-FXD 33UF -10 +10TA0 OHM	56289	150D336X9010B2
A1A1DS1				(SEE A1DS1)		
A1A1DS2				(SEE A1DS2)		
A1A1DS3				(SEE A1DS3)		
A1A1DS4	1990-1119	4	1	LED-SET LUM-INT-25MCD IF-25MA-MAX BVR-6V	28480	1990-1119
A1A1DS5		4		P/O A1A1DS4		
A1A1DS6		4		P/O A1A1DS4		
A1A1DS7		4		P/O A1A1DS4		
A1A1DS8		4		P/O A1A1DS4		
A1A1J1	1251-3119	2	1	CONN-POST TYPE .100-PIN-SPCG 20-CONT	28480	1251-3119
A1A1J2	1251-3025	9	1	CONN-POST TYPE .100-PIN-SPCG 34-CONT	28480	1251-3025
A1A1J3	1200-0645	6	2	SOCKET-STRP 12-CONT DIP-SLDR	91506	325-AGID-12
A1A1J4	1200-0645	6		SOCKET-STRP 12-CONT DIP-SLDR	91506	325-AGID-12
A1A1Q1	1854-0810	2	4	TRANSISTOR NPN SI PD-625MW FT-200MHZ	56289	CT-1058
A1A1Q2	1854-0810	2		TRANSISTOR NPN SI PD-625MW FT-200MHZ	56289	CT-1058
A1A1Q3	1854-0810	2		TRANSISTOR NPN SI PD-625MW FT-200MHZ	56289	CT-1058
A1A1Q4	1854-0810	2		TRANSISTOR NPN SI PD-625MW FT-200MHZ	56289	CT-1058
A1A1R1	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A1R2	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A1R3	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A1A1R4	0698-7229	8	5	RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A1A1R5	0698-7212	9	4	RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A1A1R6	0698-7264	1	5	RESISTOR 14.7K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1472-F
A1A1R7	0698-7216	3	2	RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A1A1R8	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A1A1R9	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A1A1R10	0698-7230	1	2	RESISTOR 562 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-562R-F
A1A1R11	0698-7229	8		RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A1A1R12	1810-0370	7	5	NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A1A1R13	1810-0370	7		NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A1A1R14	1810-0370	7		NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A1A1R15	1810-0370	7		NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A1A1R16	1810-0370	7		NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A1A1S1	08672-60075	9	1	SLIDE SW AY 1C	28480	08672-60075
	5020-3440	7	5	SPRING DETENT	28480	5020-3440
A1A1S2	08672-60077	1	1	S SWT RF ON-OFF	28480	08672-60077
	5020-3440	7		SPRING DETENT	28480	5020-3440
A1A1S3	08672-60076	0	3	SLIDE SW AY 2C	28480	08672-60076
	5020-3440	7		SPRING DETENT	28480	5020-3440
A1A1S4	08672-60076	0		SLIDE SW AY 2C	28480	08672-60076
	5020-3440	7		SPRING DETENT	28480	5020-3440
A1A1S5	3130-0517	4	1	SHAFT & INDEX ASSEMBLY 1.250 STRUT CTR	76854	4-8337-224
	3130-0537	8	1	SHAFT & INDEX ASSEMBLY 1.250 STRUT CTR	28480	3130-0537
	5001-0157	7	1	SPRING-ROTARY SW	28480	5001-0157
	~~5001-0383~~	1	1		28480	5001-0383
	5040-6948	8	1	INSUL-MALE ROTOR	28480	5040-6948
	5040-6949	9	1	INSUL-FEM ROTOR	28480	5040-6949
A1A1S6	08672-60076	0		SLIDE SW AY 2C	28480	08672-60076
	5020-3440	7		SPRING DETENT	28480	5020-3440
A1A1U1	1820-1740	8	2	IC-INTERFACE DRVR DISPLAY	27014	DS8863N
A1A1U2	1820-1740	8		IC-INTERFACE DRVR DISPLAY	27014	DS8863N
A1A1U3	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A1A1U4	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A1A1XDS1-DS3				NOT ASSIGNED		
A1A1XDS4	1200-0507	9		SOCKET-IC-DIP 16-CONT DIP-SLOR	06776	ICN-163B-S3-G30

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A1XDS5	1200-0507	9		SOCKET-IC-DIP 16-CONT DIP-SLOR	06776	ICN-163B-S3-G30
A1A1XDS6	1200-0507	9		SOCKET-IC-DIP 16-CONT DIP-SLOR	06776	ICN-163B-S3-G30
A1A1XDS7	1200-0564	8		SOCKET-IC-DIP 8-CONT DIP-SLDR	06776	ICN-083B-S3-G
A1A1XDS8	1200-0564	8		SOCKET-IC-DIP 8-CONT DIP-SLDR	06776	ICN-083B-S3-G
	0361-0028	8	15	RIVET-SEMITUB OVH .089DIA .312LG	12014	R-4008
	08672-20060	8	1	GUIDE SLIDE SW	28480	08672-20060
	08672-20061	9	2	GUIDE SLIDE SW	28480	08672-20061
	08672-20062	0	1	GUIDE SLIDE SW	28480	08672-20062
	08672-20063	1	2	GUIDE SLIDE SW	28480	08672-20063
	1200-0507	9	6	SOCKET-IC-DIP 16-CONT DIP-SLDR	06776	ICN-163B-S3-G30
	1200-0564	8	4	SOCKET-IC-DIP 8-CONT DIP-SLDR	06776	ICN-083B-S3-G
A1A2				NOT ASSIGNED		
A1A3	5086-7151	3	1	YTM ASSEMBLY (INCLUDES A1A3A1)	28480	5086-7151
A1A3	5086-6151	1	1	YTM ASSEMBLY (RESTORED 5086-7151)	28480	5086-6151
A1A3A1	5061-1036	9	1	YTM, HEATER CONTROL ASSEMBLY	28480	5061-1036
A1A3A1C1	0180-2182	6	1	CAP-FXD 18UF -10 +10TAO OHM	56289	150D186X9050R2
A1A3A1C2	0160-0127	2	2	CAP-FXD 1UF -20 +20ZSU	09969	RPE113-149Z5U105M50V
A1A3A1CR1	1901-0033	2	9	DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A1A3A1CR2	1901-0376	6	10	DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A3A1J1	1200-0508	0	1	SOCKET-IC-DIP 14-CONT DIP-SLDR	06776	ICN143BS3G30
A1A3A1MP1	0380-0322	5	2	SPACER-RVT-ON .062-IN-LG .152-IN-ID	28480	0380-0322
A1A3A1MP2	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	28480	0380-0322
A1A3A1Q1	1853-0038	4	2	TRANSISTOR PNP SI TO-39 PD-1W FT=100MHZ	28480	1853-0038
A1A3A1Q2	1853-0038	4		TRANSISTOR PNP SI TO-39 PD-1W FT=100MHZ	28480	1853-0038
A1A3A1R1	0698-7245	8	2	RESISTOR 2.37K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2371-F
A1A3A1R2	0698-7260	7	37	RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A3A1R3	0698-7273	2	2	RESISTOR 34.8K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3482-F
A1A3A1R4	0698-7284	5		RESISTOR 100K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1003-F
A1A3A1R5	0698-7229	8		RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A1A3A1R6	0767-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A1A3A1R7	0698-3102	8	1	RESISTOR 237 +-1% .5W TF TC=0+-100	K8479	H2
A1A3A1R8	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A1A3A1R9	0698-7273	2		RESISTOR 34.8K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3482-F
A1A3A1R10	0698-8827	4	1	RESISTOR 10 +-1% .125W TF TC=0+-100	12498	CT4
A1A3A1R11	0698-7245	8		RESISTOR 2.37K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2371-F
A1A3A1U1	1826-0261	8	1	IC OP AMP LOW-NOISE 8-TO-99 PKG	72799	CA6741T SELECTED
A1A3A1VR1	1902-0176	6	1	DIODE-ZNR 47V 5% PD=1W IR=5UA	28480	1902-0176
A1A3A1VR2	1902-0025	4	5	DIODE-ZNR 10V 5% DO=35 PD= .4W TC=+ .06%	28480	1902-0025
A1A4				NOT ASSIGNED		
A1A5	08672-60128	2	1	ASSEMBLY,ALC	28480	08672-60128
A1A5C1	0180-0197	8	22	CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A5C2	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A1A5C3	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A5C4	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A1A5C5	0160-2209	5	1	CAP-FXD 360PF -5 +5MICA	28480	0160-2209
A1A5C6	0160-4084	8	17	CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C7	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C8	0160-2201	7	1	CAP-FXD 51PF -5 +5MICA	28480	0160-2201
A1A5C9	0160-3787	6	1	CAP-FXD 1UF -10 +10POLYC-MET	28480	0160-3787
A1A5C10	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A5C11	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A1A5C12	0160-0127	2		CAP-FXD 1UF -20 +20Z5U	09969	RPE113-149Z5U105M50V
A1A5C13	0140-0196	3	1	CAP-FXD 150PF -5 +5MICA	28480	0140-0196
A1A5C14	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C15	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A5C16	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C17	0160-2200	6	1	CAP-FXD 43PF -5 +5MICA	28480	0160-2200
A1A5C18	0160-2199	2	1	CAP-FXD 30PF -5 +5MICA	28480	0160-2199
A1A5C19	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C20	0160-0157	8	1	CAP-FXD 4700PF -10 +10POLYE-FL	19701	708D1CC472PK201AX

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A5C21	0160-2055	9	11	CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A5C22	0160-3486	8	2	CAP-FXD 100PF -10 +10X5E	06383	CK45XE3A101K-H
A1A5C23	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C24	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C25	0140-0192	2	2	CAP-FXD OF -0 +0C0G		
A1A5C26	0160-3878	6	1	CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A1A5C27	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C28	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5C29	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A5CR1	1901-0539	3		DIODE-SCHOTTKY SM SIG	28480	1901-0539
A1A5CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A1A5CR3	1901-0050	3	40	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A5CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A5CR5	1901-1096	9	1	DIODE-PIN	28480	1901-1096
A1A5CR6	1901-0539	3	3	DIODE-SCHOTTKY SM SIG	28480	1901-0539
A1A5CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A1A5CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A1A5CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A5CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A5CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A5L1	9140-0144	0	6	INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A1A5L2	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A1A5L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A1A5L4	9100-1623	8	1	INDUCTOR RF-CH-MLD 27UH +-5%	91637	IM-4 27UH 5%
A1A5Q1				NOT ASSIGNED		
A1A5Q2	1853-0012	4	1	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	04713	2N2904A
A1A5Q3	1853-0322	9	7	TRANSISTOR PNP 2N2948A SI TO-39 PD=400MW	28480	1853-0322
A1A5Q4	1854-0404	0	6	TRANSISTOR NPN SI TO-18 PD-360MW	28480	1854-0404
A1A5Q5	1854-0013	7	1	TRANSISTOR NPN 2N2218A SI TO-5 PD-800MW	07263	2N2218A
A1A5Q6	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A5Q7	1854-0712	3	2	TRANSISTOR-DUAL NPN PD=1.8W	06665	MAT-01GH
A1A5Q8	1854-0712	3		TRANSISTOR-DUAL NPN PD=1.8W	06665	MAT-01GH
A1A5Q9	1853-0020	4	12	TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A5Q10	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A5Q11	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A5Q12	1853-0322	9		TRANSISTOR PNP 2N2946A SI TO-46 PD=400MW	28480	1853-0322
A1A5Q13	1853-0322	9		TRANSISTOR PNP 2N2946A SI TO-46 PD=400MW	28480	1853-0322
A1A5Q14	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A5R1	0699-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A5R2	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A5R3	0757-0465	6	10	RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1003-F
A1A5R4	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1003-F
A1A5R5	0698-3159	5	1	RESISTOR 26.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2612-F
A1A5R6	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1001-F
A1A5R7	2100-3353	8	5	RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3353
A1A5R8	0757-0442	9	20	RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A5R9	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A5R10	0698-3432	7	2	RESISTOR 26.1 +-1% .125W TF TC=0+-100	D8439	MK2
A1A5R11	0698-3167	3	6	RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1962-F
A1A5R12	0757-0439	4	2	RESISTOR 6.81K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-6911-F
A1A5R13	0698-3155	1	3	RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4641-F
A1A5R14	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1001-F
A1A5R15	0698-0085	0	5	RESISTOR 2.81K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2611-F
A1A5R16	0698-0085	0		RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2611-F
A1A5R17	2100-3353	8		RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3353
A1A5R18	0757-0260	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1001-F
A1A5R19	0698-3260	8		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A5R20	0757-1094	9	2	RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1471-F
A1A5R21	2100-3274	2	8	RESISTOR-TRMR 10K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3274
A1A5R22	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A5R23	2100-3274	2		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3274
A1A5R24	0698-0083	8	7	RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A1A5R25	0757-0438	3	10	RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A5R26	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A5R27	0757-0279	0	1	RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A1A5R28	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A5R29	0698-4414	7	1	RESISTOR 158 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-158R-F
A1A5R30	0698-4014	3	1	RESISTOR 787 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-787R-F
A1A5R31	0698-3626	1	1	RESISTOR 180 +-5% 2W MO TC=0+-200	12498	FP-69
A1A5R32	0698-3510	2	1	RESISTOR 453 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-453R-F
A1A5R33	0698-3495	2	1	RESISTOR 866 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-866R-F
A1A5R34	0757-0346	2	5	RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A1A5R35				NOT ASSIGNED		
A1A5R36	0757-0394	0	6	RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A1A5R37	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A5R38	0757-0317	7	2	RESISTOR 1.33K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1331-F
A1A5R39	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A5R40	0698-0084	9	7	RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A1A5R41	0698-0085	0		RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A1A5R42	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A1A5R43	0698-0085	0		RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A1A5R44	0698-3444	1	4	RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A1A5R45	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A5R46	0757-0416	7	2	RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A1A5R47	0757-0276	7	1	RESISTOR 61.9 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6192-F
A1A5R48	0757-0290	5	3	RESISTOR 6.19K +-1% .125W TF TC=0+-100	19701	5033R-1/8-TO-6191-F
A1A5R49	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A1A5R50	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A5R51	0698-3132	4	3	RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A1A5R52	0698-3132	4		RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A1A5R53	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A5R54	2100-3274	2		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3274
A1A5R55	0698-3162	0	3	RESISTOR 46.4K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4642-F
A1A5R56	0757-0403	2	2	RESISTOR 121 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-121R-F
A1A5R57	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A5R58	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A5R59	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A1A5R60	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A5R61	0757-0200	7	1	RESISTOR 5.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5621-F
A1A5R62	0698-3449	6	1	RESISTOR 28.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2872-F
A1A5R63	0698-3236	9	2	RESISTOR 15K +-0.25% .125W TF TC=0+-50	12498	NC55
A1A5R64	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4641-F
A1A5R65	0698-3445	2	1	RESISTOR 348 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-348R-F
A1A5R66	0698-3236	9		RESISTOR 15K +-0.25% .125W TF TC=0+-50	12498	NC55
A1A5R67	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A5R68	0757-0278	9	1	RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A1A5R69	2100-3351	6	2	RESISTOR-TRMR 500 10% TKF SIDE-ADJ 1-TRN	28480	2100-3351
A1A5R70	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A5R71	0698-7576	8	2	RESISTOR 217 +-0.1% .125W TF TC=0+-25	19701	5033R-1/8-T9-21/R-B
A1A5R72	0757-0402	1	3	RESISTOR 110 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-111-F
A1A5R73	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A1A5R74	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A5R75	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A5R76	2100-3274	2		RESISTOR TRMR 10K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3274
A1A5R77	0757-0440	7	2	RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-7501-F
A1A5R78	0757-0447	4	1	RESISTOR 16.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1622-F
A1A5R79	0757-0421	4	5	RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A1A5TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A5TP2				NOT ASSIGNED		
A1A5TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A5TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A5TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A5TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A5U1	1826-0486	9	1	ANALOG MULTIPLEXER 8 CHNL 16 -DIP-P	04713	MC14052BCP
A1A5U2	1826-0501	9	3	ANALOG MULTIPLEXER 6 CHNL 16 -DIP-P	04713	MC14053BCP
A1A5U3	1826-0081	0	3	IC OP AMP WB 8-TO-99 PKG	27014	LM318H
A1A5U4	1826-0059	2	6	IC OP AMP GP 8-TO-99 PKG	27014	LM201AH
A1A5U5	1820-0125	1		IC COMPARATOR GP DUAL 10-TO-100 PKG	07263	UA711HC
A1A5U6	1826-0081	0		IC OP AMP WB 8-TO-99 PKG	27014	LM318H
A1A5U7	1826-0081	0		IC OP AMP WB 8-TO-99 PKG	27014	LM318H
A1A5U8	1820-0477	6	3	IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A1A5U9	1825-0013					
A1A5VR1	1902-0041	4	4	DIODE-ZNR 5.11V 5% DO35 PD=.4W	07263	1N751A
A1A5VR2	1902-0025	4		DIODE-ZNR 10V 5% DO=35 PD=.4W TC=+.06%	28480	1902-0025
A1A5VR3	1902-0064	1	1	DIODE-ZNR 7.5V 5% DO=35 PD=.4W TC=+.05%	28480	1902-0064
A1A5VR4	1902-3082	9	1	DIODE-ZNR 4.64V 5% DO=35 PD=.4W	28480	1902-3082
A1A5VR5	1902-0579	3	1	DIODE-ZNR 5.1V 5% PD=1W IR=10VA	28480	1902-0579
				A1A5 MISCELLANEOUS		
	1200-0061	4	1	INSULATOR-FLG-BSHG NYLON	28480	1200-0081
	1480-0073	6	12	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
	4040-0748	3	7	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0755	2	1	EXTR-PC BD VIO POLYC .062-IN-BD-THKNS	28480	4040-0755
	4330-0145	9	2	INSULATOR-BEAD GLASS	28480	4330-0145
A1A6	08672-60197	6	1	BOARD ASSEMBLY, DETECTOR	28480	08672-60197
A1A6C1	0160-0174	9	3	CAP-FXD 0.47UF -20 +80X5V	09969	RPE123-149ZSU474Z50V
A1A6C2	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A6C3	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A6C4	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A6C5	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A6C6	0160-2240	4	1	CAP-FXD OF -0 +0COK	09641	301-000-COKO-209C
A1A6C7	0160-0174	9		CAP-FXD 0.47UF -20 +80X5V	09969	RPE123-149ZSU474Z50V
A1A6C8	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A6C9	0160-2207	3	3	CAP-FXD 300PF -5 +5MICA	28480	0160-2207
A1A6C10	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A6C11	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A6C12	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A6C13	0160-3456	6	1	CAP-FXD 1000PF -10 +10X5E	06363	CK45XE3A102K-H
A1A6C14	0160-2207	3		CAP-FXD 300PF -5 +5MICA	28480	0160-2207
A1A6C15	0160-3466	8		CAP-FXD 100PF -10 +10XSE	06383	CK45XE3A101K-H
A1A6C16	0160-0575	4	1	CAP-VAR 0.047UF -20 +20X7R	06132	B37987-M5473-M51
A1A6C17	0180-2205	4	3	CAP-FXD 60UF -10 +10TA0 OHM	56289	150D606X9006B2
A1A6C18	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A6C19				NOT ASSIGNED		
A1A6C20	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A6C21	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A6C22				NOT ASSIGNED		
A1A6C23	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A6C24	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A1A6C25	0160-2256	2		CAP-FXD OF -0 +0COG	09641	301-000-COHO-919C
A1A6C26	0160-2207	3		CAP-FXD 300PF -5 +5MICA	28480	0160-2207
A1A6C27	0160-3094	8	1	CAP-FXD 0.1UF -10 +10X5R	06383	FD22X5R2A104K
A1A6C28	0160-3879	7	3	CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A1A6C29	0160-0574	3	1	CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A1A6C30	0180-0291	3	20	CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A6CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A1A6CR2	1901-0539	3		DIODE-SCHOTTKY SM SIG	28480	1901-0539
A1A6CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A1A6CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A1A6CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A1A6CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A6L1	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A1A6L2	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A1A6L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A1A6L4				NOT ASSIGNED		
A1A6Q1	1853-0034	0	2	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A1A6Q2	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A6Q3	1853-0316	1	1	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A1A6Q4				NOT ASSIGNED		
A1A6Q5	1853-0388	7	1	TRANSISTOR-DUAL PNP TO-78 PD=600MW	28480	1853-0388
A1A6Q6	1855-0081	1	2	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A1A6Q7	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A1A6Q8	1854-0345	8	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A1A6Q9	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A1A6Q10	1855-0049	1	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A1A6R1	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A1A6R2	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A1A6R3	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A6R4	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A6R5	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A6R6	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A1A6R7	0757-0401	0	5	RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A1A6R8	0698-3432	7		RESISTOR 26.1 +-1% .125W TF TC=0+-100	D8439	MK2
A1A6R9	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A1A6R10	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A1A6R11	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A1A6R12	2100-2039	5	2	RESISTOR-TRMR 20K 5% WW SIDE-ADJ 10=TRN	12697	76-3
A1A6R13	0757-0419	0	3	RESISTOR 681 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-681R-F
A1A6R14	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A1A6R15	2100-2039	5		RESISTOR-TRMR 20K 5% WW SIDE-ADJ 10-TRN	12697	76-3
A1A6R16	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A1A6R17	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A1A6R18	0698-3435	0	1	RESISTOR 38.3 +-1% .125W TF TC=0+-100	D8439	MK2
A1A6R19	0698-3151	7	4	RESISTOR 2.87K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2871-F
A1A6R20	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A6R21	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A1A6R22	0757-0422	5	1	RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A1A6R23	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A1A6R24	0698-3151	7		RESISTOR 2.87K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2871-F
A1A6R25	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A1A6R26	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A1A6R27	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A1A6R28	2100-3164	9	1	RESISTOR-TRMR 10 20% TKF SIDE-ADJ 17-TRN	73138	89PR10
A1A6R29	0757-0439	4		RESISTOR 5.81K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6811-F
A1A6R30	0757-0461	2	3	RESISTOR 68.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6812-F
A1A6R31	0698-3456	5	1	RESISTOR 287K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2873-F
A1A6R32	0757-0459	8		RESISTOR 56.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5622-F
A1A6R33	2100-1922	3	1	RESISTOR-TRMR 5K 10% TKF SIDE-ADJ 22-TRN	32997	3059Y-1-502
A1A6R34	0757-0429	1	1	RESISTOR 1.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1621-F
A1A6R35	0698-3162	0		RESISTOR 46.4K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4642-F
A1A6R36	2100-3273	1	1	RESISTOR-TRMR 2K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3273
A1A6R37	0699-2418	5	1	RESISTOR 17.74K +-1% .125W TF TC=0+-10		
A1A6R38	2100-3056	8	2	RESISTOR-TRMR 5K 10% TKF SIDE-ADJ 17-TRN	73138	89PR5K
A1A6R39	2100-3056	8		RESISTOR-TRMR 5K 10% TKF SIDE-ADJ 17-TRN	73138	89PR5K
A1A6R40	0699-2376	8	1	RESISTOR 30.615K +-0.1% .125W TF	09535	PR1/8
A1A6R41	0699-0780	4	1	RESISTOR 4.84K +-0.1% .1W TF TC=0+-15	09535	PR1/10
A1A6R42	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A1A6R43	0698-0085	0		RESISTOR 2.81K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A1A6R44	0698-3152	8	3	RESISTOR 3.48K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3481-F
A1A6R45				NOT ASSIGNED		
A1A6R46	0698-6329	7	1	RESISTOR 845 +-1% .125W TF TC=0+-25	12498	NE55

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A6R47	0811-2031	2	1	RESISTOR 815 +-3% .25W PN TC=+5900+-300	20940	143-1/4-815R-3
A1A6R48	0698-8584	0	2	RESISTOR 274 +-1% .125W TF TC=0+-25	2M627	CRB14 OR CRB25
A1A6R49-51				NOT ASSIGNED		
A1A6R52	0698-8584	0		RESISTOR 274 +-1% .125W TF TC=0+-25	2M627	CRB14 OR CRB25
A1A6R53	0698-6362	8	1	RESISTOR 1K +-0.1% .125W TF TC=0+-25	12498	NE55
A1A6R54	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4841-F
A1A6R55	0698-7576	8		RESISTOR 217 +-0.1% .125W TF TC=0+-25	19701	5033R-1/8-T9-217R-8
A1A6R56	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A1A6R57	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A1A6R58	0698-3260	9	13	RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A6R59	0698-7278	7	1	RESISTOR 56.2K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5622-F
A1A6R60	0698-7235	6	2	RESISTOR 909 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-909R-F
A1A6R61	0698-7235	6		RESISTOR 909 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-909R-F
A1A6R62	0698-7267	4	1	RESISTOR 19.6K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1962-F
A1A6R63	0698-7257	2	1	RESISTOR 7.5K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-7501-F
A1A6R64	0698-7236	7	7	RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A1A6R65	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A1A6R66	0698-3447	4	1	RESISTOR 422 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-422P-F
A1A6R67	0698-7220	9	2	RESISTOR 215 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-215R-F
A1A6R68	0698-3438	3	1	RESISTOR 147 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-147R-F
A1A6R69	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=8 +-180	10400	C3-1/8-TO-1001-F
A1A6R70	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A1A6R71	0757-0274	5	2	RESISTOR 1.21K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1211-F
A1A6R72	0698-7284	5	2	RESISTOR 100K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1003-F
A1A6R73	0757-0459	8	2	RESISTOR 56.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5622-F
A1A6R74	0698-7188	8	9	RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A6R75	0757-0458	7	10	RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A6RT1	0837-0124	4	1	THERMISTOR DISC 250-OHM TC=-4.4%/C-DEG	83186	23D14%5/3
A1A6TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A6TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A6TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A6TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A6TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A6TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A6TP7	1251-0600	0	35	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A6TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A6U1	1826-0932	0	1	IC OP AMP PRCN 8-DIP-C PKG	06665	OP-27FZ
A1A6U2	1826-0501	9		ANALOG MULTIPLEXER 6 CHNL 16 -DIP-P	04713	MC14053BCP
A1A6U3	1826-0059	2		IC OP AMP GP 8-TO-99 PKG	27014	LM201AH
A1A6U4	1826-0501	9		ANALOG MULTIPLEXER 6 CHNL 16 -DIP-P	04713	MC14053BCP
A1A6U5	1826-0059	2		IC OP AMP GP 8-TO-99 PKG	27014	LM201AH
A1A6U6	1826-0520	2	1	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071BCP
A1A6U7	1826-0266	3	1	IC OP AMP LOW-DRIFT 8-TO-99 PKG	06665	OP-05EJ
A1A6U8	1826-0229	8	2	IC OP AMP LOW-DRIFT 8-TO-99 PKG	06665	OP-05CJ
A1A6U9	1820-0125	1	2	IC COMPARATOR GP DUAL 10-TO-100 PKG	07263	UA711HO
A1A6U10	1820-1422	3	1	IC MV TTL L5 MONOSTBL RETRIG	01295	SN74L5122N
A1A6U11	1820-1144	0	2	IC GATE TTL L5 NOR QUAD 2-INP	01295	SN74LS02N
A1A6VR1	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	07263	1N751A
A1A6VR2	1902-3182	0	1	DIODE-ZNR 12.1V 5% DO-35 PD=.4W	28480	1902-3182
A1A6VR3	1902-0049	2	1	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A1A6VR4	1902-3048	7	1	DIODE-ZNR 3.48V 5% DO-35 PD=.4W	28480	1902-3048
A1A6W1	08672-60064	6	1	CABLE ASSEMBLY, DETECTOR	28480	08672-60064
				A1A6 MISCELLANEOUS		
	1400-0249	0	1	CABLE TIE .062-.625-DIA .081-WD NYL	16958	08-465/GRAY
	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72982	99-012-062-0250
	4040-0748	3		EXTR-PC BD BLK POLYC .082-IN-BD-THKNS	28480	4040-0748
	4040-0754	1	1	EXTR-PC BD BLU POLYC .062-IN-BD-THKNS	28480	4040-0754
	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A1A7	08672-60116	9	1	ASSEMBLY, SRD BIAS	28480	08672-60116
A1A7C1	0180-2141	6	5	CAP-FXD 3.3UF -10 +10TA0 OHM	56289	150D335X9050B2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A7C2	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A7C3	0180-2141	6		CAP-FXD 3.3UF -10 +10TA0 OHM	56289	150D335X9050B2
A1A7C4	0180-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0180-2055
A1A7C5	0160-2150	5	6	CAP-FXD 33PF -6 +5MICA	28480	0180-2150
A1A7C6	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A7CR1	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	12403	5082-2800
A1A7CR2	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A1A7Q1-Q3				NOT ASSIGNED		
A1A7Q4	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A7Q5	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A7Q6, Q7				NOT ASSIGNED		
A1A7Q8	1854-0071	7	23	TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A7Q9	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A7Q10	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A7Q11	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A7Q12	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A7Q13	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A7Q14	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A7Q15	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A7R1	0698-3161	9	1	RESISTOR 38.3K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-3832-F
A1A7R2	0698-3158	4	1	RESISTOR 23.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2372-F
A1A7R3	0757-0443	0	1	RESISTOR 11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1102-F
A1A7R4	2100-3353	8		RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3353
A1A7R5	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A7R6	0698-3160	8	2	RESISTOR 31.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2162-F
A1A7R7	0698-3160	8		RESISTOR 31.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-3162-F
A1A7R8	0698-3157	3		RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1962-F
A1A7R9	0698-3157	3		RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1962-F
A1A7R10	0698-3157	3		RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1962-F
A1A7R11	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A7R12	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A7R13	0757-0441	8	1	RESISTOR 8.25K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-8251-F
A1A7R14	0698-3152	8		RESISTOR 3.48K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-3481-F
A1A7R15	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A7R16	0698-3152	8		RESISTOR 3.48K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-3481-F
A1A7R17	0757-0442	8		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A7R18	2100-3353	8		RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3353
A1A7R19	0757-0462	3	1	RESISTOR 75K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-7502-F
A1A7R20	0757-0440	7		RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-7501-F
A1A7R21	0757-0290	5		RESISTOR 6.19K +-1% .125W TF TC=0+-100	19701	5033R-1/8-T0-6191-F
A1A7R22	0757-0481	2		RESISTOR 68.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-6812-F
A1A7R23	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A7R24	0757-0461	2		RESISTOR 68.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-6812-F
A1A7R25	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A1A7R26	0698-3157	3		RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1962-F
A1A7R27	0698-3157	3		RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1962-F
A1A7R28	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-101-F
A1A7R29	2100-3353	8		RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3353
A1A7R30	0698-0093	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1961-F
A1A7R31	2100-3274	2		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3274
A1A7R32	0757-0419	0		RESISTOR 681 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-681R-F
A1A7TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A7TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A7TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A7U1				NOT ASSIGNED		
A1A7U2	1826-0547	3	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	01295	TL072ACP
A1A7U3				NOT ASSIGNED		
A1A7U4	1820-0477	8		IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A1A7U5	1820-0681	4	1	IC GATE TTL 5 NAND QUAD 2-INP	01295	5N74500N
A1A7VR1	1902-0025	4		DIODE-ZNR 10V 5% 00-35 PD=.4W TC=+.06%	28480	1902-0025

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
				A1A7 MISCELLANEOUS		
	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
	4040-0748	3		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	28480	4040-0753
A1A8	08672-60051	1	1	ASSEMBLY, YTM DRIVER	28480	08672-60051
A1A8C1	0180-2141	6		CAP-FXD 3.3UF -10 +10TAO OHM	56289	150D335X9050B2
A1A8C2	0180-3143	6		CAP-FXD 3.3UF -10 +10TAO OHM		
A1A8C3	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A1A8C4	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A1A8C5	0180-2141	6		CAP-FXD 3.3UF -10 +10TAO OHM	56289	150D335X9050B2
A1A8C6	0160-2150	5		CAP-FXD 33PF -5 +5MICA	28480	0160-2150
A1A8C7	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A1A8C8	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A8C9	0160-2150	5		CAP-FXD 33PF -5 +5MICA	28480	0160-2150
A1A8C10	0160-2150	5		CAP-FXD 33PF -5 +5MICA	28480	0160-2150
A1A8C11	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A8C12	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A8C13	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A8C14	0160-2150	5		CAP-FXD 33PF -5 +5MICA	28480	0160-2150
A1A8C15	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A8C16	0160-2150	5		CAP-FXD 33PF -5 +5MICA	28480	0160-2150
A1A8C17	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A8C18	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A1A8C19	0160-4812	2	1	CAP-FXD 220PF -5 +5COG	28480	0160-4812
A1A8C20	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A8C21	0160-0174	9		CAP-FXD 0.47UF -20 +80X5V	09969	RPE123-149Z5U474Z50V
A1A8CR1	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8CR2	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8CR5	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8CR6	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8CR7	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8CR8	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8CR9	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A1A8Q1	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A8Q2	1853-0451	5	3	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A1A8Q3	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A8Q4	1855-0020	8	5	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	04713	SFE793
A1A8Q5	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	04713	SFE793
A1A8Q6	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	04713	SFE793
A1A8Q7	1854-0712	3		TRANSISTOR-DUAL NPN PO=1.8W	06665	MAT-01GH
A1A8Q8	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A8Q9	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A1A8Q10	1853-0235	3	2		28480	1853-0235
A1A8Q11	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A8Q12	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A8Q13	1853-0235	3			28480	1853-0235
A1A8Q14	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A8Q15	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A8Q16	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A8R1	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A1A8R2	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A1A8R3	0757-0442	8		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A8R4	0699-2446	4	1	RESISTOR 11K +-1% .05W PN TC=0+-2		
A1A8R5	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A1A8R6	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A8R7	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A8R8	0757-0470	3	1	RESISTOR 162K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1623-F
A1A8R9	0699-2420	2	1	RESISTOR 3.79K +-0.1% .125W PN TC=0+-10		

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A8R10	0699-5355	1	1	RESISTOR 5.82K +-0.1% .125W PN TC=0+-10		
A1A8R11	2100-3103	6	5	RESISTOR-TRMR 10K 10% TKF SIDE-ADJ	73138	89PR10K
A1A8R12	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A1A8R13	0698-3457	6	1	RESISTOR 316K +-1% .125W TF TC=0+-100	12498	CT4
A1A8R14	0757-1094	9		RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A1A8R15	0698-3260	9		RESISTOR 464K +-1% .125W TF TC=0+-100	12498	CT4
A1A8R16	2100-3103	6		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ	73138	89PR10K
A1A8R17	2100-3274	2		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3274
A1A8R18	0699-2419	9	1	RESISTOR 10.4K +-0.1% .05W PN TC=0+-10		
A1A8R19	0699-3409	0	1	RESISTOR 14.7K +-0.1% .05W PN TC=0+-10		
A1A8R20	2100-3152	5	1	RESISTOR-TRMR 5K 10% TF SIDE-ADJ 25-TRN	19612	1202-P
A1A8R21	0699-2423	5	1	RESISTOR 25.6K +-1% .05W PN TC=0+-10		
A1A8R22	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A8R23	2100-3274	2		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3274
A1A8R24	0699-1832	7	1	RESISTOR 17.8K +-0.1% .05W PN TC=0+-10		
A1A8R25	0699-0722	8	1	RESISTOR 23.7K +-0.1% .05W PN TC=0+-10		
A1A8R26	0757-0419	0		RESISTOR 681 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-681R-F
A1A8R27	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A1A8R28	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A1A8R29	0699-2421		1	RESISTOR 5.13K +-0.1% .05W PN TC=0+-2		
A1A8R30	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A8R31	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A8R32	2100-3274	2		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3274
A1A8R33	0698-3162	0		RESISTOR 46.4K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4642-F
A1A8R34	0757-0289	2	2	RESISTOR 13.3K +-1% .125W TF TC=0+-100	19701	5033R-1/8-TO-1332-F
A1A8R35	0699-0059	8	2	RESISTOR 5K +-0.1% .05W PN TC=0+-2		
A1A8R36	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A8R37	0698-3151	7		RESISTOR 2.87K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2871-F
A1A8R38	0698-3151	7		RESISTOR 2.87K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2871-F
A1A8R39	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A8R40	0699-0059	6		RESISTOR 5K +-0.1% .05W PN TC=0+-2		
A1A8R41	2100-3103	6		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ	73138	89PR10K
A1A8R42	0699-0118	4	2	RESISTOR 20K +-1% .05W PN TC=0+-10		
A1A8R43	0699-0118	4		RESISTOR 20K +-1% .05W PN TC=0+-10		
A1A8R44	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A8R45	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A1A8R46	2100-3103	6		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ	73138	89PR10K
A1A8R47	2100-3103	6		RESISTOR-TRMR 10K 10% TKF SIDE-ADJ	73138	89PR10K
A1A8R48	0699-0642	0	0	RESISTOR 10K +-0.1% .125W PN TC=0+-10		
A1A8R49	0699-0642	9		RESISTOR 10K +-0.1% .125W PN TC=0+-10		
A1A8R50	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A8R51	0699-0096	1	1	RESISTOR 12K +-0.1% .125W PN TC=0+-10		
A1A8R52	0699-0642	9		RESISTOR 10K +-0.1% .125W PN TC=0+-10		
A1A8R53	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A8R54	0699-0790	0	1	RESISTOR 100K +-1% .05W PN TC=0+-10		
A1A8R55	0699-0486	0	1	RESISTOR 2K +-1% .125W PN TC=0+-10		
A1A8R56	0757-0293	7	2	RESISTOR 1.96K +-1% .05W PN TC=0+-10		
A1A8R57	0757-0293	7		RESISTOR 1.96K +-1% .05W PN TC=0+-10		
A1A8R58	0699-0237	6	1	RESISTOR 1.71K +-1% .05W PN TC=0+-10		
A1A8R59	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A1A8R60	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A8R61	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A8R62	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A8R63	0698-3438	4	1	RESISTOR 178 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1700-F
A1A8R64	2100-3351	6		RESISTOR-TRMR 500 10% TKF SIDE-ADJ 1-TRN	28480	2100-3351
A1A8R65	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A1A8R66	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A1A8R67	0698-8625	5	1	RESISTOR 1K +-1% .125W PN TC=0+-10		
A1A8R68	0757-0289	2		RESISTOR 13.3K +-1% .125W TF TC=0+-100	19701	6033R-1/8-TO-1332-F
A1A8R69	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A8U1	1826-0502	0	2	ANALOG SWITCH 4 SPST 14 -DIP-P	04713	MC14066BCP
A1A8U2	1820-0477	0	4	IC OP AMP GP 8-TO-99 PKG		
A1A8U3	1820-0477	0		IC OP AMP GP 8-TO-99 PKG		
A1A8U4	1826-0502	0		ANALOG SWITCH 4 SPST 14 -DIP-P	04713	MC14066BCP
A1A8U5	1826-0229	8		IC OP AMP LOW-DRIFT 8-TO-99 PKG	06665	OP-05CJ
A1A8U6	1820-0477	0		IC OP AMP GP 8-TO-99 PKG		
A1A8U7	1826-0059	2		IC OP AMP GP 8-TO-99 PKG	27014	LM201AH
A1A8U8	1826-0059	2		IC OP AMP GP 8-TO-99 PKG	27014	LM201AH
A1A8U9	1820-0477	0		IC OP AMP GP 8-TO-99 PKG		
A1A8VR1	1902-0041	4		DIODE-ZNR 5 11V 5% DO-35 PD=.4W	07263	1N751A
A1A8VR2	1902-0025	4		DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
A1A8VR3	1902-0025	4		DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
A1A8VR4	1902-3193	3	1	DIODE-ZNR 13.3V 5% DO-35 PD=.4W	28480	1902-3193
A1A8VR5	1902-0680	7	2	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.4W	04713	1N827
A1A8VR6	1902-3268	3	1	DIODE-ZNR 26.1V 5% DO-35 PD=.4W	28480	1902-3268
				A1A8 MISCELLANEOUS		
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
	4040-0748	3		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0752	9	1	EXTR-PC BD YEL POLYC .062-IN-BD-THKNS	28480	4040-0752
A1A9	08672-60046	4	1	BD AY MOD METER	28480	08672-60046
A1A9C1	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A9C2	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A9C3	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A9C4	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C5	0180-2207	5	5	CAP-FXD 100UF -10 +10TA0 OHM	56289	150D107X9010R2
A1A9C6	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C7	0180-2207	5		CAP-FXD 100UF -10 +10TA0 OHM	56289	150D107X9010R2
A1A9C8	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A1A9C9	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C10	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C11	0180-1746	5	4	CAP-FXD 15UF -10 +10TA0 OHM	56289	150D156X9020B2
A1A9C12	0180-1746	5		CAP-FXD 15UF -10 +10TA0 OHM	56289	150D156X9020B2
A1A9C13	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A9C14	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C15	0160-3875	3	2	CAP-FXD 22PF -5 +5C0G	09969	RPE121-105C0G220J200V
A1A9C16	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A9C17	0160-3875	3		CAP-FXD 22PF -5 +5C0G	09969	RPE121-105C0G220J200V
A1A9C18	0160-2252	8	1	CAP-FXD 0F -0 +0C0G	09641	301-000-C0H0-629C
A1A9C19	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A1A9C20	0180-1746	5		CAP-FXD 15UF -10 +10TA0 OHM	56289	150D156X9020B2
A1A9C21	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C22	0180-1746	5		CAP-FXD 15UF -10 +10TA0 OHM	56289	150D156X9020B2
A1A9C23	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C24	0180-2207	5		CAP-FXD 100UF -10 +10TA0 OHM	56289	150D107X9010R2
A1A9C25	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C26	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C27	0180-2206	4		CAP-FXD 60UF -10 +10TA0 OHM	56289	150D606X9006B2
A1A9C28	0180-2206	4		CAP-FXD 60UF -10 +10TA0 OHM	56289	150D606X9006B2
A1A9C29	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A9C30	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A1A9C31	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A1A9CR1	1901-0535	9	6	DIODE-SCHOTTKY SM SIG	28480	1901-0535
A1A9CR2	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A1A9CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A9CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A9CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A9CR6	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A1A9CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A9CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A9CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A9CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A9CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A9CR13	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A1A9CR14	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A1A9CR15	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A1A9Q1	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A9Q2	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A9Q3	1854-0610	0	5	TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A1A9Q4	1854-0610	0		TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A1A9Q5	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A9Q6	1854-0019	3	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1A9Q7	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1A9Q8	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A9Q9	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A9Q10	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A9Q11	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A9Q12	1854-0610	0		TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A1A9Q13	1854-0610	0		TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A1A9Q14	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT-800MHZ	28480	1854-0247
A1A9Q15	1854-0610	0		TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A1A9Q16	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A1A9Q17	1853-0451	5		TRANSISTOR PNP 2N3700 SI TO-12 PD=360MW	28480	1853-0451
A1A9R1	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A9R2	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A1A9R3	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A9R4	0757-0397	3	1	RESISTOR 68.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-68R1-F
A1A9R5	0757-0797	7	1	RESISTOR 90.9 +-1% .5W TF TC=0+-100	K8479	H2
A1A9R6	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A1A9R7	0683-1055	5	1	RESISTOR 1M +-5% .25W CF TC=0-800	19701	(CR-25) 1-4-5P-1M
A1A9R8	0698-7270	9	4	RESISTOR 26.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2612-F
A1A9R9	0698-7270	9		RESISTOR 26.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2612-F
A1A9R10	0698-7270	9		RESISTOR 26.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2612-F
A1A9R11	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A9R12	0757-0418	9	2	RESISTOR 619 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-619R-F
A1A9R13	0698-7229	8		RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A1A9R14	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A1A9R15	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A1A9R16	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A1A9R17	0757-0389	3	1	RESISTOR 33.2 +-1% .125W TF TC=0+-100	D8439	MK2
A1A9R18	0698-4390	8	1	RESISTOR 66.5 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-66R5-F
A1A9R19	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A9R20	0698-7233	4	3	RESISTOR 750 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-750R-F
A1A9R21	2100-2574	3	3	RESISTOR-TRMR 500 10% TKF SIDE-ADJ 1-TRN	73138	82PAR500
A1A9R22	0696-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A9R23	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A1A9R24	0698-7230	1		RESISTOR 562 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-562R-F
A1A9R25				NOT ASSIGNED		
A1A9R26	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A9R27	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A9R28				NOT ASSIGNED		
A1A9R29	0698-7288	9	5	RESISTOR 147K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1473-F
A1A9R30	0698-7233	4		RESISTOR 750 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-750R-F
A1A9R31	0698-7253	8	3	RESISTOR 5.11K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5111-F
A1A9R32	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A1A9R33	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A1A9R34	2100-2632	4	1	RESISTOR-TRMR 100 10% TKF SIDE-ADJ 1-TRN	73138	82PAR100
A1A9R35	0698-7220	9		RESISTOR 215 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-215R-F
A1A9R36	0698-7224	3	2	RESISTOR 316 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-316R-F
A1A9R37	2100-2574	3		RESISTOR-TRMR 500 10% TKF SIDE-ADJ 1-TRN	73138	82PAR500

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A9R38	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A9R39	0698-7209	4	1	RESISTOR 75 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-75R0-F
A1A9R40	0698-7224	3		RESISTOR 316 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-316R-F
A1A9R41	0698-7243	6	1	RESISTOR 1.96K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1961-F
A1A9R42	0698-3443	0	1	RESISTOR 287 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-287R-F
A1A9R43	0698-7205	0	4	RESISTOR 51.1 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-51R1-F
A1A9R44	0698-7238	8	1	RESISTOR 1.21K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1211-F
A1A9R45	0757-0403	2		RESISTOR 121 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-121R-F
A1A9R46	0698-7241	4	1	RESISTOR 1.62K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1621-F
A1A9R47	0757-0402	1		RESISTOR 110 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-111-F
A1A9R48	0757-0180	2	1	RESISTOR 31.6 +-1% .125W TF TC=0+-100	D8439	MK2
A1A9R49	0757-0378	0	1	RESISTOR 11 +-1% .125W TF TC=0+-100	19701	5033R-1/8-TO-11RO-F
A1A9R50	0698-8890	9	1	RESISTOR 4.75 +-1% .125W TF TC=0+-100	19701	SFR25H
A1A9R51	0757-0199	3	1	RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A1A9R52	0757-0290	5		RESISTOR 6.19K +-1% .125W TF TC=0+-100	19701	5033R-1/8-TO-6191-F
A1A9R53	0757-0418	6		RESISTOR 619 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-619R-F
A1A9R54	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A9R55	0698-7229	8		RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A1A9R56	0698-3444	1		RESISTOR 318 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-318R-F
A1A9R57	0698-7205	0		RESISTOR 51.1 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-51R1-F
A1A9R58	0698-7205	0		RESISTOR 51.1 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-51R1-F
A1A9R59	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A1A9R60	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A9R61	0698-7265	2	2	RESISTOR 16.2K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1622-F
A1A9R62				NOT ASSIGNED		
A1A9R63	0698-7205	0		RESISTOR 51.1 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-51R1-F
A1A9R64	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A9R65	0698-3132	4		RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A1A9R66	0698-7233	4		RESISTOR 750 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-750R-F
A1A9R67	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A9R68	0698-7263	0	1	RESISTOR 13.3K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1332-F
A1A9R69	7100-2574	3		RESISTOR-TRMR 500 10% TKF STOF-ADJ 1-TRN	73138	82PAR500
A1A9R70	0698-7251	6	1	RESISTOR 4.22K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-4221-F
A1A9TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A9TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A9TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A9TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A9TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A1A9U1	1820-0919	1	1	IC COMPTR ECL A/D DUAL	04713	MC1650L
A1A9U2	1826-0256	1	1	IC COMPARATOR HS DUAL 14-DIP-P PKG	18324	NE522N
A1A9U3	1820-1374	4	2	ANALOG SWITCH 4 SPST 16 -DIP-P	24355	AD7510DIJN
A1A9U4	1820-2015	2	2	IC GATE CMOS EXCL-OR QUAD	04713	MC14070BCP
A1A9U5	1820-1962	6	1	IC DCDR CMOS BCD-TO-DEC	04713	MC14028BCP
A1A9U6	1820-1746	4	1	IC BFR CMOS INV HEX	04713	MC14049UBCP
A1A9U7	1820-1374	4		ANALOG SWITCH 4 SPST 16 -DIP-P	24355	AD7510DIJN
A1A9VR1	1902-3203	6	2	DIODE-ZNR 14.7V 5% DO-35 PD=.4W	28480	1902-3203
A1A9VR2	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	07263	1N751A
A1A9VR3	1902-3203	8		DIODE-ZNR 14.7V 5% DO-35 PD=.4W	28480	1902-3203
	1200-0173	5	1	INSULATOR-ASIR DAPIGL	13103	7717-88 DAP
	4040-0748	3		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0751	8	1	EXTR-PC ORN POLYC .062-IN-BD-THKNS	28480	4040-0751
A1A10	08672-60047	5	1	ASSEMBLY, LEVEL CONTROL	28480	08672-60047
A1A10C1	0180-0141	2	1	CAP-FXD 50UF -75 +10AL-ELECTLT5 OHM	56289	30D506G050DD2
A1A10C2	0180-1846	6	1	CAP-FXD 2.2UF -10 +10TAO OHM	12344	T110B225K035A5
A1A10C3	0180-0374	3	1	CAP-FXD 10UF -10 +10TAO OHM	56289	150D106X9020B2
A1A10C4	0180-0116	1	1	CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D685X9035B2
A1A10C5	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A10C6	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A1A10C7	0180-0153	4	3	CAP-FXD 1000PF -10 +10POLYE-FL	19701	708D1AA102PK201A%
A1A10C8	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A10C9	0160-0153	4		CAP-FXD 1000PF -10 +10POLYE-FL	19701	708D1AA102PK201AX
A1A10C10	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A10C11	0160-0153	4		CAP-FXD 1000PF -10 +10POLYE-FL	19701	708D1AA102PK201AX
A1A10CR1	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR13	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR14	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR15	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR17	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10CR19	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A10QK	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
K1A10Q2	1853-0322	9		TRANSISTOR PNP 2N2946A SI TO-46 PD=400MW	28480	1853-0322
A1A10Q3	1853-0322	9		TRANSISTOR PNP 2N2946A SI TO-46 PD=400MW	28480	1853-0322
A1A10Q4	1853-0322	9		TRANSISTOR PNP 2N2946A SI TO-46 PD=400MW	28480	1853-0322
A1A10Q5	1853-0322	9		TRANSISTOR PNP 2N2946A SI TO-46 PD=400MW	28480	1853-0322
A1A10Q6	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A10Q7	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A10Q8	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A10Q9	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A10Q10	1853-0020	4		TRANSISTOR NPN SI PD=300MW FT=150MHZ	2M627	XA228CP20-1
A1A10Q11	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A10Q12	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	04713	SFE793
A1A10Q13	1855-0020	9		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	04713	SFE793
A1A10Q14	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A1A10Q15	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A1A10R1	0698-7288	9		RESISTOR 147K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1473-F
A1A10R2	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R3	0698-3154	0	1	RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A1A10R4	0698-7261	1		RESISTOR 14.7K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1472-F
A1A10R5	0698-7264	1		RESISTOR 14.7K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1472-F
A1A10R6	0698-7264	1		RESISTOR 14.7K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1472-F
A1A10R7	0698-7264	1		RESISTOR 14.7K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1472-F
A1A10R8	0698-7262	9	1	RESISTOR 12.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1212-F
A1A10R9	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A10R10	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A10R11	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A10R12	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A10R13	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R14	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R15	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R16	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R17	0811-2505	5	1	RESISTOR 400K +-0.025% .5W PN TC=0+-5	01686	7030
A1A10R18	0698-1160	6	1	RESISTOR 200K +-0.1% .1W TF TC=0+-5	09535	PR1/10
A1A10R19	0689-2417	8	1	RESISTOR 100K +-0.05% .125W TF TC=0+-10	09535	PR1/8
A1A10R20	0699-0473	2	1	RESISTOR 50K +-0.1% .1W TF TC=0+-10	09535	PR1/10
A1A10R21	0699-0642	7	2	RESISTOR 10K +-0.1% .1W TF TC=0+-5	09535	PR1/10
A1A10R22	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A1A10R23	0698-7288	9		RESISTOR 147K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1473-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A10R24	0698-7288	9		RESISTOR 147K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1473-F
A1A10R25	0698-7288	9		RESISTOR 147K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1473-F
A1A10R26	0698-7288	9		RESISTOR 147K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1473-F
A1A10R27	0699-0303	7	1	RESISTOR 1.33K +-1% .1W TF TC=0+-5	09535	PR1/10
A1A10R28	0698-0642	7		RESISTOR 10K +-1% .1W TF TC=0+-5	09535	PR1/10
A1A10R29	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A1A10R30	0698-3280	9		RESISTOR 484K +-1% .125W TF TC=0+-100	12498	CT4
A1A10R31	2100-3161	6	1	RESISTOR-TRMR 20K 10% TKF SIDE-ADJ	73138	89PR20K
A1A10R32	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R33	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R34	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R35	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R36	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A1A10R37	0698-2418	8	1	RESISTOR 32.28K +-0.5% .125W TF TO-01	PR1/8	
A1A10R38	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A10R39	0698-7270	9		RESISTOR 26.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2612-F
A1A10R40	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A1A10R41	0698-7277	6	4	RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5112-F
A1A10R42	0698-7277	6		RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5112-F
A1A10R43	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R44	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R45	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A10R46	0698-7265	2		RESISTOR 16.2K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1622-F
A1A10R47	0757-0402	1		RESISTOR 110 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-111-F
A1A10R48	0698-7253	8		RESISTOR 5.11K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5111-F
A1A10R49	0757-0274	5		RESISTOR 1.21K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1211-F
A1A10R50	0757-0317	7		RESISTOR 1.33K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1331-F
A1A10R51	0698-7253	8		RESISTOR 5.11K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5111-F
A1A10U1	1820-0535	7	4	IC-INTERFACE DRVR AND DUAL	01295	SN75451BP
A1A10U2	1820-0535	7		IC-INTERFACE DRVR AND DUAL	01295	SN75451BP
A1A10U3	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A1A10U4	1820-0535	7		IC-INTERFACE DRVR AND DUAL	01295	SN75451BP
A1A10U5	1820-0535	7		IC-INTERFACE DRVR AND DUAL	01295	SN75451BP
A1A10U6	1820-1976	2	3	IC BFR CMOS NON-INV HEX	04713	MC14050DCP
A1A10U7	1826-0035	4	1	IC OP AMP LOW-DRIFT 8-TO-99 PKG	27014	LM308AH
A1A10U8	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A1A10U9	1826-0059	2		IC OP AMP GP 8-TO-99 PKG	27014	LM201AH
A1A10VR1	1902-0680	7		DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.4W	04713	1N827
A1A10VR2	1902-3245	6	1	DIODE-ZNR 21.5V 5% DO-35 PD=.4W	28480	1902-3245
				A1A10 MISCELLANEOUS		
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
	4040-0748	3		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0750	7	1	EXTR-PC BD RED POLYC .062-IN-BD-THKNS	28480	4040-0750
A1A11	08672-60148	7	1	DIGITAL PROCESSOR ASSEMBLY	28480	08672-60146
A1A11C1	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A11CR1	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A11CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A11CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A11CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A11CR5	1901-0050	0		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A11CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A11CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A11CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1A11R1	0698-7277	6		RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5112-F
A1A11R2	1810-0277	3	1	NETWORK-RES 10-SIP 2.2K OHM X 9	C1433	750-101
A1A11R3	1810-0206	8	2	NETWORK-RES 8-SIP 10.0K OHM X 7	C1433	750-81
A1A11R4	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R5	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R6	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A11R7	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R8	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R9	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R10	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R11	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R12	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A11R13	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A11R14	1810-0206	8		NETWORK-RES 8-SIP 10.0K OHM X 7	C1433	750-81
A1A11R15	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R16	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R17	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R18	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R19	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R20	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R21	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R22	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R23	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R24	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A1A11R25				NOT ASSIGNED		
A1A11R26	0698-7277	6		RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5112-F
A1A11R27	0757-0280	3	13	RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A1A11TP1	0360-1730	9	6	CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
A1A11TP2	0360-1730	9		CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
A1A11TP3	0360-1730	9		CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
A1A11TP4	0360-1730	9		CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
A1A11TP5	0360-1730	9		CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
A1A11TP6	0360-1730	9		CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
A1A11TP7	0360-1730	9		CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
A1A11TP8	0360-1730	9		CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
A1A11U1	1820-2085	6	5	IC GATE CMOS AND-OR QUAD	27014	CD4019BCN
A1A11U2	1820-2015	2		IC GATE CMOS EXCL-OR QUAD	04713	MC14070BCP
A1A11U3	1820-2085	6		IC GATE CMOS AND-OR QUAD	27014	CD4019BCN
A1A11U4	1820-1976	2		IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A1A11U5	1820-2085	6		IC GATE CMOS AND-OR QUAD	27014	CD4019BCN
A1A11U6	1820-2085	6		IC GATE CMOS AND-OR QUAD	27014	CD4019BCN
A1A11U7	1820-1355	1	1	IC ENCDR CMOS 8-BIT	04713	MC14532BCP
A1A11U8	08672-80018	2	1	PROM RANGE ENCODER	28480	08672-80018
A1A11U9	1820-1976	2		IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A1A11U10	1820-2085	6		IC GATE CMOS AND-OR QUAD	27014	CD4019BCN
A1A11U11	1820-1486	9	1	IC GATE CMOS AND QUAD 2-INP	04713	MC14019BCP
				A1A11 MISCELLANEOUS		
	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
	4040-0748	3		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS U	28480	4040-0748
	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-IN-BD-THKNS	28480	4040-0749
A1A12	08672-67005	9	1	AMPLIFIER ASSEMBLY, INCLUDES A1A12~~0~~1	28480	08672-67005
A1A12	08672-69005	3	1	AMPLIFIER ASSEMBLY, RESTORED 08672-67005	28480	08672-69005
A1A12U1				NSR, P/O A1A12		
A1A13	08672-60217	1	1	INTERCONNECT ASSEMBLY	28480	08672-60217
A1A13C1	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A1A13C2	0180-0291	3		CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A1A13J1	1251-8930	5	1	CONN-POST TYPE .100-PIN-SPCG 34-CONT	28480	1251-8830
A1A13J2	1200-1204	5	2	SOCKET-IC-DIP 14-CONT DIP DIP-SLOR	00779	2-641609-2
A1A13P1-13				NOT ASSIGNED		
A1A13P14	1251-3421	9	1	CONN-RECT D-SUBMIN 24-CKT 17-CONT	28480	1251-3421
A1A13R1-R4				NOT ASSIGNED		
				A1A13 MISCELLANEOUS		
	0380-0334	9	4	STANDOFF-RVT-ON .375-IN-LG 4-40-THD	28480	0380-0334
	0380-0896	8	4	STANDOFF-RVT-ON .438-IN-LG 4-40-THD	28480	0380-0896
	2200-0169	0	5	SCREW-MACH 4-40 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A1A14	08672-60178	3	1	MOTHER BOARD ASSEMBLY	28480	08672-60178

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1A14C1	0180-0183	2	1	CAP FXD 10UF -76 +10AL-ELCTLT25 OHM	56289	30D106G050CB2
A1A14C2				NOT ASSIGNED		
A1A14C3	0180-2207	6		CAP-FXD 100UF -10 +10TAO OHM	56289	150D107X9010R2
A1A14C4	0180-2207	6		CAP-FXD 100UF -10 +10TAO OHM	56289	150D107X9010R2
A1A14J1-J7				NOT ASSIGNED		
A1A14J8	1251-3905	4	1	CONN-POST TYPE .100-PIN-SPCG 20-CONT	28480	1251-3905
A1A14J9	1251-4433	5	1	CONN-POST TYPE .100-PIN-SPCG 34-CONT	28480	1251-4433
A1A14J10				NOT ASSIGNED		
A1A14J11	1200-1204	5		SOCKET-IC-DIP 14-CONT DIP DIP-SLOR	00779	2-641609-2
A1A14J12	1250-0257	1	6	CONNECTOR-RF SMB M PC 50-OHM	16179	5162-5013-09
A1A14J13	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	16179	5162-5013-09
A1A14J14	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	16179	5162-5013-09
A1A14J15	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	16179	5162-5013-09
A1A14J16	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	16179	5162-5013-09
A1A14J17	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	16179	5162-5013-09
A1A14XA1-A4				NOT ASSIGNED		
A1A14XA5	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A1A14XA6	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A1A14XA7	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A1A14XA8	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A1A14XA9	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A1A14XA10	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A1A14XA11A	1251-8116	8	8	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A1A14XA11B	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A1A14XA12				NOT ASSIGNED		
A1A14XA13	1251-8115	6	1	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS		
				A1A14 MISCELLANEOUS		
	0380-0688	6	1	SPACER-RVT-ON .156-IN-LG .15-IN-ID	28480	0380-0688
A1A14Z4	0380-0817	3	2	SPACER-RVT-ON .085-IN-LG .152-IN-ID	28480	0380-0817
	03431-01201	8	1	FOOT	28480	03431-01201
				A1 CHASSIS PARTS		
A1AT1	08672-60206	7	1	PROGRAMMABLE ATTENUATOR, 110 DB (INCLUDES A1W14, 5061-0962)	28480	08672-60206
A1AT2	0960-0699	9	1	INSOLATOR	16453	PMI-9482
A1AT3				NOT ASSIGNED		
A1CR1	08672-60128	4	1	LEVELING DETECTOR	28480	08672-60129
A1DC1	0955-0101	7	1	DIRECTIONAL COUPLER	06587	1818
A1DS1	1990-0399	0	1	DISPLAY-AN-DOT MAT 1-CHAR .135-H	28480	5082-7304
A1DS2	1990-0686	8	2	DISPLAY-NUM-DOT MAT 1-CHAR .29-H	28480	5082-7300,CAT F.G.
A1DS3	1990-0686	8		DISPLAY-NUM-DOT MAT 1-CHAR .29-H	28480	5082-7300,CAT F.G.
A1FL1	08672-60093	1	1	HIGH PASS FILTER	28480	08672-60093
A1J1	08672-60132	9	1	CONNECTOR-RF OUTPUT (DOES NOT INCLUDE HEX NUT OR LOCK WASHER)	28480	08672-60132
	2950-0079	0	1	HEX NUT	28480	2950-0079
	2190-0120	0	1	LOCK WASHER	78189	1928-02
A1J2				NSR, P/O A1W12		
A1J3				NSR, P/O A1W17		
A1J4				NSR, P/O A1W18		
A1M1	1120-0585	3	1	METER 2.50-IN; 1 MA FSD; TAUT BAND; LIN	28480	1120-0585
A1Q1	1853-0344	5	1	TRANSISTOR PNP 2N5878 SI TO-3 PD=150W	04713	2N5876
A1R1	2100-3840	8	1	RES-V SS 10K 10% LIN	32997	82A1A-B56-8A0569
A1R2	2100-2590	3	1	RES-V SS 10K 10% 10	12697	392
A1R3	2100-3530	3	1	RES-V SS W/SW 10K 20% LIN SPST NO	01121	GH4G0325103MZ
A1R4	0811-3409	0	1	RESISTOR 40 +-1% 12W PWI TC=0+-2	20940	HS10
A1W1	08672-20206	4	1	CABLE, RF INPUT	28480	08672-20206
A1W2, W3				NOT ASSIGNED		
A1W4	1250-1397	2	1	ADAPTER CABLE, ISOLATOR INPUT	05876	95-547-99024
A1W5	08672-20067	5	1	CABLE ASSEMBLY, YIG INPUT	28480	08672-20067
A1W6	08672-20066	4	1	CABLE ASSEMBLY, YIG OUTPUT OUTPUT (EXCEPT OPTIONS 001,005,034,038)	28480	08672-20066

A1S5

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1W7	08672-20065	3	1	CABLE ASSEMBLY, DIRECTIONAL COUPLER	28480	08672-20065
A1W8	08672-20130	3		CABLE, RF OUTPUT, EXCEPT OPTIONS 002,	28480	08672-20130
A1W8	08672-20130	3	2	CABLE, RF OUTPUT (DOES NOT INCLUDE A1J1)	28480	08672-20130
A1W8	08672-20185	8	1	CABLE, RF OUTPUT, OPTION 004 ONLY (DOES NOT INCLUDE A1J1) (DOES NOT INCLUDE A3J6)	28480	08672-20185
A1W8	8120-2474	0	1	CABLE, RF OUTPUT, OPTION 005 ONLY (INCLUDES A3J6)	28480	8120-2474
A1W9	08672-60065	7	1	CABLE ASSEMBLY, ALC	28480	08672-60065
A1W10	08672-60071	5	2	CABLE, 14-CONDUCTOR	28480	08672-60071
A1W11	08672-60071	5		CABLE, 14-CONDUCTOR	28480	08672-60071
A1W12	08672-60063	5	1	CABLE ASSEMBLY, EXT. ALC INPUT (YELLOW; INCLUDES A1J2)	28480	08672-60063
A1W13				NOT ASSIGNED		
A1W14	5061-0962	8	1	CABLE ASSEMBLY, ATTENUATOR DRIVER (FOR OPTIONS 001 AND 005 NO CABLE IS NECESSARY, FOR OPTIONS 034 AND 038 ORDER A1W19)	28480	8120-4121
A1W15	08672-60091	9	1	CBL AY 34 COND	28480	08672-60091
A1W16	08672-60057		1		28480	08672-60057
A1W17	08672-60062	4	1	CABLE ASSEMBLY, AM INPUT ORANGE: INCLUDES A1J3)	28480	08672-60062
A1W18	08672-60060	2	1	CABLE ASSEMBLY, FM INPUT BROWN; INCLUDES A1J4)	28480	08672-60060
A1W19	08672-60180	7	1	CABLE ASSEMBLY, ATTENUATOR DRIVER (OPTIONS 034, 038)	28480	08672-60180
A2A1	08672-60209	1	1	DCU FRONT PANEL 90ARD ASSEMBLY (DOES NOT INCLUDE A2DS4 THROUGH A2DS11)	28480	08672-60209
A2A1C1	0160-0229	7	7	CAP-FXD 33UF -10 +10TA0 OHM	56289	150D338X9010B2
A2A1C2	0160-4831	3	1	CAP-FXD 4700PF -10 +10X7R	09969	RPA10X7R472K100V
A2A1C3	0160-4574	1	5	CAP-FXD 1000PF -10 +10X7R	09969	RPA10X7R102K100V
A2A1C4	0160-4830	2	1	CAP-FXD 2200PF -10 +10X7R	09969	RPA10X7R222K100V
A2A1C5	0160-3336	1	3	CAP-FXD 100PF -10 +10X7R	09969	RPA10X7R101K50V
A2A1C6	0160-3336	1		CAP-FXD 100PF -10 +10X7R	09969	RPA10X7R101K50V
A2A1C7	0160-3336	1		CAP-FXD 100PF -10 +10X7R	09969	RPA10X7R101K50V
A2A1C8	0160-0229	7		CAP-FXD 33UF -10 +10TA0 OHM	56289	150D338X9010B2
A2A1C9	0160-4574	1		CAP-FXD 1000PF -10 +10X7R	09969	RPA10X7R102K100V
A2A1C10	0160-4574	1		CAP-FXD 1000PF -10 +10X7R	09969	RPA10X7R102K100V
A2A1C11	0160-4574	1		CAP-FXD 1000PF -10 +10X7R	09969	RPA10X7R102K100V
A2A1C12	0160-4574	1		CAP-FXD 1000PF -10 +10X7R	09969	RPA10X7R102K100V
A2A1C13	0160-0229	7		CAP-FXD 33UF -10 +10TA0 OHM	56289	1500336X9010B2
A2A1CR1	1901-0040	1	26	DIODE-SWITCHING 30V 50MA 2NS DO-36	9N171	1N4148
A2A1CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-36	9N171	1N4148
A2A1CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-36	9N171	1N4148
A2A1DS1-3	1990-0783	8	3	LED-LIGHT BAR LUM-INT-GMCD IF=30MA-MAX	28480	HLMP-2635
A2A1DS12-19	1990-1118	3	8	LED-SET LUM-INT-GMCD IF=25MA-MAX BVR-BV	28480	HLMP-2300(MATCICO OCT)
A2A1J1	1261-3024	8	2	CONN-POST TYPE .100-PIN-SPCG 26-CONT	28480	1251-3024
A2A1J2A			3	(INCLUDES A2A1MP1 (16 EACH)		
A2A1J2B			3	(INCLUDES A2A1MP1 (24 EACH)		
A2A1J2C			3	(INCLUDES A2A1MP1 (24 EACH)		
A2A1MP1	1200-0448	7	64	SOCKET-STRP 1-CONT DIP-SLDR (PART OF A2A1J2A,B,C)	27284	05-31-0001
A2A1Q1	1854-0071	7	18	TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A1Q2	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A1Q3	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A1Q4	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A1Q5	1853-0020	4	10	TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A2A1Q6	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A1Q7	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A1Q8	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A1R1	0698-7253	8	3	RESISTOR 5.11K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5111-F
A2A1R2	1810-0370	7	5	NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A2A1R3	1810-0370	7		NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A2A1R4	1810-0370	7		NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A2A1R5	1810-0370	7		NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A2A1R6	1810-0370	7		NETWORK-RES 8-SIP 220.0 OHM X 7	C1433	750-81
A2A1R7	0757-0317	7	2	RESISTOR 1.33K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1331-F
A2A1R8	0757-0317	7		RESISTOR 1.33K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1331-F
A2A1R9	0698-7244	7	3	RESISTOR 2.15K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2151-F
A2A1R10	0698-7277	6	3	RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5112-F
A2A1R11	0698-7253	8		RESISTOR 5.11K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5111-F
A2A1R12	0698-7277	6		RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5112-F
A2A1R13	0698-7277	6		RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5112-F
A2A1R14	0698-7284	1	1	RESISTOR 14.7K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1472-F
A2A1R15	0698-7253	8		RESISTOR 5.11K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5111-F
A2A1R16	0698-7212	9	2	RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A2A1R17	0698-7260	7	4	RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A2A1R18	0698-7273	2	2	RESISTOR 34.8K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3482-F
A2A1R19	0698-7269	6	1	RESISTOR 23.7K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2372-F
A2A1R20	0698-7268	6	2	RESISTOR 21.5K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2152-F
A2A1R21	0698-7268	5		RESISTOR 21.5K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2152-F
A2A1R22	0698-7236	7	5	RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A2A1R23	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A2A1R24	0698-7244	7		RESISTOR 2.15K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2151-F
A2A1R25	0698-7254	9	1	RESISTOR 5.62K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5621-F
A2A1R26	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A2A1R27	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A2A1R28	0698-7229	8	1	RESISTOR 511K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A2A1R29	0698-7244	7		RESISTOR 2.15K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2151-F
A2A1R30	0698-7273	2		RESISTOR 34.8K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3482-F
A2A1R31	0698-7280	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A2A1R32	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A2A1R33	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A2A1R34	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A2A1R35	0698-7236	7		RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A2A1R36	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A2A1S1	3101-0624	3	6	SWITCH-SENS SPDT-DB SUBMIN 4A 250VAC	21649	B3-40001
A2A1S2	3101-0624	3		SWITCH-SENS SPDT-DB SUBMIN 4A 250VAC	21649	B3-40001
A2A1S3	3101-0624	3		SWITCH-SENS SPDT-DB SUBMIN 4A 250VAC	21649	B3-40001
A2A1S4	3101-0624	3		SWITCH-SENS SPDT-DB SUBMIN 4A 250VAC	21649	B3-40001
A2A1S5	3101-0624	3		SWITCH-SENS SPDT-DB SUBMIN 4A 250VAC	21649	B3-40001
A2A1S6	3101-0624	3		SWITCH-SENS SPDT-DB SUBMIN 4A 250VAC	21649	B3-40001
A2A1U1	1820-3298	5	1	IC GATE CMOS/74HC OR QUAD 2 INP	27014	MM74HC33N
A2A1U2	1820-1740	8	1	IC-INTERFACE ORVR DISPLAY	27014	DS8863N
A2A1U3	1820-1197	9	8	IC GATE TTL LS NAND QUAD 2 INP	01295	SN74LS00N
A2A1U4	1820-1433	6	2	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A2A1U5	1820-1433	6		IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A2A1U6	1820-3182	6	1	IC RGTR CMOS/74HC D-TYPE 4-BIT	04713	MC74HC173N
A2A1U7	1826-0065	0	2	IC COMPARATOR PRCN 8-DIP-P PKG	27014	LM311N
A2A1U8	1826-0065	0		IC COMPARATOR PRCN 8-DIP-P PKG	27014	LM311N
A2A1U9	1820-1199	1	4	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2A1U10	1820-2031	2	1	IC SHF-RGTR CMOS ASYNCHRO PRL-IN	04713	MC14021BCP
A2A1XA2DS1	86290-00034	6		LAMP, CONTACT	28480	86290-00034
	0361-0457	7	10	EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
A2A1XA2DS2	86290-00034	6		LAMP, CONTACT	28480	86290-00034
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
A2A1XA2DS3	88290-00034	8		LAMP, CONTACT	28480	86290-00034
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
A2A1XA2DS4	86290-00034	6		LAMP, CONTACT	28480	86290-00034

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
A2A1XA2DS5	86290-00034	6		LAMP CONTACT	23480	86290-00034
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
A2A1XA2DS6	86290-00034	6		LAMP, CONTACT	28480	86290-00034
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
A2A1XA2DS7	86290-00034	6		LAMP, CONTACT	28480	86290-00034
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
A2A1XA2DS8	86290-00034	6		LAMP, CONTACT	28480	86290-00034
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
A2A1XA2DS9	86290-00034	6		LAMP, CONTACT	28480	86290-00034
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
	86290-00034	6	10	LAMP, CONTACT	28480	86290-00034
	0361-0457	7		EYELET-RLD-FLG .065-00 .125-LG .008-THK	23730	M407R
	0340-1163	0	3	SPACER-IC FOR A 16 DIP IC; 0.053 IN DIA	17117	8682-2
	08872-20209	7	1	FRONT PANEL BOARD	28480	09672-20209
	1200-0648	9	4	SOCKET-STRP 12-CONT SIP DIP-SLDR	55322	55-112-G-2
	1200-0649	0	2	SOCKET-STRP 8-CONT SIP DIP-SLDR	55322	55-108-G-2
	1251-0600	0	23	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12380	94-155-1010-01-03-00
A2A2	~~0980~~-0684	2	1	ROTARY PULSE GENERATOR INPUT POWER: 5VDC	28480	OEDS-8831
A2A3	08872-60212	6	1	ASSEMBLY, VCO, 160-240 MHZ	28480	08672-60212
A2A3C1	0160-3456	6		CAP-FXD 1000PF -10 +10XSE	06383	CK45XE3A102K-H
A2A3C2	0160-0164	7	1	CAP-FXD 0.038UF -10 +10POLYE-FL	19701	703D1HP393PK201AX
A2A3C3	0160-3879	7	7	CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A2A3C4	0160-0118	1	2	CAP-FXD 6.8UF -10 +10TA0 OHM	56289	150D685X9035B2
A2A3C5	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A2A3C6	0160-2259	6	1	CAP-FXD 12PF -5 +5COG	09641	301-000-COG0-120J
A2A3C7	0160-6650	8	7	CAP-FXD 0.022UF -1 +1POLYC-MET	28480	0160-6650
A2A3C8	0160-0166	9	2	CAP-FXD 0.068UF -10 +10POLYE-FL	19701	708D1MP683PK201AX
A2A3C9	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C10	0160-3456	8		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C11	0160-6650	8		CAP-FXD 0.022UF -1 +1POLYC-MET	28480	0160-6650
A2A3C12	0160-3456	6	16	CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C13	0160-2211	1	1	CAP-FXD 5UF -50 +10AL-ELCTLTO OHM	56289	30D606F150CC2
A2A3C14	0160-2214	4	1	CAP-FXD 90UF -75 +10AL-ELCTLTO OHM	56289	30D906G16CC2
A2A3C15	0160-0166	9		CAP-FXD 0.068UF -10 +10POLYE-FL	19701	708D1MP683PK201AX
A2A3C16	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C17	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C18	0160-3456	6	2	CAP-FXD 100PF -10 +10X5E	06383	CK45XE3A101K-H
A2A3C19	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C20	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C21	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C22	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C23	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C24	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C25	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C26	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C27	0160-2240	4	1	CAP-FXD OF -0 +0COK	09641	301-000-COK0-209C
A2A3C28	0160-2262	0	2	CAP-FXD 18PF -5 +5COG	09641	301-000-COG0-160J
A2A3C29	0160-2262	0		CAP-FXD 18PF -5 +5COG	09641	301-000-COG0-160J
A2A3C30	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C31	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A2A3C32	0140-0195	2	2	CAP-FXD 130PF -5 +5MICA	28480	0140-0195
A2A3C33	0140-0195	2		CAP-FXD 130PF -5 +5MICA	28480	0140-0195
A2A3CR1	0122-0085	1	4	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	50545	1S2208(B)
A2A3CR2	0122-0085	1		DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	50545	1S2208(B)
A2A3CR3	0122-0085	1		DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	50545	1S2208(B)
A2A3CR4	0122-0085	1		DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	50545	1S2208(B)
A2A3J1	1250-0544	9	3	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A2A3J2	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A2A3L1	9140-0180	4	1	INDUCTOR RF-CH-MLD 2.7MH +-10%	91637	IM-4 2.7UH 10%

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A3L2	9140-1190	8	2	INDUCTOR RF-CH-MLD 4.7MH +-5%	06383	TPFT0410-472J
A2A3L3	9140-1190	8		INDUCTOR RF-CH-MLD 4.7MH +-5%	06383	TPFT0410-472J
A2A3L4	9100-2249	8	1	INDUCTOR RF-CH-MLD 150NH +-10%	91637	IM-2 15UH 10%
A2A3L5	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH +-10%	32159	6-02728
A2A3L6	9100-2248	5	2	INDUCTOR RF-CH-MLD 120NH +-10%	91637	IM-2 12UH 10%
A2A3L7	9100-2254	3	1	INDUCTOR RF-CH-MLD 390NH +-10%	91637	IM-2 39UH 10%
A2A3L8	9100-2248	5		INDUCTOR RF-CH-MLD 120NH +-10%	91637	IM-2 12UH 10%
A2A3MP1	08672-20135	8	1	VCO COVER	28480	08672-20135
A2A3Q1	1855-0276	6	1	TRANSISTOR J-FET 2N4A18A N-CHAN D-MODE	04713	2N4416A
A2A3Q2	1854-0345	8	3	TRANSISTOR NPN 2N5179 SI TO-72 PD-200MW	04713	2NG179
A2A3Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD-200MW	04713	2NG179
A2A3Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD-200MW	04713	2NG179
A2A3Q5	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT-150MHZ	2M627	XA22BCP20-1
A2A3Q6	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A2A3R1	0757-0199	3	57	RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A3R2	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A3R3	0698-3156	2	2	RESISTOR 14.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1472-F
A2A3R4	0757-0834	3	1	RESISTOR 5.62K +-1% .5W TF TC=0+-100	K8479	H2
A2A3R5	0757-0279	0	8	RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A2A3R6	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A3R7	0757-0279	0		RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A2A3R8	0757-0278	9	4	RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A2A3R9	0757-0346	2	10	RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A2A3R10	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A3R11	0698-3444	1	12	RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A3R12	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A3R13	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A2A3R14	0757-0180	2	1	RESISTOR 31.6 +-1% .125W TF TC=0+-100	D8439	MK2
A2A3R15	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A3R16	0757-0278	9		RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A2A3R17	0757-0279	0		RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A2A3R18	0698-3440	7	3	RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-196R-F
A2A3R19	0757-0428	1	1	RESISTOR 1.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1621-F
A2A3R20	0698-3160	8	4	RESISTOR 31.8K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3162-F
A2A3R21	0693-3452	1	2	RESISTOR 147K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1473-F
A2A3R22	0757-0123	3	1	RESISTOR 34.8K +-1% .125W TF TC=0+-100	12498	CT4
A2A3R23	0757-0416	7	3	RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A2A3R24	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-196R-F
A2A3R25	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A3R26	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A2A3R27	0757-0278	9		RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A2A3R28	0757-0418	9	4	RESISTOR 619 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-619R-F
A2A3R29	0757-0279	0		RESISTOR 3.18K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A2A3R30	0757-0418	9		RESISTOR 619 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-619R-F
A2A3R31	0698-0083	8	23	RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A3R32	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A3R33	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A3R34	0757-0401	0	6	RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A2A3S1	3101-1524	4	1	SWITCH-SL DP3T SUBMIN, SA 125VAC/DC PC	79727	GI-154-0005
A2A3T1	08672-80003	5	1	COIL, INDUCTOR	28480	08672-80003
A2A3U1	1820-1225	4	1	IC FF ECL D-M/S DUAL	04713	MC10231P
A2A3U2	1820-0794	0	1	IC FF ECL D-M/S	04713	MC1670L
	86701-40001	9	4	EXTRACTOR, P.C. BOARD	28480	00701-40001
	2180-0016	3	2	WASHER-LK INTL T 3/8 IN .377-IN-ID	20400	2190 0010
	2200-0101	0	6	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	4330-0145	9	1	INSULATOR-BEAD GLASS	28480	4330-0145
A2A4	08672-60211	3	1	ASSEMBLY, 20/30 PHASE DETECTOR	28480	08872-60211
A2A4C1	0180-0116	1		CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D685X9035B2
A2A4C2	0180-6650	8		CAP-FXD 0.022UF -1 +1POLYC-MET	28480	0160-6650
A2A4C3	0180-0197	8	18	CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A4C4	0180-0141	2	1	CAP-FXD 50UF -76 +10AL-ELCTLTS OHM	56289	30D506G050DD2
A2A4C5	0160-4835	7	8	CAP-FXD 0.1UF -10 +10X7R	09969	RPA20X7R104K50VPT
A2A4C6	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A2A4C7	0160-0161	4	2	CAP-FXD 0.01UF -10 +10POLYE-FL	19701	708D1CC103PK201AX
A2A4C8	0160-0161	4		CAP-FXD 0.01UF -10 +10POLYE-FL	19701	708D1CC103PK201AX
A2A4C9	0160-2290	4	2	CAP-FXD 0.15UF -10 +10POLYE-FL	19701	708D1MP154PK800AX
A2A4C10	0160-4800	6	1	CAP-FXD 120PF -5 +5COG	09969	RPA10COG121J100V
A2A4C11	0160-4835	7		CAP-FXD 0.1UF -10 +10X7R	09969	RPA20X7R104K50VPT
A2A4C12	0160-2290	4		CAP-FXD 0.15UF -10 +10POLYE-FL	19701	708D1MP154PK800AX
A2A4C13	0160-6650	8		CAP-FXD 0.022UF -1 +1POLYC-MET	28480	0160-6650
A2A4C14	0160-4835	7		CAP-FXD 0.1UF -10 +10X7R	09969	RPA20X7R104KS0VPT
A2A4C15	0160-6294	8	1	CAP-FXD 1000PF -5 +5COG	06383	DA13COG1H102J
A2A4C16	0160-3334	9	2	CAP-FXD 0.01UF -10 +10X7R	09969	RPA10X7R103K50V
A2A4C17	0160-4835	7		CAP-FXD 0.1UF -10 +10X7R	09969	RPA20X7R104K50VPT
A2A4C18	0160-7284	9	1	CAP-FXD 0.047UF -10 +10POLYE-FL		
A2A4C19	0160-6650	8		CAP-FXD 0.022UF -1 +1POLYC-MET	28480	0160-6650
A2A4C20	0160-6650	8		CAP-FXD 0.022UF -1 +1POLYC-MET	28480	0160-6650
A2A4C21	0160-5901	0	1	CAP-FXD OF -0 +0COG	06383	MA12COG2D100D
A2A4C22	0160-6650	8		CAP-FXD 0.022UF -1 +1POLYC-MET	28480	0160-6650
A2A4C23	0160-6649	5	3	CAP-FXD 0.1UF -1 +1POLYC-MET	28480	0160-6649
A2A4C24	0160-6649	5		CAP-FXD 0.1UF -1 +1POLYC-MET	28480	0160-6649
A2A4C25	0160-6649	5		CAP-FXD 0.1UF -1 +1POLYC-MET	28480	0160-6649
A2A4C26	0160-0301	4	1	CAP-FXD 0.012UF -10 +10POLYE-FL	19701	708D1EH123PK201AX
A2A4C27	0160-4835	7		CAP-FXD 0.10F -10 +10X7R	09969	RPA20X7R104K50VPT
A2A4C28	0160-4835	7		CAP-FXD 0.10F -10 +10X7R	09969	RPA20X7R104K50VPT
A2A4C29	0160-4835	7		CAP-FXD 0.10F -10 +10X7R	09969	RPA20X7R104K50VPT
A2A4C30	0160-4835	7		CAP-FXD 0.10F -10 +10X7R	09969	RPA20X7R104K50VPT
A2A4C31	0160-4805	1		CAP-FXD 47PF -5 +5COG	09969	RPA10COG470J100V
A2A4CR1	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A2A4CR2	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A2A4CR3	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A2A4CR4	1901-0535	9		DIODE-SCHOTTKY SM SIG	28480	1901-0535
A2A4L1	9100-1629	4	2	INDUCTOR RF-CH-MLD 47UH +-5%	91637	IM-4 47UH 5%
A2A4L2	9100-1629	4		INDUCTOR RF-CH-MLD 47UH +-5%	91637	IM-4 47UH 5%
A2A4L3	9140-1191	9	4	INDUCTOR RF-CH-MLD 3.9MH +-5%	06383	TPFT0410-392J
A2A4L4	9140-1191	9		INDUCTOR RF-CH-MLD 3.9MH +-5%	06383	TPFT0410-392J
A2A4L5	9140-1191	9		INDUCTOR RF-CH-MLD 3.9MH +-5%	06383	TPFT0410-392J
A2A4L6	9140-1191	9		INDUCTOR RF-CH-MLD 3.9MH +-5%	06383	TPFT0410-392J
A2A4Q1	1854-0713	7		TRANSISTOR NON SI TO-92 PD=300MW	2M627	CP4071
A2A4R1	0757-0280	3		RESISTOR 1K +-1% .125W TF TC-0+-100	12498	CT4-1/8-TO-1001-F
A2A4R2	0698-3629	4	1	RESISTOR 270 +-5% 2W MO TC=0+-200	12498	FP-69
A2A4R3	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A2A4R4	0698-3153	9	3	RESISTOR 3.83K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3831-F
A2A4R5	0698-3153	9		RESISTOR 3.83K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3831-F
A2A4R6	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A4R7	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A4R8	0757-0440	7	1	RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-7501-F
A2A4R9	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A4R10	0757-0438	3	29	RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A4R11	0757-0440	7	1	RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-7501-F
A2A4R12	0757-0422	5	2	RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A2A4R13	0757-0422	5	2	RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A2A4R14	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A4R15	0698-3160	8		RESISTOR 31.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3162-F
A2A4R16	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A4R17	0757-0467	8	2	RESISTOR 121K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1213-F
A2A4R18	0698-6362	8	4	RESISTOR 1K +-0.1% .125W TF TC=0+-25	12498	NE55
A2A4R19	0698-6362	8		RESISTOR 1K +-0.1% .125W TF TC=0+-25	12498	NE55
A2A4R20	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A4R21	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A4R22	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A4R23	0757-0819	4	1	RESISTOR 909 +-1% .5W TF TC=0+-100	K8479	H2
A2A4R24	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A4R25	0757-0424	7	1	RESISTOR 1.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1101-F
A2A4R26	0698-3443	0	1	RESISTOR 287 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-287R-F
A2A4R27	0698-3153	9		RESISTOR 3.83K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3831-F
A2A4R28	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A2A4R29	0757-0200	7	1	RESISTOR 5.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5521-F
A2A4R30	0757-0422	5	2	RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A2A4R31	0757-0278	9		RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A2A4R32	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A2A4R33	0698-6362	8		RESISTOR 1K +-0.1% .125W TF TC=0+-25	12498	NE55
A2A4R34	0698-7394	9	1	RESISTOR 698 +-0.1% .125W TF TC=0+-25	19701	5033R-1/8-T9-698R-R
A2A4R35	0698-6362	8		RESISTOR 1K +-0.1% .125W TF TC=0+-25	12498	NE55
A2A4R36	0757-0467	8		RESISTOR 121K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1213-F
A2A4R37	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A4R38	0698-3154	0	2	RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A2A4R39	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-196R-F
A2A4R40	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D6439	MK2
A2A4R41	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D6439	MK2
A2A4R42	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D6439	MK2
A2A4R43	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D6439	MK2
A2A4R44	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D6439	MK2
A2A4R45	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D6439	MK2
A2A4R46	0698-3158	4	1	RESISTOR 23.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2372-F
A2A4R47	0698-3441	8	4	RESISTOR 215 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-215R-F
A2A4R48	0698-3441	8		RESISTOR 215 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-215R-F
A2A4R49	0698-3441	8		RESISTOR 215 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-215R-F
A2A4R50	0698-3441	8		RESISTOR 215 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-215R-F
A2A4TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A4TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A4TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A4TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A4U1	1820-0429	8	2	IC V RGLTR-FXD-POS 4.8/5.2V TO-39 PKG	27014	LM309H
A2A4U2	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01285	SN74LS00N
A2A4U3	1820-0281	0	1	IC FF TTL J-K M/S PULSE CLEAR DUAL	01295	SN74107N
A2A4U4	1820-1645	3	2	IC MV TTL LS MONOSTBL RETRIG		
A2A4U5	1826-0783	9	1	IC OP AMP LOW-NOISE 8-DIP-C PKG	18324	NE5534AFE
A2A4U6	1826-0716	8	2	IC OP AMP LOW-NOISE DUAL 8-DIP-C PKG	18324	NE5534AFE
A2A4U7	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A2A4U8	1820-1422	3		IC MV TTL LS MONOSTBL RETRIG	01295	SN74LS122N
A2A4U9	1820-1645	2	1	IC BFR TTL LS BUS QUAD	01295	SN74LS126AN
A2A4U10	1826-0716	8		IC OP AMP LOW-NOISE DUAL 8-DIP-C PKG	18324	NE5532AFE
A2A4VR1	1902-3234	3	1	DIODE-ZNR 19.6V 5% DO-35 PO=.4W	28480	1902-3234
	08672-20136	9	1	COVER-PHASE DET	28480	08672-20136
	0890-0212	3		TUBING-FLEX .032-ID TFE .012-WALL	28480	0890-0212
	1205-0250	9		THERMAL LINK SGL TO-5/TO-39-CS	05820	2604 TH SE
	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A2A5	08672-60145	4	1	ASSEMBLY, 20/30 DIVIDER	28480	08672-60145
A2A5C1	0160-2055	9	12	CAP-FXD 0.01UF -20 +80YSV	28480	0180-2055
A2A5C2	0100-0229	7		CAP-FXD 33UF -10 +10TAO OHM	56289	150D336X9010B2
A2A5C3	0180-0229	7		CAP-FXD 33UF -10 +10TAO OHM	56289	150D336X9010B2
A2A5C4	0180-2205	3	1	CAP-FXD 0.33UF -10 +10TAO OHM	56289	150D334X9035A2
A2A5C5	0180-3466	8		CAP-FXD 100PF -10 +10XSE	06383	CK45XE3A101K-H
A2A5C6	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0180-2055
A2A5C7	0180-0229	7		CAP-FXD 33UF -10 +10TAO OHM	56289	150D336X9010B2
A2A5C8	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A5C9	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C10	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A5C11	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C12	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C13	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C14	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C15	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C16	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C17	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C18	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A2A5C19	0180-3537	4	1	CAP-FXD 680PF -5 +5MICA	28480	0180-3537
A2A5C20	0180-0229	7		CAP-FXD 33UF -10 +10TA0 OHM	56289	150D336X9010B2
A2A5CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A5J1	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A2A5L1	08672-80001	3	7	INDUCTOR-TOROID	28480	08672-80001
A2A5L2	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH +-10%	91637	IM-4 5.6UH 5%
A2A5L3	08672-80001	3		INDUCTOR-TOROID	28480	08672-80001
A2A5MP1	08672-20134	7	1	COVER, DIVIDER	28480	08672-20134
A2A5Q1	1854-0019	3	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A2A5R1	0698-3628	3	1	RESISTOR 220 +-5% 2W MO TC=0+-200	12498	FP-69
A2A5R2	0757-0397	3	1	RESISTOR 58.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-68R1-F
A2A5R3	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A5R4	2100-2413	8	1	RESISTOR-TRMR 200 10% TKF SIDE-ADJ 1-TRN	73138	82PAR200
A2A5R5	0698-7216	3	16	RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R6	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R7	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R8	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R9	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R10	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R11	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A5R12	0698-3150	6	1	RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A2A5R13	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A5R14	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A5R15	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R16	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R17	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R18	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R19	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R20	0698-3157	3	1	RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1962-F
A2A5R21	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R22	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R23	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R24	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R25	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R26	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R27	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R28	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R29	0757-0422	5		RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A2A5R30	0757-0418	9		RESISTOR 619 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-619R-F
A2A5R31	0757-0418	9		RESISTOR 619 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-619R-F
A2A5R32	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R33	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A5R34	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R35	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R36	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5R37	0698-7216	3		RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A2A5TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A5TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A5TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A5TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A5TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A5TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A5U1	1820-1251	6	5	IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A2A5U2	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A2A5U3	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A2A5U4	1820-1251	6	1	IC MV TTL MUNUSTEL	01295	SN74121N
A2A5U5	1820-0686	9	1	IC GATE TTL S AND TPL 3-INP	01295	SN74S11N
A2A5U6	1820-0629	0	2	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A2A5U7	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A2A5U8	1820-1384	6	1	IC PRESCR ECL	52648	SP8647BDG
A2A5U9	1820-0429	8		IC V RGLTR-FXD-POS 4.8/5.2V TO-39 PKG	27014	LM309H
A2A5U10	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A2A5U11	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A2A5U12	1820-0909	9	1	IC MULTR TTL	01295	SN74167N
A2A5U13	1820-0751	9	2	IC CNTR TTL DECD-NEG-EDGE-TRIG PRESET	01295	SN74196N
A2A5U14	1820-0751	9		IC CNTR TTL DECD-NEG-EDGE-TRIG PRESET	01295	SN74196N
A2A5U15	1820-0685	8	1	IC GATE TTL S NAND TPL 3-INP	01295	SN74S10N
A2A5U16	1820-0690	5	1	IC BFR TTL S NAND DUAL 4-INP	01295	SN74S40N
				A2A5 MISCELLANEOUS		
	0890-0212	3	2	TUBING-FLEX .032-ID TFE .012-WALL	28480	0890-0212
	1200-0081	4	1	INSULATOR-FLG-BSHG NYLON	28480	1200-0081
	1205-0250	9	2	THERMAL LINK SGL TO-5/TO-39-CS	05820	2604 TH 5E
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2200-0103	2	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	86701-40001	9		EXTRACTOR, P.C. BOARD	28480	86701-40001
	3050-0079	3	15	WASHER-FL NM NO. 2 .94-IN-ID .188-IN-OD	23050	2
	10534-4001	2	8	TACK-RUBBER	28480	10534-4001
A2A6				NOT ASSIGNED		
A2A7	08672-60009	9	1	ASSEMBLY, INTERFACE	28480	08672-60009
A2A7C1	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A2A7C2	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A2A7C3	0180-3877	5	20	CAP-VAR 100PF -20 +20X7R	09989	RPE121-105X7R101M200V
A2A7C4	0180-3877	5		CAP-VAR 100PF -20 +20X7R	09989	RPE121-105X7R101M200V
A2A7C5	0180-0218	4	1	CAP-FXD 0.15UF -10 +10TA0 OHM	56289	150D154X9035A2
A2A7C6	0180-0376	5	2	CAP-FXD 0.47UF -10 +10TA0 OHM	56289	150D474X9035A2
A2A7C7	0180-3876	6	6	CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A2A7C8	0180-0573	2	1	CAP-VAR 4700PF -20 +20X7R	06383	FD12X7R2A472M
A2A7C9	0180-1745	4	1	CAP-FXD 1.5UF -10 +10TA0 OHM	56289	150D155X9020A2
A2A7C10	0190-0376	5		CAP-FXD 0.47UF -10 +10TA0 OHM	56289	150D474X9035A2
A2A7CR1	1991-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A7CR2	1991-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A7CR3	1991-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A7CR4	1991-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A7CR5	1991-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A7CR6	1991-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A7CR7	1991-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A7DS1	1990-0404	8	4	LED-LAMP LUM-INT=500UCD IF=50MA-MAX	28480	HLMP-1000
A2A7DS2	1990-0404	8		LED-LAMP LUM-INT=500UCD IF=50MA-MAX	28480	HLMP-1000
A2A7DS3	1990-0404	8		LED-LAMP LUM-INT=500UCD IF=50MA-MAX	28480	HLMP-1000
A2A7DS4	1990-0404	8		LED-LAMP LUM-INT=500UCD IF=50MA-MAX	28480	HLMP-1000
A2A7J1	1251-5316	5	1	CONN-POST TYPE .100-PIN-SPCG 34-CONT	28480	1251-5316
A2A7L1	08672-80001	3		TOROID-FILTER, 600UH	28480	08672-80001
A2A7Q1	1853-0020	4		TRANSISTOR PNP SI PD-300MW FT=150MHZ	2M627	XA22BCP20-1
A2A7Q2	1853-0020	4		TRANSISTOR PNP SI PD-300MW FT=150MHZ	2M627	XA22BCP20-1
A2A7Q3	1853-0020	4		TRANSISTOR PNP SI PD-300MW FT=150MHZ	2M627	XA22BCP20-1
A2A7Q4	1853-0020	4		TRANSISTOR PNP SI PD-300MW FT=150MHZ	2M627	XA22BCP20-1
A2A7Q5	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A7Q6	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A7Q7	1853-0020	4		TRANSISTOR PNP SI PD-300MW FT=150MHZ	2M627	XA22BCP20-1
A2A7R1	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R2	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A7R3	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R4	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R5	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R6	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R7	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R8	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R9	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R10	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R11	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R12	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R13	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R14	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R15	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R16	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R17	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R18	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R19	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R20	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R21	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R22	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R23	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R24	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R25	0757-0465	6	7	RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A2A7R26	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A2A7R27	0698-3450	9	1	RESISTOR 42.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4222-F
A2A7R28	0698-3161	9	1	RESISTOR 38.3K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3832-F
A2A7R29	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R30	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6111-F
A2A7R31	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A7R32	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A7R33	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A7R34	0698-3442	9	5	RESISTOR 237 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-237R-F
A2A7R35	0698-3402	9		RESISTOR 237 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-237R-F
A2A7R36	0698-3442	9		RESISTOR 237 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-237R-F
A2A7R37	0698-3442	9		RESISTOR 237 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-237R-F
A2A7R38	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A7R39	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R40	0757-0458	7	13	RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A7R41	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R42	0698-3154	0		RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A2A7R43	0757-0485	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A2A7R44	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A7R45	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A7R46	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A7R47	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A7R48	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A7TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A7U1	1826-0502	0	5	ANALOG SWITCH 4 SPST 14 -DIP-P	04713	MC14066BCP
A2A7U2	1826-0502	0		ANALOG SWITCH 4 SPST 14 -DIP-P	04713	MC14066BCP
A2A7U3	1820-1962	6	5	IC DCDR CMOS BCD-TO-DEC	04713	MC14028BCP
A2A7U4	1820-2083	4	1	IC CNTR CMOS UP/DOWN POS-EDGE-TRIG	27014	CD4029BCN
A2A7U5	1820-1962	6		IC DCDR CMMOSBCD-TO-DEC	04713	MC14028BCP
A2A7U6	1820-1746	4	12	IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A7U7	1820-1961	5	3	IC GATE CMOS NAND TPL 3-INP	04713	MC14023BCP
A2A7U8	1820-1747	5	13	IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A7U9	1826-0502	0		ANALOG SWITCH 4 SPST 14 -DIP-P	04713	MC14066BCP
A2A7U10	1826-0502	0		ANALOG SWITCH 4 SPST 14 -DIP-P	04713	MC14066BCP
A2A7U11	1826-0502	0		ANALOG SWITCH 4 SPST 14 -DIP-P	04713	MC14066BCP
A2A7U12	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A7U13	1820-1745	3	7	IC GATE CMOS NOR QUAD 2-INP	04713	MC14001BCP

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A7U14	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A7U15	1820-1569	9	2	IC MV CMOS MONOSTBL RETRIG/RESET DUAL	04713	MC14538BCL
A2A7U16	1820-1569	9		IC MV CMOS MONOSTBL RETRIG/RESET DUAL	04713	MC14538BCL
A2A7U17	1820-1963	7	7	IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	04713	MC14013BCP
A2A7U18	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A7U19	1820-2080	1	26	IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14036BCP
A2A7U20	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A7U21	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A7U22	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A7U23	1820-1745	3		IC GATE CMOS NOR QUAD 2-INP	04713	MC14001BCP
A2A7U24	1820-1976	2	7	IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A2A7U25	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A7U26	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
				A2A7 MISCELLANEOUS		
	4040-0748	3	5	EXTR-PC BD BLK POLYC .082-IN-BD-THKNS	28480	4040-0748
	4040-0750	7	1	EXTR-PC BD RED POLYC .082-IN-BD-THKNS	28480	4040-0750
	3050-0079	3		WASHER-FL NM NO. 2 .094-IN-ID .188-IN-OD	23050	2
	10534-4001	2		TACK-RUBBER	28480	10534-4001
A2A8	08672-60140	9	1	ASSEMBLY, OUTPUT REGISTER	28480	08672-60140
A2A8C1	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A8C2	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A8C3	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A8C4	0160-3878	0		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A2A8C5	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A8C6	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A8C7	0180-4389	8	1	CAP-VAR 100PF -5 +SCOG	08989	RPE121-105COG101J200V
A2A8DS1	2140-0016	8	1	LAMP-INCAND 683 5VDC 60MA T-1 BULB	71744	683
A2A8L1	08672-80001	3		INDUCTOR-TOROID	28480	08872-80001
A2A8Q1	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A8Q2	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A8Q3	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A8Q4	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A8R1	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A8R2	0683-1055	5	1	RESISTOR 1M +-5% .25W CF TC=0-800	19701	(CR-25) 1-4-5P-1M
A2A8R3	0757-0461	2	2	RESISTOR 68.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6812-F
A2A8R4	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R5	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R6	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R7	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R8	0757-0100	0		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R9	0757-0461	2		RESISTOR 68.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6812-F
A2A8R10	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R11	0757-0439	4	1	RESISTOR 6.81K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6811-F
A2A8R12	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A8R13	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R14	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R15	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R16	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A8R17	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R18	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R19	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R20	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R21	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A8R22	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A8R23	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A8R24	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A8R25	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A2A8R26	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A2A8R27	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A2A8TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A8TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A8TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A2A8U1	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U2	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U3	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U4	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A8U5	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U6	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U7	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U8	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U9	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U10	1820-1955	7	5	IC ADDR CMOS FULL ADDER 4-BIT	04713	MC14008BCP
A2A8U11	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U12	1820-1283	4	4	IC SHF-RGTR TTL LS R-S PRL-IN PRL-OUT	01295	SN74LS95BN
A2A8U13	1820-1283	4		IC SHF-RGTR TTL LS R-S PRL-IN PRL-OUT	01295	SN74LS95BN
A2A8U14	1820-1283	4		IC SHF-RGTR TTL LS R-S PRL-IN PRL-OUT	01295	SN74LS95BN
A2A8U15	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U16	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U17	1820-1955	7		IC ADDR CMOS FULL ADDER 4-BIT	04713	MC14008BCP
A2A8U18	1820-1955	7		IC ADDR CMOS FULL ADDER 4-BIT	04713	MC14008BCP
A2A8U19	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A8U20	1820-1955	7		IC ADDR CMOS FULL ADDER 4-BIT	04713	MC14008BCP
A2A8U21	1820-1745	3		IC GATE CMOS NOR QUAD 2-INP	04713	MC14001BCP
A2A8U22	1820-1283	4		IC SHF-RGTR TTL LS R-S PRL-IN PRL-OUT	01295	SN74LS95BN
A2A8U23	1820-1444	9	2	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS298N
A2A8U24	08672-80014	8	1	PROM DIVIDER 2	28480	08672-80014
A2A8U25	08672-80015	9	1	PROM DIVIDER 1	28480	08672-80015
A2A8U26	1820-1976	2		IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A2A8U28	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A8U29	1820-1955	7		IC ADDR CMOS FULL ADDER 4-BIT	04713	MC14008BCP
A2A8XU23	1200-0507	9	1	SOCKET-IC-DIP 16-CONT DIP-SLOR	06776	ICN-1639-S3-G30
				A2A8 MISCELLANEOUS		
	1480-0073	6	6	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
	4040-0748	3		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0753	0	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0753
	3050-0079	3		WASHER-FL NM NO. 2 .094-IN-ID .188-IN-OD	23050	2
	10534-4001	2		TACK-RUBBER	28480	10534-4001
A2A9	08672-60017	9	1	ASSEMBLY, HP-IB ADDRESS	28480	08672-60017
A2A9C1	0180-0291	3	1	CAP-FXD 1UF -10 +10TAO OHM	56289	150D105X9035A2
A2A9C2	0160-0572	1	3	CAP-VAR 2200PF -20 +20X7R	06383	FD12X7R2A222M
A2A9C3	0160-0572	1		CAP-VAR 2200PF -20 +20X7R	06383	FD12X7R2A222M
A2A9C4	0160-0574	3	3	CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A2A9C5	0160-3877	5		CAP-VAR 100PF -20 +20X7R	06383	RPE121-105X7R101M200V
A2A9C6	0160-0571	0	5	CAP-VAR 470PF -20 +20X7R	06383	FD11X7R2A471M
A2A9C7	0160-0574	3		CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A2A9C8	0160-0574	3		CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A2A9C9	0160-0174	9	1	CAP-FXD 0.47UF -20 +80X5V	09969	RPE123-149Z5U474Z50V
A2A9CR1	1901-0518	8	10	DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A9CR2	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A9CR3	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A9CR4	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A9CR5	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A9J1	1251-3283	1	1	CONN-RECT MICRORBN 24-CKT 24-CONT	28480	1251-3283
A2A9L1	08672-80001	3		INDUCTOR-TOROID	28480	08672-80001
A2A9Q1	1854-0039	7	1	TRANSISTOR NPN 2N30535 SI TO-39 PD=1W	04713	2N30535
A2A9R1	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R2	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R3	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A9R4	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A9R5	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A9R6	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A9R7	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A9R8	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A9R9	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R10	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A9R11	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A9R12	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A9R13	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A9R14	0698-3160	8		RESISTOR 31.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3182-F
A2A9R15	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A9R16	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A9R17	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1981-F
A2A9R18	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A9R19	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A2A9R20	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A9R21	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A9R22	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R23	0757-0485	8		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A2A9R24	0757-0485	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A2A9R25	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R26	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R27	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R28	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R29	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R30	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9R31	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A9S1	3100-3371	1	1	SWITCH-RTRY DP4T-NS .55-DIA IDX-ANG-36	02111	87-9-231
A2A9S2	3100-3372	2	1	SWITCH-RTRY SP8T-NS .55-DIA IDX-ANG-36	02111	87-9-230
A2A9S3	3100-3369	7	1	SWITCH-RTRY SP8T-NS .55-DIA IDX-ANG-36	02111	87-9-232
A2A9S4	3100-3370	0	1	SWITCH-RTRY SP3T-NS .55-DIA IDX-ANG-36	02111	87-9-233
A2A9U1	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A9U2	1820-1962	6		IC DCDR CMOS BCD-TO-DEC	04713	MC14028BCP
A2A9U3	1820-1962	6		IC DCDR CMOS BCD-TO-DEC	04713	MC14028BCP
A2A9U4	1820-1962	6		IC DCDR CMOS BCD-TO-DEC	04713	MC14028BCP
A2A9U5	1820-1112	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A2A9U6	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2A9U7	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A9U8	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2A9U9	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A9U10	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2A9U11	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2A9U12	1820-1522	4	2	IC-INTERFACE XCVR INSTRUMENT BUS IEEE	04713	MC3440AP
A2A9U13	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2A9U14	1820-1522	4		IC-INTERFACE XCVR INSTRUMENT BUS IEEE	04713	MC3440AP
A2A9U15	1820-1961	5		IC GATE CMOS NAND TPL 3-INP	04713	MC14023BCP
A2A9U16	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A9U17	1820-1964	8	2	IC FF CMOS J-K POS-EDGE-TRIG DUAL	04713	MC14027BCP
A2A9U18	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A9U19	1820-1964	8		IC FF CMOS J-K POS-EDGE-TRIG DUAL	04713	MC14027BCP
A2A9U20	1820-1423	4		IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A2A9U21	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A9U22	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A9U23	1820-1963	7		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	04713	MC14013BCP
A2A9U24	1820-1745	3		IC GATE CMOS NOR QUAD 2-INP	04713	MC14001BCP
A2A9U25	1820-2079	8		IC GATE CMOS NOR DUAL 4-INP	04713	MC14002BCP
A2A9U26	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A9U27	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A9U28	1820-1976	2		IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A2A9U29	1820-1558	6	2	IC-INTERFACE SER-XMTR/RCVR QUAD	04713	MC3441AP
A2A9U30	1820-1558	6		IC-INTERFACE SER-XMTR/RCVR QUAD	04713	MC3441AP

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
				A2A9 MISCELLANEOUS		
	0380-0643	3	2	STANDOFF-HEX .255-IN-LG 8-32-THD	28480	0380-0643
	1200-0173	5	1	INSULATOR-XSTR DAP-GL	13103	7717-86 DAP
	1530-1088	4	2	MACHINED PART-BRS CLEVIS	28480	1530-1098
	4040-0748	3		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0755	2	2	EXTR-PC BD VIO POLYC .062-IN-BD-THKNS	28480	4040-0755
	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
	3050-0079	3		WASHER-FL NM NO. 2 .094-IN-ID .188-IN-OD	23050	2
	10534-4001	2		TACK-RUBBER	28480	10534-4001
A2A10	08672-60149	8	1	ASSEMBLY, REGISTER I	28480	08672-60149
A2A10C1	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A10C2	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A10C3	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A10C4	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A2A10C5	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A2A10C6	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A2A10CR1	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A10CR2	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A10L1	08672-80001	3		INDUCTOR-TOROID	28480	08672-80001
A2A10Q1	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A2A10R1	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A10R2	0438-0199	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R3	0438-0199	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R4	0438-0199	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R5	0436-0199	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R6	0757-0199	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R7	0698-3442	9		RESISTOR 237 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-237R-F
A2A10R8	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A10R9	0757-0290	5	1	RESISTOR 6.19K +-1% .125W TF TC=0+-100	19701	CT4-1/8-TO-1002-F
A2A10R10	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A10R11	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R12	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R13				NOT ASSIGNED		
A2A10R14	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R15	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R16	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R17	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R18	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R19	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R20	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10R21	0757-0280	3	24	RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A10U1	1820-0701	8	1	IC LCH TTL L D-TYPE 4-BIT	07263	93L14PC
A2A10U2	1820-1965	8	1	IC GATE CMOS NOR TPL 3-INP	04713	MC140258CP
A2A10U3	08672-80012	8	1	PROM BAND-DECODER 2	28480	08672-80012
A2A10U4	1820-1748	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A10U5	1820-1745	3		IC GATE CMOS NOR QUAD 2-INP	04713	MC14001BCP
A2A10U6	1820-1976	2		IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A2A10U7	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A10U8	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A10U9	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A10U10	1820-1745	3		IC GATE CMOS NOR QUAD 2-INP	04713	MC14001BCP
A2A10U11	1820-1976	2		IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A2A10U12	1820-1944	8		IC GATE CMO NAND QUAD 1INP	04713	MC14011BCP
A2A10U13	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A10U14	08672-80013	7	1	PROM BAND-DECODER 1	28480	08672-80013
A2A10U15	1820-0910	2	4	IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	5N74L583AN
A2A10U16	1820-0961	3	1		28480	1820-0961
A2A10U17	1820-1976	2		IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A2A10U18	1820-1976	2		IC BFR CMOS NON-INV HEX	04713	MC14050BCP
A2A10U19	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A10U20	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A10U21	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A10U22	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A10U23	1820-2080	1		IC SHF-RGTR CMOS SYNCHRO PRL-IN PRL-OUT	04713	MC14035BCP
A2A10U24	1820-0946	4	1	IC GATE CMOS NOR QUAD 2-INP	04713	MC14001UBCP
A2A10U25	1820-1444	8		IC MUXR/DATA-SEL TTL LS 2-TO-LINE QUAD	01295	SN74LS298N
A2A10U26	1820-1144	6	4	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A2A10U27	1820-1112	8	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
				A2A10 MISCELLANEOUS		
	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
	4040-0748	3		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0746
	4040-0755	2		EXTR-PC BD VID POLYC .062-IN-BD-THKNS	28480	4040-0755
	3050-0079	3		WASHER-FL NM NO. 2 .094-IN-ID .188-IN-OD	23050	2
	10534-4001	2		TACK-RUBBER	28480	10534-4001
A2A11	08672-60012	4	1	ASSEMBLY, TIMING CONTROL	28480	08672-60012
A2A11C1	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A2A11C2	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A2A11C3	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A2A11C4	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	160D225X9020A2
A2A11C5	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A2A11C6	0160-0572	1		CAP-VAR 2200PF -20 +20X7R	06383	FD12X7R2A222M
A2A11C7	0160-0571	0		CAP-VAR 470PF -20 +20X7R	06383	FD11X7R2A471M
A2A11C8	0160-3334	9		CAP-FXD 0.01UF -10 +10X7R	09969	RPA10X7R103K60V
A2A11C9	0160-0127	2	1	CAP-FXD 1UF -20 +20Z5U	09969	RPE113-149Z5U105M50V
A2A11C10	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A2A11C11	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A2A11C12	0160-0571	0		CAP-VAR 470PF -20 +20X7R	06383	FD11X7R2A471M
A2A11C13	0160-0571	0		CAP-VAR 470PF -20 +20X7R	06383	FD11X7R2A471M
A2A11C14	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A11C15	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A2A11C16	0160-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A2A11C17	0160-0571	0		CAP-VAR 470PF -20 +20X7R	06383	FD11X7R2A471M
A2A11C18	0160-0570	9	1	CAP-VAR 220PF -20 +20X7R	09969	RPE121-105X7R221M100V
A2A11C19	0140-0194	3	1	CAP-FXD 110PF -5 +5MICA	38480	0140-0196
A2A11C20	0140-0194	1	1	CAP-FXD 110PF -5 +5MICA	28480	0140-0194
A2A11CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR4	1901-0376	6	2	DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A2A11CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR7	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A2A11CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR9	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A11CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR12	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2600
A2A11CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR14	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A2A11CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR16				NOT ASSIGNED		
A2A11CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR18	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A11CR19- A2A11CR21				NOT ASSIGNED		
A2A11L1	08672-80001	3		INDUCTOR-TOROID	28480	08672-80001
A2A11Q1	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A11Q2	1853-0015	7	1	TRANSISTOR PNP SI PD-200MW FT=600MHZ	28480	1853-0015
A2A11Q3	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A2A11Q4	1854-0071	7		TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A11Q5	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A2A11Q6	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	2M627	XA22BCP20-1
A2A11Q7	1854-0019	3		TRANSISTOR NPN SI PD=18 PD=360MW	28480	1854-0019
A2A11R1	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A2A11R2	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A11R3	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R4	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A11R5	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R6	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R7	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R8	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R9	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R10	0757-0100	3		RESISTOR 31.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3160-F
A2A11R11	0757-0485	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A2A11R12	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A2A11R13	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A11R14	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R15	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R16	0757-0483	4	2	RESISTOR 82.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-8252-F
A2A11R17	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A11R18	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R19	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R20	0757-0198	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R21	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R22	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A11R23	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R24	0696-0063	8		RESISTOR 1.98K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A11R25	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R26	0757-0279	0		RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A2A11R27	0698-3156	2		RESISTOR 14.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1472-F
A2A11R28	0698-0083	8		RESISTOR 1.98K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A11R29	0757-0279	0		RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A2A11R30	0698-3132	4	1	RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A2A11R31	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A2A11R32	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A11R33	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R34	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R35	0757-0199	3		RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2152-F
A2A11R36	0698-3160	8		RESISTOR 31.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3162-F
A2A11R37	0757-0463	4		RESISTOR 82.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-8252-F
A2A11R38	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A2A11R39				NOT ASSIGNED		
A2A11R40	0698-3452	1		RESISTOR 147K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1473-F
A2A11R41	0767-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R42	0767-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A2A11R43	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A11R44	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A2A11R45	0757-0442	9	16	RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R46	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A2A11R47				NOT ASSIGNED		
A2A11S1	3101-1277	4	1	SWITCH-TGL SEC-SW SPDT .5A 120VAC PC	78553	T8203
A2A11U1	1820-1746	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A11U2	1820-2015	2	1	IC GATE CMOS EXCL-OR QUAD	04713	MC14070BCP
A2A11U3	1820-1963	7		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	04713	MC14013BCP
A2A11U4	1820-1963	7		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	04713	MC14013BCP
A2A11U5	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A2A11U6	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A2A11U7	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A2A11U8	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A2A11U9	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A11U10	1820-1745	3		IC GATE CMOS NOR QUAD 2-INP	04713	MC14001BCP
A2A11U11	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A11U12	1820-1748	4		IC BFR CMOS INV HEX	04713	MC14049UBCP
A2A11U13	1820-1204	9	1	IC GATE TTL LS NAND DUAL 4-INP	01295	SN74LS20N
A2A11U14	1820-1194	6	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS193N
A2A11U15	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS66AN
A2A11U16	1820-1197	8		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2A11U17	1820-1197	8		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2A11U18	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04710	MC14011BCP
A2A11U19	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A11U20	1820-1963	7		IC FF CMOS O-TYPE POS-EDGE-TRIG DUAL	04713	MC14013BCP
A2A11U21	1820-1432	5	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS163AN
A2A11U22	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2A11U23	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2A11U24	08672-80019	3	1	PROM-OFFSET	28480	08672-80019
A2A11U25	1820-1747	5		IC GATE CMOS NAND QUAD 2-INP	04713	MC14011BCP
A2A11U26	1820-1960	4	1	IC GATE CMOS NAND DUAL 4-INP	04713	MC14012BCP
A2A11U27	1820-1963	7		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	04713	MC14013BCP
A2A11U28	1820-1963	7		IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	04713	MC14013BCP
A2A11U29	1820-1961	6		IC GATE CMOS NAND TPL 3-INP	04713	MC14023BCP
A2A11U30	1820-0910	2		IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN74LS83AN
A2A11U31	1820-0910	2		IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN74LS83AN
A2A11U32	1820-0661	0	1	IC GATE TTL OR QUAD 2-INP	01295	SN7432N
A2A11U33	1820-0910	2		IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN74LS83AN
A2A11U34	1820-1423	4	2	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
				A2A11 MISCELLANEOUS		
	0340-0060	4	1	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	08291	011-6809 000 209
	0360-1730	8	12	CONNECTOR-SGL CONT PIN .058-IN-BSC-SZ	00779	61038-5
	4040-0747	2	1	EXTR-PC BD GRA POLYC .062-IN-BD-THKNS	28480	4040-0747
	4040-0748	3		EXTR-PC BD GRA POLYC .062-IN-BD-THKNS	28480	4040-0748
	1480-0073	6		PIN-ROLL .062-IN-DIA .25-IN-ID .188-IN-OD	72962	99-012-062-0250
	3050-0079	3		WASHER-FL NM NO. 2 .094-IN-ID .188-IN-OD	23050	2
	10534-4001	2		TACK-RUBBER	28480	10534-4001
A2A12	08672-60213	7	1	MOTHERBOARD ASSEMBLY	28480	08672-60213
A2A12C1	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C2	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C3	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C4	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C5	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C6	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C7	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C8	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C9	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C10	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C11	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C12	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C13	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C14	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C15	0160-3877	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C16	0160-3677	5		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A2A12C17	0160-3679	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A2A12C18	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A2A12CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A12CR2	1901-0535	9	5	DIODE-SCHOTTKY SM SIG	28480	1901-0535
A2A12CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A2A12J1	1251-3024	8		CONN-POST TYPE .100-PIN-SPCG 26-CONT	28480	1251-3024
A2A12J2	1250-1255	1	1	CONNECTOR-RF SMB M PC 50-OHM	98291	51-051-0000
A2A12J3	1251-8929	2	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8929
A2A12R1	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A2A12R2	0757-0158	4	1	RESISTOR 619 +-1% .5W TF TC=0+-100	K8479	H2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A2A12VR1	1902-0049	2	1	DIODE-ZNR 6.19V 5% 00-35 PD=.4W	28480	1902-0049
A2A12W1	08672-20193	8	1	CABLE ASSY-COAX-10 MHZ	28480	08672-20193
A2A12XA2A3	1251-8116	8	3	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A4	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A5	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A7A	1252-2856	9	12	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A7B	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A7C	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A8A	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A8B	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A8C	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A9C	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A10BA	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A10C	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A11A	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A11B	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A2A12XA2A11C	1252-2856	9		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
				A2A12 MISCELLANEOUS		
	0360-0817	3	1	SPACER-RVT-ON .095-IN-LG .152-IN-ID	28480	0380-0817
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
	3050-0079	3		WASHER-FL NM NO. 2 .094-IN-ID .188-IN-OD	23050	2
				A2 CHASSIS PARTS		
A2BT1	08672-60092	0	1	BATTERY PACK	28480	08672-60092
	85660-00054	6	1	CLAMP, BATTERY	28480	85660-00054
A2DS1- A2DS3				NOT ASSIGNED		
A2DS4	1990-0686	8		DISPLAY-NUM-DOT MAT 1-CHAR .29-H	28480	5082-7300,CAT F,G.
A2DS5	1990-0686	8	4	DISPLAY-NUM-DOT MAT 1-CHAR .29-H	28480	5082-7300,CAT F,G.
A2DS6	1990-0686	8		DISPLAY-NUM-DOT MAT 1-CHAR .29-H	28480	5082-7300,CAT F,G.
A2DS7	1990-0686	8		DISPLAY-NUM-DOT MAT 1-CHAR .29-H	28480	5082-7300,CAT F,G.
A2DS8	1990-0651	7	4	DISPLAY-AN-DOT MAT	28480	5082-7340
A2DS9	1990-0651	7		DISPLAY-AN-DOT MAT	28480	5082-7340
A2DS10	1990-0651	7		DISPLAY-AN-DOT MAT	28480	5082-7340
A2DS11	1990-0651	7		DISPLAY-AN-DOT MAT	28480	5082-7340
A2S1	3101-0613	0	1	SWITCH-TGL PRI-SW SPOT SA 120YAC PC	09353	7101-U11-J60 MODIFIED
A2W1	08672-60028	0	1	CABLE RIBBON-26 COND	28480	08672-60026
A2W2	08672-60030	6	1	CBL AY VCO OUTPUT	28480	08672-60030
A2W3	5060-0369	7	1	RIBBON CBL AY 34	28480	5060-0369
A2W4	5060-0366	4	1	RIBBON CBL AY 50	28480	5060-0366
A2XBT1	08672-60029	3	1	BATTERY HOLDER ASSEMBLY	28480	08672-60029
				INCLUDES:		
	0362-0227	1	2	CONNECTOR-SGL CONT SKT 1.14-MM-BSC-SZ	27264	02-05-5216
	0363-0067	9	2	CONTACT, BATTERY	28480	0363-0067
	0520-0164	1	4	SCREW-MACH 2-56 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
	08672-00009	3	1	SUPPORT, BATTERY PAK	28480	08672-00009
	08672-20030	2	1	HOLDER, BATTERY	28480	08672-20030
	0400-0082	8	1	GROMMET, CHANNEL	K1793	G51H/-B
A3A1				REFERENCE AND M/N ASSEMBLY		
A3A1A1	86701-60021	5	1	REFERENCE PHASE DETECTOR ASSEMBLY	28480	86701-60021
A3A1A1C1	0180-0197	8	10	CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A3A1A1C2	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A3A1A1C3	0180-1746	5	7	CAP-FXD 15UF -10 +10TA0 OHM	56289	150D156X9020B2
A3A1A1C4	0180-3879	7	7	CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A1A1C5	0140-0190	7	1	CAP-FXD 39PF -5 +5MICA	28480	0140-0190
A3A1A1C6	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A1A1C7	0160-2055	9	29	CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C8	0180-1846	6	1	CAP-FXD 2.2UF -10 +10TA0 OHM	12344	1110B225K035A3
A3A1A1C9	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A1A1C10	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C11	0180-0197	6		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A1C12	0160-2199	2	1	CAP-FXD 30PF -5 +5MICA	28480	0160-2199
A3A1A1C13	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D22X9020A2
A3A1A1C14	0160-2204	0	4	CAP-FXD 100PF -5 +5MICA	28480	0160-2204
A3A1A1C15	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A3A1A1C16	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C17	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C18	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C19	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C20	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C21	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C22	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C23	0160-0553	0	2	CAP-FXD 22UF -20 +20TAO OHM	12344	T354H226M025A5
A3A1A1C24	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C25	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C26	0160-2204	0		CAP-FXD 100PF -5 +5MICA	28480	0160-2204
A3A1A1C27	0140-0193	0	4	CAP-FXD 82PF -5 +5MICA	28480	0140-0193
A3A1A1C28	0180-0553	0		CAP-FXD 22UF -20 +20TAO OHM	12344	T354H226M025A5
A3A1A1C29	0160-2055	8		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C30	0140-0193	0		CAP-FXD 82PF -5 +5MICA	28480	0140-0193
A3A1A1C31	0180-1746	5		CAP-FXD 15UF -10 +10TAO OHM	56289	150D156X9020B2
A3A1A1C32	0170-0066	9	1	CAP-FXD 0.027UF -10 +10POLYE-FL	19701	708D1HJ273PK201AX
A3A1A1C33	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C34	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C35	0140-0193	0		CAP-FXD 82PF -5 +5MICA	28480	0140-0193
A3A1A1C36	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C37	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C38	0140-0193	0		CAP-FXD 82PF -5 +5MICA	28480	0140-0193
A3A1A1C39	0160-3454	4	25	CAP-FXD 220PF -10 +10XSE	06383	CK45XE3A221K-H
A3A1A1C40	0180-1746	5		CAP-FXD 16UF -10 +10TAO OHM	56289	150D156X9020B2
A3A1A1C41	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C42	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C43	0160-2206	2	1	CAP-FXD 160PF -5 +5MICA	28480	0160-2206
A3A1A1C44	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C45	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C46	0140-0210	2	3	CAP-FXD 270PF -5 +5MICA	28480	0140-0210
A3A1A1C47	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C48	0140-0210	2		CAP-FXD 270PF -5 +5MICA	28480	0140-0210
A3A1A1C49	0160-2201	7	1	CAP-FXD 51PF -5 +5MICA	28480	0160-2201
A3A1A1C50	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C51	0140-0210	2		CAP-FXD 270PF -5 +5MICA	28480	0140-0210
A3A1A1C52	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C53	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A1A1C54	0180-0183	2		CAP-FXD 10UF -75 +10AL-ELCTLT25 OHM	56289	30D106G050CB2
A3A1A1C55	0180-1746	5		CAP-FXD 15UF -10 +10TAO OHM	56289	150D156X9020B2
A3A1A1C56	0180-0229	7	2	CAP-FXD 33UF -10 +10TAO OHM	56289	150D336X9010B2
A3A1A1C57	0160-2204	0		CAP-FXD 100PF -5 +5MICA	28480	0160-2204
A3A1A1C58	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A1A1C59	0160-3879	6	31	CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A1C60	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A1A1C61	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A1C62	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A1CR1	1901-0518	8	7	DIODE-SCHOTTKY SM SIG	12403	5082-2800
A3A1A1CR2	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A3A1A1CR3	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A3A1A1CR4	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A3A1A1CR5	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A3A1A1CR6	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A3A1A1J1	1250-0544	9	8	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A3A1A1J2				NSR; P/O A3A1A1W1		
A3A1A1J3	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A1J4	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A3A1A1J5	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A3A1A1J6	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A3A1A1L1	9140-0236	3	2	INDUCTOR RF-CH-MLD 82UH +-5%	91637	IM-4 82UH 5%
A3A1A1L2	9140-0236	3		INDUCTOR RF-CH-MLD 82UH +-5%	91637	IM-4 82UH 5%
A3A1A1L3	9140-0143	9	2	INDUCTOR RF-CH-MLD 3.3UH +-10%	91637	IM-2 3.3UH 10%
A3A1A1L4	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH +-10%	91637	IM-2 3.3UH 10%
A3A1A1L5	9100-2281	2	1	INDUCTOR RF-CH-MLD 2.7UH +-10%	91637	IM-2 2.7UH 10%
A3A1A1L6	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH +-10%	91637	IM-4 10UH 10%
A3A1A1L7	9100-2255	4	4	INDUCTOR RF-CH-MLD 470NH +-10%	91637	IM-2 .47UH 10%
A3A1A1L8	9100-0388	6	1	INDUCTOR RF-CH-MLD 330NH +-10%	91637	IM-2 .33UH 10%
A3A1A1L9	9100-2257	8	3	INDUCTOR RF-CH-MLD 820NH +-10%	91637	IM-2 .82UH 10%
A3A1A1L10	9100-2255	4		INDUCTOR RF-CH-MLD 470NH +-10%	91637	IM-2 .47UH 10%
A3A1A1L11	9100-2257	6		INDUCTOR RF-CH-MLD 820NH +-10%	91637	IM-2 .82UH 10%
A3A1A1L12	9100-2255	4		INDUCTOR RF-CH-MLD 470NH +-10%	91637	IM-2 .47UH 10%
A3A1A1L13	9100-2257	6		INDUCTOR RF-CH-MLD 820NH +-10%	91637	IM-2 .82UH 10%
A3A1A1L14	9100-2255	4		INDUCTOR RF-CH-MLD 470NH +-10%	91637	IM-2 .47UH 10%
A3A1A1L15	9100-2256	5	1	INDUCTOR RF-CH-MLD 580NH +-10%	91637	IM-2 .56UH 10%
A3A1A1Q1	1854-0019	3	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A1A1Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A1A1Q3	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3A1A1Q4	1855-0049	1	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A3A1A1Q5	1853-0451	5	13	TRANSISTOR PNP 2N3788 SI TO-18 PD=360MW	28480	1853-0451
A3A1A1Q6	1853-0451	5		TRANSISTOR PNP 2N3788 SI TO-18 PD=360MW	28480	1853-0451
A3A1A1Q7	1853-0034	0	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A3A1A1R1	0757-0399	5	2	RESISTOR 82.6 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-82R5-F
A3A1A1R2	0757-0417	8	1	RESISTOR 582 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-562R-F
A3A1A1R3	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A1R4	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A1R5	0696-3156	2		RESISTOR 14.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1472-F
A3A1A1R6	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A1R7	0757-0420	3	3	RESISTOR 750 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-751-F
A3A1A1R8	0757-0438	3	9	RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A1A1R9	0757-0399	5		RESISTOR 82.5 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-82R5-F
A3A1A1R10	0688-7222	1	1	RESISTOR 261 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-261R-F
A3A1A1R11	0698-7219	5	2	RESISTOR 196 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-196R-F
A3A1A1R12	0757-0442	9	11	RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A1A1R13	0698-3453	2	3	RESISTOR 196K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1963-F
A3A1A1R14	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A1A1R15	0698-3453	2		RESISTOR 196K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1963-F
A3A1A1R16	0757-0441	8	6	RESISTOR 8.25K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-8251-F
A3A1A1R17	0698-3438	3	2	RESISTOR 147 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-147R-F
A3A1A1R18	0757-5548	2	14	RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A1A1R19	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A1A1R20	0767-0441	8		RESISTOR 8.25K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-8251-F
A3A1A1R21	0698-3438	3		RESISTOR 147 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-147R-F
A3A1A1R22	0608-3136	8	1	RESISTOR 17.8K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1782-F
A3A1A1R23	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A1A1R24	0698-3154	0		RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A3A1A1R25	0757-0348	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A1A1R26	0757-0280	3	21	RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A1A1R27	0698-3154	0		RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A3A1A1R28	0698-3450	9	1	RESISTOR 42.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4222-F
A3A1A1R29	0698-3449	6	2	RESISTOR 28.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2872-F
A3A1A1R30	0757-0444	1	2	RESISTOR 12.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1212-F
A3A1A1R31	0698-3154	0		RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A3A1A1R32	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A1A1R33	0698-3154	0		RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A3A1A1R34	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A1A1R35	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12496	CT4-1/8-TO-1001-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A1R36	0757-0444	1		RESISTOR 12.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1212-F
A3A1A1R37	0757-0200	7	1	RESISTOR 5.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5621-F
A3A1A1R38	0757-0421	4	4	RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A1A1R39	0757-0440	7	3	RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-7501-F
A3A1A1R40	0757-0394	0	10	RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A1A1R41	0698-3448	3	2	RESISTOR 383 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-383R-F
A3A1A1R42	0698-0085	0	3	RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A3A1A1R43	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A1A1R44	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A1A1R45	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A1A1R46	0698-3154	0		RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A3A1A1R47	0698-3453	2		RESISTOR 196K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1963-F
A3A1A1R48	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A1A1R49	0698-7285	5	1	RESISTOR 110K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1103-F
A3A1A1R50	0698-3187	3	4	RESISTOR 19.0K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1962-F
A3A1A1R51	0698-3157	3		RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1962-F
A3A1A1R52	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A1R53	0698-3440	7	3	RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-196R-F
A3A1A1R54	0698-7234	5	1	RESISTOR 825 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-825R-F
A3A1A1R55	0698-7257	2	2	RESISTOR 7.5K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-7501-F
A3A1A1R56	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A1A1R57	0698-3446	3		RESISTOR 383 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-383R-F
A3A1A1R58	0698-7246	9	1	RESISTOR 2.61K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2611-F
A3A1A1R59	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-196R-F
A3A1A1R60	0757-0276	7	1	RESISTOR 61.9 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6192-F
A3A1A1R61	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A1A1R62	0757-1094	9	6	RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A3A1A1R63	0698-0085	0		RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A3A1A1R64	0698-3132	4	2	RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A3A1A1R65	0698-0085	0		RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A3A1A1R66	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A1A1R67	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A1A1R68	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A1R69	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A1R70	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A1R71	0757-0274	6	1	RESISTOR 1.21K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1211-F
A3A1A1R72	0698-3132	4		RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A3A1A1R73	0757-0317	7	2	RESISTOR 1.33K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1331-F
A3A1A1R74	0757-0288	2	1	RESISTOR 13.3K +-1% .125W TF TC=0+-100	19701	5033R-1/8-TO-1332-F
A3A1A1R75	0698-7236	7	1	RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1001-F
A3A1A1T1	86701-60082	8	2	TRANSFORMER, RF GRN	28480	86701-50082
A3A1A1T2	86701-60082	6		TRANSFORMER, RF, GRN	28480	86701-50082
A3A1A1TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1,14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A1A1U1	1821-0001	4	1	TRANSISTOR ARRAY 14-PIN PLSTC DIP	04713	MC3346P
A3A1A1U2	1820-0328	6	1	IC GATE TTL NOR QUAD 2-INP	01295	SN7402N
A3A1A1U3	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A3A1A1U4	1820-0802	1	5	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A3A1A1U5	1820-0477	6	6	IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A3A1A1U6	1820-0429	8	1	IC V RGLTR-FXD-POS 4.8/5.2V TO-39 PKG	27014	LM309H
A3A1A1VR1	1902-3082	9	3	DIODE-ZNR 4.64V 5% DO-35 PD=.4W	28480	1902-3082
A3A1A1VR2	1902-3256	9	1	DIODE-ZNR 23.7V 5% DO-35 PD=.4W	28480	1902-3256
A3A1A1W1	88701-60059	9	1	CABLE ASSEMBLY. GRAY/ORANGE/WHITE	28480	86701-80059
				A3A1A1 MISCELLANEOUS		
	1205-0250	9	1	THERMAL LINK SGL TO-5/TO-39-CS	05820	2604 TH SE
	2190-0019	6	4	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
	2190-0124	4	7	WASHER-LK INTL T NO. 10 .195-IN-ID	16179	500222
	2200-0103	0	4	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2200-0139	4	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2950-0078	9	4	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
	6040-0239	9		HEAT SINK COMPOUND SIL	13103	THERMALCOTE

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
	86701-20040	4	1	COVER, P.C. (PHASE LOCK)	28480	86701-20040
	86701-40001	9	6	EXTRACTOR, P.C.	28480	86701-40001
A3A1A2	86701-60020	4	1	100 MHZ VCXO ASSEMBLY	28480	86701-60020
A3A1A2C1	0121-0495	5	3	CAP-VAR AIR	74970	187-0309-125
A3A1A2C2	0121-0495	5		CAP-VAR AIR	74970	187-0309-125
A3A1A2C3	0121-0495	5		CAP-VAR AIR	74970	187-0309-125
A3A1A2C4	0121-0493	3	1	CAP-VAR AIR	74970	187-0306-125
A3A1A2C5	0180-0049	9	1	CAP-FXD 20UF -75 +10AL-ELCTLT10.8 OHM	56289	30D206G0S0CC2
A3A1A2C6	0160-3456	6	3	CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A3A1A2C7	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C8*	0160-2251	7	1	CAP-FXD 0F -0 +0COG	09641	301-000-C0H-589C
A3A1A2C9	0160-4084	8	1	CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A3A1A2C10	0140-0191	8	1	CAP-FXD 56PF -5 +5MICA	28480	0140-0191
A3A1A2C11	0160-2204	0		CAP-FXD 100PF -5 +5MICA	28480	0160-2204
A3A1A2C12	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C13	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C14	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C15	0160-2261	9	9	CAP-FXD 15PF -5 +5COG	09641	301-000-COG0-150J
A3A1A2C16	0160-2261	9		CAP-FXD 15PF -5 +5COG	09641	301-000-COG0-150J
A3A1A2C17	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C18	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C19	0160-2261	9		CAP-FXD 15PF -5 +5COG	09641	301-000-COG0-150J
A3A1A2C20	0160-2261	9		CAP-FXD 15PF -5 +5COG	09641	301-000-COG0-150J
A3A1A2C21	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C22	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C23	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C24	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C25	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C26	0160-2261	9		CAP-FXD 15PF -5 +5COG	09641	301-000-COG0-150J
A3A1A2C27	0160-2261	9		CAP-FXD 15PF -5 +5COG	09641	301-000-COG0-150J
A3A1A2C28	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C29	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C30	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C31	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C32	0160-2261	9		CAP-FXD 15PF -5 +5COG	09641	301-000-COG0-150J
A3A1A2C33	0160-2261	9		CAP-FXD 15PF -5 +5COG	09641	301-000-COG0-150J
A3A1A2C34	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C35	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C36	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A2C37	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A2C38	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A2C39	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C40	0160-2238	0	1	CAP-FXD 0F -0 +0COK	09641	301-000-COK0-159C
A3A1A2C41	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A2C42	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A2C43	0180-0116	1	7	CAP-FXD 6.8UF -10 +10TA0 OHM	58289	150D685X9035B2
A3A1A2C44	0160-2253	9	1	CAP-FXD 0F -0 +0COG	09641	301-000-COH0-689C
A3A1A2C45				NOT ASSIGNED		
A3A1A2C46	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A2C47	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C48	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A3A1A2C49	0160-3456	6		CAP-FXD 1000PF -10 +10X5E	06383	CK45XE3A102K-H
A3A1A2C50	0180-0116	1		CAP-FXD 6.8UF -10 +10TA0 OHM	56289	150D685X9035B2
A3A1A2C51	0160-4299	7	6	CAP-FXD 2200PF -20 +20X5R	09969	DD09NWB302X5R222M250V
A3A1A2C52	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C53	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C54	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C55	0160-3454	4		CAP-FXD 220PF -10 +10X5E	06383	CK45XE3A221K-H
A3A1A2C56	0160-2437	1	15	CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5W0 502Z
A3A1A2CR1	0122-0245	5	1	DIODE-VVC 1N5139 6.8PF 10%	04713	1N5139

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A2CR2				NOT ASSIGNED		
A3A1A2CR3	1901-0539	3	2	DIODE-SCHOTTKY SM SIG	28480	1901-0539
A3A1A2CR4	1901-0539	3		DIODE-SCHOTTKY SM SIG	28480	1901-0539
A3A1A2J1	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A3A1A2J2	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A3A1A2J3	1250-0544	9		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-049-0000-220
A3A1A2J4				PART OF A3A1A2W1		
A3A1A2L1				NOT ASSIGNED		
A3A1A2L2	9100-2250	6	1			
A3A1A2L3	9140-0158	6	2	INDUCTOR RF-CH-MLD 1UH +-10%	91837	IM-2 1UH 10%
A3A1A2L4*	9140-0353	3	1			
A3A1A2L5	9100-2538	3	1			
A3A1A2L6	9100-2251	0	4	INDUCTOR RF-CH-MLD 220NH +-10%	91637	IM-2 .22UH 10%
A3A1A2L7	9100-2251	0		INDUCTOR RF-CH-MLD 220NH +-10%	91637	IM-2 .22UH 10%
A3A1A2L8	9100-2251	0		INDUCTOR RF-CH-MLD 220NH +-10%	91637	IM-2 .22UH 10%
A3A1A2L9	9100-2251	0		INDUCTOR RF-CH-MLD 220NH +-10%	91637	IM-2 .22UH 10%
A3A1A2L10				PART OF CIRCUIT BOARD		
A3A1A2L11				PART OF CIRCUIT BOARD		
A3A1A2L12				PART OF CIRCUIT BOARD		
A3A1A2L13				NOT ASSIGNED		
A3A1A2L14	9100-2247	4	2	INDUCTOR RF-CH-MLD 100NH +-10%	91637	IM-2 .1UH 10%
A3A1A2L15	9100-2247	4		INDUCTOR RF-CH-MLD 100NH +-10%	91637	IM-2 .1UH 10%
A3A1A2Q1	1854-0345	8	15	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2Q5	1854-0247	8	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A3A1A2Q6	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2Q8	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2Q9	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2Q10	1854-0404	0	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A1A2Q11	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A2R1	0757-0279	0	4	RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A3A1A2R2	0757-0419	0	2	RESISTOR 681 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-681R-F
A3A1A2R3	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-196R-F
A3A1A2R4	0757-0422	5	6	RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A3A1A2R5	0888-3155	1	7	RESISTOR 4 R4K +-1% 125W TF TC=0+-100	12498	CT4-1/8-TO-4841-F
A3A1A2R6	0698-7224	3	1	RESISTOR 316 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-316R-F
A3A1A2R7	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A1A2R8	0757-0422	5		RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A3A1A2R9	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A1A2R10	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A2R11	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A1A2R12	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A2R13	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A1A2R14	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A2R15	0757-0422	5		RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A3A1A2R16	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A2R17	0698-3150	6	16	RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A1A2R18	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A1A2R19	0698-7198	0	2	RESISTOR 26.1 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-26R1-F
A3A1A2R20	0698-3443	0	6	RESISTOR 287 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-287R-F
A3A1A2R21	0698-3429	2	3	RESISTOR 19.6 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A3A1A2R22	0698-3443	0		RESISTOR 287 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-287R-F
A3A1A2R23	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A1A2R24	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A2R25	0699-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A1A2R26	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A2R27	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A2R28	0757-0422	5		RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A3A1A2R29	0698-7198	0		RESISTOR 26.1 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-26R1-F
A3A1A2R30	0698-3443	0		RESISTOR 287 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-287R-F
A3A1A2R31	0698-3429	2		RESISTOR 19.6 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A3A1A2R32	0698-3443	0		RESISTOR 287 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-287R-F
A3A1A2R33	0698-3443	0		RESISTOR 387 +-1% .125W TF TC=0+-100	13400	CT4-1/8-TO-207R-F
A3A1A2R34	0698-3429	2		RESISTOR 19.6 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A3A1A2R35	0698-3443	0		RESISTOR 287 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-287R-F
A3A1A2R36	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A1A2R37	0757-0422	5		RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A3A1A2R38	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A2R39	0698-3150	8		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A1A2R40	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A2R41	0757-0384	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A1A2R42	0698-0084	9	6	RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A3A1A2R43	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4641-F
A3A1A2R44	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A3A1A2R45	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A3A1A2R46	0757-0279	0		RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A3A1A2R47	0757-0439	4	2	RESISTOR 6.81K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6811-F
A3A1A2R48	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A2R49	0757-0279	0		RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A3A1A2R50	0757-0439	0		RESISTOR 6.81K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6811-F
A3A1A2R51	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A1A2R52	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A1A2R53	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A1A2R54	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A1A2R55	0757-0422	5		RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A3A1A2R56	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A1A2R57	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A2R58	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A2R59	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A1A2R60	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A1A2R61	0698-3441	8	1	RESISTOR 215 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-215R-F
A3A1A2R62	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A1A2R63- A3A1A2R66				NOT ASSIGNED		
A3A1A2R67*	0698-3437	4	2			
A3A1A2R68*	0698-4037	2	1			
A3A1A2R69*	0698-3437	4				
A3A1A2T1	86701-60081	7	3	TRANSFORMER, RF, BLUE	28480	86701-60081
A3A1A2T2	86701-60081	7		TRANSFORMER, RF, BLUE	28480	86701-60081
A3A1A2T3	86701-60081	7		TRANSFORMER, RF, BLUE	28480	86701-60081
A3A1A2TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A1A2TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A1A2TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A1A2TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A1A2W1	86701-60031	7	1	CABLE ASSEMBLY, GRAY/RED/WHITE	28480	86701-60031
A3A1A2Y1	0410-1086	5	1	CRYSTAL-QUARTZ 100 MHZ HC-35/U-HLDR	28480	0410-1086
				A3A1A2 MISCELLANEOUS		
	1200-0173	5	1	INSULATOR-XSTR DAP-GL	13103	7717-86 DAP
	1400-0401	6	1	CABLE TIE .75-DIA .094-WD NYL	06394	SST1M-M-8
	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	16179	500222
	2200-0139	4		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2580-0002	4	14	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
	4330-0145	9	2	INSULATOR-BEAD GLASS	28480	4330-0145
	86701-60073	7	1	SHIELD ASSEMBLY	28480	86701-60073
	86701-20039	1	1	COVER, P.C. VCXO	28480	86701-20039
	86701-40001	9		EXTRACTOR, P.C.	28480	86701-40001

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A3	86701-60098	6	1	M/W PH DET BD AY	28480	86701-50098
A3A1A3C1	0160-4299	7	4	CAPACITOR-FXD 2200PF +-20% 250VDC CER	56289	C067F251F222M522-CDH
A3A1A3C2	0160-0574	3	5	CAPACITOR-FXD .022UF +-20% JOVDC CER	28480	0160-0574
A3A1A3C3	0160-4289	7		CAPACITOR-FXD 2200PF +-20% 250VDC CER	56289	C067F251F222M522-CDH
A3A1A3C4	0160-0100	3	1	CAPACITOR-FXD 4,7UF+-10% 05VOC TA	56289	150D475X903582
A3A1A3C5	0160-0572	1	2	CAPACITOR-FXD 2200PF +-20% 100VDC CER	28480	0160-0572
A3A1A3C6	0160-0572	1		CAPACITOR-FXD 2200PF +-20% 100VDC CER	28480	0160-0572
A3A1A3C7	0160-3876	4	3	CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A3A1A3C8	0160-3877	6	1	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A3A1A3C9	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A3A1A3C10	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A3A1A3C11	0160-3873	1	2	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER	28480	0160-3873
A3A1A3C12	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A3A1A3C13	0160-3878	6	25	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A3A1A3C14	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A3A1A3C15	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A3A1A3C16	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A3A1A3C17	0160-0197	8	3	CAPACITOR-FXD 2.2UF+-10% 20VDC 7A	56289	150D225X9020A2
A3A1A3C18	0160-4299	7		CAPACITOR-FXD 2200PF +-20% 250VDC CER	56289	C067F251F222MS22-CDH
A3A1A3C19	0160-0291	3	2	CAPACITOR-FXD 1UF+-10% 35VDC 7A	56289	1500105X8035A2
A3A1A3C20	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A3A1A3C21	0160-4299	7		CAPACITOR-FXD 2200PF +-20% 250VDC CER	56289	C067F251F222MS22-CDH
A3A1A3C22	0160-0574	3		CAPACITOR-FXD .022UF +-20% 100VDC CER	28480	0160-0574
A3A1A3J1	1250-0690	6	1	CONNECTOR-RF SMB M SQL-HOLE-FR 50 OHM	28480	1250-0690
A3A1A3L1	9100-1641	0	3	INDUCTOR RF-CH-MLD 240UH 5%	28480	9100-1541
A3A1A3L2	9100-2259	8	1	INDUCTOR RF-CH-MLD 1.5UH 10%	28480	9100-2259
A3A1A3L3	9100-1641	0		INDUCTOR RF-CH-MLD 240UH 5%	28480	9100-1641
A3A1A3L4	9100-2891	4	9	INDUCTOR RF-CH-MLD 50NH 10%	28480	9100-2891
A3A1A3L5	9100-2891	4		INDUCTOR RF-CH-MLD 50NH 10%	28480	9100-2891
A3A1A3L6	9100-2248	5	3	INDUCTOR RF-CH-MLD 120NH 10%	28480	9100-2248
A3A1A3L7	9100-2248	6		INDUCTOR RF-CH-MLD 120NH 10%	28480	9100-2248
A3A1A3L8	9100-2248	6		INDUCTOR RF-CH-MLD 120NH 10%	28480	9100-2248
A3A1A3MP1	85660-20136	7	1	M/N PHASE DET BD	28480	85660-20136
A3A1A3MP2				NOT ASSIGNED		
A3A1A3MP3	0620-0129	6	13	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3A1A3MP4	0590-0533	5	15	THREADED INSERT-NUT 2-56 .06-IN-LG SST	28480	0590-0533
A3A1A3MP5	1205-0285	0	6	HEAT SINK SGL BIP	28480	1205-0285
A3A1A3MP6	2190-0014	1	3	WASHER-LK INTL T NO. 2 .089-IN ID	78189	1902-00-00-2580
A3A1A3MP7	2190-0124	4	9	WASHER-LK INTL T NO. 10 .185-IN ID	28480	2190-0124
A3A1A3MP8	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3A1A3MP10	2050-0078	9	5	NUT-HEX-DBL-CHAM 10-32-THD .007-IN-THK	28480	2050-0078
A3A1A3MP11				NOT ASSIGNED		
A3A1A3MP12	86701-20101	8	1	CV-PC M/N PH DET	28480	86701-20101
A3A1A3MP13	85660-20068	4	4	GROUND LUG	28480	85660-20068
A3A1A3MP14	86701-00032	2	1	HEATSINK	28480	86701-00032
A3A1A3MP15				NOT ASSIGNED		
A3A1A3MP16	86701-40001	9		EXTRACTOR PC	28480	86701-40001
A3A1A3MP17				NOT ASSIGNED		
A3A1A3MP18	8151-0013	4	2	WIRE 22AWG 1X22	28480	8151-0013
A3A1A3Q1	1853-0461	6	4	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01296	2N3799
A3A1A3Q2	1853-0461	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A3A1A3Q3	1854-0345	8	6	TRANSISTOR NPN 2N3179 SI TO-72 PD=200MW	04713	2N5179
A3A1A3Q4	1854-0245	9		TRANSISTOR NPN 2N3179 SI TO-72 PD=200MW	04713	2N5179
A3A1A3R1	0698-3164	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A3A1A3R2	0698-3164	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A3A1A3R3	0698-3164	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A3A1A3R4	0698-3164	0		RESISTOR 4.22K 1% .136W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A3A1A3R5	0698-7267	4	1	RESISTOR 19.6K 1% .05W F TC=0+-100	24548	C3-1/8-TO-1962-F
A3A1A3R6	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-TO-101-F
A3A1A3R7	0899-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A3R8	0899-7192	4	2	RESISTOR 14.7 1% .05W F TC=0+-100	24548	C3-1/8-TO-14R7-F
A3A1A3R9	0757-0290	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1001-F
A3A1A3R10	0757-0290	3		RESISTOR 1K 1% .125W F TC=0+-100	24548	CT4-1/8-TO-1001-F
A3A1A3R11	0698-3164	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A3A1A3R12	0698-7212	9	5	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-TO-100R-F
A3A1A3R13	0698-3167	3	2	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1962-F
A3A1A3R14	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24548	CT4-1/8-TO-511R-F
A3A1A3R15	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24548	CT4-1/8-TO-511R-F
A3A1A3R16	0698-7246	1	7	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-TO-3161-F
A3A1A3R17	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-TO-3161-F
A3A1A3R18	0698-7223	2	6	RESISTOR 287 1% .05W F TC=0+-100	24546	C3-1/8-TO-287R-F
A3A1A3R19	0698-7256	1	1	RESISTOR 6.81K 1% .05W F TC=0+-100	24546	C3-1/8-TO-0811-F
A3A1A3R20	0698-7246	1		RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-TO-3161-F
A3A1A3R21	0698-7220	9	2	RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-TO-215R-F
A3A1A3R22	0698-7220	9		RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-TO-215R-F
A3A1A3R23	0698-7182	4		RESISTOR 14.7 1% .05W F TC=0+-100	24546	C3-1/8-TO-14R7-F
A3A1A3R24	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A3A1A3R25	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A3A1A3R26	0767-0441	8	2	RESISTOR 6.26K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-8251-F
A3A1A3R27	0767-0441	3		RESISTOR 6.26K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-8251-F
A3A1A3R28	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1962-F
A3A1A3R29	0698-3162	0	1	RESISTOR 48.4K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4842-F
A3A1A3R30	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4842-F
A3A1A3TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1A3TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1A3TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1A3TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1A3TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1A3TP6	1261-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1A3TP7	1261-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3A1A3U1	1820-1344	8	1	IC PL LOOP 14-DIP-C PKG	04713	MC 12040L
A3A1A3U2	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A3A1A3U3	1810-0251	3	3	NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0251
A3A1A3U4	1820-1225	4	2	IC FF ECL D-M/S DUAL	04713	MC10231P
A3A1A3U5	1810-0204	6	6	NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81-R1K
A3A1A3U6	1820-3126	6	2	IC CNTR ECL HEXADEC SYNCHRO	04713	MC10136P
A3A1A3U7	1820-0602	1	4	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A3A1A3U8	1810-0204	6		NETWORK-RES 8-SIP 1.0K OHM X 7	11236	760-81-R1K
A3A1A3U9	1820-0806	5	2	IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A3A1A3U10	1820-0820	3	2	IC FF ECL J-BAR K-BAR COM CLOCK DUAL	04713	MC10135L
A3A1A3U11	1810-0204	5		NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81-R1K
A3A1A3U12	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC101B2P
A3A1A3U13	1820-0251	3		NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0251
A3A1A3U14	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A3A1A3U15	1810-0204	6		NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-91-R1K
A3A1A3U16	1820-3126	8		IC CNTR ECL HEXADEC SYNCHRD	04713	MC10136P
A3A1A3U17	1810-0251	3		NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0251
A3A1A3U18	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A3A1A3U19	1810-0204	6		NETWORK-RES 8-SIP 1.0K OHM X7	11236	750-81-R1K
A3A1A3U20	1820-0806	5		IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A3A1A3U21	1820-0820	3		IC FF ECL J-BAR K-BAR COM CLOCK DUAL	04713	MC10135L
A3A1A3U22	1810-0204	5		NETWORK-RES 6-SIP 1.0K OHM X 7	11236	750-81 R1K
A3A1A3U23	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A3A1A3U24	0955-0063	0	1	U-WAVE MIXER 500 MHZ MAX	28480	0955-0063
A3A1A3VR1	1902-3082	9	1	DIODE-ZNR 4.64V 5% DO-35 PD=.4W	28480	1902-3082
A3A1A3W1	06701-60051	1	1	CBL AY IF IN-OUT	28480	06701-60051
A3A1A3W2	08673-60261	9	1	CABLE ASSY	28480	08673-60261
				A3A1A3 MISCELLANEOUS		
	2190-0112	0	12	WASHER-LK HLGL NO. 2 .088-IN-ID	28480	2190-0112
	6040-0454	0	2	THERMAL COMPOUND	28480	6040-0454

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
	7121-4611	2	1	LABEL-INFORMATION .16-IN-WD .15-IN-LG	28480	7121-4811
A3A1A4	86701-60029	3	1	M/N VCO ASSEMBLY (INCL. A3A1A4A1, A3A1A4A2)	28480	86701-60029
A3A1A4	86701-60071	5	1	M/N VCO ASSEMBLY (RESTORED 08672-60029) A3A1A4 MISCELLANEOUS	28480	86701-60071
	0380-0020	0	1	SPACER-RND .25-IN-LG .128-IN-ID	28480	0380-0020
	0520-0128	7	7	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	0520-0133	4	2	SCREW-MACH 2-56 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	610-0003	8	1	NUT-HEX-DBL-CHAM W-56-THD .062-IN-THK	28480	0610-0003
	2190-0045	8	4	WASHER-LK HLCL NO.2.088-IN-ID	76854	1501-009
	3050-0672	2	1	WASHER-SHLDR NO. 4.118-IN-ID .25-IN-OD	86928	6508-12
	86701-20048	0	1	PROBE	28480	86701-20046
	86701-20047	1	1	SUPPORT RESONATOR	28480	86701-20047
	86701-20049	3	1	TUNING SCREW	28480	86701-20049
A3A1A4A1				VCO RESONATOR ASSEMBLY (NSR,P/O A3A1A4)		
A3A1A4A2	86701-60027	1	1	BOARD ASSEMBLY, M/N VCO	28480	86701-60027
A3A1A4A2C1	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A4A2C2	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A4A2C3	0160-3878	7		CAP-VAR 0.010F -20 +20X7R	09969	RPE121-105X7R103M100V
A3A1A4A2C4	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A4A2C5	0180-2139	1				
A3A1A4A2C6	0680-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A4A2C7	0180-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A4A2C8	0180-3878	1		CAP-FXD 0F -0 +0C0G	09969	RPE121-105C0G4R7D200V
A3A1A4A2C9	0180-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A4A2C10	0160-3878	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A1A4A2C11	0180-2161	0	1	CAP-VAR 0.75UF -10 +10TA0 OHM	56289	150D754X9050A2
A3A1A4A2L1	9140-0770	8	2	INDUCTOR RF-CH-MLD 50NH +-10%	24226	10-M050K-2
A3A1A4A2L2	9140-0770	8		INDUCTOR RF-CH-MLD 50NH +-10%	24226	10-M050K-2
A3A1A4A2L3	86701-20051	7	1	INDUCTOR	28480	86701-20051
A3A1A4A2L4	9140-0158	6		INDUCTOR RF-CH-MLD 1UH +-10%	91637	IM-2 1UH 10%
A3A1A4A2Q1	~~1854-0686~~	0	2	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686A
A3A1A4A2Q2	1854-0610	0	1	TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A3A1A4A2R1	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1001-F
A3A1A4A2R2	0698-7219	6		RESISTOR 196 +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-196R-F
A3A1A4A2R3	0698-7193	5	1	RESISTOR 16.2 +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-16R2-F
A3A1A4A2R4	0698-3154	0	12	RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4221-F
A3A1A4A2R5	0757-0428	1	4	RESISTOR 1.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1621-F
A3A1A4A2R6	0698-7262	9	1	RESISTOR 12.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-1212-F
A3A1A4A2R7	0757-0428	1		RESISTOR 1.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1621-F
A3A1A4A2R8	0698-7254	9	1	RESISTOR 5.62K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-5621-F
A3A1A4A2R9	0698-7254	0	2	RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-51R1-F
A3A1A4A2R10	0698-7265	2	1	RESISTOR 16.2K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-1622-F
A3A1A4A2R11	0698-7250	5	1	RESISTOR 3.83K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-3831-F
A3A1A4A2R12	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-101-F
A3A1A4A2R13	0757-0400	9	1	RESISTOR 90.9 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-90R9-F
A3A1A4A2TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSG-SZ SQ	12360	94-155-1010-01-03-00
A3A1A4A2W1	86701-60056	8	1	CABLE ASSEMBLY, VCO OUTPUT	28480	86701-60058
A3A1A4A2W2	86701-20050	6	1	CABLE, S/R JUMPER	28480	86701-20050
	0340-0840	8	1	INSULATOR SLBL-LAC-CMPD	32559	T0-11-04
	86701-20052	8	2	SPACER, INSULATOR	28480	86701-20052
	0590-0528	6	3	THREADED INSERT-NUT A-40 .065-IN-LG SST	28480	0590-0526
	1251-2313	6	1	CONNECTOR-SGL CONT SKT .04-IN-BSG-SZ RND	00779	3-332070-5
A3A1A5	86701-60097	5	1	M/N OUTPUT BD AY	28480	86701-60097
A3A1A5C1	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C2	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C3	0160-3874	2	1	CAP-FXD 0F -0 +0C0G	09969	RPE121-105C0G100D200V
A3A1A5C4	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C5	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C6	0160-4383	0	1	CAP-FXD 0F -0 +0C0G	09959	RPE121-105C0G6R8D200V

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A5C7	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C8	0160-3873	1		CAP-FXD 0F -0 +0COG	09969	RPE121-105COG4R7D200V
A3A1A5C9	0160-4491	1	1	CAP-FXD 0F -0 +0COG	09969	RPE121-105COG8R2D200V
A3A1A5C10	0160-4490	0	1	CAP-FXD 0F -0 +0COG	09969	RPE121-105COG1R8C200V
A3A1A5C12	0160-2261	9		CAP-FXD 15PF -5 +5COG	09641	301-000-COGO-150J
A3A1A5C13	0160-2290	4	2	CAP-FXD 0.15UF -10 +10POLYE-FL	19701	708D1MP154PK800AX
A3A1A5C14	0160-2290	4		CAP-FXD 0.15UF -10 +10POLYE-FL	19701	708D1MP154PK800AX
A3A1A5C15	0140-0195	3	1	CAP-FXD 150PF -5 +5MICA	28480	0140-0196
A3A1A5C16	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C17	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09959	RPE121-105X7R102M100V
A3A1A5C18	0160-4389	6	1	CAP-VAR 100PF -5 +5COG	09969	RPE121-105COG101J200V
A3A1A5C19	0160-3876	4		CAP-FXD 47PF -20 +20X7R	09969	RPE121-105X7R470M200V
A3A1A5C20	0160-3878	5		CAP-VAR 1000PF -20 +20X7R	09959	RPE121-105X7R102M100V
A3A1A5C21	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09959	RPE121-105X7R102M100V
A3A1A5C22	0160-3876	6		CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C23	0160-4351	2	1	CAP-FXD 1000PF -20 +20X5F	33095	54-713-032-X5F-102M
A3A1A5C24	0160-0161	4	2	CAP-FXD 0.01UF -10 +10POLYE-FL	19701	708DICC103PK201AX
A3A1A5C25	0160-0153	4	1	CAP-FXD 1000PF -10 +10POLYE-FL	19701	708DIAA102PK201AX
A3A1A5C26	0160-0161	4		CAP-FXD 0.01UF -10 +10POLYE-FL	19701	708DICC103PK201AX
A3A1A5C27	0160-3534	1	1	CAP-FXD 510PF -5 +5MICA	28480	0160-3534
A3A1A5C28	0160-0298	8	1	CAP-FXD 1500PF -10 +10POLYE-FL	19701	708D1AA15S2PK201AX
A3A1A5C29	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A3A1A5C30	0160-0575	6		CAP VAR 1000PF -20 +20X7R		
A3A1A5C31	0180-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A3A1A5C33	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C34	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C35	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C36	0180-0291	3		CAP-FXD 1UF -10 +10TA0 OHM	56289	150D105X9035A2
A3A1A5C37	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A1A5C38	0180-0630	4	1	CAP-FXD 4.7UF -20 +20TA0 OHM	12344	T355G475M050AS
A3A1A5CR3	1901-0040	1	2	DIODE-SWITCHING 30V 50MA 2N5 DO=35	9N171	1N4148
A3A1A5CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2N5 DO=35	9N171	1N4148
A3A1A5CR5	1901-1098	1	2	DIODE-SWITCHING 1N4150 50V 200MA 4N5	07283	1N4150
A3A1A5CR6	1901-0518	8		DIODE-SCHOTTKY SM SIG	12403	5082-2800
A3A1A5CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4N5	07263	1N4150
A3A1A5J1	1250-0657	5	2	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0000-220
A3A1A5J2	1250-0657	5		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0000-220
A3A1A5J3	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	16179	5162-5013-09
A3A1A5L1	9100-2891	4		INDUCTOR RF-CH-MLD 50NH +-10%	32159	6-02729
A3A1A5L2	9100-2891	4		INDUCTOR RF-CH-MLD 50NH +-10%	32159	6-02729
A3A1A5L3	9135-0073	3	2	INDUCTOR RF-CH-MLD 51NH +-6.596%	24226	10M051X-1
A3A1A5L4	0100-2091	4		INDUCTOR RF-CH-MLD 50NH +- 10%	32159	0-02729
A3A1A5L6	9100-1634	1	1	INDUCTOR RF-CH-MLD 75UH +-5%	91637	1M-4 75UH 5%
A3A1A5L7	9100-1635	2	1	INDUCTOR RF-CH-MLD 81UH +-5%	91637	1M-4 81UH 5%
A3A1A5L8	9100-1620	5	1	INDUCTOR RF-CH-MLD 15UH +-10%	91637	1M-4 15UH 10%
A3A1A5L9	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH +-5%	91637	1M-4 100UH 5%
A3A1A5L10	9100-2891	4		INDUCTOR RF-CH-MLD 50NH +-10%	32159	6-02729
A3A1A5L11	9100-2891	4		INDUCTOR RF-CH-MLD 50NH +-10%	32159	6-02729
A3A1A5L12	9135-0079	9	1	INDUCTOR 100NH +-5.5% 2.6D-MMX6.6LG-MM	24226	10M0100X-1
A3A1A5L13	9135-0073	3		INDUCTOR RF-CH-MLD 51NH +-6.596%	24226	10M051X-1
A3A1A5L14	9140-0144	0	1	INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A3A1A5L15	9100-1641	0		INDUCTOR RF-CH-MLD 240UH +-5%	91637	IM-4 240UH 5%
A3A1A5MP3	2190-0009	4		WASHER-LK INTL T NO. 8 .168-IN-ID	U1453	1908
A3A1A5MP4	2190-0124	4		WASHER-LK INTL T NO. 10 .195-IN-ID	16179	500222
A3A1A5MP5	2200-0101	0		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3A1A5MP6	2580-0002	4		NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
A3A1A5MP7	2950-0078	9		NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A3A1A5MP8	3060-0070	3	1	WASHER-FL NM NO.2 .004-IN ID .180 IN-00	23050	2
A3A1A5MP9	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A3A1A5MP10	8151-0013	4		WIRE 22AWG 1X22	28480	B151-0013

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A5MP11	86701-20100	7	1	COV-PC M/N OUT	28480	86701-20100
A3A1A5MP12	85660-20068	4		GROUND LUG	28480	85660-20068
A3A1A5MP13	88701-40001	9		EXTRACTOR PC	28480	88701-40001
A3A1A5MP14	2200-0103	2	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3A1A5MP15	0520-0128	7		SCREW-MACH 2-56 .25-IN-LG-PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3A1A5MP16	0590-0533	5		THREADED INSERT-NUT 2-56 .05-IN-LG SST	46384	KFS2-256
A3A1A5MP17	1205-0285	0		HEAT SINK SGL DIP	13103	6007A-TOP
A3A1A5MP18	85660-00065	9	1	HEAT SINK	28480	85660-00065
A3A1A5MP19	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3A1A5MP20	6040-0454	0		HEAT SINK COMPOUND SYNTH/REFRC	82895	52022IJ
A3A1A5Q1	1854-0546	1	2	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A3A1A5Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A5Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A5Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A5Q5	1854-0546	1		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A3A1A5Q6	1854-0686	0		TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	28480	1854-0686
A3A1A5Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A1A5Q8	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A3A1A5Q9	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A3A1A5Q10	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3A1A5R1	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A1A5R2	0698-7248	1		RESISTOR 3.16K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3161-F
A3A1A5R3	0698-7243	6	4	RESISTOR 1.96K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1961-F
A3A1A5R4	0698-7205	0		RESISTOR 51.1 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-51R1-F
A3A1A5R5	0698-7223	2		RESISTOR 287 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-287R-F
A3A1A5R6	0698-7248	1		RESISTOR 31.6K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3161-F
A3A1A5R7	0698-7243	6		RESISTOR 1.96K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1961-F
A3A1A5R8	0757-0316	6	1	RESISTOR 42.2 +-1% .125W TF TC=0+-100	D8439	MK2
A3A1A5R9	0698-7221	0	2	RESISTOR 237 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-237R-F
A3A1A5R10	0698-7188	8	4	RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A3A1A5R11	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A1A5R12	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A1A5R13	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A1A5R14	0757-1094	8		RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A3A1A5R15	0757-1094	8		RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A3A1A5R16	0757-1094	8		RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A3A1A5R17	0757-1094	8		RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A3A1A5R18	0698-7280	7	2	RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A3A1A5R19	0698-7248	1		RESISTOR 3.16K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3161-F
A3A1A5R20	0698-7223	2		RESISTOR 287 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-287R-F
A3A1A5R21	0698-7223	2		RESISTOR 287 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-287R-F
A3A1A5R22	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A3A1A5R23	0698-7229	8	3	RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A3A1A5R24	0698-7212	8		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A1A5R25	0698-7221	0		RESISTOR 237 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-237R-F
A3A1A5R26	0698-7243	6		RESISTOR 1.98K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1961-F
A3A1A5R27	0698-7248	1		RESISTOR 3.16K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3161-F
A3A1A5R28	0698-7243	8		RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A3A1A5R29	0698-7243	8		RESISTOR 1.96K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1961-F
A3A1A5R30	0698-7100	7	1	RESISTOR 10.1 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R1-F
A3A1A5R31	0698-7227	6	1	RESISTOR 422 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-422R-F
A3A1A5R32	0698-7188	8		RESISTOR 10 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-10R-F
A3A1A5R33	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A1A5R34	0757-0279	0		RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A3A1A5R35	0698-7223	2		RESISTOR 287 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-287R-F
A3A1A5R36	0698-7210	7	1	RESISTOR 82.5 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-82R5-F
A3A1A5R37	0698-7257	2		RESISTOR 7.5K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-7501-F
A3A1A5R38	0698-7260	7		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1002-F
A3A1A5R39	0698-7229	8		RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A3A1A5R40	0757-0440	7		RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-7501-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A1A5R41	0757-0198	3	1	RESISTOR 21.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-2152-F
A3A1A5R42	0698-7272	1	1	RESISTOR 31.6K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-3162-F
A3A1A5R43	0698-7277	6	1	RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-5112-F
A3A1A5R44	0698-0024	7	1	RESISTOR 2.61K +-1% .5W TF TC=0+-100	K8478	H2
A3A1A5R45	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A3A1A5R46	0757-0447	4	1	RESISTOR 16.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1622-F
A3A1A5R47	0698-7188	8		RESISTOR 10K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-10R-F
A3A1A5R48	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1001-F
A3A1A5U1	1826-0059	2	1	IC OP AMP GP 8 TO-99 PKG	27014	LM21AH
A3A1A5U2	1820-3485	2	1	IC PRESCR ECL	04713	MC12090L
A3A1A5VR1	1802-3070	5	2	DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1802-3070
A3A1A5VR2	1802-3070	5	2	DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1802-3070
A3A1A5W1	85660-60103	2	1	JUMPER WIRE AY	28480	85660-60103
A3A1A6	86701-60101	6	1	M/N REFERENCE MOTHERBOARD ASSEMBLY	28480	86701-60101
A3A1A6C1	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C2	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C3	0180-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C4	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C5	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C6	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C7	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C8	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C9				DELETED		
A3A1A6C9	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C10	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C11	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C12	0160-2437	1		CAP-FXD 5000PF -20 +80X5V	09641	2425-086 X5WO 502Z
A3A1A6C13	0160-6211	7	2	CAP-FXD 10PF -20 +20X5F	33095	54-779-003-X5F-100M
A3A1A6C14	0160-6211	7		CAP-FXD 10PF -20 +20X5F	33095	54-779-003-X5F-100M
A3A1ABC15	0160-2437	1		CAP-FXD 5000PF -20 +80X5V		
A3A1A6XA3A1A	5060-0112	8	2	CONN 15 CONT DIP	28480	5060-0112
A3A1A6XA3A1B	5060-0112	8		CONN 15 CONT DIP	28480	5060-0112
A3A1A6XA3A1A1	1251-4423	3	1	CONNECTOR-PC EDGE	26742	190-275-01
A3A1A6XA3A1A2	1251-4174	1	1	CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-4174
A3A1A6XA3A1A3	1251-2856	9	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS		
A3A1A6XA3A1A5	1251-5020	1		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-5020
	0360-1514	7	5	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
	2190-0009	4	13	WASHER-LK INTL T NO. 8. 168-IN-ID	U1453	1908
	2580-0002	4	12	NUT-HEX-DBL-CHAM 8-32-THD 085-IN-THK	00000	ORDER BY DESCRIPTION
	86701-00031	1	2	INSULATOR FOR A3A1A6XA3A1A2	28480	86701-00031
	86701-00048	8	1	INSULATOR FOR A3A1A6XA3A1A1	28480	86701-00046
	1251-0600	0	35	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
	85660-00037	5	1	INSULATOR FOR A3A1A6-XA3A1A5	28480	85660-00037
A3A2				NOT ASSIGNED		
A3A3	86701-60096	9	1	POSITIVE REGULATOR ASSEMBLY	28480	86701-60096
A3A3C1	0180-2205	3	1	CAP-FXD 0.33UF -10 +10TAO OHM	56289	150D334X9035A2
A3A3C2	0180-0116	1		CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D695X9035B2
A3A3C3	0180-1746	5		CAP-FXD 15UF -10 +10TAO OHM	56289	150D156X9020B2
A3A3C4	0160-5904	3	5	CAP-FXD 30PF -5 +5COG	06383	MA12COG2D300J
A3A3C5	0180-0228	6	7	CAP-FXD 22UF -10 +10TAO OHM	56289	150D228X9015B2
A3A3C6	0180-0116	1		CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D685X9035B2
A3A3C7	0180-0228	6		CAP-FXD 22UF -10 +10TAO OHM	56289	150D226X9015B2
A3A3C8	0160-5909	8	4	CAP-FXD 0.047UF -10 +10X7R	D4222	SA20C4773KAAH
A3A3C9	0160-5909	8		CAP-FXD 0.047UF -10 +10X7R	D4222	SA20C4773KAAH
A3A3C10	0160-5904	3		CAP-FXD 30PF -5 +5COG	06383	MA12COG2D300J
A3A3C11	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A3A3C12	0180-0228	6		CAP-FXD 22UF -10 +10TAO OHM	56289	150D226X9015B2
A3A3C13	0160-0127	2	4	CAP-FXD 1UF -20 +20Z5U	09969	RPE113-149Z5U105M50V
A3A3C14	0160-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A3A3C15	0160-4831	3	1	CAP-FXD 4700PF -10 +10X7R	09969	RPA10X7R472K100V

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A3C16	0180-0116	1		CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D685X9035B2
A3A3CR1	1884-0018	5	4	THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A3A3CR2	1884-0046	9	1	THYRISTOR-SCR VRRM=50	11983	C230F
A3A3CR3	1990-0487	7	1	LED-LAMP LUM-INT-2MCD BVR=5V	28480	HLMP-1401
A3A3CR4	1901-0033	2	15	DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A3CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A3CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A3CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A3CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A3CR9	1990-0486	6	4	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A3A3CR10	1990-0488	6		LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A3A3CR11	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A3CR12	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A3F1	2110-0036	9	1	FUSE (INCH) 8A 125V NTD FE UL	75915	312 008
A3A3F2	2110-0003	0	1	FUSE (INCH) 3A 250V NTD FE UL	75915	312 003
A3A3Q1	1854-0810	2	8	TRANSISTOR NPN SI PD=625MW FT=200MHZ	56288	C1-1058
A3A3Q2	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD-360MW	28480	1853-0451
A3A3Q3	1853-0012	4	1	TRANSISTOR PNP 2N2904A SI TO-39 PD-500MW	04713	2N2904A
A3A3Q4	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A3A3Q5	1854-0072	8	2	TRANSISTOR NPN 2N3054 SI TO-66 PD=25W	04713	2N3054
A3A3Q6	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A3A3Q7	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A3A3Q8	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A3A3Q9	1854-0005	7	1	TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	07263	2N708
A3A3Q10	1854-0039	7	1	TRANSISTOR NPN 2N30535 SI TO-39 PD=1W	04713	2N30535
A3A3R1	0757-0443	0	2	RESISTOR 11K +-1% .125W TF TC=0+-100	12496	CT4-1/8-TO-1102-F
A3A3R2	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12496	CT4-1/8-TO-101-F
A3A3R3	0811-1859	8	1	RESISTOR 27 +-5% 2W PWI TC=0+-800	11502	SPH
A3A3R4	0757-0420	3		RESISTOR 750 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-751-F
A3A3R5	0757-0443	0		RESISTOR 11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1102-F
A3A3R6	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A3R7	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A3R8	0698-3442	9	1	RESISTOR 237 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-237R-F
A3A3R9	0698-8465	6	1	RESISTOR 7.15K +-0.5% .125W TF TC=0+-50	12498	NC55
A3A3R10	0698-6835	0	9	RESISTOR 3.16K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-0
A3A3R11	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A3R12	0757-0278	9	3	RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A3A3R13	0683-0275	9	5	RESISTOR 2.7 +-5% .25W CF TC=0-400	19701	(CR-25) 1-4-SP-2E7
A3A3R14	0698-3444	1	6	RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A3A3R15	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A3R16	0757-0278	9		RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A3A3R17	0698-3162	0		RESISTOR 48.4K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4642-F
A3A3R18	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A3R19	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A3R20	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A3A3R21	0757-0317	7		RESISTOR 1.33K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1331-F
A3A3R22	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A3A3R23	0757-0278	9		RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A3A3R24	0698-3629	4	1	RESISTOR 270 +-5% 2W MO TC=0+-200	12498	FP-89
A3A3R25	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A3A3R26	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A3R27	0812-0019	4	3	RESISTOR .33 +-5% 3W PWI TC=0+-90	01686	T2B-79
A3A3R28	0812-0019	4		RESISTOR .33 +-5% 3W PWI TC=0+-90	01000	T2B-70
A3A3R29	0812-0019	4		RESISTOR .33 +-5% 3W PWI TC=0+-90	01686	T2B-79
A3A3R30	0757-0419	0		RESISTOR 681 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-681R-F
A3A3R31	0757-0420	3		RESISTOR 750 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-751-F
A3A3R32	0698-3154	0		RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A3A3R33	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A3R34	0698-8466	7	1	RESISTOR 942 +-0.5% .125W TF TC=0+-50	12498	NC55
A3A3R35	0698-6835	0		RESISTOR 3.16K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-D

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A3R36	0698-6835	0		RESISTOR 3.16K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-D
A3A3R37	0683-0275	9		RESISTOR 2.7 +-5% .25W CF TC=0+-400	19701	(CR-25) 1-4-5P-2E7
A3A3R38	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A3A3R39	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A3R40	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	08439	MK2
A3A3R41	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A3R42	0757-0418	0	1	RESISTOR 619 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-619R-F
A3A3R43	0698-3156	2	3	RESISTOR 14.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1472-F
A3A3R44	0757-0459	8	1	RESISTOR 56.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5622-F
A3A3R45	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A3R46	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A3R47	0757-0288	1	1	RESISTOR 9.09K +-1% .125W TF TC=0+-100	19701	5033R-1/8-TO-9091-F
A3A3R48	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A3R49	0698-8464	5	2	RESISTOR 12.6K +-0.5% .125W TF TC=0+-50	12498	NC55
A3A3R50	2100-3095	5	1	RESISTOR-TRMR 200 10% TKF SIDE-ADJ	73138	89PR200
A3A3R51	0757-0440	7		RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-7501-F
A3A3R52	0698-0084	9		RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A3A3R53	0698-4405	6	1	RESISTOR 107 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-107R-F
A3A3R54	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A3R55	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A3R56	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A3R57	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A3R58	0698-3634	1	1	RESISTOR 470 +-5% 2W M? TC=0+-200	12498	FP-69
A3A3R59	0698-3162	0	3	RESISTOR 48.4K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4842-F
A3A3R60	0757-0416	7	15	RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A3R61	0698-3631	8	1	RESISTOR 330 +-5% 2W MO TC=0+-200	12498	FP-69
A3A3RT1	0837-0125	6	1	THERMISTOR DISC 1K-OHM TC=-4.4%/C-DEG	6E259	STD-0163
A3A3TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12380	94-155-1010-01-03-00
A3A3TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12380	94-155-1010-01-03-00
A3A3TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12380	94-155-1010-01-03-00
A3A3TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12380	94-155-1010-01-03-00
A3A3TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12380	94-155-1010-01-03-00
A3A3TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12380	94-155-1010-01-03-00
A3A3U1	1826-0161	7	1	IC OP AMP GP QUAD 14-DIP-P PKG	27014	LM324N
A3A3U2	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A3A3U3	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A3A3VR1	1902-3171	7	2	DIODE-ZNR 11V 5% DO-35 PD=.4W TC=+.002%	28480	1902-3171
A3A3VR2	1902-0686	3	2	DIODE-ZNR 6.2V 2% DO-7 PD=.4W TC=+.002%	04713	1N825
A3A3VR3	1902-3252	5	1	DIODE-ZNR 22.6V 2% DO-35 PD=.4W	28480	1902-3252
A3A3VR4	1902-0049	2	2	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A3A3VR5	1902-0686	3		DIODE-ZNR 6.2V 2% DO-7 PD=.4W TC=+.002%	04713	1N825
A3A3VR6	1902-3082	9		DIODE-ZNR 4.64V 5% DO-35 PD=.4W	28480	1902-3082
A3A3XF1	2110-0269	0	10	FUHLR-CLP-TYP	91506	6008-32CN
A3A3XF2	2110-0269	0		FUHLR-CLP-TYP	91506	6008-32CN
	00789-601	7	1	PROBE ASSY	28480	00789-601
	0520-0128	7		SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	0590-0528	6		THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0526
	1200-0081	4	2	INSULATOR-FLG-BSHG NYLON	28480	1200-0081
	1205-0280	8	5	HEAT SINK TO-66-CS		
	2190-0014	1	3	WASHER-LK INTL T NO. 2 .089-IN-ID	78189	1902-00-00-2580
	2190-0027	6	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	78189	1914-00
	2200-0107	6	1	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2950-0051	8	1	NUT-HEX-DBL-CHAM 1/4-29-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	5000-9043	6	3	PIN	28480	5000-9043
	5040-8843	2	3	EXTRACTOR	28480	5040-6843
	86701-20036	8	1	MOUNTING BLOCK, DIODE	28480	86701-20036
A3A4	86701-60095	3	1	NEGATIVE REGULATOR ASSEMBLY	28480	86701-60095
A3A4C1	0160-5904	3		CAP-FXD 30PF -5 +5COG	06383	MA12COG2D300J
A3A4C2	0180-0228	6		CAP-FXD 22UF -10 +10TAO OHM	56289	150D228X9015B2
A3A4C3	0180-1746	5		CAP-FXD 15UF -10 +10TAO OHM	56289	150D156X9020B2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A4C4	0160-5904	3		CAP-FXD 30PF -5 +5COG	06383	MA12COG2D300J
A3A4C5	0180-0228	6		CAP-FXD 22UF -10 +10TAO OHM	56289	150D226X901582
A3A4C6	0160-5904	3		CAP-FXD 30PF -5 +5COG	08383	MA12COG2D300J
A3A4C7	0180-0228	6		CAP-FXD 22UF -10 +10TAO OHM	56289	150D226X9015B2
A3A4C8	0180-1731	8		CAP-FXD 4.7UF -10 +10TAO OHM	56289	150D475X9050B2
A3A4C9	0160-5909	6		CAP-FXD 0.047UF -10 +10X7R	04222	SA20C4773KAAH
A3A4C10	0160-1746	5		CAP-FXD 15UF -10 +10TAO OHM	56289	150D156X9020B2
A3A4C11	0160-0127	2		CAP-FXD 1UF -20 +20Z5U	09969	RPE113-149Z5U105M50V
A3A4C12	0160-0575	4	1	CAP-VAR 0.047UF -20 +20X7R	06132	B37987-M5473-M51
A3A4C13	0160-0127	2		CAP-FXD 1UF -20 +20Z5U	09969	RPE113-149Z5U105M50V
A3A4C14	0160-0127	2		CAP-FXD 1UF -20 +20Z5U	09969	RPE113-149Z5U105M50V
A3A4C15	0160-5909	8		CAP-FXD 0.047UF -10 +10X7R	04222	SA20C4773KAAH
A3A4C16	0160-0100	3	1	CAP-FXD 4.7UF -10 +10TAO OHM	56289	150D475X9035B2
A3A4C17	0160-6295	7	1	CAP-FXD 910PF -5 +5COG	06383	DA13COG1H911J
A3A4CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A4CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A4CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A4CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A4CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A4CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A4CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A4CR8	1901-0662	3	3	DIODE-PWR RECT 100V 6A	04713	MR751
A3A4CR9	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A4CR10	1990-0486	6		LED-LAMP LUM-INT=2MCD IF=25MA-MAX 8VR-5V	28480	HLMP-1301
A3A4CR11	1990-0486	6		LED-LAMP LUM-INT=2MCD IF=25MA-MAX 8VR-5V	28480	HLMP-1301
A3A4CR12	1901-0682	3		DIOGE-PWR RECT 100V 6A	04713	MR751
A3A4CR13	1990-0486	8		LED-LAMP LUM-INT=500UCD IF=50MA-MAX	28480	HLMP-1000
A3A4CR14	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A4CR15	1901-0743	1	1	DIODE-PWR RECT 1N4004 400V 1A DO-41	11983	1N4004
A3A4CR16- A3A4CR24				NOT ASSIGNED		
A3A4CR25	1884-0018	5		THYRISTOR-SCR 2N4186 VRRM-200	04713	2N4186
A3A4CR26	1884-0018	6		THYRISTOR-SCR 2N4186 VRRM-200	04713	2N4186
A3A4CR27	1884-0018	5		THYRISTOR-SCR 2N4186 VRRM-200	04713	2N4186
A3A4F1	2110-0083	6	1	FUSE (INCH) 2.5A 250V NTD FE UL	11870	04.025
A3A4F2	2110-0043	6	1	FUSE (INCH) 1.5A 250V NTD FE UL	11870	04.015
A3A4F3	2110-0010	9	1	FUSE (INCH) 5A 250V NTD FE UL	75915	312005
A3A4K1	0490-0916	6	1	RELAY-REED 1A 500MA 100VDC 5VDC-COIL	15636	R-6966-1
A3A4Q1	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT-200MHZ	56289	CT-1058
A3A4Q2	1854-0072	8		TRANSISTOR NPN 2N3054 SI TO-66 PD=25W	04713	2N3054
A3A4Q3	1853-0001	1	1	TRANSISTOR PNP SI TO-39 PD=600MW	28480	1853-0001
A3A4Q4	1853-0007	7	4	TRANSISTOR PNP 2N3261 SI TO-18 PD=360MW	04713	2N3251
A3A4Q5	1854-0271	8		TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0271
A3A4Q6	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A3A4Q7	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A3A4R1	0812-0020	7	2	RESISTOR .39 +-5% 3W PWI TC=0+-90	91637	CW2B1-3-T2-39/100-J
A3A4R2	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A4R3	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A4R4	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A4R5	0698-6835	0		RESISTOR 3.16K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-D
A3A4R6	0698-6835	0		RESISTOR 3.16K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-D
A3A4R7	0698-6835	0		RESISTOR 3.16K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-D
A3A4R8	0683-0275	9		RESISTOR 2.7 +-5% .25W CF TC=0-400	19701	(CR-25) 1-4-5P-2E7
A3A4R9	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A3A4R10	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A4R11	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A4R12	0757-0428	1		RESISTOR 1.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1621-F
A3A4R13	0698-3447	4	2	RESISTOR 422 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-422R-F
A3A4R14	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A3A4R15	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A4R16	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A3A4R17	0811-1665	6	1	RESISTOR .82 +-5% 2W PWI TC=0+-800	11502	SPH
A3A4R18	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A4R19	0698-3449	6		RESISTOR 26.7K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2872-F
A3A4R20	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A4R21	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A4R22	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A4R23	0812-0020	7		RESISTOR .39 +-5% 3W PWI TC=0+-90	91837	CW281-3-T2-39/100-J
A3A4R24	0698-8464	5		RESISTOR 12.5K +-0.5% .125W TF TC=0+-50	12498	NC55
A3A4R25	0698-6835	0		RESISTOR 3.18K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-D
A3A4R26	0698-6835	0		RESISTOR 3.18K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-D
A3A4R27	0683-0275	9		RESISTOR 2.7 +-5% .25W CF TC=0+-400	19701	(CR-25) 1-4-5P-2E7
A3A4R28	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A3A4R29	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A4R30	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A4R31	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A4R32	0812-0066	1	3	RESISTOR .33 +-5% 2W PWI TC=0+-800	11502	SPH
A3A4R33	0812-0066	1		RESISTOR .33 +-5% 2W PWI TC=0+-800	11502	SPH
A3A4R34	0812-0066	1		RESISTOR .33 +-5% 2W PWI TC=0+-800	11502	SPH
A3A4R35	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A4R36	0757-0441	8		RESISTOR 8.25K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-8251-F
A3A4R37	0698-6835	0		RESISTOR 3.16K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-3161-D
A3A4R38	0698-7050	3	1	RESISTOR 4.48K +-0.5% .125W TF TC=0+-50	12498	NC55
A3A4R39	0698-6853	2	1	RESISTOR 7.68K +-0.5% .125W TF TC=0+-50	12498	NC55-1/8-T2-7691-D
A3A4R40	0683-0275	9		RESISTOR 2.7 +-5% .25W CF TC=0-400	19701	(CR-25) 1-4-5P-2E7
A3A4R41	0757-0441	9		RESISTOR 8.25K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-8251-F
A3A4R42	0698-3160	8	1	RESISTOR 31.8K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3162-F
A3A4R43	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A4R44	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A4R45	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A4R46	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A4R47	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A4R48	0757-0401	0	21	RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A4TP1	1251-0800	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A4TP2	1251-0800	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A4TP3	1251-0800	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A4TP4	1251-0800	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A4TP5	1251-0800	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A4U1	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A3A4U2	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A3A4U3	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	27014	LM301AN
A3A4VR1	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
A3A4VR2	1902-3171	7		DIODE-ZNR 11V 5% DO-35 PD=.4W TC=+.062%	28480	1902-3171
A3A4VR3	1902-3330	0	1	DIODE-ZNR 44.2V 2% DO-35 PD=.4W	28480	1902-3330
A3A4VR4	1902-0049	2		DIODE-ZNR 6.19V 6% DO-35 PD=.4W	28480	1902-0049
A3A4XF1	2110-0269	0		FUHLR-CLP-TYP	91506	6008-22CN
A3A4XF2	2110-0269	0		FUHLR-CLP-TYP	91506	6008-22CN
A3A4XF3	2110-0269	0		FUHLR-CLP-TYP	91506	6008-22CN
				A3A4 MISCELLANEOUS		
	0590-0526	6		THREADED INSERT-NUT 4-40 .085-IN-LG SST	28480	0590-0526
	1200-0081	4		INSULATOR-FLG-BSHG NYLON	28480	1200-0081
	1205-0280	8		HEAT SINK TO-66-CS	13103	61660 BASE ONLY
	2200-0105	4	1	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
					28480	3050-0891
	5000-9043	6		PIN	28480	5000-9043
	5040-6843	2		EXTRACTOR	28480	5040-6843
A3A5	08673-60229	6	1	DIGITAL-TO-ANALOG CONVERTER ASSEMBLY	28480	08673-60229
A3A5C1	0180-2141	6	1	CAP-FXD 3.3UF -10 +10TAO OHM	56289	150D335X8050B2
A3A5C2	0160-3879	7	24	CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A5C3	0180-0229	7	2	CAP-FXD 33UF -10 +10TAO OHM	56289	150D336X9010B2

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A5C4	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A5C5	0180-0116	1	7	CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D685X9035B2
A3A5C6	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A5C7	0180-3721	0	1	CAP-FXD 22UF -20 +20AL-ELCTLT7.6OHM	00494	KM50T22RM6.3X16LL
A3A5C8	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A5C9	0180-1731	8	2	CAP-FXD 4.7UF -10 +10TAO OHM	56289	150D475X9050B2
A3A5C10	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A5C11	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A5L1	9100-1631	8	1	INDUCTOR RF-CH-MLD 56UH +-5%	91637	IM-4 56UH 5%
A3A5L2	9100-1641	0	4	INDUCTOR RF-CH-MLD 240UH +-5%	91637	IM-4 240UH 5%
A3A5L3	9100-1641	0		INDUCTOR RF-CH-MLD 240UH +-5%	91637	IM-4 240UH 5%
A3A5MP1	0590-0526	6		THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0526
A3A5MP2	2200-0103	2	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3A5MP3	5000-9043	6		PIN-PC BOARD EXTRACTOR	28480	5000-9043
A3A5MP4	5040-6843	2		EXTRACTOR-PC BOARD	28480	5040-6843
A3A5Q1	1854-0474	4	1	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A3A5Q2	1853-0451	5	7	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A3A5Q3	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A3A5Q4	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A3A5R1	0698-3132	4	3	RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A3A5R2	0699-0476	5	1	RESISTOR 100 +-0.1% .1W TF TC=0+-10	09535	PR1/10
A3A5R3	0698-3442	9	2	RESISTOR 237 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-237R-F
A3A5R4	0699-2410	1	1	RESISTOR 250 +-0.1% .125W TF TC=0+-5	09535	PR1/8
A3A5R5	0699-0078	3	1	RESISTOR 2.1K +-0.1% .1W TF TC=0+-10	09535	PR1/10
A3A5R6	0698-3150	6	4	RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A5R7	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A5R8	2100-4215	3	1	RESISTOR-TRMR 100 10% TF SIDE-ADJ 25-TRN	18612	1202Y100R10
A3A5R9	0699-0236	5	1	RESISTOR 2.5K +-0.1% .1W TF TC=0+-5	09535	PR1/10
A3A5R10	0757-0401	0	4	RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A5R11	0757-0466	6	6	RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A3A5R12	0757-0317	7	1	RESISTOR 1.33K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1331-F
A3A5R13	0698-3136	8	1	RESISTOR 17.8K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1782-F
A3A5R14	0757-0438	3	7	RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A5R15	2100-3122	9	1	RESISTOR-TRMR 100 10% TKF SIDE-ADJ	73138	89PR100
A3A5R16	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A3A5R17	0699-0072	7	1	RESISTOR 6.81M +-1% .125W TF TC=0+-150	19701	5053YL6M810F
A3A5R18	0699-0642	7	1	RESISTOR 10K +-0.1% .1W TF TC=0+-5	09535	PR1/10
A3A5R19	0757-1094	9	2	RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A3A5R20	0698-3455	4	1	RESISTOR 261K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2613-F
A3A5R21	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A5R22	0898-4037	0	1	RESISTOR 46.4 +-1% .125W TF TC=0+-100	D8439	MK2
A3A5R23	0757-0290	5	2	RESISTOR 6.19K +-1% .125W TF TC=0+-100	19701	5033R-1/8-TO-6191-F
A3A5R24	0757-0818	3	1	RESISTOR 826 +-1% .5W TF TC=0+-100	K8479	H2
A3A5R25	0698-3408	7	1	RESISTOR 2.15K +-1% .5W TF TC=+-100	K8479	H2
A3A5R26	0698-3454	3	1	RESISTOR 215K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2153-F
A3A5R27	0757-0346	2	20	RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A5R28	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A5R29	0757-0158	4	1	RESISTOR 619 +-1% .5W TF TC=0+-100	K8479	H2
A3A5TP1	1251-0600	0	79	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A5TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A5TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A5TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A5TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A5U1	1826-0607	6	1	IC V RGL TR-FXD-POS 14.7/15.3V TO-220 PKG	27014	LM340AT-15
A3A5U2	1826-1590	8	1	IC OP AMP PRCN QUAD 14-DIP-P PKG	10899	LT1014CN
A3A5U3	08673-80098	9	2	IC EPROM 256K D27258	28480	08673-80098
A3A5U4	08673-80098	9		IC EPROM 256K D27258	28480	08673-80098
A3A5U5	1826-1386	0	1	D/A 12-BIT 18-PLASTIC CMOS	24355	AD7541AKN
A3A5VR1	1902-0692	1	1	DIODE-ZNR 6.3V 1% DO=7 PD=.4W TC=+.001%	28480	1902-0692
A3A5VR2	1902-0958	2	1	DIODE-ZNR 10V 5% DO=35 PD=.4W TC=+.075%	28480	1902-0958

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A5VR3	1902-0095	6	1	DIODE-ZNR 27V 6% DO=41 PD=1W	04713	1N4750A
A3A6	86701-60016	8	1	YTO DRIVER ASSEMBLY	28480	86701-60016
A3A6C1	0160-3451	1	7	CAP-FXD 0.01UF -20 +80Y5V	09969	DD106NWB305Y5V103Z100V
A3A6C2	0180-1731	8		CAP-FXD 4.7 UF -10 +10TA0 OHM	56289	150D475X9050B2
A3A6C3	0180-0116	1		CAP-FXD 6.8UF -10 +10TA0 OHM	56289	150D685X9035B2
A3A6C4	0160-0574	3	6	CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A3A6C5	0180-0116	1		CAP-FXD 6.8UF -10 +10TA0 OHM	56289	150D685X9035B2
A3A6C6	0160-3451	1		CAP-FXD 0.01UF -20 +80Y5V	09969	DD106NWB305Y5V103Z100V
A3A6C7	0180-2139	2	1	CAP-FXD 10UF -20 +20WT-SLG-TA-ELCTLT6	56289	1090106X0060C2
A3A6C8	0160-3451	1		CAP-FXD 0.01UF -20 +80Y5V	09969	DD106NWB305Y5V103Z100V
A3A6C9	0160-3452	2	1	CAP-FXD 0.02UF -20 +20Y5V	09969	DD107NWB305Y5V203M100V
A3A6C10	0180-0229	7		CAP-FXD 33UF -10 +10TA0 OHM	56289	1500336X9010B2
A3A6C11	0160-3451	1		CAP-FXD 0.01UF -20 +80Y5V	09969	DD106NWB305Y5V103Z100V
A3A6C12	0160-3451	1		CAP-FXD 0.01UF -20 +80Y5V	09969	DD106NWB305Y5V103Z100V
A3A6C13	0180-0197	8	8	CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A3A6C14	0180-0228	6	4	CAP-FXD 22UF -10 +10TA0 OHM	56289	150D226X9015B2
A3A6C15	0180-1746	5	1	CAP-FXD 15UF -10 +10TA0 OHM	56289	150D156X9020B2
A3A6C16	0160-3451	1		CAP-FXD 0.01UF -20 +80Y5V	09969	DD106NWB305Y5V103Z100V
A3A6C17	0160-3460	2	1	CAP-FXD 0.05UF -20 +80Y5V	09969	DD112NWE302Y5V503Z100V
A3A6C18	0160-3451	1		CAP-FXD 0.01UF -20 +80Y5V	09969	DD106NWB305Y5V103Z100V
A3A6C19	0160-3877	5	1	CAP-VAR 100PF -20 +20X7R	09969	RPE121-105X7R101M200V
A3A6CR1	1901-0033	2	6	DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A6CR2	1901-0040	1	18	DIODE-SWITCHING 30V 50MA 2N5 DO-35	9N171	1N4148
A3A6CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2N5 DO-35	9N171	1N4148
A3A6CR4				NOT ASSIGNED		
A3A6CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A6CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A6CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A6CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A6CR9	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A6CR10	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-35	9N171	1N645
A3A6CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A6Q1	1854-0237	7	1	TRANSISTOR NPN SI TO-66 PD=20W FT=10MHZ	28480	1854-0237
A3A6Q2	1854-0810	2	2	TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A3A6Q3	1854-0022	8	2	TRANSISTOR NPN SI TO-39 PD=700MW	07263	517843
A3A6Q4	1854-~~0232~~ 0279	2	1	TRANSISTOR NPN SI TO-39 PD=1W FT=15MH2	28480	1854-0232
A3A6Q5	1854-0712	4	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1854-0712
A3A6Q6	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	56289	CT-1058
A3A6Q7	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A6Q8	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A3A6Q9	1854-0712	3	2	TRANSISTOR-DUAL NPN PD=1.8W	06665	MAT-01GH
A3A6Q10	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A3A6Q11	1853-0050	0	2	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A6Q12	1853-0012	4	2	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	04713	2N2904A
A3A6Q13	1853-0050	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0050
A3A6R1, R2				NOT ASSIGNED		
A3A6R3	0757-0456	6	1	RESISTOR 43.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4322-F
A3A6R4	0698-4492	1	1	RESISTOR 32.4K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-3242-F
A3A6R5	0757-0440	7	3	RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-7501-F
A3A6R6	0757-0440	7		RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-7501-F
A3A6R7	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1961-F
A3A6R8	0698-3440	7	5	RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-196R-F
A3A6R9	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A6R10	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1003-F
A3A6R11	0698-3157	3	3	RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1962-F
A3A6R12	0757-0442	9	8	RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A3A6R13	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-196R-F
A3A6R14	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-101-F
A3A6R15	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-825R-F
A3A6R16	0811-3440	9	1	RESISTOR 126 +-1% 25W PWN TC=0+-2	01686	ALN-25

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A6R17	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1003-F
A3A6R18	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A3A6R19	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1002-F
A3A6R20	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4641-F
A3A6R21	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4641-F
A3A6R22	0757-0290	5		RESISTOR 6.19K +-1% .125W TF TC=0+-100	19701	5033R-1/8-T0-6191-F
A3A6R23	0757-0348	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A6R24	0811-2936	6	1	RESISTOR 15 +-0.1% .5W PN TC=0+-5	14140	1251-1/4-C-15R-B
A3A6R25	2100-0635	3	2	RESISTOR-TRMR 2K 10% TKF SIDE-ADJ 20-TRN	32987	3008P-P25-202
A3A6R26	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-5111-F
A3A6R27	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-5111-F
A3A6R28	0757-0467	8	2	RESISTOR 121K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1213-F
A3A6R29	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A6R30	0698-8025	4	1	RESISTOR 1.91K +-0.25% .125W TF TC=0+-50	19701	5033R-1/8-T2-1911-C
A3A6R31	0757-0402	1	1	RESISTOR 110 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-111-F
A3A6R32	0757-0458	7	7	RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-5112-F
A3A6R33	0757-0428	1	2	RESISTOR 1.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1621-F
A3A6R34	2100-0635	3		RESISTOR-TRMR 2K 10% TKF SIDE-ADJ 20-TRN	32997	3009P-P25-202
A3A6R35	0698-3153	9	2	RESISTOR 3.83K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-3831-F
A3A6R36	0698-3447	4	3	RESISTOR 422 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-422R-F
A3A6R37	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-5112-F
A3A6R38	0698-5673	2	1	RESISTOR 3.9K +-1% .125W TF TC=0+-25	12498	NESS
A3A6R39	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-4641-F
A3A6R40	0698-8420	3	1	RESISTOR 4.22K +-1% .125W TF TC=0+-25	19701	5033R-1/8-T0-4221-F
A3A6R41	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-101-F
A3A6R42	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A6TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A6TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A6TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A6TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A6TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A8U1	1826-0092	3	2	IC OP AMP GP DUAL 8-TO-99 PKG	28480	1826-0092
A3A6VR1	1902-0680	7	1	DIODE-ZNR 1N827 6.2V 5% DO=7 PD=.4W	04713	1N827
A3A6VR2	1902-3404	9	2	DIODE-ZNR 82.5V 5% DO-7 PD=.4W TC-+.082%	28480	1902-3404
A3A6VR3	1902-3323	1	1	DIODE-ZNR 42.2V 5% DO-35 PD=.4W TC=+.08%	28480	1902-3323
A3A6VR4	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.08%	28480	1902-0025
				A3A6 MISCELLANEOUS		
	0390-0526		4			
	1200-0081	4	28	INSULATOR-FLG-BSHG NYLON	28480	1200-0081
	1205-0280	8	1	HEAT SINK TO-66-CS		
	5000-9043	8	8	PIN	28480	5000-9043
	5040-6843	2	8	EXTRACTOR	28480	5040-6843
	2200-0107	6	8	SCREW-MACH 4-40 .375-IN-LG PAN-HD POZI	00000	ORDER BY DESCRIPTION
	2200-0143	0	2	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2190-0003	8	4	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0003
	2260-0001	5	4	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2360-0117	6		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0199	4		SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3A7	08671-80017	8	1	YTO HF DRIVER BD	28480	08671-60017
A3A7C1	0160-0578	7	4	CAP-FXD 0.047UF -1 +1POLYC-MET	28480	0160-0578
A3A7C2	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C3	0160-0578	7		CAP-FXD 0.047UF -1 +1POLYC-MET	28480	0160-0578
A3A7C4	0160-0573	2	1	CAP-VAR 4700PF -20 +20X7R	06383	FD12X7R2A472M
A3A7C5	0160-0127	2	2	CAP-FXD 1UF -20 +20Z5U	09969	RPE113-149Z5U105M50V
A3A7C6	0160-3874	2	3	CAP-FXD OF -0 +0COG	09969	RPE121-105COG100D200V
A3A7C7	0160-0127	2		CAP-FXD 1UF -20 +20Z5U	09969	RPE113-149Z5U105M50V
A3A7C8	0160-4298	6	1	CAP-FXD 4700PF -20 +20X5R	09969	DD12NWB302X5R472M250V
A3A7C9	0160-2055	8	20	CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A7C10	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C11	0160-4084	8	9	CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A7C12	0160-0174	9	1	CAP-FXD 0.47UF -20 +80X5V	09969	RPE123-149Z5U474Z50V
A3A7C13	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C14	0180-0491	5	2	CAP-FXD 10UF -20 +20TAO OHM	12344	T355E106M025A5
A3A7C15	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X902CA2
A3A7C16	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A3A7C17	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C18	0160-4084	0		CAP-FXD 0.1UF -30 +30X7R	09969	RPE122-139X7R104M50V
A3A7C19*	0160-0134	1	1	CAP-FXD 220PF -5 +5MICA	28480	0160-0134
A3A7C20	0160-3533	0	1	CAP-FXD 470PF -5 +5MICA	28480	0160-3533
A3A7C21	0160-3878	6	5	CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A7C22	0160-0158	9	1	CAP-FXD 5600PF -10 +10POLYE-FL	19701	708D1CC552PK201AX
A3A7C23	0180-1719	2	1	CAP-FXD 22UF -10 +10WT-SLG-TA-ELCTLT4	56289	108D226X9025C2
A3A7C24	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C25	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C26	0180-0116	1		CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D685X9035B2
A3A7C27	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C28	0180-0228	6		CAP-FXD 22UF -10 +10TAO OHM	56289	150D226X9015B2
A3A7C29	0160-2055	8		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A7C30	0160-0116	1		CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D685X9035B2
A3A7C31	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C32	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C33	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A3A7C34	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A3A7C35	0180-0234	4	1	CAP-FXD 33UF -20 +20WT-SLG-TA-ELCTLT4	56289	109D336X0075F2
A3A7C36	0180-0228	6		CAP-FXD 22UF -10 +10TAO OHM	56289	150D226X9015B2
A3A7C37	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C38	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C39	0180-0491	5		CAP-FXD 10UF -20 +20TAO OHM	12344	T355E106M025A5
A3A7C40	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C41	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A7C42	0160-2202	8	1	CAP-FXD 75PF -5 +5MICA	28480	0160-2202
A3A7C43	0140-0194	1	2	CAP-FXD 110PF -5 +5MICA	28480	0140-0194
A3A7C44	0160-3872	0	1	CAP-FXD 0F -0 +0C0G	09969	RPE121-105C0G2R2C200V
A3A7C45	0160-0578	7		CAP-FXD 0.047UF -1 +1POLYC-MET	28480	0160-0578
A3A7C46	0160-0578	7		CAP-FXD 0.047UF -1 +1POLYC-MET	28480	0160-0578
A3A7C47	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A7C48*	0160-2248	2	1	CAP-FXD 0F -0 +00C0G	09641	301-000-C0H0-439C
A3A7C49	0160-3491	9	1	CAP-FXD 0.47UF -20 +20X5V	09969	RPE123-166Z5U474M50V
A3A7C50	0160-3874	2		CAP-FXD 0F -0 +0C0G	09969	RPE121-105C0G100D200V
A3A7CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A7CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A7CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A7CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A7CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A7CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A7CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A7K1	0490-0564	0	2	RELAY-REED 1C 350MA 70VAC 5VDC-COIL 10VA	84696	118DIP-87
A3A7K2	0490-0564	0		RELAY-REED 1C 350MA 70VAC 5VDC-COIL 10VA	84696	118DIP-87
A3A7L1	9100-2259	8	1	INDUCTOR RF-CH-MLD 1.5OH +-10%	91637	IM-2 1.5UH 10%
A3A7MP1	1200-0173	5		INSULATOR-XSTR DAP-GL	13103	7717-86 DAP
A3A7MP2	1205-0011	0		HEAT SINK TO-S/TO-39-CS	13103	2228B
A3A7MP3	1205-0037	0		HEAT SINK TO-18-CS	98978	TXBF-018-025B
A3A7MP4	5000-9043	6		PIN	28480	5000-9043
A3A7MP5	5040-6843	2		EXTRACTOR	28480	5040-6843
A3A7MP6	86701-20017	5	1	BD YTO FM DRIV	28480	86701-20017
A3A7Q1	1854-0013	7	1	TRANSISTOR NPN 2N2218A SI TO-6 PD=800MW	07263	2N2218A
A3A7Q2	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	04713	2N2904A
A3A7Q3	1854-0401	7	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A3A7Q4	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A7Q5	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A7Q6	1854-0345	8	4	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A7Q7	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A3A7Q8	1854-0247	9	4	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A3A7Q9	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A3A7Q10	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	28480	1853-0451
A3A7Q11	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3A7Q12	1854-0020	6	1	TRANSISTOR NPN SI TO-8 PD=25W	28480	1854-0020
A3A7Q13	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO=18 PD=400MW	04713	2N2907A
A3A7Q14	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO=18 PD=360MW	28480	1853-0451
A3A7Q15	1855-0417	7	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0417
A3A7R1	0757-0447	4	2	RESISTOR 16.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1622-F
A3A7R2	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A7R3	0757-0443	0	1	RESISTOR 11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1102-F
A3A7R4	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A3A7R5	0698-7277	6	1	RESISTOR 51.1K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5112-F
A3A7R6	0698-7258	3	1	RESISTOR 8.25K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-8251-F
A3A7R7	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A3A7R8	0757-0465	6		RESISTOR 100K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1003-F
A3A7R9	0698-3441	8	1	RESISTOR 215 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-215R-F
A3A7R10	0698-0085	0	4	RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A3A7R11	0698-3432	7	1	RESISTOR 26.1 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R13	0698-3154	0	1	RESISTOR 4.22K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4221-F
A3A7R15	0757-0375	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R16	0757-0375	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R17	0757-0376	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R18	0757-0376	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R19	0757-0376	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R20	0757-0376	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R21	0757-0401	0		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-101-F
A3A7R22	0698-3155	1		RESISTOR 4.64K +-1% /125W TF TC=0+-100	12498	CT4-1/8-TO-4641-F
A3A7R23	0698-3444	1	2	RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-316R-F
A3A7R24	0698-7224	3	4	RESISTOR 316 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-316R-F
A3A7R26	0698-7276	5	2	RESISTOR 46.4K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-4642-F
A3A7R27	0698-7276	5		RESISTOR 46.4K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-4642-F
A3A7R28	2100-3353	8	1	RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3353
A3A7R29	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1861-F
A3A7R30	0683-1555	0	2	RESISTOR 1.5M +-5% .25W CF TC=0-900	09133	CF 1/4
A3A7R31	0698-4414	7	2	RESISTOR 158 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-158R-F
A3A7R32	0698-3157	3		RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1962-F
A3A7R33	0698-7271	0	1	RESISTOR 28.7K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2872-F
A3A7R34	0698-7283	4	1	RESISTOR 90.9K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-9092-F
A3A7R35	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A3A7R36	0698-7272	1	1	RESISTOR 31.6K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-3162-F
A3A7R37	0757-0416	7	6	RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A7R38	0757-0316	6	1	RESISTOR 42.2 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R39	0?98-3155	1		RESISTOR 4.84K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4641-F
A3A7R40	2100-3354	9	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 1-TRN	28480	2100-3354
A3A7R41	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A3A7R42	0698-3153	9		RESISTOR 3.83K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3831-F
A3A7R43	0698-3152	8	2	RESISTOR 3.48K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3481-F
A3A7R44	0698-7229	6	1	RESISTOR 511 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-511R-F
A3A7R45	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A7R46	2100-3350	5	1	RESISTOR-TRMR 200 10% TKF SIDE-ADJ 1-TRN	28480	2100-3350
A3A7R47	0757-0420	3	4	RESISTOR 750 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-751-F
A3A7R48	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R49	0698-3429	2	3	RESISTOR 18.6 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A3A7R50	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R51	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R52	0757-0420	3		RESISTOR 750 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-761-F
A3A7R53	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A7R54	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4641-F
A3A7R55	0698-3443	0	1	RESISTOR 287 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-287R-F
A3A7R56	0698-3150	6		RESISTOR 2.37K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2371-F
A3A7R57	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A7R58	0757-0441	6	2	RESISTOR 8.25K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-8251-F
A3A7R59	0757-0441	8		RESISTOR 8.25K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-8251-F
A3A7R60	0757-0447	4		RESISTOR 16.2K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1822-F
A3A7R61*	0698-0083	8	11	RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A3A7R62	0698-3447	4		RESISTOR 422 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-422R-F
A3A7R63	0698-3436	3	1	RESISTOR 147 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-147R-F
A3A7R65*	0698-3155	1	8	RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4641-F
A3A7R66	0698-3442	9		RESISTOR 237 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-237R-F
A3A7R67	0698-3437	2	1	RESISTOR 133 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-133R-F
A3A7R68	0757-0419	0	2	RESISTOR 681 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-681R-F
A3A7R69	0757-0428	1		RESISTOR 1.62K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1621-F
A3A7R70	0757-0424	7	4	RESISTOR 1.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1101-F
A3A7R71	0686-1525	0	1	RESISTOR 1.5K +-5% .5W CC TC=0+-647	01121	EB1525
A3A7R72	0757-0348	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A7R73	0757-0802	5	2	RESISTOR 162 +-1% .5W TF TC=0+-100	K8470	H2
A3A7R74	0757-0394	0	7	RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A7R75*	0698-0063	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A3A7R77	0757-0420	3		RESISTOR 750 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-751-F
A3A7R78	0757-0802	5		RESISTOR 162 +-1% .5W TF TC=0+-100	K8479	H2
A3A7R79	0698-3452	1	1	RESISTOR 147K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1473-F
A3A7R80	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A3A7R81	0698-7224	3		RESISTOR 316 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-316R-F
A3A7R82	0698-7224	3		RESISTOR 316 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-316R-F
A3A7R83	0683-1555	0		RESISTOR 1.5M +-5% .25W CF TC=0-900	09133	CF 1/4
A3A7R84	0698-4414	7		RESISTOR 158 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-158R-F
A3A7R85	0698-7212	9	5	RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A7R86	0757-0279	0	1	RESISTOR 3.16K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3161-F
A3A7TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A7TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A7TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A7TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A7TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A7U1	1826-0013	8	1	IC OP AMP LOW-NOISE 8-TO-99 PKG	24355	AD741CH
A3A7U2	1826-0081	0	1	IC OP AMP WB 8-TO-99 PKG	27014	LM318H
A3A7U3	1826-0044	5	2	IC OP AMP GP DUAL 14-DIP-C PKG	07263	UA739DC
A3A8	10811-60102	7	1	10MHZ REFERENCE OSCILLATOR ASSEMBLY	28480	10811-80102
	0400-0001	1	1	GROMMET-RND .562-IN-ID .75-IN-GRV-OD	73734	1662
	1620-0094	7	3	SHOCK MOUNT .45-EFF-HGT 1-LB-LOAD-CAP	76005	J-2824-2-1
	86701-00042	4	1	SUPPORT BOTTOM SHOCK MOUNT	28480	86701-00042
	86701-00043	5	1	SUPPORT TOP SHOCK MOUNT	28480	86701-00043
	2420-0001	5	2	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
	2190-0018	5	2	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
A3A8P1				NSR, P/O A3A8		
A3A8W1				NSR, P/O A3A8		
A3A9C1	0160-3036	8	6	CAP-FXD 5000PF -20 +80X5V	09641	2425-011 X5V 502Z
A3A9C2	0160-3036	8		CAP-FXD 5000PF -20 +80X5V	09641	2425-011 X5V 502Z
A3A9C3	0160-4748	1	3	CAP-FXD 1000PF -20 +20	33095	54779004X5F102M
A3A9C4	0160-3036	8		CAP-FXD 5000PF -20 +80X5V	09641	2425-011 X5V 502Z
A3A9C5	0160-3036	8		CAP-FXD 5000PF -20 +80X5V	09641	2425-011 X5V 502Z
A3A9C6	0160-4748	1		CAP-FXD 1000PF -20 +20	33095	54779004X5F102M
A3A9C7	0160-3036	8		CAP-FXD 5000PF -20 +80X5V	09641	2425-011 X5V 502Z
A3A9C8	0160-4748	1		CAP-FXD 1000PF -20 +20	33095	54779004X5F102M
A3A9C9	0160-3036	8		CAP-FXD 5000PF -20 +80X5V	09641	2425-011 X5V 502Z
A3A9J1	1250-0691	7	6	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-045-4610-220
A3A9J2	1250-0691	7		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-045-4610-220
A3A9J3	1250-0691	7		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-045-4610-220

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A9J4	1250-0691	7		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-045-4610-220
A3A9J5	1250-0691	7		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-045-4610-220
A3A9J6	1250-0691	7		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-045-4610-220
	86701-00010	6	1	COVER, SAMPLER	28480	86701-00010
	86701-00011	7	1	COVER, PHASE LOCK	28480	86701-00011
A3A9U1	86701-67001	5	1	SAMPLER, 2-6.5 GHZ	28480	86701-67001
A3A9W1	86701-20064	2	1	CABLE ASSEMBLY, YTO OUTPUT	28480	86701-20064
A3A9W2	86701-20066	4	1	CABLE ASSEMBLY, ATTENUATOR OUTPUT	28480	86701-20066
A3A9W3	86701-20065	3	1	CABLE ASSEMBLY, FILTER INPUT	28480	86701-20065
A3A9W4	86701-60052	2	1	CABLE ASSEMBLY, COAX, BLACK	28480	86701-60052
A3A9A1	0955-0098	1	1	DIRECTIONAL COUPLER ASSEMBLY	28480	0955-0098
A3A9A2	86701-60025	9	1	ASSEMBLY, YTO INTERCONNECT	28480	86701-60025
A3A9A2J1	1250-0543	8	1	CONNECTOR-RF SMB M PC 50-OHM	98291	51-053-0349-BE8
A3A9A2W1	86701-60010	2	1	CABLE ASSEMBLY, YTO LOOP RIBBON	28480	86701-60010
A3A9A2W2	86701-60009	9	1	CABLE ASSEMBLY, YTO LOOP RIBBON	28480	86701-60009
A3A9A3	5086-7131	9	1	2-6.2 GHZ YTO ASSEMBLY	28480	5086-7131
A3A9A4	~~86701-60024~~	8	1	ASSEMBLY, YTO PHASE DETECTOR	28480	86701-60024
A3A9A4C1	0160-2307	4	2	CAP-FXD 47PF -5 +5MICA	28480	0160-2307
A3A9A4C2	0160-2307	4		CAP-FXD 47PF -5 +5MICA	28480	0160-2307
A3A9A4C3	0160-0574	3		CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A3A9A4C4	0160-0574	3		CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A3A9A4C5	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A9A4C6	0160-0574	3		CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A3A9A4C7				NOT ASSIGNED		
A3A9A4C8				NOT ASSIGNED		
A3A9A4C9	0160-3538	5	2	CAP-FXD 750PF -5 +5MICA	28480	0160-3538
A3A9A4C10	0160-3538	5		CAP-FXD 750PF -5 +5MICA	28480	0160-3538
A3A9A4C11	0160-0165	8	1	CAP-FXD 0.056UF -10 +10POLYE-FL	19701	708D1MP563PK201AX
A3A9A4C12	0160-0575	4	1	CAP-VAR 0.047UF -20 +20X7R	06132	B37987-M5473-MS1
A3A9A4C13	0160-3873	1	1	CAP-FXD OF -0 +0COG	09969	RPE121-105COG4R7D200V
A3A9A4C14	0160-2453	1	1	CAP-FXD 0.22UF -10 +10POLYE-FL	19701	708D1MV224PK800AX
A3A9A4C15	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A4C16	0160-0168	1	1	CAP-FXD 0.1UF -10 +10POLYE-FL	19701	708D1MR104PK201AX
A3A9A4C17	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A4C18	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A4C19	0180-0116	1		CAP-FXD 8.8UF -10 +10TAO OHM	56289	150D685X9035B2
A3A9A4C20	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A3A9A4C21	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A3A9A4C22	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A4C23	0160-3874	2		CAP-FXD OF -0 +0COG	09969	RPE121-105COG100D200V
A3A9A4C24	0160-0574	3		CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A3A9A4C25	0140-0190	7	1	CAP-FXD 39PF -5 +5MICA	28480	0140-0190
A3A9A4C26	0160-3490	8	1	CAP-FXD 1UF -20 +20X5V	09969	RPE113Z5U105M50V
A3A9A4C27	0160-0574	3		CAP-VAR 0.022UF -20 +20X7R	06383	FD12X7R2A223M
A3A9A4C28	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A3A9A4C29	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A3A9A4C30	0160-2200	6	1	CAP-FXD 43PF -5 +5MICA	28480	0160-2200
A3A9A4C31	0160-2264	2	1	CAP-FXD 20PF -5 +5COG	09641	301-000-COG0-200J
A3A9A4C32	0140-0194	1		CAP-FXD 110PF -5 +5MICA	28480	0140-0194
A3A9A4C33	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A3A9A4CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A9A4CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A9A4CR3				NOT ASSIGNED		
A3A9A4CR4				NOT ASSIGNED		
A3A9A4CR5	1901-0050	3	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3A9A4CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A9A4CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A9A4CR8-A3A9A4CR10				NOT ASSIGNED		
A3A9A4CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A9A4CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A9A4CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A9A4CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A3A9A4J1-J6	1251-0600	0	6	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A9A4L1	9100-2254	3	2	INDUCTOR RF-CH-MLD 390NH +-10%	91637	IM-2 .39UH 10%
A3A9A4L2	9100-1620	5	3	INDUCTOR RF-CH-MLD 15UH +-10%	91637	IM-4 15UH 10%
A3A9A4L3	9100-1620	5		INDUCTOR RF-CH-MLD 15UH +-10%	91637	IM-4 15UH 10%
A3A9A4L4	9100-1641	0		INDUCTOR RF-CH-MLD 240UH +-5%	91637	IM-4 240UH 5%
A3A9A4L5	9100-1620	5		INDUCTOR RF-CH-MLD 15UH +-10%	91637	IM-4 15UH 10%
A3A9A4L6	9100-1641	0		INDUCTOR RF-CH-MLD 240UH +-5%	91637	IM-4 240UH 5%
A3A9A4L7	9100-0368	6	3	INDUCTOR RF-CH-MLD 330NH +-10%	91637	IM-2 .33UH 10%
A3A9A4L8	9140-0179	1	2	INDUCTOR RF-CH-MLD 22UH +-10%	91637	IM-4 22UH 5%
A3A9A4L9	9100-2254	3		INDUCTOR RF-CH-MLD 390NH +-10%	91637	IM-2 .39UH 10%
A3A9A4L10	9100-0368	6		INDUCTOR RF-CH-MLD 330NH +-10%	91637	IM-2 .33UH 10%
A3A9A4L11	9140-0179	1		INDUCTOR RF-CH-MLD 22UH +-10%	91637	IM-4 22UH 5%
A3A9A4Q1	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=380MW	28480	1854-0404
A3A9A4Q2	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=380MW	28480	1853-0451
A3A9A4Q3	1855-0395	0	1	TRANSISTOR J-FET N-CHAN D-MODE TO-52 SI	17856	FN2645
A3A9A4Q4	1854-0712	3		TRANSISTOR-DUAL NPN PD=1.8W	06665	MAT-01GH
A3A9A4Q5	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=380MW	28480	1854-0404
A3A9A4R1	0698-7288	9	1	RESISTOR 147K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1473-F
A3A9A4R2	0757-0464	5	1	RESISTOR 90.9K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-9092-F
A3A9A4R3	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A9A4R4	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A3A9A4R5	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A9A4R6	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A9A4R7	0698-7219	6	2	RESISTOR 196 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-196R-F
A3A9A4R8	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A9A4R9	0698-7219	6		RESISTOR 196 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-196R-F
A3A9A4R10	0698-3429	2		RESISTOR 19.6 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A3A9A4R11	0698-3429	2		RESISTOR 19.6 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A3A9A4R12	0698-3440	7		RESISTOR 100 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-100R-F
A3A9A4R13	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-196R-F
A3A9A4R14	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A3A9A4R15	0698-3155	1		RESISTOR 4.64K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4641-F
A3A9A4R16	0757-0280	3	5	RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A9A4R17	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A9A4R18	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A9A4R19	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A9A4R20*	0757-0421	4	7	RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A9A4R21	0757-1094	9		RESISTOR 1.47K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1471-F
A3A9A4R22	0698-3152	8		RESISTOR 3.48K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-3481-F
A3A9A4R23				NOT ASSIGNED		
A3A9A4R24	0698-3157	3		RESISTOR 19.6K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1962-F
A3A9A4R25	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A9A4R26	0698-4020	1	1	RESISTOR 9.53K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-9531-F
A3A9A4R27	0698-0085	0		RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2811-F
A3A9A4R28	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A9A4R29	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A9A4R30	2100-3212	8	1	RESISTOR-TRMR 200 10% TKF TOP-ADJ 1-TRN	28480	2100-3212
A3A9A4R31	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A9A4R32	0757-0440	7		RESISTOR 7.5K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-7501-F
A3A9A4R33	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A9A4R34	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A9A4R35	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A9A4R36	0757-0438	3		RESISTOR 5.11K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5111-F
A3A9A4R37	0757-0422	6	2	RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A3A9A4R38	0757-0422	5		RESISTOR 909 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-909R-F
A3A9A4R39	0757-0467	8		RESISTOR 121K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1213-F
A3A9A4R40				NOT ASSIGNED		

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A9A4R41				NOT ASSIGNED		
A3A9A4R42				NOT ASSIGNED		
A3A9A4R43	0757-0458	7		RESISTOR 51.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-5112-F
A3A9A4R44	0757-0442	9		RESISTOR 10K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1002-F
A3A9A4R45	0698-3132	4		RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A3A9A4R46	0698-3132	4		RESISTOR 261 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2610-F
A3A9A4R47	0757-0416	7		RESISTOR 511 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-511R-F
A3A9A4R48	0698-7236	7	1	RESISTOR 1K +-1% .05W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A9A4R49	0757-0439	4	1	RESISTOR 6.81K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6811-F
A3A9A4R50	0698-0085	0		RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A3A9A4R51	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A3A9A4R52	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F
A3A9A4R53	2100-3211	7	1	RESISTOR-TRMR 1K 10% TKF TOP-ADJ 1-TRN	28480	2100-3211
A3A9A4R54	0698-7245	8	1	RESISTOR 2.37K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-2371-F
A3A9A4R55	0698-7242	6	1	RESISTOR 1.78K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-1781-F
A3A9A4R56	0698-7253	8	1	RESISTOR 5.11K +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-5111-F
A3A9A4R57	0757-0418	9	1	RESISTOR 519 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-519R-F
A3A9A4R58	0698-3451	0	1	RESISTOR 133K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1333-F
A3A9A4TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A9A4TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A9A4TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A9A4TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A9A4TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A9A4U1	1826-0092	3		IC OP AMP GP DUAL 8-TO-99 PKG	28480	1826-0092
A3A9A4U2	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P PKG	27014	LM311N
A3A9A4U3	1826-0044	5		IC OP AMP GP DUAL 14-DIP-C PKG	07263	UA739DC
A3A9A4U4	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74L5123N
A3A9A4U5	1820-1344	8	1	IC PL LOOP 14-DIP-C PKG	04713	MC12040L
A3A9A4U6	1820-0802	1	1	IC GATE ECL NOP QUAD 2-INP	04713	MC10102P
A3A9A4U7	1820-0817	8	2	IC FF ECL D-M/S DUAL	04713	MC10131P
A3A9A4U8	1810-0204	6	1	NETWORK-RES 8-SIP 1.0K OHM X 7	01433	750-81
A3A9A4U9	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A3A9A4VR1	1902-1260	1	2	DIODE-ZNR 1N5525C 6.2V 2% DO-7 PD=.4W	04713	1N5525C
A3A9A4VR2	1902-1260	1		DIODE-ZNR 1N5525C 6.2V 2% DO-7 PD=.4W	04713	1N5525C
A3A9A4VR3	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	07263	1N751A
A3A9A4VR4	1902-3104	6	1	DIODE-ZNR 5.62V 5% DO-35 PD=.4W	28480	1902-3104
	4330-0145	9	2	INSULATOR-BEAD GLASS	28480	4330-0145
A3A9A5	86701-60089	5	1	ASSEMBLY, SAMPLER	28480	86701-80069
A3A9A5C1	0121-0046	2	2	CAP-VAR COG	52763	304322 9/35PF N650
A3A9A5C2	0121-0046	2		CAP-VAR COG	52763	304322 9/35PF N650
A3A9A5C3	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A3A9A5C4	0180-0118	1		CAP-FXD 6.8UF -10 +10TAO OHM	56289	150D685X9035B2
A3A9A5C5	0180-2055	9		CAP-FXD 0.01UF -20 +80YSV	28480	0160-2055
A3A9A5C6	0180-2150	5	1	CAP-FXD 33PF -5 +5MICA	28480	0160-2150
A3A9A5C7	0180-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A5C8	0180-3878	8		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A9A5C9	0180-0197	8		CAP-FXD 2.2UF -10 +10TAO OHM	56289	150D225X9020A2
A3A9A5C10	0160-2285	3	1	CAP-FXD 22PF -5 +5COG	09641	301-000-COGO-220J
A3A9A5C11	0160-3878	6		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A9A5C12	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A5C13	0180-0228	6		CAP-FXD 22UF -10 +10TAO OHM	56289	150D226X9015B2
A3A9A5C14	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A5C15	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A5C16				NOT ASSIGNED		
A3A9A5C17	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A9A5C18	0160-3878	8		CAP-VAR 1000PF -20 +20X7R	09969	RPE121-105X7R102M100V
A3A9A5C19	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A9A5C20	0160-0938	4	1	CAP-FXD 430PF -5 +5MICA	28480	0160-0939
A3A9A5C21	0160-2055	9		CAP-FXD 0.01UF -20 +80YSV	28480	0160-2055
A3A9A5C22*	0140-0196	2	1	CAP-FXD 130PF -5 +5MICA	28480	0140-0196

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A9A5C23	0160-2055	9		CAP-FXD 0.01UF -20 +80YSV	28480	0160-2055
A3A9A5C24	0140-0193	0	2	CAP-FXD 82PF -5 +5MICA	28480	0140-0193
A3A9A5C25	0140-0193	0		CAP-FXD 82PF -5 +5MICA	28480	0140-0193
A3A9A5C26	0160-2308	5	1	CAP-FXD 36PF -5 +5MICA	28480	0160-2308
A3A9A5C27	0160-2055	9		CAP-FXD 0.01UF -20 +80YSV	28480	0160-2055
A3A9A5C28	0160-2055	9		CAP-FXD 0.01UF -20 +80YSV	28480	0160-2055
A3A9A5C29	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A9A5C30	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A9A5C31	0160-2055	9		CAP-FXD 0.01UF -20 +80YSV	28480	0160-2055
A3A9A5C32	0160-3879	7		CAP-FXD 0.01UF -20 +20X7R	09969	RPE121-105X7R103M100V
A3A9A5E1				NOT ASSIGNED		
A3A9A5J1	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	00779	2-331677-9
A3A9A5J2				NOT ASSIGNED		
A3A9A5L1				NSR, P/O CIRCUIT BOARD		
A3A9A5L2	9140-0144	0	1	INDUCTOR RF-CH-MLD 4.7UH +-10%	91637	IM-2 4.7UH 10%
A3A9A5L3	9100-1623	8	1	INDUCTOR RF-CH-MLD 27UH +-5%	91637	IM-4 27UH 5%
A3A9A5L4	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH +-10%	91637	IM-2 .22UH 10%
A3A9A5L5	9100-2258	7	2	INDUCTOR RF-CH-MLD 1.2UH +-10%	91637	IM-2 1.2UH 10%
A3A9A5L6	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH +-10%	91637	IM-2 1.2UH 10%
A3A9A5L7	9140-0770	8	1	INDUCTOR RF-CH-MLD 50NH +-10%	24226	10-M050K-2
A3A9A5L8				NSR, P/O CIRCUIT BOARD		
A3A9A5L9				NSR, P/O CIRCUIT BOARD		
A3A9A5L10	9140-0539	7	1	INDUCTOR RF-CH-MLD 3UH +-5%	91637	IM-2 3UH 5%
A3A9A5L11	9100-0368	6		INDUCTOR RF-CH-MLD 330NH +-10%	91637	IM-2 .33UH 10%
A3A9A5L12	9100-2249	6	2	INDUCTOR RF-CH-MLD 150NH +-10%	91637	IM-2 .15UH 10%
A3A9A5L13	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH +-10%	91637	IM-2 .18UH 10%
A3A9A5L14	9100-2249	8		INDUCTOR RF-CH-MLD 150NH +-10%	91637	IM-2 .15UH 10%
A3A9A5Q1	1854-0247	8		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
	1200-0173	5	7	INSULATOR-XSTR DAP-GL	13103	7717-86 DAP
A3A9A5Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A9A5Q3	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A3A9A5Q4	1855-0235	7	1	TRANSISTOR J-FET N-CHAN D-MODE TO-S2 SI	04713	U310(SELECTED)
A3A9A5Q5	1853-0015	7	1	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A3A9A5Q6	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A9A5Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3A9A5Q8	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
	1200-0173	5		INSULATOR-XSTR DAP-GL	13103	7717-86 DAP
A3A9A5R1	2100-3383	4	1	RESISTOR-TRMR 50 10% TKF TOP-ADJ 1-TRN	28480	2100-3383
A3A9A5R2	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A9A5R3	0698-3440	7		RESISTOR 196 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-196R-F
A3A9A5R4	0698-0085	0		RESISTOR 2.61K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2611-F
A3A9A5R5	0757-0424	7		RESISTOR 1.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1101-F
A3A9A5R6	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A9A5R7	0757-0278	9	1	RESISTOR 1.78K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1781-F
A3A9A5R8	0757-0796	6	1	RESISTOR 82.5 +-1% .5W TF TC=0+-100	K8479	H2
A3A9A5R9	0757-0399	5	1	RESISTOR 82.5 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-82R5-F
A3A9A5R10	0698-3457	6	1	RESISTOR 316K +-1% .125W TF TC=0+-100	12498	CT4
A3A9A5R11	0757-0470	3	1	RESISTOR 162K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1623-F
A3A9A5R12				NOT ASSIGNED		
A3A9A5R13	0698-7316	3	1	RESISTOR 147 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-147R-F
A3A9A5R14				NOT ASSIGNED		
A3A9A5R15	0757-0424	7		RESISTOR 1.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1101-F
A3A9A5R16	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	08439	MK2
A3A9A5R17	0757-0424	7		RESISTOR 1.1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1101-F
A3A9A5R18	0757-0419	0		RESISTOR 681 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-681R-F
A3A9A5R19	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A9A5R20	0698-7224	3		RESISTOR 316 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-316R-F
A3A9A5R21	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A9A5R22	0698-7195	7	1	RESISTOR 19.8 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-19R8-F
A3A9A5R23	0698-0083	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1961-F

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A9A5R24	0698-0084	9	1	RESISTOR 2.15K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-2151-F
A3A9A5R25	0698-0082	7	2	RESISTOR 464 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4640-F
A3A9A5R26	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A9A5R27	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A9A5R28	0698-0082	7		RESISTOR 464 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-4640-F
A3A9A5R29	0698-7212	9		RESISTOR 100 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-100R-F
A3A9A5R30	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A9A5R31	0757-0420	3		RESISTOR 750 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-751-F
A3A9A5R32	0698-3439	4	2	RESISTOR 178 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-178R-F
A3A9A5R33	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A9A5R34	0757-0280	3		RESISTOR 1K +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-1001-F
A3A9A5R35	0698-3439	4		RESISTOR 178 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-178R-F
A3A9A5R36	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A9A5R37	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A9A5R38	0757-0276	7	2	RESISTOR 61.9 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6192-F
A3A9A5R39	0757-0276	7		RESISTOR 61.9 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-6192-F
A3A9A5R40	0757-0394	0		RESISTOR 51.1 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-51R1-F
A3A9A5R41	0698-7196	8	1	RESISTOR 21.5 +-1% .05W TF TC=0+-100	12498	C3-1/8-TO-21R5-F
A3A9A5TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
	1205-0011	0	3	HEAT SINK TO-5/TO-38-C5	13103	22268
	1205-0037	0	2	HEAT SINK TO-18-C5	98978	TXBF-019-0259
	1251-3172	7	2	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	00779	2-331677-9
	4330-0146	9		INSULATOR-BEAD GLASS	28480	4330-0146
A3A9A6	0955-0331	5	1	ATTENUATOR ASSEMBLY, 18 DB	28480	0955-0331
A3A9A7	9135-0040	4	1	6.2 GHZ LOW PASS FILTER ASSEMBLY	12598	F-3469
A3A10	08672-60215	9	1	MOTHER BOARD ASSEMBLY	28480	08672-60215
A3A10CR1	1901-0743	1	1	DIODE-PWR RECT 1N4004 400V 1A DO-41	11983	1N4004
A3A10CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A3A10CR3	1990-0517	4	1	LED-LAMP LUM-INT=3MCD IF=20MA-MAX BVR=5V	28480	5082-4655
A3A10J1				NSR, P/O A3W11		
A3A10J2	1251-3905	4	1	CONN-POST TYPE .100-PIN-SPCG 20-CONT	28480	1251-3905
A3A10J3	1252-0473	7	1	CONN-POST TYPE .100-PIN-SPCG 5-CONT	28480	1252-0473
A3A10J4	1251-8836	0	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8836
A3A10K1	0490-0618	5	1	RELAY 2C 24VDC-COIL 5A 115VAC	77342	R40-E0161-1
A3A10L1	9100-3922	4	12	INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L2	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L3	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L4	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L5	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L6	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L7	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L8	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L9	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L10	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L11	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10L12	9100-3922	4		INDUCTOR-FIXED 120-1300 HZ	28480	9100-3922
A3A10R1	0757-0421	4		RESISTOR 825 +-1% .125W TF TC=0+-100	12498	CT4-1/8-TO-825R-F
A3A10R2	0627-3321	0	1	RESISTOR 3.3K +-10% .5W CC TC=0+647	01121	EB3321
A3A10R3	0683-7515	4	1	RESISTOR 750 +-5% .25W CF TC=0-400	19701	(CR-25) 1-4-5P-750E
A3A10R4	0686-7525	2	1	RESISTOR 7.5K +-5% .5W CC TC=0+647	01121	EB7525
A3A10R5	0683-2225	3	1	RESISTOR 2.2K +-5% .25W CF TC=0-400	19701	(CR-25) 1-4-5P-2K2
A3A10XA3A2	1251-8116	8	4	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A3A10XA3A3	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A3A10XA3A4	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A3A10XA3A5	1251-8116	8		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS		
A3A10XA3A6	1252-2856	9	2	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS		
A3A10XA3A7	1252-2856	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS		
	0380-0677	3	1	SPACER-RVT-ON .150-IN-LG .152-IN-ID	28480	0380-0677
	0380-0076	6	4	SPACER-RVT-ON .5-IN-LG .152-IN-ID	28480	0380-0076
	0380-1819	7	2	SPACER-RVT-ON .313-IN-LG .15-IN-ID	28480	0380-1819

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
	0380-1715	2	5	STANDOFF-RVT-ON .156-IN-LG 4-40-THD	28480	0380-1715
	0590-0528	6	14	THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0528
	1251-2313	6	10	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	00779	3-332070-5
A3A11	0980-0443	1	1	POWER LINE MODULE (DOES NOT INCLUDE A3F1)	05245	F2058D
A3A11TB1				LINE VOLTAGE SELECTOR CARD, NSR, P/O A3A11		
A3A12	08673-60133	1	1	RECTIFIER ASSEMBLY	28480	08673-60133
A3A12C1	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A12C2	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A12C3	0160-2055	9		CAP-FXD 0.01UF -20 +80Y5V	28480	0160-2055
A3A12C4	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A3A12C5	0160-0230	0	1	CAP-FXD 1UF -20 +20TA0 OHM	56289	150D105X0050A2
A3A12C6	0160-4084	8		CAP-FXD 0.1UF -20 +20X7R	09969	RPE122-139X7R104M50V
A3A12C7	0160-0197	8		CAP-FXD 2.2UF -10 +10TA0 OHM	56289	150D225X9020A2
A3A12C8	0160-6633	7	2	CAP-FXD 2.2UF -20 +80Y5V	06383	FD23Y5V2A225Z
A3A12C9	0160-6633	7		CAP-FXD 2.2UF -20 +80Y5V	06383	FD23Y5V2A225Z
A3A12C10	0160-4005	3	1	CAP-FXD 1UF -20 +20Y5V	09969	RPE114-130ZSU105M100V
A3A12CR1	1901-0662	3	13	DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR2	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR3	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR4	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR5	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR6	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR7	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR8	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR9	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR10	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR11	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR12	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR13	1901-0765	7	2	DIODE-PWR RECT 1N5812 50V 20A 35NS DO-4	30043	1N5812
A3A12CR14	1901-0765	7		DIODE-PWR RECT 1N5812 50V 20A 35NS DO-4	30043	1N5812
A3A12CR15				NOT ASSIGNED		
A3A12CR16	1884-0018	5	2	THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A3A12CR17	1801-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A3A12CR18	1884-0018	5		THYRISTOR-SCR 2N4186 VRRM=200	04713	2N4186
A3A12DS1	1990-0487	7	1	LED-LAMP LUM-INT-2MCD BVR-5V	28480	HLMP-1401
A3A12F1	2110-0001	8	1	FUSE (INCH) 1A 250V NTD FE UL	75915	312 001
A3A12MP1				NOT ASSIGNED		
A3A12MP2	0590-0526	6		THREADED INSERT-NUT 4-40 .065-IN-LG SST	28480	0590-0528
A3A12MP3	1200-0081	4		INSULATOR-FLG-BSMG NYLON	28480	1200-0081
A3A12MP4	1251-2313	6		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	00779	3-332070-5
A3A12MP5	2740-0003	5	3	NUT-HEX-W/LKWR 10-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
A3A12MP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	12360	94-155-1010-01-03-00
A3A12MP7	5000-9043	6		PIN-P.C. BOARD EXTRACTOR	28480	5000-9043
A3A12MP8	5040-6843	2		BOARD EXTRACTOR	28480	5040-6843
A3A12MP9	86701-00018	4	1	HEAT SINK	28480	86701-00018
A3A12MP10	2740-0003	5		NUT-HEX-W/LKWR 10-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
A3A12MP11	2200-0107	6		SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3A12MP12	3050-0894	0	1	WASHER-FL MTLC 5.0 MM 5.4-MM-ID	28480	3050-0894
A3A12R1	0698-0093	8		RESISTOR 1.96K +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-1961-F
A3A12R2	2100-3123	0	1	RESISTOR-TRMR 500 10% TKF SIDE-ADJ	73138	89PR500
A3A12R3	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A12R4	0698-3444	1		RESISTOR 316 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-316R-F
A3A12R5	0698-3447	4		RESISTOR 422 +-1% .125W TF TC=0+-100	12498	CT4-1/8-T0-422R-F
A3A12R6	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A12R7	0698-3428	1	1	RESISTOR 14.7 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A3A12R8	0757-0346	2		RESISTOR 10 +-1% .125W TF TC=0+-100	D8439	MK2
A3A12U1	1826-0126	4	1	IC V RGLTR-FXD-POS 17.3/18.7V TO-3 PKG	07283	7818KC
	1200-0043	8	1	INSULATOR-XSTR ALUMINUM	76530	322047
A3A12VR1	1902-3263	8	1	DIODE-ZNR 24.9V 2% DO-35 PD=4W	28480	1902-3263

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A3A12VR2	1902-3404	9		DIODE-ZNR 82.5V 5% DO-7 PD= 4W TC=+.082%	28480	1902-3404
A3A12XF1	2110-0269	0	1	FUHLR-CLP-TYP	91506	6008-32CN
				A3 CHASSIS PARTS		
A3AT1	86701-60066	8	2	TERMINATION, 50 OHM	28480	86701-60066
A3AT2	86701-60066	8		TERMINATION, 50 OHM	28480	86701-60066
A3B1	3160-0288	8	1	[illegible]		[illegible]
A3C1	0180-0452	8	1	CAP-FXD -75 +10AL-ELCTLT0.09 OHM	09023	5001334U025AC2A
A3C2	0180-0454	0	1	CAP-FXD 4200UF -75 +10AL-ELCTLT0.1 OHM	09023	500422U075AC2A
A3C3	0180-0453	9	1	CAP-FXD 8700UF -75 +10AL-ELCTLT0.086 OHM	09023	DOM872U040AC2A
A3C4	0180-2788	9	1	CAP-FXD -100 +10AL -ELCTLT0.054 OHM	19701	3188EE303V025AH
A3C6	0160-4065	5	1	CAP-FXD 0.1UF -20 +20PPR-MET	11890	PME 271 M 610
A3F1	2110-0003	0	1	FUSE (INCH) 3A 250V NTD FE UL (100/120 VAC)	75915	312 003
A3F1	2110-0043	8	1	FUSE (INCH) 1.5A 250V NTD FE UL (220/240 VAC)	11870	04.015
A3J1				NSR (P/O A3W11)		
A3J2-J6				NOT ASSIGNED		
A3J7				NSR; P/O A3W7		
A3J8				NSR; P/O A3W5		
A3J9				NSR; P/O A3W2		
A3J10				NSR; P/O A3W3		
A3P1	5060-0346	0	1		28480	5060-0346
A3Q1	1854-0618	8	2	TRANSISTOR NPN SI DARL TO-3 PD=150W	04713	MJ3000
A3Q2	1854-0294	8	1	TRANSISTOR NPN SI TO-3 PO=115W FT=500KHZ	28480	1854-0294
A3Q3	1854-0618	8		TRANSISTOR NPN SI DARL TO-3 PD=150W	04713	MJ3000
A3Q4	1854-0679	1	1	TRANSISTOR NPN 2N5885 SI TO-3 PD=200W	04713	2N5885
A3S1	3101-0070	3	1	SWITCH-SD DPDT MINTR .5A 125VAC/DC (FREQ. STD. INT/EXT SWITCH)	79727	GF-128-0000
A3T1	86701-60032	8	1	TRANSFORMER	28480	86701-60032
A3W1	86701-60046	4	1	CABLE ASSEMBLY,FM INPUT (BROWN)	28480	86701-60046
A3W2	86701-60007	7	1	CABLE ASSEMBLY,FREQ.STD.OUTPUT(GRA/VIO)	28480	86701-60007
A3W3	86701-60063	5	1	CABLE ASSEMBLY,FREQ. REF. (GRAY)	28480	86701-60063
A3W4	86701-60039	5	1	CABLE ASSEMBLY,YTM TUNE(YELLOW)	28480	86701-60039
A3W5	86701-60005	5	1	CABLE ASSEMBLY, 10 MHZ OUTPUT(GRA/BLU)	28480	86701-60005
A3W6	86701-60049	7	1	CABLE ASSEMBLY, 10 MHZ OUTPUT (BLUE)	28480	86701-80049
A3W7	86701-80004	4	1	CABLE ASSEMBLY, 100 MHZ OUTPUT (GRA/GRN)	28480	86701-60004
A3W8	86701-60053	3	1	CABLE ASSEMBLY,M/N OUTPUT(WHT/ORG)	28480	86701-60053
A3W9				NOT ASSIGNED		
A3W10				NOT ASSIGNED		
A3W11	86701-60050	0	1	CABLE ASSEMBLY (A1 INTERCONNECT) (INCLUDES A3J1 AND A3A10J1)	28480	86701-60050
A3W12				NOT ASSIGNED		
A3W13	86701-60006	6	1	CABLE ASSEMBLY,FREQ.STD. INPT(GRA/BLK)	28480	86701-60006
A3W14	86701-60056	6	1	CABLE ASSEMBLY,20/30MHZ OUTPUT (GREEN)	28480	86701-60056
A3W15	88701-60033	9	1	CABLE ASSEMBLY,FM TUNE (VIOLET)	28480	86701-60033
A3W16	86701-60055	5	1	CABLE ASSEMBLY,YTO TUNE (GRAY)	28480	86701-60055
A3W17	86701-60054	4	1	CABLE ASSEMBLY,INTEGRATED FM OUT (WHITE)	28480	86701-60054
A3W18	5080-9462	9	1	HP-IB ADAPTER	28480	5060-9462
				MISCELLANEOUS PARTS (SEE FIGURE 8-1)		
MP1	1450-1345	5	2	TILT STAND SST	28480	1460-1345
MP2	5040-7201	8	4	FOOT	28480	5040-7201
MP3	5041-6819	4	2	HANDLE, CAP-FRONT	28480	5041-6819
MP4	5001-0439	8	2	TRIM, FRONT SIDE	28480	5001-0439
MP5	5060-9805	4	2	STRAP HANDLE 21 IN	28480	5060-9805
MP6	0515-1132	4	2	SCREW-MACH M5 X 0.8 10MM-LG	28480	0515-1132
MP7	5041-6820	7	2	HANDLE, CAP-REAR	28480	5041-6820
MP8	5060-9938	4	2	SIDE COVER	28480	5060-9938
MP9	0515-1232	5	4	SCREW-MACH M3.5 X 0.6 8MM-LG PAN-HD	28480	0515-1232
MP10	5040-7221	2	4	STANDOFF, REAR PANEL	28480	5040-7221
MP11	0515-1245	0	1	SCREW-SPCL M3.5 X 0.6 12MM-LG	00000	ORDER BY DESCRIPTION
[illegible]	[illegible]			[illegible]		

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
MP12	0510-1253	0	1	RETAINER-RING E-RING-EXT 3.580-MM-DIA	K5569	5133-14-ZI
MP13	5061-9436	9	1	COVER TOP 21 IN	28480	5061-9436
MP14	5040-7202	9	1	TRIM. TOP	28480	5040-7202
MP15	5061-9448	3	1	COVER BOTTOM 21 IN	28480	5061-9448
MP16	08672-20214	4	1	INSULATOR, A3A10 MTHR/BD	28480	08672-20214
MP17-MP20				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-2)		
MP21	5021-5803	2	1	FRAME-FRONT	28480	5021-5803
MP22	2360-0334	9	4	SCREW-MACH 6-32 .312-IN-LG 100 DEG	28480	2360-0334
MP23	86701-20001	7	1	FRAME SUPPORT	28480	86701-20001
MP24	2360-0333	8	28	SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP25	86701-20003	9	1	GUIDE PIN	28480	86701-20003
MP26	0520-0166	3	3	SCREW-MACH 2-56 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP27	86701-00003	7	1	CHASSIS RF MODULE DIV	28480	86701-00003
MP28	0515-1331	5	12	SCREW-METRIC SPECIALTY M4 X 0.7 THD; 7MM	28480	0515-1331
MP29	0515-1055	0	4	SCREW-MACH M4 X 0.7 6MM-LG 90-DEG-FLH-HD	28480	0515-1055
MP30	86701-00062	8	1	STRUT LOWER LEFT	28480	86701-00062
MP31	2360-0115	4	15	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP32	5021-5883	8	2	STRUT, UPPER CORNER	28480	5021-5883
MP33	2360-0195	0	7	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP34	0360-0268	6	4	TERMINAL-SLDR LUG LK-MTG FOR-#6-SCR	79963	804-.138
MP35	0515-0896	5	4	SCREW-MACH M4 X 0.7 10MM-LG	28480	0515-0896
MP36	2420-0001	5	3	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
MP37	1400-0907	8	1	CABLE CLAMP-HFCL .312-DIA .5-WD		
MP38	3050-0227	3	3	WASHER-FL MTLC NO. 6 .149-IN-ID	80120	AN960C-6
MP39	2190-0018	5	17	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP40	2360-0197	2	4	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP41	0520-0166	3		SCREW-MACH 2-56 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP42	0590-0106	8	2	NUT-HEX-PLSTC LKG 2-56-THD .143-IN-THK	00000	ORDER BY DESCRIPTION
MP43	86701-20092	6	1	FRAME-REAR	28480	86701-20092
MP44	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP45	86701-00057	1	1	DIVIDER CENTER	28480	86701-00057
MP46	86701-20005	1	1	GUIDE-P.C. BOARD (REAR)	28480	86701-20005
MP47	86701-20006	2	1	GUIDE-P.C. BOARD (FRONT)	28480	86701-20006
MP48	2190-0017	4	19	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
MP49	2580-0002	4	3	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
MP50	88701-00002	6	1	CHASSIS CONT MODULE DIV	28480	86701-00002
MP51	5001-8232	5	1	GUSSET, SIDE	28480	5001-8232
MP52	86701-00063	9	1	STRUT LOWER RIGHT	28480	86701-00063
MP53-MP70				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-4)		
MP71	5040-6927	3	2	DIVIDER STRIP	28480	5040-6927
MP72	1480-0553	5	8	CLIP, WINDOW	28480	1480-0553
MP73	08672-20019	6	1	WINDOW, RF	28480	08672-20019
MP74	08672-00064	0	2	RFI SCREEN	28480	08672-00064
MP75	08640-40044	2	1	SCREW, METER ZERO	28480	08640-40044
MP76	1460-0553	5		CLIP, WINDOW	28480	1460-0553
MP77	1460-0553	5		CLIP, WINDOW	28480	1460-0553
MP78	08672-20194	9	1	WINDOW-CONTROLLER	28480	08672-20194
MP79	08672-00064	0		RFI SCREEN	28480	08672-00064
MP80	1460-0553	5		CLIP, WINDOW	28480	1460-0553
MP81	5040-6927	3		DIVIDER STRIP	28480	5040-6927
MP82	08731-210	2	1	NUT, KNURLED, RF OUTPUT	28480	08731-210
MP83	0370-2389	7	2	KNOB, RANGE	28480	0370-2389
MP84	0590-1649	6		INSULATOR	00000	ORDER BY DESCRIPTION
MP85	0370-0584	0	1	KNOB, VERNIER	28480	0370-0584
MP86	08672-00047	9	1	PANEL-FRONT-RF	28480	08672-00047
MP87	08672-00002	6	1	PANEL-FRONT-CONTROLLER	28480	08672-00002
MP88	08672-40005	3	4	PUSHBUTTON	28480	08672-40005

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
MP89	0370-2389	7		KNOB, TUNING	28480	0370-2389
MP90	00310-48801	0	2	WASHER, SHOULDERED INSULATING	28480	00310-48801
MP91-MP100				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-5)		
MP101	1460-0553	5		STAMPING-BE-CU CLIP-WINDOW	28480	1460-0553
MP102	2200-0142	9	9	SCREW-MACH 4-40 .312-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
MP103	08672-20037	9	4	SUPPORT FRONT PANEL	28480	08672-20037
MP104	08672-00035	5	1	METER SPACE	28480	08672-00035
MP105	08672-00050	4	1	METER CLAMP	28480	08672-00050
MP106	2200-0105	4	8	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP107, MP108				NOT ASSIGNED		
MP109	08672-20057	3	1	HEAT SINK	28480	08672-20057
MP110	08672-20056	2	1	LED PAD	28480	08672-20056
MP111	2200-0143	0	11	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP112	2190-0019	6	47	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP113	2200-0105	4		SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP114	08672-00037	7	1	SUB PANEL	28480	08672-00037
MP115	2200-0137	2	5	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP116	2190-0017	4		WASHER-LK HLCL NO. 8 .188-IN-ID	28480	2190-0017
MP117	2850-0001	8	3	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP118	2190-0016	3	2	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
MP119				NOT ASSIGNED		
MP120	1400-0017	0	2	CLMP-CA .312-DIA .375-WD NYL	28520	3310 RED
MP121	2200-0105	4		SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP122	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP123	3050-0105	6	25	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
MP124	3130-0517	4	1	SHAFT & INDEX ASSEMBLY 1.250 STRUT CTR	76854	4-8337-224
MP125	2190-0022	1	1	WASHER-LK INTL T 3/8 IN .384-IN-ID	78189	1820-00
MP126	2950-0030	3	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP127	08672-00034	4	1	POT BRACKET	28480	08672-00034
MP128	2950-0079	0	1	NUT-HEX-DBL-CHAM 5/8-24-THD .125-IN-THK	28480	2950-0079
MP129	0590-1011	6	1	NUT-HEX-DBL-CHAM 7/16-28 THD .12-IN-THK	28480	0590-1011
MP130	2190-0104	0	1	WASHER-LK INTL T 7/16 IN .439-IN-ID	78189	1922-04
MP131	2950-0132	6	1	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP132	08672-20083	5	2	PANEL BUSHING	28480	08672-20083
MP133	5020-0446	7	2	HEX NUT	28480	5020-0446
MP134	2190-0067	4	2	WASHER-LK INTL T 1/4 IN .256-IN-ID	78189	1914-05
MP135	2200-0155	4	6	SCREW-MACH 4-40 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP136	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP137	3050-0105	6		WASHER-FL MTLC NO.4 .125-IN-ID	28480	3050-0105
MP138-MP150				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-6)		
MP151	1460-0553	5		STAMPING-BE-CU CLIP-WINDOW	28480	1460-0553
MP152	2200-0142	9		SCREW-MACH 4-40 .312-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
MP153	08672-20037	9		SUPPORT, FRONT PANEL	28480	08672-20037
MP154-MP157				NOT ASSIGNED		
MP158	08672-20032	4	1	LED HEATSINK	28480	08672-20032
MP159	2200-0142	9		SCREW-MACH 4-40 .312-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
MP160	08672-20037	9		SUPPORT, FRONT PANEL	28480	08672-20037
MP161	2200-0137	2		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP162	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP163, MP164				NOT ASSIGNED		
MP165	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP166	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
MP167	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP168	08672-00122	1	1	SUB PANEL	28480	08672-00122
MP169	0510-1148	2	1	RETAINER-PUSH-ON KB-TO-SHFT EXT	78553	C4154-017-27
MP170	2200-0143	0		SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP171	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP172	3050-0105	6		WASHER FL MTLC NO. 4 .115-IN-ID	28480	3030-0105

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
MP173-MP200				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-7)		
MP201	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP202	4320-0002	6	1	U CHANNEL NPRN .047-IN-WD-CHAN	28480	4320-0002
MP203	2360-0113	2	6	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP204	08672-00028	6	1	SUPPORT, PC FRONT	28480	08672-00028
MP205	08672-00032	2	1	SHIELD, ALC BOARD	28480	08672-00032
MP206	2360-0113	2		SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP207				NOT ASSIGNED		
MP208	08672-00029	7	1	SUPPORT, PC REAR	28480	08672-00029
MP209	2360-0113	2		SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP210	3050-0105	6		WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
MP211	2200-0103	2	47	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP212	08672-00043	5	1	RF TOP COVER	28480	08672-00043
MP213	2200-0169	0	1	SCREW-MACH 4-40 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP214				NOT ASSIGNED		
MP215	08672-00026	4	1	SUPPORT, REAR	28480	08672-00026
MP216, MP217				NOT ASSIGNED		
MP218	2360-0201	9	1	SCREW-MACH 8-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP219	08672-00039	9	1	DECK, RF OUTPUT ASSEMBLY	28480	08672-00039
MP220	3050-0010	2	4	WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0010
MP221	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP222	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP223	2360-0205	3	1	SCREW-MACH 6-32 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP224	08672-20114	3	1	RFI SUPPRESSOR	28480	08672-20114
MP225-MP230				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-8)		
MP231	2360-0113	2		SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP232				NOT ASSIGNED		
MP233	2200-0149	6	2	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP234	2360-0195	0		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP235	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP236	3050-0066	8	1	WASHER-FL MTLC NO. 6 .147-IN-ID	73734	1451
MP237	1400-0017	0		CLMP-CA .312-DIA .375-WD NYL	28520	3310 RED
MP238	2360-0113	2		SCREW-MACH 6-32 .25-IN-LG-PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP239	3050-0105	6		WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
MP240	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP241	2200-0143	0		SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP242	2200-0142	9		SCREW-MACH 4-40 .312-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
MP243	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP244				NOT ASSIGNED		
MP245	08672-00048	0	1	TIE BAR	28480	08672-00048
MP246				NOT ASSIGNED		
MP247	08672-00038	4	1	GUSSET, HINGE PLATE	28480	08672-00038
MP248	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP249	2360-0115	4		SCREW MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP250	1400-0755	3	2	CLIP-CMPNT .25-DIA .75-WD PVC	06915	KKU-4
MP251	08672-00031	1	1	BRACKET, ATTENUATOR	28480	08672-00031
MP252	1400-0755	3		CLIP-CMPNT .25-DIA .75-WD PVC	06915	KKU-4
MP253	0520-0127	6	1	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP254	2190-0890	1	1	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0890
MP255	08672-20113	2	1	SHIELD, ATTENUATOR	28480	08672-20113
MP256	08672-00061	7	1	ISOLATOR, BRACKET	28480	08672-00061
MP257	3050-0105	6		WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
MP258	2190-0010	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP259	2200-0143	0		SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP260	08672-20112	1	1	ISOLATOR SHIELD	28480	08672-20112
MP261	1200-0081	4	9	INSULATOR-FLG-BSHG NYLON	28480	1200-0081
MP262				NOT ASSIGNED		
MP263	08672-00040	2	2	RIGHT GUSSET	28480	08672-00040

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
MP264, MP265				NOT ASSIGNED		
MP266	2420-0001	5		NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
MP267	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP268	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP269	0520-0163	0	1	SCREW-MACH 2-56 .188-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP270	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP271	2360-0190	5	2	SCREW-MACH 6-32 .188-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
MP272	2360-0334	9		SCREW-MACH 6-32 .312-IN-LG 100 DEG	28480	2360-0334
MP273	08672-00075	3	1	TIE BAR (POTENTIOMETER SUPPORT)	28480	08672-00075
MP274-MP300				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-9)		
MP301	86701-00016	2	1	SUPPORT-CAPACITOR	28480	86701-00016
MP302	1400-0673	4	1	CLMP-CA 2-DIA .5-WD SST	18076	MS21103-32
MP303	3050-0227	3		WASHER-FL MTLC NO. 6 .149-IN-ID	80120	AN960C-6
MP304	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP305	2360-0197	2		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP306	2190-0011	8	8	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1910-00
MP307	2580-0099	1	8	SCREW-MACH 10-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP308	0360-0268	6		TERMINAL-SLDR LUG LK-MTG FOR-#6-SCR	79963	804-.138
MP309	86701-00004	8	1	SUPPORT-PC GUIDE	28480	86701-00004
MP310	2190-0017	4		WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
MP311	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP312	2190-0017	4		WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
MP313	2510-0101	7	6	SCREW-MACH 8-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP314	2190-0018	5		WASHER-LK HLCL NO. 8 .141-IN-ID	28480	2190-0018
MP315	2360-0199	4	4	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP316	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP317	2380-0195	0		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP318	2190-0017	4		WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
MP319	2510-0101	7		SCREW-MACH 8-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP320	5040-0170	6	1	BOARD SUPPORT	28480	5040-0170
				MISCELLANEOUS PARTS (SEE FIGURE 6-10)		
MP321	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP322	2200-0155	4		SCREW-MACH 4-40 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP323	2200-0139	4	4	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP324	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP325	86701-00030	0	1	BAFFLE, AIR, BOTTOM	28480	86701-00030
MP326	86701-00024	2	1	SCOOP, AIR	28480	88701-00024
MP327	86701-00029	7	1	BAFFLE, AIR, TOP	28480	86701-00029
MP328	2200-0105	4		SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP329				NOT ASSIGNED		
MP330	5021-3208	7	1	HOUSING-REF BLK	28480	5021-3208
MP415	2360-0220			SCREW		
MP416	2420-0003			NUT, HEX		
MP417	5040-6999			FAN COVER		
MP418	5001-6544			BRACKET MOUNTING		
MP419	3160-0300			FAN GUARD		
MP420	8120-5990			FAN CORD		
MP421	0380-1730			SPACER		
MP422	1400-0510			CLAMP, CABLE		
MP331	2190-0019	6		WASHER-LK HLCL NO. 4. 115-IN-ID	28480	2190-0019
MP332	86701-40001	9	1	EXTRACTOR. PC	28480	86701-40001
MP333-MP350				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-11)		
MP351	2360-0117	6	7	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP352	2360-0117	6		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP353	86701-00028	6	1	SPRING. FLAT	28480	86701-00028
MP354	2380-0117	6		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP355	0360-0268	6		TERMINAL-SLDR LUG LK-MTG FOR-#6-SCR	79963	804-138
MP356	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
MP357	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP358	2360-0117	6		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP359	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP360	2360-0219	9	2	SCREW-MACH 6-32 1.375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP361	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP362	08672-00020	8	1	PANEL, REAR, HP-IB	28480	08672-00020
MP363	08672-00013	9	1	PANEL, REAR, SUB	28480	08672-00013
MP364	08672-00018	4	1	PLATE, REAR GUIDE	28480	08672-00018
MP385-MP370				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-12)		
MP371	1200-0081	4		INSULATOR-FLG-BSHG NYLON	28480	1200-0081
MP372	1200-0043	8		INSULATOR-XSTR ALUMINUM	76530	322047
MP373	2190-0102	8	4	WASHER-LK INTL T 15/32 IN .472-IN-ID	78188	1922-01
MP374	2950-0035	8	1	NUT-HEX-DBL-CHAM 15/32-32-THO	00000	ORDER BY DESCRIPTION
MP375	6960-0121	8	1	PLUG-HOLE DOME-HD FOR .625-D-HOLE BRS	28480	6960-0121
MP376	6960-0111	6	1	PLUG-HOLE DOME-HD FOR .531-D-HOLE BRS	57771	D2733
MP377	86701-00027	5	1	PANEL-REAR	28480	86701-00027
MP378	2200-0111	2	9	SCREW-MACH 4-40 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP379	2200-0115	6	9	SCREW-MACH 4-40 75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP380	86701-20004	0	1	HEAT SINK	28480	86701-20004
MP381-MP400				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-13)		
MP401-MP409				NOT ASSIGNED		
MP410	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP411				NOT ASSIGNED		
MP412	86701-00066	2	1	COVER GUARD	28480	86701-00066
MP413	3030-0152	1	3	SCREW-SET 4-40 .312-IN-LG SMALL CUP-PT	28480	3030-0152
MP414				NOT ASSIGNED		
MP415	2360-0220			SCREW		
MP416	2420-0003			NUT, HEX		
MP417	5040-6999			FAN COVER		
MP418	5001-6544			BRACKET, MOUNTING		
MP419	3160-0300			FAN GUARD		
MP420	8120-5990			FAN CORD		
MP421	0380-1730			SPACER		
MP422	1400-0510			CLAMP, CABLE		
MP423-MP430				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-14)		
MP431	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP432	2380-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP433	08672-00004	8	1	GUSSET, RIGHT DCU	28480	08672-00004
MP434	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP435	08672-00003	7	1	GUSSET, CENTER DCU	28480	08872-00003
MP436-MP450				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-15)		
MP451	2200-0145	2	1	SCREW-MACH 4-40 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP452	2190-0019	6		WASHER-LK HLCL NO.4 .115-IN-ID	28480	2190-0019
MP453	3050-0105					
MP454				NOT ASSIGNED		
MP455	85660-00054	6	1	CLAMP BATTERY	28480	85660-00054
MP456				NOT ASSIGNED		
MP457				NOT ASSIGNED		
MP458	0624-0097	9	1	SCREW-TPG 4-40 .188-IN-LG PAN-HD-POZI	28480	0824-0097
MP459	06672-60028	3	1	BATTERY HOLDER ASSEMBLY	28480	08672-60029
MP460	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP461	2360-0333	9		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP462	2510-0121	1	3	SCREW-MACH 6-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP463-MP465				NOT ASSIGNED		
MP466	08672-20146	1	1	MOUNTING BLOCK	28480	08672-20146
MP467	0624-0268	6	3	SCREW-TPG 4-24 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
MP468	08672-00127	6	1	LEFT GUSSET	28480	08672-00127
MP469, MP470				NOT ASSIGNED		
MP471	0624-0268	6		SCREW-TPG 4-24 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP472	08672-20120	1	1	STEP WASHER	28480	08672-20120
MP473	2360-0195	0		SCREW-MACH 6-32 312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP474	2190-0018	6		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP475	3050-0010	2		WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0010
MP476				NOT ASSIGNED		
MP477	08672-20142	7	1	AMPLIFIER HOUSING	28480	08672-20142
MP478				NOT ASSIGNED		
MP479	2510-0121	1		SCREW-MACH 8-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP480	0624-0268	6		SCREW-TPG 4-24 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP481	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP482	2200-0137	2		SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP483	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP484				NOT ASSIGNED		
MP485	2360-0334	9		SCREW-MACH 6-32 .312-IN-LG 100 DEG	28480	2360-0334
MP486	08672-00015	1	1	SUPPORT-FRONT OCU	28480	08672-00015
MP487	06672-00006	0	1	TIE BAR	28480	08672-00006
MP488	2360-0113	2		SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP489-MP500				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 6-16)		
MP501	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP502	86701-00011	7	1	COVER-PHASE LOCK	28480	86701-00011
MP503	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP504	86701-20009	5	1	HOUSING-CASTING	28480	86701-00011
MP505	2200-0103	2		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP506	86701-00054	8	1	SPACER-SAMPLER	28480	86701-00054
MP507	3050-0105	6		WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
MP508	2200-0136	3	1	SCREW-MACH 4-40 .188-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
MP509	2200-0111	2		SCREW-MACH 4-40 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP510	86701-00010	6	1	COVER-SAMPLER	28480	86701-00010
MP511	2190-0124	4	6	WASHER-LK INTL T NO. 10 .195-IN-ID	16179	500222
MP512	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP513	0620-0247	1	2	SCREW-MACH 2-56 .625-IN-LG PAN-HD-POZI	28480	0520-0247
MP514	2360-0117	6		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP515	2360-0117	6		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP516	2360-0197	2		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP517	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP518	3050-0010	2		WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0010
MP519	1400-0024	9	1	CLMP-CA .25-DIA .5-WD NYL	85480	F6NY-250NA
MP520	86701-00058	2	1	DECK-YTO PHASE LOCK	28480	86701-00058
MP521-MP660				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 8-132)		
MP661	1400-0082	9	2	CLMP-CA .125-DIA .375-WD NYL	85480	F4NY-125 NA
MP662	2190-0891	2	2	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	2190-0891
MP663	2190-0018	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP664	2200-0141	8	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP665	2360-0333	8		SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
MP666	08672-00012	8	1	COVER, CONTROLLER	28480	08672-00012
MP667-MP680				NOT ASSIGNED		
				MISCELLANEOUS PARTS (SEE FIGURE 8-134)		
MP681	2200-0151	0	2	SCREW-MACH 4-40 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP682	2190-0019	6		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0019
MP683	0570-0034	9	5	SCREW-MACH 4-40 .25-IN-LG RD-HD-SLT	00000	ORDER BY DESCRIPTION
MP684	1400-0907	7	1	CABLE CLAMP-HFCL .125-DIA .5-WD		
MP685	3050-0227	3		WASHER-FL MTLC NO. 6 .149-IN-ID	80120	AN960C-6
MP686	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
MP687	2360-0197	2		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

Table 6-4. Code List of Manufacturers

Mfr. Code	Manufacturer Name	Address			Zip Code
C1433	AB ELEKTRONIK GMBH	SALZBURG		AU	A-501
D8439	ROEDERSTEIN/RESISTA GMBH	LANDSHUT		GM	8300
K1793	BOWTHORPE HELLERMAN LTD ELEC DIV	WEST SUSSEX		EG	
K5589	SALTERFIX LTD	WEST MIDLANDS		EG	
K8479	HOLSWORTHY ELECTRONICS LTD	HOLSWORTHY		EG	
S0545	NEC ELECTRONICS INC	MTN VIEW	CA	US	84043
U1453	BARBER & COLEMAN LTD	SALE CHES		EG	
00000	ANY SATISFACTORY SUPPLIER				
00115	ACE GLASS INC	VINELAND	NJ		08360
00494	ADDRESSOGRAPH FARRINGTON	TREVOSE	PA		44117
00779	AMP INC	HARRISBURG	PA	US	17111
01121	ALLEN-BRADLEY CO INC	EL PASO	TX	US	79935
01295	TEXAS INSTRUMENTS INC	DALLAS	TX	US	75265
01686	RCL ELECTRONICS INC	NORTHBROOK	IL	US	60062
02111	HAMILTON STANDARD CONTROLS INC	WINDWOR LOCKS	CT	US	06096
04072	BELL INDUSTRIES INC. MILLER JW DIV	COMPTON	CA		90224
04222	AVX CORP	GREAT NECK	NY	US	11021
04713	MOTOROLA INC	ROSELLE	IL	US	60195
05245	CORCOM INC	LIBERTYVILLE	IL	US	60048
05820	EG & G INC	WELLESLEY	MA	US	02181
05878	U S POLYMERIC INC	STAMFORD	CT		08904
06132	COMPUTER TERMINAL CORP	SAN ANTONIO	TX		78784
06383	PANDUIT CORP	TINLEY PARK	IL	US	60477
06394	HOOVER UNIVERSAL INC BALL & RLR DIV	SALINE	MI		68310
06587	AMERICAN SILVER CO ING	FLUSHING	NY		11364
06665	PRECISION MONOLITHICS INC	SANTA CLARA	CA	US	95054
06776	ROBINSON NUGENT INC	NEW ALBANY	IN	US	47150
06915	RICHCO PLASTIC CO	CHICAGO	IL	US	60648
07283	FAIRCHILD SEMICONDUCTOR CORP	CUPERTINO	CA	US	95014
09023	CORNELL-DUBILIER/SANGAMO	WAYNE	NJ	US	07470
09133	KIERULFF ELECTRONICS INC	LOS ANGELES	CA		90015
08353	C & K COMPONENTS INC	NEWTON	MA	US	02158
09464	DRYCO MFG CO INC	CHICAGO	IL		60612
09535	JOHNSON MATTHEY AND MALLORY LTD	TORONTO		CN	
09553	MARCONI INSTR DIV ENGLISH ELEC CORP	ENGLEWOOD	NJ		07831
09641	ELECTRI-FLEX COMPANY	ROSELLE	IL		60172
09922	BURNDY CORP	NORWALK	CT	US	06856
09969	DALE ELECTRONICS INC	YANKTON	SD	US	57078
10899	EASTERN AIR DEVICES INC	GREAT NECK	NY		11021
11502	IRC INC	BOONE	NC	US	28607
11870	MELABS INC	PALO ALTO	CA		94304
11890	TOMIC ELECTRIC DIV	DETROIT	MI		48234
11983	NORTRONICS CO INC	MINNEAPOLIS	MN		55427
12014	CHICAGO RIVET & MACHINE CO	NAPERVILLE	IL	US	60540
12330	MONTROSE PRODUCTS CO	AUBURN	MA	US	01501
12344	TALLY CORP	KENT	WA		98031
12360	ALBANY PROD CO DIV OF PHEUMO DYN	NORWALK	CT		06850
12403	CANFIELD H O CO OF INDIANA INC THE	SEYMOUR	IN		47274
12496	CRYSTALONICS, DIV TELEDYNE	CAMBRIDGE	MA		02140
12598	RLC ELECTRONICS INS	MT KISCO	NY	US	10549
12697	CLAROSTAT MFG CO INC	DOVER	NH	US	03820
13103	THERMALLOY INC	DALLAS	TX	US	75234
14140	EDISON ELEK DIV MCGRAW-EDISON	MANCHESTER	NH		03130
15636	ELEC-TROL INC	SAUGUS	CA	US	91350
16179	M/A-COM INC	BURLINGTON	MA	US	01803
16453	WESTERN MICROWAVE INC	SUNNYVALE	CA	US	94089
16956	DENNISON MFG CO	FRAMINGHAM	MA	US	01701
17117	ELECTRONIC MOLDING CORP	WOONSOCKET	RI	US	02896
17858	SILICONIX INC	SANTA CLARA	CA	US	95054
18076	UMPCO INC	GARDEN GROVE	CA		91746
18324	SIGNETICS CORP	SUNNYVALE	CA	US	94086
18612	VISHAY INTERTECHNOLOGY INC	MALVERN	PA	US	19366

Table 6-. Code List of Manufacturers

Mfr. Code	Manufacturer Name	Address			Zip Code
19701	MEPCO/CENTRALAB INC	RIVIERA	FL	US	33404
2M627	ROHM CORP	IRVINE	CA	US	92713
20940	MICRO-OHM CORP	EL TORO	CA	US	92630
21649	OTTO CONTROLS DIV OTTO ENGRG INC	CARPENTERSVILLE	IL		60110
23050	PRODUCT COMPONENT CORP	MT VERNON	NY		10553
23730	MARK EYELET & STAMPING CO	WATERBURY	CT		06716
24226	GOWANDA ELECTRONICS CORP	GOWANDA	NY	US	14070
24355	ANALOG DEVICES INC	NORWOOD	MA	US	02062
24931	SPECIALTY CONNECTOR CO	FRANKLIN	IN	US	46131
26742	METHODE ELECTRONICS INC	CHICAGO	IL	US	60858
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	US	95052
27264	MOLEX INC	LISLE	IL	US	60532
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA		94304
28520	HEYCO MOLDED PRODUCTS	KENTWORTH	NJ	US	07033
30043	SOLID STATE DEVICES INC	LA MIRADA	CA		90638
32159	WEST-CAP ARIZONA	SAN FERNANDO	CA	US	91340
32559	BIVAR INC	SANTA ANA	CA		92705
32997	BOURNS INC	RIVERSIDE	CA	US	92507
33095	SPECTRUM CONTROL INC	ERIE	PA	US	16505
33399	TELE-TECH CORP	BOZEMAN	MT	US	59771
34899	FAIR RITE PRODUCTS CORP	WALLKILL	NY	US	12589
46384	PENN ENGINEERING & MFG CORP	DOYLESTOWN	PA	US	18901
52648	PLESSEY SEMICONDUCTORS	SANTA ANA	CA		82705
52763	STETTNER & CO	LAUF		GM	D-856
55322	SAMTEC	NEW ALBANY	IN		47150
56289	SPRAGUE ELECTRIC CO	LEXINGTON	MA	US	02173
57771	STIMPSON EDWIN S CO INC	BROOKLYN	NY		11705
6E259	AMETEK INC	PAOLI	PA	US	19301
71744	GENERAL INSTRUMENT CORP	CLIFTON	NJ	US	07012
72799	GENERAL ELECTRIC CO	FAIRFIELD	CT	US	06430
72962	ELASTIC STOP NUT DIVOF HARVARD	UNION	NJ	US	07083
73138	BECKMAN INDUSTRIAL CORP	FULLERTON	CA	US	82635
73734	FEDERAL SCREW PRODUCTS CO	CHICAGO	IL		60618
74970	EF JOHNSON CO	WASECA	MN	US	56093
75915	LITTELFUSE INC	DES PLAINES	IL	US	60016
76005	LORD CORP INDUSTRIAL PROD DIV	ERIE	PA	US	16514
76381	3M CO	ST PAUL	MN	US	55144
76530	MONADNOCK CO, THE	CITY OF IND	CA		91747
76854	OAK SWITCH SYSTEMS INC	CRYSTAL LAKE	IL	US	60014
77342	POTTER & BRUMFIELD INC	PRINCETON	IN	US	47671
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN	IL		60125
78488	STACKPOLE CARBON CO	ST MARYS	PA		15867
78553	TINNERMAN PRODUCTS INC	CLEVELAND	OH		44101
79727	C-W INDUSTRIES	WARMINSTER	PA		18974
79963	ZIERICK MFG CO	MT KISCO	NY		10549
80120	SCHNITZER ALLOY PRODUCTS CO	ELIZABETH	NJ		07206
83186	VICTORY ENGINEERING CORP	SPRINGFIELD	NJ	US	07081
85480	BRADY W H CO	MILWAUKEE	WI		53209
86926	SEASTROM MFG CO	GLENDALE	CA		91201
9N171	UNITRODE CORP	LEXINGTON	MA	US	02173
91506	AUGAT INC	MANSFIELD	MA	US	02048
91637	DALE ELECTRONICS INC	COLUMBUS	NE	US	68801
92895	AMERICAN OIL & SUPPLY CO	NEWARK	NJ		07105
94696	MAGNECRAFT ELECTRIC CO	CHICAGO	IL		60630
98291	ITT SEALECTRO CORP	TRUMBULL	CT	US	06611
98978	INTL ELECTRONIC RESEARCH CORP	BURBANK	CA	US	91502

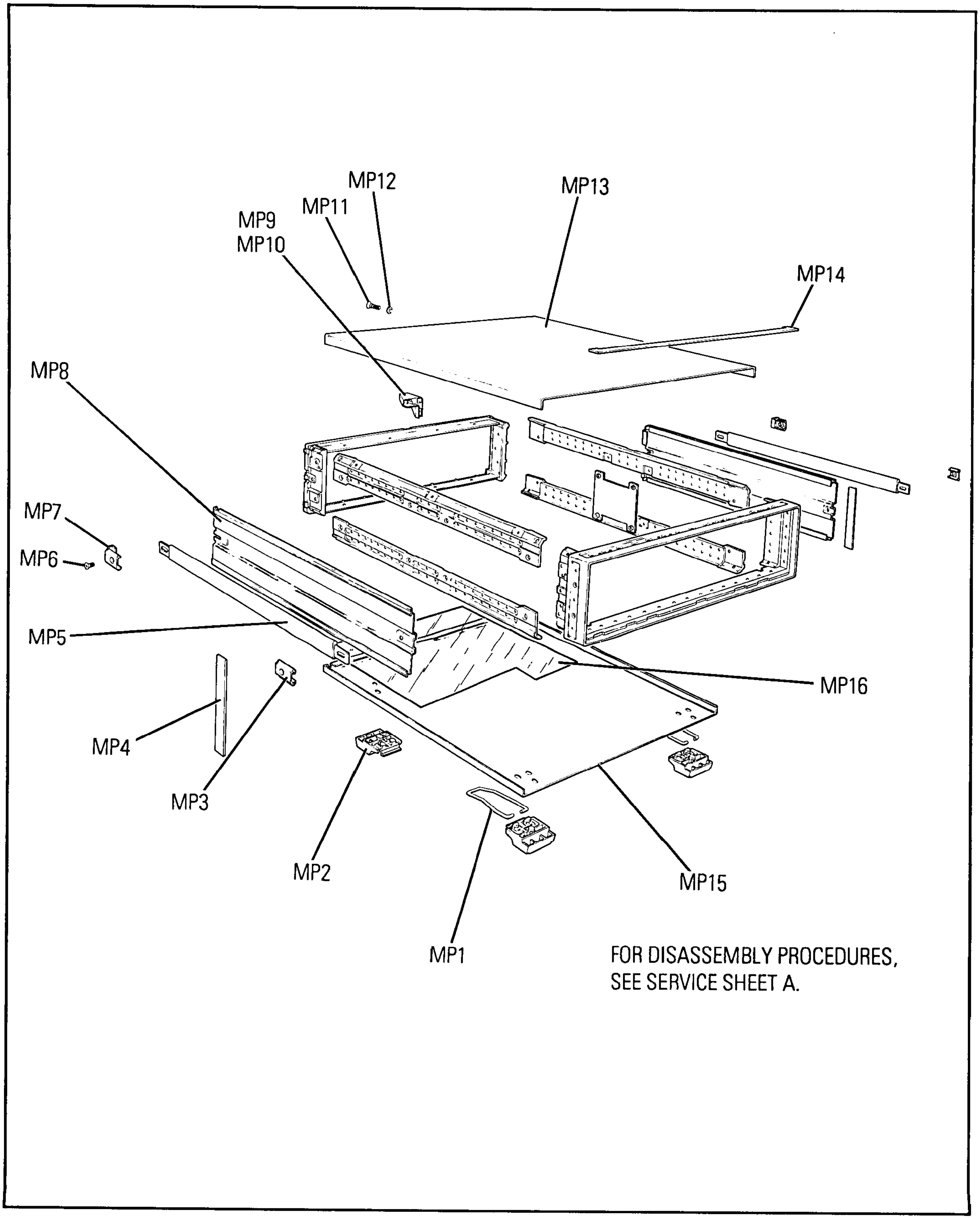


Figure 6-1. Cabinet Illustrated Parts Breakdown

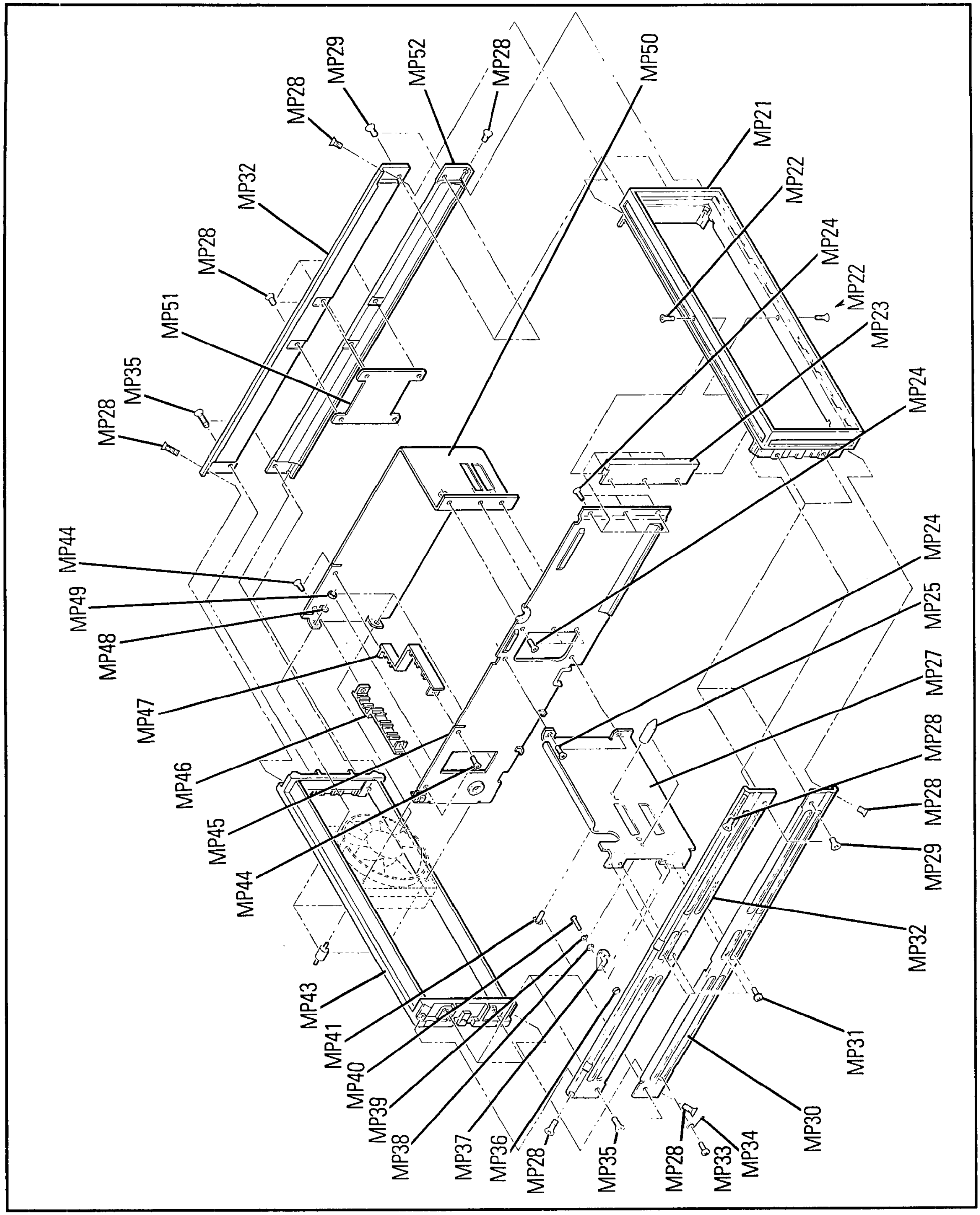


Figure 6-2. Cabinet and Frame Illustrated Parts Breakdown

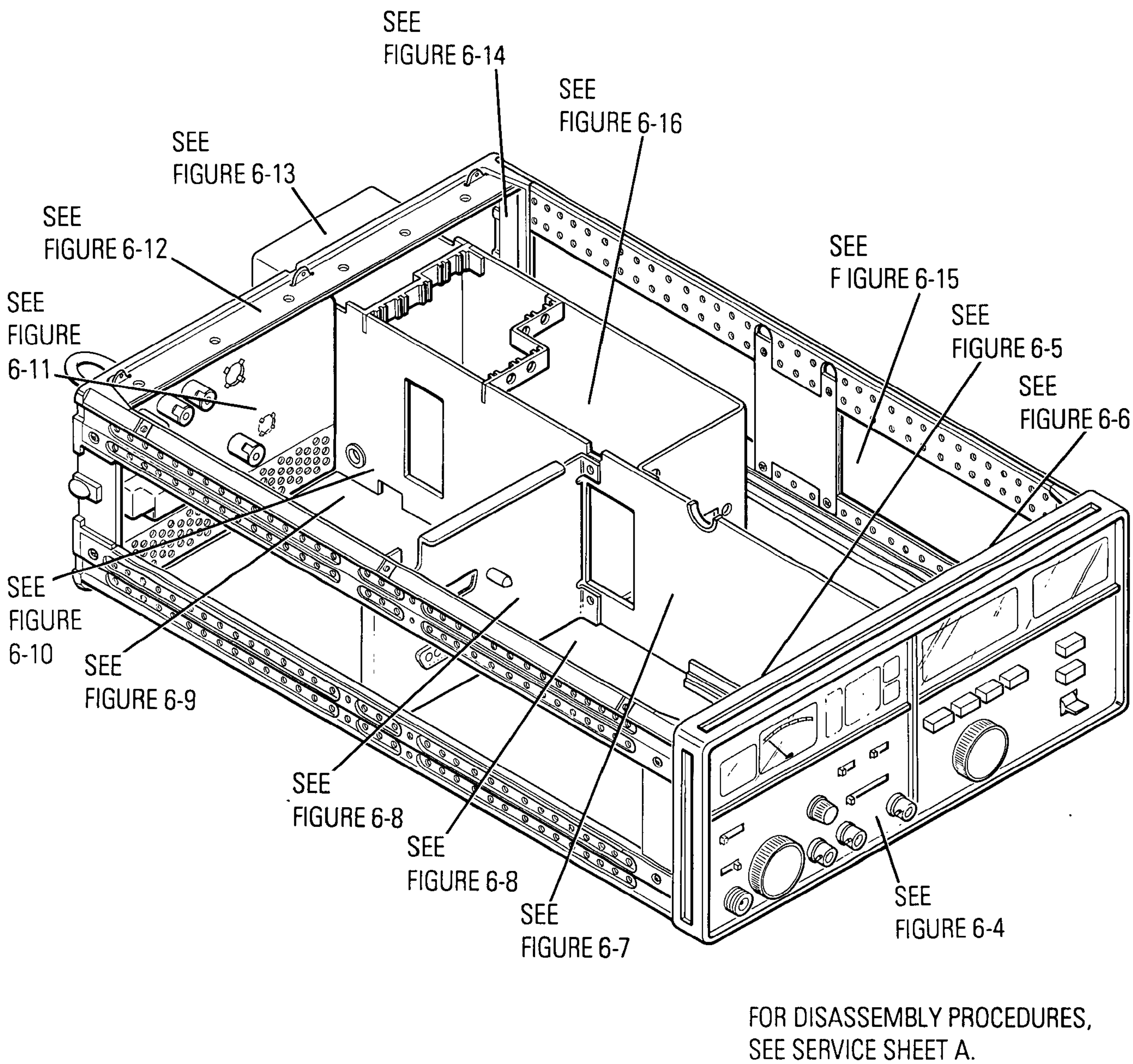


Figure 6-3. Overall Illustrated Parts Breakdown

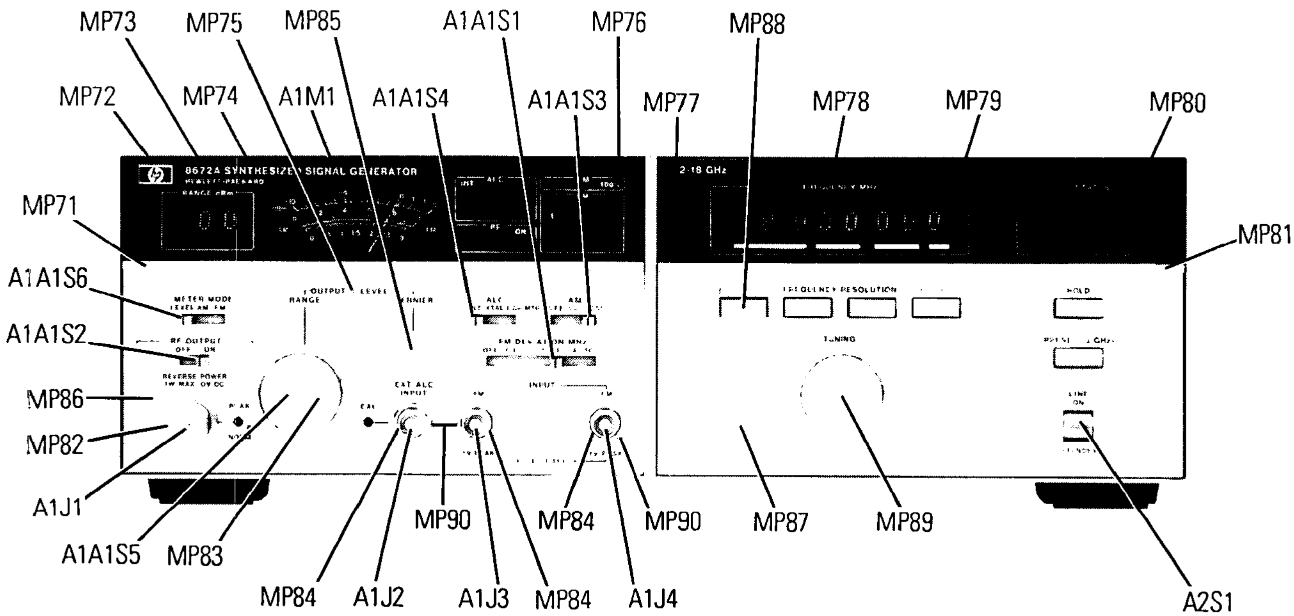


Figure 6-4. Front Panel Photo, Front View

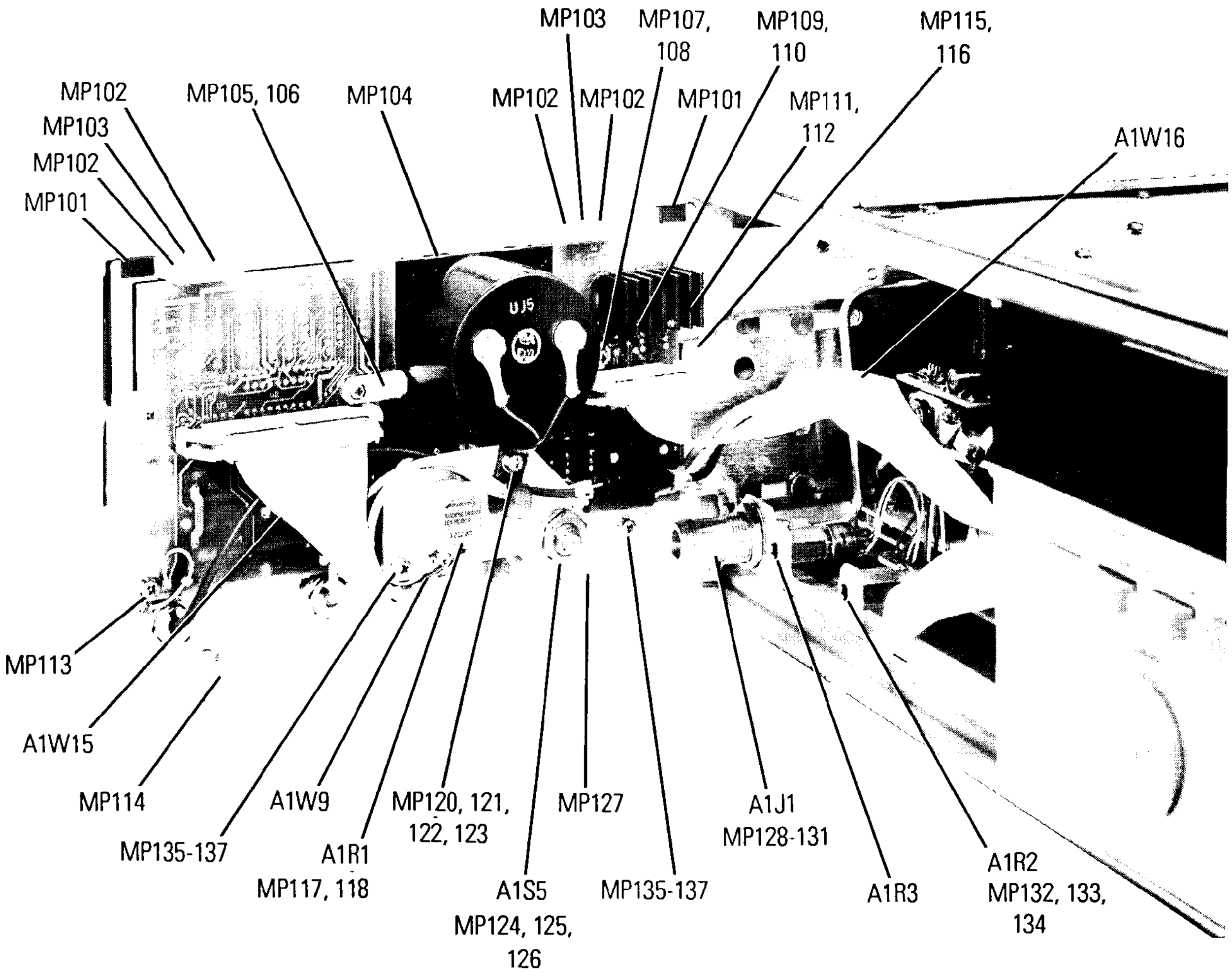


Figure 6-5. RF Front Panel, Inside View (Left Side)

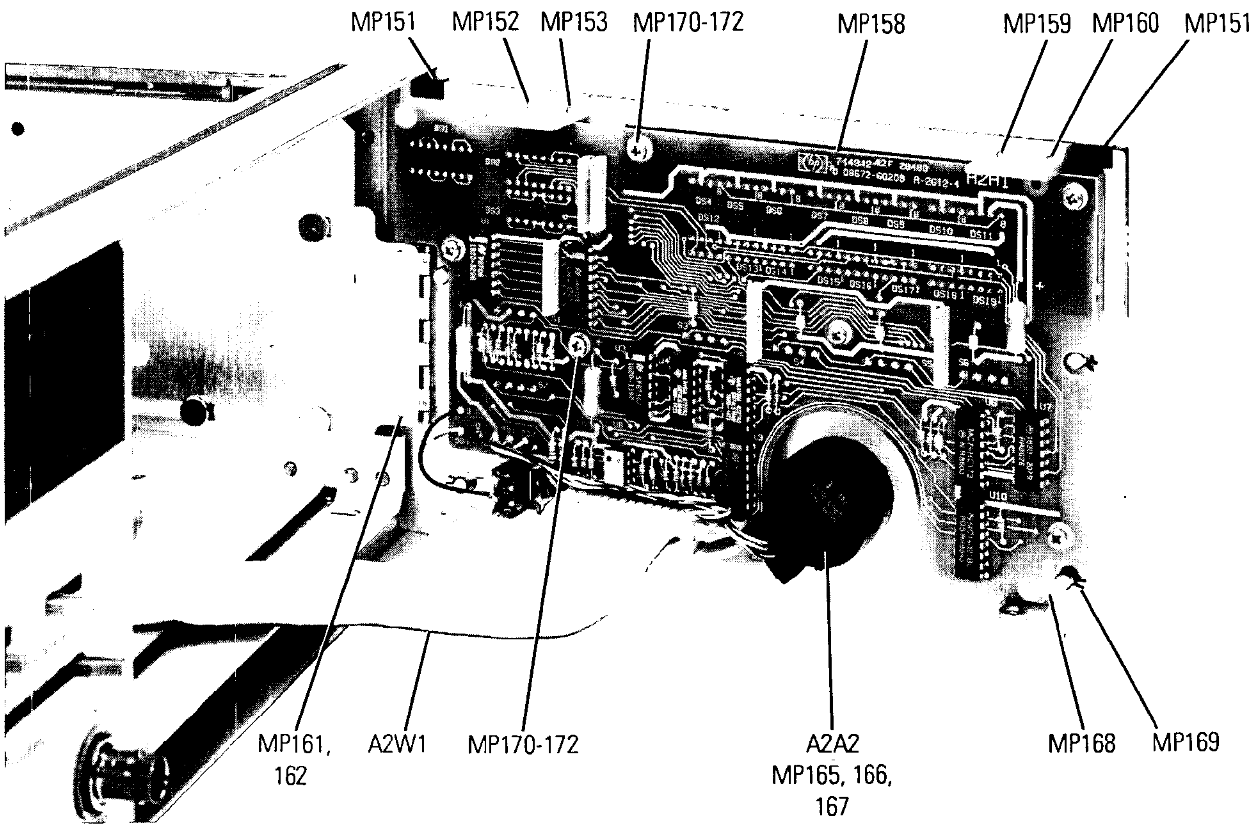


Figure 6-6. DCU Front Panel, Inside View (Right Side)

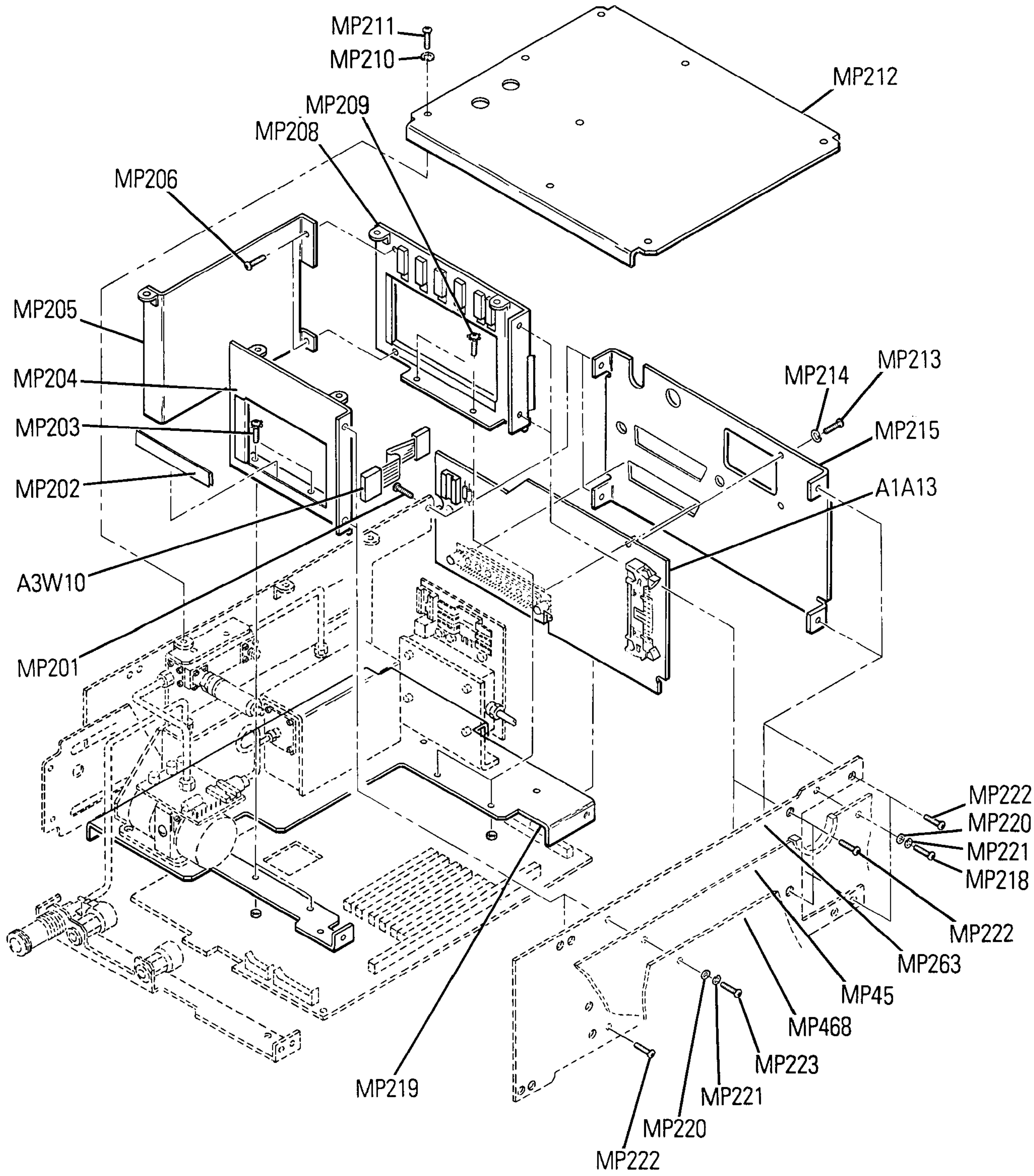


Figure 6-7. A1 Card Cage Illustrated Parts Breakdown

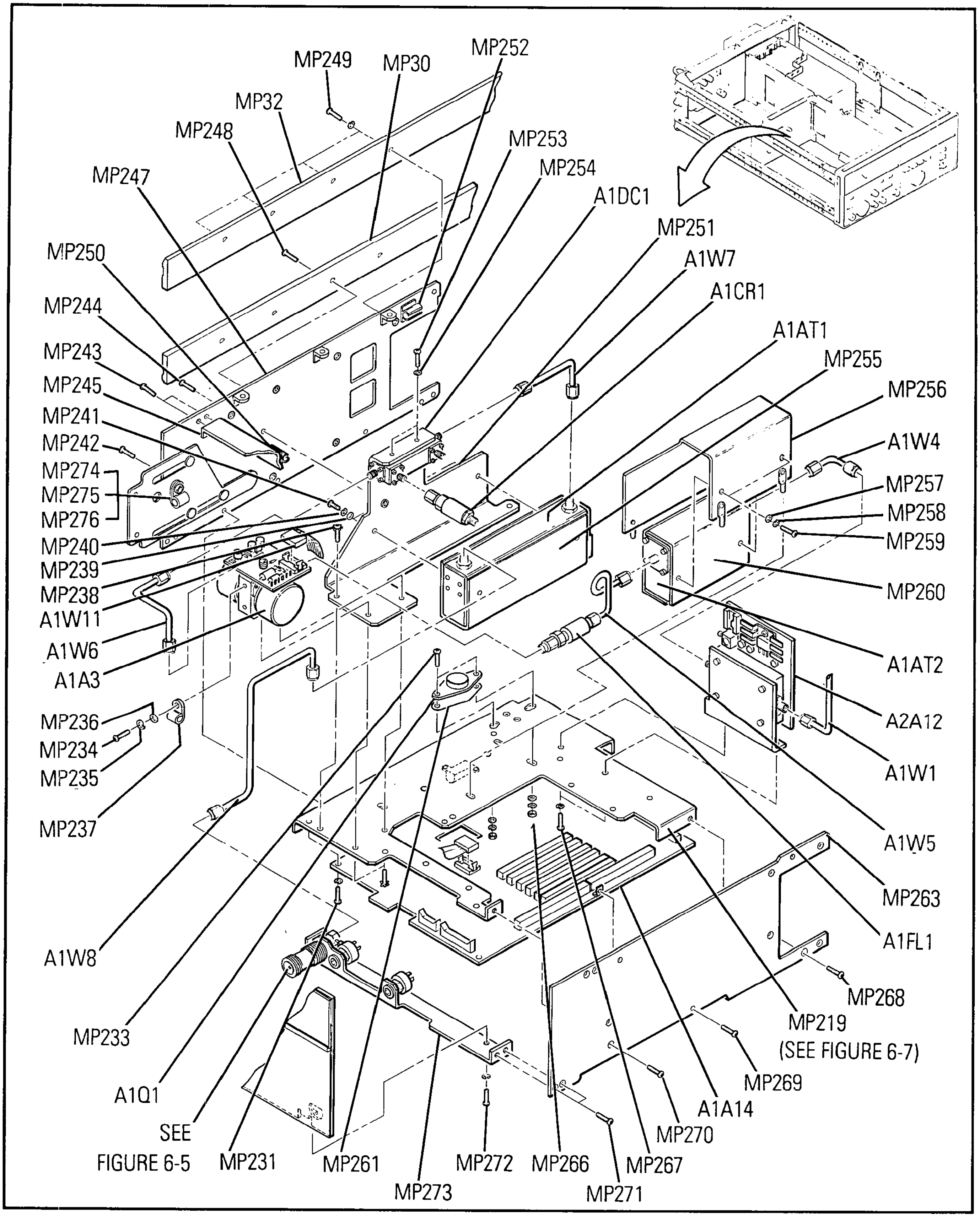


Figure 6-8. A1 Microwave Circuits Illustrated Parts Breakdown

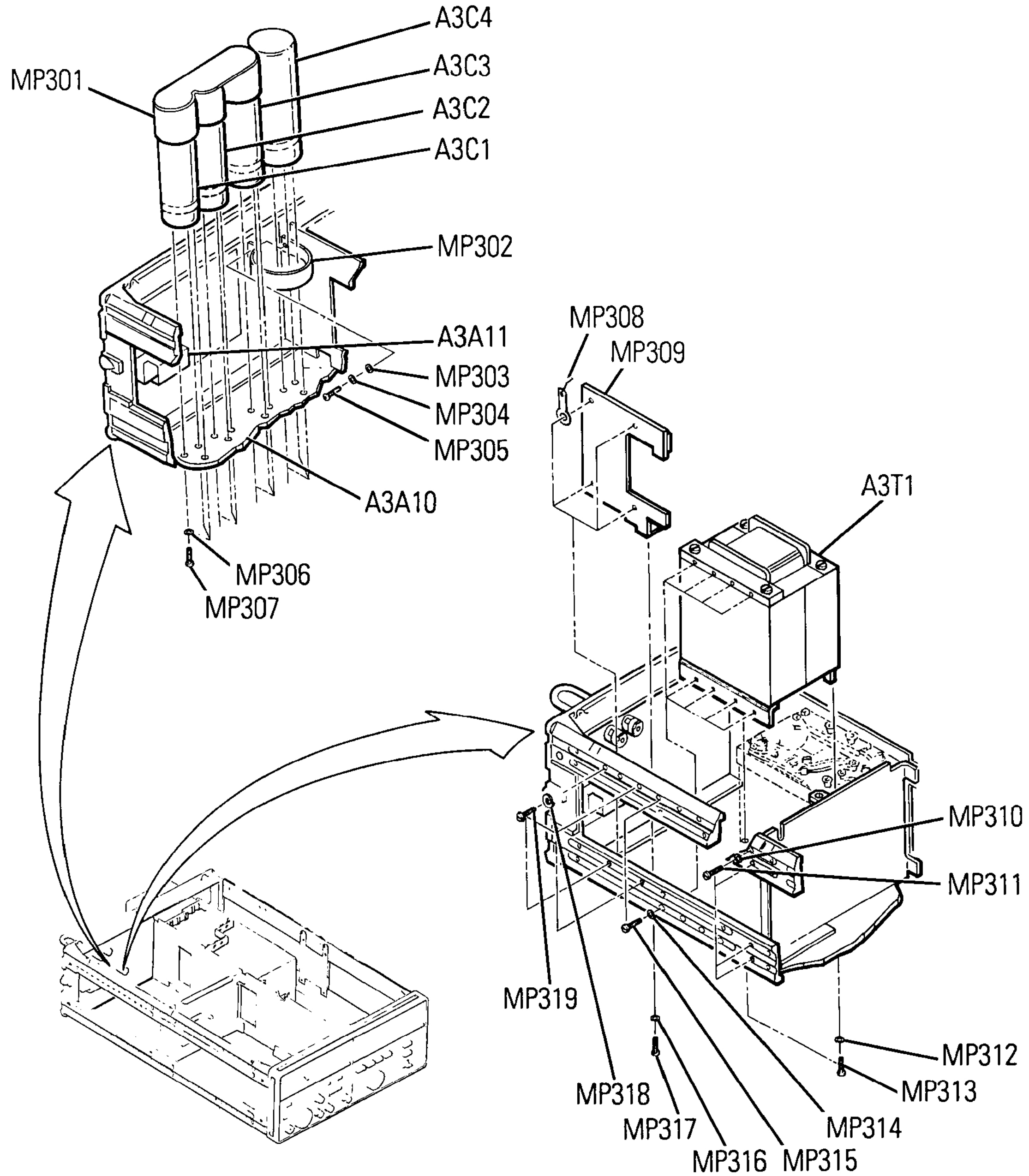


Figure 6-9. A3 Power Supply and RF Source Illustrated Parts Breakdown

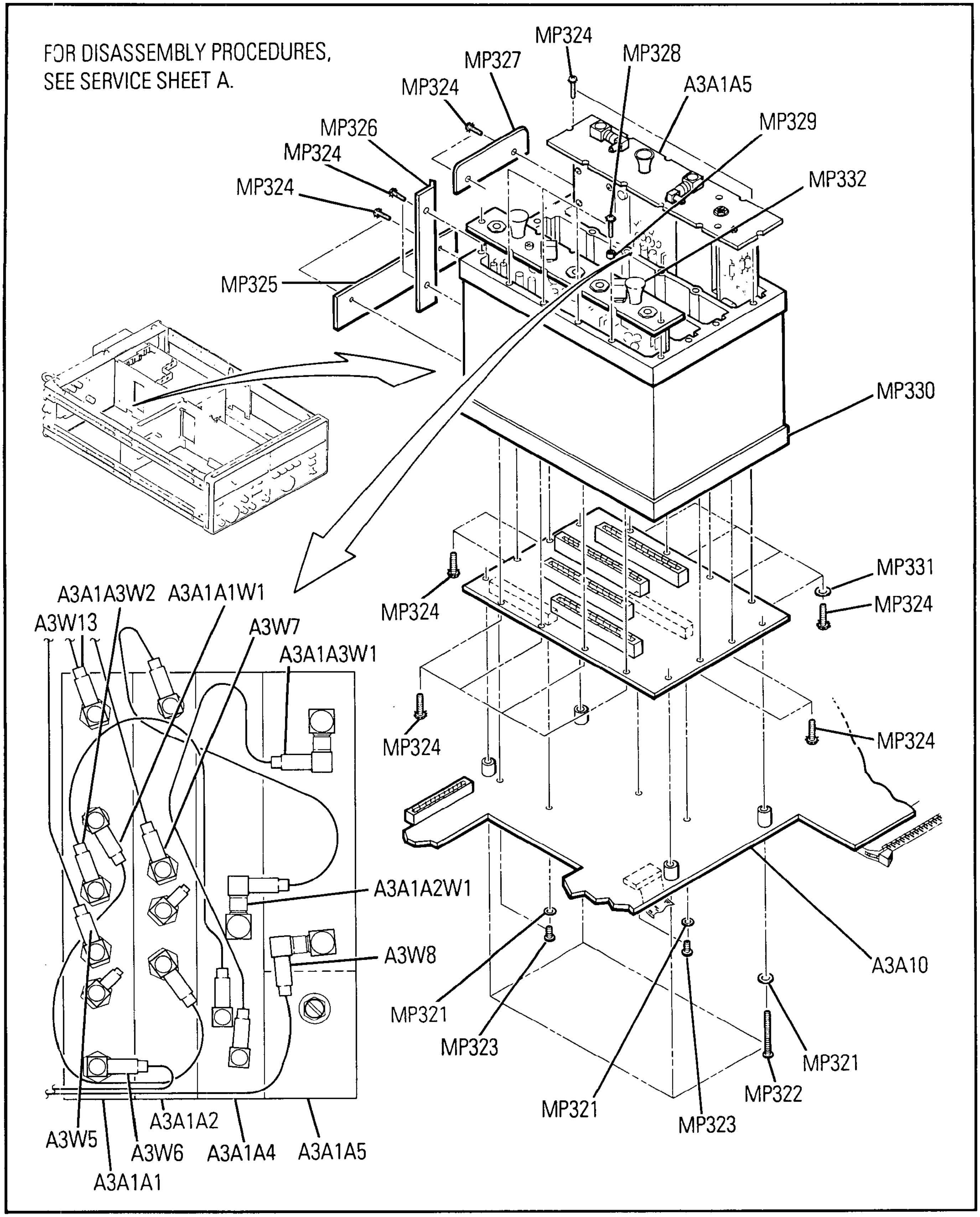


Figure 6-10. A3 RF Source Illustrated Parts Breakdown

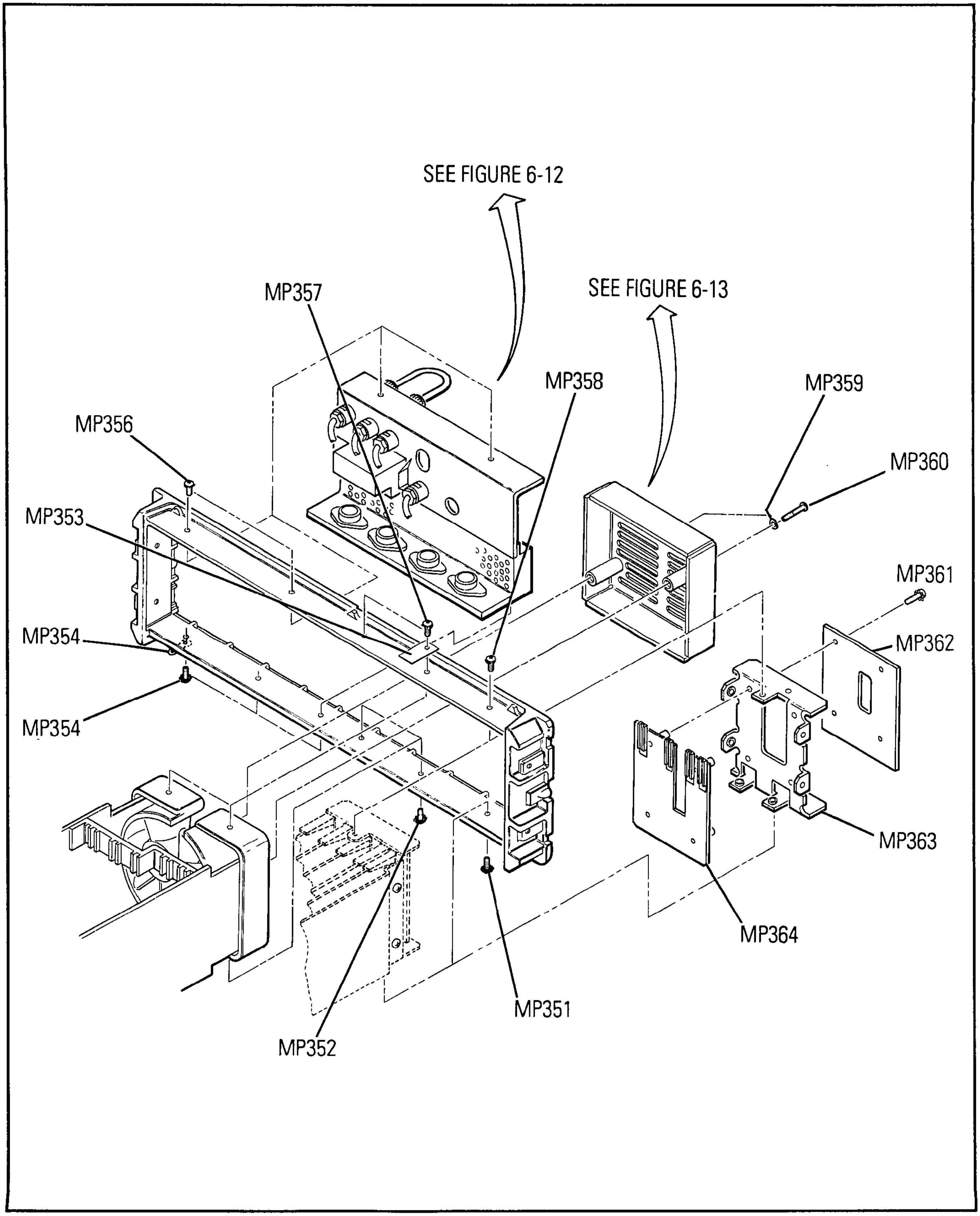


Figure 6-11. A3 Rear Panel Illustrated Parts Breakdown

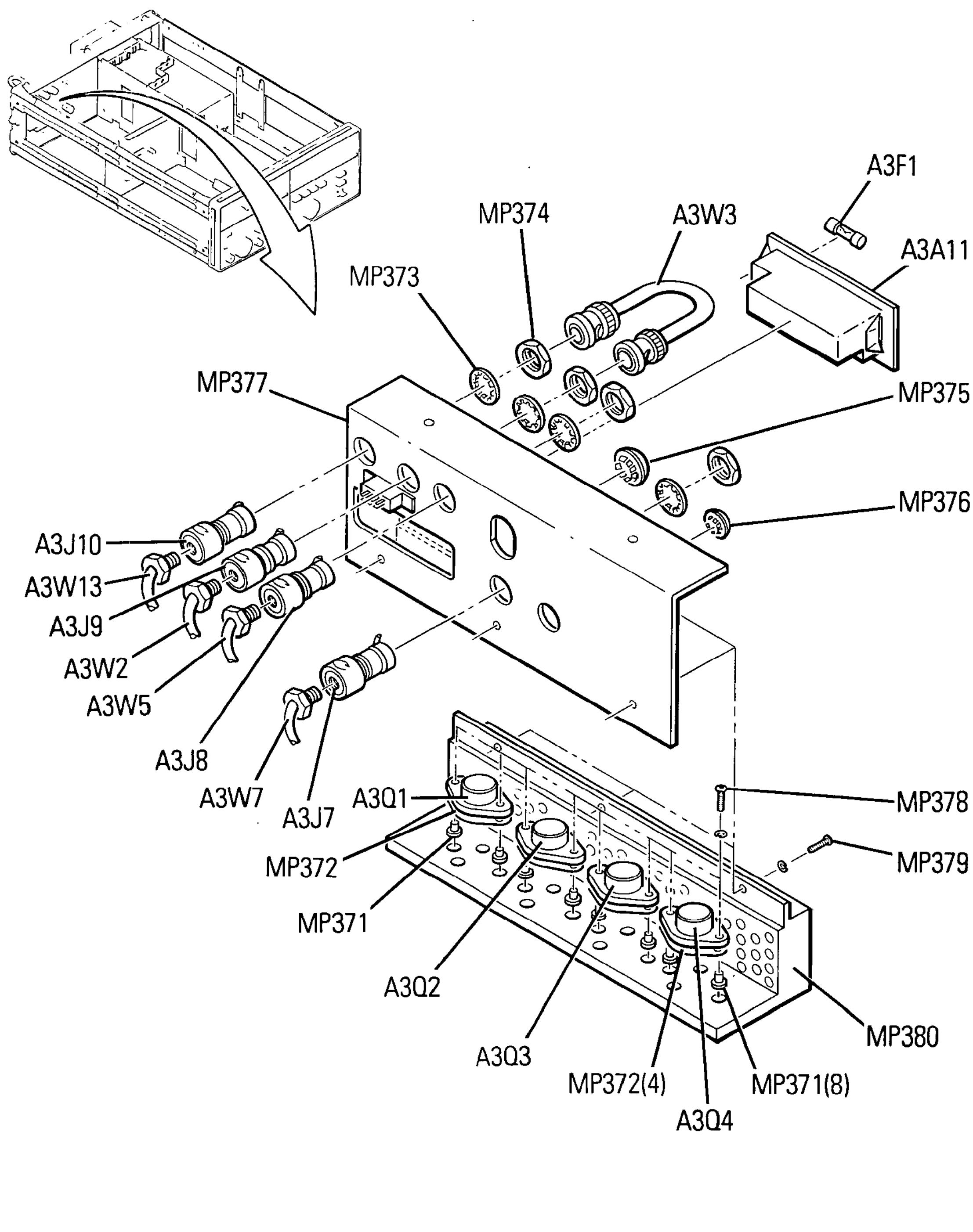


Figure 6-12. A3 Power Supply and Rear Panel Illustrated Parts Breakdown

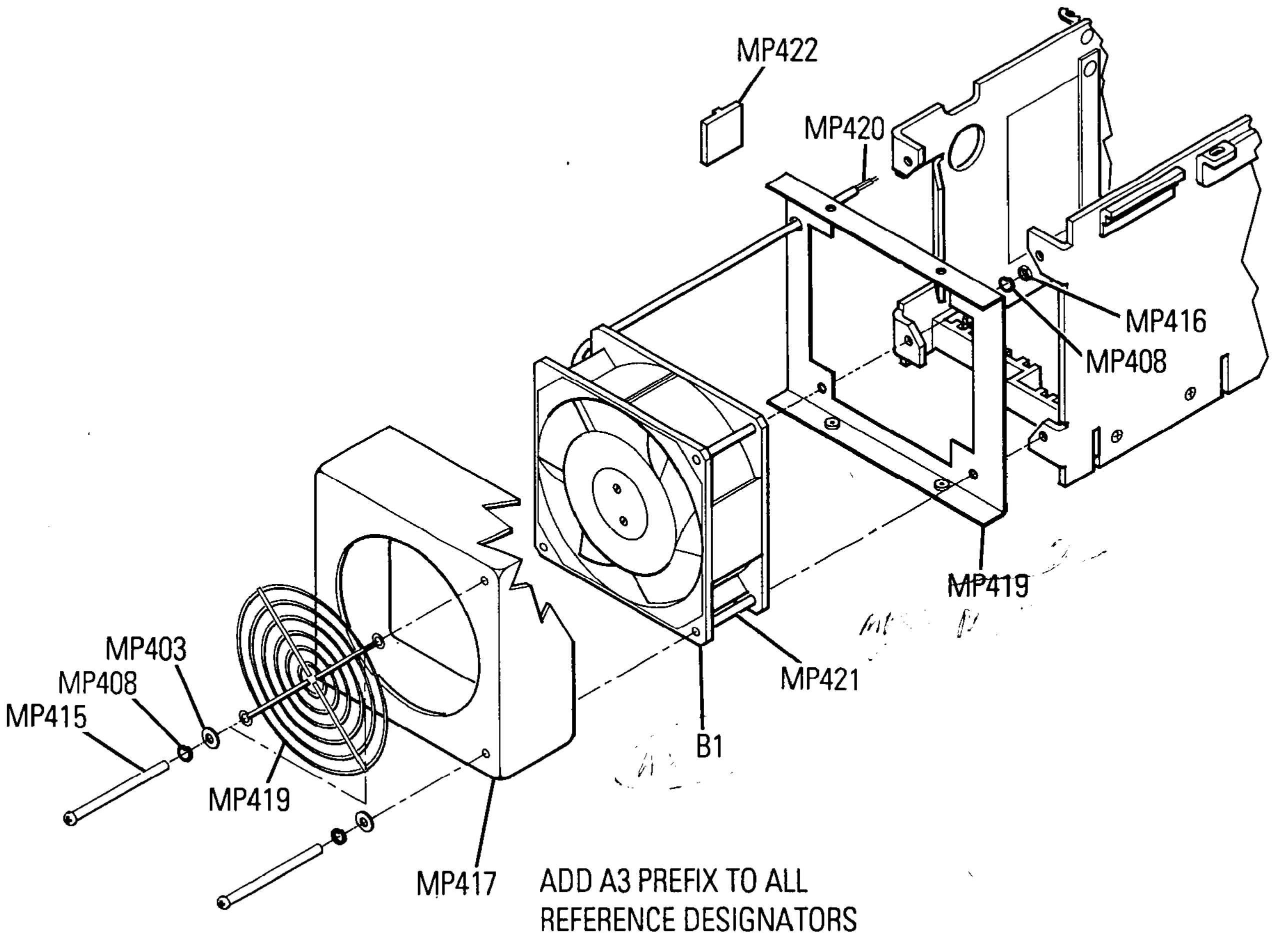


Figure 6-13. A3 Fan Assembly Illustrated Parts Breakdown (Except Option 003)

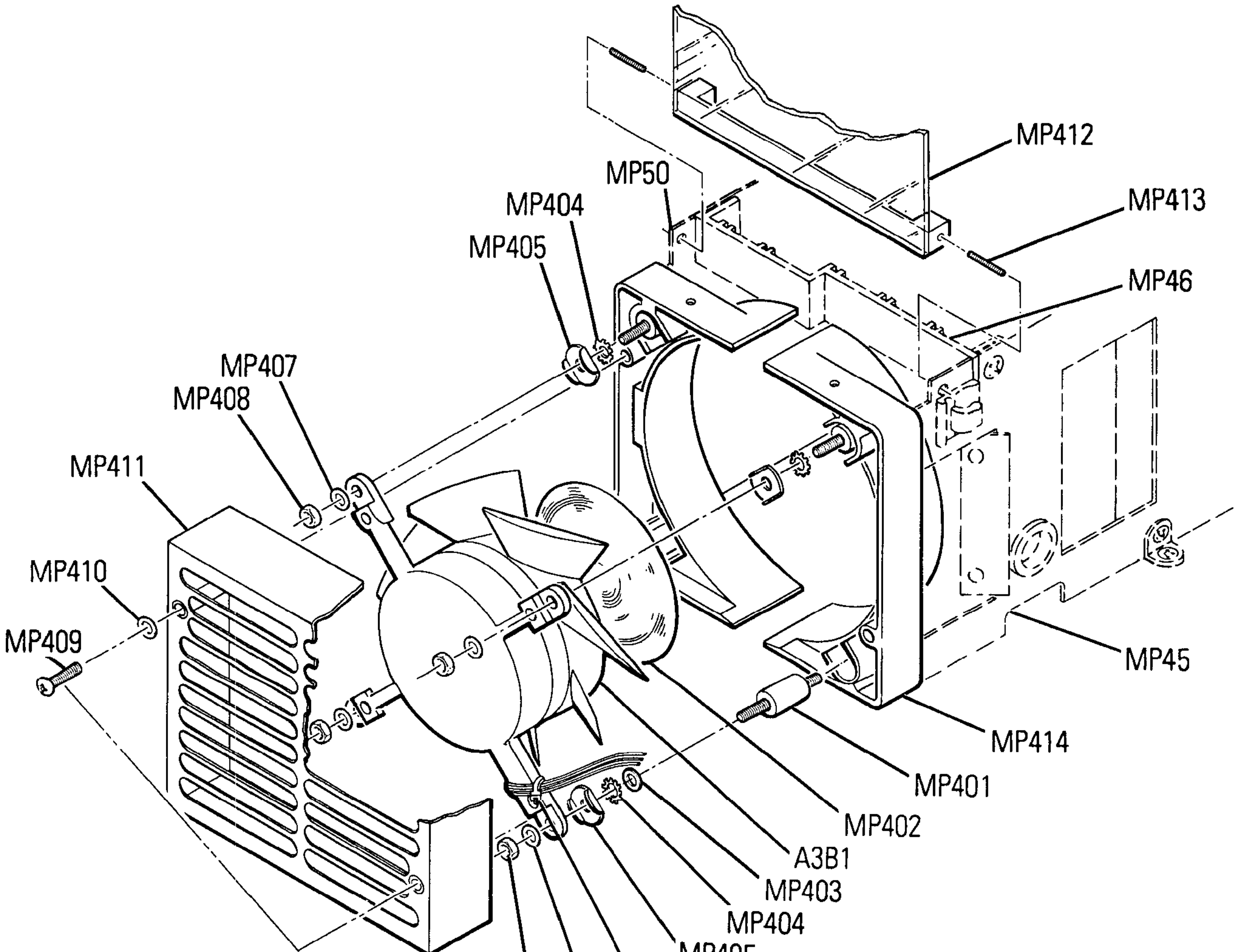


Figure 6-14. A3 Fan Assembly Illustrated Parts Breakdown (Option 003 Only)

And Non-Option 003 For Prefixes
2930A and Below

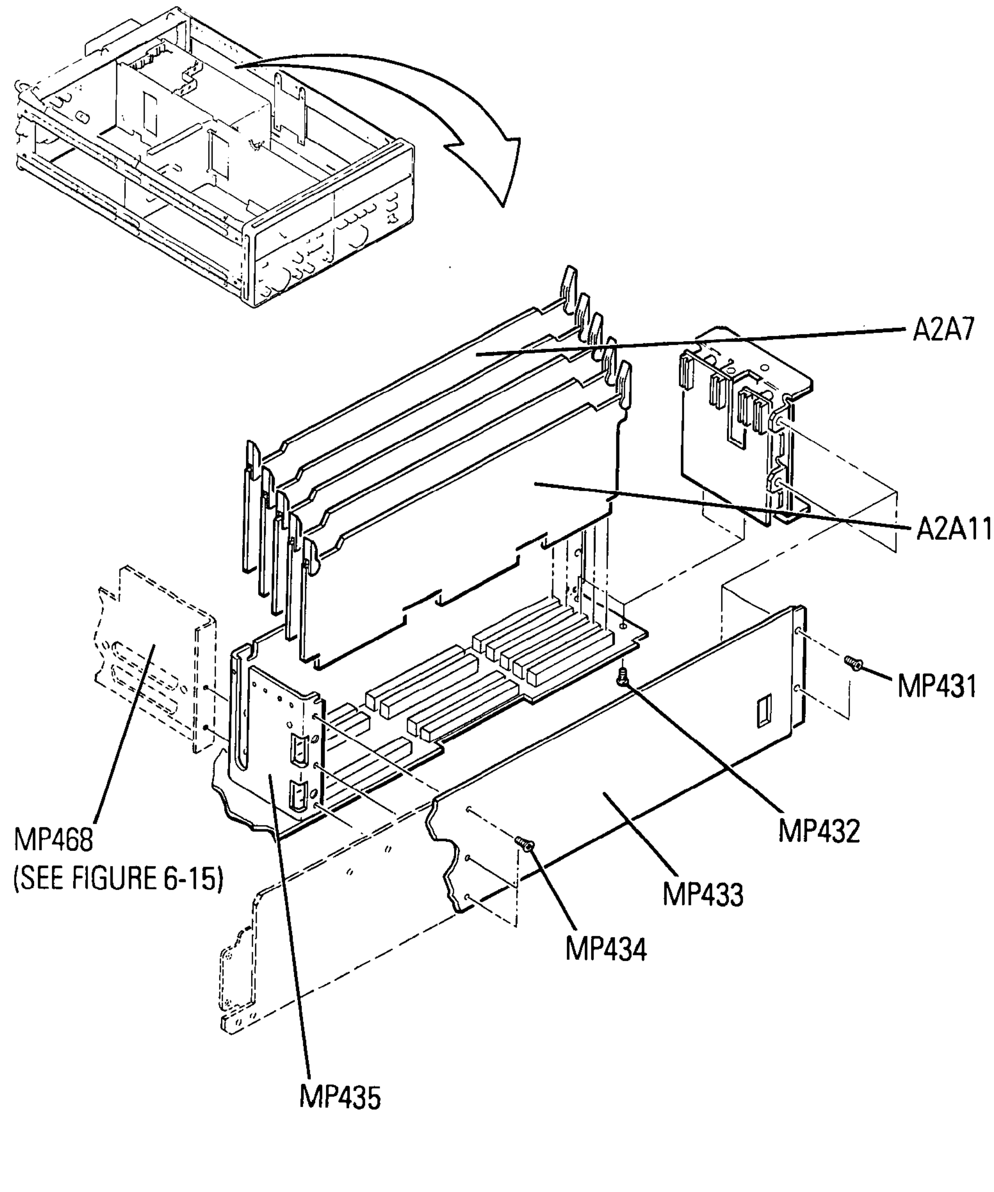


Figure 6-15. P/O A2 Controller Assembly and Rear Panel Illustrated Parts Breakdown

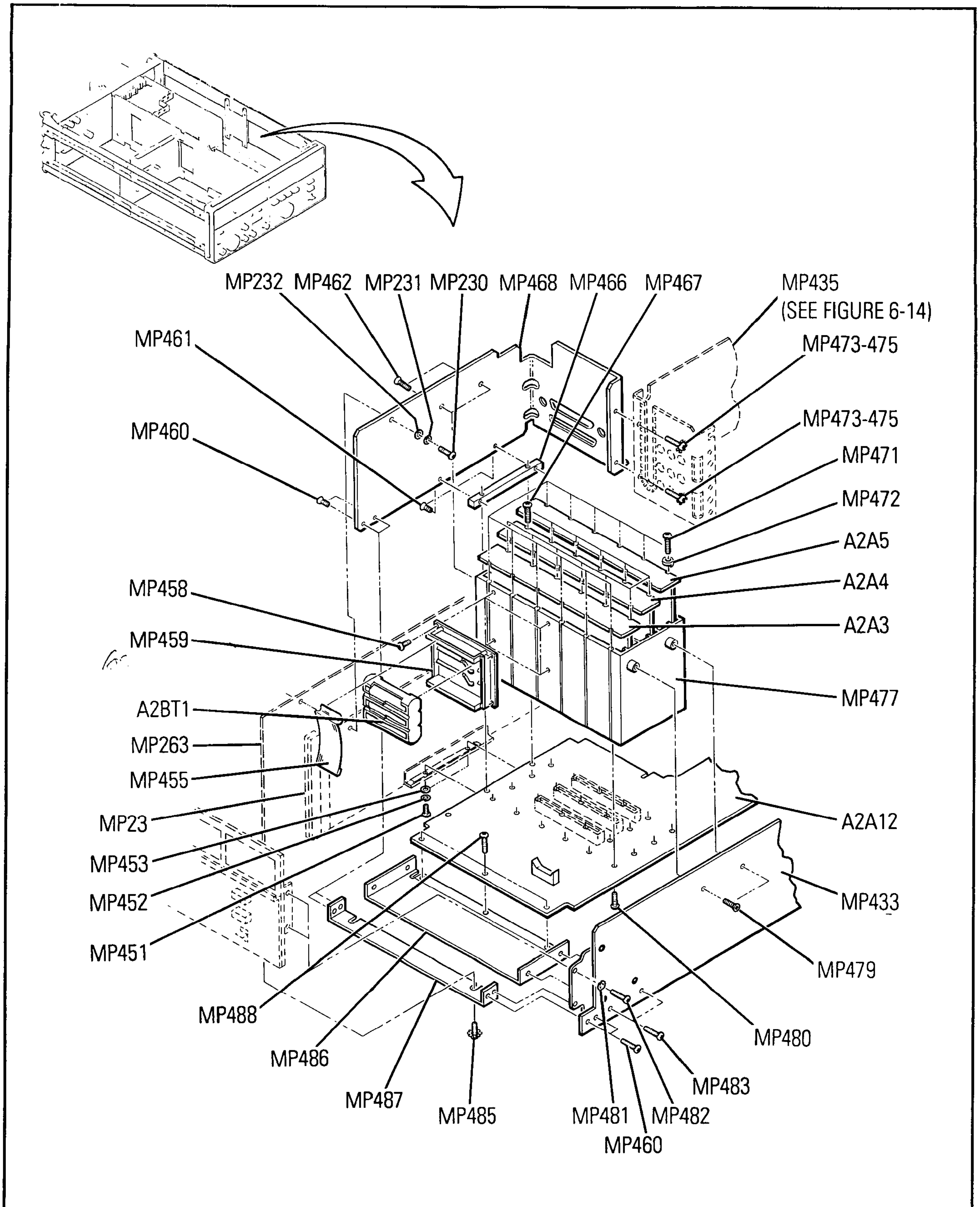


Figure 6-16. P/O A2 Controller Assembly Illustrated Parts Breakdown

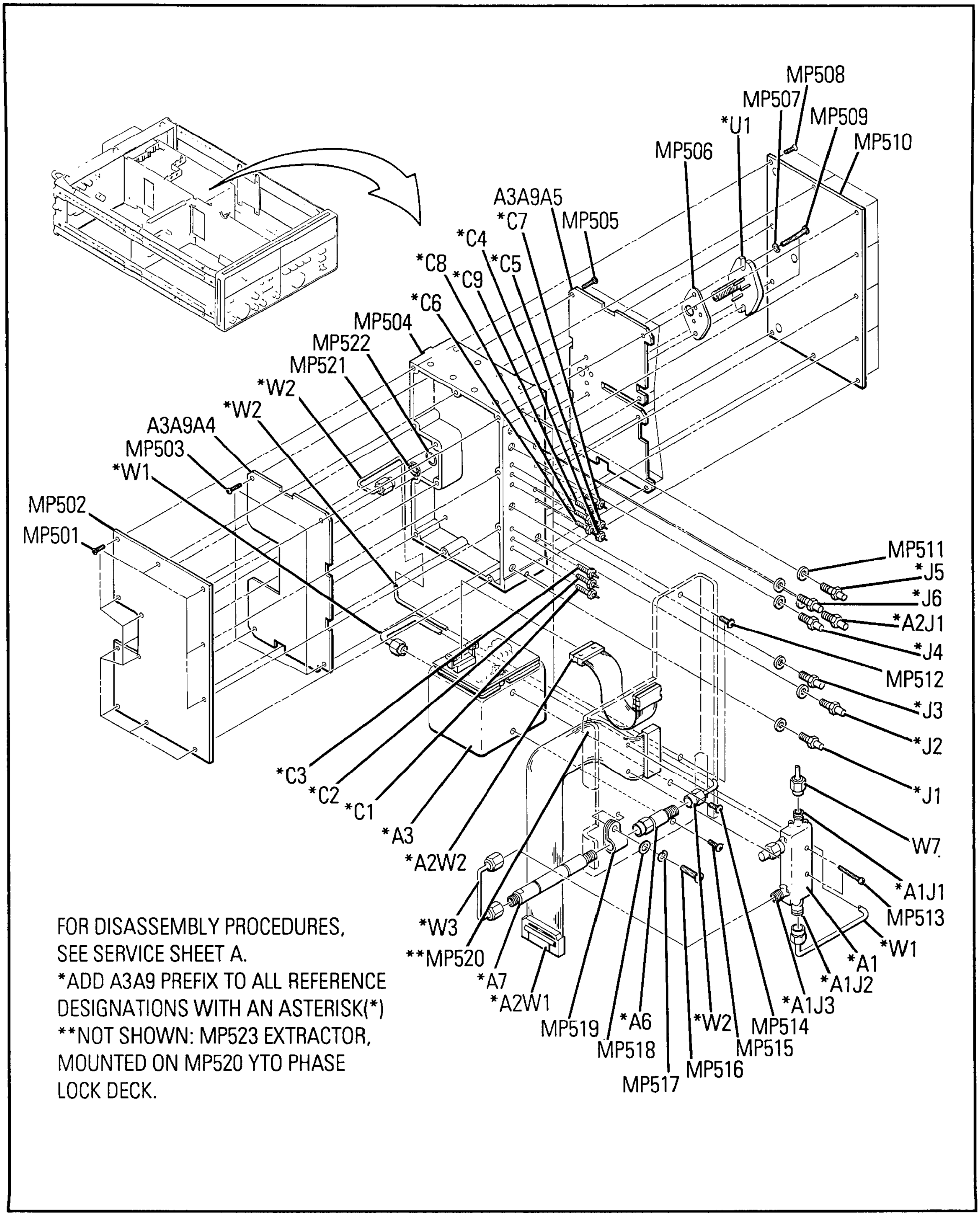


Figure 6-17. A3A9 YTO Loop Assembly Illustrated Parts Breakdown

7

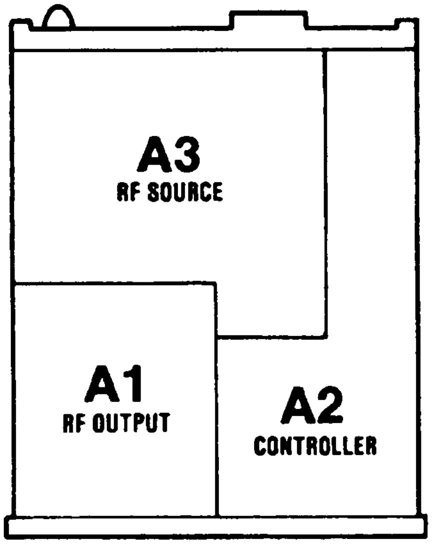
Manual Updates

Introduction

This section normally contains information for adapting the manual to older instruments, and for making modifications to improve instrument performance. The new *Manual Update* makes this section unnecessary by merging old and new information on replacement pages to be inserted into the main text of the manual.

If your instrument's serial number prefix is 2708A or lower, consult the title page and preface for the correct manual to use.

Index To Service Sheets by Assembly



MAJOR ASSEMBLIES, TOP VIEW

Assembly	Description	Service Sheet
A1A1	RF Front Panel	20
A1A2	Not Assigned	
A1A3	YTM Control	15
A1A4	Not Assigned	
A1A5	RF Amplifier and ALC	14
A1A6	ALC Detector	17
A1A7	SRD Bias Board	16
A1A8	YTM Driver	15
A1A9	Metering Assembly	21
A1A10	RF Output Level Control	18
A1A11	Digital Processor	19
A1A12	Power Amplifier	14
A1A13	Interconnect Assembly	14,19
A1A14	A1 Motherboard	14–20
A2A1	DCU Front Panel	31,32
A2A2	Rotary Pulse Generator	20
A2A3	160–240 MHz VCO	8
A2A4	20/30 MHz Phase Detector	7

Assembly	Description	Service Sheet
A2A5	20/30 MHz Divider	6
A2A6	Not Assigned	
A2A7	HP-IB Interface	24,25
A2A8	Output Register	29,30
A2A9	HP-IB Address	22,23
A2A10	Register 1	26
A2A11	Timing and Control	27,28
A2A12	A2 Mothreboard	6–8, 22–32
A3A1	Reference and M/N	
A3A1A1	Reference Phase Detector	1
A3A1A2	100 MHz VCXO	2
A3A1A3	M/N Phase Detector	3
A3A1A4	M/N VCO	4
A3A1A4A1	VCO Resonator	4
A3A1A4A2	VCO Board	4
A3A1A5	M/N Output	5
A3A1A6	M/N Reference Motherboard	1–3,5
A3A1A7	Reference and M/N Housing	
A3A2	Not Assigned	
A3A3	Positive Regulator	34
A3A4	Negative Regulator	35
A3A5	DAC	9
A3A6	YTO Driver	10
A3A7	YTO/FM Coil Driver	13
A3A8	10 MHz Reference Oscillator	1
A3A9	YTO Loop	11,12
A3A9A1	Directional Coupler	13
A3A9A2	YTO Interconnect	11–13
A3A9A3	2.0–6.6 GHz YTO	13
A3A9A4	YTO Phase Detector	12
A3A9A5	Sampler	11
A3A9A6	18 dB Attenuator	13
A3A9A7	6.2 GHz Low Pass Filter	13
A3A9A8	Preamplifier	13
A3A10	RF Source Motherboard	1,3,4, 6,10,13, 25,30–35
A3A11	Line Module	33
A3A12	Rectifier Assembly	33

8

Service

Introduction

This section contains information for troubleshooting and repairing the Signal Generator. Included are block diagrams, schematic diagrams, principles of operation, and procedures for troubleshooting, repair, disassembly, and reassembly.

Failure Modes and Service Strategy

General

Instrument problems usually fall into four general categories: turn-on errors, operator errors, instrument performance out of specification and catastrophic failures. The troubleshooting strategy is different for each category.

Turn-on Errors

If the FREQUENCY MHz display indicates an out-of-range frequency or an unstable display when the Signal Generator is first turned on, press the PRESET (3 GHz) key. The display should change to 3000.000 MHz and remain stable. If the frequency doesn't change to 3000.000 MHz, go to service sheet BD1 to begin troubleshooting. If the instrument does not operate properly when first turned on, but presets to 3 GHz, turn the instrument off and wait for five minutes before turning the instrument back on. The FREQUENCY MHz display should still indicate 3000.000 MHz. If the frequency display is incorrect, go to service sheet BD1 to begin troubleshooting.

Operator Errors

Apparent failures can result from operator errors and may take one of two forms: invalid front panel settings and HP-IB errors. Invalid front panel settings for performance outside of specifications may cause the UNLVL annunciator to light. The annunciator may light in INT ALC mode when the instrument is set for an output level of more than +8 dBm. Using external ALC modes with no input at the external ALC input will also light the UNLVL annunciator.

Invalid HP-IB program codes can cause the instrument to malfunction. Setting the line switch to off and then on will clear the problem and return the instrument to local operation. The instrument may also be cleared remotely and then reprogrammed with the correct codes. The instrument will accept out-of-range frequencies when remotely programmed. The front panel and status byte will indicate that the frequency is out of range and the ϕUNLOCKED annunciator may light. Preset the instrument or reprogram a frequency within the specified frequency range.

Instrument Performance Out of Specification

Two levels of testing can be performed to verify that the instrument is operating normally and within specification. The first level of testing is the "Abbreviated Performance Tests" in section IV of the Operating Manual. These tests involve the least amount of time and can reveal much about overall operation. For a complete test, perform the full Performance Tests. The specifications are listed in table 1-1 of the Operating Manual.

If a parameter is only slightly out of limits, it can often be brought into specification by an adjustment. The procedures for all adjustments are in chapter 5. A cross-reference table for performance tests and adjustment procedures is also included. If the adjustment fails to bring the parameter into specification, use the troubleshooting procedures starting on service sheet BD1.

Catastrophic Failures

When a catastrophic failure occurs, begin troubleshooting on service sheet BD1. The information there is used to quickly isolate the problem to one of the major functional sections of the instrument. Troubleshooting catastrophic failures in the Signal Generator is structured into three levels:

a. The overall troubleshooting level, where problems are isolated to the power supply or one of the functional sections. This level of troubleshooting is supported by service sheet BD1, which includes diagrams, theory of operation, and troubleshooting information.

b. The functional level of troubleshooting isolates the malfunction to a circuit or circuit board. This level of troubleshooting is supported by service sheets BD2 through BD10, which include diagrams, theory of operation, and troubleshooting information.

c. Circuit level troubleshooting isolates the problem to a stage within the circuits shown on the schematic. This level of troubleshooting is supported by service sheets 1 through 35, which include circuit level block diagrams, schematics, theory of operation, and troubleshooting information. It is expected that further troubleshooting, to the component level, depends on the skill and experience of the troubleshooter.

Service Sheets

The foldout pages in the last part of this section are the service sheets. They consist of block diagrams, circuit schematic diagrams, supplemental diagrams, troubleshooting information, internal views, and disassembly procedures. Table 8-1 summarizes the symbology used on the service sheets.

Table 8-1. Schematic Diagram Notes (1 of 8)

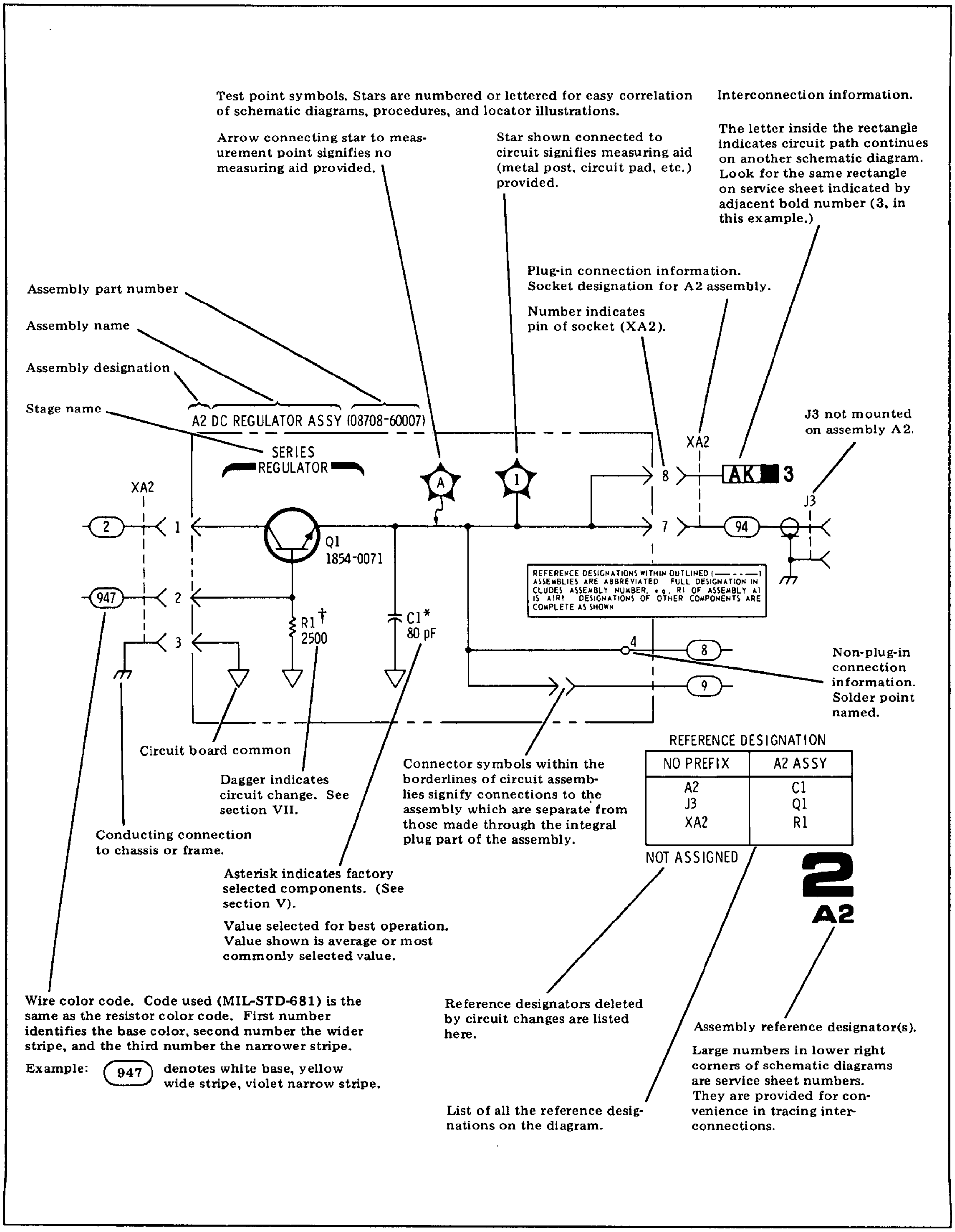


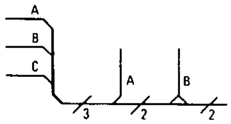
Table 8-1. Schematic Diagram Notes (2 of 8)

SCHEMATIC DIAGRAM NOTES

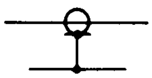
*	Asterisk denotes a factory-selected value. Value shown is typical.
†	Dagger indicates circuit change. See Section VII.
	Tool-aided adjustment.
O	Manual control.
	Encloses front-panel designation.
	Encloses rear-panel designation.
	Circuit assembly borderline.
	Other assembly borderline.
	Heavy line with arrows indicates path and direction of main signal.
	Heavy dashed line with arrows indicates path and direction of main feedback.
	Indicates stripline (i.e., RF transmission line above ground).
CW	Wiper moves toward cw with clockwise rotation of control (as viewed from shaft or knob).
1	Numbered Test Point measurement aid provided.
	Encloses wire or cable color code. Code used is the same as the resistor color code. First number identifies the base color, second number identifies the wider stripe, and the third number identifies the narrower stripe, e.g., denotes white base, yellow wide stripe, violet narrow stripe.
	A direct conducting connection to earth, or a conducting connection to a structure that has a similar function (e.g., the frame of an air, sea, or land vehicle).
	A conducting connection to a chassis or frame.
	Common connections. All like-designation points are connected.
AK 12	Letters = off-page connection, e.g., AK Number = Service Sheet number for off-page connection, e.g., 12
1 THIS PAGE	Number (only) = on-page connection.

Table 8-1. Schematic Diagram Notes (3 of 8)

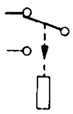
SCHEMATIC DIAGRAM NOTES



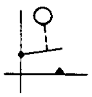
Indicates multiple paths represented by only one line. Letters or names identify individual paths. Numbers indicate number of paths represented by the line.



Coaxial or shielded cable.



Relay. Contact moves in direction of arrow when energized.



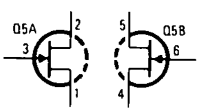
Indicates a pushbutton switch with a momentary (ON) position.

Indicates a PIN diode.

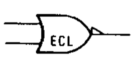
Indicates a current regulation diode.

Indicates a voltage regulation diode.

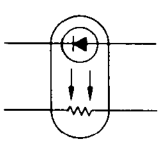
Indicates a Schottky (hot-carrier) diode.



Multiple transistors in a single package—physical location of the pins is shown in package outline on schematic.



Identification of logic families as shown (in this case, ECL).

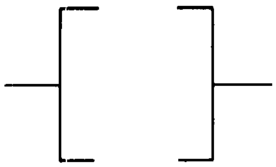


Indicates an opto-isolator of a LED and a photoresistor packaged together. The resistance of the photoresistor is a function of the current flowing through the LED.

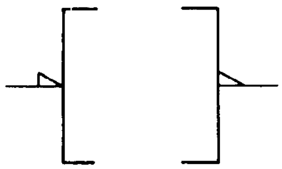
Table 8-1. Schematic Diagram Notes (4 of 8)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

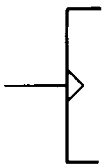
Input and Output Indicators



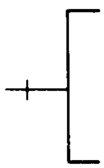
Implied Indicator—Absence of polarity indicator (see below) implies that the active state is a relative high voltage level. Absence of negation indicator (see below) implies that the active state is a relative high voltage level at the input or output.



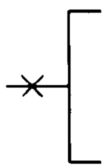
Polarity Indicator—The active state is a relatively low voltage level.



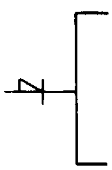
Dynamic Indicator—The active state is a transition from a relative low to a relative high voltage level.



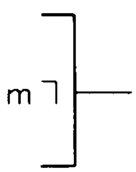
Inhibit Input—Input that, when active, inhibits (blocks) the active state outputs of a digital device.



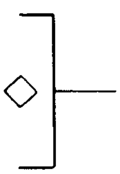
Analog Input—Input that is a continuous signal function (e.g., a sine wave).



Polarity Indicator used with Inhibit Indicator—Indicates that the relatively low level signal inhibits (blocks) the active state outputs of a digital device.



Output Delay—Binary output changes state only after the referenced input (m) returns to its inactive state (m should be replaced by appropriate dependency or function symbols).



Open Collector Output—Output that must form part of a distributed connection.

Table 8-1. Schematic Diagram Notes (5 of 8)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

Input and Output Indicators (Cont'd)

3-STATE	Three-state Output—Indicates outputs that can have a high impedance (disconnect) state in addition to the normal binary logic states.

Combinational Logic Symbols and Functions

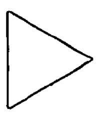
&	AND—All inputs must be active for the output to be active.
≥1	OR—One or more inputs being active will cause the output to be active.
≥m	Logic Threshold—m or more inputs being active will cause the output to be active (replace m with a number).
=1	EXCLUSIVE OR—Output will be active when one (and only one) input is active.
=m	m and only m—Output will be active when m (and only m) inputs are active (replace m with a number).
=	Logic Identity—Output will be active only when all or none of the inputs are active (i.e., when all inputs are identical, output will be active).
	Amplifier—The output will be active only when the input is active (can be used with polarity or logic indicator at input or output to signify inversion).
X/Y	Signal Level Converter—Input level(s) are different than output level(s).
←→	Bilateral Switch—Binary controlled switch which acts as an on/off switch to analog or binary signals flowing in both directions. Dependency notation should be used to indicate affecting/affected inputs and outputs. Note: amplifier symbol (with dependency notation) should be read to indicate unilateral switching.
X→Y	Coder—Input code (X) is converted to output code (Y) per weighted values or a table.
(Functional Labels)	The following labels are to be used as necessary to ensure rapid identification of device function.
MUX	Multiplexer—The output is dependent only on the selected input.
DEMUX	Demultiplexer—Only the selected output is a function of the input.
CPU	Central Processing Unit
PIO	Peripheral Input/Output
SMI	Static Memory Interface

Table 8-1. Schematic Diagram Notes (6 of 8)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

Sequential Logic Functions

1 	Monostable—Single shot multivibrator. Output becomes active when the input becomes active. Output remains active (even if the input becomes inactive) for a period of time that is characteristic of the device and/or circuit.
G 	Oscillator—The output is a uniform repetitive signal which alternates between the high and low state values. If an input is shown, then the output will be active if and only if the input is in the active state.
FF	Flip-Flop—Binary element with two stable states, set and reset. When the flip-flop is set, its outputs will be in their active states. When the flip-flop is reset, its outputs will be in their inactive states.
T	Toggle Input—When active, causes the flip-flop to change states.
S	Set Input—When active, causes the flip-flop to set.
R	Reset Input—When active, causes the flip-flop to reset.
J	J Input—Analogous to set input.
K	K Input—Analogous to reset input.
D	Data Input—Always enabled by another input (generally a C input—see Dependency Notation). When the D input is dependency-enabled, a high level at D will set the flip-flop; a low level will reset the flip-flop. Note: strictly speaking, D inputs have no active or inactive states—they are just enabled or disabled.
m	Count-Up Input—When active, increments the contents (count) of a counter by "m" counts (m is replaced with a number).
—m	Count-Down Input—When active, decrements the contents (count) of a counter by "m" counts (m is replaced with a number).
→ m	Shift Right (Down) Input—When active, causes the contents of a shift register to shift to the right or down "m" places (m is replaced with a number).
← m	Shift Left (Up) Input—When active, causes the contents of a shift register to shift to the left or up "m" places (m is replaced with a number).

NOTE

For the four functions shown above, if m is one, it is omitted.

(Functional Labels)	The following functional labels are to be used as necessary in symbol build-ups to ensure rapid identification of device function.

Table 8-1. Schematic Diagram Notes (7 of 8)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

Sequential Logic Functions (Cont'd)

mCNTR	Counter—Array of flip-flops connected to form a counter with modulus m (m is replaced with a number that indicates the number of states: 5 CNTR, 10 CNTR, etc.).
REG	Register—Array of unconnected flip-flops that form a simple register or latch.
SREG	Shift Register—Array of flip-flops that form a register with internal connections that permit shifting the contents from flip-flop to flip-flop.
ROM	Read Only Memory—Addressable memory with read-out capability only.
RAM	Random Access Memory—Addressable memory with read-in and read-out capability.

Dependency Notation

mAm	Address Dependency—Binary affecting inputs of affected outputs. The m prefix is replaced with a number that differentiates between several address inputs, indicates dependency, or indicates demultiplexing and multiplexing of address inputs and outputs. The m suffix indicates the number of cells that can be addressed.
Gm	Gate (AND) Dependency—Binary affecting input with an AND relationship to those inputs or outputs labeled with the same identifier. The m is replaced with a number or letter (the identifier).
Cm	Control Dependency—Binary affecting input used where more than a simple AND relationship exists between the C input and the affected inputs and outputs (used only with D-type flip-flops).
Vm	OR Dependency—Binary affecting input with an OR relationship to those inputs or outputs labeled with the same identifier. The m is replaced with a number or the letter (the identifier).
Fm	Free Dependency—Binary affecting input acting as a connect switch when active and a disconnect when inactive. Used to control the 3-state behavior of a 3-state device.

NOTE

The identifier (m) is omitted if it is one—that is, when there is only one dependency relationship of that kind in a particular device. When this is done, the dependency indicator itself (G, C, F, or V) is used to prefix or suffix the affected (dependent) input or output.

Table 8-1. Schematic Diagram Notes (8 of 8)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

Miscellaneous

⎎	Schmitt Trigger — Input characterized by hysteresis; one threshold for positive going signals and a second threshold for negative going signals.
Active	Active State — A binary physical or logical state that corresponds to the true of an input, an output, or a function. The opposite of the inactive state.
Enable	Enabled Condition — A logical state that occurs when dependency conditions are satisfied. Although not explicitly stated in the definitions listed above, functions are assumed to be enabled when their behavior is described. A convenient way to think of it as follows:

A function becomes active when:
- it is enabled (dependency conditions — if any — are satisfied)
- and its external stimulus (e.g., voltage level) enters the active state.

Manual Updating

Instruments manufactured after the publication of this manual may have parts and circuitry different from those shown in this manual. New service information for these changes along with the appropriate serial number prefixes will be provided as *Manual Update*. Errors in the manual will also be corrected.

Keep this manual up to date by periodically requesting the latest *Manual Update* from your Hewlett-Packard office.

Safety Considerations

Before Applying Power

Verify that the instrument is set to match the available line voltage and that the correct fuse is installed. An uninterrupted safety earth ground must be provided from the main power source to the instrument input wiring terminals, power cable, or supplied power cable set.

Warnings and Cautions

Pay attention to WARNINGS and CAUTIONS. They must be followed for your protection and to avoid damage to the equipment.

Warning

Maintenance described herein is performed with power supplied to the instrument and with protective covers removed. Such maintenance should be performed only by service-trained personnel who are aware of the hazards involved (for example, fire and electrical shock). Where maintenance can be performed without power supplied, the power should be removed.

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. (Grounding one conductor of a two conductor outlet is not sufficient protection.) In addition, verify that a common ground exists between this instrument and any other equipment used in conjunction with it prior to energizing any of the units.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

Warning (cont'd)

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure that the common terminal is connected to neutral (that is, the grounded side of the mains supply).

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so. Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.

Caution

Do not disconnect or remove any boards in the Signal Generator unless the instrument is unplugged. Some boards contain devices that can be damaged if the board is removed when the power is on. Several components, including MOS devices, can be damaged by electrostatic dischage. Use conductive foam and grounding straps when servicing is required on sensitive components. Use care when unplugging ICs from high-grip sockets.

After Service Safety Checks

Visually inspect interior of 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 resistance from instrument enclosure to ground pin on power cable plug. The reading must be less than one ohm. Flex the power cable while making this measurement to determine whether intermittent discontinuities exist.

Check any indicated front or rear panel ground terminals that are marked, using the above procedures.

Check resistance from instrument enclosure to line and neutral (tied together) with the power switch on and the power source disconnected. The minimum acceptable resistance is two megohms. Replace any component that results in a failure.

Check line fuse to verify that a correctly rated fuse is installed.

Recommended Test Equipment

Test equipment and accessories required to maintain the Signal Generator are listed in table 1-3, "Recommended Test Equipment", in the Operating Manual. Equipment other than that listed may be used if it meets the critical specifications listed in the table.

Service Tools, Aids, and Information

Service Accessories

HP 11712-60001..... Output Register Test Board HP
08672-60017......... Special Extender Boards (3 each)

Required Service Tools

Pozidriv Screwdrivers

Many screws in the Signal Generator appear to be Phillips type, but are not. To avoid damage to the screw head slots, Pozidriv screwdrivers should be used. HP 8710-0899 is the No. 1 Pozidriv. HP 8710-0900 is the No. 2 Pozidriv.

Tuning Tools

For adjustments requiring non-metallic tuning tools, use the HP 8710-0033 blade tuning tool or the HP 8710-1010 (JFD Model No. 5284) hex tuning tool. For other adjustments an ordinary small screwdriver or suitable tool is sufficient. No matter which tool is used, never force any adjustment control. This is especially critical when adjusting variable inductors or capacitors.

Hardware

The Signal Generator has a mixture of Unified National (inch) and metric screws. The metric screws are defined in Industrial Fasteners publication (IFI 500) and are identified in the replaceable parts list as M (metric). Met ric screws have a shiny silver appearance and are used throughout the instrument. The Unified National screws have a dull steel-gray appearance. Do not use a metric screw in a Unified National nut; thread damage will result.

Assembly Locations

Assemblies in the Signal Generator are numbered in groups, both by function and by location. Refer to lettered service sheet(s) for identification of assemblies. In addition, each tab has major assembly location figures. Also, each tab has a table listing the service sheets where each major assembly is found.

Parts and Cable Locations

The location of individual components mounted on printed circuit boards or other assemblies are shown near the schematic diagram. The part reference designator is the assembly designator plus the part designator. For example, A2A3R9 is R9 on the A2A3 assembly. For specific component descriptions and ordering information, refer to table 6-3, "Replaceable Parts", in chapter 6. Chassis and frame parts, as well as mechanical parts (MP) and cables (W), are identified on "illustrated parts breakdowns" (IPBs), in chapter 6, or in this section on the lettered diagrams.

Test Points and Adjustment Locations

Most test points and adjustments are indicated on circuit board assemblies. Test points and adjustments can also be found on the component locator figure near the assembly's schematic diagram. Test points identified on block diagrams are also shown on the lettered service sheets following the schematic diagram foldouts at the end of chapter 8.

Service Aids on Printed Circuit Boards

Service aids on printed circuit boards include test points, indicators, some reference designations, adjustment names, and assembly part numbers.

Other Service Documents

Service Notes, Manual Change Supplements, and other service literature are available through Hewlett-Packard. For further information, contact your nearest Hewlett-Packard office. Service information should be filed in chapter 8 for easy reference.

Repair and Replacement

After Repair Adjustment Procedure

After repairs are made, adjustments may be needed to assure optimum performance. Refer to table 5-3, "Post Repair Adjustments" in chapter 5 of this manual, to determine what, if any, adjustments are needed after any repair is made.

Disassembly and Reassembly Procedures

Disassembly and reassembly procedures begin on service sheet A. Top and bottom cover removal procedures are described there and also in the following paragraph.

Top and Bottom Cover Removal

1. Place the instrument with the appropriate cover up.
2. Remove the appropriate rear panel standoffs MP9.
3. Loosen the captive screw securing the cover to the frame.
4. Slide the cover to the rear and remove.
5. For replacement, follow the above steps in reverse order.

Etched Circuits (Printed Circuit Boards)

The etched circuit boards in the Signal Generator have plated-through holes which make a solder path through to both sides of the insulating material. Soldering can be done from either side of the board with equally good results. When soldering to any circuit board, keep in mind the following recommendations:

1. Avoid unnecessary component unsoldering and soldering. Excessive replacement can result in damage to the circuit board and/or adjacent components.
2. Do not use a high power soldering iron on etched circuit boards. A 35-watt soldering iron is recommended. Excessive heat may lift a conductor or damage the board.

Caution

Do not use a sharp metal object such as an awl or twist drill in the following step. Sharp objects may damage the plated-through conductor.

3. Use a suction device or wooden toothpick to remove solder from component mounting holes. When using a suction device make sure that equipment is properly grounded to prevent electrostatic discharge from damaging MOS devices. Refer to the following table, "Etched Circuit Soldering Equipment", for information on available tools for working on etched circuit boards.

Table 8-2. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended	HP Part No.
Soldering Tool	Soldering, Heat Staking	Wattage: 35W Tip Temp.: 390—440°C (735—825°F)	Ungar No. 135 Ungar Division Eldon Ind, Corp. Compton, CA 90220	8690-0167
Soldering Tip	Soldering, Unsoldering	*Shape:Chisel	*Ungar PL113	8690-0007
Soldering Tip	Heat Staking	Shape:Cupped	HP 5020-8160 or modified Ungar Pl11	5020-8160
De-Solder Aid	To remove molten solder from connection	Suction Device	Soldapullt by Edsyn Co., Van Nuys, CA 91406	8690-0227
Rosin (Flux) Solvent	To remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board.	Freon TF	8500-0232
Solder	Component replacement, Circuit Board repair wiring	Rosin (flux core, high tin content (63/37 tin/lead)), 18 gauge (AWG) 0.040 in. diameter preferred.		8090-0607

* For working on circuit boards; for general pupose work, use No. 555 Handle (8690-0261) and No. 4037 Heating Unit $47\frac{1}{2}$—$56\frac{1}{2}$ W (HP 8690-0006); tip temperature of 850—900°F; and Ungar No. PL113 $1\frac{1}{8}$ inch chisel tip.

Electrostatic Discharge (ESD) Precautions

Electrostatic discharge (ESD) can cause damage to certain devices in the Signal Generator. The damage can range from slight degradation of a parameter to catastrophic failures.

MOS, CMOS, and other static sensitive devices are used in this instrument. They are prone to damage from both static electricity and transient signals. They must be handled carefully. When working on the Signal Generator, keep in mind the following recommendations to avoid damaging these sensitive components:

1. Use a static-free work station with a pad of conductive rubber or similar material.
2. Do not remove any board unless the Signal Generator has been unplugged.
3. After removing boards from the Signal Generator, be sure that they are placed on a conductive surface to guard against ESD damage. Do not stack boards.
4. When removing a MOS or CMOS device from a high grip socket, be careful not to damage it. Avoid removing devices from these

sockets with pullers. Instead, use a small screwdriver to pry the device up from one end, slowly pulling it up one pair of pins at a time.

5. Once a MOS or CMOS device has been removed from an assembly, immediately stick it into a pad of conductive foam or other suitable holding medium.
6. When replacing a MOS or CMOS device, ground the foam on which it resides to the instrument before removing it. If a device requires soldering, make sure that the assembly is lying on a pad of conductive material, and that the pad, soldering iron tip, and personnel, are grounded to the assembly. Apply as little heat as possible.
7. Before turning the instrument off, remove any large ac sources that may be driving MOS switches.

Module Exchange Program

Table 6-1 lists assemblies that are available on an exchange basis. Refer to the table, and the "Exchange Assemblies" paragraph in chapter 6 for further information.

Non-Repairable Assemblies

The following assemblies are not factory repairable and must be discarded:

A1AT2	Isolator
A1CR1	Crystal Detector
A1FL1	High Pass Filter
A2A2	Rotary Pulse Generator
A3A9A1	Directional Coupler
A3A9A6	Attenuator
A3A9A7	Low Pass Filter
A3A9U1	Sampler

Factory Selected Components (*)

Some component values are selected at the factory to provide optimum compatibility with associated components. These components are identified on individual schematics and the replaceable parts list by an asterisk (*). Refer to table 5-1, "Factory Selected Components", for the selection procedures.

Periodic Maintenance

Cleaning

Cleaning Intervals

Hewlett-Packard recommends a 6-month interval between cleaning for some parts of the Signal Generator and a 12-month interval for other parts. However, cleaning intervals are mostly dependent upon where the Signal Generator is used. The Signal Generator should be cleaned more often if it is used in a dusty or very humid area.

Cleaning Solution

Hewlett-Packard recommends using either of two cleaning solutions on printed circuit (PC) board edge connectors. For best cleaning results, we recommend an ammonium hydroxide solution (NH_4OH, 29.5% NH_3 by weight). However, using concentrated solutions of ammonia requires using gloves, eye goggles, and proper ventilation. The second recommendation is an 80:20 solution of isopropyl alcohol and water (IPA/H_2O). This should serve as a satisfactory cleaner where one would rather not use ammonium hydroxide.

Top Cover Removal and Replacement

1. At the rear corners of the top cover, remove the two plastic standoffs.
2. At the center-rear of the top cover, loosen the captive screw securing the cover to the frame.
3. Slide the cover to the rear and remove it.
4. When the cleaning is completed, position the cover on top of the Signal Generator and gently slide it as far forward as possible.
5. Secure the cover to the frame by tightening the captive screw at the center-rear of the cover.
6. Replace the two plastic standoffs to the rear corners of the Signal Generator.

6-Month Cleaning

Warning

Before cleaning, make sure the Signal Generator is disconnected from the power source to eliminate the possiblity of electrical shock.

Caution

In procedures that call for a vacuum cleaner to remove dust, do not use a blower or compressed air. Doing so will cause the dust to be transferred throughout the Signal Generator.

The following items should be cleaned at 6-month intervals and more often if located in very dusty or humid areas:

Fan

1. At the rear of the Signal Generator, remove two screws and lock washers that secure the fan cover.
2. Remove the fan cover.
3. Using a vacuum cleaner and a soft-bristle brush, remove dust from the fan and its cover.
4. Replace the fan cover.

Vents

1. Locate the ventilation holes at the rear of the Signal Generator (in the lower right corner as viewed from the rear).
2. Using a vacuum cleaner and a soft-bristle brush, remove dust from the ventilation holes.

Power Supply Filter Capacitors

1. Inside the Signal Generator, locate the power supply filter capacitor area (just behind and to the right of the fan as viewed from the rear).
2. Using a vacuum cleaner and a soft-bristle brush, remove dust from the entire area.

Area in Front of Fan

1. Locate the hinged plastic cover just above the fan.
2. Rotate the plastic cover into its upright position.
3. Using the plastic-loop PC board extractors, remove all of the boards.

Note

As you remove each board, locate its silkscreened reference designation. (The reference designations are A3A3, A3A4, A3A5, A3A6, and A3A7.) When you return the boards, you can identify the proper slot by matching reference designations on the PC board, the motherboard, and the plastic cover.

4. Using a vacuum cleaner and a soft-bristle brush, remove dust from the fan and the entire area in front of it.
5. Using a vacuum cleaner and a soft-bristle brush, remove dust from each of the PC boards.

Caution

In the next step, do not let the cleaning solution touch circuit portions of the PC board. This could cause residual flux on solder connections to liquify and contaminate the edge connectors.

6. Using a lint-free cloth saturated with cleaning solution, rub each PC board edge connector 3 or 4 times to remove any foreign material.
7. Rinse the PC board edge connectors with deionized water and wipe them dry.

Note

Before returning the PC boards to their their normal places, it is a good idea to inspect them for heat damage. The PC boards that are mounted directly in front of the fan, produce relatively high amounts of heat. Heat discoloration of the PC board material can be a sign that the fan is not working properly.

8. Carefully insert the PC boards into their guides and mother board connectors. (The component side of each PC board faces right when viewed from the rear of the Signal Generator.)
9. Lower the hinged plastic cover to its normal position.

12-Month Cleaning

Warning

Before cleaning, make sure the Signal Generator is disconnected from the power source to eliminate the possiblity of electrical shock.

Caution

In procedures that call for a vacuum cleaner to remove dust, do not use a blower or compressed air. Doing so will cause the dust to be transferred throughout the Signal Generator.

Digital Control Unit (DCU) Area

1. Just behind and to the left of the fan (as viewed from the rear), locate the long aluminum cover over the DCU assembly.
2. Remove the screw and lock washer located at the rear of the cover.
3. Remove the cover by sliding it to the rear and up.

Note

Before removing any PC board, notice that each board in the DCU has a unique set of color-coded plastic extractors. At the forward end, these extractors match the colors of the guides on the aluminum frame.

4. Remove all five PC boards. To remove each board, grasp both of its extractors. Then, by pulling up on the extractors, the board will gently pry itself from its mother board connectors.

Caution

In the next step, do not use a vacuum cleaner to remove dust from the A2 Assembly PC boards. The boards have static sensitive devices that can be damaged by a vacuum cleaner.

5. Using a soft-bristle brush only, remove dust from the PC boards.
6. Using a vacuum cleaner and a soft-bristle brush, remove dust from the entire DCU area (especially from the mother board connectors).

Caution

In the next step, do not let the cleaning solution touch circuit portions of the PC board. This could cause residual flux on solder connections to liquify and contaminate the edge connectors.

7. Using a lint-free cloth saturated with cleaning solution, rub each PC board edge connector 3 or 4 times to remove any foreign material.
8. Rinse the PC board edge connectors with deionized water and wipe them dry.

Caution

The next step requires care to ensure that PC board edge connectors are properly aligned with the mother board connectors. When properly aligned, the PC board will press snuggly into the mother board connectors. However, if they are not properly aligned, pressure on the PC board can damage the mother board and its connector.

9. Carefully insert the PC boards into their guides and mother board connectors. Ensure that the extractors match the colors on their plastic guides.
10. Install the DCU cover by tilting its front-end down and into the locking slots provided for the cover's front tabs. Then, lower the cover into place and secure it with its screw and lock washer.

Battery, Contacts

1. Locate the battery pack in the general area of the forward-right corner of the Signal Generator (as viewed from the front).
2. With your fingers, remove the spring retaining clip that holds the battery pack in its plastic holder.

Caution

In the next two steps, be careful not to bend the spring-contacts in the battery holder.

3. Using a lint-free cloth saturated with cleaning solution, rub each contact on the battery pack and holder 3 or 4 times to remove any foreign matter.
4. Using a lint-free cloth saturated with deionized water, rinse the contacts. Then wipe them dry.
5. Position the battery pack so that its contacts are on the right side and facing to the rear. Place the battery pack into its holder.

Note

The next step refers to the top and bottom of the spring retaining clip. The bottom of the clip is identified by a single bend of metal; the top is identified by a double bend.

6. Slip the bottom end of the spring retaining clip under the bottom lip of the plastic battery holder. Snap the top end of the clip over the top of the holder.

Schematic Symbology

Basic Logic Symbology

The logic symbols used in this manual are based on the American National Standards Institute (ANSI) Y32.14-1973, "Graphic Symbols for Logic Diagrams (Two State Devices)." A summary of this symbology is provided to aid in interpreting these symbols.

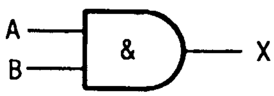
Power supply and ground connections are not shown on the symbols. This information is tabulated on the right margins of the service sheets.

Gates and Qualifiers. This section includes a brief description of the basic logic symbols used on the service sheets, a summary of indicator symbols, a discussion of contiguous blocks, control blocks, and dependency notation, and a summary of symbology for some of the more complex devices.

Qualifiers are that portion of a device symbol that denotes the logic function. For example, "&" denotes the AND function. See figure 8-1 for a summary of the basic logic symbols and their qualifiers.

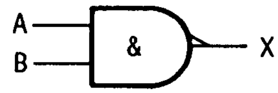
Indicator Symbols. Indicator symbols identify the active state of a device's input or output, as shown in figure 8-2.

AND GATE

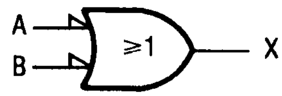


A	B	X
H	H	H
H	L	L
L	H	L
L	L	L

NAND GATE

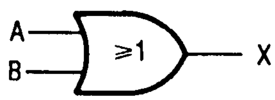


OR GATE WITH INVERTED INPUTS



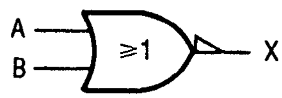
A	B	X
H	H	L
H	L	H
L	H	H
L	L	H

OR GATE

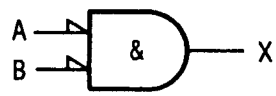


A	B	X
H	H	H
H	L	H
L	H	H
L	L	L

NOR GATE

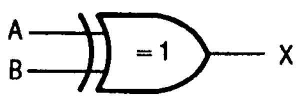


AND GATE WITH INVERTED INPUTS



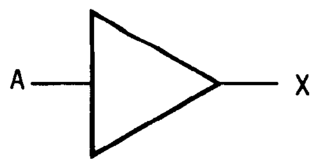
A	B	X
H	H	L
H	L	L
L	H	L
L	L	H

EXCLUSIVE-OR GATE

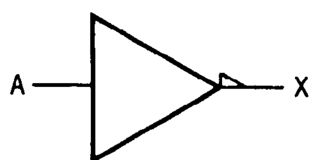


A	B	X
H	H	L
H	L	H
L	H	H
L	L	L

BUFFER



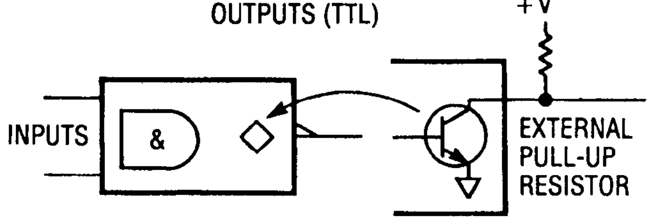
A	X
H	H
L	L



INVERTER

A	X
H	L
L	H

OPEN COLLECTOR OUTPUTS (TTL)



OPEN EMITTER OUTPUTS (ECL)

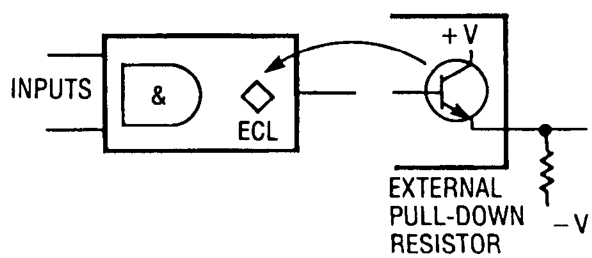
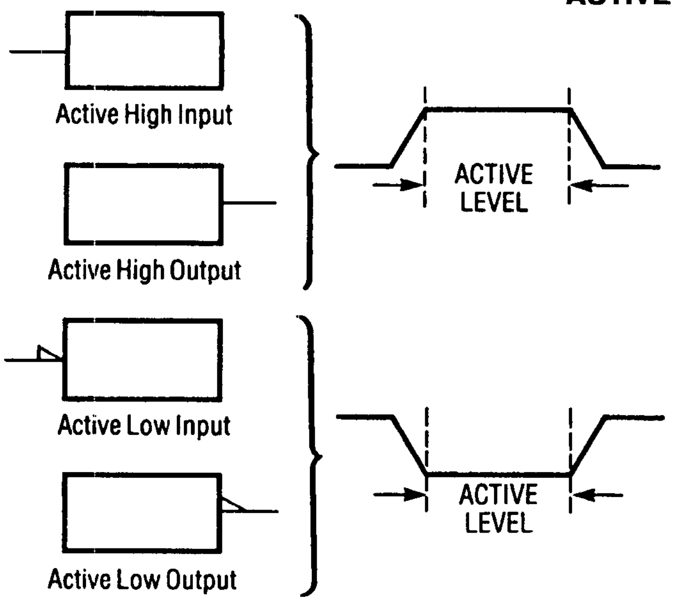


Figure 8-1. Basic Logic Symbols and Qualifiers

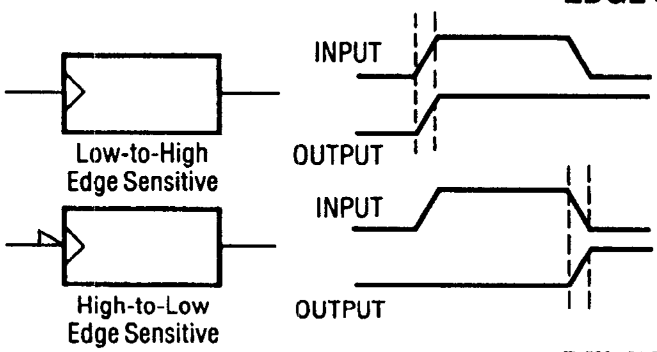
ACTIVE LEVELS



ACTIVE HIGH inputs and outputs are indicated by the absence of the polarity indicator symbol.

ACTIVE LOW inputs and outputs are indicated by the presence of the polarity indictor symbol (⊵).

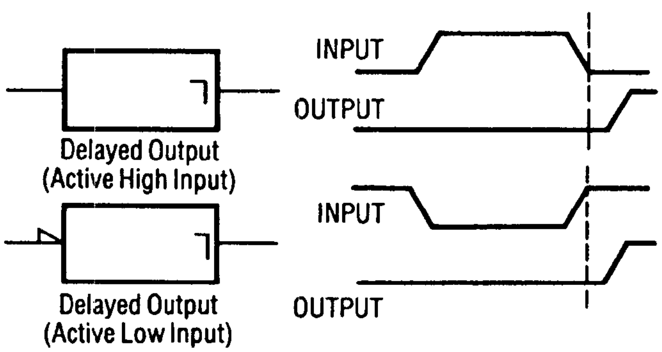
EDGE SENSITIVE INPUTS



EDGE SENSITIVE (low-to-high) inputs are indicated by the presence of the dynamic indicator symbol ( ).

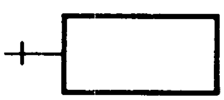
EDGE SENSITIVE (high-to-low) inputs are indicated by the presence of both the dynamic indicator and the polarity indicator symbols ( ).

DELAYED OUTPUT RESPONSE



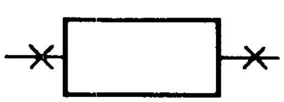
OUTPUT DELAY indicator symbol (˥) shows that the output becomes effective *after* the input signal returns to its inactive state.

INHIBIT INPUTS



INHIBIT indicator symbol (+) indicates an input that, when active, inhibits (blocks) the output(s) from achieving their active states (the outputs remain inactive).

ANALOG LINES



ANALOG indicator symbol (X) indicates a line that has an analog input or output.

Figure 8-2. Indicator Symbols

Contiguous Blocks. Two symbols may share a common boundary, parallel or perpendicular to the direction of the signal flow. Note that in the examples shown in figure 8-3, there is generally no logic connection across a horizontal line, but there is always an implied logic connection across a vertical line. Notable exceptions to this rule are the horizontal lines beneath control blocks and between sections of shift registers and counters (dividers).

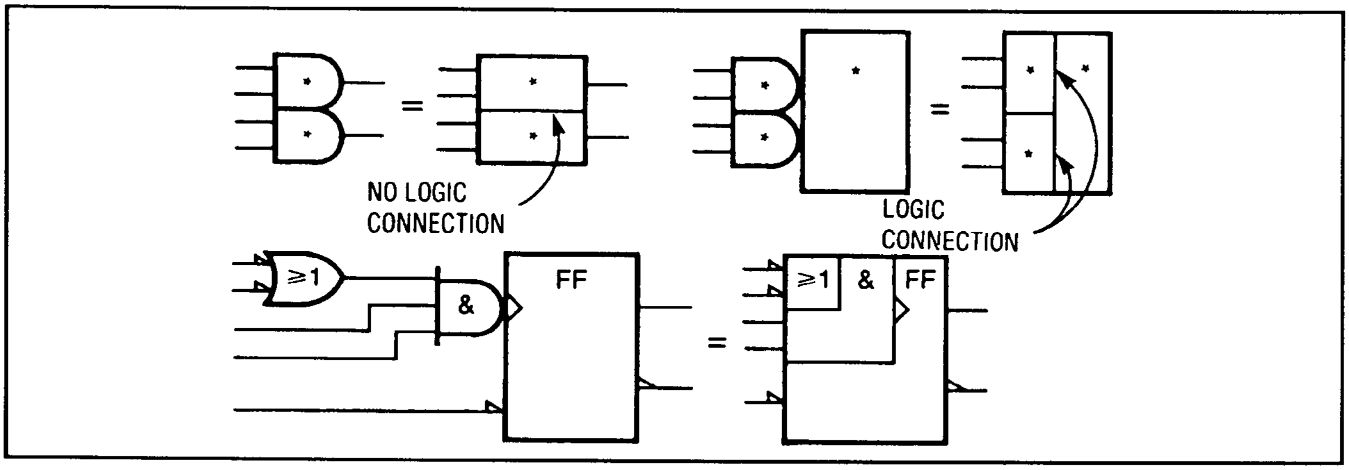
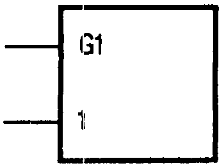
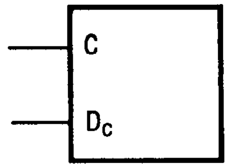


Figure 8-3. Contiguous Blocks

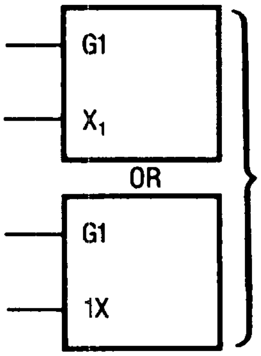
Dependency Notation. Dependency notation simplifies symbols for complex integrated circuit elements by defining the relationship between inputs and outputs without actually showing all the elements and connections involved (see figures 8-8 through 8-10). The following examples use the letter A for address, C for control, G for AND, V for OR, and F for free dependencies. The dependent input or output is labeled with a number that is either prefixed (e.g., 1X) or subscripted (e.g., X1). They both mean the same thing. Note that many times a controlled line may already be labeled with a number that indicates input or output weighting (for example, in a coder). In this case, the controlling or gating input will be labeled with a letter.



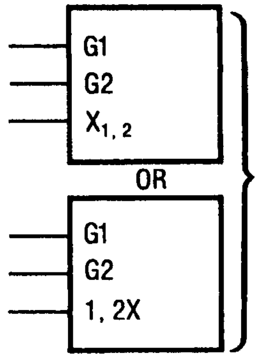
The input that controls or gates other inputs is labeled with a C or a G, followed by an identifying number.
The controlled or gated input or output is labeled with the same number. In this example, 1 is controlled by G1.



If a particular device has only one gating or control input, then the identifying number may be eliminated and the relationship shown with a subscript.

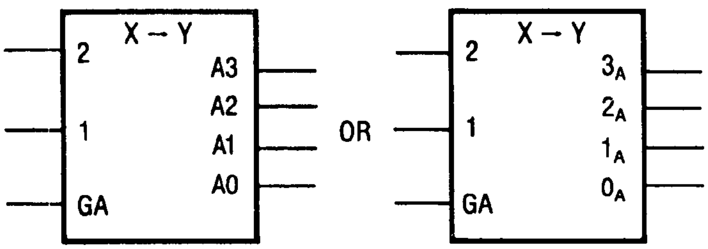


When the controlled or gated input or output already has a functional label (X is used here), that label will be prefixed or subscripted by the identifying number.



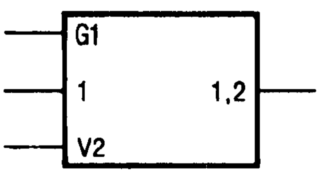
If the input or output is affected by more than one gate or control input, then the identifying numbers of each gate or control input will appear in the prefix or subscript, separated by commas. In this example, X is controlled by G1 and G2.

Figure 8-4. AND Dependency Notation

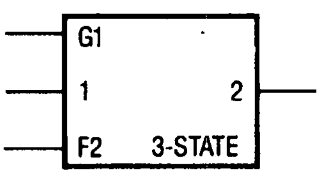


When GA is active, the active address line (0 through 3) is the decoded value of the 1 and 2 binary inputs. When the controlled address lines have a functional value, that value will be prefixed or subscripted by the identifying letter.

Figure 8-5. Address Dependency Notation



When a V input is active, the output will be in its active state. With the V input inactive, the device functions as if the V input doesn't exist.



When an F input is active, the output is enabled to function normally. When an F input is inactive, the output becomes a high impedance, effectively removing that device from the circuit.

The 3-STATE label is sometimes used with the free dependency notation.

Figure 8-6. OR and Free Dependency Notation

Common Control Block. The control block is used in conjunction with an array of related symbols in order to group common logic lines. Figure 8-7 shows how the control block is usually represented. Figure 8-8 shows a quad D-type flip-flop with reset. This can be redrawn as shown in figure 8-9. Note that the representation shown in figure 8-9 can be used when the flip-flops are functionally scattered around the schematic (i.e., not used as a quad unit).

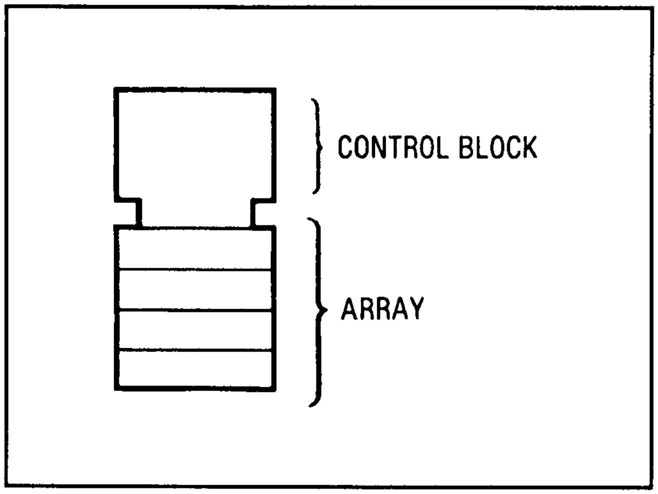


Figure 8-7. Common Control Block

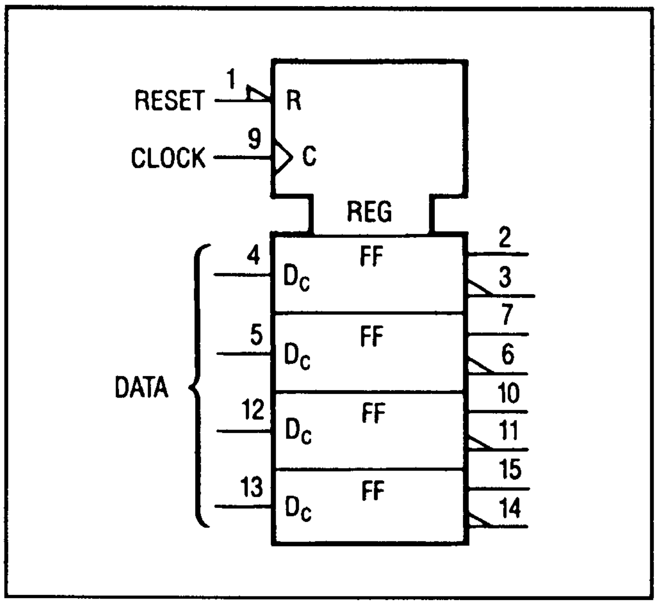


Figure 8-8. Quad D-Type Latch (Combined)

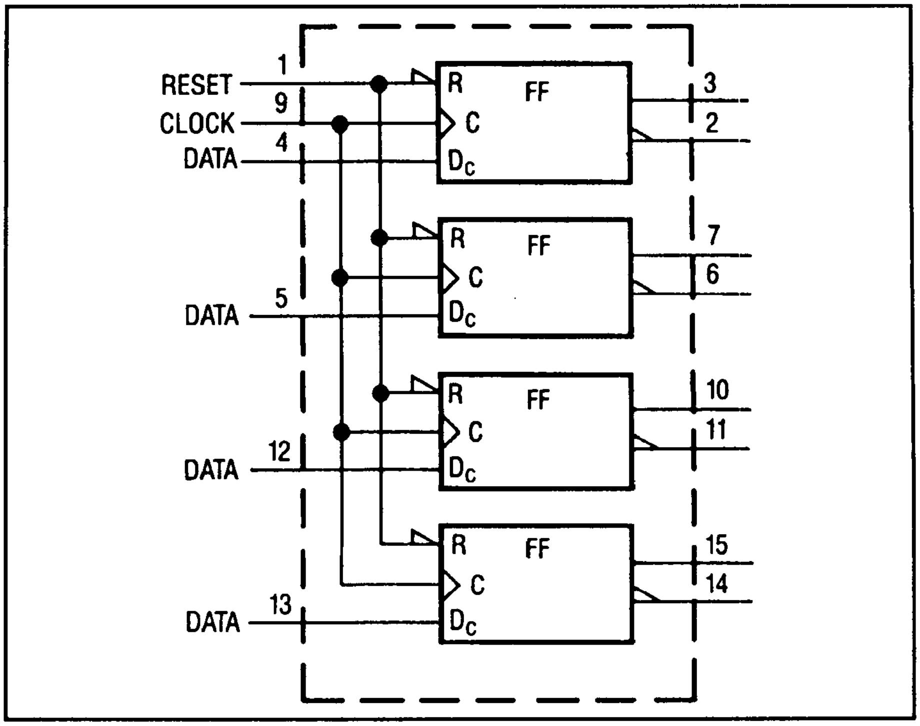


Figure 8-9. Quad D-Type Latch (Individual)

Complex Device Symbology

Figures for complex device symbology show how the basic symbols can be combined to illustrate the behavior of fairly complex devices.

Shift Register. The shift register (see figure 8-10) control block shows common inputs to a bidirectional shift register. Notice that "$>m$" means shift the contents to the right or down by "m" units. And "$<m$" means shift the contents to the left or up by "m" units. Note: If $m = 1$, then "m" may be omitted. Inputs "a" and "b" are each single IC pins that have two functions. Input "a" enables one of the inputs to the top D-type flip-flop (1D) and also shifts the register contents down "m" units. Input "b" enables one of the inputs to the bottom flip-flop (2D), and also shifts the register contents up "m" units. Input "c" loads all four flip-flops in parallel (3D). Input "d" is a common reset. The output delay indicator is used because these are master-slave flip-flops.

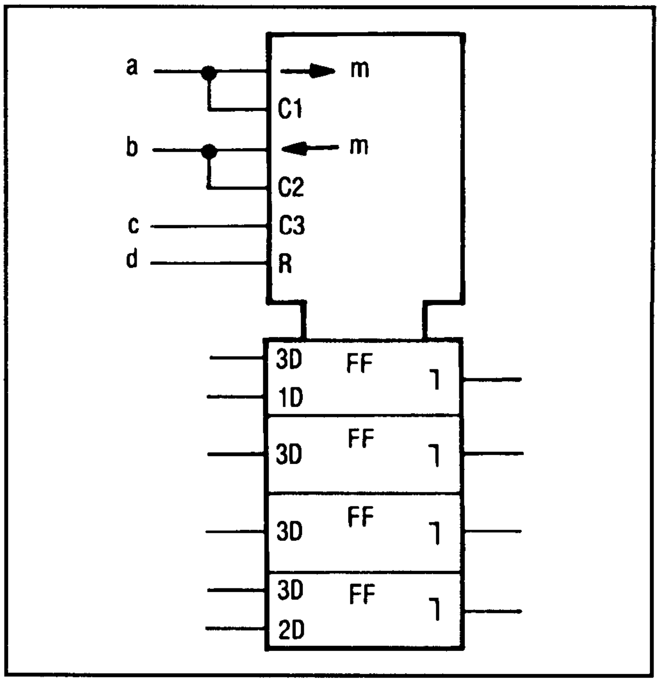


Figure 8-10. Shift Register

AND-OR Selector. The selector control block simplifies the AND portion of a quad AND-OR select gate (see figure 8-11). When G1 is high, the data presented at the "1" inputs is gated through. When G2 is high, the data presented at the "2" inputs is gated through.

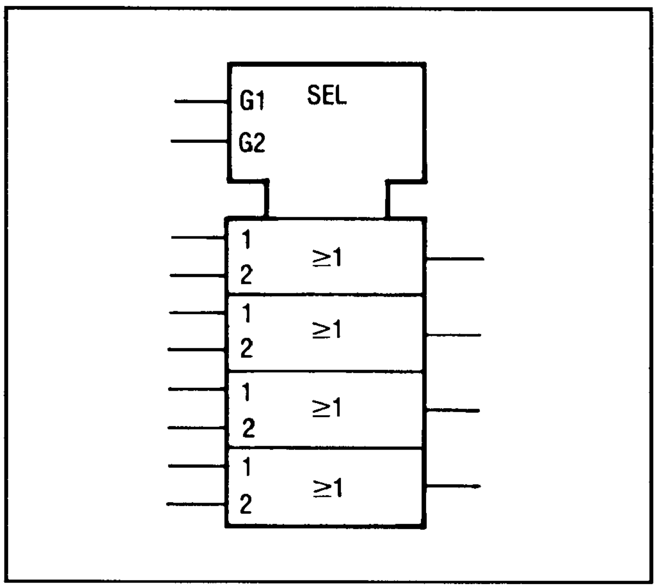


Figure 8-11. AND-OR Selector

UP-DOWN Counter. The counter control block shows common inputs to a Presettable Decade UP-DOWN Counter (see figure 8-12). Notice that "$+m$" means count up (increment the count) by "m"; "$-m$" means count down by "m". Note: if m=1, then "m" may be omitted. Since the D-type flip-flops are master-slave, the output delay indicator is used. The "=9, +1" and "=0, −1" notation defines when the carry and borrow outputs are generated. They also define it as a decade counter; a binary counter would have the carry indicated with "=15, +1". Flip-flop weighting is indicated in parentheses. Input "C1" allows all four "D1" flip-flops to be preset in parallel.

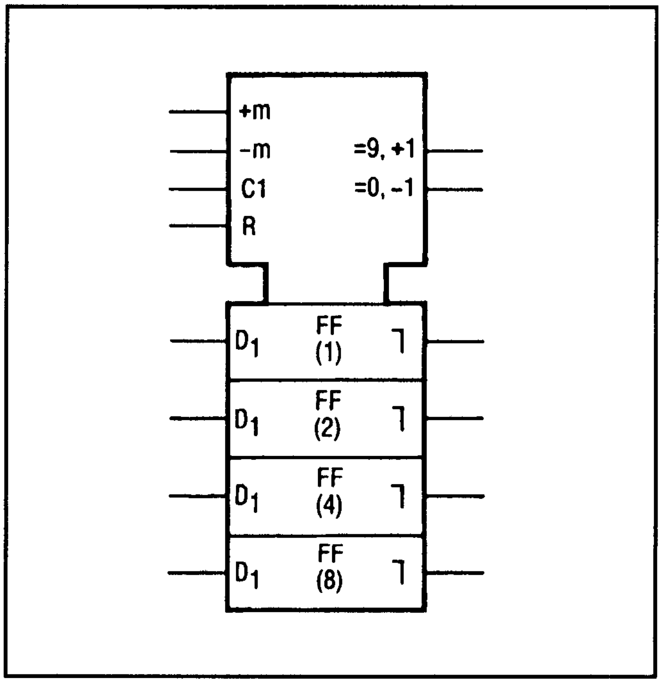


Figure 8-12. UP-DOWN Counter

Quad D-Type Latch. The register control block illustrates a quad D-type latch (see figure 8-13). There is a common active-low reset (R), and a common edge-triggered control input (C). Since there is only one dependency relationship, the controlling input is not numbered and the controlled functions (D) are subscripted with a "C".

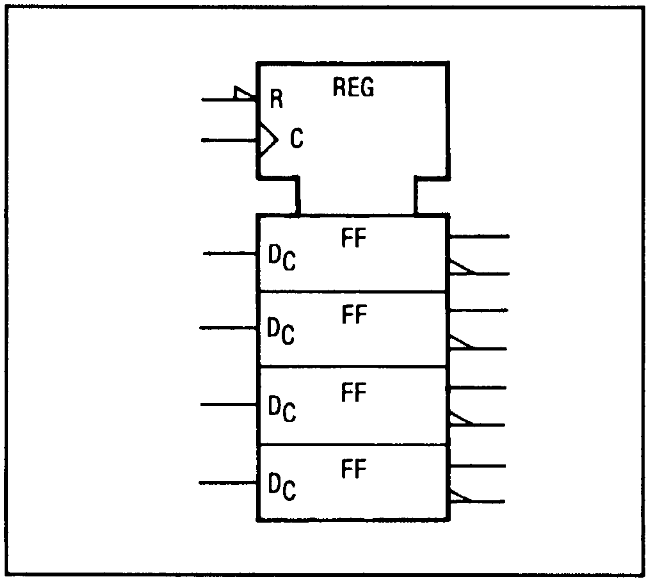


Figure 8-13. Quad D-Type Latch

BD1 Overall Block Diagram and Troubleshooting

References

Servicing Strategy	Beginning of Chapter 8
Operator's Checks	Section III (Operating Manual)
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5

Principles of Operation

Major Assemblies

The Signal Generator consists of three major assemblies as listed below:

A1 RF Output Assembly
A2 Digital Control Unit Assembly
A3 RF Source Assembly

These assemblies are shown in figure 8-14 with their associated subsystems. Each is discussed briefly below:

A1 RF Output Assembly. This assembly amplifies and levels baseband (2 to 6.2 GHz) frequencies. For frequencies above 6.2 GHz, the RF output assembly provides frequency multiplication as well as amplification and leveling. The RF output can be leveled between −10 and +13 dBm with additional dynamic range provided by a 110 dB step attenuator. AM takes place in this assembly. Control of the FM drive signal occurs here though actual FM occurs in A3. The subsystems of the RF Output Assembly are:

- Microwave Signal Path Circuits
- ALC AM Circuits

A2 Digital Control Unit Assembly. The Digital Control Unit is a digital state machine that controls the entire operation of the Signal Generator. Part of the RF Phase Locked Loops subsystem is also contained in the Digital Control Unit assembly. The subsystems of the Digital Control Unit assembly are:

- DCU Remote/Local Interface
- DCU Frequency Control

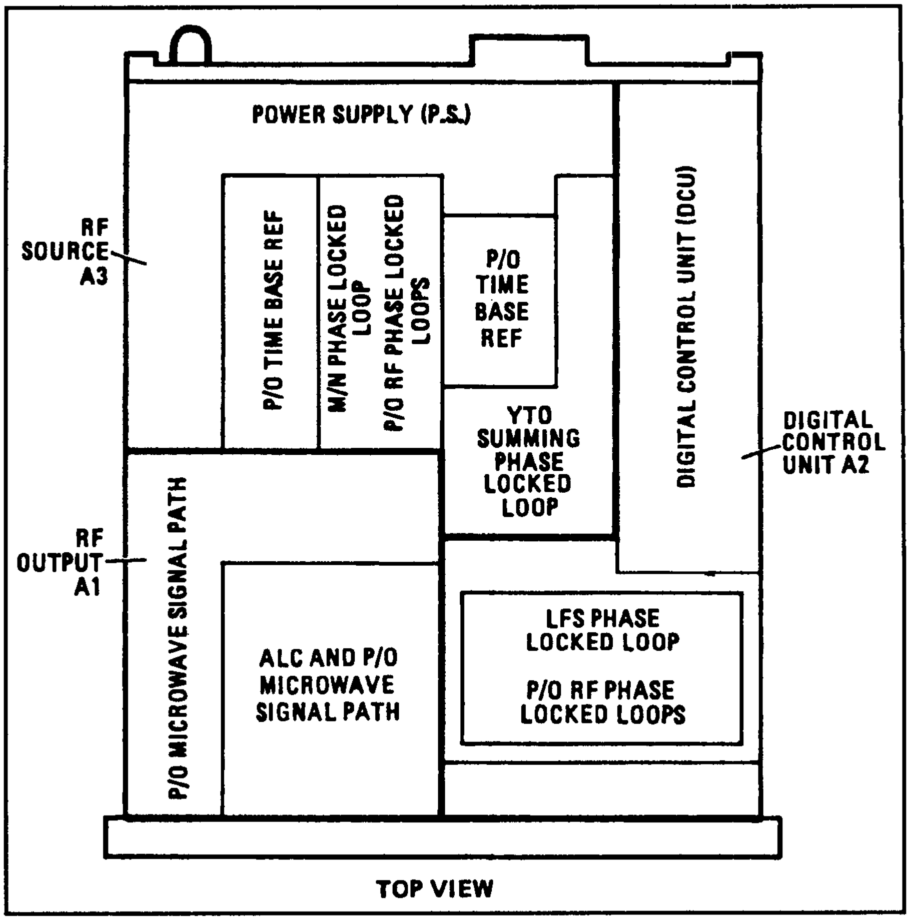


Figure 8-14. Major Assemblies

A3 RF Source Assembly. The RF Source assembly contains four phase locked loops, an internal 10 MHz reference oscillator and FM circuits. The phase locked loops are tuned by the Digital Control Unit (DCU) to produce frequencies between 2 and 6.2 GHz with 1 kHz resolution. The phase locked loops are phase locked to the 10 MHz internal reference oscillator or an external 5 or 10 MHz frequency reference. The subsystems of the RF Source are:

- Time Base Reference
- Part of the RF Phase Locked Loops
- YIG Tuned Oscillator (YTO — Includes FM)

Functional Description

Functionally, the Signal Generator can be divided into nine electrical subsystems. The nine subsystems are listed below with the major assemblies of which they are a part:

- Time Base Reference, A3
- RF Phase Locked Loops, A2 and A3
- YTO Summing Phase Locked Loop, A3
- Microwave Signal Path, A1

- Automatic Level Control (ALC), A1
- DCU Remote/Local Interface, A2
- DCU HP-IB Interface, A2
- DCU Frequency Control, A2
- Power Supplies, A3

The electrical subsystems are illustrated in the block diagram of BD1. Each block of BD1 is further detailed by the block diagram indicated in the lower right hand corner of each block on BD1. The following description is referenced to BD1. A more detailed description of each block accompanies the associated block diagram, BD2 — BD9.

Time Base Reference. The Time Base Reference generates precise reference signals of 10, 20, 100 and 400 MHz. These frequencies are derived from an internal 10 MHz reference oscillator or from an external 5 or 10 MHz frequency source. The Time Base Reference subsystem consists of the following:

- 10 MHz Reference Oscillator
- Reference Phase Locked Loop

RF Phase Locked Loops. The two RF Phase Locked Loops are used to phase lock the YTO Summing Phase Locked Loop output frequency to the reference signals of the Time Base Reference. The RF Phase Locked Loops subsystem consists of the following:

- Low Frequency Source (LFS) Phase Locked Loop
- M/N Phase Locked Loop

The LFS phase locked loop controls the 1 kHz through 1 MHz digits of the YIG Tuned Oscillator (YTO) Summing phase locked loop. The M/N phase locked loop controls the 10 MHz to 1 GHz digits of the YTO Summing phase locked loop. The RF Phase Locked Loops subsystem is located in the A3 RF Source major assembly (M/N phase locked loop) and the A2 Digital Control Unit major assembly (LFS phase locked loop).

YIG Tuned Oscillator (YTO) Summing Phase Locked Loop. The YTO Summing phase locked loop generates baseband frequencies of 2.0 to 6.2 GHz directly using a YIG Tuned Oscillator (YTO). The YTO is phase locked to reference frequencies from the Low Frequency Source (LFS) phase locked loop and the M/N phase locked loop. FM also takes place within the YTO Summing phase locked loop.

The output of the YTO is downconverted to a frequency between 20 and 30 MHz using a harmonic of the M/N frequency reference. This intermediate frequency is then phase compared to the output of the LFS phase locked loop and the YTO frequency is adjusted until the two frequencies are equal. Because the YTO output is downconverted instead of divided, a 1 kHz change in the reference signal from the LFS phase locked loop will change the output frequency of the YTO by 1 kHz.

The M/N phase locked loop output signal is used to tune the YTO output in 10 MHz steps and the LFS output signal is used to fine tune the YTO output over a 10 MHz range. Together, the M/N and LFS output signals control the YTO output frequency from 2 to 6.2 GHz in 1 kHz steps.

The YTO Summing Loop consists of the following assemblies:

- Digital to Analog Converter
- YIG Tuned Oscillator (YTO) Driver
- YTO Sampler
- YTO Phase Detector
- YTO High Frequency Driver

Microwave Signal Path. The Microwave Signal Path performs five basic functions:

1. Multiplies the 2 to 6.2 GHz baseband signal from the YTO Summing phase locked loop to generate frequencies from 6.2 to 18 GHz.
2. Amplifies the 2 to 6.2 GHz baseband signal to produce the specified power levels over the 2 to 18 GHz frequency range.
3. Provides step attenuation (10 dB/step) to increase the dynamic range of the leveled RF output.
4. Detects the output level to provide a feedback signal to the ALC circuitry.
5. Drives the ALC circuitry to provide AM. Processes drive signals for both AM and FM (though FM actually occurs in A3).

The microwave signal path is contained in the A1 RF Output major assembly. The Microwave Signal Path consists of:

- RF Amplifier
- YIG Tuned Multiplier
- SRD Control
- Part of ALC Detector
- Part of RF Output Level Control

Automatic Level Control. The primary function of the ALC circuitry is to provide accurate calibrated output power over the Signal Generator's 2 to 18 GHz frequency range. In addition, an external ALC input makes it possible to automatically control the level at a remote load.

Internal ALC detects the level at the output of the YIG Tuned Multiplier (YTM) using a directional coupler and a crystal detector. The output of the YTM is leveled over a −10 to +13 dBm range by the ALC circuitry. Additional dynamic range is provided by a 110 dB step attenuator to achieve leveled output as low as −120 dBm.

External ALC modes use an external crystal detector or a power meter's recorder output instead of the internal crystal detector to provide the feedback. During external leveling, the output power of the YTM should be kept within a −10 to +3 dBm range if possible. Setting the attenuation in the signal path too high may cause an unleveled condition if the output power available from the YTM is not enough to overcome the attenuation setting and the losses in the external signal path.

Crystal leveling requires the crystal detector to be operating in the square law region (the output of the detector is proportional to the detected power in watts). Operation outside the square law region will not allow the vernier to be calibrated over the 13 dB range.

Power meter leveling is slower than crystal detector leveling but has the advantages of temperature compensation and a much wider dynamic range (limited only by the power sensor). With automatic ranging power meters, the range must be held to prevent oscillations in the output level. The oscillations occur when the Signal Generator responds to the range change (which rescales the feedback voltage) while the power meter settles. The result is that the power meter is continually trying to settle by changing ranges while the Signal Generator is responding to each range change by setting the level outside of the new range.

The AM input is added directly to the ALC/AM modulator drive signal after passing through correction circuitry in the ALC subsystem.

DCU Remote/Local Interface. The DCU processes inputs from the front panel in local mode and the HP-IB in remote mode. In local mode, the operator enters data with the front panel switches and the TUNING knob. The TUNING knob is a Rotary Pulse Generator (RPG) which provides continuous control of frequency tuning. Selectable tuning resolution coupled with the RPG provides convenient control when setting output frequency.

DCU HP-IB Interface. Remote mode uses a combination of special ASCII program codes and arguments to simulate the front panel controls. The HP-IB Address assembly is used to decode the information on the HP-IB and to generate control signals for managing the input data. The HP-IB Interface assembly is used to decode the program codes and arguments so the DCU Frequency Control subsystem can alter the frequency setting of the instrument.

DCU Frequency Control. The DCU produces tuning information and frequency band related information based on the current front panel frequency. Tuning information comes from the DCU Remote/Local Interface as tuning and resolution for local mode, or actual frequency information for remote mode.

Each frequency change requires a cycling of the frequency data through three registers. Register 1 holds the front panel frequency, rounds the desired frequency according to the frequency resolution and decodes the appropriate frequency band. Register 2 divides the Register 1 frequency by 1, 2 or 3 to produce a baseband frequency and indicates whether the frequency is evenly divisible. Register

3 generates the tuning information for the phase locked loops to generate the appropriate baseband frequency.

Power Supplies. The power supplies supply all of the dc operating voltages required by the instrument. The +22 volt regulator is activated whenever power is supplied to the Signal Generator. The reference oscillator's oven is powered by this supply to keep the crystal at operating temperature whenever the instrument is connected to line mains. The remaining voltage regulators are are not enabled until the front panel LINE switch is set to ON. The power supplies are located in the A3 RF Source major assembly.

Troubleshooting Procedures

General

If the instrument is not operating properly in local mode, use the following Overall Level Procedure to isolate the problem to one of the nine subsystems. The appropriate Functional Level Procedures (associated with BD2 through BD10) and Circuit Level Procedures (associated with service sheets 1 through 35) should then be followed to isolate the problem to the defective assembly within the subsystem, and then to the defective component within the defective assembly.

Once the defective component has been replaced, perform the Overall Level Procedure again to check for other possible malfunctions.

When the Overall Level Procedure can be performed with no failures, do the "Abbreviated Performance Test" procedures in Section IV of the Operating Manual before placing the instrument back into service.

Overall Level Procedure

The Overall Level Procedure is divided into nine checks, as follows:

Turn-On Check (√1)
Power Supply Checks (√2)
Front Panel Checks (√3)
Baseband (2 — 6.2 GHz) Checks (√4) and (√5)
YTO Frequency Check (√4a)
Reference Phase Locked Loop Check (√4b)
LFS Phase Locked Loop Check (√4c)
M/N Phase Locked Loop Check (√4d)
YTO Power Check (√5)
YTO/FM Check (√6)
Output Level Check (√7)
ALC Check (√8)
AM Check (√9)

The nine checks should be run in sequence because each check assumes that previous checks have been performed and no malfunctions have occurred. Also, because of the interrelationship of the various subsystems of the Signal Generator, it is difficult to determine which subsystem is at fault without performing the checks in the order indicated. If a remote programming problem is suspected, do the nine checks. If no problems are found, begin the remote programming troubleshooting with service sheet BD7.

Troubleshooting Hints

Before troubleshooting power problems, ensure that the output frequency is correct. Incorrect frequency tuning can cause severe power holes due to internal filtering. In addition, a phase locked loop can phase lock on an incorrect frequency if the tuning data is incorrect. Therefore, always perform the frequency checks before attempting to troubleshoot power problems.

Power problems can be caused by a mistuned YTM. If the UNLVL annunciator is on, adjust the Signal Generator's PEAK/NORM control. If adjusting the control extinguishes the annunciator, the problem is probably an adjustment problem. Drift problems in the YTM will show up as power problems either immediately after tuning to a frequency above 16 GHz or after a settling period of about 10 minutes. A test for correct adjustment to minimize the effects of YTM drift is found on BD5.

Equipment

Frequency Counter................	HP 5343A
Digital Voltmeter.................	HP 3455 or HP 3456A
Power Meter.....................	HP 436A
Oscilloscope......................	HP 1980B

Turn-On Check ($\surd$1)

1. Set the LINE switch to STANDBY. Remove all external cables from the front and rear panels of the Signal Generator, including the line cord.
2. Set the rear panel FREQ STANDARD INT/EXT switch to INT and connect the short jumper (A3W3) between A3J9 and A3J10.
3. After the line cord has been disconnected from the Signal Generator for at least one minute, reconnect the line cord and check for the following indications:

   The front panel STANDBY and OVEN COLD annunciators should be lighted. The fan should be off. All of these indications are controlled by the +22V power supply which is on whenever the line cord is connected.

   If the above indications are correct, proceed with step 6.

   If any of the above indications are incorrect, proceed with step 4.
4. Remove the top cover and observe the +22V indicator on A3A12 Rectifier assembly.

If the +22V indicator is on and the STANDBY and/or OVEN COLD annunciators are off, check the associated LEDs and proceed with step 6.

If the indicator is off, proceed with step 5.

5. Observe the Primary "ON" indicator. This indicator is located on the A3 motherboard and can be checked by removing the Signal Generator's bottom cover.

   If this indicator is ON, the transformer is on and there is power at the input of the +22 volt regulator. Go to BD10 to further isolate the problem.

   If the indicator is off, check that the fuse is not open and that the Voltage Selection Card is properly installed. See Section II of the Operating Manual for the Voltage Selection Card installation procedure.

Note An improper voltage selection can cause all supplies to be on, but too low in voltage. This is indicated by dim front panel displays.

Once the repair or adjustments have been completed, repeat steps 1 through 5.

6. Leave the LINE switch set to STANDBY until the OVEN COLD annunciator turns off. This should occur within 15 minutes or less depending on how long the Signal Generator was disconnected from main power.

   Once the OVEN COLD annunciator turns off, set the LINE switch to ON.

Note The OVEN COLD annunciator may flicker on and off temporarily just as the oven stabilization temperature is reached. This is normal.

The FREQUENCY MHz display should show a frequency between 2.0 and 18.599 997 GHz. If the frequency is not within these limits or the display is not stable, press the PRESET (3 GHz) key.

If the display is within the given range or can be preset to 3 GHz, proceed with step 7 to confirm proper operating voltages.

If the display indicates a frequency outside the given range or cannot be stabilized, proceed with step 7 to check the power supply voltages. If the voltages are correct, go to BD9 to troubleshoot the frequency control portion of the Digital Control Unit (DCU).

Power Supply Checks (√2)

7. An improper operating voltage can manifest itself in unpredictable ways. Therefore, check the power supply voltages before continuing with any troubleshooting.

   Remove the top cover and check the voltages at the following test points.

Test Point	Voltage
A3A3TP1	+22 ± 0.2 Vdc
A3A3TP6	+11 ± 1.1 Vdc
A3A3TP5	+20 ± 0.002 Vdc
A3A3TP2	+5.2 ± 0.1 Vdc
A3A4TP5	−5.2 ± 0.05 Vdc
A3A4TP1	−40.0 +0.6, −1.0 Vdc
A3A4TP4	−10.0 ± 0.2 Vdc

   If any voltage is incorrect, proceed to "Power Supply Adjustments" in chapter 5 and attempt to adjust the faulty output to the correct voltage.

   If the voltage cannot be adjusted, proceed to BD10 to isolate the power supply fault.

   If any adjustments or repairs are required, repeat this procedure from step 1 after making the appropriate adjustments or repairs.

   If all voltages are correct, proceed with step 8.

Front Panel Checks (√3)

8. Press PRESET (3 GHz) to set the Signal Generator's frequency to 3 GHz. Set the remainder of the front panel controls as follows:

RF OUTPUT	OFF
PEAK-NORM	NORM (in detent)
RANGE	fully counterclockwise
VERNIER	fully counterclockwise
ALC	INT
ALC CAL	fully clockwise

9. Press the HOLD key. Verify that the Signal Generator's displays indicate the following conditions:

RANGE dB	−110 dB
Meter	<−10 dBm
ALC	INT and UNLVL
RF	OFF
FREQUENCY	3000.000 MHz
RESOLUTION	All four segments extinguished

STATUS	OVEN COLD may be lighted. ϕ UNLOCKED should be lighted. All others should be extinguished.

If the displays are correct, proceed with step 10.

If any display is incorrect, proceed to BD7 to isolate the problem to either the front panel or the DCU.

10. Set the ALC selector to XTAL and then PMTR while observing the ALC annunciators.

    The XTAL and PMTR annunciators should light when the ALC selector is in the corresponding position. The UNLVL annunciator should remain on.

    If the indication is correct, set the ALC selector to INT and continue with step 11.

    If any or all indications are incorrect, go to BD7 to isolate the problem to the front panel or the DCU.

11. Set the RF OUTPUT switch to ON.

    The RF ON annunciator should light and the RF OFF annunciator should extinguish. In addition, the UNLVL annunciator in the ALC block and the ϕ UNLOCKED annunciator in the STATUS block should also extinguish.

    If the RF annunciator indication is correct, continue with step 12. The UNLVL and ϕ UNLOCKED annunciators will be checked in subsequent steps.

    If the RF annunciator indication is not correct, proceed to BD7 to isolate the problem to the front panel or the DCU.

12. Set the FM DEVIATION MHz switch successively to .03, .1, .3, 1, 3, and 10. Verify that the FM status annunciator corresponding to each switch setting illuminates and that all others extinguish. Return the FM DEVIATION MHz switch to OFF and verify that all FM status annunciators are extinguished. *The FM OVER MOD LED should not come on at any time during this check.*

    If the indications are correct, go to step 13.

    If the indications are not correct, go to BD7.

13. Set the AM switch to 30% and then 100%. Verify that the AM status annunciator corresponding to each switch setting illuminates and that the remaining annunciator is extinguished. Return the AM switch to OFF and verify that both AM status annunciators are extinguished.

    If the indications are correct, go to step 14.

    If the indications are not correct, go to BD7.

14. Press the rightmost FREQUENCY RESOLUTION key and verify that all of the segments under the FREQUENCY MHz display light.

    If the indication is correct, proceed with step 15.

    If the indication is not correct, go to Service Sheet 31 to troubleshoot the frequency resolution circuitry.

15. Press each of the remaining FREQUENCY RESOLUTION keys in a right to left sequence. Verify that each subsequent key lights the segment above the key and all segments to the left of the key. The segments to the right of the key should extinguish.

    If the indication is correct, proceed with step 16.

    If the indication is not correct, go to service sheet 31 to troubleshoot the frequency resolution circuitry.

16. Press the HOLD key and verify that all the lighted segments under the FREQUENCY MHz display are extinguished.

    If all of the segments extinguish, proceed with step 17.

    If the segments do not extinguish, go to service sheet 31 to troubleshoot the frequency resolution circuitry.

17. Press the rightmost FREQUENCY RESOLUTION key.
    Tune the frequency using the TUNING knob. The frequency should increment in 1 kHz steps when the TUNING knob is turned clockwise, and decrement in 1 kHz steps when turned counterclockwise. Do not tune above 6 GHz in this step to avoid changing frequency resolution.

    If the frequency can be tuned in 1 kHz steps, proceed with step 18.

    If the frequency cannot be tuned, go to BD9 to troubleshoot the DCU frequency control circuitry.

18. Repeat step 17 for the other three FREQUENCY RESOLUTION keys. Each key should allow tuning of the digit over the rightmost lighted segment.

    If the frequency can be tuned using all available tuning resolutions, proceed with "Baseband Check" beginning with step 19.

    If the frequency cannot be tuned for one or all selected tuning resolutions, go to service sheet 31 to troubleshoot the frequency resolution circuitry.

Baseband Checks

YTO Frequency Check ($\sqrt{}$4a)

19. Disconnect the semi-rigid coax from the output of coupler A3A9A1J1 (BD1 TPH), and connect the frequency counter in its place. Connect the frequency reference (10 MHz) output of the frequency counter to A3J10 on the Signal Generator's rear panel. Set the FREQ STANDARD INT/EXT switch to EXT. With a common timebase, the frequency counter will agree with the Signal Generator's front panel frequency within ±1 count for any selected frequency counter resolution.

20. Set the frequency to each of the frequencies listed below.

    The Signal Generator should remain phase locked at each frequency and the frequency counter should agree with the Signal Generator's frequency display ±1 count.

Frequency (MHz)	LFS Divider Number (N1)
2 000.000	3000.0
2 000.001	2999.9
2 001.112	2888.8
2 002.223	2777.7
2 003.334	2666.6
2 004.445	2555.5
2 005.556	2444.4
2 006.667	2333.3
2 007.778	2222.2
2 008.889	2111.1
2 009.999	2000.1

If the instrument remains phase locked for all of the frequencies, proceed with step 21.

If the frequency is not correct or the ϕ UNLOCKED annunciator is lighted at any or all frequencies, proceed with the Reference Phase Locked Loop check beginning with step 22.

21. Set the Signal Generator frequency to each of the frequencies listed below.

    The Signal Generator should remain phase locked at each frequency and the frequency counter should agree with the Signal Generator's frequency display ±1 count.

Frequency (MHz)	M/N Divider Numbers M	N
2 090.000	8	11
2 280.000	9	12
2 470.000	10	13
2 660.000	11	14
2 850.000	12	15
3 040.000	13	16
3 230.000	14	17
3 420.000	15	18
3 610.000	16	19
3 800.000	17	20
3 990.000	18	21
4 180.000	19	22
4 370.000	20	23
4 560.000	21	24
4 750.000	22	25
4 940.000	23	26
5 130.000	24	27
5 320.000	25	28
5 510.000	26	29
5 700.000	27	30
5 900.000	27	31
6 100.000	27	32

If the instrument remains phase locked for all of the frequencies, proceed with the YTO Power Check beginning with step 27.

If the frequency is not correct or the ϕ UNLOCKED annunciator is lighted at any or all frequencies, proceed with the Reference Phase Locked Loop check beginning with step 22.

Reference Phase Locked Loop Check ($\sqrt{}$4b)

22. With the frequency counter and Signal Generator using a common timebase (see step 19), check the frequency at the following test points.

Test Point	Frequency
TPA	100 MHz
TPB	10 MHz
TPD	10 MHz
TPE	400 MHz
TPC	20 MHz

If the frequency counter agrees with the values indicated ±1 count, proceed with the LFS Phase Locked Loop check beginning with step 23.

If any or all of the frequencies are incorrect, go to BD2 to isolate the problem.

LFS Phase Locked Loop Check (√4c)

23. Disconnect the green cable from A2A3J1 (BD1 TPF) and connect the frequency counter in its place.
24. Set the Signal Generator frequency to each of the frequencies listed below.

    The LFS Loop should remain phase locked at each frequency and the frequency counter should agree with the given frequency ±1 count.

Signal Generator Frequency (MHz)	LFS Output (MHz)
2 000.000	30.000
2 000.001	29.999
2 001.112	28.888
2 002.223	27.777
2 003.334	26.666
2 004.445	25.555
2 005.556	24.444
2 006.667	23.333
2 007.778	22.222
2 008.889	21.111
2 009.999	20.001

If the frequencies are correct, proceed with step 25, M/N Phase Locked Loop Check.

If one or more of the frequencies are incorrect, proceed to BD3 to isolate the problem within the LFS Phase Locked Loop.

M/N Phase Locked Loop Check (√4d)

25. Reconnect the green cable to A2A3J1 and disconnect the white/orange cable from A3A1A5J3 (TPG). Connect the frequency counter to A3A1A5J3.
26. Set the Signal Generator frequency to each of the frequencies listed below. The M/N Loop should remain phase locked at each frequency and the frequency counter should agree with the given frequency within ±1 count.

Signal Generator Frequency (MHz)	M/N Frequency (MHz)
2 090.000	192.727273
2 280.000	192.500000
2 470.000	192.307692
2 660.000	192.142857
2 850.000	192.000000
3 040.000	191.875000
3 230.000	191.764706
3 420.000	191.666667
3 610.000	191.578947
3 800.000	191.500000
3 990.000	191.428571
4 180.000	191.363636
4 370.000	191.304348
4 560.000	191.250000
4 750.000	191.200000
4 940.000	191.153846
5 130.000	191.111111
5 320.000	191.071429
5 510.000	191.034483
5 700.000	191.000000
5 900.000	191.290323
6 100.000	191.562500

If the frequencies are correct, the YTO Summing phase locked loop is at fault. Go to BD4 to isolate the problem.

If any frequency is not correct, go to to BD3 to isolate the problem in the M/N phase locked loop.

When the problem has been corrected, repeat the procedure from step 1.

YTO Power Check (√5)

27. Disconnect the frequency counter and connect the power meter to BD1 TPH.

28. Tune the Signal Generator from 2 000.000 MHz to 6 100.000 MHz, in 100 MHz steps and verify that the power is greater than +10 dBm for each frequency.

    If the level is correct, reconnect the cable to BD1 TPH and proceed with YTO/FM check beginning with step 29.

    If the level is low at any or all points, proceed to BD4 to isolate the problem.

YTO/FM Checks (√6)

29. Press PRESET (3 GHz). Set the Signal Generator AM switch to OFF, the FM DEVIATION MHz switch to .3, the METER MODE switch to FM, and the output power level to −10 dB. Connect the spectrum analyzer to the Signal Generator's RF OUTPUT connector. Connect a BNC TEE to the Signal Generator's FM INPUT connector and the DVM and the test oscillator to the BNC TEE.

30. Set the test oscillator to 100 kHz and, starting from 0 Vrms, increase the amplitude of the 100 kHz signal to obtain the first carrier null (modulation index = 2.404). Verify that the voltage applied is 0.567 ±0.049 Vrms and that the front panel meter indicates 240 ±30 kHz.

    If both indications are correct, go to step 31.

    If the voltage applied is incorrect, proceed to BD4 to isolate the cause.

    If only the front panel meter indication is incorrect, and:

    a. if the Meter indication is out of tolerance only, go to "FM Adjustments", Chapter 5 to adjust the meter.

       or

    b. if the Meter needle moves slightly or not at all, reverses direction or jumps, go to "Meter Checks", BD6.

31. Leave the test oscillator output frequency set at 100 kHz and reduce its amplitude to zero Vrms. Set the Signal Generator FM DEVIATION MHz switch to 1. Slowly increase the amplitude of the test oscillator past the Signal Generator's second carrier null until the OVER MOD Led illuminates. Do not exceed 0.707 Vrms. Verify that the voltage is 0.497 ±0.060 Vrms.

    If the indication is correct, the FM circuits are probably working. If further verification is needed, perform the "FM Adjustments" procedures in chapter 5. Otherwise, proceed with step 32, "Output Level Check".

    If the indication is not correct, go to BD4 to troubleshoot the Overmodulation Detector.

Output Level Check (√7)

32. Connect the power meter to the Signal Generator's RF OUTPUT connector.

33. Set the Signal Generator's ALC selector to XTAL, the OUTPUT LEVEL RANGE to 0 dB and remove the input (if any) from the EXT ALC INPUT.

34. Tune the Signal Generator from 2 to 18 GHz in 100 MHz steps. With no feedback at the external ALC input, the Signal

Generator will deliver maximum available output power. The power should not drop below +8 dBm for any frequency.

If the power does not drop below +8 dBm for any frequency, proceed with ALC Check.

If the output level is low at any or all frequencies, go to BD5 to isolate the cause.

ALC Check (√8)

35. Set the Signal Generator to 2 GHz, the METER MODE switch to LEVEL, the ALC switch to INT, and the RANGE switch to 0 dB. Starting from a fully cw position, slowly turn the VERNIER fully counterclockwise. Verify that the power meter reading varies from +3 dBm to −10 dBm ±1.5 dB. The UNLVL annunciator should remain off.

    If the power meter reading is correct and the annunciator remains off, go to step 36.

    If the power meter reading varies gradually through a dB range smaller than indicated or at a lower dBm level and if the UNLVL annunciator remains off, go to chapter 5 to perform the ALC adjustments. If adjustment fails, go to BD6.

    If the power does not vary gradually or the UNLVL annunciator lights, the Automatic Loop Control is malfunctioning. Go to BD6.

36. Again rotate the VERNIER slowly from a fully clockwise to a fully counterclockwise position. Verify that the Signal Generator's Meter gradually indicates +3 dBm to −10 dBm ±1.5 dB.

    If the Meter indication is correct, go to step 37.

    If the Meter indication is out of tolerance only, go to chapter 5 to perform the ALC adjustments.

    If the Meter needle moves slightly or not at all, reverses direction or jumps, go to "Meter Checks", BD6.

37. Adjust the VERNIER for a power meter reading of +2 dBm. Tune the Signal Generator from 2 to 18 GHz in 100 MHz steps.

    Verify that the power meter reading varies by no more than ±1.5 dB in the 1st band, ±2 dB in the 2nd band, and ±2.5 dB in the 3rd band. The UNLVL annunciator should remain off.

    If the indications are correct, go to step 38.

    If the UNLVL annunciator lights at any frequency, go to BD6 to determine the cause.

    If the power level varies more than indicated, go to chapter 5 to adjust Flatness. If adjustment fails, go to BD6.

AM Check ($\surd$9)

38. Press the PRESET (3 GHz) key. Set the AM switch to 30% and the METER MODE switch to AM. Connect a BNC TEE to the Signal Generator's AM INPUT and the test oscillator and the DVM to the BNC TEE. Set the test oscillator output to 10 kHz and 0.707 Vrms. Connect the spectrum analyzer to the RF OUTPUT connector. Set the Signal Generator output power level to −10 dBm.

    The Signal Generator's OUTPUT Meter should indicate 30% ± 3% on the 0—3 scale and the first sidebands displayed on the spectrum analyzer should be about 16.5 dB below the carrier.

    If both readings are correct, continue with step 39.

    If the voltage applied is incorrect, proceed to BD6 to isolate the cause.

    If only the front panel indications are incorrect, and:

    a. if the Meter indication is out of tolerance only, go to "AM Meter Adjustment" in chapter 5 to adjust the meter.

       or

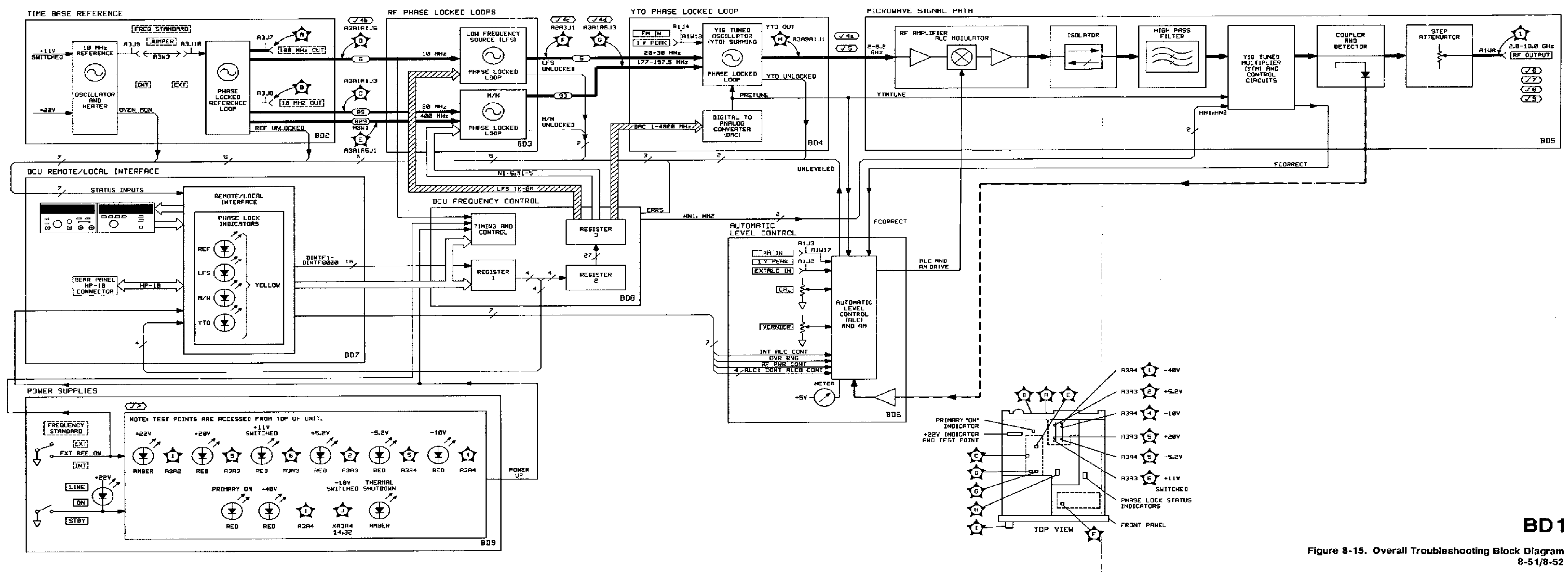
    b. if the Meter needle moves slightly or not at all, reverses direction or jumps, go to "Meter Checks", BD6.

39. Set the AM switch to 100%. Adjust the input voltage to obtain sidebands 12 dB below the carrier level.

    The input voltage should be 0.354 ±0.018 Vrms and the Signal Generator's OUTPUT Meter should indicate between 40% and 60% on the 0—1 scale.

    If both indications are correct, the AM circuits are probably working properly. If any doubt exists, perform the AM adjustment procedure in chapter 5.

    If either or both indications are incorrect, proceed to BD6 to further isolate the malfunction.



BD1

Figure 8-15. Overall Troubleshooting Block Diagram
8-51/8-52

BD1

Overall Troubleshooting Block Diagram SERVICE SHEET

BD2 Time Base Reference

References

Principles of Operation

Time Base Reference generates precise reference signals of 10, 20, 100 and 400 MHz. These frequencies are derived from an internal oven controlled 10 MHz crystal oscillator or from an external 5 or 10 MHz frequency source. The 10, 20 and 400 MHz reference signals are used as frequency references for the M/N Phase Locked Loop, the Low Frequency Source (LFS) Phase Locked Loop and the Digital Control Unit (DCU). Two reference frequencies (10 and 100 MHz) are available on the rear panel of the instrument.

The Time Base Reference consists of two sections:

- Reference Phase Locked Loop Phase Detector, Service Sheet 1
- Reference Phase Locked Loop Oscillator and Frequency Multiplier, Service Sheet 2

The Reference Phase Locked Loop Oscillator and Frequency Multiplier section contains a 100 MHz voltage controlled crystal oscillator (VCXO) which is phase locked to the 10 MHz Reference Oscillator (or external 5 or 10 MHz frequency source). The output of the 100 MHz VCXO is routed to the rear panel for use as an external frequency reference and to the Reference Phase Detector and the quadrupler.

The quadrupler produces a 400 MHz reference that is used in the M/N Phase Locked Loop for downconversion of the M/N VCO output. The level of the 400 MHz reference is critical for suppression of spurious mixing products and is adjusted for a −10 to −13 dBm level (see chapter 5, "Adjustments").

The Reference Phase Detector divides the 100 MHz VCXO output by 5 to produce the 20 MHz reference signal and then divides the 20 MHz reference by 2 to produce three 10 MHz reference signals. One of the 10 MHz reference signals is routed to the rear panel for use as an external reference and a second is terminated inside the instrument. The third is used by the phase detection circuitry to generate the tuning voltage for the 100 MHz VCXO.

All three reference signals are phase locked to the internal 10 MHz crystal oscillator signal which produces reference frequencies with accuracy comparable to the internal 10 MHz crystal oscillator.

Troubleshooting

General

It is assumed that the troubleshooting information associated with Service Sheet BD1 has been used to isolate a malfunction to the Time Base Reference, BD2. The following troubleshooting procedure can be used to further isolate the problem to one of the following assemblies:

- 10 MHz Reference Oscillator
- Reference Phase Detector
- 100 MHz VCXO

Equipment

Frequency Counter................	HP 5343A
Variable Power Supply.............	HP 6200B
Digital Voltmeter (DVM)..........	HP 3455A or HP 3456A
Spectrum Analyzer................	HP 8566B

Troubleshooting Procedure

This procedure is divided into three checks:

400 MHz Output Check (√1)
Reference Loop Phase Lock Check (√2)
10 MHz Reference Oscillator Check (√3)

If the Reference Oscillator and the 100 MHz VCXO Assembly function properly, the Reference Phase Detector Assembly is probably defective.

400 MHz Output Check (√1)

1. Switch the RF OUTPUT switch ON.
2. Disconnect the grey/red/white (829) 400 MHz cable, A3A1A2W1(TPA), from A3A1A3J1.
3. Connect the spectrum analyzer to cable A3A1A2W1.
4. Observe the 400 MHz signal displayed on the spectrum analyzer. Note its frequency and power. Its frequency should be 400 MHz ±6 kHz and its power should be −12.0 ±1 dBm.
5. Connect a DVM to 100 MHz TUNE, A3A1A2TP1. Verify that the voltage at A3A1A2TP1 is −8.0 ±0.1 Vdc.

   If the voltage is not correct, slowly adjust A3A1A2C4 until the DVM reading is correct. Then go to step 6.

   If the voltage at A3A1A2TP1 will not adjust as indicated, go to chapter 5 and make the necessary Reference Loop VCXO adjustments. Then go to "10 MHz Reference Oscillator Check".
6. Verify that the 400 MHz output displayed on the spectrum analyzer is as stated in step 4. If there has been a change, it is due to the adjustment of the voltage at A3A1A2TP1.

If the frequency and power of the 400 MHz signal are correct, reconnect all cables. All assemblies in BD2 function properly.

If either the frequency or power of the 400 MHz signal is not correct, continue with the next check.

Reference Loop Phase Lock Check (√2)

7. Connect the spectrum analyzer to 10 MHz OUT, A3J8, on the rear panel of the signal generator. Verify that the signal displayed on the spectrum analyzer is 10 MHz ±50 Hz and that the power is >= −1 dBm.

   If the signal at A3J8 is correct, the Reference Loop is phase locked. Go to chapter 5, "Reference Loop (VCXO) Adjustment", and make the adjustments that apply to the 400 MHz signal (A3A1A2C1, -C2 and -C3). If the 400 MHz signal can be properly adjusted, reconnect the 400 MHz cable, A3A1A2W1, to A3A1A3J1. The Reference Loop is functioning as it should.

   If the 400 MHz signal cannot be adjusted, one or more of the following circuits on A3A1A2 is defective: the 100 MHz Buffer, the Quadrupler, and the 400 MHz Amplifier. Go to service sheet 2.

   If the 10 MHz signal at A3J8 is not correct, go to chapter 5 and make the necessary VCXO adjustments. Then perform the next check.

10 MHz Reference Oscillator Check (√3)

Note

Let the instrument run for at least one-half hour to warm up; then verify that the OVEN COLD annunciator on the front panel is OFF.

8. Disconnect the grey jumper cable, A3W3, from the FREQ STANDARD output, A3J9, on the rear panel.
9. Connect the frequency counter to A3J9. Verify that the frequency counter reads 10 MHz ±50 Hz.

   If the frequency is correct, proceed to step 10.

   If the frequency is incorrect, adjust the Reference Oscillator, using the procedure in chapter 5, "10 MHz Reference Oscillator Adjustment". Then proceed to step 10.

   If the Reference Oscillator cannot be adjusted, it may be defective. Before replacing it, go to service sheet 1 to verify biasing.
10. Disconnect the frequency counter from the FREQ STANDARD output, A3J9.
11. Connect the spectrum analyzer to A3J9.

12. Verify that there is a 10 MHz signal with power of 7 dBm or greater.

    If the power is correct, reconnect the grey jumper cable, A3W3, to the FREQ STANDARD output, A3J9, on the rear panel of the signal generator and go to step 13.

    If the power is not correct, replace the 10 MHz Reference Oscillator Assembly, A3A8, and go to chapter 5 to adjust the new oscillator.

Reference Phase Detector Check by Elimination

13. Reconnect the grey/orange/white 100 MHz cable, A3A1A1W1, to A3A1A2J1(TPB). Make sure that the grey/black (80) reference oscillator cable, A3W13, is connected to A3A1A1J1.

14. Connect a DVM to A3A1A2TP1 and try to set the voltage to −8.0 ±.1 volts.

    If the voltage will not adjust as indicated, Assembly A3A1A1 is defective. Go to service sheet 1.

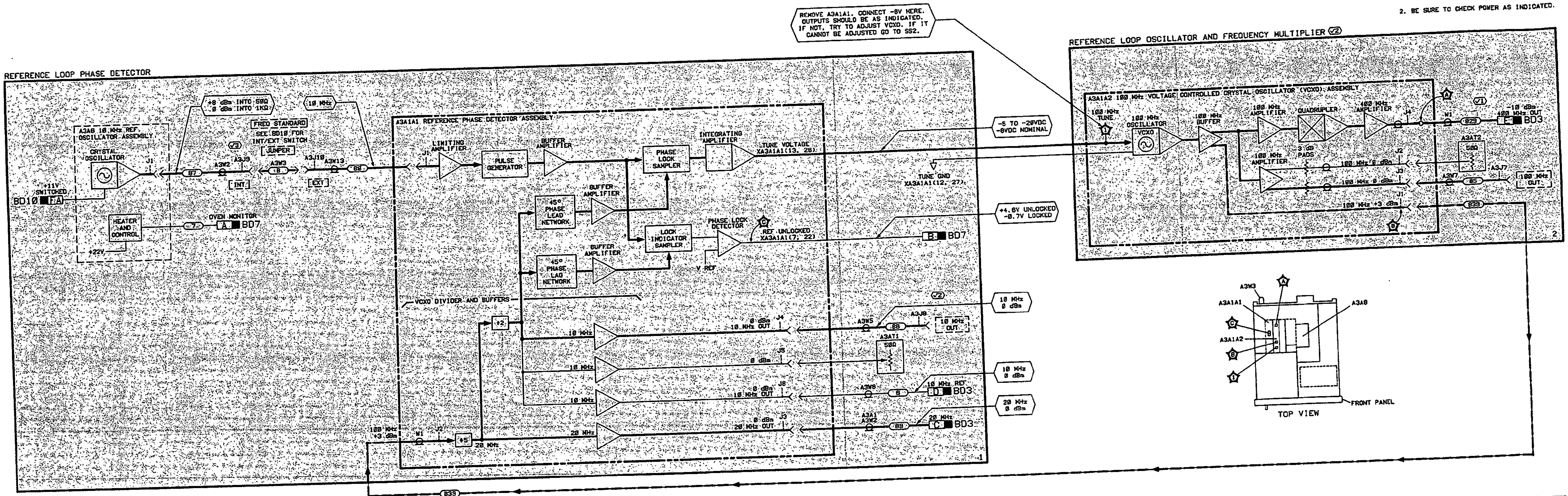
    If the voltage adjusts as indicated, verify that the reference-loop phase locks by measuring the frequency at A3J8 on the rear panel. It should be 10 MHz ±50 Hz.

BD2

Time Base Reference
Block Diagram
SERVICE SHEET

TROUBLESHOOTING NOTES:

1. IF ✓1 AND ✓2 ARE NORMAL, THEN A3A1A1 IS AT FAULT
2. BE SURE TO CHECK POWER AS INDICATED.



BD2

Figure 8-16. Time Base Reference Block Diagram

BD3 RF Phase Locked Loops

References

Principles of Operation

General

The two RF Phase Locked Loops are used to phase lock the YTO Summing phase locked loop output frequency to the reference signals of the Time Base Reference (BD2). The two RF Phase Locked Loops are:

- The Low Frequency Source (LFS) phase locked loop, which is used to control the 1 kHz through 1 MHz digits of the YIG Tuned Oscillator (YTO) Summing phase locked loop output frequency.
- The M/N phase locked loop, which controls the 10 MHz to 1 GHz digits of the YTO Summing phase locked loop output frequency.

Low Frequency Source (LFS) Phase Locked Loop

The LFS phase locked loop synthesizes the 1 MHz, 100 kHz, 10 kHz and 1 kHz digits of the YTO Summing phase locked loop output frequency. The LFS phase locked loop synthesizes an output frequency that can be set between 20.001 MHz and 30.000 MHz with 1 kHz resolution. The Digital Control Unit (DCU) decodes the four least significant digits of the desired YTO Summing phase locked loop frequency and sends tuning data to the LFS phase locked loop as 16 bits, LFS 1K — 8M. The data sets the LFS phase locked loop output frequency. The LFS phase locked loop output frequency is given by the following equation:

$$f_{LFS} = 30 - x.xxx \text{ MHz}$$

where:

f_{LFS} = the LFS phase locked loop output frequency, and $x.xxx$ signifies the four least significant digits of the YTO Summing phase locked loop frequency.

The YTO Summing phase locked loop frequency can be calculated from the instrument's output frequency by using the following equations:

Band 1 (2 — 6.2 GHz) $f_{YTO} = f_{OUT}$

Band 2 (6.2 — 12.4 GHz) $f_{YTO} = f_{OUT} / 2$

Band 3 (12.4 — 18 GHz) $f_{YTO} = f_{OUT} / 3$

where:

f_{YTO} = the YTO Summing phase locked loop output frequency
f_{OUT} = the instrument's output frequency.

The LFS phase locked loop consists of three assemblies:

20/30 Divider
20/30 Phase Detector
160 — 240 MHz VCO

Inputs to the 20/30 MHz Divider are the 10 MHz reference signal from the Time Base Reference (BD2), and 16 bits of digital information (LFS 1K — 8M) from the A2A8 Output Register assembly. A feedback signal from the 160–240 MHz VCO Assembly is also an input to the 20/30 MHz Divider assembly.

The divide by 10/11 prescaler output, in conjunction with a programmable divider, generates a nominal 80 kHz output when the LFS phase locked loop is locked. In the 20/30 Phase Detector Assembly, this signal is phase compared to the 80 kHz reference signal (10 MHz divided by 125) to generate a pulse whose width is proportional to the phase difference (error) between the two signals at the input of the phase detector.

The error signal is integrated to obtain a dc tuning voltage, which keeps the VCO frequency tuned to produce a minimum error. If the error signal indicates a large phase error, the Phase Lock Detector will light the ϕ UNLOCKED status annunciator on the front panel.

The 160 — 240 MHz VCO Assembly contains a voltage controlled oscillator that is controlled by the TUNE OUT signal from the 20/30 Phase Detector. The VCO can be tuned from 160.008 to 240 MHz with 1 kHz resolution. The oscillator output is routed to the 20/30 Divider assembly after being filtered and is used as the feedback signal for the LFS phase locked loop.

The 160 — 240 MHz VCO output is also divided by eight and filtered to obtain a relatively clean signal between 20.001 MHz and 30.000 MHz. This signal is used as a reference for the YTO Summing phase locked loop.

M/N Phase Locked Loop

The M/N phase locked loop synthesizes the 10 MHz through 1 GHz digits of the YTO Summing phase locked loop output frequency. The output of the M/N phase locked loop is a signal between 177 and 197.5 MHz. The DCU decodes the four most significant digits of the YTO Summing phase locked loop frequency and sends tuning data to the M/N phase locked loop as two binary numbers (M and N). The data sets the output of the M/N phase locked loop which is used as a reference for the YTO Summing phase locked loop. The M/N phase locked loop output frequency is given by the following equation:

$$f_{M/N} = [200 - 10(M/N)]\ \text{MHz}$$

where:

$f_{M/N}$ = M/N frequency out
M = M number
N = N number

A single step in the tuning of the M/N phase locked loop produces a 10 MHz step in the output frequency of the YTO Summing phase locked loop. Smaller steps are controlled by the LFS phase locked loop and together the RF Phase Locked Loops control the YTO Summing phase locked loop over a 2000.000 to 6199.999 MHz range with 1 kHz resolution.

The M/N phase locked loop consists of three assemblies:

M/N Phase Detector
M/N Voltage Controlled Oscillator (VCO)
M/N Output

The inputs to the M/N Phase Detector are two reference signals (20 MHz and 400 MHz) from the Time Base Reference (BD2), 11 bits of information from Output Register Assembly A2A8, and the 355 — 395 MHz output from the M/N Output Assembly. The 355 — 395 MHz signal is mixed with the 400 MHz reference to produce a 5 — 45 MHz IF. The IF signal is then filtered and amplified before entering the M Divider.

The M divider and N divider are used to scale the two phase detector input frequencies for phase comparison by the Phase/Frequency Detector. Using two dividers in the M/N Phase Detector gives the phase locked loop a larger range than using a single divider. The output of the Phase/Frequency Detector is integrated to generate a tuning voltage for the M/N VCO. The VCO is tuned to produce a minimum phase/frequency error between the outputs of the two dividers. If a large error is detected, the Phase Lock Detector lights the ϕ UNLOCKED annunciator on the front panel.

The M/N VCO Assembly contains a voltage controlled oscillator that is controlled by the TUNE signal from the M/N Phase Detector. The VCO can be tuned from 355 — 395 MHz and is set so that the Nth harmonic of the M/N Phase Locked Loop frequency is within 20 to 30 MHz of the desired YTO Summing Phase Locked Loop frequency.

The M/N Output Assembly splits the M/N VCO output into two paths. One path, 355 — 395 MHz OUT, serves as the feedback path to the M/N Phase Detector. This path amplifies and filters the 355 — 395 MHz output from the M/N VCO before it passes to the Mixer on the M/N Phase Detector Assembly. The other path, M/N OUT 177 — 197 MHz, divides the M/N VCO output by two and amplifies it for use in the YTO Summing Phase Locked Loop.

Table 8-8 lists the M and N numbers, M/N output frequencies and YTO frequencies for all valid M/N phase locked loop output frequencies.

Troubleshooting

General

It is assumed that the troubleshooting information associated with service dheet BD1 was used to isolate the problem to either or both of the following:

LFS Phase Locked Loop
M/N Phase Locked Loop

When troubleshooting the phase locked loops, always ensure that the reference frequencies used by the phase locked loop in question are correct. Signal level and frequency are important for correct operation of the phase locked loop. The following troubleshooting procedures can be used to further isolate the problem to one of the following subassemblies:

LFS Phase Locked Loop
20 — 30 Divider
20 — 30 Phase Detector
160 — 240 MHz VCO
M/N Phase Locked Loop
M/N Phase Detector
M/N VCO
M/N Output

Equipment

Frequency Counter...	HP 5340A or HP 5343A
Oscilloscope.........	HP 1980A
Digital Voltmeter (DVM)............	HP 3455A or HP 3456A
Spectrum Analyzer..	HP 8566B
Test Oscillator......	HP 8640B
Power Meter........	HP 436A Opt. 022
Power Sensor........	HP 8481A

Procedures

The following procedures are divided into ten checks, as follow:

LFS Phase Locked Loop Checks

10 MHz Reference Check (√1)
160 — 240 MHz VCO Check (√2)
20/30 MHz Divider Check (√3)
20/30 MHz Divider Auxiliary Check (√3)
20/30 MHz Divider Input Check (√4)
20/30 MHz Phase Detector Check (√5)

M/N Phase Locked Loop Checks

LFS Phase Locked Loop Troubleshooting

10 MHz Reference Check (√1)

1. Disconnect the blue cable, A3W6, from A2A12J2 (TPI) on the controller motherboard.
2. Connect a frequency counter to A3W6. The frequency counter reading should be 10 MHz ±50 Hz. If the frequency is correct, connect a power meter to A3W6 and verify that the power is >= −2 dBm.

   If either the frequency or power is incorrect, the Time Base Reference is defective. Go to BD2.

   If both the frequency and power are correct, reconnect the blue cable to A2A12J2 and continue with the next check.

160 — 240 MHz VCO Check (√2)

Note

If any of the following tests on Assembly A2A3 fail, go to service sheet 8.

3. Place Assembly A2A3 160 — 240 MHz VCO on an extender board. Leave the cables disconnected.
4. Using the spectrum analyzer, verify both the frequency and power at A2A3J2 (TPA) and A2A3J1 (TPG) at the switch settings indicated in table 8-3 below.

   If all of the above checks are correct, continue with the "20/30 MHz Divider Check".

Table 8-3. Frequency and Power Tests for Assembly A2A3

Set Test Switch A2A3S1 to:	Connect Spectrum Analyzer to:	Verify that the frequency is:	Verify that the power is:
Test High Freq	A2A3J2	>240 MHz	−4 to +4 dBm
Test Lo Freq	A2A3J2	<160 MHz	−4 to +4 dBm
Test High Freq	A2A3J1	>30 MHz	−2 to +5 dBm
Test Lo Freq	A2A3J1	<19 MHz	−2 to +5 dBm

20/30 MHz Divider Check (√3)

5. Connect the red cable A2W2 to A2A3J2 (TPA) and A2A5J1.
6. Without removing Assembly A2A5, connect a frequency counter to 80 kHz REF, A2A5TP2 through the small hole in A2A5. The frequency should be 80 kHz ±50 Hz.

   If the frequency is correct, go to Step 7.

   If the frequency is not correct, the Divide by 125 circuit is defective. Go to service sheet 6.
7. Set Test Switch A2A3S1, located on A2A3 160 — 240 MHz VCO Assembly, to TEST HIGH FREQ.
8. Set the Signal Generator to 3.000 000 GHz.
9. Connect the frequency counter to A2A5TP3. The frequency should be greater than 80 kHz.

   If the frequency is correct, the 20/30 MHz Divider Assembly, A2A5, is good. Proceed with "20/30 MHz Phase Detector Check".

   If the frequency is not correct, the 20/30 MHz Divider Auxiliary Check may be used to view the actual waveforms. Otherwise go directly to "20/30 MHz Divider Input Check".

20/30 MHz Divider Auxiliary Check (√3)

10. Verify that the red cable, A2W2, is connected to A2A3J2 (TPA) and A2A5J1.
11. Connect an oscilloscope to 80 kHz REF, A2A5TP2. The waveform should be as shown in figure 8-17.

    If the waveform is correct, go to step 12.

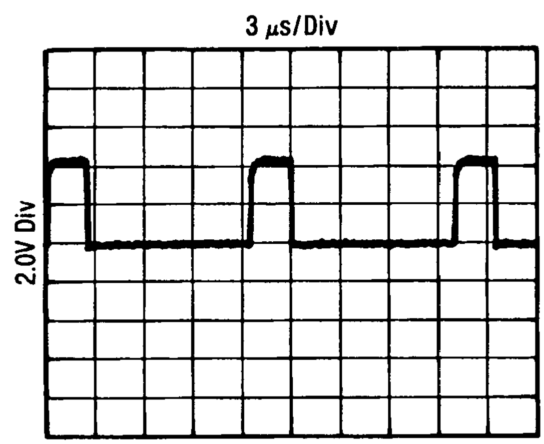


Figure 8-17. 80 kHz Reference, A2A5TP2

If the waveform is not correct, the divide-by-125 circuit is defective. Go to service sheet 6.

12. Verify that Test Switch A2A3S1, located on A2A3 160 — 240 MHz VCO Assembly, is set to TEST HIGH FREQ.
13. Verify that the Signal Generator is set to 3.000 000 GHz.
14. Connect an oscilloscope to A2A5TP3. The waveform should appear as shown in figure 8-18.

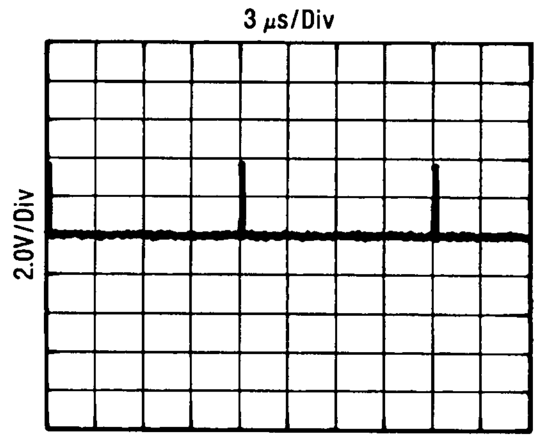


Figure 8-18. A2A5TP3, A2A3S1 Test Switch Set HIGH

If the waveform is as shown, the 20/30 MHz Divider Assembly, A2A5, is good. Proceed with "20/30 MHz Phase Detector Check".

If the waveform is not as shown, proceed with the next check.

20/30 MHz Divider Input Check (√4)

Note

By means of two selected frequencies, this check causes each LFS input line to produce a digital high and low. If the LFS input lines toggle, this check proves that the LFS input lines are not shorted to ground and not open. It does not prove that the LFS input lines are not shorted to each other. Neither does it prove that the DCU can produce the correct digital inputs to the LFS for all front panel frequencies 1 through 9999 kHz (the frequency range of the four least significant digits). Therefore, after completing this check, it may be helpful to tune directly to the frequencies that cause LFS unphase lock. The LFS input pins that should be high are those whose respective frequency values add up to the frequency shown by the four least significant digits on the front-panel display. Use tables 8-4 and 8-5 below for pin numbers and frequency values.

---

15. Place A2A5 on an extender board.

16. Set the Signal Generator to the frequencies listed in table 8-4 below and verify the logic levels for each frequency at the edge-connector pins with a DVM.

    If the logic levels are correct, the 20/30 MHz Divider Assembly is defective. Go to service sheet 6.

    If any of the logic levels is not correct, the corresponding output level from the Output Register, A2A8, must be verified.

Table 8-4. XA2A5: LFS 1K—8M Inputs

Frequency (MHz)	XA2A5 Pins and Frequency Values															
	11 8 MHz	13 4 MHz	12 2 MHz	14 1 MHz	15 800 kHz	17 400 kHz	16 200 kHz	18 100 kHz	33 80 kHz	35 40 kHz	34 20 kHz	36 10 kHz	29 8 kHz	31 4 kHz	30 2 kHz	32 1 kHz
3339.999	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
3336.666	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0

17. Place A2A8 on a special extender board (P/N 08673-60016) or on three 30-pin extender boards.

18. Set the Signal Generator to the frequencies listed in table 8-5 below and verify the logic levels at XA2A8A and XA2A8B that were incorrect at connector XA2A5.

    If these logic levels are still incorrect, A2A8 is either defective or its inputs are incorrect. Go to service sheet 30.

    If these logic levels are correct, the signal paths from A2A8 to A2A5 on the motherboard are defective. Go to service sheets 6 and 30.

Table 8-5. XA2A8: LFS 1K—8M Outputs

Frequency (MHz)	XA2A8 Pins and Frequency Values															
	B10 8 MHz	B23 4 MHz	B18 2 MHz	A30 1 MHz	B25 800 kHz	B7 400 kHz	B2 200 kHz	A14 100 kHz	A29 80 kHz	A10 40 kHz	A6 20 kHz	A17 10 kHz	A15 8 kHz	A26 4 kHz	A22 2 kHz	A3 1 kHz
3339.999	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
3336.666	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0

20/30 MHz Phase Detector Check (√5)

19. Set the Signal Generator to 3.000 000 GHz and Test Switch A2A3S1, located on Assembly A2A3 160 — 240 MHz VCO, to TEST HIGH FREQ.

20. Connect a voltmeter to A2A4TP4, TUNE OUT. This is the VCO tune voltage and it should measure greater than +14 Vdc.

    If the voltage is correct, proceed with the next step.

If the voltage is not correct, the 20/30 MHz Phase Detector is defective. Go to service sheet 7.

21. Set Test Switch A2A3S1 to TEST LO FREQ. The voltmeter should now read less than + 4 Vdc.

    If the voltage is not correct, the 20/30 MHz Phase Detector, A2A4, is defective. Go to service sheet 7.

    If the voltage is correct, continue with the next step.

22. Set Test Switch A2A3S1 to NORMAL, remove the extender board from Assembly A2A3 and place Assembly A2A3 back in the instrument.
23. Reconnect the red cable, A2W2, to A2A5J1 and A2A3J2 (TPA).
24. Reconnect the green cable, A3W14, to A2A3J1 (TPG).
25. Disconnect the green cable, A3W14, at A3A9J3 on A3A9, the YTO Loop Assembly, and connect the frequency counter to this end of the cable.
26. Verify that the LFS frequency is correct throughout band one. Use "LFS Phase Lock Loop Check" in BD1.

    If the frequency is correct, verify that the LFS Phase Lock Indicator, A2A7DS4, located in the controller module, is ON.

    If the LFS Phase Lock Indicator is not ON, go to service sheet 7 and repair the phase lock circuitry.

    If the LFS frequency is not correct, measure the resistance of the Low Pass Filter on Assembly A2A3 from pins 17 or 35 to the junction of R10 and C18, also on Assembly A2A3. It should be zero ohms.

    If the resistance is not zero ohms, the Low Pass Filter or Test Switch A2A3S1 is defective. Go to service sheet 8.

27. Finally, measure the power at the output of the green cable, A3W14. It should be >= −2 dBm.

    If the power is incorrect, re-verify the power limits in "160 — 240 MHz VCO Check".

M/N Phase Locked Loop Troubleshooting

20 MHz Reference Check (√6)

1. Connect the frequency standard output from the spectrum analyzer to A3J10 on the rear panel of the Signal Generator. Set the Frequency Standard Switch A3S1 on the rear panel of the Signal Generator to the EXT position.
2. Disconnect A3A1A3W2 (89) cable (TPF) from A3A1A1J3 20 MHz Out and connect the spectrum analyzer to A3A1A1J3. The indicated frequency should be 20 MHz at at a power level of 0 dBm ±2 dBm on the spectrum analyzer.

If the 20 MHz output is not as indicated, the problem is in the Time Base Reference Loop. Proceed to BD2 to isolate the problem.

If the indicated Frequency is correct, reconnect cable A3A1A3W2 (89) to A3A1A1J3 and proceed with step 3.

400 MHz Reference Check (√7)

3. Disconnect cable A3A1A2W1 (829) from A3A1A3J1 400 MHz In (TPE) and connect the output of the cable to the spectrum analyzer. The frequency indicated on the analyzer should be 400 MHz at a power level of −12 dBm ±2 dBm.

   If the frequency and/or power level indicated on the spectrum analyzer is not correct, the problem is in the Time Base Reference Loop. Proceed to BD2 to further isolate the problem.

   If the frequency and power level indicated on the spectrum analyzer are correct, connect cable A3A1A2W1 (829) to A3A1A3J1 and proceed with step 4.

M/N Phase Detector Check (√8)

4. Disconnect Cable A3A1A3W1 (92) from A3A1A5J1 (355—395 MHz Out, TPD). Connect the spectrum analyzer to A3A1A5J1. The frequency indicated on the analyzer should be approximately 355 MHz at a power level of +3 dBm ±6 dBm.

   If the indicated frequency and/or power level on the analyzer are not correct, then proceed with step 18, M/N OUTPUT checks.

   If the indicated frequency and power level are correct on the analyzer display, then continue with the next step.

5. With cable A3A1A3W1 (92) disconnected from A3A1A5J1 (TPD), connect the voltmeter to A3A1A4TP1.

6. The voltage measured at A3A1A4TP1 should be approximately −1V.

   If the voltage is correct, proceed with step 7.

   If the voltage is not correct, proceed with step 9.

7. Reconnect cable A3A1A3W1 (92) to A3A1A5J1 and disconnect cable A3A1A3W2 (89) from the 20 MHz Out connector (A3A1A1J3).

8. Connect the voltmeter to A3A1A4TP1. The voltage should be approximately −38V.

   If the voltage is correct, proceed with "M/N VCO Checks".

   If the voltage is not correct, proceed with step 9.

9. Remove A3A1A3 (M/N Phase Detector Assembly) and place it on an extender board. Connect the voltmeter to pin 21 of XA3A1A3.

10. Disconnect or, if already disconnected in step 7, leave disconnected cable A3A1A3W2 (20 MHz OUT). The voltage should be approximately −8.0V.

    If the voltage is not as indicated, go to service sheet 3.

    If the voltage is as indicated, proceed with step 11.

11. Reconnect cable A3A1A3W2 and disconnect cable A3A1A2W1 (400 MHz IN).

12. Connect the voltmeter to pin 6 on XA3A1A3, the voltage should be approximately −8.0V.

    If the voltage is not as indicated, go to service sheet 3.

    If the voltage is as indicated, proceed with step 13.

13. Set the Signal Generator to each frequency shown in table 8-6 and check the corresponding logic level on each A3A1A3 edge connector pin shown. The built-in logic tester on A2A8 may be used to check the logic levels.

    If all of the logic levels are correct, A3A1A3 is at fault. Proceed to service sheet 3 to further isolate the problem.

    If any of the logic levels are incorrect, proceed with step 14 to determine if the problem is with the A2A8 Output Register assembly or the interconnects between the A3A1A3 and A2A8 assemblies.

14. Set the Signal Generator to each frequency shown in table 8-7 and check for the corresponding logic level on each edge connector pin shown.

    If all of the logic levels are correct, there is then a problem with the interconnects between the A3A1A3 and A2A8 Assemblies.

    Go to service sheet 3 and service sheet 30 to further isolate the faulty interconnect.

    If any of the logic levels are not correct, the problem is on the A2A8 Output Register assembly. Go to service sheet 30 to isolate the problem.

Table 8-6. XA3A1A3: M1—M5 and N1—N6 Inputs

XA3A1A3 Pin No. →	M5 15	M4 29	M3 14	M2 28	M1 13	N6 24	N5 9	N4 25	N3 10	N2 23	N1 8
6180 MHz	1	0	0	1	1	1	0	0	0	0	0
6050 MHz	0	1	1	0	0	0	1	1	1	1	1

Table 8-7. XA2A8: M1—M5 and N1—N6 Outputs

XA2A8 Pin No. →	M5 -C10	M4 -C25	M3 -C27	M2 -C12	M1 -C26	N6 -B14	N5 -B26	N4 -C6	N3 -C4	N2 -B27	N1 -B28
6.180 GHz	1	0	0	1	1	1	0	0	0	0	0
6.050 GHz	0	1	1	0	0	0	1	1	1	1	1

M/N VCO Check (√9)

Initial conditions: Cable A3A1A3W1 (92) connected to the 20 MHz Out connector (A3A1A1J3) and cable A3A1A3W2 (89) is disconnected.

15. Place A3A1A5 on an extender board and disconnect cable A3A1A4A2W2 (9) VCO Output from A3A1A5J3 (TPB).
16. Connect the spectrum analyzer to the output of cable A3A1A4A2W2 (9).

    The frequency should be approximately 396 MHz at a level of −2 dBm.

    If the frequency and power level are correct, leave cable A3A1A4A2W2 (9) connected to the spectrum analyzer and proceed with the next step.

    If the frequency and/or power level are not correct, the VCO is either defective or requires adjustment. Proceed to the M/N adjustment procedure in Chapter 5 and attempt to adjust the VCO. If it cannot be adjusted, replace it.
17. Disconnect cable A3A1A3W1 (92) from the 20 MHz Output (A3A1A1J3) and connect cable A3A1A3W2 (89) in its place. This should tune the VCO to its lowest frequency.

    The spectrum analyzer should indicate a signal with a frequency of approximately 342 MHz at a power level of 0 dBm.

    If the frequency and power level are correct, reconnect cable A3A1A4A2W2 (9) to A3A1A5J3 and proceed to the "M/N Output Check" beginning with step 18.

    If the frequency and/or power level are not correct, the VCO is either defective or requires adjustment. Proceed to the M/N adjustment procedure in Chapter 5 and attempt to adjust the VCO. If the VCO cannot be adjusted, replace it.

M/N Output Check (√10)

Initial conditions: Cable A3A1A3W2 (89) is connected to the 20 MHz Output (A3A1A1J3) and cable A3A1A3W1 (92) is disconnected from A3A1A5J1 (355—395 MHz Output).

18. Disconnect cable A3W8 (93) from A3A1A5J2 (M/N OUT, TPC) and connect the spectrum analyzer to A3A1A5J2 (M/N OUT, TPC).

The indicated frequency on the spectrum analyzer should be approximately 171 MHz at a power level of 0 dBM.

If the indicated frequency and power level are correct, reconnect cable A3W8 (93) to M/N Out at A3A1A5J2.

If the indicated frequency is the same as noted in step 17, the divide by two circuit on A3A1A5 is at fault or the M/N VCO output is too low. Verify that the M/N VCO output level is at least −2 dBm (see preceding M/N VCO checks steps 15 through 17).

If the indicated level is correct, proceed to service sheet 5 to troubleshoot the divide-by-two circuit and the output amplifier.

19. Disconnect cable A3A1A3W1 (92) from 355—395 MHz Out (A3A1A5J1) and connect the spectrum analyzer to the 355—395 MHz Out connector (A3A1A5J1, TPD).

    The frequency indicated on spectrum analyzer should be approximately 378 MHz at a power level of +3 dBm ±6 dBm.

    If the indicated frequency and level are correct, the M/N Phase Locked Loop is functioning correctly.

    If the indicated frequency and/or power level are not correct, then A3A1A5 is at fault. Proceed to service sheet 5 to further isolate the faulty component.

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies

Freq. MHz	M	N	M/N MHz
2000	17	11	184.545455
2010	16	11	185.454545
2020	15	11	186.363636
2030	14	11	187.272727
2040	13	11	188.181818
2050	12	11	189.090909
2060	11	11	190.000000
2070	10	11	190.909091
2080	9	11	191.818182
2090	8	11	192.727273
2100	27	12	177.500000
2110	26	12	178.333333
2120	25	12	179.166667
2130	24	12	180.000000
2140	23	12	180.833333
2150	22	12	181.666667
2160	21	12	182.500000
2170	20	12	183.333333
2180	19	12	184.166667
2190	18	12	185.000000
2200	17	12	185.833333
2210	16	12	186.666667
2220	15	12	187.500000
2230	14	12	188.333333
2240	13	12	189.166667
2250	12	12	190.000000
2260	11	12	190.833333
2270	10	12	191.666667
2280	9	12	192.500000
2290	8	12	193.333333
2300	27	13	179.230769
2310	26	13	180.000000
2320	25	13	180.769231
2330	24	13	181.538462
2340	23	13	182.307692
2350	22	13	183.076923

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
2360	21	13	183.846154
2370	20	13	184.615385
2380	19	13	185.384615
2390	18	13	186.153846
2400	17	13	186.923077
2410	16	13	187.692308
2420	15	13	188.461538
2430	14	13	189.230769
2440	13	13	190.000000
2450	12	13	190.769231
2460	11	13	191.538462
2470	10	13	192.307692
2480	9	13	193.076923
2490	8	13	193.846154
2500	27	14	180.714286
2510	26	14	181.428571
2520	25	14	182.142857
2530	24	14	182.857143
2540	23	14	183.571429
2550	22	14	184.285714
2560	21	14	185.000000
2570	20	14	185.714286
2580	19	14	186.428571
2590	18	14	187.142857
2600	17	14	187.857143
2610	16	14	188.571429
2620	15	14	189.285714
2630	14	14	190.000000
2640	13	14	190.714286
2650	12	14	191.428571
2660	11	14	192.142857
2670	10	14	192.857143
2680	9	14	193.571429
2690	8	14	194.285714
2700	27	15	182.000000
2710	26	15	182.666667

Table 8-8. Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
2720	25	15	183.333333
2730	24	15	184.000000
2740	23	15	184.666667
2750	22	15	185.333333
2760	21	15	186.000000
2770	20	15	186.666667
2780	19	15	187.333333
2790	18	15	188.000000
2800	17	15	188.666667
2810	16	15	189.333333
2820	15	15	190.000000
2830	14	15	190.666667
2840	13	15	191.333333
2850	12	15	192.000000
2860	11	15	192.666667
2870	10	15	193.333333
2880	9	15	194.000000
2890	8	15	194.666667
2900	27	16	183.125000
2910	26	16	183.750000
2920	25	16	184.375000
2930	24	16	185.000000
2940	23	16	185.625000
2950	22	16	186.250000
2960	21	16	186.875000
2970	20	16	187.500000
2980	19	16	188.125000
2990	18	16	188.750000
3000	17	16	189.375000
3010	16	16	190.000000
3020	15	16	190.625000
3030	14	16	191.250000
3040	13	16	191.875000
3050	12	16	192.500000
3060	11	16	193.125000
3070	10	16	193.750000

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
3080	9	16	194.375000
3090	8	16	195.000000
3100	27	17	184.117647
3110	26	17	184.705882
3120	25	17	185.294118
3130	24	17	185.882353
3140	23	17	186.470588
3150	22	17	187.058824
3160	21	17	187.647059
3170	20	17	188.235294
3180	19	17	188.823529
3190	18	17	189.411765
3200	17	17	190.000000
3210	16	17	190.588235
3220	15	17	191.176471
3230	14	17	191.764706
3240	13	17	192.352941
3250	12	17	192.941176
3260	11	17	193.529412
3270	10	17	194.117647
3280	9	17	194.705882
3290	8	17	195.294118
3300	27	18	185.000000
3310	26	18	185.555556
3320	25	18	186.111111
3330	24	18	186.666667
3340	23	18	187.222222
3350	22	18	187.777778
3360	21	18	188.333333
3370	20	18	188.888889
3380	19	18	189.444444
3390	18	18	190.000000
3400	17	18	190.555556
3410	16	18	191.111111
3420	15	18	191.666667
3430	14	18	192.222222

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
3440	13	18	192.777778
3450	12	18	193.333333
3460	11	18	193.888889
3470	10	18	194.444444
3480	9	18	195.000000
3490	8	18	195.555556
3500	27	19	185.789474
3510	26	19	186.315789
3520	25	19	186.842105
3530	24	19	187.368421
3540	23	19	187.894737
3550	22	19	188.421053
3560	21	19	188.947368
3570	20	19	189.473684
3580	19	19	190.000000
3590	18	19	190.526316
3600	17	19	191.052632
3610	16	19	191.578947
3620	15	19	192.105263
3630	14	19	192.631579
3640	13	19	193.157895
3650	12	19	193.684211
3660	11	19	194.210526
3670	10	19	194.736842
3680	9	19	195.263158
3690	8	19	195.789474
3700	27	20	186.500000
3710	26	20	187.000000
3720	25	20	187.500000
3730	24	20	188.000000
3740	23	20	188.500000
3750	22	20	189.000000
3760	21	20	189.500000
3770	20	20	190.000000
3780	19	20	190.500000
3790	18	20	191.000000

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
3800	17	20	191.500000
3810	16	20	192.000000
3820	15	20	192.500000
3830	14	20	193.000000
3840	13	20	193.500000
3850	12	20	194.000000
3860	11	20	194.500000
3870	10	20	195.000000
3880	9	20	195.500000
3890	8	20	196.000000
3900	27	21	187.142857
3910	26	21	187.619048
3920	25	21	188.095238
3930	24	21	188.571429
3940	23	21	189.047619
3950	22	21	189.523810
3960	21	21	190.000000
3970	20	21	190.476190
3980	19	21	190.952381
3990	18	21	191.428571
4000	17	21	191.904762
4010	16	21	192.380952
4020	15	21	192.857143
4030	14	21	193.333333
4040	13	21	193.809524
4050	12	21	194.285714
4060	11	21	194.761905
4070	10	21	195.238095
4080	9	21	195.714286
4090	8	21	196.190476
4100	27	22	187.727273
4110	26	22	188.181818
4120	25	22	188.636364
4130	24	22	189.090909
4140	23	22	189.545455
4150	22	22	190.000000

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
4160	21	22	190.454545
4170	20	22	190.909091
4180	19	22	191.363636
4190	18	22	191.818182
4200	17	22	192.272727
4210	16	22	192.727273
4220	15	22	193.181818
4230	14	22	193.636364
4240	13	22	194.090909
4250	12	22	194.545455
4260	11	22	195.000000
4270	10	22	195.454545
4280	9	22	195.909091
4290	8	22	196.363636
4300	27	23	188.260870
4310	26	23	188.695652
4320	25	23	189.130435
4330	24	23	189.565217
4340	23	23	190.000000
4350	22	23	190.434783
4360	21	23	190.869565
4370	20	23	191.304348
4380	19	23	191.739130
4390	18	23	192.173913
4400	17	23	192.608696
4410	16	23	193.043478
4420	15	23	193.478261
4430	14	23	193.913043
4440	13	23	194.347826
4450	12	23	194.782609
4460	11	23	195.217391
4470	10	23	195.652174
4480	9	23	196.086957
4490	8	23	196.521739
4500	27	24	188.750000
4510	26	24	189.166667

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
4520	25	24	189.583333
4530	24	24	190.000000
4540	23	24	190.416667
4550	22	24	190.833333
4560	21	24	191.250000
4570	20	24	191.666667
4580	19	24	192.083333
4590	18	24	192.500000
4600	17	24	192.916667
4610	16	24	193.333333
4620	15	24	193.750000
4630	14	24	194.166667
4640	13	24	194.583333
4650	12	24	195.000000
4660	11	24	195.416667
4670	10	24	195.833333
4680	9	24	196.250000
4690	8	24	196.666667
4700	27	25	189.200000
4710	26	25	189.600000
4720	25	25	190.000000
4730	24	25	190.400000
4740	23	25	190.800000
4750	22	25	191.200000
4760	21	25	191.600000
4770	20	25	192.000000
4780	19	25	192.400000
4790	18	25	192.800000
4800	17	25	193.200000
4810	16	25	193.600000
4820	15	25	194.000000
4830	14	25	194.400000
4840	13	25	194.800000
4850	12	25	195.200000
4860	11	25	195.600000
4870	10	25	196.000000

**Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)**

Freq. MHz	M	N	M/N MHz
4880	9	25	196.400000
4890	8	25	196.800000
4900	27	26	189.615385
4910	26	26	190.000000
4920	25	26	190.384615
4930	24	26	190.769231
4940	23	26	191.153846
4950	22	26	191.538462
4960	21	26	191.923077
4970	20	26	192.307692
4980	19	26	192.692308
4990	18	26	193.076923
5000	17	26	193.461538
5010	16	26	193.846154
5020	15	26	194.230769
5030	14	26	194.615385
5040	13	26	195.000000
5050	12	26	195.384615
5060	11	26	195.769231
5070	10	26	196.153846
5080	9	26	196.538462
5090	8	26	196.923077
5100	27	27	190.000000
5110	26	27	190.370370
5120	25	27	190.740741
5130	24	27	191.111111
5140	23	27	191.481481
5150	22	27	191.851852
5160	21	27	192.222222
5170	20	27	192.592593
5180	19	27	192.962963
5190	18	27	193.333333
5200	17	27	193.703704
5210	16	27	194.074074
5220	15	27	194.444444
5230	14	27	194.814815

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

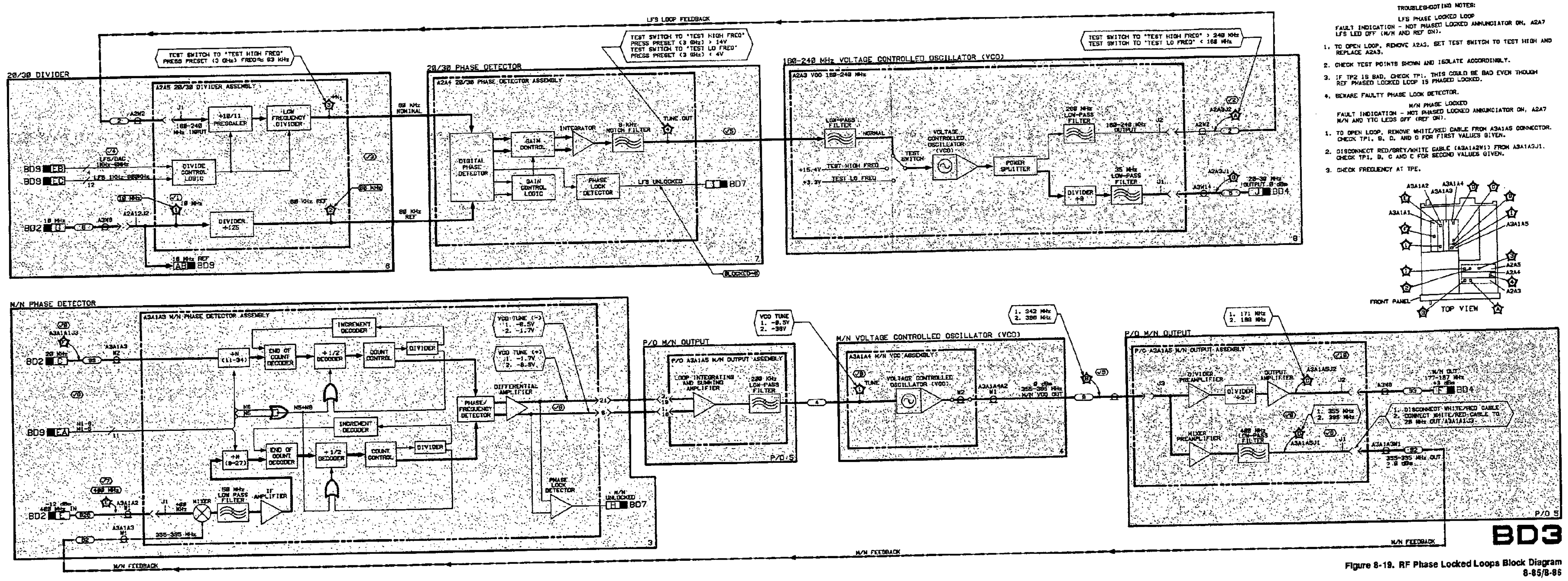
Freq. MHz	M	N	M/N MHz
5240	13	27	195.185185
5250	12	27	195.555556
5260	11	27	195.925926
5270	10	27	196.296296
5280	9	27	196.666667
5290	8	27	197.037037
5300	27	28	190.357143
5310	26	28	190.714286
5320	25	28	191.071429
5330	24	28	191.428571
5340	23	28	191.785714
5350	22	28	192.142857
5360	21	28	192.500000
5370	20	28	192.857143
5380	19	28	193.214286
5390	18	28	193.571429
5400	17	28	193.928571
5410	16	28	194.285714
5420	15	28	194.642857
5430	14	28	195.000000
5440	13	28	195.357143
5450	12	28	195.714286
5460	11	28	196.071429
5470	10	28	196.428571
5480	9	28	196.785714
5490	8	28	197.142857
5500	27	29	190.689655
5510	26	29	191.034483
5520	25	29	191.379310
5530	24	29	191.724138
5540	23	29	192.068966
5550	22	29	192.413793
5560	21	29	192.758621
5570	20	29	193.103448
5580	19	29	193.448276
5590	18	29	193.793103

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
5600	17	29	194.137931
5610	16	29	194.482759
5620	15	29	194.827586
5630	14	29	195.172414
5640	13	29	195.517241
5650	12	29	195.862069
5660	11	29	196.206897
5670	10	29	196.551724
5680	9	29	196.896552
5690	8	29	197.241379
5700	27	30	191.000000
5710	26	30	191.333333
5720	25	30	191.666667
5730	24	30	192.000000
5740	23	30	192.333333
5750	22	30	192.666667
5760	21	30	193.000000
5770	20	30	193.333333
5780	19	30	193.666667
5790	18	30	194.000000
5800	17	30	194.333333
5810	16	30	194.666667
5820	15	30	195.000000
5830	14	30	195.333333
5840	13	30	195.666667
5850	12	30	196.000000
5860	11	30	196.333333
5870	10	30	196.666667
5880	9	30	197.000000
5890	8	30	197.333333
5900	27	31	191.290323
5910	26	31	191.612903
5920	25	31	191.935484
5930	24	31	192.258065
5940	23	31	192.580645
5950	22	31	192.903226

Table 8-8.
Listing of all M and N Numbers and Resulting Frequencies (continued)

Freq. MHz	M	N	M/N MHz
5960	21	31	193.225806
5970	20	31	193.548387
5980	19	31	193.870968
5990	18	31	194.193548
6000	17	31	194.516129
6010	16	31	194.838710
6020	15	31	195.161290
6030	14	31	195.483871
6040	13	31	195.806452
6050	12	31	196.129032
6060	11	31	196.451613
6070	10	31	196.774194
6080	9	31	197.096774
6090	8	31	197.419355
6100	27	32	191.562500
6110	26	32	191.875000
6120	25	32	192.187500
6130	24	32	192.500000
6140	23	32	192.812500
6150	22	32	193.125000
6160	21	32	193.437500
6170	20	32	193.750000
6180	19	32	194.062500
6190	18	32	194.375000



TROUBLESHOOTING NOTES:

LFS PHASE LOCKED LOOP

FAULT INDICATION - NOT PHASED LOCKED ANNUNCIATOR ON, A2A7 LFS LED OFF (M/N AND REF ON).

1. TO OPEN LOOP, REMOVE A2A3, SET TEST SWITCH TO TEST HIGH AND REPLACE A2A3.
2. CHECK TEST POINTS SHOWN AND ISOLATE ACCORDINGLY.
3. IF TP2 IS BAD, CHECK TP1. THIS COULD BE BAD EVEN THOUGH REF PHASED LOCKED LOOP IS PHASED LOCKED.
4. BEWARE FAULTY PHASE LOCK DETECTOR.

M/N PHASE LOCKED

FAULT INDICATION - NOT PHASED LOCKED ANNUNCIATOR ON, A2A7 M/N AND YTO LEDS OFF (REF ON).

1. TO OPEN LOOP, REMOVE WHITE/RED CABLE FROM A3A1A5 CONNECTOR. CHECK TP1, B, C, AND D FOR FIRST VALUES GIVEN.
2. DISCONNECT RED/GREY/WHITE CABLE (A3A1A2W1) FROM A3A1A3J1. CHECK TP1, B, C AND C FOR SECOND VALUES GIVEN.
3. CHECK FREQUENCY AT TPE.

Figure 8-19. RF Phase Locked Loops Block Diagram
8-85/8-86

BD3

RF Phase Locked Loops
Block Diagram
SERVICE SHEET

BD4 YTO Summing Phase Locked Loop

References

Principles of Operation

General

The YTO Summing phase locked loop generates baseband frequencies from 2.0 — 6.2 GHz directly using a YIG Tuned Oscillator (YTO). The YTO is phase locked to reference frequencies from the Low Frequency Source (LFS) phase locked loop and the M/N phase locked loop.

The output of the YTO is downconverted to a frequency between 20 and 30 MHz using a harmonic of the M/N frequency reference. This intermediate frequency is then phase compared to the output of the LFS phase locked loop and the YTO frequency is adjusted until the two frequencies are equal. Because the YTO output is downconverted instead of divided, a 1 kHz change in the reference frequency of the LFS phase locked loop will change the output frequency of the YTO by 1 kHz.

The M/N phase locked loop reference frequency is used to step the YTO output in 10 MHz steps and the LFS phase locked loop reference is used to control the YTO output in 1 kHz steps over a 10 MHz range. Together, the M/N phase locked loop and the LFS phase locked loop control the YTO output frequency from 2 to 6.2 GHz in 1 kHz steps.

The 2 to 6.2 GHz baseband signal is multiplied by two or three to produce frequencies from 6.2 to 18 GHz. Multiplying the baseband frequency causes the frequency resolution to be multiplied as well. For example, the baseband frequency is doubled to obtain frequencies between 6.2 and 12.4 GHz (band 2). A 1 kHz change in the YTO output frequency for an instrument frequency in band 2 will cause a change in the multiplied frequency of 2 kHz.

The YTO Summing phase locked loop consists of the following assemblies:

Digital to Analog Converter (DAC), Service Sheet 9
YIG Tuned Oscillator (YTO) Driver, Service Sheet 10
YTO Sampler, Service Sheet 11
YTO Phase Detector, Service Sheet 12
YTO/FM Coil Driver, Service Sheet 13

FM Subsystem
P/O Metering Assembly, Service Sheet 21
P/O YTO/FM Coil Driver, Service Sheet 13
P/O YTO Phase Detector Assembly, Service Sheet 12

Digital to Analog Converter

The Digital to Analog Converter (DAC) is used to pretune the YTO to within 50 MHz of the desired frequency. The pretuning is required to prevent the YTO Summing phase locked loop from phase locking on the wrong harmonic of the M/N phase locked loop reference frequency. The Digital Control Unit (DCU) controls the DAC with the DAC 1 — 4800 MHz control lines. The DAC output, YTO PRETUNE, is used as an input to the YTO Driver.

Yig Tuned Oscillator (YTO) Driver

The YTO Driver sums the YTO PRETUNE voltage from the Digital to Analog Converter with the YTO TUNE 2 signal, and the low frequency components (>100 Hz) of the correction signal from the phase detector. The combined signal is used to drive the main coil of the YTO. The main coil of the YTO is used for large changes of the YTO frequency. A smaller coil, the high frequency coil, is driven by the higher frequency components of the phase detector error voltage.

YTO Sampler

The sampler assembly is used to downconvert the microwave output of the YTO to an RF frequency between 20 and 30 MHz. A harmonic generator is used to produce harmonics of the 177.5 to 197.5 MHz M/N phase locked loop reference which are mixed with the output of the YTO. The M/N phase locked loop is tuned by setting the M and N dividers so that the Nth harmonic of the M/N phase locked loop output will be within 30 MHz of the YTO output frequency.

The IF frequency is buffered and filtered to remove unwanted mixing products and the resulting IF signal is routed to the YTO Phase Detector to be compared with the 20 to 30 MHz output of the LFS phase locked loop.

YTO Phase Detector

This circuit receives the 20 — 30 MHz signal from the LFS Loop and the selected IF signal from the Sampler. These two signals are compared in a phase/frequency detector. The output of the phase/frequency detector consists of two separate pulse trains. These are compared in a differential amplifier whose output is a single pulse train. The duty cycle of this pulse train is proportional to the difference between the IF signal from the Sampler and the 20 — 30 MHz signal from the LFS loop. This pulse train is then integrated to generate the YTO TUNE 1 signal. The FM elements of the YTO Phase Detector are discussed under "FM Subsystem" below.

YTO/FM Coil Driver

This assembly receives the YTO TUNE 1 signal from the YTO Phase Detector, amplifies it and routes it to a crossover network consisting of a 100 Hz high pass filter in the YTO/FM Coil Driver Assembly and a 100 Hz low pass filter in the YTO Driver Assembly. This network sends the FM signal (100 Hz to 3 MHz) to the FM coil of the YTO, and the YTO tuning signal (YTO TUNE 2 plus YTO PRETUNE) to the main YTO coil. The FM elements of this circuit are discussed under "FM Subsystem" below.

FM Subsystem

Metering Assembly. The FM signal enters the Metering Assembly directly from the front panel. In the following order, the FM signal passes through the Band Switched Attenuator, FM Amplifier, Range Attenuator and exits through the Emitter Follower. Both attenuators respond to control signals from the front panel or the HP-IB Interface Assembly. To provide constant peak deviation in all bands, the Band Switched Attenuator attenuates the FM signal by a factor of 1, 1/2 or 1/3 as the frequency is changed from 1st to 2nd to 3rd bands. To provide selectable peak deviation ranges, the Range Attenuator attenuates the FM signal by 0, 10, 20 and 30 dB corresponding to FM peak deviations of 10, 3, 1, and .3 MHz. The FM Amplifier permits precise adjustment of its gain to ensure calibrated FM.

The FM Meter Driver converts the FM signal to a dc level that is proportional to the level of the FM input signal. This dc level is routed to the front panel meter and to the Overmod Detector that drives the FM OM signal active if the FM signal is too high. The FM Overmod Detector also receives an input from the overmodulation detector in the YTO Loop.

YTO/FM Coil Driver. In the YTO/FM Coil Driver, the FM Signal from the Metering Assembly takes two paths: one is through a 0/40 dB attenuator and an FM amplifier and shaping network to the FM Coil Driver. The second path is through an integrator and a 0/40 dB attenuator to the Loop Integrator in the YTO Phase Detector. The first path directly modulates the YTO. However, any modulating frequency within the bandwidth of the YTO loop will be canceled out by the loop. The second path provides for modulation within the YTO Loop bandwith by applying the modulating signal at a point within the loop.

YTO Phase Detector. This assembly receives the Integrated FM signal and applies it directly to the Loop Integrator to frequency modulate within the YTO Loop bandwidth. In response to a local/remote FM OFF command, the FM switch grounds the IFM signal, thereby terminating low frequency modulation (roughly 50 Hz to 100 kHz FM).

The FM Overmodulation Detector detects excessive frequency modulation, trigerring the Divide Selector to select divide by 3 instead of divide by 2 and the FM Status Enable to signal FM overmodulation on the front panel. The FM Status Enable also causes the Band Switched Attenuator on the Metering Assembly to block the FM signal at 50 ms intervals. The higher divide number helps keep the modulating frequency within the bandwidth of the YTO Loop and the periodic interruption of the FM signal further delays unphase lock.

Troubleshooting

General

It is assumed that the troubleshooting information associated with service sheet BD1 was used to isolate a YTO Summing phase locked loop malfunction. The following troubleshooting information can be used to further isolate the problem to one of the following YTO assemblies:

Digital to Analog Converter Assembly
YTO Driver Assembly
YTO High Frequency Driver Assembly
Sampler Assembly
YTO Loop Assembly

Equipment

Frequency Counter................	HP 5340A or HP 5343A
Signal Generator..................	HP 8656A
Digital Voltmeter (DVM)..........	HP 3455A or HP 3456A
Oscilloscope	HP 1980B

Troubleshooting Procedures

The following procedures are divided into ten checks as follow:

YTO Loop Tune Checks

YTO Tune Check (√1)
YTO Driver Check (√2)
DAC Check (√3)
DAC Digital Input Check (√4)

YTO Loop Assembly Checks

Sampler Output Check (√5)
Directional Coupler and Sampler (√6)
YTO/FM/Coil Driver and YTO Phase Detector Check (√7)

FM Checks

FM Amplifier Check (√8)
FM 40 Check (√9)
FM Overmodulation Check (√10)

YTO Loop Tune Checks

YTO Tune Check (√1)

1. With the frequency counter connected to A3A9A1J1(TPA). Connect A3A6TP5 (GND) to A3A7TP2 (TUN VOLT) with a jumper cable.
2. Tune the Signal Generator to 2000.000 MHz. Wait approximately 30 seconds for drift to minimize, and verify that the frequency counter reads 2000.0 ±0.1 MHz. Then tune the Signal Generator to 6199.000 MHz, again wait approximately 30 seconds, and verify that the frequency counter reads 6199.0 ±0.1 MHz.

   If the end-point frequencies (2.000 GHz and 6.199 GHz) are in tolerance, adjustment is unnecessary. Go to "YTO Loop Assembly Checks".

   If the end-point frequencies are out of tolerance, note by how much, and perform the "YTO Driver Adjustments" in chapter 5.

   If adjustment is impossible, proceed to "YTO Driver Check".

   If adjustment can be made, continue with step 3.
3. Remove the jumper cable connecting A3A6TP5(GND) to A3A7TP2.
4. Verify that the YTO loop is phase locked throughout band one. Use procedure "YTO Frequency Check", BD1. Allow the Signal Generator to run for an hour and then repeat Steps 1 and 2 to verify that the end-point frequencies do not drift out of tolerance.

   If the end-point frequencies drift out of tolerance, the YTO Driver Assembly, A3A6, needs repair. Go to service sheet 10.

YTO Driver Check (√2)

5. Ground A3A6TP1.
6. Connect a DVM to A3A6TP2, YTO COIL.
7. Set the Signal Generator to 2.000 GHz. Verify that the voltage is −37.2±0.5 Vdc.
8. Set the Signal Generator to 6.199 GHz. Verify that the voltage is −31.5 ±0.5 Vdc.

   If the main coil tune voltages are as indicated, the YTO is not functioning properly. Go to service sheet 13 to troubleshoot the YTO Assembly.

   If the main coil tune voltages are not as indicated, continue with "DAC Check".

DAC Check (√3)

9. Connect the DVM to YTO PRETUNE.
10. Set the Signal Generator to 2.000 GHz. Verify that the voltage is −6.000 ±0.005 Vdc.

11. Set the Signal Generator to 6.199 GHz. Verify that the voltage is -18.6 ± 0.005 Vdc.

    If the DAC voltages are correct, go to service sheet 10. The YTO Driver Assembly, A3A6, needs repair.

    If the DAC pretune voltages are not correct, go to "YTO Pretune DAC Adjustment" in chapter 5 and try to adjust the DAC.

    If the DAC cannot be adjusted, go to "DAC Digital Input Check".

Note

For variations of the voltages in steps 10 and 11 $>\pm 0.1$ Vdc, use this procedure to verify that the RF Output Assembly is not loading the DAC output.

If the DAC cannot be adjusted, disconnect the yellow YTM TUNE cable, A3W4, from A1A14J16 in the RF Output Assembly and try to tune the DAC again according to chapter 5.

If the DAC still cannot be tuned, check A3W4 for continuity and a short to ground. If A3W4 is defective, replace it. If A3W4 is not defective, go to "DAC Digital Input Check".

If the DAC can be retuned when A3W4 is disconnected, inspect the connector on A3W4 and its respective connector in the RF Output Assembly, A1A14J16, for damage.

If no damage is visible, re-connect A3W4 and lift the YTM Driver Assembly, the SRD Assembly, the ALC Assembly and the remaining assemblies in the RF Output Assembly, one at a time, until the DAC voltage returns to normal as specified in "YTO Pretune DAC Adjustment", chapter 5. The assembly in the RF Output Assembly that loads the DAC voltage is defective. Turn to an Assembly Index, printed on the tabbed dividers in chapter 8, to find the appropriate service sheet.

If the DAC voltages at A3A5TP5 do not return to normal after the assemblies in the RF Output Assembly have been removed, the Motherboard Assembly, A1A14, is defective. Go to service sheets 14 through 21.

DAC Digital Input Check (√4)

Note

This check selects two frequencies to cause each DAC input line to produce a digital high and low. If the DAC input lines toggle, this check proves that the DAC input lines are not shorted to ground and not open. It does not prove that the DAC input lines are not shorted

Note (cont'd)

to each other. Neither does it prove that the DCU can produce the correct digital inputs to the DAC for all frequencies 10 MHz through 6199 MHz. Further, it cannot prove that the DAC is working when the DCU is found defective. Therefore, after completing this check, it may be helpful in troubleshooting both the Controller and the DAC to try to re-tune the DAC, stopping to check the DAC inputs at any frequency that does not permit tuning. The pins that should be high are those whose respective frequency values in MHz add up to the front panel frequency in MHz. Refer to tables 8-9 and 8-10 below and service sheet 9.

12. Put the DAC Assembly, A3A5, on an extender board.
13. Set the Signal Generator to the first frequency shown in table 8-9 below.

Table 8-9. XA3A5: DAC 1—4800 MHz Inputs

	XA3A5 Pins and Frequency Values													
Front Panel Frequency	7 4800 MHz	8 3200 MHz	9 800 MHz	10 400 MHz	11 200 MHz	12 100 MHz	13 80 MHz	25 40 MHz	26 20 MHz	27 10 MHz	28 8 MHz	29 4 MHz	30 2 MHz	31 1 MHz
5799 MHz	1	0	1	0	0	1	1	0	0	1	1	0	0	1
3866 MHz	0	1	0	1	1	0	0	1	1	0	0	1	1	0

14. With a logic probe or DVM verify the logical states for the first frequency at each edge connector pin listed in table 8-9. Repeat steps 13 and 14 for the second frequency.

    If the levels are as indicated, the DAC is defective. Go to service sheet 9.

    If the levels are not as indicated, continue with step 15 to verify the outputs of the Output Register Assembly, A2A8, in the DCU.

15. Place A2A8 on a special extender assembly (P/N 08672-60016) or on three 30-pin extender boards.
16. Set the Signal Generator to the first frequency shown in the table 8-10 below.

Table 8-10. XA2A8: DAC 1—4800 MHz Outputs

	XA2A8 Pins and Frequency Values													
Front Panel Frequency	B13 4800 MHz	B29 3200 MHz	C2 800 MHz	C19 400 MHz	C5 200 MHz	C3 100 MHz	B24 80 MHz	B8 40 MHz	B3 20 MHz	A13 10 MHz	B10 8 MHz	B23 4 MHz	B18 2 MHz	A30 1 MHz
5799 MHz	1	0	1	0	0	1	1	0	0	1	1	0	0	1
3866 MHz	0	1	0	1	1	0	0	1	1	0	0	1	1	0

17. With a logic probe or DVM verify the logical states for the first frequency at each edge connector pin listed in table 8-10. Repeat steps 16 and 17 for the second frequency.

    If the levels are as shown, there is a problem between A2A8 and A3A5 on either the Controller motherboard, A2A12, or the RF Source Assembly motherboard, A3A10. Go to service sheets 30 and 9.

    If the levels are not as shown, the cause of the malfunction is in the Controller. Go to service sheet BD9.

    After the Controller and/or motherboard repairs have been made, be sure to retune both the DAC, A3A5, and the YTO Driver Assembly, A3A6, according to the procedures in chapter 5 ("YTO Pretune Digital-to-Analog Converter" adjustment and "YTO Driver Adjustment"). Then check the YTO loop for phase lock at A3A9A1J1(TPA), according to "YTO Frequency Check", BD1.

    If the YTO loop phase locks, reconnect A1W1, and go to "Output Level Checks", BD1, to verify the frequency and power at RF OUTPUT connector, A1J1, on the front panel.

    If the YTO loop still does not phase lock, continue with "YTO Loop Assembly Checks".

YTO Loop Assembly Checks

Conditions

The M/N and LFS frequencies are accurate and at correct power as specified in BD1.

RF out at the Directional Coupler, A3A9A1J1(TPA), is 10 dBm or greater and is within 2 MHz of the frequency displayed on the front panel of the Signal Generator when A3A7TP2 is grounded.

If the frequency is not within these limits, go to "YTO Tune Check" to re-tune the YTO.

Sampler Output Check (√5)

18. Observe the conditions listed above.
19. Ground A3A7TP2.
20. Set the Signal Generator to 2100 MHz.
21. Disconnect the short, black IF OUT cable, A3A9W4(TPE), from A3A9J2.
22. Connect a power meter to A3A9J2.
23. Verify that the power at IF OUT, A3A9J2, is ≥−2.5 dBm.

    If the power at IF OUT is correct, the Sampler and Sampler Assembly are working. Go to "YTO/FM/Coil Driver and YTO Phase Detector Check".

If the power is too low, go to "Directional Coupler and Sampler Input Check".

Note The above IF power check is enough to verify that the Sampler and Sampler Assembly are working. A frequency check will usually not be necessary.

Directional Coupler and Sampler Input Check ($\surd$6)

24. Observe the conditions listed above under YTO Loop Assembly Checks
25. Ground A3A7TP2.
26. Put the YTO Loop Assembly, A3A9, in the service position.
27. Connect the power meter to A3A9A1J1 (TPA).
28. Tune through the first band and record the minimum power observed and the frequency at which this power is observed. Press HOLD to keep the Signal Generator at this frequency.

    If the observed power meets the minimum power limit as listed in table 8-11, check #3, continue the power checks in table 8-11, starting with check #4 and moving downward through power check #8.

    If the observed power does not meet the minimum power limit as listed in table 8-11, check #3, do power checks #2 and #1 in table 8-11, in that order.

Note Components whose inputs are correct but whose outputs are not are malfunctioning. Any passive component that causes a power loss greater than that listed in table 8-11 is defective. Go to service sheet 13 for troubleshooting information on all components listed in table 8-11.

If the power to the Sampler (check #4) is correct, the Sampler and/or Sampler Assembly, A3A9A5, is defective. Go to service sheet 11.

Table 8-1.
Directional Coupler: Input and RF and Sampled Outputs

Check No.	Component Description	Connect Power Meter to Output of:	Maximum Insertion Loss	Verify Minimum Power Limit
#1	YTO RF Out	A3A9A3J2	N/A	≥+11.25 dBM
#2	Semi-rigid Cable	A3A9W1	1/4 dB	≥+11.0 dBM
#3	Coupler Out	A3A9A1J1	1 dB	≥+10.0 dBM
#4	Semi-rigid Cable	A3A9W2	1/4 dB	≥−28.5 dBM
#5	18 dB Pad	A3A9A6	18 dB	≥−28.25 dBM
#6	LP Filter	A3A9A7	1.0 dB	≥−10.25 dBM
#7	Semi-rigid Cable	A3A9W3	1/4 dB	≥−9.25 dBM
#8	Sampled Coupler Out	A3A9A1J3	19 dB	≥−9.0 dBM

YTO/FM/Coil Driver and YTO Phase Detector Check (√7)

29. Remove the ground from A3A7TP2. Press PRESET (3 GHz).

    Disconnect the small black IF cable, A3A9W4(TPE), from IF IN, A3A9J1.

Note

Under this condition, if it is necessary to set the Signal Generator to STANDBY, the Phase/Frequency Detector (U5) in A3A9A4 may change states once the instrument is turned back on, causing positive instead of negative voltages to appear at the referenced test points. Momentarily reconnect the the small black IF cable, A3A9W4, to A3A9J1 to cause the voltages to turn negative again. All voltages must hold.

30. Measure the voltage at A3A6TP1 with a DVM. It should be −4.8 to −6.2 Vdc.

    If this voltage is correct, go to step 36.

    If this voltage is not correct, continue with the next step.

31. Measure the voltage at A3A7TP2. This voltage should be −6.0 ±1.0 Vdc.

    If this voltage is correct, A3A7 is defective. Go to service sheet 13.

    If this voltage is not correct, continue with the next step.

32. Disconnect the gray YTO TUNE 1 cable, A3W16, from A3A9J6 on the YTO Loop Assembly, A3A9.

33. Measure the voltage on the inner male pin of A3A9J6 using a test probe. (Be careful not to bend the pin.) The voltage should be −6.5 ±1.0 Vdc.

If this voltage is not correct, the Phase Detector Assembly, A3A9A4, is defective. Go to service sheet 12.

If this voltage is correct, the Phase Detector Assembly, A3A9A4, is working. Continue with the next step.

34. Reconnect the gray YTO TUNE 1 cable, A3W16, to A3A9J6 on the YTO Loop Assembly, A3A9.
35. Take A3A7 out of the Signal Generator and measure the voltage at pin 10 on edge connector XA3A7. It should be −6.5 ±1.0 Vdc.

    If the voltage is not correct, the black cable, A3A9W4, is defective. Go to service sheet 12.

    If the voltage is correct, A3A7 is defective. Go to service sheet 13.
36. Disconnect the green LFS cable, A3W14 (TPD), from A3A9J3 and connect it to IF IN, A3A9J1(TPE). Then, starting with step 30 above, repeat the procedure through step 35 if necessary. Voltages for all test points will be positive and have the same range except for A3A6TP1, which should be >+6.0 Vdc.

    If all of the above voltage checks pass, A3A9A4, A3A9W4, and most of A3A7 are working. The high frequency coil driver circuitry on A3A7 and its ac output, FM COIL DRIVE, through the purple cable, A3W15, remain unverified. This output will cause the YTO loop to unphase lock if it is not correct! It must be verified indirectly because it varies rapidly in both frequency and amplitude. Proceed with the next step .
37. Reconnect all cables on the YTO Loop Assembly, A3A9.
38. Verify that the YTO loop phase locks. Use the procedure "YTO Frequency Check", BD1.

    If at this point the YTO loop fails to lock and all the recommended checks have been made, turn to service sheet 13 and verify the dc biasing on A3A7 and check the purple cable, A3W15. for continuity and a short to ground.

FM Checks

FM Amplifier Check (√8)

39. Press the PRESET (3 GHz) key and set the FM DEVIATION MHz switch to 10.
40. Connect a BNC TEE to the Signal Generator's FM INPUT.
41. Connect the test oscillator (use the 50 ohm output) to the BNC TEE. Set the test oscillator to 5 MHz and 0V.
42. Connect the oscilloscope to A3A7TP5.
43. Adjust the test oscillator output level for a 3 Vpp display on the oscilloscope.

If the test oscillator output level cannot be adjusted to produce the indicated oscilloscope display, proceed to service sheet 21.

Otherwise, continue with the next step.

44. Set the FM DEVIATION MHz switch to the following settings and observe the corresponding signal level:

FM DEVIATION MHz	SIGNAL LEVEL
3	0.9 Vpp
1	0.3 Vpp
0.3	0.09 Vpp
0.1	3.0 Vpp
0.03	0.9 Vpp

If the above voltages are correct, go to step 45.

If any of the above voltages is incorrect, go to service sheet 21 to troubleshoot the Metering Assembly, A1A9.

FM 40 Check (√9)

45. Place A3A7 on an extender board and leave the Signal Generator's FM DEVIATION MHz switch set to 0.03.

Using the DVM, measure the voltage at edge connector pin 29 (TPF). The DVM should read +4.5 Vdc. Set the FM DEVIATION MHz switch to 0.3. The DVM should read 0 Vdc.

If the voltage changes as indicated, and if the indications in steps 43 and 44 are correct, the FM circuitry of A3A7 is at fault. Go to service sheet 13.

If the voltage does not change as indicated, go to service sheet 19 to troubleshoot the Local/Remote FM Atten Selector.

FM Overmodulation Check (√10)

46. Press the Signal Generator's PRESET (3 GHz) key and set the FM DEVIATION MHz switch to 10.

47. Connect the DVM to the open end of the BNC TEE. Set the test oscillator to 100 kHz and an amplitude of 0.045 Vrms. The OVER MOD light should not be on. Increase the amplitude of the test oscillator signal to 0.065 Vrms. The OVER MOD light should now be on.

If the indications are correct, the FM overmodulation circuitry on SS12 is working. Go to step 48.

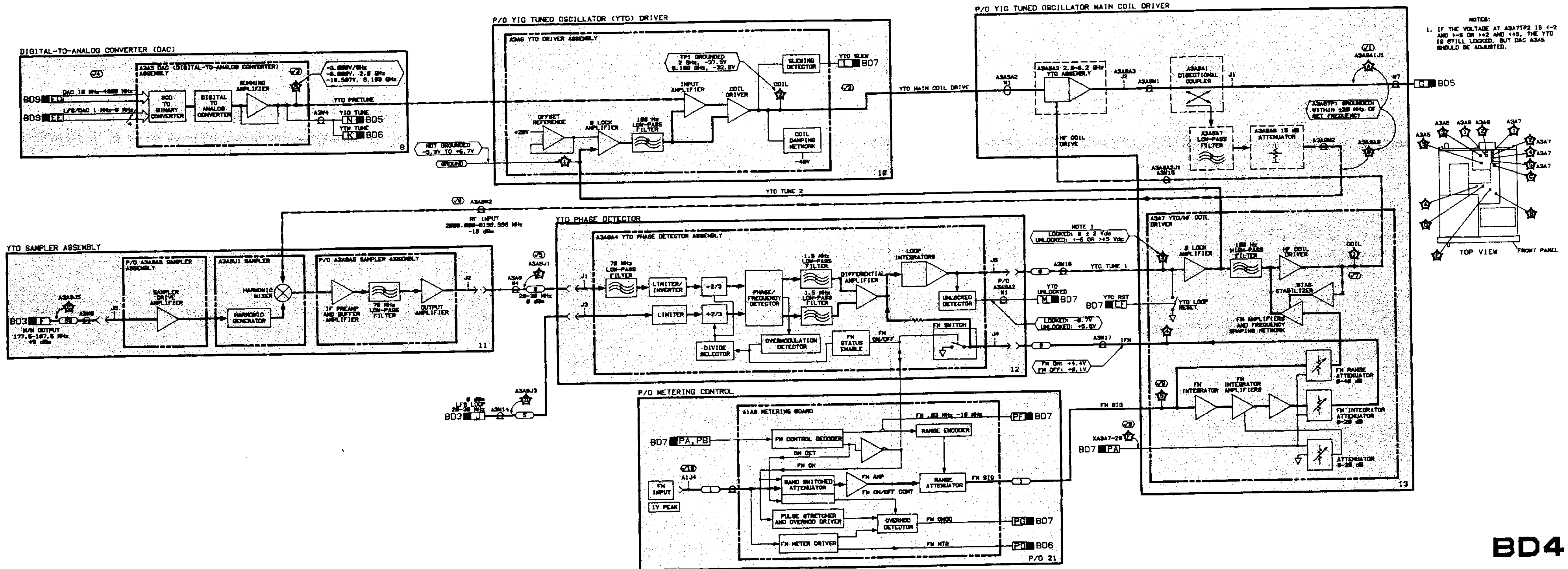
If the OVER MOD annunciator comes on too early or too late, go to chapter 5 V to make the necessary adjustments.

If the OVER MOD annunciator stays either on or off, go to "FM Procedure", step 4, service sheet 12.

48. Set the FM DEVIATION MHz switch to 3. Set the output of the test oscillator to 1 MHz and an amplitude of 0 Vrms. The OVER MOD annunciator should remain off. Increase the amplitude of the test oscillator signal to 0.82 Vrms. The OVER MOD annunciator should illuminate.

    If the indication is correct, the Overmodulation Detector on service sheet 21 is working.

    If the indication is not correct, go to service sheet 21, FM Circuitry Troubleshooting.



BD4

Figure 8-20. YTO Summing Loop Block Diagram
8-101/8-102

BD4

YTO Summing Loop
Block Diagram
SERVICE SHEET

BD5 Microwave Signal Path

References

Principles of Operation

General

The Microwave Signal Path performs four basic functions:

- Multiplies the 2 to 6.2 GHz baseband signal from the YTO Summing Phase Locked Loop to generate frequencies from 6.2 to 18 GHz.
- Amplifies the 2 to 6.2 GHz baseband signal to produce the specified power levels over the 2 to 18 GHz frequency range.
- Provides step attenuation (10 dB/step) to increase the dynamic range of the leveled RF output.
- Detects the output level to provide a feedback signal to the ALC circuitry.

The Microwave Signal Path is functionally divided into the following assemblies:

RF Amplifier, part of the RF Amplifier and ALC Assembly, Service Sheet 14

YIG Tuned Multiplier (YTM) Control Assembly, Service Sheet 15
SRD Control Assembly, Service Sheet 16
ALC Detector Assembly, Service Sheet 17
RF Output Level Control Assembly, Service Sheet 18

RF Amplifier

The RF amplifier is used to amplify the 2 to 6.2 GHz baseband signal to a level high enough to drive the Step Recovery Diode (SRD) in the YTM assembly. The RF amplifier also contains the ALC modulator that is controlled by the ALC circuitry to maintain a constant RF output signal level. This is discussed more fully under ALC operation, service sheet BD6.

YTM Control and SRD Control

The YIG Tuned Multiplier (YTM) is a broadband frequency multiplier with an input frequency range of 2.0 to 6.2 GHz and an output frequency range of 2. 0 to 18.0 GHz. This range is divided into three bands which correspond to frequency bands and the associated YTM input and output frequency ranges are listed in table 8-12.

Table 8-12.

Band Number	Input Frequency Range (GHz)	Output Frequency Range (GHz)
1	2.0 to <6.2	2.0 to <6.2
2	3.1 to <6.2	6.2 to <12.4
3	4.1 to <6.2	12.4 to <18.6

The YTM uses a Step Recovery Diode (SRD) (see figure 8-21) to produce a harmonically rich comb spectrum. The desired output frequency is selected by tuning a filter to the desired harmonic. The filter also suppresses the undesired harmonics.

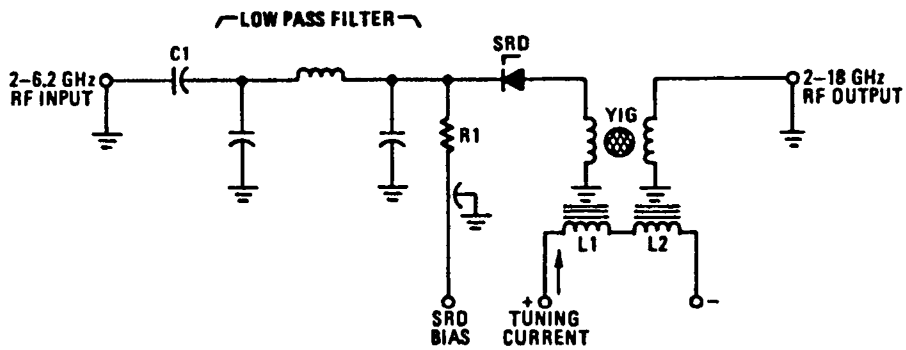


Figure 8-21. YTM Simplified Schematic Diagram

In band 1 (2 — 6.2 GHz), the Step Recovery Diode (SRD) is forward biased to prevent harmonic generation and to pass the fundamental signal with very little loss. The YIG Tuned Filter (YTF) in the YTM assembly is tuned to the input signal frequency and the overall effect is that the amplifier output signal is passed directly to the output of the YTM.

In the multiplied bands (6.2—18 GHz), the SRD is biased to act as a charge controlled switch. Proper biasing of the SRD produces a very narrow pulse when the diode is switched from forward to reverse bias by the RF input signal. The pulse width is determined by the circuit inductance and the diode capacitance. Narrow pulse widths (<100 ps) are required to obtain high conversion efficiency to 18 GHz. The proper timing of the switching action is controlled by the dc voltage bias level.

The SRD in the YTM is forward biased by the SRD Bias Assembly whenever the Signal Generator's output frequency is in band 1 (2 to 6.2 GHz). For frequencies in the multiplied bands, the SRD Bias Assembly supplies a fixed dc bias.

The YIG Tuned Filter (YTF) within the YTM assembly is tuned by varying the magnetic current around the YIG sphere. The variation in magnetic field is controlled by varying the current in a tuning coil near the YIG. The tuning current is supplied by the YTM Control assembly. The tracking of the YTF filter is critical to minimize attenuation of the desired signal. In addition, the YIG sphere is temperature sensitive and can cause tuning drift due to large frequency changes. The drift problem is most evident for frequency changes above 16 GHz and does not affect most applications.

ALC Detector Assembly

The ALC Detector assembly senses the output power from the YTM. A crystal detector is connected to the coupled port of a directional coupler to provide a dc voltage that is proportional to the YTM output power in watts. The ALC circuitry uses this voltage to control the output level from −10 to +13 dBm. This is discussed more fully under ALC operation on BD6.

RF Output Level Control

The RF Output Level Control assembly drives a 110 dB step attenuator to increase the dynamic range of the instrument. The output of the YTM will always be between −10 and +13 dBm for a leveled output and the attenuator is used to attenuate the YTM output signal in 10 dB steps to give a possible output level range of −120 to +13 dBm. If the output level is set higher than the maximum power available from the YTM, the ALC circuitry will indicate that the output level is uncalibrated and the meter will indicate the approximate power available.

Troubleshooting

General

It is assumed that the troubleshooting procedures associated with BD1 have been used to isolate a problem to the Microwave Signal Path, illustrated on BD5.

The following procedure is designed to:

- Verify that the microwave signal path is capable of delivering the specified power, and
- Isolate any problems encountered.

Some of the following steps may be skipped, but only if you have experience with the Signal Generator and with these procedures. For anyone lacking this experience, all steps should be performed.

Troubleshooting Hints

Squegging. Squegging is an unstable YTM output caused by too much power being applied to the YIG sphere. Squegging causes erratic power changes in the output level and spurious sidebands on the carrier. See figure 8-22 for an example of squegging. This condition occurs primarily in Band 1 because the RF input signal (rather than some harmonic of the RF signal) is applied to the YTF. Squegging can occur in Band 1 when using external leveling due to compensation of the internal circuitry for external losses in the signal path. To prevent squegging when externally leveling, the input level to the YTM is clamped to a safe power level at the input to the YTM. If squegging occurs during external leveling, first try to readjust the clamp circuit.

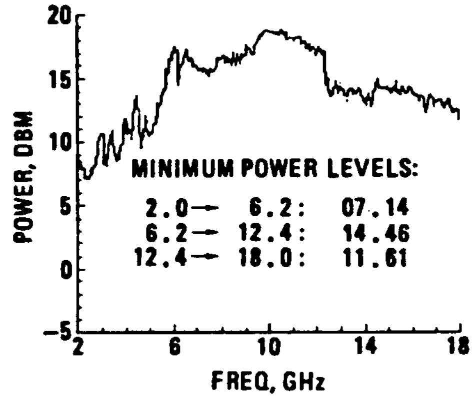


Figure 8-22. Band 1 Squegging

Programmable Attenuator. The microwave signal path is checked using no attenuation. If the troubleshooting indicates that the microwave chain is working correctly but power problems are symptoms of the failure, check the programmable attenuator. See check 4 for more information regarding troubleshooting the attenuator.

Equipment

Power Meter..................... HP 436A
Power Sensor..................... HP 8481A
Digital Voltmeter................. HP 3455A or HP 3456A

Procedures

The troubleshooting procedure is divided into the following checks:

Microwave Signal Path Input Power Check (√1)
YTM Checks (√2)
Final Output Power Check (√3)
Programmable Output Attenuator Check (√4)

If a check indicates a problem, procedures are provided to isolate the problem to a service sheet.

Microwave Signal Path Input Power Check (√1)

1. Remove the cable from the input of the RF amplifier assembly and connect the power meter to the cable.
2. Set the Signal Generator frequency to 2.0 GHz and select 100 MHz tuning resolution.
3. Tune from 2.0 to 6.1 GHz while observing the power meter.

The power should not drop below +11.5 dBm at any frequency.

If the power is correct, reconnect the cable to the input of the RF amplifier and proceed with step 4, "YTM Checks".

If the power drops below +11.5 dBm, the YIG Tuned Oscillator is defective. Go to service sheet 13 to troubleshoot.

YTM Checks (√2)

4. Disconnect A1W6 from the YTM output connector. Connect the power sensor to the output of the YTM.
5. Disconnect the blue cable from A1A12J3. This disables the ALC modulator and prevents the ALC circuitry from attenuating the RF signal.
6. Set the Signal Generator frequency to 6.2 GHz and select 100 MHz tuning resolution.
7. Slowly tune from 6.2 to 18.0 GHz while observing the power meter.

   The output level should not drop below +9 dBm at any frequency. A typical plot of output level versus frequency is shown in figure 8-23.

Note Ignore the unstable output (squegging) in band 1. Squegging occurs due to the directional coupler being disconnected in step 4 and the ALC modulator being disabled in step 5.

If the power does not drop below +9 dBm, proceed with the Final Output Check beginning with step 19.

If the power drops below +9 dBm, proceed with the YTM Control checks beginning with step 8.

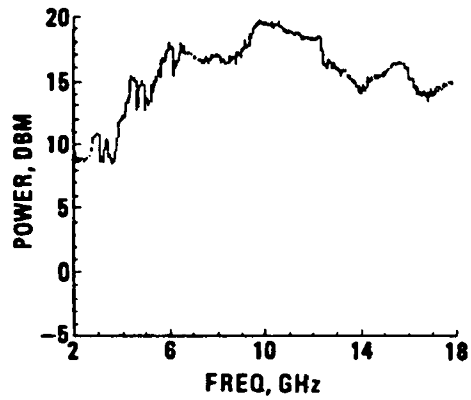


Figure 8-23. Typical YTM Output Power

YTM Control Checks (√2a)

8. Connect the voltmeter to A1A8TP1 SENSE. This test point is a direct measure of the tuned frequency of the YTF in the YTM assembly. Set the Signal Generator frequency to 2 GHz.

   The voltage should be −1 ±0.5 Vdc.

   If the voltage is correct, proceed with step 9.

   If the voltage is not correct, proceed with step 11 to check the inputs to the A1A8 YTM Control assembly.

9. Set the Signal Generator frequency to 10.0 GHz.

   The voltmeter should indicate a voltage of −5.3 ±0.5 Vdc.

   If the voltage is correct, proceed with step 10.

   If the voltage is not correct, proceed with step 11 to check the inputs to the YTM Control assembly.

10. Set the Signal Generator frequency to 18.0 GHz.

    The voltmeter should indicate a voltage of −9.5 ±0.5 Vdc.

    If the voltage is correct, proceed with "SRD Bias Checks" beginning with step 13.

    If the voltage is not correct, proceed with step 11 to check the inputs to the YTM Control assembly.

11. Remove A1A8 YTM Control and replace it on a 36 pin extender card. Using a voltmeter, check the following edge connector pins for the indicated dc level.

Table 8-13. YTM Control Inputs

Frequency (GHz)	XA1A8		
	6	10	13
2.0 GHz	−6	<1	<.1
10.0 GHz	−15	>3.5	<.1
18.0 GHz	−18	>3.5	>11

If all of the voltages are correct, proceed with step 12.

If XA1A8-6 YTM TUNE is incorrect at any or all frequencies, use service sheets 9 and 15 to troubleshoot the problem to the Digital to Analog Converter (service sheet 9) or the motherboard between the DAC and the A1A8 YTM Control.

If XA1A8-10 NBAND1 or XA1A8-13 BP are incorrect at any or all frequencies, use service sheets 15 and 16 to troubleshoot the problem to the A1A7 SRD Bias (service sheet 16) or the motherboard between the SRD Bias and the A1A8 YTM Control.

12. Using the voltmeter, check the following edge connector pins for the indicated logic levels.

Table 8-14. YTM Control Band Inputs

Frequency (GHz)	XA1A8-						
	8	9	11	12	14	15	16
10.0 GHz	H1	L1	H2	L2	H3	L3	H3
18.0 GHz	L1	H1	L2	H2	H3	H3	L3
	H1 >−5 L1 <−28		H2 >11 L2 <1		H3 >−13 L3 <−28		

If all of the voltages are correct, the YTM Control assembly is defective or requires adjustment. Perform "YTM Adjustment" in chapter 5. If the YTM cannot be adjusted, use service sheet 15 to troubleshoot.

If any or all of the voltages are incorrect, use service sheets 15 and 16 to isolate the problem to the A1A7 SRD Bias (service sheet 16) or the motherboard between the SRD Bias and the A1A8 YTM Control.

SRD Bias Checks (√2b)

13. Connect the voltmeter to A1A7TP2 SRD BIAS. Set the Signal Generator frequency to 3 GHz and set the RF OUTPUT switch to off.

The voltage should be −6.5 ±0.1 Vdc.

If the voltage is correct, proceed with step 14.

If the voltage is not correct, proceed with step 15 to check the inputs to the A1A7 SRD Bias assembly.

14. Set the Signal Generator frequency to 7.0 GHz. The RF OUTPUT switch must be set to the off position for this check.

    The voltmeter should indicate a voltage of −0.5 ±0.05 Vdc.

    If the voltage is correct, the SRD Bias assembly is working correctly. Proceed with "YTM Input Check", beginning with step 16.

    If the voltage is not correct, proceed with step 15 to check the inputs to the SRD Bias assembly.

15. Remove A1A7 SRD Bias assembly and replace it on a 36 pin extender card. Using a voltmeter or the built-in logic probe circuit on A2A8, check the logic levels (XA1A7 pins 8 and 9) for the following frequencies.

Table 8-15. HN1 and HN2 Inputs

Frequency (GHz)	XA1A7- 8	9
7.0 GHz	H	L
15.0 GHz	L	H

If the levels are correct, A1A7 SRD Bias assembly is defective. Go to service sheet 16 to troubleshoot.

If any logic level is incorrect, the problem is on A2A10 Register 1 assembly or on the motherboard. Go to service sheet 26 to troubleshoot.

YTM Input Check (√2c)

16. Disconnect the cable (A1W5) and high pass filter (A1FL1) between the A1AT2 isolator and A1A3 YTM assembly. Connect a 10 dB attenuator and the cable and high pass filter to the output of the isolator. Connect the power sensor to the output of the attenuator/cable/filter assembly.

17. Set the Signal Generator frequency to 2 GHz and the output level range to 0 dB. Tune the Signal Generator in 100 MHz steps from 2 to 6.2 GHz and verify that the minimum power for each frequency range listed below is above the level indicated. Note that the levels indicated do not take into account the attenuator added in the test setup. The actual power meter readings will be less than the actual level by the value of the attenuator.

    2 — 4 GHz >+18 dBm

4 — 5.5 GHz >+19 dBm
5.5 — 6.2 GHz >+20 dBm

If the level is correct, the input level to the YTM is sufficient. Reconnect the cable and high pass filter and proceed with the final output power check beginning with step 19. If the level is not sufficient, proceed with step 18.

18. Connect at least a 10 dB attenuator to the output of the RF Amplifier A1A12 and connect the power meter to the attenuator. Verify that the output level is above the levels indicated below. Note that the indicated levels do not take into account the attenuator connected between the power sensor and the output of the RF amplifier. The power meter will indicate a level that is lower than the actual level by the value of the attenuator.

    2 — 4 GHz >21 dBm
    4 — 5.5 GHz >22 dBm
    5.5 — 6.2 GHz >23 dBm

    If the output level is sufficient, check the loss in the associated cables (<.5 dB each), the isolator (<2 dB), and the high pass filter (<1 dB). If any component shows excessive loss, replace it.

    If the level is not sufficient, the amplifier is probably defective. Go to service sheet 14 to check the biasing of the Amplifier-Modulator Assembly, A1A12, before replacing it.

Final Output Power Check ($\surd$3)

This procedure checks the output of the Signal Generator for power problems due to the A1DC1 Directional Coupler, the A1AT1 Programmable Attenuator, connector and cable failures, and YTM adjustment problems.

19. Replace the YTM output cable (A1W6) and connect the power meter to the output of the Signal Generator.
20. Set the Signal Generator to 2.0 GHz at an output level of 0 dBm. Set the ALC switch to XTAL leveling.
21. Slowly tune from 2 to 6.2 GHz and observe the power meter.

    The power should be greater than +9 dBm.

    If the power is correct, proceed with step 24.

    If the power is less than +9 dBm at any baseband frequency, proceed with step 22.

22. Adjust the PEAK/NORM control on the front panel at the each low power frequency to maximize the output level. If the power can be adjusted to more than +9 dBm, the YTM requires adjustment. Perform "YTM Adjustments" in chapter 5.

    If the output power cannot be adjusted for more than +9 dBm at the lower power frequencies, verify that adjusting the PEAK/NORM control varies the voltage at A1A8TP4 —

C.S. The voltage should vary approximately 0.9 volts at a 7 GHz output frequency. If the voltage does vary proceed with step 23. Otherwise, use service sheet 15 to troubleshoot the PEAK/NORM control

23. Check the interconnecting RF cables after the YTM, directional coupler, attenuator (with 0 dB attenuation) and the output connector. Use the power meter to measure the input and output level of each of these components. There should be no more than about 1 dB of loss through these components at 3 GHz. If excessive loss (>1 dB) is found in any of these components, replace the component.

24. Slowly tune the Signal Generator from 6.1 to 18 GHz and observe the power meter. Tuning slowly minimizes the effect of YTM drift due to self-heating of the YIG sphere.

    The power should be greater than +9 dBm.

    If the power is correct, proceed with step 25 to verify the YTM adjustment.

    If there are any power holes noted, there is a problem with a connector or cable. If there are two power holes that are in different bands, the connector problem is before or at the input of the YTM. If there is a single power hole, the problem is between the output of the YTM and the output connector. Use the power meter to isolate where the problem occurs by tracing back at each connection until the power hole cannot be detected. The component previously tested should be defective.

    If the power level is low over large portions of the band, attempt to adjust the YTM using the "YTM Adjustment" procedure in chapter 5. If the YTM cannot be adjusted, replace it.

25. Set the Signal Generator to 2 GHz at +13 dBm and INT leveling. Replace the instrument covers and wait 30 minutes. This wait is required to allow the YIG sphere in the YTM to temperature stabilize.

26. Set the Signal Generator to 18 GHz and monitor the power meter.

    The output power should be at least 4.5 dBm immediately after tuning, at least +8 dBm after 30 seconds and greater than +8 dBm after 5 minutes. Verify that after 30 minutes the output level is still greater than +8 dBm. The output power should increase to a maximum value and then remain at that value as the YTM stabilizes.

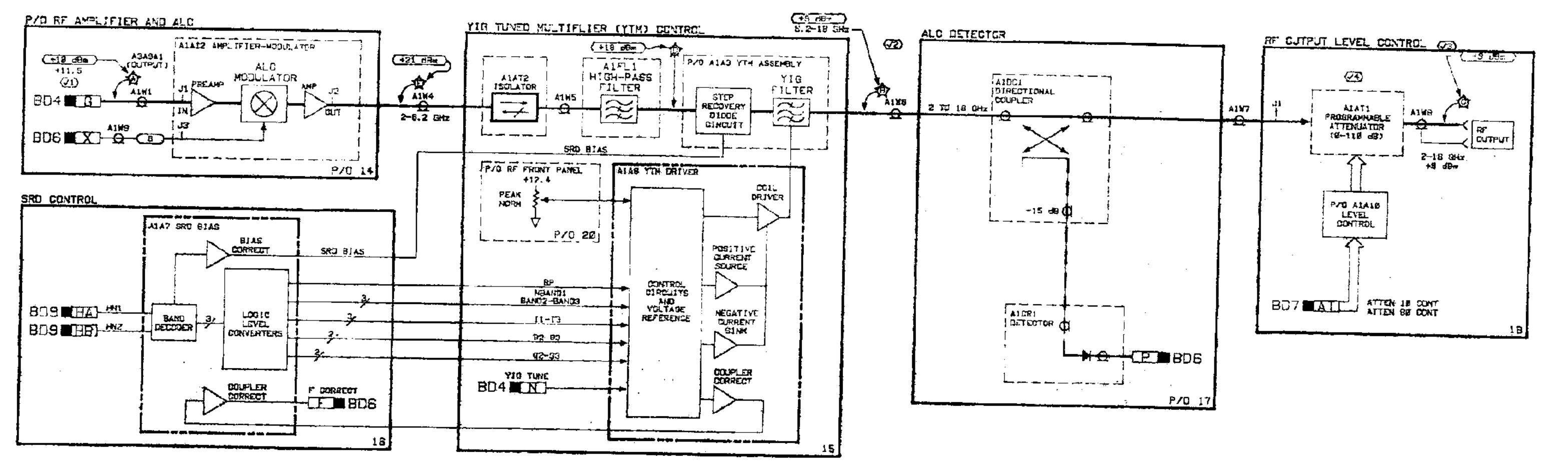
    If maximum power is reached and then stays at the maximum level, the YTM is adjusted properly.

    If maximum power is reached and then the power level decreases, the YTM requires adjustment. Perform "YTM Adjustment", in chapter 5 and then recheck the adjustment using steps 25 and 26.

Programmable Output Attenuator Check ($\surd$4)

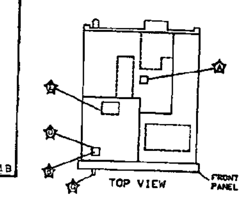
All of the checks in this procedure set the programmable attenuator for zero attenuation. Therefore, if power problems are a symptom of the failure, it is possible that the programmable attenuator is defective. To check the attenuator, perform the Output Level, High Level Accuracy and Flatness test in Section IV (Operating Manual) followed by the Low Level Accuracy test. These two tests check the attenuator's full attenuation range.

If the attenuator fails any of the tests, go to service sheet 18 for further troubleshooting information.



TROUBLESHOOTING NOTES:
FAULT INDICATION: NO OR LOW POWER:

1. MEASURE POWER AT TEST POINTS IN ORDER SHOWN UNTIL LOW POWER IS FOUND.
2. IF TP B INDICATES LOW POWER TROUBLESHOOT SERVICE SHEET 16 THEN 15.



BD5

Figure 8-24. Microwave Signal Path Block Diagram
8-115/8-116

BD5

Microwave Signal Path
Block Diagram
SERVICE SHEET

BD6 Automatic Level Control (ALC)

References

Overall Block Diagram .... Service Sheet BD1
Disassembly Procedures .... Service Sheet A
Interior Views .... Service Sheet B
Illustrated Parts Breakdown (IPB) .. Chapter 6
Post Repair Adjustments .... Chapter 5

Principles of Operation

General

The primary function of the ALC circuitry is to provide accurately calibrated output power and wideband linear AM over the Signal Generator's 2 to 18 GHz frequency range. In addition, an external ALC input makes it possible to automatically control the level at a remote load.

Internal ALC detects the level at the output of the YIG Tuned Multiplier (YTM) using a directional coupler and a crystal detector. The output of the YTM is leveled over a −10 to +13 dBm range by the ALC circuitry. Additional dynamic range is provided by a 110 dB step attenuator to achieve leveled output as low a −120 dBm.

External ALC modes use an external crystal detector or a power meter's recorder output instead of the internal crystal detector to provide the feedback signal. During external leveling, the output power of the YTM should be kept within a −10 to +3 dBm range if possible. Setting the attenuation in the signal path too high may cause an unleveled condition if the output power available from the YTM is not enough to overcome the attenuation setting and the losses in the external signal path.

Crystal leveling requires the crystal detector to be operating in the square law region (the output of the detector is proportional to the detected power in watts). Operation outside the square law region will not allow the vernier to be calibrated over the 13 dB range.

Power meter leveling is slower than crystal detector leveling but has the advantages of temperature compensation and a much wider dynamic range (limited only by the power sensor). With automatic ranging power meters, the range must be held to prevent oscillations in the output level. The oscillations occur when the Signal Generator responds to the range change (which rescales the feedback voltage) while the power meter settles. The result is that the power meter is continually trying to settle by changing ranges and the Signal Generator is responding to each range change by setting the level outside of the new range.

The ALC circuitry provides for AM in both internal and external leveling modes at 30% and 100% selectable amplitude modulation depths. Both percent selections ensure wideband AM in both leveling modes by switching A1A5C12 *out of* and A1A5R19 *into* the leveling loop.

Internal ALC

During internal ALC, the inputs to the ALC Reference Amplifier on ALC Detector Assembly A1A6 are:

F Correct
ALC Reference

The F Correct signal is used to compensate for power losses after the directional coupler. This includes power losses from the ouput port of the directional coupler, cabling, the attenuator and the output connector. These losses are frequency dependent and F Correct is adjusted for the best compromise over the entire frequency range.

In local, the ALC Reference input is the reference voltage produced by the front panel VERNIER. In remote, it is the voltage produced by the reference Digital to Analog Converter. Note that the ALC Reference is a voltage that is linearly proportional to the detected level in dB. This means an equal change in voltage indicates an equal change of detected power in dB.

The detector output is linearly proportional to the detected power in watts. To make the detector output linearly proportional to the detected power in dB to sum with the ALC Reference, the detector output is routed through a logarithmic amplifier. The detector output simultaneously passes through the Logarithmic Amplifier's high gain/low frequency operational input amplifier (A1A6U7) and low gain/high frequency differential input amplifier (A1A6Q6 through Q9). (Overlapping bandwidths ensure continuous amplification.) The Logarithmic Amplifier is adjusted at measured RF OUTPUT power of + 8 and −10 dB (to shift the higher and lower voltage ends of the Logarithmic Amplifier curve) and at −3 dB (A1A6R32) to provide a dc offset to shift the overall curve. The logarithmically amplified detector output is then amplified absolutely and summed with the ALC Reference and the F Correct signal to form the Error voltage. So that the Error voltage can be used to drive the ALC Modulator (in A1A12) to attenuate power, it is first integrated (A1A5U3) and then converted to an exponentiated current (A1A5Q2), linear in amperes.

When properly adjusted, the ALC circuitry attenuates RF output power so that the detector ouput at ALC summing junction A1A6R46 is equal to the sum of the ALC Reference and F Correct voltages. All three voltages sum algebraically to virtual zero, forming the Error voltage.

The summing junction permits the operation of the VERNIER, which controls the ALC Reference voltage in local mode. The output of the Reference Amplifier (A1A6U6) is set to zero Vdc at −3 dBm RF OUTPUT power, corresponding approximately to midway in the ALC Reference voltage range. The VERNIER produces an increasing negative or positive voltage at the summing junction as its setting rises above or below −3 dBm. The detector output voltage increases or decreases in opposition to the ALC Reference voltage as the power that the detector senses increases or decreases to keep the Error voltage zero. With the OUTPUT LEVEL RANGE set to 0 dB, the ALC Reference voltage range permits leveling from −10 to +3 dBm. (Without the the ALC Reference voltage the ALC closed loop would level power unchangeably at approximately −3 dBm.)

Overrange mode (+ 10 dB OUTPUT LEVEL RANGE) shifts the Reference Amplifier output by 1.17 Vdc, the equivalent of a 10 dB shift. The VERNIER can then level power from zero to +13 dBm.

The ALC Reference voltage is calibrated in remote by setting the Gain of the Reference DAC at −10 dBm on RF Output Level Control Assembly A1A10. Calibration of the VERNIER Reference voltage is fixed by component design.

During AM operation the AM INPUT signal passes through a log amplifier before entering the ALC summing junction. This provides linear, calibrated AM independent of RF output level and modulation depth.

External ALC

External ALC operation is essentially the same as internal ALC. However, the EXT ALC signal passes through an absolute value amplifier and log amplifier before entering the internal leveling loop. The output of the absolute value amplifier is negative regardless of the polarity of its input. This allows the use of a positive or negative external detector to get the negative input required by the external ALC circuitry.

When operating in band 1, a power clamp circuit limits the power applied to the YTM to prevent output instability (squegging). The power clamp is apparent in internal as well as external ALC because it is set to limit power to +12 dBm.

The output of the internal detector's log amp is used as stabilizing feedback for the two external leveling modes. The internally detected signal is coupled to the external ALC feedback signal to aid in suppressing transients. The degree of coupling is different for crystal detector leveling and power meter leveling due to the different reaction times of detection. The coupling is changed by switching in different values of capacitance (A1A6C16 for crystal detector leveling and A1A6C17 for power meter leveling). The same ac coupling ensures broadband AM in both external leveling modes even though the external ALC loop may not allow the higher rates.

Troubleshooting

General

It is assumed that the troubleshooting procedures associated with BD1 have been used to isolate a problem to the ALC. These procedures assume that the instrument has sufficient power (+8 dBm) over the full frequency range. The following procedures can be used to further isolate the problem to one of the following assemblies:

- ALC Assembly — Service Sheet 14
- Detector Assembly — Service Sheet 17
- Level Control Assembly — Service Sheet 18
- RF Front Panel Assembly — Service Sheet 20

Equipment

Oscilloscope	HP1980B
Digital Voltmeter	HP 3455A or HP3456A
Power Meter	HP 436A
Power Sensor	HP 8481A

Procedure

The following troubleshooting procedure is divided into the following checks:

ALC Reference Check (√1)
F CORRECT Check (√2)
Detector Assembly Check (√3)
ALC Assembly Check (√4)
External ALC Check (√5)
AM Check (√6)
Meter Checks (√7)

Troubleshooting Hints

ALC in Remote Mode. If the ALC reference level cannot be controlled in remote mode (but works normally in local mode) the problem is with the Level Control DAC, or the Local/Remote Switch on service sheet 18.

Unleveled ALC. Insufficient output power will cause the UNLVL annunciator to light. Ensure that enough power is available before troubleshooting the ALC.

ALC Reference Check (√1)

1. Connect the voltmeter to A1A10 TP4 "DAC" and turn the front panel VERNIER fully clockwise then fully counterclockwise while observing the voltmeter.

Note For remote troubleshooting, program +3 dBm vernier for the clockwise position and −10 dBm vernier for the counterclockwise position.

The voltages should be as follow:

Vernier Position	Voltage
fully counterclockwise	0.0V (typical)
fully counterclockwise	−6.5V (typical)

If the voltages are as shown, proceed with step 4.

If the voltages are not as shown, proceed with step 2.

2. Connect the voltmeter to A1A10 TP1 "−6.2."

   The voltmeter should read −6.2 ±0.05 Vdc.

   If the voltage is correct, the negative voltage reference is working. Proceed with step 3.

   If the voltage is not correct, proceed to service sheet 18 to troubleshoot the negative voltage reference.

3. Connect the voltmeter to XA1A10-6(TPD). Turn the front panel VERNIER fully clockwise and then fully counterclockwise while observing the voltmeter.

   The voltage should be 0 Vdc at the fully clockwise position and −6.2 Vdc at the fully counterclockwise position.

   If the voltage is correct, the Local/Remote switch is defective. Go to service sheet 18 to troubleshoot.

   If the voltage is not correct, the Vernier is defective or a connection is broken. Go to service sheet 18 to troubleshoot.

F CORRECT Check (√2)

4. Remove A1A6 ALC Detector assembly and replace it on a 36 pin extender board. Set the Signal Generator's ALC switch to XTAL to isolate the F Correct signal. Set the Signal Generator to each of the frequencies listed below and check the voltage at XA1A6-24 (TPA) at each frequency.

   The voltages should be as shown below:

Freq	Voltage
2.0 GHz	+0.005 ±0.005 Vdc
6.2 GHz	+0.035 ±0.01 Vdc
12.4 GHz	+0.475 ±0.05 Vdc
18.0 GHz	+0.575 ±0.05 Vdc

   If the voltages are correct, proceed with step 5.

   If the voltage is not correct, the problem may be on the A1A7 SRD Bias assembly, service sheet 16, or the A1A6 Detector assembly, service sheet 17. To isolate the two assemblies, remove the A1A6 Detector assembly and check the voltage at XA1A7-15.

Detector Assembly Check (√3)

5. Disconnect the blue cable A1A12J3(TPC). This opens the ALC loop and prevents the ALC Modulator from attenuating power by removing its drive current.
6. Set the Signal Generator to 7 GHz, the OUTPUT LEVEL RANGE to 0 dB, the VERNIER fully clockwise, the ALC switch to XTAL, and the RF OUTPUT switch to ON. Note that these settings remove all attenuation from the microwave chain by disabling the power clamp (which works only in the 1st band) and setting the Programmable Attenuator to zero dB. Further, the VERNIER is set to a known position.
7. Connect a power meter to the Signal Generator's RF OUTPUT.
8. While observing the power meter display, adjust the PEAK/NORM control on the front panel of the Signal Generator. The power meter should indicate that the output level varies (approximately 2 to 3 dB) as the control is adjusted.

   If the PEAK/NORM control varies the output power, proceed with step 9.

   If the PEAK/NORM control does not vary the output power, go to step 10.

   If the power at RF OUTPUT measures less than +8 dBm, return to BD5 to troubleshoot the microwave chain.
9. Attach the DVM test probe to A1A6U7-3 (TPB) and, while observing the DVM display, adjust the PEAK/NORM control. The voltage should follow the variations displayed by the power meter as the PEAK/NORM control is adjusted. The voltage should be 0.16 ±0.05 Vdc at an output level of +13 dBm.

   If the voltage follows the variations displayed on the power meter, proceed with step 11.

   If the voltage does not follow the variations displayed on the power meter, the Detector or Detector Cable A1A6W1 is defective. To determine which, repeat the same check at the center conductor pin of the Detector output. Refer to service sheet 17 if necessary.
10. Set the OUTPUT LEVEL RANGE switch to −10 dB. Verify that the power reading drops 10 dB. (If the power does not drop 10 dB, return to BD5 to troubleshoot the microwave chain.) Disconnect the power meter and connect an APC-3.5 (female) to N (male) connector (1205-1744) to RF OUTPUT. Disconnect Detector A1CR1 from the Directional Coupler and connect it to the APC-3.5(f) to N(m) connector. Then using a short BNC to BNC cable, two SMC(f) to BNC(f) connectors (1205-0832) and

an SMC barrel, connect the Detector output to A1A6W1. Attach the DVM test probe to A1A6U7-3 (TPB) and, while observing the DVM display, rotate the OUTPUT LEVEL RANGE switch from −10 to −20 dB. Verify that the reading is approximately 500 ±100 mV at −10 dB and decreases by approximately 350 mV at −20 dB.

If the voltage is correct, the Detector is working. Reconnect the Detector to the Directional Coupler and Detector Cable A1A6W1 and go to step 11.

If the voltage is incorrect, the Detector or Detector cable is defective. To determine which, repeat the check at the center conductor pin of the Detector output. Refer to service sheet 17 if necessary.

11. Connect the DVM to A1A6TP3. Set the Signal Generator's AM switch and FM DEVIATION MHz switch to OFF. Set the ALC switch to INT to couple the Log Amplifier output to the Buffer Amplifier. Vary the PEAK/NORM control while observing the DVM and the power meter displays. The voltage should vary with the level displayed on the power meter (40 mV/dB). The voltage for a +13 dBm output should be +0.5 ±0.1 Vdc.

    If the voltage is correct, the detected level is entering the summing junction. Proceed with step 12.

    If the voltage is not correct, there is a problem with the Log Amplifier, Internal/External switch or Buffer Amplifier. Go to service sheet 17 to troubleshoot.

12. Set the OUTPUT LEVEL RANGE switch to 0 dB. Connect the DVM to A1A6TP2. This test point is the sum of the ALC Reference voltage, the F Correct signal and, when in +10 dB OUTPUT LEVEL RANGE, the attenuation due to the overrange circuitry. The DVM should indicate −0.7 ±0.05 Vdc.

    If the voltage is correct, proceed with step 13.

    If the voltage is incorrect, the Internal ALC/Overrange selector or ALC Reference Amplifier is defective. Proceed to service sheet 17 to troubleshoot.

13. Set the OUTPUT LEVEL RANGE to +10 dB. The DVM should read −1.9 ±0.1 Vdc.

    If the voltage is correct, proceed with step 14.

    If the voltage is not correct, the Internal ALC/Overrange switch or one of the inputs to the switch is defective. Proceed to service sheet 17 to troubleshoot.

14. Set the ALC switch to XTAL (crystal detector leveling mode). The voltage should be −1.4 ±0.1 Vdc.

    If the voltage is correct, proceed with step 15.

If the voltage is not correct, the Internal ALC/Overrange switch or one of the inputs to the switch is defective. Proceed to service sheet 17 to troubleshoot.

15. Connect the oscilloscope to A1A6TP7 and select 100 MHz tuning resolution on the Signal Generator. Set the oscilloscope for 20 millisecond sweep time. Quickly tune the Signal Generator from 2 to 18 GHz while observing the oscilloscope. The oscilloscope display should indicate narrow (4 ms) negative going pulses as the tune knob is turned.

    If the pulses are present, the ALC holdoff circuitry is working normally. Proceed with step 16.

    If the pulses are not present, troubleshoot the ALC holdoff circuitry using service sheet 18.

ALC Assembly Check (√4)

Initial conditions:

Blue cable disconnected from A1A12J3 of RF Amplifier Assembly. AM switch OFF.

16. Connect the DVM to A1A5TP1. This test point represents the Error voltage from ALC Detector Assembly A1A6. Remove ALC Detector Assembly A1A6 from the instrument to isolate the effects of the Error voltage from the AM circuitry on the Signal Generator's ALC Assembly A1A5. The voltage should be 0 ±0.025 Vdc.

    If the voltage is correct, the AM circuitry is turned OFF. Proceed with step 17.

    If the voltage is incorrect, the AM circuitry is interfering with the ALC circuitry. Use service sheet 14.

17. Replace ALC Detector Assembly A1A6. Set the Signal Generator to 7 GHz, the OUTPUT LEVEL RANGE to 0 dB, the VERNIER fully clockwise, and the ALC switch to INT. Set the RF OUTPUT switch to OFF to eliminate the effects of the feedback signal. The voltage should be 0.4 ±0.2 Vdc.

    If the voltage is correct, proceed with step 18.

    If the voltage is not correct, the signal from ALC Detector Assembly A1A6 is not correct. Use service sheets 14 and 17 to isolate the problem to ALC Detector Assembly A1A6 or ALC Assembly A1A5.

18. Connect the DVM to A1A5TP6. This test point represents the modulator drive signal. Set the RF OUTPUT switch to ON. Keep the ALC switch set to INT. The voltage should be greater than +5 Vdc.

    If the voltage is correct, proceed with step 19.

If the voltage is not correct, use service sheet 14 to troubleshoot the Error Amplifier and Modulator Driver.

19. Set the ALC switch to XTAL. Switching from INT to XTAL mode has the effect of changing the Error voltage from positive (too much power) to negative (too little power) because there is no feedback signal at the EXT ALC input. The voltage should be less than −4 Vdc.

    If the voltage is correct, proceed with step 20.

    If the voltage is not correct, use service sheet 14 to troubleshoot the Error Amplifier and the Modulator Driver.

20. Reconnect the blue modulator drive cable to A1A12J3(TPC). Set the ALC switch to XTAL. The voltage should be less than −4 Vdc.

    If the voltage is correct, proceed with step 21.

    If the voltage is incorrect, the Modulator or blue modulator drive cable is defective. Use service sheet 14 to troubleshoot.

21. Set the ALC switch to INT and the RF OUTPUT switch to OFF. This should turn on the Modulator to reduce the output level. The voltage should be greater than +1 Vdc.

    If the voltage is correct, proceed with step 22.

    If the voltage is not correct, use service sheet 14 to troubleshoot the Modulator Drive circuitry.

22. If the preceding checks are correct, but the Signal Generator still does not level, use service sheet 14 to troubleshoot the ALC Assembly. When the Signal Generator is leveled, A1A5TP1 should be 0 ±0.05 Vdc.

    If the output is leveled (as indicated by the power meter) but the UNLVL annunciator is lighted, troubleshoot the Unleveled Detector using service sheet 14.

External ALC Check (√5)

If the Signal Generator is operating normally in internal ALC mode but will not level in external ALC mode, the problem is limited to the front panel connector and cable, or the external ALC circuitry on the ALC Detector Assembly. Use service sheet 14 to troubleshoot.

Use service sheet 17 to troubleshoot the external ALC input. A1A6TP6 can be used to monitor the feedback signal after the external ALC input amplifier.

AM Check (√6)

If the Signal Generator is leveling power correctly, go to service sheet 14 to troubleshoot AM malfunctions. Otherwise perform the checks on this service sheet.

Meter Checks (√7)

Condition:

The Signal Generator levels power accurately.

The following checks use a second meter driver to isolate the cause of a meter malfunction to either the meter driver or the meter. If a second meter driver causes the meter to respond correctly, the first meter driver is unquestionably defective. If a second meter driver does not cause the meter to respond correctly, the meter itself is defective. The AM meter driver is least affected by other circuitry and is, therefore, an excellent second check for FM and Level meter malfunctions.

AM Meter Check.

Note

Use this procedure as a second check for a Level meter or FM meter malfunction only.

23. Set the Signal Generator to 2 GHz, the METER MODE switch to AM, the ALC switch to INT and the RANGE switch to 0 dB. Connect a BNC TEE to the Signal Generator's AM INPUT and the test oscillator (50 ohm output) and DVM to the BNC TEE.

    Set the test oscillator output to 10 kHz and 0.707 Vrms. Verify that the Signal Generator's meter reading is full scale.

    If the meter needle moves very little or not at all, jumps or hangs at a certain level, the meter is defective. Go to service sheet 20.

    If the meter indication is correct, the first meter driver, FM or Level, is defective. Go to service sheet 14 or 21, whichever applies.

Level Meter Check.

Note

Use this procedure as a second check for an AM meter malfunction only.

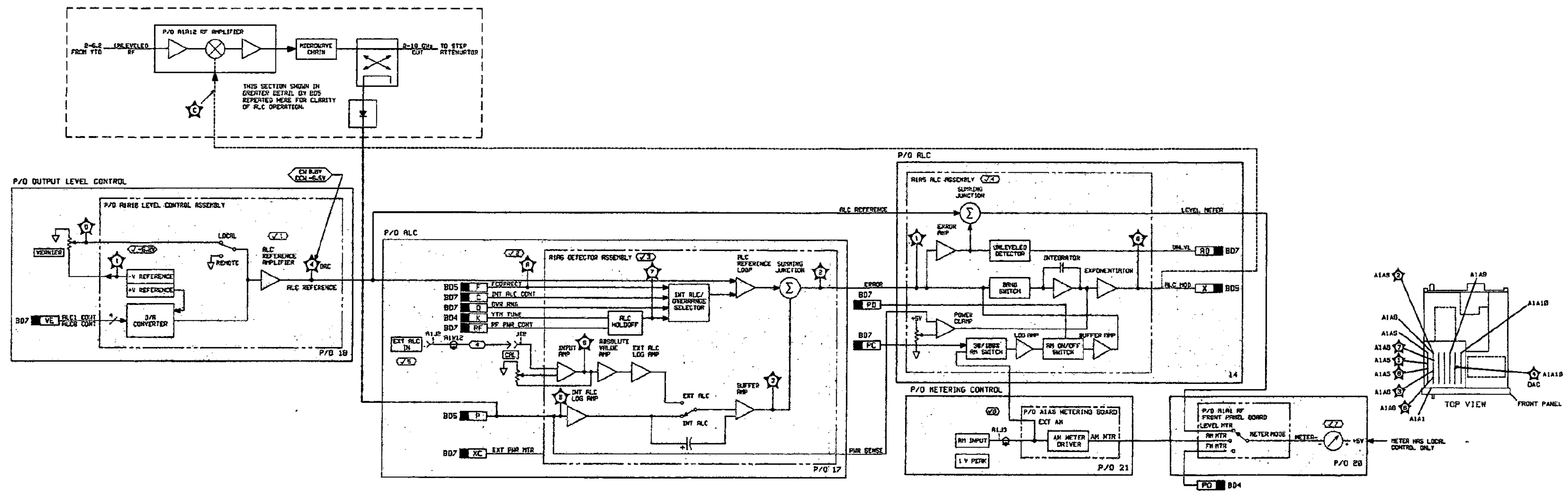
24. Set the Signal Generator to 2 GHz, the METER MODE switch to LEVEL, the ALC switch to INT, and the RANGE switch to 0 dB. Starting from a fully clockwise position, slowly turn the VERNIER fully counterclockwise. Verify that the Signal Generator's meter gradually indicates +3 dBm to − 10 dBm ±1.5 dB. *The UNLVL annunciator should remain off.*

If the Meter indication is correct, the AM Meter Driver is defective. Go to service sheet 21.

If the meter needle moves slightly or not at all, reverses direction or jumps, the meter is defective. Go to service sheet 20.

BD6

Automatic Level Control (ALC)
Block Diagram
SERVICE SHEET



BD6

Figure 8-25. ALC Block Diagram
8-129/8-130

BD7 DCU Remote/Local Interface

References

Principles of Operation

General

The Digital Control Unit (DCU) is divided into three sections:

- DCU Remote/Local Interface
- DCU HP-IB Interface
- DCU Frequency Control

DCU Remote/Local Interface. The DCU processes inputs from the front panel in local mode and from the HP-IB in remote mode. In local mode, the operator enters data with the front panel switches and the TUNING knob. The TUNING knob is a Rotary Pulse Generator (RPG), which provides continuous control of frequency tuning. Selectable tuning resolution coupled with the RPG provides convenient control of setting frequency.

Remote mode uses a combination of special ASCII program codes and arguments to simulate the front panel controls. The HP-IB Address assembly is used to decode the information on the HP-IB and generate control signals for managing the input data. The HP-IB Interface assembly is used to decode the program codes and arguments so the DCU Frequency Control subsystem can alter the frequency setting of the instrument.

DCU Frequency Control. The DCU produces tuning information and frequency band related information based on the current front panel frequency. Tuning information comes from the DCU Remote/Local Interface as tuning and resolution for local mode, or actual frequency information for remote mode.

Each frequency change requires a cycling of the frequency data through three registers. Register 1 holds the front panel frequency, rounds the desired frequency according to the frequency resolution and decodes the appropriate frequency band. Register 2 divides the Register 1 frequency by 1,2 or 3 to produce a baseband frequency and indicates whether the frequency is evenly divisible. Register 3 generates the tuning information for the phase locked loops to generate the appropiate baseband frequency.

The baseband (band 1) and the multiplied band frequencies are:

Band 1: 2–6.2 GHz
Band 2: 6.2–12.4 GHz
Band 3: 12.4–18 GHz

Remote operation loads frequency data directly into the first register to be processed by registers 2 and 3. Local control indicates tuning direction and resolution for incrementing or decrementing the Register 1 frequency.

DCU Remote/Local Interface

The DCU Remote/Local Interface consists of five assemblies:

HP-IB Address
RF Front Panel
DCU Front Panel
Digital Processor
P/O HP-IB Interface

The DCU Remote/Local Interface is made up of the RF Front Panel, DCU Front Panel, Digital Processor and part of the HP-IB interface assembly. The DCU HP-IB Interface is made up of the HP-IB Address and part of the HP-IB interface assembly. The DCU Remote/Local Interface is discussed below.

RF Front Panel. The RF Front Panel contains the controls for controlling the level and modulation of the output signal. The controls on the RF Front Panel are:

Peak/Norm control (see BD5)
RF Output On/Off switch
Output Level Range Selector
Output Level Vernier (see BD6)
ALC Selector
External ALC Input and CAL Control (see BD6)
AM Function Switch
AM Input (see BD6)
FM Deviation MHz switch
FM Input (see BD4)

The data from the various switches and selectors is routed to the Digital Processor assembly or the related circuitry.

The RF Front Panel displays include the RANGE dB display, the meter and the ALC FM, AM and RF output status annunciators. The RANGE dB display indicates the range selected by the range selector in local mode or the programmed range in remote mode. All status annunciators but one, UNLVL, also indicate the front panel settings when in local mode and the programmed settings when in remote mode. The UNLVL status annunciator alone represents neither a remote nor local setting. It is controlled by the ALC level sensing circuitry and automatically signals the user when the RF output is no longer calibrated.

DCU Front Panel. The DCU Front Panel assembly displays frequency related information and instrument status. The frequency tuning controls and the line switch are also located on the DCU Front Panel assembly.

Digital Processor. The Digital Processor assembly selects the information from the HP-IB Interface assembly in remote mode or the RF Front Panel controls in local mode. The Digital Processor latches the remote data when programmed and also latches the local data during the local to remote transition to prevent the front panel settings from changing. The vernier level will change due to the change from a variable voltage source to a DAC.

The range data from the output level range selector is encoded to match the data format of the remote programmed data. The local or remote data (depending on the instrument mode) is then decoded for the RANGE dB display. If the range data is not within the instrument's range, the decoder will light the UNLVL annunciator on the front panel. As with the other front panel controls, the local range data is latched on the local to remote transition to avoid resetting the attenuator.

P/O HP-IB Interface. The HP-IB Interface contains the phase lock indicators for the four phase locked loops. The indicators are used to indicate which phase locked loop is not locked. In addition, a reset circuit for the YTO Summing Phase Locked Loop is included on this assembly to reset the loop if it is unlocked or if the YTO is slewing excessively.

Troubleshooting

General

It is assumed that the troubleshooting information associated with Service Sheet BD1 was used to isolate the problem to the DCU Remote/Local Interface or there is a problem involving only one mode (local or remote) but not the other. The following troubleshooting procedures can be used to further isolate the problem to one of the following subassemblies:

- RF Front Panel Assembly — Service Sheet 20
- DCU Front Panel Assembly — Service Sheet 31, 32
- Digital Processor Assembly — Service Sheet 19

Equipment

Digital Voltmeter	HP 3455A or HP 3456A
Controller	HP 85B or HP 9826/36A

Note

The Signal Generator has a built-in logic probe on the A2A8 Output Register Assembly. To use the probe, connect a clip lead to A2A8TP2. The other end of the clip lead can then be used to probe logic levels and can also be used for checking for pulse activity. The indicator near the test point will light for a logic high, extinguish for a logic low and will pulse if repetitive pulses are present. If the logic probe is used, the voltmeter is not required.

Procedures

The following procedures are divided into three checks, as follow:

Local Digital Processor Assembly Checks (√1)
Remote Digital Processor Assembly Checks (√2)
Frequency Controls Check (√3)

Local Digital Processor Assembly Checks (√1)

1. Set the Signal Generator to the following conditions:

RF OUTPUT	On
RANGE Control	Fully counterclockwise
VERNIER	Fully counterclockwise
ALC	set to INT
Frequency	3000.000 MHz

2. Set the RANGE selector to each position shown below and check for the corresponding logic level at each test point shown. Position 1 of the RANGE selector corresponds to the selector being fully counterclockwise and position 13 corresponds to the fully clockwise position.

RANGE Selector Position	RANGE dB Display	XA1A11TP-				
		80	40	20	10	OVR RNG
2	−100	1	0	1	0	0
7	−50	0	1	0	1	0
13	−10	0	0	0	0	1

   If all of the logic levels are correct, proceed with step 3.

   If either the logic levels or the RANGE dB display are incorrect, go to Step 9 and use table 8-20 to isolate the defective assembly to either service sheet 19 or 20.

3. Set the RF output switch to OFF. Verify that the RF ON annunciator extinguishes and the RF OFF anunciator lights.

   If the indication is correct, proceed with step 4

   If the indication is not correct, go to step 9 and use table 8-17 to isolate the defective assembly to either service sheet 19 or 20.

4. Set the ALC selector to INT, XTAL and PWR MTR and verify that corresponding ALC status annunciators illuminate.

   If the indications are correct, continue with step 5.

   If the indications are not correct, go to step 9 and use table 8-16 to isolate the defective assembly to either service sheet 19 or 20.

5. Set the FM DEVIATION MHz switch successively to 0.03, .1, .3, 1, 3, 10. Verify that the FM status annunciator corresponding to each setting illuminates and that all others are extinguished.

Return the FM DEVIATION MHz switch to OFF and verify that all FM status annunciators are extinguished. *The FM OVER MOD LED should not come on at any time during this test.*

If the indications are correct, continue with step 8.

If the FM OVER MOD LED comes on and all other indications are correct, go to step 6.

If any indication (excluding FM OVER MOD) is incorrect, go to step 9 and use table 8-19 to isolate the defective assembly to one of service sheets 19, 20 or 21.

6. Place Metering Assembly A1A9 on an extender board. Using a DVM, measure the voltage at pin 17 as the FM DEVIATION MHz switch is moved successively through the following settings: OFF, 0.03, 0.1, 0.3, 1, 3, 10. The DVM reading should be +0.1 Vdc for OFF and +4.4 Vdc for the remaining settings.

   If the voltages are correct, go to step 9 and use table 8-19 to isolate the defective assembly to one of service sheets 19, 20 or 21.

   If the voltages are not correct, go to step 7.

7. Turn off the Signal Generator. Block off edge connector pin 17 on Assembly A1A9 with static free material. (Be careful to block off pin 17 only.) Place A1A9 back in the RF Output Assembly on the extender board. Turn the Signal Generator on and verify that the FM OVER MOD LED does not illuminate as the FM DEVIATION MHz switch is moved through all of its settings and back to OFF. Verify also that the voltage readings at pin 17 are as stated in step 6.

   If the indications are correct, the FM ON/OFF CONT line was held low by the YTO Phase Detector Assembly. Remove the static free material from pin 17 and go to service sheet 12, "FM Procedure", step 4.

   If the indications are not correct, go to step 9 and use table 8-19 to isolate the defective assembly to one of services sheets 19, 20 or 21.

8. Set the AM function switch to 30% and then to 100%. Verify that the 30% and 100% annunciators light and extinguish correspondingly. Return the AM function switch to OFF. Verify that both AM annunciators are extinguished.

   If the indications are correct, continue with step 10.

   If the indications are not correct, use table 8-18 to isolate the defective assembly to service sheet 19 or 20.

Service Sheet 20 Input/Output Tables

9. On RF Front Panel Assembly Schematic Diagram (service sheet 20), figure 8-96, all front panel controls create outputs that exit from the right of the assembly, pass through the Digital Processor Assembly on service sheet 19 and, except for FM signals, return directly to the left of the assembly on service sheet 20 as inputs to activate corresponding RF front panel displays. FM output signals pass first through the Digital Processor Assembly and then through the Metering Assembly on service sheets 19 and 21 respectively before returning as decoded inputs to service sheet 20.

   When an RF front panel control fails to produce a corresponding RF front panel display, use tables 8-16 through 8-20 to isolate the cause of the malfunction to one of service sheets 19, 20 or 21.

Table 8-16. Service Sheet 20 Input/Output Table: ALC S1

ALC Switch Settings	ALC S1 Output Lines		Corresponding Input Lines	
	XA1A11A		XA1A11B	
	8	7	27	28
	LOC INT ALC	LOC EXT PWR MTR	INT ALC CONT	EXT PWR MTR CONT
INT	H	L	H	L
XTAL	L	L	L	L
PWR MTR	L	H	L	H

Table 8-17. Service Sheet 20 Input/Output Table: RF On/Off S2

RF OUTPUT On/Off Switch Settings	RF S2 Output Line	Corresponding Input Line
	XA1A11A	XA1A11B
	9	35
	LOC RF PWR	RF PWR CONT
OFF	L	L
ON	H	H

Table 8-18.
Service Sheet 20 Input/Output Table: AM S3

AM Switch Settings	AM S3 Output Lines		Corresponding Input Lines	
	XA1A11A		XA1A11B	
	3	2	30	29
	LOC AM ON/OFF	LOC AM ATTN 10	AM ON/OFF CONT	AM ATTEN 10 CONT
OFF	H	L	L	L
30%	L	H	H	H
100%	H	L	H	L

Table 8-19. Service Sheet 20 Input/Output Table: FM S4

FM DEVIATION MHz Switch Settings	FM S4 Output Lines			Corresponding Input Lines							
	XA1A11A			XA1A11B							
	6	5	4	17	16	34	33	32	31	30	29
	LOC FM ATTN 10	LOC FM ATTN 20	LOC FM ATTN 40	FM * ON/OFF CONT	FM * ON	FM 0.03	FM 0.1	FM 0.3	FM 1	FM 3	FM 10
OFF	H	H	H	L	L	L	L	L	L	L	L
0.03	H	L	H	H	L	H	L	L	L	L	L
0.1	L	L	H	H	L	L	H	L	L	L	L
0.3	H	H	L	H	L	L	L	H	L	L	L
1	L	H	L	H	L	L	L	L	H	L	L
3	H	L	L	H	L	L	L	L	L	H	L
10	L	L	L	H	L	L	L	L	L	L	H

* Logical states with no signal at FM INPUT. With a signal at FM INPUT, FM overmodulation may occur, which will cause pin 16 to be held high by either pin 17 or the FM Meter Driver. (*Pin 17 is a bidirectional control line and is not a direct input to A1A1 [service sheet 20]. An excessive FM modulation index will cause the Overmodulation Detector on A3A9A4 to hold pin 17 low and, thereby, pin 16 high.)*

Table 8-20.
Service Sheet 20 Input/Output Table:
OUTPUT LEVEL RANGE — Switch 5

Switch Settings	S5 Output Lines XA1A11A Pin Nos.							Input Lines XA1A11A Pin Nos.						
	10 R0	11 R1	12 R2	13 R3	14 R4	15 R5	16 R6	36 LED 10	35 LED 20	34 LED 40	33 LED 80	32 LED 100	18 HB	17 VB
+10	L	L	L	L	L	L	L	H	L	L	L	L	H	H
+0	H	L	L	L	L	L	L	L	L	L	L	L	H	H
−10	H	L	L	L	L	L	H	H	L	L	L	L	H	L
−20	L	H	L	L	L	L	H	L	H	L	L	L	H	L
−30	L	H	L	L	L	L	L	H	H	L	L	L	H	L
−40	L	L	H	L	L	L	L	L	L	H	L	L	H	L
−50	L	L	H	L	L	L	H	H	L	H	L	L	H	L
−60	L	L	L	H	L	L	H	L	H	H	L	L	H	L
−70	L	L	L	H	L	L	L	H	H	H	L	L	H	L
−80	L	L	L	L	H	L	L	L	L	L	H	L	H	L
−90	L	L	L	L	H	L	H	H	L	L	H	L	H	L
−100	L	L	L	L	L	H	H	L	L	L	L	H	H	L
−110	L	L	L	L	L	H	L	H	L	L	L	H	H	L

If the outputs from service sheet 20 are not correct or if both the outputs *from* and the inputs *to* service sheet 20 are correct, the cause of the malfunction is on service sheet 20. Otherwise the cause of the malfunction is on the assembly through which the output signal passes, service sheet 19, or in the case of FM signals, service sheets 19 or 21.

Access service sheet 20 inputs and outputs at their corresponding input and output edge connector pins on either service sheet 19 or 21.

Remote Digital Processor Assembly Checks (√2)

10. Set the Signal Generator to the following conditions using the front panel controls.

RF OUTPUT	On
VERNIER	Fully counter-clockwise
ALC	Set to INT
Frequency	3000.000 MHz

11. Connect the controller to the Signal Generator. Set the Signal Generator to remote mode with the command:

```
REMOTE 719
```

Verify that the REMOTE annunciator in the STATUS block lights. The front panel annunciators should now indicate:

RF OUTPUT	ON
RANGE	−110 dB
LEVEL METER	<−10 dBm
ALC	INT
Frequency	3000.000 MHz

If all indications are correct, proceed with step 12.

If the REMOTE annunciator does not light, check the HP-IB cable and verify that the Signal Generator is set to the correct HP-IB address. If the problem cannot be corrected, go to BD8 to check the DCU HP-IB Interface assembly.

If the REMOTE annunciator does light, but the front panel annunciators have changed, use service sheet 19 to troubleshoot the appropriate Local/Remote Selector. The local data should be latched at the Local/Remote Selector on the local to remote transition.

12. Enter the following program into the controller and then execute the program:

```
10    OUTPUT 719;"L3K003"
20    WAIT 1
30    FOR I=0 TO 9
40    OUTPUT 719;"K";I
50    WAIT 1
60    NEXT I
70    OUTPUT 719;"K:"
80    WAIT 1
90    OUTPUT 719;"K;"
100    WAIT 1
110    OUTPUT 719;"K<"
120    WAIT 1
130    OUTPUT 719;"K="
140    WAIT 1
150    OUTPUT 719;"K>"
160    WAIT 1
170    OUTPUT 719;"K?0"
180    END
```

The RANGE dB display should indicate +10 dB through −140 dB in 10 dB steps. The UNLVL annunciator should light for indications −120 dB through −140 dB. At −140 dB, connect the DVM to A1A11TP OVR RNG. The DVM should show a logic high.

If the indications are correct, proceed to step 13.

If any indication is incorrect, go to BD8 to troubleshoot the HP-IB Interface.

13. Enter the following program into the controller and then execute the program:

```
10  FOR I=1 TO 13
20  OUTPUT 719;"O"&CHR$(I+47)
30  WAIT 1
40  NEXT I
50  GOTO 10
60  END
```

The RANGE dB display should alternate between 0 and +10 dB; the ALC annunciators should repeat the sequence INT, XTAL, INT, PMTR; and the RF annunciators should alternate between ON and OFF. Although the ϕ UNLOCKED and UNLVL annunciators are directly unprogrammable, the ϕ UNLOCKED annunciator should extinguish when the RF annunciator is ON and light when the RF annunciator is OFF. The UNLVL annunciator should light when RF is OFF and ALC is in XTAL or PMTR.

This check tests overrange, the three ALC modes, and RF ON and OFF to see if they can be remotely programmed. The 10 dB alternation in the RANGE dB display is due to selecting overrange. The ALC annunciators indicate the changing ALC programming code argument. The alternation of the RF ON and OFF annunciators is due to the RF output being part of the ALC programming code.

If the indications are correct, proceed with step 14.

If any indication is incorrect, go to BD8 to troubleshoot the DCU HP-IB Interface.

14. Enter the following program into the controller and then execute the program:

```
10  FOR I=0 TO 6
20  OUTPUT 719;"N";6--I
30  WAIT 1.5
40  NEXT I
50  OUTPUT 719;"N";I
60  END
```

The FM status annunciators should illuminate for 1.5 seconds and then extinguish in the following order: 0.03, 0.1, 0.3, 1, 3, 10.

If the indications are correct, go to step 15.

If the indications are not correct, go to BD8 to troubleshoot the DCU HP-IB Interface.

15. Enter the following program into the controller and then execute the program:

```
10  FOR I=3 TO 1 STEP --1
20  OUTPUT 719;"M";I
30  WAIT 1.5
40  NEXT I
50  OUTPUT 719;"M";I
60  END
```

The AM status annunciators should illuminate for 1.5 seconds and then extinguish in the following order: 30%, 100%.

If the indications are correct, go to step 16.

If the indications are not correct, go to BD8 to troubleshoot the DCU HP-IB Interface.

Frequency Controls Check (√3)

16. Place the Signal Generator in local mode by setting the line switch to off and then on. Press the PRESET (3 GHz) key and verify that the FREQUENCY MHz display indicates 3000.000 MHz.

17. Press each of the keys under the FREQUENCY RESOLUTION display. Each key should light the corresponding light bar above the key and all bars to the left of the key.

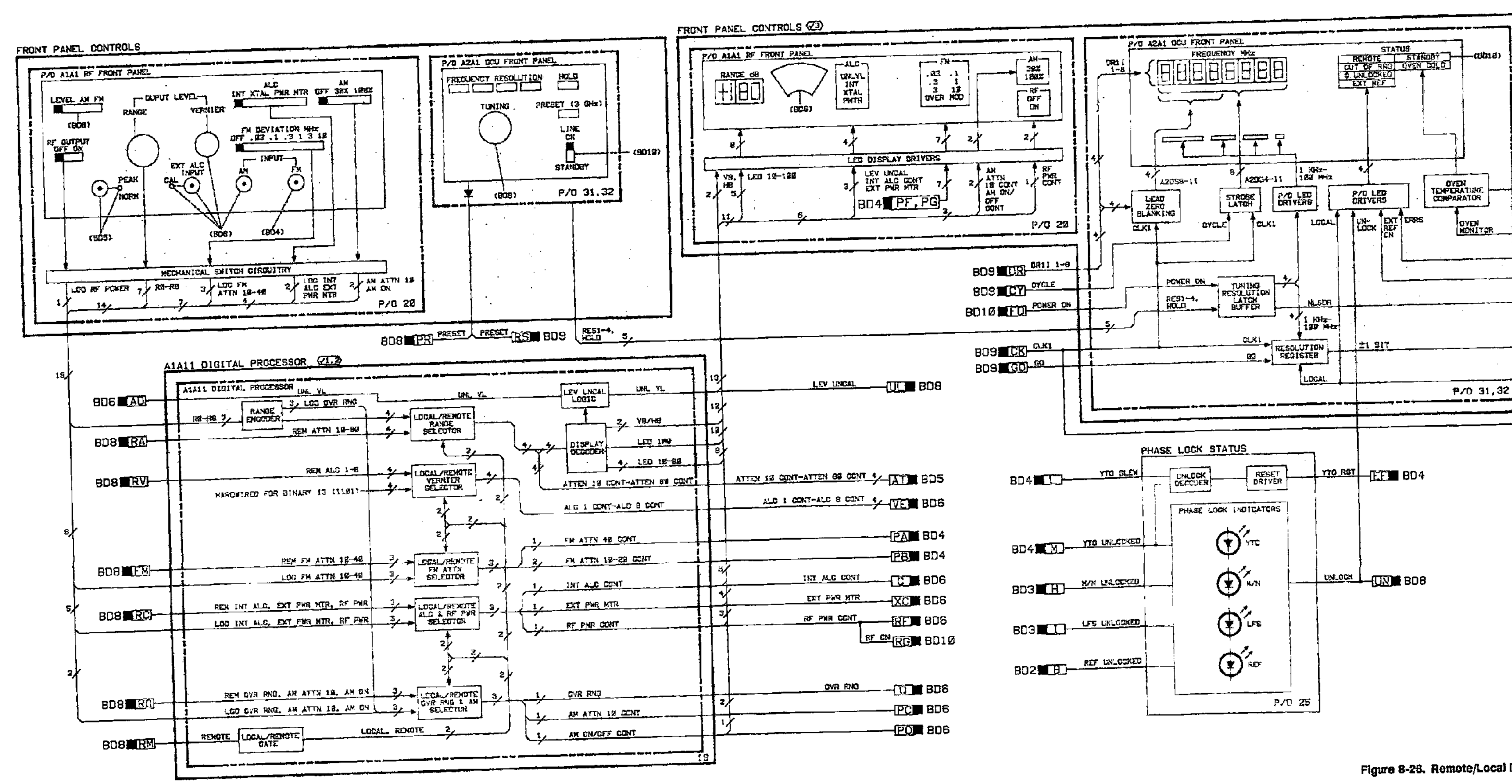
    If the indication is correct, proceed with step 18.

    If any or all keys do not work, use service sheet 32 to troubleshoot the Frequency Resolution Selector, Frequency Resolution Latch and Frequency Resolution Indicators.

18. Press the HOLD key and verify that all Frequency Resolution indicators (light bars) are extinguished.

BD7

Remote/Local Interface
Block Diagram
SERVICE SHEET



BD7

Figure 8-26. Remote/Local Interface Block Diagram
8-143/8-144

BD8 DCU HP-IB Interface

References

Overall Block Diagram	Service Sheet BD1
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5

Principles of Operation

General

The Digital Control Unit (DCU) is divided into three sections:

- DCU Remote/Local Interface
- DCU HP-IB Interface
- DCU Frequency Control

DCU Remote/Local Interface. The DCU processes inputs from the front panel in local mode and the HP-IB in remote mode. In local mode, the operator enters data with the front panel switches and the TUNING knob. The TUNING knob is a Rotary Pulse Generator (RPG) which provides continuous control of frequency tuning. Selectable tuning resolution coupled with the RPG provides convenient control of setting frequency.

DCU HP-IB Interface. Remote mode uses a combination of special ASCII program codes and arguments to simulate the front panel controls. The HP-IB Address assembly is used to decode the information on the HP input data. The HP-IB Interface assembly is used to decode the program codes and arguments so the DCU Frequency Control subsystem can alter the frequency setting of the instrument.

DCU Frequency Control. The DCU produces tuning information and frequency band related information based on the current front panel frequency. Tuning information comes from the DCU Remote/Local Interface as tuning and resolution for local mode, or actual frequency informatiion for remote mode.

Each frequency change requires a cycling of the frequency data through three registers. Register 1 holds the front panel frequency, rounds the desired frequency according to the frequency resolution and decodes the appropriate frequency band. Register 2 divides the Register 1 frequency by 1, 2 or 3 to produce a baseband frequency and indicates whether the frequency is evenly divisible. Register 3 generates the tuning information for the phase locked loops to generate the appropriate baseband frequency.

The baseband (band 1) and the multiplied band frequencies are:

Band 1: 2–6.2 GHz
Band 2: 6.2–12.4 GHz
Band 3: 12.4–18 GHz.

Remote operation loads frequency data directly into the first register to be processed by registers 2 and 3. Local control indicates tuning direction and resolution for incrementing or decrementing the Register 1 frequency.

DCU HP-IB Interface

The DCU HP-IB Interface consists of two assemblies:

- HP-IB Address
- P/O HP-IB Interface

The Remote/Local Interface is made up of the RF Front Panel, DCU Front Panel, Digital Processor and part of the HP-IB Interface assembly. The DCU HP-IB Interface is made up of the HP-IB Address and part of the HP-IB Interface assembly. The DCU HP-IB Interface is discussed below.

HP-IB Address. The HP-IB Address assembly receives characters from the HP-IB data lines under control of 3 handshake lines. The five HP-IB control lines are decoded to determine whether the character received is an HP-IB address, bus command or a data character. If the character is an address and the address matches the Signal Generator's talk or listen address, the Signal Generator will switch to talk or listen mode.

If the character received is a command (e.g. the serial poll bus command) the Signal Generator will decode the command and perform the required function. Table 3-3 lists all of the bus commands that the Signal Generator can process.

If the character received is a data character and the Signal Generator has been addressed to listen, the HP-IB Address assembly will instruct the HP-IB Interface assembly to determine whether the data character is a programming code or an argument and to process the data appropriately.

P/O HP-IB Interface. The HP-IB Interface assembly decodes the data from the HP-IB Address assembly into programming codes and arguments. Each programming code corresponds to an address within the Signal Generator that holds the data for a specific function.

The program string (data input) is processed in a left to right sequence. The first character of the program string must be a program code so that the first argument will be placed in the correct data latch. As each new argument is received, the address set by the first program code is incremented. This allows the first programming code to be specified and the remaining program codes to be left out to produce an abbreviated program string (see Section III). Specifying another programming code within the program string will reset the internal address and the remaining arguments will again be placed at successive addresses.

The HP-IB Interface assembly will recognize programming codes for AM and FM modulation.

Troubleshooting

General

It is assumed that the troubleshooting information associated with Service Sheet BD1 was used to isolate the problem to the DCU Remote/Local Interface or there is a problem involving only one mode (local or remote) but not the other. The following troubleshooting procedures can be used to further isolate the problem to one of the following subassemblies:

- HP-IB Address Assembly – Service Sheet 22, 23
- HP-IB Interface Assembly – Service Sheet 24, 25

Equipment

Controller........................ HP 85B or HP 9826/36A
Digital Voltmeter................. HP 3455A or HP 3456A
Oscilloscope...................... HP 1980B

Note

The Signal Generator has a built-in logic probe on the A2A8 Output Register Assembly. To use the probe, connect a clip lead to A2A8TP2. The other end of the clip lead can then be used to probe logic levels and can also be used for checking for pulse activity. The indicator near the test point will light for a logic high, extinguish for a logic low and will pulse if repetitive pulses are present. If the logic probe is used, the oscilloscope and voltmeter are not required.

Troubleshooting Procedures

The following procedures are divided into three checks as follow:

Remote, Talk and Listen Checks (√1)
Data Control Checks (√2)
Serial and Parallel Poll Check (√3)

Remote, Talk and Listen Checks (√1)

1. Set the Signal Generator to the following conditions using the front panel controls.

RF Output	On
RANGE Control	Fully counter-clockwise
VERNIER	Fully counter-clockwise
ALC	set to INT
Frequency	3000.000 MHz

2. Connect the controller to the Signal Generator. Set the Signal Generator to remote mode with the command:

```
REMOTE 719
```

Verify that the REMOTE annunciator in the STATUS block lights. The front panel displays should now indicate:

RF Output	ON
RANGE	−110 dB
LEVEL	−10 dBm
ALC	INT
Frequency	3000.000 MHz

If all indications are correct, proceed with step 4.

If the REMOTE annunciator does not light, check the HP-IB cable and verify that the Signal Generator is set to the correct HP-IB address. If the problem cannot be corrected, continue with step 3 to check the remote and listen signals.

If the REMOTE annunciator does light, but the front panel annunciators have changed, use service sheet 19 to troubleshoot the appropriate Local/Remote Selector. The local data should be latched at the Local/Remote Selector on the local to remote transition.

3. Use the voltmeter or the built-in logic probe on A2A8 Output Register assembly to check A2A9U19B-15, Listen, and A2A9U17B-15, Remote. Both signals should be a TTL high.

   If the indication is correct, go to service sheet 24 to trace the Remote signal to the front panel annunciator.

   If the Listen signal is not correct, go to service sheet 22 to troubleshoot the handshake circuits and the Talk, Listen and Remote Decoding citcuit. If the Remote signal is not correct, use service sheet 22 to troubleshoot the Remote flip-flop and the handshake circuitry. The Listen signal must be correct before the Remote can be checked.

4. Enter and run the following program to test the Source Handshake and output data latches.

   ```
   10 REMOTE 719
   20 ENTER 719 USING "#,B";V
   30 DISP V
   40 END
   ```

   The controller should display a zero after the program is executed.

   If the controller displays a zero, proceed with the Data Control Checks beginning with step 6.

   If no number is displayed, go to service sheet 22 to troubleshoot the Source Handshake circuit.

   If the number displayed is not zero, proceed with step 5.

5. Execute a serial poll with the command:

   ```
   SPOLL(719)
   ```

If the number displayed is the same as the number displayed in step 4, the Source Handshake circuit is working properly. Proceed with step 6.

If the number displayed is not the same as the number displayed in step 4, use service sheet 22 to troubleshoot the Source Handshake circuit and the output data latch.

Data Control Checks (√2)

6. Enter and execute the following program. This program will exercise each of the RF Program Selectors and the Interface Storage Register control lines.

```
10 SEND 7; MTA LISTEN 19
20 OUTPUT 7;"P1Q1R1S1T1U1V1W1Z1K1L1M1N701"
30 GOTO 20
40 END
```

Use the oscilloscope or built-in logic probe on the A2A8 Output Register assembly to observe the following signals.

Signal	A2A7-
REM 1000 CLK	U3–1
REM FM CNTL	U3–2
REM VERNIER CNTL	U3–3
REM 1 CLK	U3–4
REM 100 CLK	U3–6
REM 10 CLK	U3–7
REM AM CNTL	U3–14
REM ALC CNTL	U3–15
INTF CLK 1	U5–14
INTF CLK 2	U5–15
INTF CLK GO	U6–10
REM ATTN CNTL	U25–3
REG RST	U26–12

Pulse activity should be evident for all of the signals and the front panel should indicate a frequency of 11 111.111 MHz (the 1 kHz digit will be unstable). The RF output should be on and the output level should be –8 dBm. In addition, the ALC mode should be INT.

If there is pulse activity for all of the signals, and the front panel indications are correct, proceed with the Serial and Parallel Poll checks.

If there is pulse activity for all of the signals but the front panel indications are not correct (or the Signal Generator dos not accept data), proceed to service sheet 24 to troubleshoot the RF Program Selectors and the data being routed through them.

If any or all of the signals do not indicate pulse activity, go to service sheet 24 to troubleshoot the Instruction Decoders and related circuitry.

Serial and Parallel Poll Check (√3)

To determine whether the serial and parallel poll circuits are working correctly, perform the HP-IB portion of the Operator's Checks in Section III of the Operating Manual. The checks will also verify the Signal Generator's processing of the other HP-IB bus commands.

If any part of the checks fail, go to the service sheet 23 to troubleshoot the Bus Command Decoder and/or the serial and parallel poll circuits.

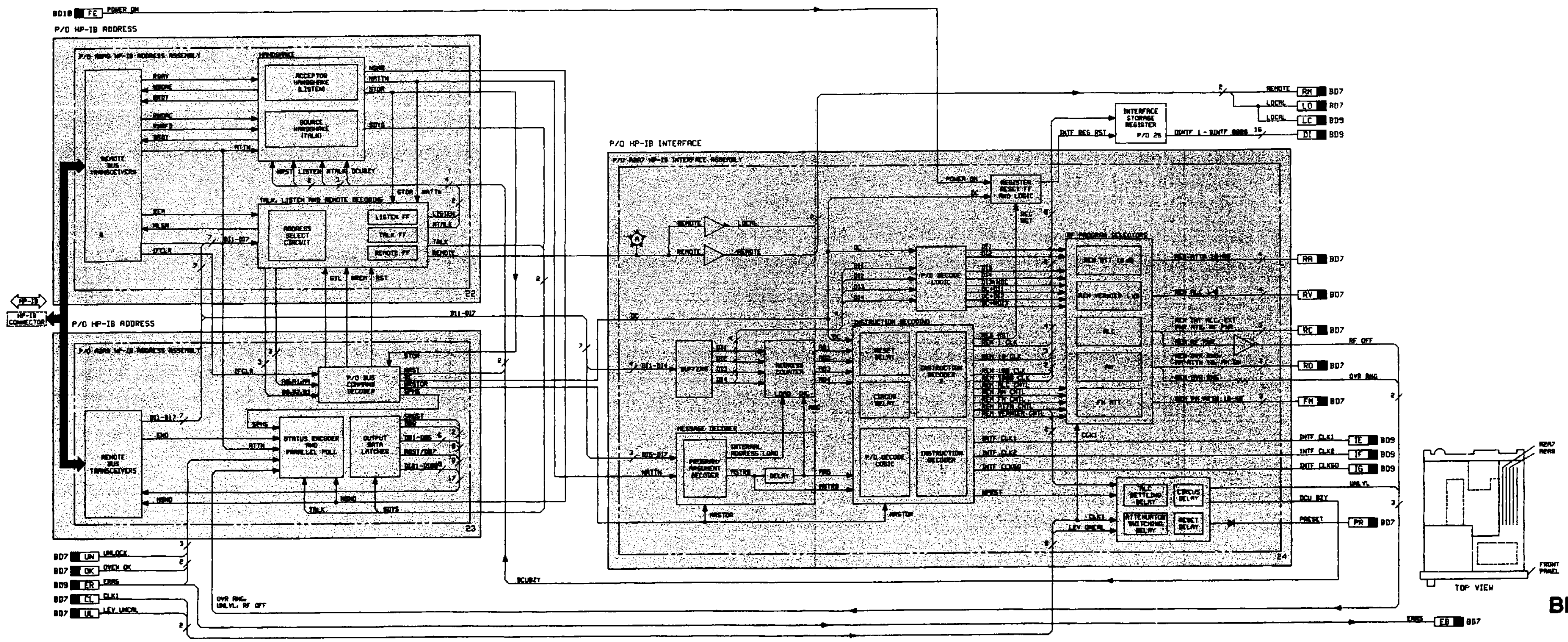


Figure 8-27. DCU HP-IB Interface Block Diagram
8-151/8-152

BD8

DCU HP-IB Interface Block Diagram SERVICE SHEET

BD9 DCU Frequency Control

References

Overall Block Diagram............ Service Sheet BD1
Disassembly Procedures........... Service Sheet A
Interior Views................... Service Sheet B
Illustrated Parts Breakdown (IPB).. Chapter 6
Post Repair Adjustments.......... Chapter 5

Principles of Operation

General

The Digital Control Unit (DCU) is divided into three sections:

- DCU Remote/Local Interface
- DCU DCU HP-IB Interface
- DCU DCU Frequency Control

DCU Remote/Local Interface. The DCU processes inputs from the front panel in local mode and the HP-IB in remote mode. In local mode, the operator enters data with the front panel switches and the TUNING knob. The TUNING knob is a Rotary Pulse Generator (RPG) which provides continuous control of frequency tuning. Selectable tuning resolution coupled with the RPG provides convenient control of setting frequency.

DCU HP-IB Interface. Remote mode uses a combination of special ASCII program codes and arguments to simulate the front panel controls. The HP-IB Address assembly is used to decode the information on the HP-IB and generate control signals for managing the input data. The HP-IB Interface assembly is used to decode the program codes and arguments so the DCU Frequency Control subsystem can alter the frequency setting of the instrument.

DCU Frequency Control. The DCU produces tuning information and frequency band related information based on the current front panel frequency. Tuning information comes from the DCU Remote/Local Interface as tuning and resolution for local mode, or actual frequency information for remote mode.

The baseband (band 1) and the multiplied band frequencies are:

Band 1: 2–6.2 GHz
Band 2: 6.2–12.4 GHz
Band 3: 12.4–18 GHz.

Each frequency change requires a cycling of the frequency data through three registers. Register 1 holds the front panel frequency, rounds the desired frequency according to the frequency resolution and decodes the appropriate frequency band. Register 2 divides the Register 1 frequency by 1, 2 or 3 to produce a baseband frequency and indicates whether the frequency is evenly divisible. Register 3 generates the tuning information for the phase locked loops to generate the appropriate baseband frequency.

Remote operation loads frequency data directly into the first register to be processed by registers 2 and 3. Local control indicates tuning direction and resolution for incrementing or decrementing the Register 1 frequency.

The DCU Frequency Control section consists of three assemblies:

- Timing and Control
- Register 1
- Output Register

Each is discussed separately below.

Timing and Control. The Timing and Control assembly generates all timing signals for the DCU data cycles. A data cycle consists of changing the Signal Generator's frequency by adding one to, or subtracting one from to the frequency digit selected by the FREQUENCY RESOLUTION keys. The frequency digits are stored in Register 1. If an error occurs after a single data cycle, the Timing and Control assembly will initiate additional data cycles until the error is corrected.

The ± 1 adder is also contained on the Timing and Control assembly. The data stored in Register 1 is shifted (LSB first) through the adder to increment or decrement the frequency stored in Register 1. The RPG circuitry indicates to the ± 1 adder whether the frequency should be incremented or decremented by decoding the direction the RPG is turned.

In remote mode, the frequency data is loaded directly into Register 1 via the HP-IB Interface assembly. Once the data is loaded, a data cycle is initiated to display the frequency and retune the instrument's phase locked loops.

Register 1. Register 1 stores the output frequency of the instrument for processing. The register is powered by a battery whenever the line cord is removed from the instrument. The battery is continually charged whenever the line cord is connected to the instrument. Register 1 also contains circuitry for error decoding and for band decoding.

The frequency information in Register 1 is processed during data cycles initiated by the Timing and Control assembly. A data cycle begins by shifting the data stored in Register 1 through the ± 1 adder on the Timing and Control assembly. The frequency information is modified (incremented or decremented) depending on the direction the RPG was turned and the selected frequency tuning resolution. The output of the ± 1 adder is routed back into Register 1, Register 2 and the front panel for the FREQUENCY MHz display.

Once the modified frequency is stored in Register 1, the frequency stored in Register 2 is divided according to the band number decoded on the Register 1 assembly. The divided frequency is then dumped into Register 3 where it is decoded to generate tuning information for the phase locked loops.

If the frequency cannot be evenly divided by the frequency band number, additional data cycles are initiated by the Timing and Control assembly to further add or subtract 1 from the data in Register 1. The rounding is random in direction for the first add/subtract and then continues in the same direction until the frequency is evenly divisible.

Register 2. The data stored in Register 1 is copied into Register 2 during the first nine clocks of the data cycle. During the succeeding clocks of the data cycle, the data is divided by the frequency band number. The division takes place by shifting the digits through a divider consisting of several ROMs. If the frequency is not evenly divisible by the band number, a remainder signal is generated by the divider circuitry. The Timing and Control assembly then begins another data cycle to add or subtract one from the frequency stored in Register 1. The direction (add or subtract) depends only on the last process (addition or subtraction) that was done. This results in a random roundoff.

Once the divider indicates that a division occurred with no remainder the entire contents of Register 2 are clocked into Register 3. The parallel load stores the baseband information into Register 3 for use in generating tuning information for the phase locked loops.

Register 3. The data stored in Register 3 is decoded to produce the M and N divider numbers for the M/N phase locked loop. In addition, the stored frequency information is sent to the LFS phase locked loop and to the Digital to Analog Converter for pretuning the YIG tuned oscillator.

Troubleshooting

General

It is assumed that the troubleshooting information associated with Service Sheet BD1 was used to isolate the problem to the DCU Frequency Control. The following troubleshooting procedures can be used to further isolate the problem to one of the following subassemblies:

- Register 1 Assembly – Service Sheet 26
- Timing and Control Assembly – Service Sheet 27,28
- Output Register Assembly –Service Sheet 29,30

Equipment

Oscilloscope .... HP 1980B
Digital Voltmeter .... HP 3455A or HP 3456A

Troubleshooting Procedures

The following procedures are divided into four checks, as follows:

Timing and Control Assembly Checks (√1)
Register 1 Checks (√2)
Register 2 Checks (√3)
Register 3 Checks (√4)

Timing and Control Assembly Checks (√1)

1. Remove A2A11 Timing and Control assembly and place it on the special extender board (HP PN 08672-60016). Three 30 pin extender boards may be used if the the special extender board is not available.
2. Short test point pair A2A11TP1 with an alligator clip. Connecting this test point pair causes the DCU to continually cycle the frequency data.
3. Connect channel 1 of the oscilloscope to A2A11 CLK 1. The waveform should be as shown in figure 8-28.

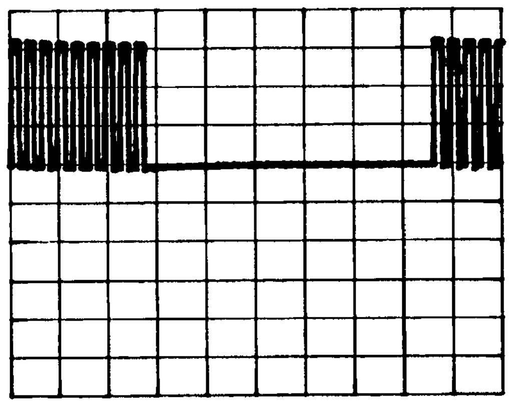


Figure 8-28. A2A11 CLK 1 Test Point

   If the waveform is as shown, leave channel 1 connected to A2A11 CLK 1 test point and continue with step 5.

   If the waveform is not as shown, continue with step 4.

4. Connect channel 2 of the oscilloscope to XA2A11B-24.

   The oscilloscope should indicate a signal at 10 MHz with a level of about 1 volt peak-to-peak.

   If the signal is correct, go to service sheet 27 to troubleshoot the clock circuitry.

   If the frequency is not correct, the Time Base Reference is at fault. Go to service sheet BD2 to isolate the problem.

5. Connect channel 2 of the oscilloscope to A2A11 CLK 2. Set the oscilloscope to chop sweep mode to eliminate retrace d-lays. The waveform should be as shown in figure 8-29.

If the waveform is correct, proceed with step 6.

If the waveform is not correct, go to service sheet 27 to troubleshoot the clock circuitry.

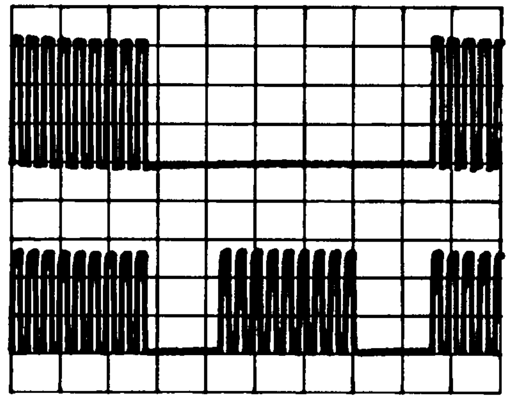


Figure 8-29. A2A11 CLK 2 Test Point

6. Connect channel 2 of the oscilloscope to XA2A11C-7, NCLK 2. The waveform should be as shown in figure 8-30.

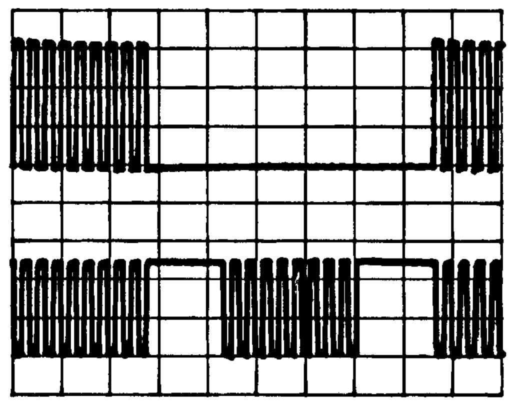


Figure 8-30. XA2A11C-7, NCLK 2

If the waveform is correct, proceed with step 7.

If the waveform is not correct, go to service sheet 27 to troubleshoot the clock circuitry.

7. Connect channel 2 of the oscilloscope to XA2A11A-30, NCLK 3. The waveform should be as shown in figure 8-31.

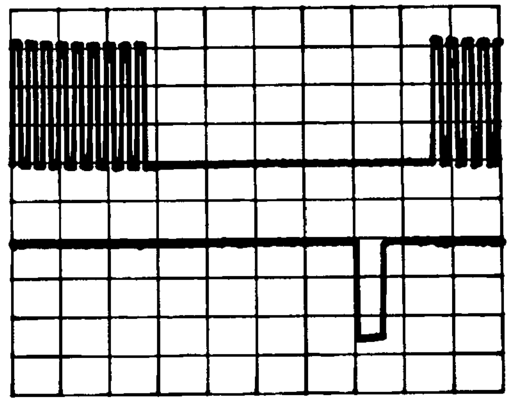


Figure 8-31. XA2A11A-30, NCLK 3

If the waveform is correct, proceed with step 8.

If the waveform is not correct, go to service sheet 27 to troubleshoot the clock circuitry.

8. Connect channel 2 of the oscilloscope to XA2A11B-30, LEFT. The waveform should be as shown in figure 8-32.

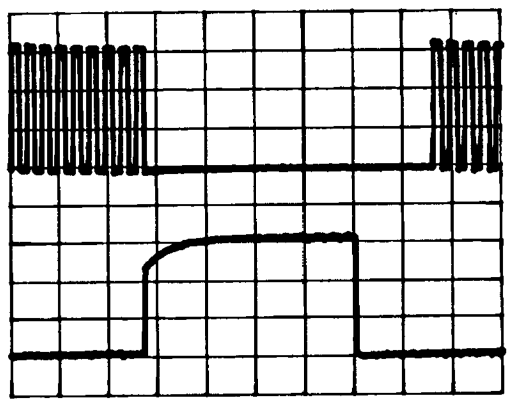


Figure 8-32. XA2A11B-30, LEFT

If the waveform is correct, proceed with step 9.

If the waveform is not correct, go to service sheet 27 to troubleshoot the Clock Counter and Left circuitry.

9. Connect channel 2 of the oscilloscope to XA2A11A-19, CYCLE. The waveform should be as shown in figure 8-33.

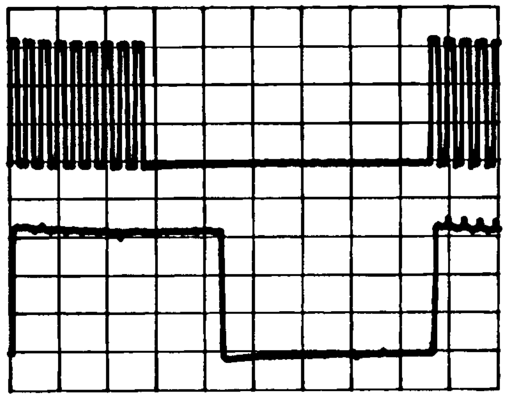


Figure 8-33. XA2A11A-19, CYCLE

If waveform is correct, proceed with step 10.

If the waveform is not correct, go to service sheet 27 to troubleshoot the N cycle circuitry.

10. Connect channel 2 of the oscilloscope to XA2A11C-1, GO. The waveform should be as shown in figure 8-34.

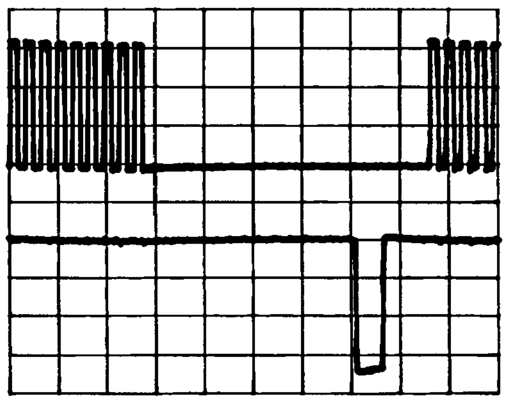


Figure 8-34. XA2A11C-1, GO

If waveform is correct, proceed with step 11.

If the waveform is not correct, go to service sheet 27 to troubleshoot the GO circuitry.

11. Connect the oscilloscope to XA2A11B-15, CLK PRTCT. Turn off the instrument and verify that the signal is at +5 volts.

    If the voltage is correct, proceed with step 12.

    If the voltage is not correct, use service sheet 27 to troubleshoot the CLK PRTCT circuit.

12. With the oscilloscope still connected to XA2A11B-15, set the Signal Generator's line switch to ON.

    After a brief (<1 second) delay, the signal should return to a TTL low (<0.7 volts).

If the signal is correct, the CLK PRTCT circuit is functioning normally. Proceed with step 13.

If the signal is not correct, use service sheet 27 to troubleshoot the CLK PRTCT circuit.

13. Disconnect the short from A2A11TP1 test point pair. Short A2A11TP2 test point pair to suppress frequency limits.
14. Connect the oscilloscope to XA2A11B-1, ERRS. Tune the Signal Generator to a frequency less than 2 GHz. If the instrument cannot be tuned, an out of range frequency can be obtained with the following procedure. Short A2A11TP1 test point pair and alternately press the 1 kHz FREQUENCY RESOLUTION key and the PRESET (3 GHz) key until an illegal frequency is obtained (0 GHz). A controller can also be used to directly program an out-of-range frequency. The oscilloscope should indicate a TTL low when above 2 GHz and a TTL high when below 2 GHz.

    If the signal is correct, proceed with step 15.

    If the signal is not correct, use service sheet 27 to troubleshoot the ERRS circuit.
15. Remove the short from A2A11TP2 test point pair (and A2A11TP1 test point pair if shorted). Connect the oscilloscope to A2A11 RPG SIGN test point.

    The signal should be low when the TUNING knob is turned clockwise and high when the TUNING knob is turned counterclockwise.

    If the signal is correct, the Timing and Control assembly is nominally working. Proceed with the Register 1 checks beginning with step 16.

    If the signal is not correct, use service sheet 27 to troubleshoot the RPG circuits.

Register 1 Checks (√2)

Register 1 stores the output frequency information for the instrument. These procedures check that the information in the register can be preset and modified. In addition, the decoding circuitry to detect frequency errors and frequency band information is checked.

Overall Check (√2a)

16. Replace A2A11 and place A2A10 Register 1 assembly on the special extender board.
17. Press PRESET (3 GHz) and observe the FREQUENCY MHz display on the Signal Generator's front panel. The displayed frequency should be 3000.000 MHz.

If the displayed frequency is correct, proceed with step 18.

If the displayed frequency is not correct, the data in Register 1 may be incorrect or the frequency display may be at fault. Proceed with Register 1 Data Check beginning with step 25.

18. Select 1 kHz FREQUENCY RESOLUTION and slowly turn the TUNING knob. The frequency display should indicate the 1 kHz digit decrements when the TUNING knob is turned counterclockwise and increments when the TUNING knob is turned clockwise.

    If the frequency does change, proceed with step 19.

    If the frequency does not change, but the FREQUENCY RESOLUTION indicators light, use service sheet 28 to isolate the problem to the ±1 adder or the NLSDR input to the adder.

    If the FREQUENCY RESOLUTION indicators do not light, use service sheet 31 to troubleshoot the tuning resolution circuitry.

19. Select the other available FREQUENCY RESOLUTION keys and verify that the least significant digit above the lighted FREQUENCY RESOLUTION indicators can be incremented and decremented.

    If the least significant digits can all be changed, proceed with step 20 to check the remainder of the circuitry on the Register 1 assembly.

    If any tuning resolution does not affect the frequency, go to service sheet 31 to troubleshoot the Resolution Register. If the indicator for the selected resolution does not work, troubleshoot the Tuning Resolution Latch.

20. Press PRESET (3 GHz) and set the output of the Signal Generator to 3018.012 MHz. Short A2A11TP1 test point pair with an alligator clip to cycle the data through the ±1 adder and through the decoding circuitry.

21. Connect channel 1 of the oscilloscope to A2A11 CLK 1 and connect channel 2 to XA2A10C-20, NERR. The waveform should be as shown in figure 8-35.

    If the waveform is correct, proceed with step 22.

    If the waveform is not correct, go to service sheet 26 to troubleshoot the Parallel Output Buffer, Combiner, and Decoding ROMs.

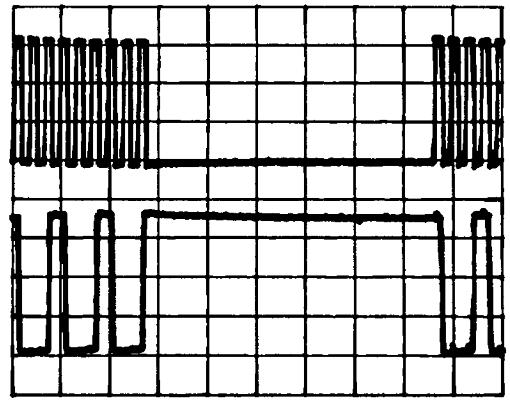


Figure 8-35. XA2A10C-20, NERR

22. Connect channel 2 to A2A10TP HNR1. The waveform should be as shown in figure 8-36.

    If the waveform is correct, proceed with step 23.

    If the waveform is not correct, go to service sheet 26 to troubleshoot the Parallel Output Buffer, Combiner, and Decoding ROMs.

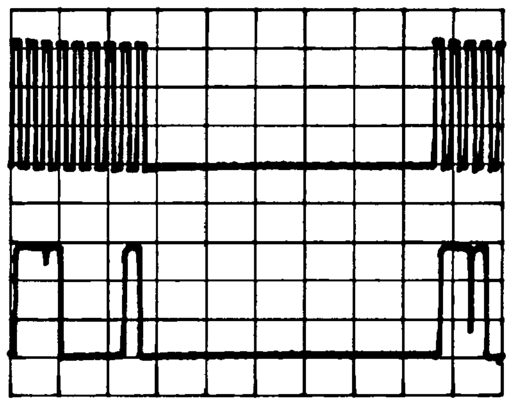


Figure 8-36. A2A10 HNR1 Test Point

23. Connect channel 2 to A2A10TP HNR2. The waveform should be as shown in figure 8-37. If the waveform is correct, proceed with step 24.

    If the waveform is not correct, go to service sheet 26 to troubleshoot the Parallel Output Buffer, Combiner, and Decoding ROMs.

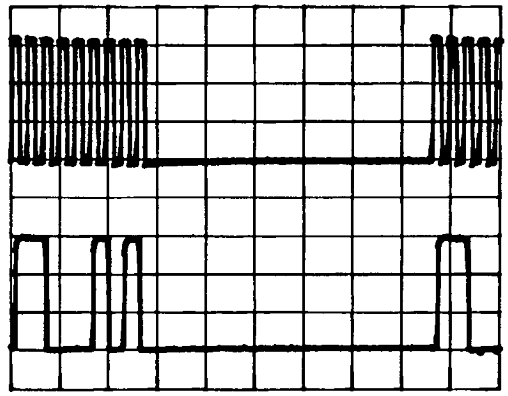


Figure 8-37. A2A10 HNR2 Test Point

24. Remove the short from A2A11TP1 test point pair. Tune to each of the frequencies listed below and check the logic level at the edge connector pins indicated. The logic probe circuitry on A2A8 may be used to check logic levels.

Table 8-21. Frequency Band Outputs

Frequency (MHz)	XA2A10B-		XA2A10C-	
	23 HN1	6 HN2	13 HN1	12 HN2
2000.000	L	L	L	L
10000.000	H	L	H	L
18000.000	L	H	L	H

If all of the levels are correct, Register 1 is working correctly. Proceed with Register 2 checks beginning with step 33.

If any or all of the levels are incorrect, go to service sheet 27 to troubleshoot the Band Latch.

Register 1 Data Check (√2b)

25. Connect channel 1 of the oscilloscope to A2A11 test point CLK 1. Press the PRESET (3 GHz) key on the front panel to set Register 1 to a known state. Short A2A11TP1 test point pair with an alligator clip. Connect channel 2 of the oscilloscope to XA2A10C-9, DR1O1.

The waveform should be as shown in figure 8-38. The single TTL high indicates that the 1 GHz bit in the register is set high.

If the waveform is correct, proceed with step 26.

If the waveform is not correct, proceed with step 28 to test the preset circuitry.

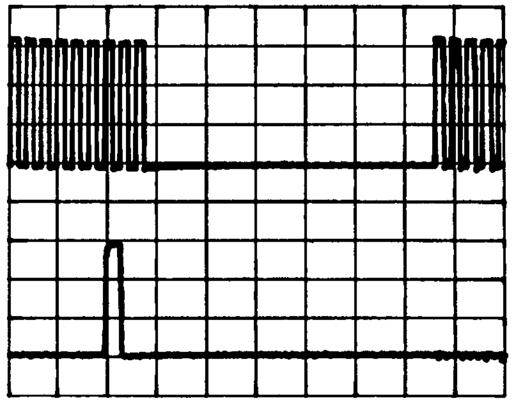


Figure 8-38. DR1O1, DR1O2

26. Connect channel 2 of the oscilloscope to XA2A10C-24, DR1O2.

    The waveform should also be as shown in figure 8-38. The single TTL high indicates that the 2 GHz bit in the register is set high.

    If the waveform is correct, proceed with step 27.

    If the waveform is not correct, proceed with step 28 to test the preset circuitry.

27. Verify that XA2A10C-23, DR1O4, and XA2A10C-22, DR1O8, do not indicate any TTL high signals.

    If the waveform does not indicate any high bits, the data in Register 1 is correct. Go to service sheet 32 to troubleshoot the frequency display.

    If the waveform does indicate one or more TTL high bits, proceed with step 28 to test the preset circuitry.

Preset Circuitry Check (√2c)

28. Connect the oscilloscope to A2A10U24-4, CLEAR. Press the PRESET (3 GHz) key on the Signal Generator.

    The oscilloscope should indicate a TTL high when the PRESET (3 GHz) key is pressed and a TTL low when the key is released.

    If the indication is correct, continue with step 29.

    If the indication is not correct, use service sheet 27 to isolate the problem to the DCU Front Panel, service sheet 31, or the Register Protect Logic on service sheet 27.

29. Remove the short from A2A11TP1 test point pair and then press the PRESET (3 GHz) key on the front panel. Remove the blue cable from A3A1J6 to disable the DCU's internal clock and enable single stepping with the switch on A2A11 Timing and Control assembly. Short A2A11TP1 test point pair again to allow stepping through a data cycle.

30. Step the DCU through a data cycle using the switch on A2A11 Timing and Control assembly. Check the following signals at each step (table 8-22) to ensure that the register has been preset correctly.

    The data cycle consists of 18 steps. The first nine correspond to the first through ninth times that A2A11 test point CLK 1 is high. To find the beginning of a data cycle, monitor A2A11 test point CLK 1 with the oscilloscope. The beginning of the data cycle is the first time the clock signal goes high after nine steps of being low.

Table 8-22. Register 1 Serial Output

Step	A2A11C-				BCD Frequency Value
	22 DR108	23 DR104	26 DR102	27 DR101	
1	L	L	L	L	0 (1 kHz)
2	L	L	L	L	0 (10 kHz)
3	L	L	L	L	0 (100 kHz)
4	L	L	L	L	0 (1 MHz)
5	L	L	L	L	0 (10 MHz)
6	L	L	L	L	0 (100 MHz)
7	L	L	H	H	3 (1 GHz)
8	L	L	L	L	0 (10 GHz)
9	L	L	L	L	0 (100 GHz)

If the results are not correct, try holding the PRESET (3 GHz) while stepping through an entire data cycle (18 steps). This will force a manual preset and may correct the levels.

If all of the signals are correct, proceed with step 31 to check the data returned from the ±1 adder.

If any or all of the levels are incorrect, use service sheet 27 to troubleshoot the preset circuitry and Serial Output Latch. Check the frequency data at the outputs of the shift registers. After a preset, only the 1G (A2A10U19-15) and 2G (A2A10U20-15) bits should be high.

31. Step through the remaining nine steps of the data cycle to restart the sequence. Press and hold the PRESET (3 GHz) key while stepping through the next 18 steps of the data cycle so that the register is reset to 3 GHz.

32. Step the DCU through another data cycle. Check the following signals at each step (table 8-23) to ensure that the data returning from the ±1 Adder is correct.

    If all of the signals are correct, Register 1 is being preset. Replace the blue cable and repeat steps 16 through 19. If the same failure occurs, use service sheet 27 to isolate the preset problem.

    If any or all of the levels are incorrect, use service sheet 28 to troubleshoot the ±1 Adder and Offset ROM circuits.

Register 2 Checks (√3)

Register 2 receives the data from Register 1 and divides the frequency by the band number. If the division leaves a remainder, the frequency is not evenly divisible by the band number and a signal is sent back to the Timing and Control assembly to round off the frequency stored in Register 1. The the results of the division are dumped into Register 3 for generation of phase locked loop tuning data.

Table 8-23. Register 1 Serial Input

Step	XA2A10C-				BCD Frequency Value
	1 (DR118)	17 (DR114)	2 (DR112)	16 (DR111)	
1	L	L	L	L	0 (1 kHz)
2	L	L	L	L	0 (10 kHz)
3	L	L	L	L	0 (100 kHz)
4	L	L	L	L	0 (1 MHz)
5	L	L	L	L	0 (10 MHz)
6	L	L	L	L	0 (100 MHz)
7	L	L	H	H	3 (1 GHz)
8	L	L	L	L	0 (10 GHz)
9	L	L	L	L	0 (100 GHz)

Data Input Buffer Check (√3a)

33. Replace A2A10 in the instrument and place A2A8 on an extender board. Remove the short from A2A11TP1 test point pair and connect channel 1 of the oscilloscope to A2A11TP CLK 1. Press the PRESET (3 GHz) key on the front panel to set Register 1 (and Registers 2 and 3) to a known state.

34. Set the Signal Generator to 15 999.999 MHz. If the instrument cannot be tuned, Register 1 is at fault. Return to the Register 1 checks beginning with step 16. Short A2A11TP1 test point pair with an alligator clip. Connect channel 2 of the oscilloscope to XA2A8B-11, NRMDR.

    The waveform should be as shown in figure 8-39. This signal is used to indicate to the Timing and Control assembly that the division (by three in this case) left a remainder. If a remainder is indicated, another data cycle is initiated and the frequency in Register 1 is incremented or decremented and the process is repeated until the frequency in Register 1 is evenly divisible by the band number.

    If the waveform is correct, proceed with step 35.

    If the waveform is not correct, proceed with step 39 to test the input signals from Register 1.

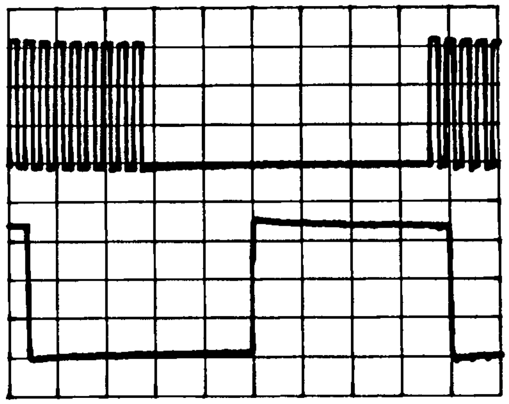


Figure 8-39. XA2A8B-11, NRMDR

35. Connect channel 2 of the oscilloscope to A2A8U23-12. This signal is the BCD 8 output from Register 1 when LEFT is low and is the Register 2 data (being divided) during the time that LEFT is high.

    The waveform should be as shown in figure 8-40.

    If the waveform is correct, proceed with step 36.

    If the waveform is not correct, proceed with step 39 to test the input signals from Register 1.

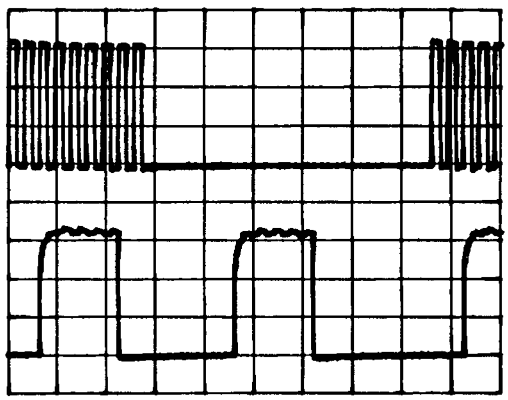


Figure 8-40. A2A8U23-12, BCD 8

36. Connect channel 2 of the oscilloscope to A2A8U23-15. This signal is the BCD 4 digit from Register 1 when LEFT is low and is the Register 2 BCD 4 digit during the time that LEFT is high.

    The waveform should be as shown in figure 8-41.

    If the waveform is correct, proceed with step 37.

    If the waveform is not correct, proceed with step 39 to test the input signals from Register 1.

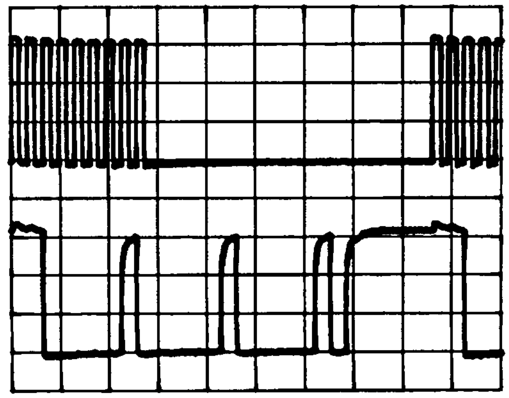


Figure 8-41. A2A8U23-15, BCD 4

37. Connect channel 2 of the oscilloscope to A2A8U23-14. This signal is the BCD 2 digit from Register 1 when LEFT is low and is the Register 2 BCD 2 digit during the time that LEFT is high.

    The waveform should be as shown in figure 8-42.

    If the waveform is correct, proceed with step 38.

    If the waveform is not correct, proceed with step 39 to test the input signals from Register 1.

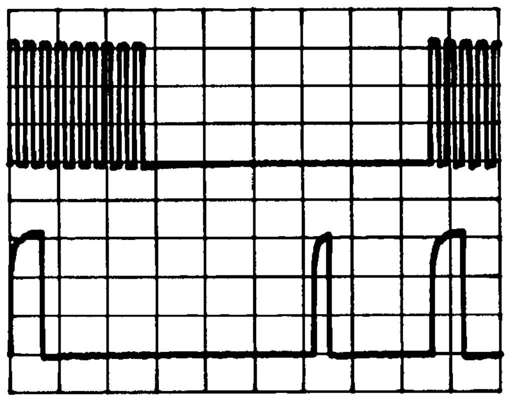


Figure 8-42. A2A8U23-14, BCD 2

38. Connect channel 2 of the oscilloscope to A2A8U23-13. This signal is the BCD 1 digit from Register 1 when LEFT is low and is the Register 2 BCD 1 digit during the time that LEFT is high.

    The waveform should be as shown in figure 8-43.

    If the waveform is correct, Register 2 is nominally working. Proceed with Register 3 checks beginning with step 43.

    If the waveform is not correct, proceed with step 39 to test the input signals from Register 1.

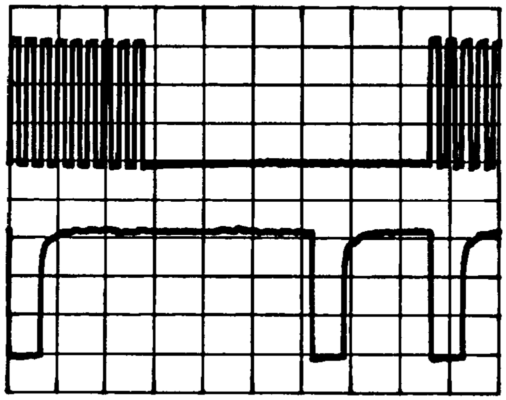


Figure 8-43. A2A8U23-13, BCD 1

Register 2 Input Check (√3b)

39. Connect channel 2 of the oscilloscope to A2A8U23-7, DR2I8. This signal is the output from Register 1.

    The waveform should be as shown in figure 8-44.

    If the waveform is correct, proceed with step 40.

    If the waveform is not correct, use service sheet 28 and Service Sheet 29 to isolate the problem to the Timing and Control assembly or the motherboard.

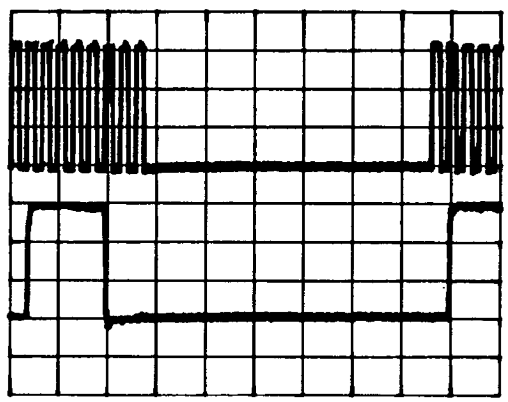


Figure 8-44. A2A8U23-7, DR2I8

40. Connect channel 2 of the oscilloscope to A2A8U23-3, DR2I4. This signal is the BCD 4 digit from Register 1.

    The waveform should be as shown in figure 8-45.

    If the waveform is correct, proceed with step 41.

    If the waveform is not correct, use service sheet 28 and Service Sheet 29 to isolate the problem to the Timing and Control assembly or the motherboard.

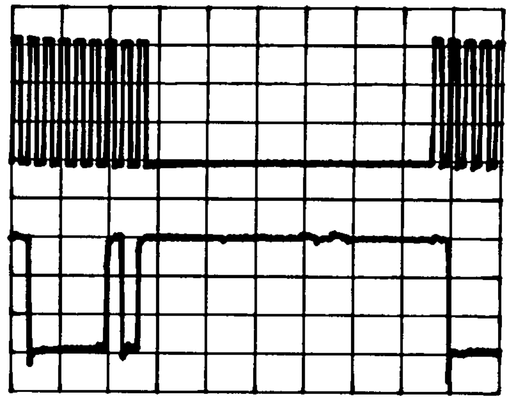


Figure 8-45. A2A8U23-3, DR2I4

41. Connect channel 2 of the oscilloscope to A2A8U23-4, DR2I2. This signal is the BCD 2 digit from Register 1.

    The waveform should be as shown in figure 8-46.

    If the waveform is correct, proceed with step 42.

    If the waveform is not correct, use service sheet 28 and Service Sheet 29 to isolate the problem to the Timing and Control assembly or the motherboard.

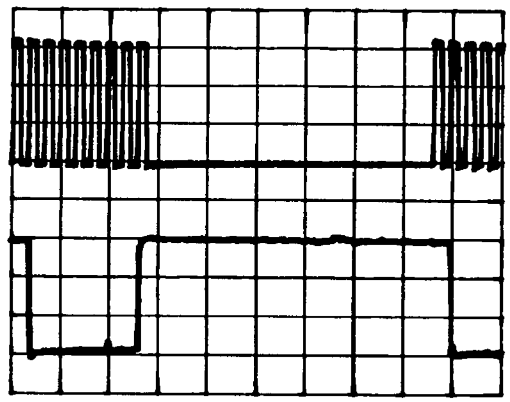


Figure 8-46. A2A8U23-4, DR2I2

42. Connect channel 2 of the oscilloscope to A2A8U23-9, DR2I1. This signal is the BCD 1 digit from Register 1.

    The waveform should be as shown in figure 8-47.

    If the waveform is correct, the divider or one of the shift registers in Register 2 is at fault. Go to service sheet 29 to troubleshoot.

    If the waveform is not correct, use service sheet 28 and service sheet 29 to isolate the problem to the Timing and Control assembly or the motherboard.

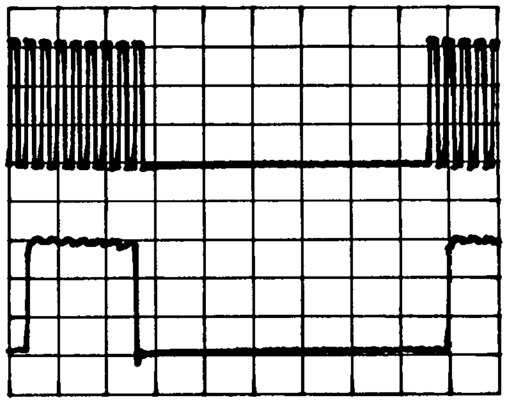


Figure 8-47. A2A8U23-9, DR2I1

Register 3 Checks (√4)

43. Remove A2A8 and place it on the special extender board (HP PN 08672-60016). Three 30 pin extender boards may be used if the special extender is not available.

44. Set the Signal Generator to the frequencies shown in table 8-24. Check the edge connector pins for the logic levels given.

    If all the edge connector pins are correct, proceed with step 45.

    If any of the edge connector pins are incorrect, use service sheet 29 and 30 to isolate the problem to the output of Register 2 or Register 3.

Table 8-24. LFS 1K — 8M Outputs

Frequency (GHz)	XA2A8A-										XA2A8B-					
	3	**6**	**10**	**14**	**15**	**17**	**22**	**26**	**29**	**30**	**2**	**7**	**10**	**18**	**23**	**25**
	1 kHz	20 kHz	40 kHz	100 kHz	8 kHz	10 kHz	2 kHz	4 kHz	80 kHz	1 MHz	200 kHz	400 kHz	8 MHz	2 MHz	4 MHz	800 kHz
3339.999	1	0	0	1	1	1	0	0	1	1	0	0	1	0	0	1
3336.666	0	1	1	0	0	0	1	1	0	0	1	1	0	1	1	0

45. Set the Signal Generator to each frequency listed in table 8-25 and check for the corresponding logic level on each edge connector pin.

Table 8-25. M1 — M5 and N1 — N6 Outputs

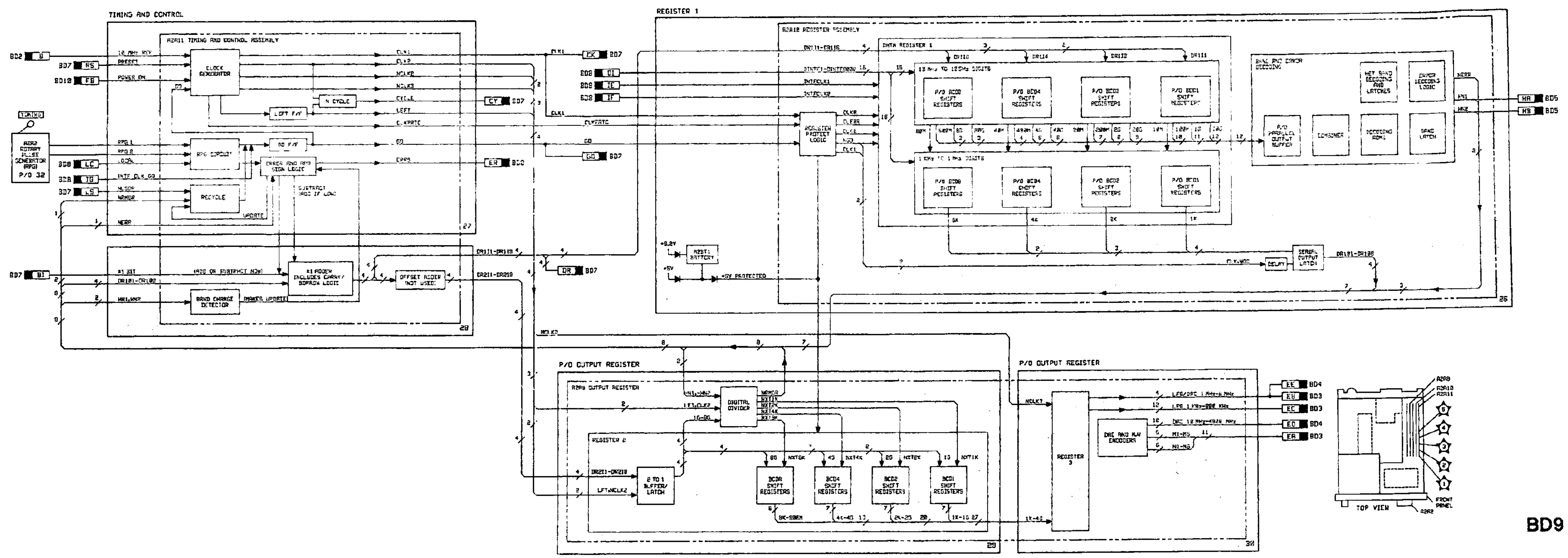
Frequency (MHz)	XA2A8B-				XA2A8C-						
	14 N6	26 N5	27 N2	28 N1	4 N3	6 N4	10 M5	12 M2	25 M4	26 M1	27 M3
6180	1	0	0	0	0	0	1	1	0	1	0
6050	0	1	1	1	1	1	0	0	1	0	1

If all the edge connector pins are correct, Register 3 is working normally.

If any of the edge connector pins are not correct, use service sheet 29 and 30 to isolate the problem to the output of Register 2 or to Register 3.

BD9

DCU Frequency Control
Block Diagram
SERVICE SHEET



BD9

Figure 8-48. DCU Frequency Control Block Diagram
8-175/8-176

BD10 Power Supplies

References

Overall Block Diagram	Service Sheet BD1
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5

Principles of Operation

General

The power supplies in the A3 RF Source section of the instrument supply all of the dc operating voltages required by the instrument. Voltages provided are as follows:

+22 Vdc
+20 Vdc
+10 Vdc
+5.2 Vdc
−5.2 Vdc
−10 Vdc
−40 Vdc

The power supply section consists of four parts:

- Mainframe Components
- Rectifier Assembly A3A12
- Positive Regulator Assembly A3A3
- Negative Regulator Assembly A3A4

Mainframe components consist of the input filter, power transformer, series pass transistors, filter capacitors, fan and power-on relay. These components serve to filter and regulate the input power. The relay applies power to the fan when the instrument line switch is ON. An indicator, located on the bottom of the instrument on the A3 motherboard, is lighted whenever ac voltages are present on the motherboard.

Rectifier Assembly A3A12 rectifies all ac secondary voltage inputs to the power supplies. Unregulated dc is then routed to the appropriate regulator assemblies. Regulated +22 Vdc is generated on this assembly.

Positive Regulator Assembly A3A3 contains the +20 Vdc Regulator, its overvoltage protection circuit, the front panel shutdown circuit, 10 MHz oscillator power supply, power up/down detector, and the +5.2 Vdc Regulator and its overvoltage protection circuit. The oscillator power supply is controlled by the rear panel FREQ STANDARD INT/EXT switch.

Negative Regulator Assembly, A3A4, contains the −10 Vdc Regulator, −5.2 Vdc Regulator, Switched −10 Vdc output, the −40 Vdc, and its associated overvoltage protection circuits.

Troubleshooting

General

It is assumed that the troubleshooting procedures associated with service sheet BD1 have been used to isolate a problem to one of the power supplies. The following troubleshooting procedures can be used to further isolate the problem to one of the following:

Front Panel Assembly — Service Sheet 32
Rectifier Assembly — Service Sheet 33
Positive Regulator Assembly — Service Sheet 34
Negative Regulator Assembly — Service Sheet 35

Equipment

Digital Voltmeter........... HP 3455A or HP 3456A

Procedures

The following procedures are divided into checks as follows:

- Rectifier Assembly
  - +22 Volt Check (√1)
- Positive Regulator Assembly
  - +20 Volt Check (√2)
  - +5.2 Volt Check (√3)
  - +11 Volt Switched Check (√4)
- Negative Regulator Assembly
  - −10 Volt Check (√5)
  - −5.2 Volt Check (√6)
  - −40 Volt Check (√7)
  - −10 Volt Switched Check (√8)

Rectifier Assembly

Rectifier Assembly A3A12 provides a regulated +22 volts as well as the unregulated voltages for the Positive and Negative Regulators. This procedure checks the +22 Volt regulated output.

+22 Volt Check (√1)

1. Connect the voltmeter to A3A12TP1.

   The voltmeter should indicate +22.00 ±0.02 Vdc

   If the indication is incorrect, attempt to adjust the voltage to +22.00 volts using A3A12R2.

   If the indication is correct, or if the voltage can be adjusted to +22.00 volts, proceed with the next check.

   If the indication is incorrect and cannot be adjusted to +22.00 volts, the Rectifier Assembly is defective. Go to service sheet 33 to isolate the problem.

Positive Regulator Assembly

Positive Regulator Assembly A3A3 provides the following voltages:

+20 Vdc
+5.2 Vdc
+11 Vdc Switched

Each is checked separately.

+20 Volt Check (√2)

2. Connect the voltmeter to A3A3TP5.

   The voltmeter should indicate +20.000 ±0.002 Vdc.

   If the indication is not correct, attempt to adjust the voltage to +20.000 Vdc using A3A3R50.

   If the voltage is correct, or if it can be adjusted, proceed with step 4.

   If the voltage cannot be adjusted, proceed with step 3 to isolate the problem.

3. Connect the voltmeter to A3A3TP4.

   The voltmeter should indicate between 27 and 33 Vdc.

   If the voltmeter indication is not correct, the Rectifier Assembly is defective. Go to service sheet 33 to isolate the problem.

   If the voltmeter indication is correct, the +20 Volt Regulator is defective. Go to service sheet 34 to isolate the problem.

+5.2 Volt Check (√3)

4. Connect the voltmeter to A3A3TP2.

   The voltmeter should indicate +5.20 ±0.01 Vdc.

   If the voltmeter indication is correct, proceed with step 6.

   If the voltmeter indication is not correct, proceed with step 5.

5. Connect the voltmeter to A3A3TP1.

   The voltmeter should indicate between 10 and 15 Vdc.

   If the voltmeter indication is not correct, the Rectifier Assembly is defective. Go to service sheet 33 to isolate the problem.

   If the voltmeter indication is correct, the +5.2 Volt Regulator is defective. Go to service sheet 34 to isolate the problem.

+11 Volts Switched (√4)

6. Ensure that the rear panel INT/EXT switch is set to INT.
7. Connect the voltmeter to A3A3TP6.

   The voltmeter should indicate +11.0 ±1.1 Vdc.

If the voltmeter indication is correct, proceed with step 10.

If the voltmeter indication is not correct, proceed with step 8.

8. Remove A3A3 and replace it on a 36 pin extender board.
9. Using the ohmmeter, check for continuity (0 ohms) between XA3A3-18 (TPA) and ground.

   If there is continuity, the Oscillator Power Supply is defective. Go to service sheet 34 to isolate the problem.

   If there is no continuity, Switch A3S1 or the wiring to it is defective.

Negative Regulator Assembly

Negative Regulator Assembly A3A4 provides the following voltages:

−10 Volts
−5.2 Volts
−40 Volts

Each is checked separately.

−10 Volt Check (√5)

10. Connect the voltmeter to A3A4TP4.

    The voltmeter should indicate −10.0 ±0.2 Vdc.

    If the voltmeter indication is correct, proceed with step 12.

    If the voltmeter indication is not correct, proceed with step 11.

11. Leave the voltmeter connected to A3A4TP4 but connect the voltmeter common lead to A3A4TP3.

    The voltmeter should indicate between −15 and −22 volts.

    If the indication is correct, the −10 Volt Regulator is defective. Go to service sheet 35 to isolate the problem.

    If the indication is not correct, the Rectifier Assembly is defective. Go to service sheet 33 to isolate the problem.

−5.2 Volt Check (√6)

12. Connect the voltmeter to A3A4TP5 with common lead to ground.

    The voltmeter should indicate −5.20 ±0.05 Vdc.

    If the indication is correct, proceed with step 132.

    If the indication is not correct, the −5.2 Volt regulator is defective, service sheet 35 to isolate the problem.

−40 Volt Check (√7)

13. Connect the voltmeter to A3A4TP1 with the common lead to ground.

    The voltmeter should indicate −40.0 ±0.6 Vdc.

    If the voltmeter indication is correct, proceed with step 15.

    If the voltmeter indication is not correct, proceed with step 14.

14. Remove the voltmeter common lead from ground and connect it to A3A4TP2.

    The voltmeter should indicate between −48 and −63 Vdc.

    If the indication is correct, the −40 Volt regulator is defective. Go to service sheet 35 to isolate the problem.

    If the indication is not correct, the Rectifier Assembly is defective. Go to service sheet 33

−10 Volt Switched Check (√8)

15. Remove Negative Regulator A3A4 and replace it on an extender board. Set the RF OUTPUT switch to ON.

16. Connect the voltmeter to XA3A4-14 or −32 (TPD), and verify that the voltmeter reads −10 volts.

    If the voltage is correct, proceed with step 17.

    If the voltage is not correct, proceed with step 22 to check the relay control input.

17. While observing the voltmeter, set the RF OUTPUT switch to OFF. With the RF OUTPUT switch in the OFF position, the −10 volt switched supply should be turned off.

    The voltmeter indication should drop from −10 volts to more than zero volts when the RF OUTPUT switch is set to OFF.

    If the voltage does change to more than zero, proceed with step 18.

    If the voltage is not correct, proceed with step 20.

18. Set the front panel RF OUTPUT switch to ON and verify that the voltmeter indication returns to −10 volts.

19. While observing the voltmeter, short A3A3TP2 to ground. Shorting the +5.2 volt supply to ground should deactivate the relay and turn off the −10 volt switched supply.

    The voltmeter indication should change to more than zero volts.

    If the voltage does change to more than zero, the power supplies are functioning normally.

    If the voltage does not change to more than zero, proceed with step 22.

20. Set the front panel RF OUTPUT switch to ON.

21. Connect the voltmeter to XA3A4-18 (TPC), and, while observing the voltmeter, set the front panel RF OUTPUT switch to OFF. The voltmeter indication should drop from +5 volts to zero volts when the key is switched.

    If the voltage does drop, relay A3A4K1 or associated components are defective. Go to service sheet 35 to isolate the problem.

    If the voltage does not drop, there is a problem with the logic latch, the switch or associated circuitry on DAC and ENABLE board A1A5. Go to service sheet 22 to isolate the problem.

22. Remove the ground from A3A3TP2, connect the voltmeter to XA3A4-18 (TPC), and, while observing the voltmeter, ground A3A3TP2.

    The voltage should drop from +5 volts to zero volts when A3A3TP2 is grounded.

    If the indication is incorrect, relay A3A4K1 is defective. Go to service sheet 35 to isolate the problem.

    If the indication is correct, proceed with step 23.

23. Remove the ground from A3A3TP2, connect the voltmeter to XA3A3-35 (TPB), then, while observing the voltmeter, ground A3A3TP2.

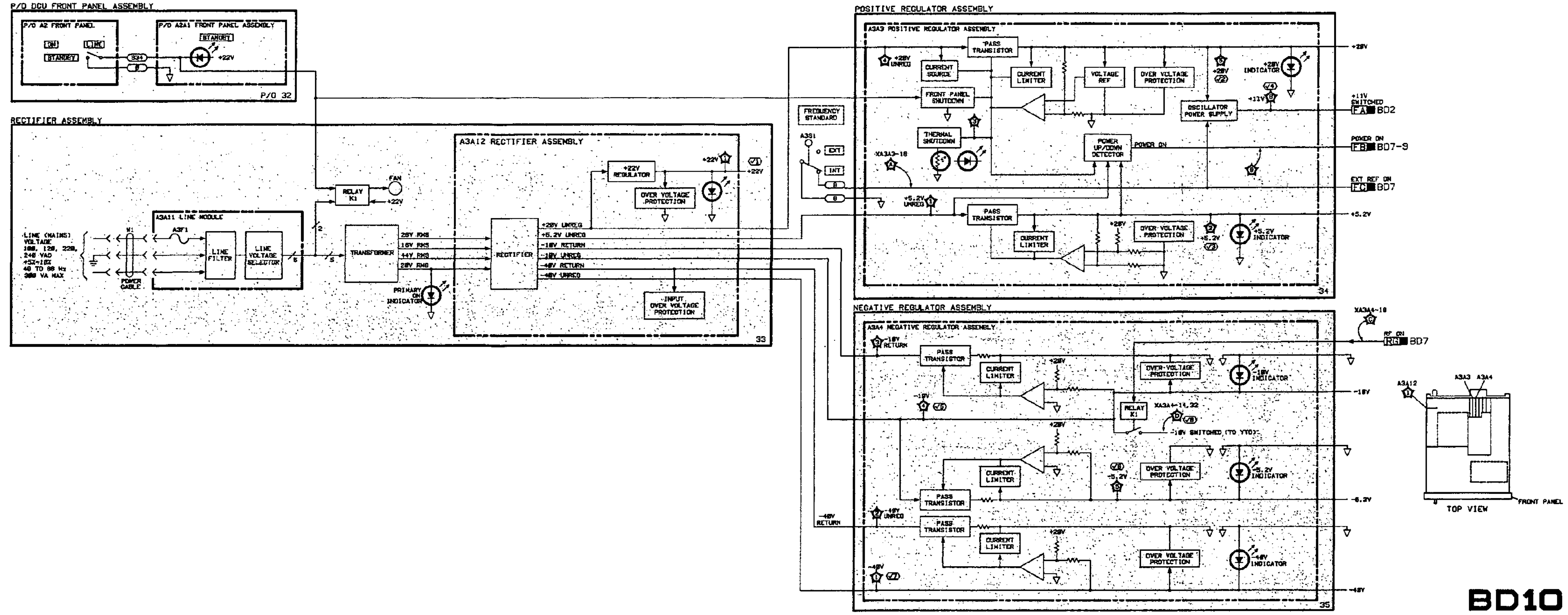
    The voltage should drop from +5 volts to zero volts when A3A3TP2 is grounded.

    If the indication is correct, there is a problem with the switch or associated components on A1A11 Digital Processor Assembly. Go to service sheet 19 to isolate the problem.

    If the indication is not correct, there is a problem with the Power Up/Down Detector on Positive Regulator A3A3. Go to service sheet 34 to isolate the problem.

BD10

Power Supply
Block Diagram
SERVICE SHEET



BD10

Figure 8-49. Power Supply Block Diagram
8-183/8-184

Service Sheet 1 Reference Phase Detector Assembly

References

Principles of Operation

General

The Reference Phase Locked Loop Phase Detector is part of the Time Base Reference. It contains Reference Oscillator A3A8 and Reference Phase Detector A3A1A1. The Reference Oscillator is the master frequency reference for the Signal Generator. The Reference Phase Detector is used to phase lock the output of a 100 MHz Voltage Controlled Crystal Oscillator (VCXO) to the output of the Reference Oscillator in order to generate the 10, 20, and 400 MHz reference frequencies required by the Signal Generator.

The Reference Phase detector divides the input from the 100 MHz VCXO down to 10 MHz and compares this 10 MHz frequency to the output of the 10 MHz Reference Oscillator. Any difference between the two frequencies will change the TUNE VOLTAGE signal to keep the two 10 MHz frequencies equal by tuning the 100 MHz VCXO. The 10 and 20 MHz reference frequency outputs are derived from the 100 MHz VCXO using frequency division.

A3A8 10 MHz Reference Oscillator

The following discussion refers to the schematic diagram of service sheet 1. The Reference Oscillator is a highly stable, temperature controlled, crystal oscillator. Its operating temperature is controlled by an internal heater control unit. The heater control unit, and the heater it controls, are powered by the +22 volt regulator that is on any time the Signal Generator is connected to the power mains. The crystal oscillator is powered by the +11 volt switched supply which is controlled by the rear panel INT/EXT switch.

A3A1A1 Reference Phase Detector Assembly

The Reference Phase Detector Assembly compares the output frequencies of the VCXO and the Reference Oscillator and generates a TUNE VOLTAGE output to fine tune the VCXO. The output of the 10 MHz Reference Oscillator is applied to a Limiting Amplifier consisting of a differential input stage followed by a voltage follower stage. The Limiting Amplifier is powered by an on board +5V Regulator. This isolates the Limiting Amplifier from any transients that may be on the +5.2 volt power supply.

The output of the Limiting Amplifier is a sine wave at TTL levels. This signal is applied to a Pulse Generator consisting of U2A, U2B, U2C and U2D. The Pulse Generator converts the sine wave to a series of narrow pulses that are buffered by the Buffer Amplifier to provide sufficient drive for the two sampling circuits, Phase Lock Sampler and Lock Indicator Sampler.

The second input to the Phase Lock Sampler is a 10 MHz frequency derived from the 100 MHz frequency output of the 100 MHz VCXO. The 100 MHz frequency is divided by 10 in U3A and U3B then phase shifted 45 degrees by Q1 and associated components. The phase shifting of the divided frequency ensures that the two inputs to the Phase Lock Sampler have the proper phase relationship.

The output of the Phase Lock Sampler is applied to the Integrating Amplifier consisting of Q4, Q5, and Q6. This circuit changes the TUNE VOLTAGE based on the error voltage produced by the Phase Lock Sampler circuit. The Tune Voltage is applied to the 100 MHz VCXO to tune the 100 MHz output so that the two 10 MHz frequencies present at the input to the Phase Lock Sampler are equal in frequency.

The second sampler, the Lock Indicator Sampler, outputs zero volts when the Reference loop is phase locked and a positive voltage when phase lock is lost. Phase Lock Detector U5 compares the output of the Lock Indicator Sampler to a −0.4 volt reference and outputs a negative voltage when the loop is phase locked and a positive voltage when it is unlocked. Zener diode VR1 clamps the output voltage swing of U5 to −0.7 volts and +4.6 volts.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD2 was used to isolate a malfunction to the Reference Phase Detector Assembly. The following information allows further isolation to the defective component on service sheet 1.

Equipment

Oscilloscope...................... HP 1980B
Digital Voltmeter (DVM).......... HP 3455A or HP 3456A

Procedures

The following procedures are divided into the following sections:

- Phase Lock Detector
- VCXO Divider and Buffers
- Phase Lock Chain

The procedures in the Phase Lock Detector section should be used if the Reference Loop seems to be phase locked but the REF phase lock indicator on A2A7 is off. The procedures in the VCXO Divider and Buffers section should be used if the Reference Loop is phase locked but the 10 MHz and/or 20 MHz frequency reference(s) are incorrect. If the Reference Phase Locked Loop is not phase locked, use the procedures in the Phase Lock Chain section.

Phase Lock Detector.

1. Connect the DVM to the negative terminal of C13 (same as U5 pin 3) and observe the DVM reading.

   The DVM should read approximately −1.3 volts.

   If the DVM indication is correct, check U5 and associated components.

   If the DVM indication is not correct, proceed with step 2.

2. Connect the oscilloscope probe to the collector (case) of Q2. Verify that the signal observed is 10 MHz (100 ns period) with a peak-to-peak amplitude of 2.9 volts.

   If the signal is correct, check CR5, CR6 and associated components.

   If the signal is not correct, check Q2 and associated components.

VCXO Driver and Buffers. For problems with the 20 MHz reference, proceed with step 3. For problems with the 10 MHz reference proceed with step 4.

3. Connect the oscilloscope probe to U3 pin 2. Verify that the signal is 20 MHz (50 ns period) with a peak-to-peak amplitude of 1.9 volts.

   If the signal is correct, check U4B and associated components.

   If the signal is not correct, U3 is defective.

4. Connect the oscilloscope probe to U3 pin 15 and verify that the signal is 10 MHz (100 ns period) with a peak-to-peak amplitude of 1.0 volt.

   If the signal is correct, check the appropriate section of U4 and associated components.

   If the signal is not correct, U3 is defective.

Phase Lock Chain.

5. Connect the oscilloscope to A3A1A1TP1 and observe the display

   The display should be as shown on service sheet 1 for A3A1A1TP1.

   If the display is correct, proceed with step 7.

   If the display is not correct, proceed with step 6.

6. Connect the oscilloscope probe to U1 pin 7 and verify that the signal is 10 MHz (100 ns period) with a peak-to-peak amplitude of 2.5 volts.

   If the signal is correct, check U2 and associated components.

If the signal is not correct, check U1 and associated components.

7. Connect the oscilloscope probe to the collector (case) of Q1 and verify that the signal is 10 MHz (100 ns period) with a peak-to-peak amplitude of 2.8 volts.

   If the signal is correct, proceed with step 9.

   If the signal is not correct, proceed with step 8.

8. Connect the oscilloscope probe to U3 pin 14 and verify that the signal is 10 MHz (100 ns period) with a peak-to-peak amplitude of 1.0 volts.

   If the signal is correct, check Q1 and associated components.

   If the signal is not correct, U3 is defective.

9. Connect the DVM to Q4 pin 3 and verify that the dc voltage is 0 volt.

   If the voltage is correct, check Q4, Q5, Q6, and associated components.

   If the voltage is not correct, check CR3, CR4 and associated components.

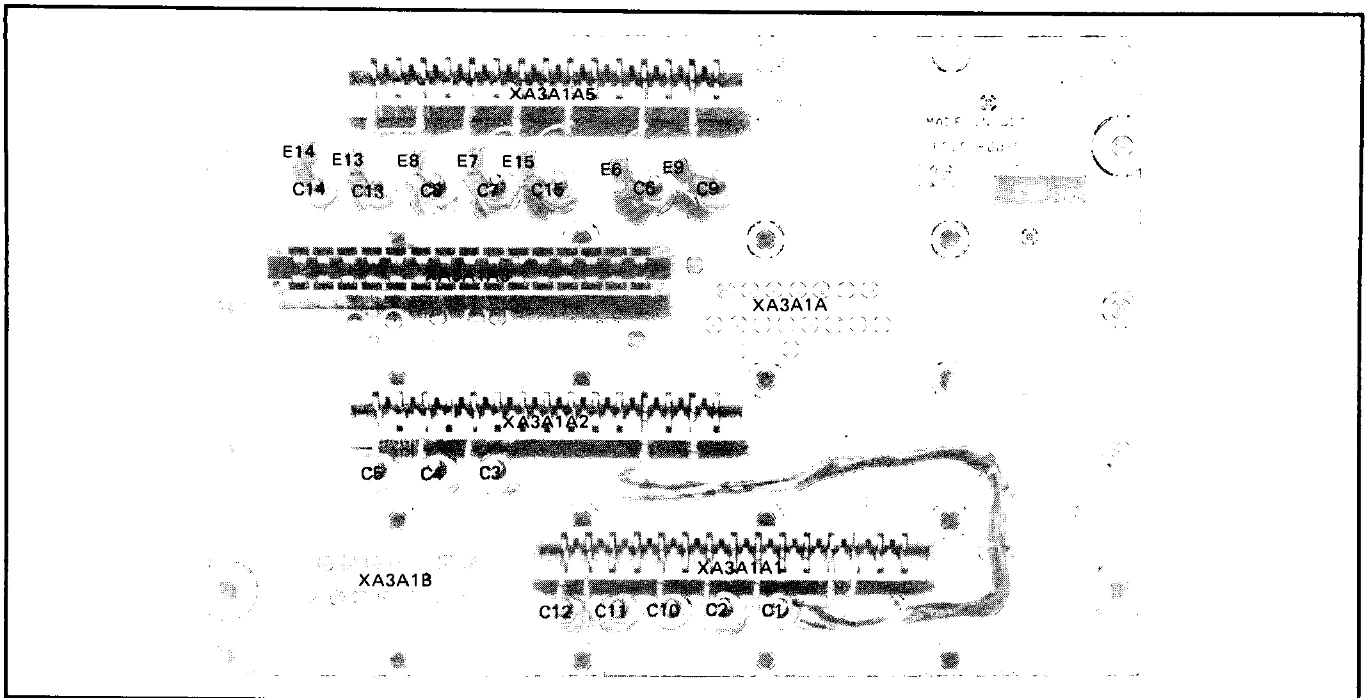
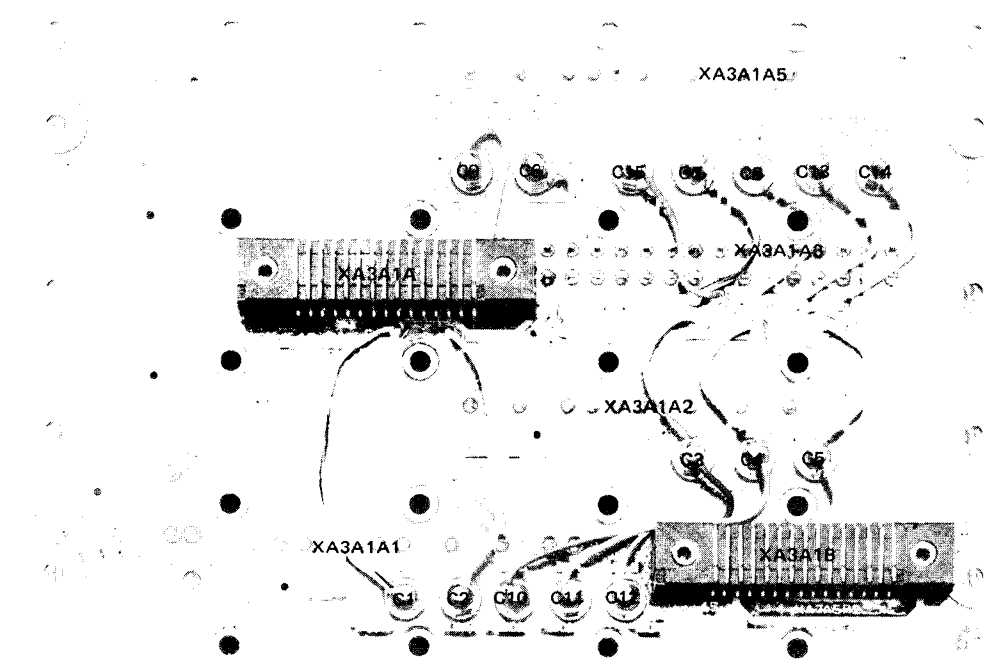


Figure 50a. A3A16 Reference and M/N Motherboard Assembly Component Locations (Top View)



CONVERT REFERENCE DESIGNATORS ON A3A1A6 AS FOLLOWS:

A7A1 to A3A1A1	A7A5 to A3A1A6	XA7A3 to XA3A1A3	XA7A5P2 to XA3A1B
A7A2 to A3A1A2	XA7A1 to XA3A1A1	XA7A4 to XA3A1A5	HULR to REF FLAG
A7A3 to A3A1A3	XA7A2 to XA3A1A2	XA7A5P1 to XA3A1A	E29 to E15
A7A4 to A3A1A5			

Figure 50b. A3A1A6 Reference and M/N Motherboard Assembly Component Locations (Bottom View)

A3A1A1 ASSEMBLY

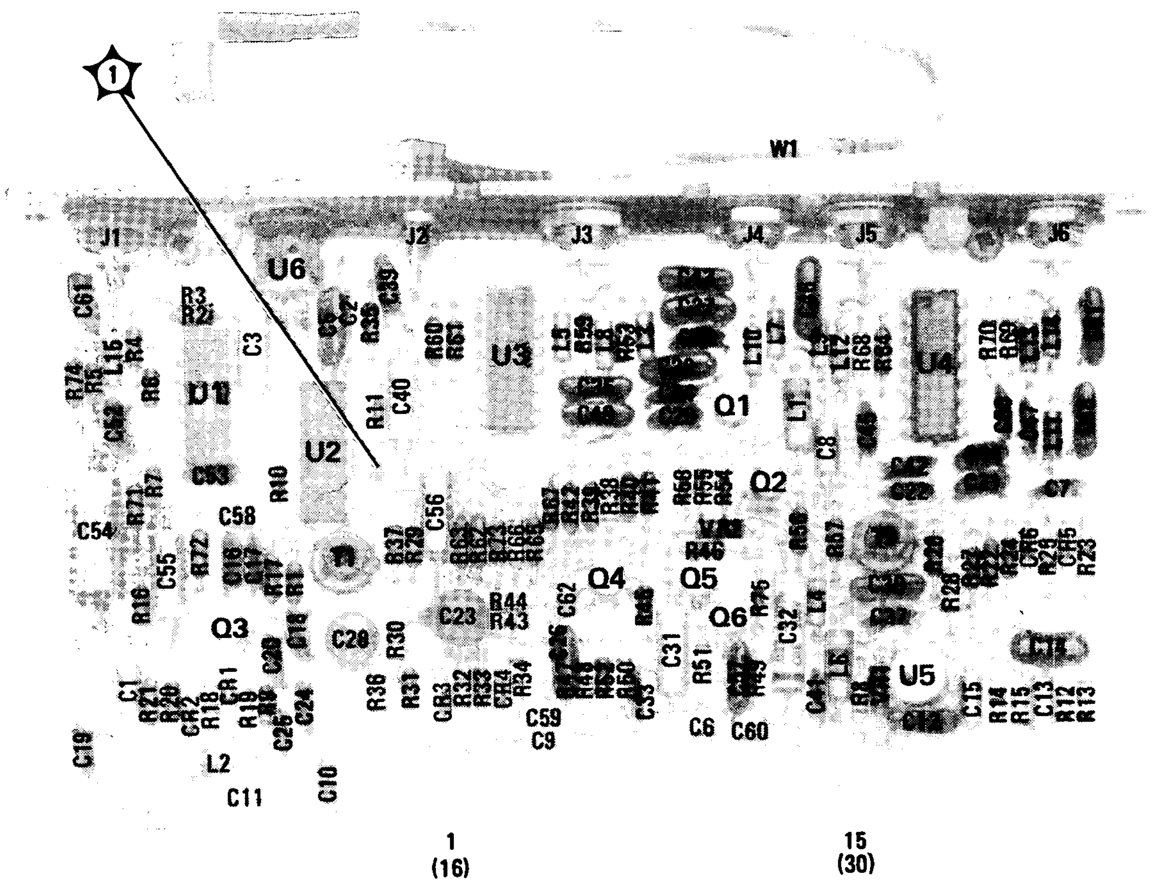
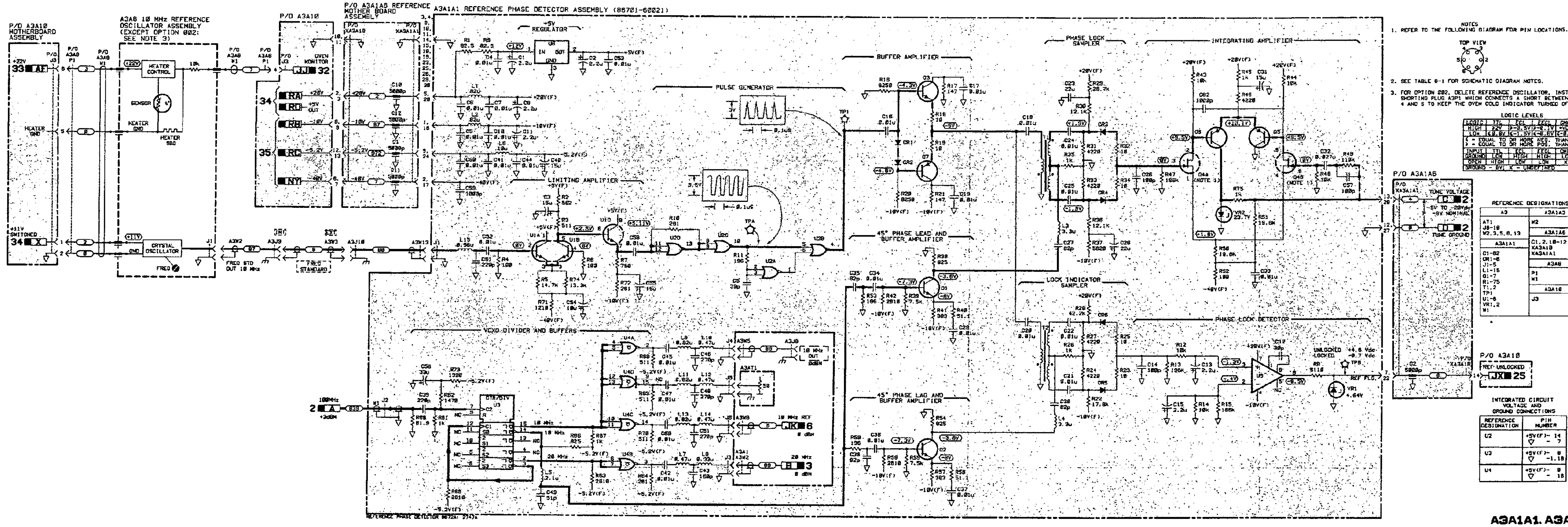


Figure 8-51. A3A1A1 Reference Phase Detector Assembly Component and Test Point Locations

1

Reference Phase Detector
Assembly A3A1A1
Schematic Diagram
SERVICE SHEET



1

A3A1A1, A3A8

Figure 8-52. Reference Phase Detector Assembly Schematic Diagram

Service Sheet 2 100 MHz VCXO Assembly

References

Overall Block Diagram	Service Sheet BD1
Time Base Reference Block Diagram	Service Sheet BD2
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB) . .	Chapter 6
Post Repair Adjustments	Chapter 5
After Service Safety Checks	Chapter 8 (Front)

Principles of Operation

General

The 100 MHz VCXO Assembly, A3A1A2, is part of the Time Base Reference. It generates a 100 MHz signal that is phase locked to the 10 MHz internal (or 5 or 10 MHz external) reference signal by circuitry on Reference Phase Detector Assembly A3A1A1. The stable 100 MHz signal thus produced is multiplied by four and routed to M/N Output Assembly A3A1A5. The 100 MHz signal is also available at rear panel connector A3J7.

Detailed Discussion

100 MHz Oscillator. The heart of the Time Base Reference Phase Locked Loop is the 100 MHz voltage controlled crystal oscillator (VCXO). Crystal Y1, that controls the frequency, and varactor diode CR1, that allows a small deviation, are both found in the VCXO's feedback path. Some degree of manual frequency control is provided by C4. Diodes CR3 and CR4 limit the VCXO's output to ±0.4 volts peak.

The output of the oscillator is buffered by 100 MHz Buffer Q9, Q8 and Q11. One output of the buffer is routed back to the A3A1A1 Assembly where it is sampled by the phase detector circuits. The other output of the buffer is applied to power splitter T1. One output of the splitter is routed through 100 MHz Amplifier Q6 to rear panel output connector A3J7. The other output goes to the Quadrupler.

Quadrupler. The Quadrupler is a Class C push-push amplifier. The output approximates a pulse and is rich in even harmonics. The 400 MHz Amplifier that follows the Quadrupler is tuned to, and therefore amplifies the 400 MHz output of the Quadrupler. The output level to the M/N Loop is critical and is set by selecting the values of R67, R68, and R69.

Troubleshooting

General

It is assumed that the troubleshooting information associated with service sheets BD1 and BD2 have been used to isolate a problem to the 100 MHz VCXO Assembly. The following procedures can be used to further isolate the problem to the defective component.

Equipment

Frequency Counter	HP 5340A or HP 5343A
Variable Power Supply	HP 6200B
Digital Voltmeter	HP 3455A or HP 3456A
Oscilloscope	HP 1980B

Procedures

There are two troubleshooting procedures. The first isolates a malfunction to either the 100 MHz Oscillator or the 100 MHz Buffer. The second isolates a malfunction to elements of the Quadrupler.

100 MHz Amplifier. There is only one active component in the 100 MHz Amplifier. Therefore, if the procedures in BD2 indicate a problem with this amplifier, check Q6 and associated components.

100 MHz Oscillator/100 MHz Buffer.

1. If it has not already been done, remove A3A1A1 and set the power supply to 8 volts.
2. Remove A3A1A2 and replace it on a 30-pin extender board, connect the negative lead of the power supply to TP1 TUNE test point and the positive lead to chassis ground.
3. Connect the Oscilloscope to the cathode of CR4. The display should show a 100 ±1 MHz sine wave at a peak-to-peak amplitude of 1.6 volt.

   If the display is as indicated, check Q8, Q9, and associated components.

   If the display is not as indicated, check Q5 and associated components.

Quadrupler.

1. If it has not already been done, repeat steps 1 and 2 above.
2. Connect the oscilloscope to the collector of Q7.

   The display should show a 100 ±1 MHz sine wave at a peak-to-peak amplitude of 2.5 volts.

   If the display is as indicated, proceed with step 3.

   If the display is not as indicated, check Q7 and associated components.
3. Connect the oscillscope to the collector of Q3.

The display should show a 100 ±1 MHz signal at a peak-to-peak amplitude of 150 mV.

If the signal is as indicated, check Q1, Q2, and associated components.

If the signal is not as indicated, check Q3, Q4, and associated components.

2

100 MHz VCXO Assembly
Schematic Diagram
SERVICE SHEET

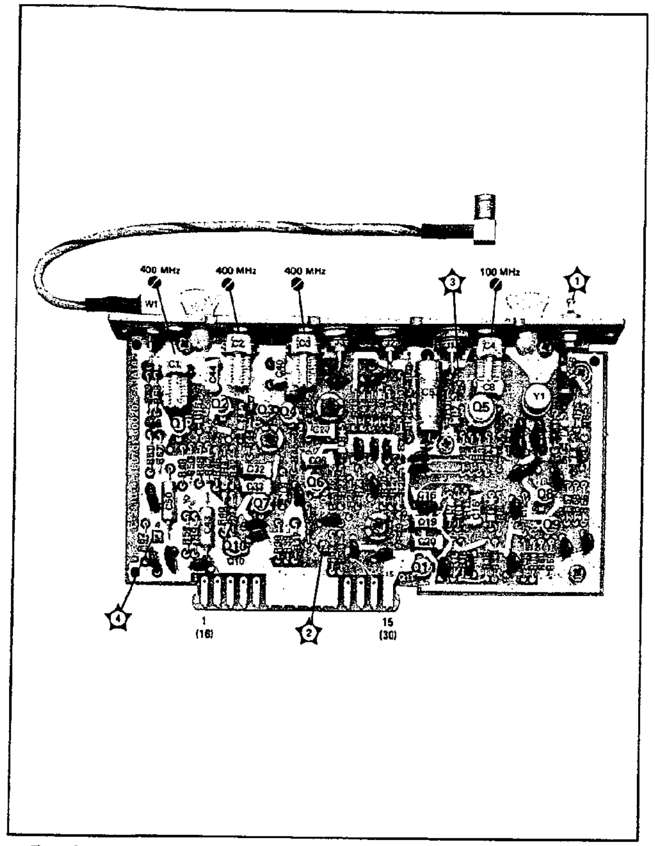
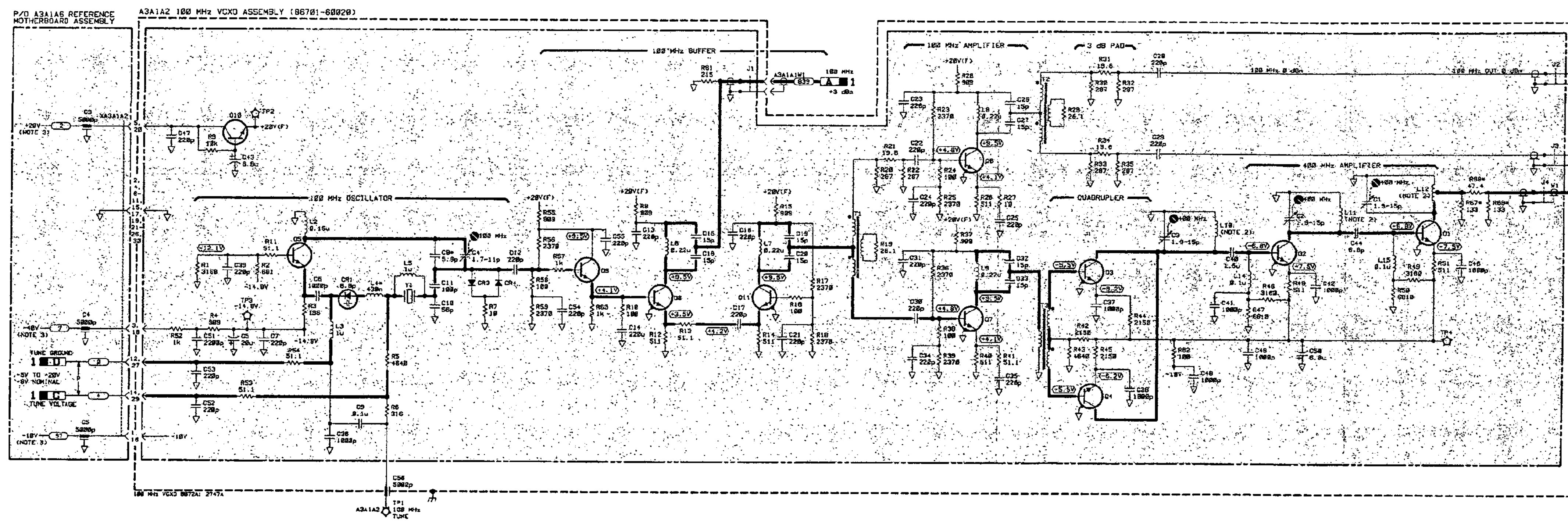


Figure 8-53. A3A1A2 100 MHz VCXO Assembly Component Adjustment and Test Point Locations



NOTES

1. SEE TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
2. A3A1A2L10-12 ARE PART OF CIRCUIT BOARD AND ARE NOT REPLACEABLE.
3. POWER SUPPLY CONNECTIONS TO THE A3A1 ASSEMBLY ARE SHOWN ON SERVICE SHEET 1.

* ASTERISK INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.

REFERENCE DESIGNATIONS

A3	A3A1A2
AT2 J7 W7	C1-44, C46-50 CR1,3,4 J1-4 L1-12,14,15 Q1-11 R1-62,67-69 T1-3 TP1-4 W1 Y1
A3A1A1	A3A1A6
W1	C3-5 XA3A1A2

NOT ASSIGNED: A3A1A2C41

2
A3A1A2

Figure 8-54. 100 MHz VCXO Assembly

Service Sheet 3 M/N Phase Detector Assembly

References

Overall Block Diagram	Service Sheet BD1
RF Phase Locked Loops Block Diagram	Service Sheet BD3
Electrostatic Discharge (ESD) Precautions	Chapter 8 (Front)
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5
After Service Safety Checks	Chapter 8 (Front)

Principles of Operation

General

The frequency output of the M/N Phase Locked Loop is dependent on the front panel frequency. A digital equivalent of the M/N frequency (dependent upon the front panel frequency's most significant digits, 10 MHz to 10 GHz) is input to the M/N Phase Locked Loop as M and N numbers. The ratio of the M and N numbers actually determine the M/N OUT frequency. The M/N OUT frequency's Nth harmonic (based on the N number and selected by the YTO pretuning) tunes the YTO frequency in 10 MHz steps. There is a 10 MHz step (or band) for each valid M/N OUT frequency (M/N ratio) and Nth harmonic (N number). This 10 MHz band complements the LFS Phase Locked Loop because its tuning range is 10 MHz and step size is 1 kHz. Together, the M/N Phase Locked Loop, YTO pretuning and LFS Phase Locked Loop are able to tune the YTO from 2000.000 to 6199.999 MHz in 1 kHz steps. The YTO frequency is the front panel frequency divided by the band number. See service sheet BD1 for a list of band numbers and corresponding frequencies.

The M/N Phase Locked Loop provides a tunable phase locked reference signal for the YIG Tuned Oscillator (the microwave signal source). The M/N OUT frequency (177.5 to 197.5 MHz) is obtained by dividing the M/N VCO signal (355—395 MHz) by two. The M/N IF signal (5—45 MHz) is the lower mixing sideband of the VCO signal and the 400 MHz reference. The M/N Phase Locked Loop is phase locked by comparing a fraction of 20 MHz (20 MHz divided by the N number) to a fraction of the IF signal (5 — 45 MHz divided by the M number) in the phase detector. The phase detector generates an error signal that is integrated and coupled to the VCO as a tuning signal. The M and N numbers are determined by the Digital Control Unit and vary with the 10 MHz steps of the YTO frequency. The M/N OUT frequency is dependent on the ratio of the M and N numbers as expressed in the following formula:

$$f_{M/N} = [200 - 10\,(M/N)]\ \text{MHz}$$

where

$f_{M/N}$ = M/N OUT frequency
M = M number
N = N number

To determine M (M varies from 8 to 27):

If the 100 MHz digit of the YTO Frequency is even then M = 17 −10 MHz digit.

If the 100 MHz digit is odd then M = 27 −10 MHz digit.

To determine N (N varies from 11 to 32):

Divide the left two (most significant) digits of the YTO Frequency by 2.

Add 1 to the result and round up if necessary to the nearest integer.

For example, if the ratio is 1-to-1 (M = N) then $f_{M/N}$ = 190.000 MHz. If the ratio is 1-to-2 (M = 2N) the $f_{M/N}$ = 195.000 MHz. Refer to table 8-8 in service sheet BD3, "Principles of Operation" for a complete list of M and N Numbers and Resulting Frequencies.

Detailed Discussion

M and N Dividers. The Phase Detector Assembly's M and N Dividers are essentially identical in operation. In each case the input frequency is divided by a divide number, an M or N number respectively (binary coded numbers input from the A2 Digital Control Unit). The resulting output pulses are phase compared to produce an error voltage which tunes the M/N VCO. The following formulas show the frequency relationship of the inputs and outputs of the dividers:

$f_N = (4/N)20$ 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 number
M = M 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 is a programmable, variable divider clocked by the 20 MHz reference signal. The N divider loads the 4 most significant bits (MSB's) of the N number, counts down from this loaded binary value as it is clocked, and outputs a pulse when it finishes the countdown. It then reloads the 4 MSB of the N number and repeats the process 3 times to count through a number of clock pulses equal to the N number.

The N divider outputs, then, exactly 4 pulses for a given N number, one at the end of each count down cycle. The number of clock pulses in each of the 4 count down cycles can be determined by dividing the N number by 4 and adding an additional clock pulse to as many as 3 of the 4 count down cycles, one for each unit in the remainder. The divide number for each count cycle is equal to the number of pulses in that cycle. For example, if $N = 16$, then $N/4 = 16/4 = 4$ with a remainder of $R=0$. An output pulse occurs every 4 clock pulses. As a second example, if $N = 30$, then $N/4 = 30/4 = 7$ with a remainder of $R = 2$. Two output pulses occur (1 every 7 clock pulses) and 2 more occur (1 every 8 clock pulses).

The N divider circuit determines the number of pulses in each of the 4 count down cycles by loading the 4 MSB of the N number and by counting down to either 0001 or 0000 before outputing a pulse. The binary value of the 4 MSB can range from 0010 to 1000 (for $N = 11$ and $N = 32$ respectively). If the N number is evenly divisible by 4, the circuit counts down to binary 0001 four times and all 4 count cyles have the same number of pulses equal to the decimal value of the 4 MSB. If the N number is not evenly divisible by 4, the circuit is forced to count down an additional clock pulse to 0000 for as many as 3 out of the 4 count cycles, once for each unit in the remainder. In this case, of course, at least 1 count cycle will have a number of pulses equal to the decimal value of the 4 MSB and from 1 to 3 count cycles will have 1 additional clock pulse.

For N numbers 11 through 15, a special circuit within the N Divider will divide the N Divider output by 2.

a. **Counting Operation and Control.** Refer to the schematic diagram, figure 8-54 and table 8-26. The N divider counter circuit includes the Programmable Down Counter (U6), the End-of-Count Decoder (U9A,B), the Count Control flip-flop (U4B), and the increment line, TP3.

   U6 is a binary presettable counter. It loads the 4 MSB of the N number, programmming lines N3 through N6, on the positive edge of the clock pulse (U6 pin 13) when U6 pin 9 is low. Having been low for most of the previous clock pulse, pin 9 remains low for only a fraction of the clock pulse during which U6 reloads and then goes high, enabling U6 to count down. U6 begins to count down on the following clock pulse.

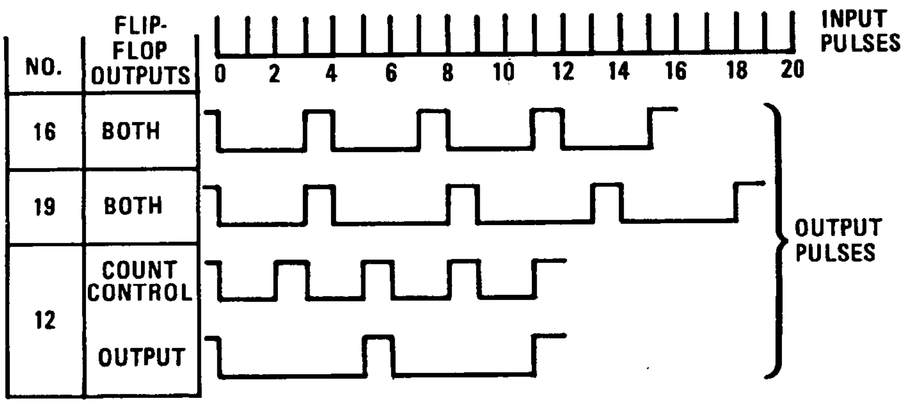


Figure 8-55. Divider Operation Timing Diagram

Table 8-26. Divider Operation

N	Input-Clock Pulses by Clock Cycle 1 2 3 4	Operation	Counter Output	End-Of-Count Decoder	Flip-Flops Count Control Pin 15	Flip-Flops Count Control Pin 14	Flip-Flops Output
16	0,4, 8,12	Load Counter	0100	Inactive	Low	High	Low
	1,5, 9,13	Minus 1	0011	Inactive	Low	High	Low
	2,6,10,14	Minus 1	0010	Active	Low	High	Low
	3,7,11,15	Minus 1	0001	Inactive	High	Low	High
19	0,4, 9,14	Load Counter	0100	Inactive	Low	High	Low
	1,5,10,15	Minus 1	0011	Inactive	Low	High	Low
	2,6,11,16	Minus 1	0010	Inactive[1]	Low	High	Low
	3,7,12,17	Minus 1	0001	Active[2]	Low	High	Low
	1,8,13,18	Minus 1	0000	Inactive	High	Low	High
12	0,3, 6, 9	Load Counter	0011	Inactive	Low	High	Low
	1,4, 7,10	Minus 1	0010	Active	Low	High	Low
	2,5, 8,11	Minus 1	0001	Inactive	High	Low	High

[1] Active for clock-pulse 2 only.
[2] Inactive for clock-pulse 3 only.
[3] High for clock-pulse 3 only.
[4] For N<16, the Output Flip-Flop goes high every other time the Counter Control Flip-Flop goes high.

The End-of-Count Decoder decodes the end of count by producing a high at U9A pin 3 or U9B pin 14. If the increment line (TP3) is low, U9B produces the high at pin 14 when the programmmable counter binary output is 0010 (U6 pins 3,2, 15 and 14 respectively). If the increment line (TP3) is high, U9A produces the high at pin 3 when the programmable counter binary output is 0001.

Count Control U4B receives the high at pin 10 and, at the next clock pulse (U4B pin 11), U4B outputs a high at pin 15. This high inhibits the End-of-Count Decoder, causes the Divider U10A to toggle (that is to divide by 2) and Divider U10B to toggle off the output of U10A (that is to divide by 4).

At the same time that U4B pin 15 goes high, U4B pin 14 goes low, enabling the Programmable Down Counter to reload. Since U4A and U4B are simultaneously clocked and U9A (or U9B, depending on the logical state of the increment line) simultaneously outputs both the end-of-count high and the N-divider output low (inverted by U7C or U7D), the outputs of U4A pin 2 and U4B pin 15 are identical for all N numbers >=16. (For all N numbers <16 the output of U4A pin 2 is half that for U4B pin 15. See item *c* "Divide-by-1 or 2 Operation", below)

U4A, then, passes the N divider output high to the Phase/Frequency Detector (U1 pin 6) on the last clock pulse of the count cycle. Thus ends the first count cycle, which will be repeated 3 times to complete the 4 cycle count sequence for a given N number. If the N number remains unchanged, this 4 cycle count sequence will, itself, be repeated until the instrument is turned off.

b. **Increment Decoder Operation.** The Increment Decoder includes the divide-by-2 flip-flop (U10A), the divide-by-4 flip-flop (U10B) and logical gates U12A,B,C and D. The Increment Decoder increments by outputing a logical high at TP3. The end-of-count high at U10 pin 9 (always output by U4B on the last clock pulse of the count cycle) causes the divider output U10A pins 2 and 3 and U10B pin 15 to vary together as follow: LHL, HLH, LHH and HLL respectively. These outputs and the possible combinations of the 2 binary least significant bits (LSB's), N1 and N2, appear as inputs to U12B, C and D. They produce the Increment Decoder output at TP3, as shown in table 8-27. It is obvious from this table that, if N1=N2=0 (that is if the N number is evenly divisible by 4), there will not be an increment because there will not be a logical high at TP3. Increments occur only for N numbers not evenly divisible by 4.

c. **Divide-by-1 or 2 Operation.** The Divide-by-1 or 2 Decoder circuit consists of U7A, C and D. It divides by 1 for all N numbers >=16 and by 2 for all N numbers <16.

U7C and U7D divide their respective N divider output lows from U9A and U9B by 1 when U7A outputs a low. U7A, a NOR gate, outputs a low only when at least one of its inputs is a high. This occurs when the binary N5 + N6 input is high (that is when the N number is >=16). U7C or U7D then passes the N divider output directly to U4A and the outputs of U4A pin 2 and U4B pin 15 are identical and simultaneous.

U7C and U7D block the N divider output to U4A when U7A outputs a high. This occurs when the N number is <16 on the last clock pulse of every other count cycle when the divide-by-2 output of U10A pin 2 alternates to a low. When U10A pin 2 alternates to a high, U7C and U7D again pass the output signal. Thus U7C and U7D effectively divide the N divider output by two and the output of U4A is half that of U4B. Refer to table 8-26 and figure 8-55.

Table 8-27. Increment Decoder Operation

Increment Decoder Control Inputs		Increment Decoder Output Sequence at TP3*			
		Count Cycle No.			
N2	N1	1 LHL	2 HLH	3 LHH	4 HLL
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 LHL, HLH, LHH< HLL (U10A-2, -3 and U10-15 respectively).

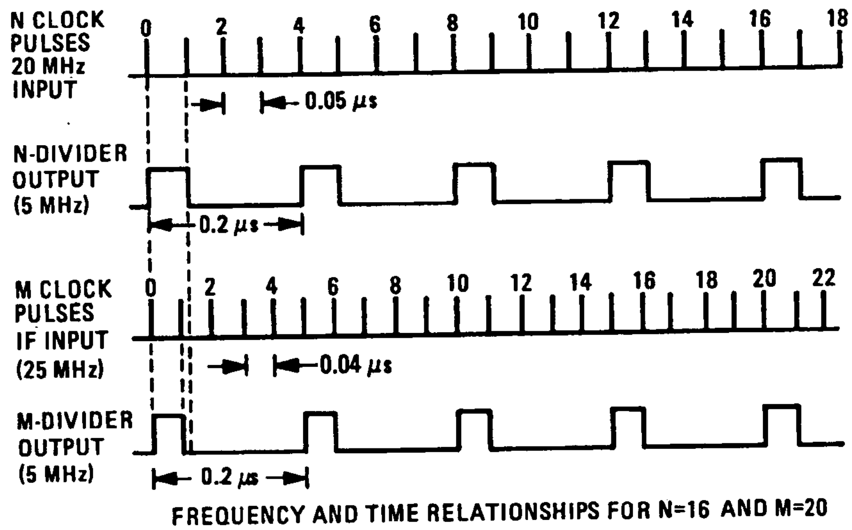


Figure 8-56. Divider Clock Pulses vs. Output Pulses Timing Diagram

The Divide-by-1 or 2 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 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 both the M and N Divider Outputs is halved for N<16.

Phase/Frequency Detector

The output of the M and N dividers are fed to the Phase/Frequency Detector, U1. When the M/N loop is unlocked and all three inputs to the M/N Phase Detector are connected (the zero dBm 355—395 MHz input signal must be substituted) the following occurs: If the output frequency of the N Divider is *higher* than that of the M Divider, a positive pulse riding on −1.7 Vdc appears at U1 pin 3 and U1 pin 12 remains at −0.8 Vdc. If the output frequency of the N Divider is *lower* than that of the M Divider, the reverse occurs: a positive pulse riding on −1.7 Vdc appears at U1 pin 12 and U1 pin 3 remains at −0.8 Vdc. When the M/N loop is locked, negative pulses (maximum 1V) appear at both pins 3 and 12 of U1 and their dc levels are virtually equal (−0.8 Vdc). The pulse width of the output pulses is a measure of the phase or frequency difference between inputs at U1 pin 6 and U1 pin 9.

Differential Pre-amplifier

Q1 and Q2 form a low-noise differential pre-amplifier whose inputs are the bases of Q1 and Q2. When the loop is locked, both its collector outputs, VCO TUNE (+) and VCO TUNE (−), are approximately −5 volts. When the loop is unlocked, these outputs swing oppositely to each other from −1 to −8.5 volts.

Phase Unlock Detector

The collector outputs of Q1 and Q2 serve as inputs to the Phase Unlock Detector, U2A and U2B. Each of these dual comparators compares its respective tune line voltage to a comparison voltage of about −4.2 volts at R29. When either tune line voltage becomes less negative than the comparison voltage, the M/N loop unlocks, causing the tune lines to swing oppositely to their extremes (−1.8 Vdc and −8.5 Vdc). The tune line that swings least negative causes its corresponding Phase Unlock Detector output (U2A pin 1 or U2B pin 7) to go high (+18.5 Vdc). The Phase Unlock Detector output corresponding to the tune line that swings most negative remains unchanged (−7.4 Vdc).

Mixer

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

The 50 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.

Troubleshooting

It is assumed that the troubleshooting information associated with Service Sheets BD1 and BD3 was used to isolate a malfunction to the M/N Phase Locked Loop. The following procedures can be used to further isolate a malfunction to the defective component.

Equipment

Frequency Counter	HP 5340A or HP5343A
Digital Voltmeter	HP 3455A or HP3456A
Logic Pulser	HP546A
Oscilloscope	HP1980B
Signal Generator	HP 8340A or HP8640B

Procedure

IF Output Check.

1. Leave the grey/red/white (829) 400 MHz cable, A3A1A2W1, connected to A3A1A3J1 and the grey/white cable (89) 20 MHz cable, A3A1A1W2, connected to A3A1A1J3.
2. Disconnect the white/red (92) 355-395 MHz cable, A3A1A3W1, from A3A1A5J1.

3. Set the low frequency signal generator to 355 MHz and zero dBm.
4. Connect the low frequency signal generator output to the 355-395 MHz cable.
5. Connect a frequency counter to U18B pin 3 (use the pin 3 end of R30).
6. Slowly tune the low frequency signal generator from 355 to 395 MHz while verifying that the frequency counter reading goes from 45 to 5 MHz.

   If the frequency counter reading is correct, verify that the IF sine wave amplitude at U18 pin 3 is >= 0.5 V_{pp} and go to step 8.

   If the frequency counter reading is incorrect, continue with step 7 to troubleshoot the Mixer and IF Amplifier.
7. Connect the frequency counter to the base of Q4 and repeat step 6. Expect the IF sine wave at the base of Q4 to be a minimum of 20 mV_{pp}. If necessary, verify that the Mixer inputs are reaching the Mixer, U24. Replace the defective parts and reconnect the 355—395 MHz cable to A3A1A5J1. Then go to step 8.

M/N Locked Loop Check.

8. Press PRESET (3 GHz).
9. Observe the M/N phase lock indicator on A2A7. The LED should be on.

   If the LED is on, perform the next two steps only, to confirm correct operation.

   If the LED is not on, continue with this procedure until the defective components have been replaced.
10. Connect the 10 MHz output from the frequency counter to the external reference input on the Signal Generator. Then connect the frequency counter input to the M/N output A3A1A5J3. The frequency should be 189.375 000 MHz.
11. Check the following frequencies (the extremes of the M/N Phase Locked Loop):

RF Output Frequency	M/N Loop Output
2100 MHz	177.500 000 MHz
6090 MHz	197.419 355 MHz

   If the frequencies are correct, the M/N VCO has adequate tuning range and is probably operating correctly. Use table 8-8 for further verification if necessary.

N Divider Check.

12. Using the oscilloscope, measure the signal at A3A1A3TP1 with the Signal Generator set to 6100 MHz. The signal should be 20 MHz divided by N/4 (N=32 at 6100 MHz) or exactly 2.50 MHz (Period = 400 ns) at ECL levels. Refer to schematic notes for definition of ECL levels.

13. Tune the Signal Generator to 2900 MHz. The signal at TP1 should be 5.0 MHz (period = 200 ns)(N=16).

14. Tune the Signal Generator to 2700 MHz. Using the frequency counter, measure the signal at TP1. It should be 2.666 667 MHz (2/N × 20 MHz; N=15).

    If steps 12,13 and 14 are correct, the N Divider is working properly and the N Decoder in the controller is operating correctly. Go to step 15.

    If steps 12,13 and 14 are not correct, proceed to step 18.

M Divider Check.

15. Disconnect both the grey/red/white (829) 400 MHz IN cable, A3A1A2W1, from A3A1A3J1 and the white/red (92) 355—395 MHz IN cable, A3A1A3W1, from A3A1A5J1. With the proper cable and easy hook, connect the 20 MHz reference signal from A3A1A1J3 to R22. (U18B converts the 20 MHz sine wave to ECL levels, which clock the M Divider at U16 pin 13.) Tune to 3010 MHz and measure the frequency at TP2. It should be 5.0 MHz (period=200 ns)(M=16).

16. Tune to 2820 MHz (M=15). The frequency at TP2 should be 2.666 667 MHz (period=375 ns).

    If steps 15 and 16 are correct, the M Divider is working properly and the M Decoder in the Digital Control Unit is operating properly. Go to step 17.

    If not, go to step 18.

17. Reconnect the 400 MHz cable, A3A1A2W1 (829), to A3A1A3J1, the 355—395 MHz cable, A3A1A3W1 (92), to A3A1A5J1, and the 20 MHz cable, A3A1A3W2 (89), to A3A1A1J3. Tune to 6090 MHz. Connect the voltmeter to A3A1A4TP1 TUNE test point. The voltage should be −35 ±0.5 Vdc. Tune to 2100 MHz. The voltage should be between −1.8 and −3.0 Vdc.

    If these voltages are correct, the Phase Detector Assembly is operating correctly. See the NOTE at the end of this section.

    If these voltages are not correct, go to step 23.

M and N Divider Logic Pulse Check.

18. The M and N Dividers are nearly identical. When clocked by the 20 MHz reference signal and the M number equals the N number, their operation and output are identical. When the N number is

<16, the M Divider always divides its output by 2, even for M numbers >=16.

Table 8-26 is written for troubleshooting the N Divider. It applies to the M Divider as well if, for all N<16 (regardless of the numerical value of M), the output of the Output flip-flop is delayed by twice the clock pulses shown. Table 8-27 applies to both dividers. To troubleshoot the Dividers perform the following steps:

19. Place the M/N Phase Detector Assembly on an extender board.
20. To perform the logic pulse check on the M Divider, disconnect the 400 MHz and 355—395 MHz cables. Using an easy hook, attach the logic pulser to R22. To pulse check the N Divider, disconnect the gray/white coaxial cable from the 20 MHz Reference. Connect the logic pulser to the gray/white cable.
21. Tune the Signal Generator to 3500 MHz (N=19) if troubleshooting the N Divider or 4980 MHz (M=19) if troubleshooting the M Divider.
22. Use the logic pulser to inject one pulse at a time. Use the Divider Operation and the Increment Decoder Operation tables to verify the proper signal at succeeding nodes until the faulty part is located.

Phase/Frequency Detector Check.

23. To troubleshoot the Phase/Frequency Detector, U1, and succeeding stages perform the following steps:
24. If both the M Divider and N Divider are working, place the M/N Phase Detector Assembly on an extender board. Reconnect the 400 MHz IN cable, A3A1A2W1 (829), to A3A1A3J1, the 355—395 MHz cable, A3A1A3W1 (92), to A3A1A5J1, and the 20 MHz cable, A3A1A3W2 (89), to A3A1A1J3.
25. Connect the oscilloscope to A3A1A3U1 pins 3 and 12. Press PRESET (3 GHz). Observe the waveforms which should be as shown in figure 8-57.

    If the waveforms are not as shown, the Phase/Frequency Detector, U1, is faulty and should be replaced.

    If the waveforms are correct, go to step 26.
26. Disconnect the 20 MHz reference input cable, A3A1A3W2 (89), from A3A1A1J3. Measure the voltages at the collectors of Q1 and Q2. The voltages should be −1.8 volts and −8.0 volts respectively.
27. Reconnect the 20 MHz reference input cable, A3A1A3W2 (89), to A3A1A1J3 and disconnect the 355—395 MHz cable, A3A1A3W1 (92), from A3A1A5J1. Measure the voltages at the collectors of Q1 and Q2 again. The voltages should be −8.0 volts and −1.8 Vdc respectively.

If the voltages in steps 26 and 27 are not correct, replace the faulty part.

Note

After repairing the A3A1A3 Assembly, perform the M/N VCO Adjustment in chapter 5.

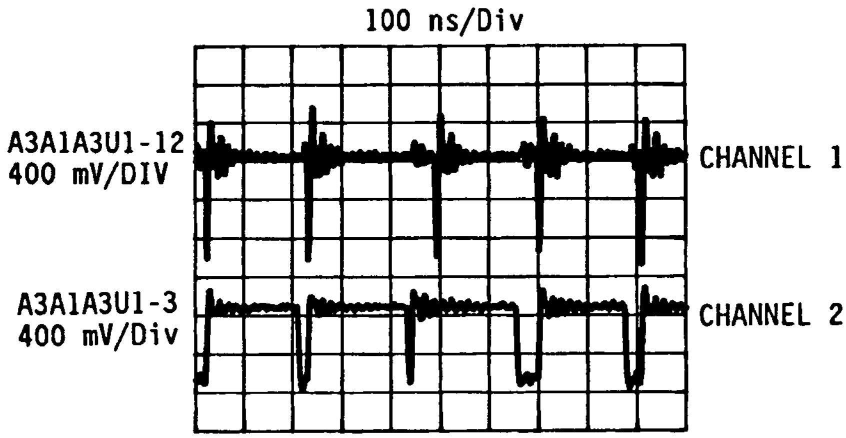
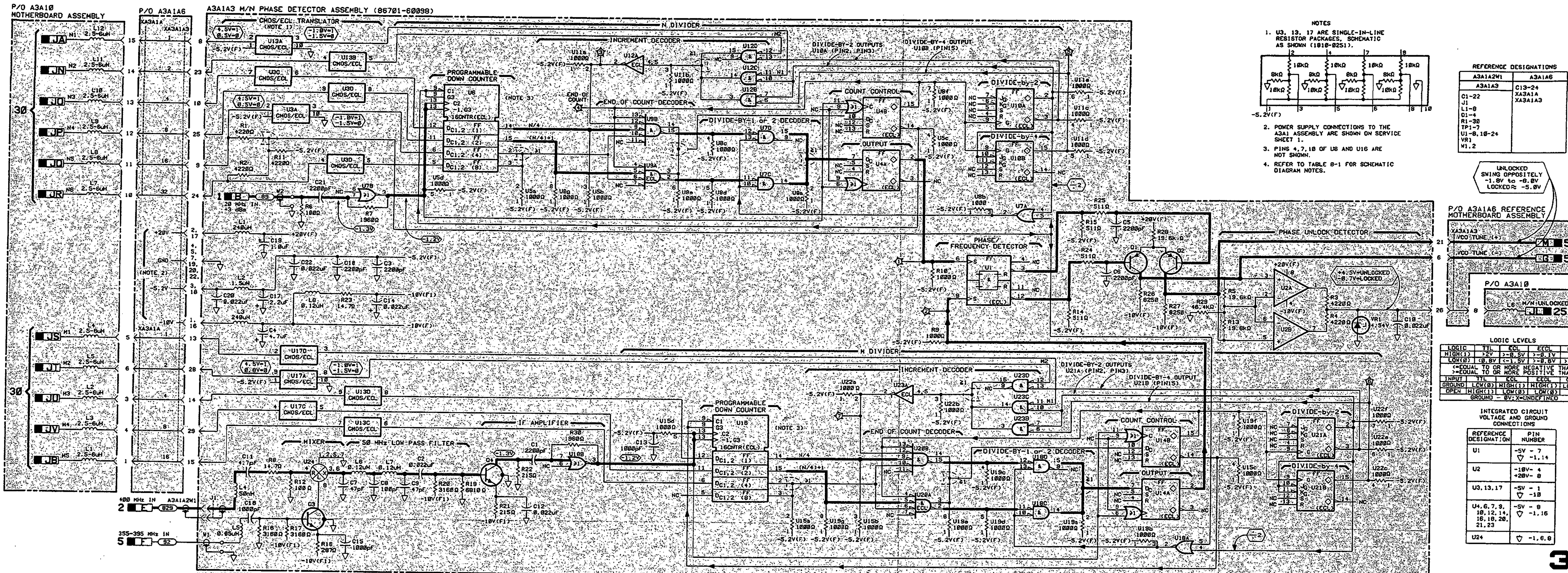


Figure 8-57. A3A1A3U1 Pins 3 and 12 Waveforms

3

M/N Phase Detector Assembly A3A1A3
Schematic Diagram
SERVICE SHEET



NOTES

1. U3, 13, 17 ARE SINGLE-IN-LINE RESISTOR PACKAGES, SCHEMATIC AS SHOWN (1810-0251).
2. POWER SUPPLY CONNECTIONS TO THE A3A1 ASSEMBLY ARE SHOWN ON SERVICE SHEET 1.
3. PINS 4,7,10 OF U6 AND U16 ARE NOT SHOWN.
4. REFER TO TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.

REFERENCE DESIGNATIONS

A3A1A2W1	A3A1A6
A3A1A3	
C1-22 J1 L1-8 Q1-4 R1-30 TP1-7 U1-8, 10-24 VR1 W1, 2	C13-24 XA3A1A XA3A1A3

LOGIC LEVELS

LOGIC	TTL	ECL	EECL	CMOS
HIGH(1)	>2V	>-0.5V	>-0.1V	VDD
LOW(0)	<0.8V	<-1.5V	>-0.8V	>0.1V

<=EQUAL TO OR MORE NEGATIVE THAN
>=EQUAL TO OR MORE POSITIVE THAN

INPUT	TTL	ECL	EECL	CMOS
GROUND	LOW(0)	HIGH(1)	HIGH(1)	LOW(0)
OPEN	HIGH(1)	LOW(0)	LOW(0)	X

GROUND – 0V; X=UNDEFINED

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATION	PIN NUMBER
U1	-5V - 7 ▽ -1, 14
U2	-10V- 4 +20V- 8
U3, 13, 17	-5V - 1 ▽ -10
U4, 6, 7, 9, 10, 12, 14, 16, 18, 20, 21, 23	-5V - 8 ▽ -1, 16
U24	▽ -1, 6, 8

3
A3A1A3

Figure 8-59. M/N Phase Detector Assemly Schematic Diagram
8-211/8-212

Service Sheet 4 M/N VCO Assembly

References

Principles of Operation

General

The frequency output of the M/N Phase Locked Loop is dependent on the front panel frequency. A digital equivalent of the M/N frequency (dependent upon the front panel frequency's most significant digits, 10 MHz to 10 GHz) is input to the M/N Phase Locked Loop as M and N numbers. The ratio of the M and N numbers actually determines the M/N OUT frequency. The M/N OUT frequency's Nth harmonic (based on the N number and selected by the YTO pretuning) tunes the YTO frequency in 10 MHz steps. There is a 10 MHz step (or band) for each valid M/N OUT frequency (M/N ratio) and Nth harmonic (N number). This 10 MHz band complements the LFS Phase Locked Loop because its tuning range is 10 MHz and step size is 1 kHz. Together, the M/N Phase Locked Loop, YTO pretuning and LFS Phase Locked Loop are able to tune the YTO from 2000.000 to 6199.999 MHz in 1 kHz steps. The YTO frequency is the front panel frequency divided by the Band Number. See Service Sheet BD1 for a list of band numbers and corresponding frequencies.

The M/N Phase Locked Loop provides a tunable phase locked reference signal for the YIG Tuned Oscillator (the Synthesizer's microwave signal source). The M/N OUT frequency (177.5 to 197.5 MHz) is obtained by dividing the M/N VCO signal (355—395 MHz) by two. The M/N IF signal (5—45 MHz) is the lower mixing sideband of the VCO signal and the 400 MHz reference. The M/N Phase Locked Loop is phase locked by comparing a fraction of 20 MHz (20 MHz divided by the N number) to a fraction of the IF signal (5—45 MHz divided by the M number) in the phase detector. The phase detector generates an error signal that is integrated and coupled to the VCO as a tuning signal. The M and N numbers are determined by the Digital Control Unit (DCU) and vary with the 10 MHz steps of the YTO frequency. The M/N VCO frequency is dependent on the ratio of the M and N numbers as expressed in the following formula:

$$f_{M/N\ VCO} = [400 - 20\,(M/N)]\ \mathrm{MHz}$$

where

$f_{M/N\ VCO}$ = M/N VCO frequency
M = M number
N = N number

To determine M (M varies from 8 to 27):

If the 100 MHz digit of the YTO Frequency is even then M = 17 −10 MHz digit.

If the 100 MHz digit is odd then M = 27 −10 MHz digit.

To determine N (N varies from 11 to 32):

Divide the left two (most significant) digits of the YTO Frequency by 2.

Add 1 to the result and round up if necessary to the nearest integer.

For example, if the ratio is 1-to-1 (M = N) then $f_{M/N\ VCO}$ = 380.000 MHz. If the ratio is 1-to-2 (M = 2N) then $f_{M/N\ VCO}$ = 390.000 MHz. Refer to table 8-8 in service sheet BD3 "RF Phase-Locked Loops", for a complete list of M and N Numbers and Resulting Frequencies.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD3 was used to isolate a malfunction to the M/N VCO Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure in chapter 5. The following information allows further isolation to the defective component.

Equipment

Digital Voltmeter (DVM)..........	HP 3455A or HP 3456A
Power Supply....................	HP 6200B
Spectrum Analyzer................	HP 8556A/8552B/141T
High Impedance Probe............	HP 1121A

Procedures

1. Remove A3A1A3 to open the M/N Phase Locked Loop.
2. Remove A3A1A4 and replace it on an extender board.
3. Connect the positive lead of the power supply to chassis ground and the negative lead to A3A1A4TP1 TUNE test point.

Caution

Do not apply a positive voltage to A3A1A4TP1. This would forward bias the VCO tuning diodes and could destroy them.

4. Set the power supply to −35 volts and connect the spectrum analyzer, using the high impedance probe, to the emitter of Q2.

   The spectrum analyzer display should show a 395 MHz signal at 0 dBm.

   If the signal is as indicated, proceed with step 5.

   If the signal is not as indicated, check Q2 and associated components.

5. Connect the high impedance probe to the base of Q1.

   The spectrum analyzer display should show a 395 MHz signal at −34 dBm.

   If the signal is as indicated, check Q1 and associated components.

   If the signal is not as indicated, replace VCO Resonator Assembly A3A1A4A1.

4

M/N VCO Assembly A3A1A4
Schematic Diagram
SERVICE SHEET

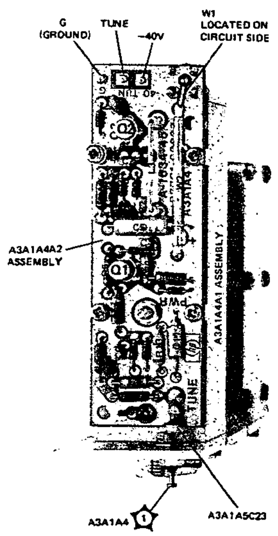
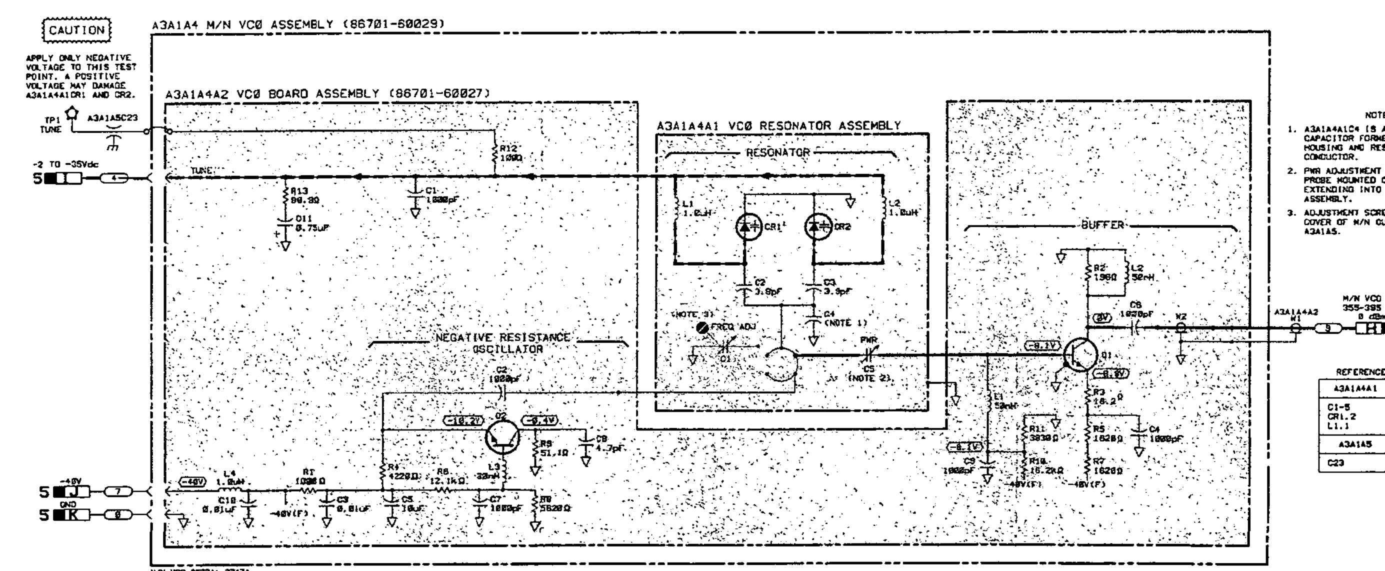


Figure 8-60. A3A1A4A2 M/N VCO Assembly Component, Adjustment and Test Point Locations



NOTES

1. A3A1A4A1C4 IS AN AIR DIELECTRIC CAPACITOR FORMED BY RESONATOR HOUSING AND RESONATOR CENTER CONDUCTOR.
2. PWR ADJUSTMENT IS AN ADJUSTABLE PROBE MOUNTED ON A3A1A4A2 AND EXTENDING INTO THE VCO RESONATOR ASSEMBLY.
3. ADJUSTMENT SCREW LOCATED ON COVER OF M/N OUTPUT ASSEMBLY A3A1A5.

REFERENCE DESIGNATIONS

A3A1A4A1	A3A1A4A2
C1-5 CR1,2 L1,1	C1-11 L1-4 Q1,2 R1-13 TP1 W1,2
A3A1A5	
C23	

4
A3A1A4

Figure 8-61. M/N VCO Assembly Schematic Diagram

Service Sheet 5 M/N Output Assembly

References

Principles of Operation

General

The frequency output of the M/N Phase Locked Loop is dependent on the front panel frequency. A digital equivalent of the M/N frequency (dependent upon the front panel frequency's most significant digits, 10 MHz to 10 GHz) is input to the M/N Phase Locked Loop as M and N numbers. The ratio of the M and N numbers actually determines the M/N OUT frequency. The M/N OUT frequency's Nth harmonic (based on the N number and selected by the YTO pretuning) tunes the YTO frequency in 10 MHz steps. There is a 10 MHz step (or band) for each valid M/N OUT frequency (M/N ratio) and Nth harmonic (N number). This 10 MHz band complements the LFS Phase Locked Loop because its tuning range is 10 MHz and step size is 1 kHz. Together, the M/N Phase Locked Loop, YTO pretuning and LFS Phase Locked Loop are able to tune the YTO from 2000.000 to 6199.999 MHz in 1 kHz steps. The YTO frequency is the front panel frequency divided by the Band Number. See Service Sheet BD1 for a list of band numbers and corresponding frequencies.

The M/N Phase Locked Loop provides a tunable phase locked reference signal for the YIG Tuned Oscillator (the Synthesizer's microwave signal source). The M/N OUT frequency (177.5 to 197.5 MHz) is obtained by dividing the M/N VCO signal (355—395 MHz) by two. The M/N IF signal (5—45 MHz) is the lower mixing sideband of the VCO signal and the 400 MHz reference. The M/N Phase Locked Loop is phase locked by comparing a fraction of 20 MHz (20 MHz divided by the N number) to a fraction of the IF signal (5—45 MHz divided by the M number) in the phase detector. The phase detector generates an error signal that is integrated and coupled to the VCO as a tuning signal. The M and N numbers are determined by the Digital Control Unit (DCU) and vary with the 10 MHz steps of the YTO frequency. The M/N OUT frequency is dependent on the ratio of the M and N numbers as expressed in the following formula:

$$f_{M/N} = [200 - 10\,(M/N)]\ \text{MHz}$$

where

$f_{M/N}$ = M/N OUT frequency
M = M number
N = N number

To determine M (M varies from 8 to 27):

If the 100 MHz digit of the YTO Frequency is even then M = 17 −10 MHz digit.

If the 100 MHz digit is odd then M = 27 −10 MHz digit.

To determine N (N varies from 11 to 34):

Divide the left two (most significant) digits of the YTO Frequency by 2.

Add 1 to the result and round up if necessary to the nearest integer.

For example, if the ratio is 1-to-1 (M = N) then $f_{M/N}$ = 190.000 MHz. If the ratio is 1-to-2 (M = 2N) then $f_{M/N}$ = 195.000 MHz. Refer to table 8-8 in service sheet BD3 "RF Phase-Locked Loops", for a complete list of M and N Numbers and Resulting Frequencies.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD3 was used to isolate a malfunction to the M/N VCO Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure in chapter 5. The following information allows further isolation to the defective component.

Equipment

Spectrum Analyzer................ HP 8556A/8552B/141T
High Impedance Probe............ HP 1121A

Procedures

There are two procedures provided below, one for 355—395 MHz OUT problems and the other for M/N OUT problems.

355—395 MHz OUT

Use this procedure if the procedures in service sheet BD3 indicate a problem with the 355—395 MHz OUT signal.

1. Remove A3A1A5 and replace it on a 30 pin extender board.
2. Connect A3A5TP5 (−5.2 Vdc) to A3A1A4TP1 TUNE test point. This sets the M/N VCO output to about 365 MHz.
3. Using the high impedance probe, connect the spectrum analyzer to the collector of Q1. The spectrum analyzer ahould show a signal of about 365 MHz at a level of +4 dBm.

If the signal is as indicated, the 400 MHz Low Pass Filter is defective. Check the output of each component of the filter network to determine where the loss of power or incorrect frequency occurs.

If the signal is not as indicated, check Q5, Q2, Q1 and associated components.

M/N OUT

Use this pocedure if the procedures in service sheet BD3 indicate a problem with the M/N OUT signal.

1. Remove A3A1A5 and replace it on a 30 pin extender board.
2. Connect A3A5TP5 (−5.2 Vdc) to A3A1A4TP1 TUNE test point. This sets the M/N VCO output to about 365 MHz.
3. Using the high impedance probe, connect the spectrum analyzer to U2 pin 9. The spectrum analyzer should show a signal of about 365 MHz at a level of about +6 dBm.

   If the signal is as indicated, proceed with step 4.

   If the signal is not as indicated, check Q6, Q7, and associated components.
4. Using the high impedance probe, connect the spectrum analyzer to U2 pin 3. The spectrum analyzer should show a signal of about 182 MHz at a level of −1 dBm.

   If the signal is as indicated, check Q3, Q4, and associated components.

   If the signal is not as indicated, check U2 and associated components.

5

M/N Output Assembly A3A1A5
Schematic Diagram
SERVICE SHEET

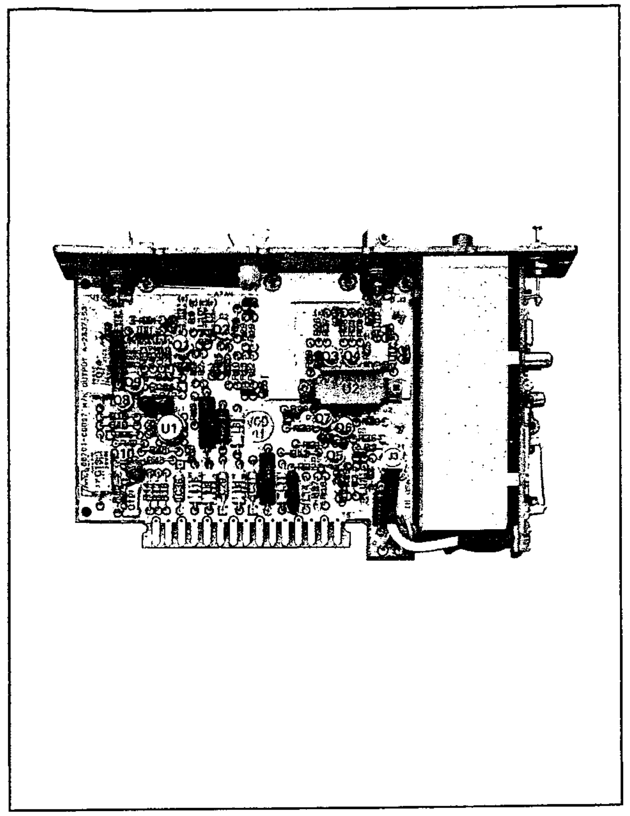
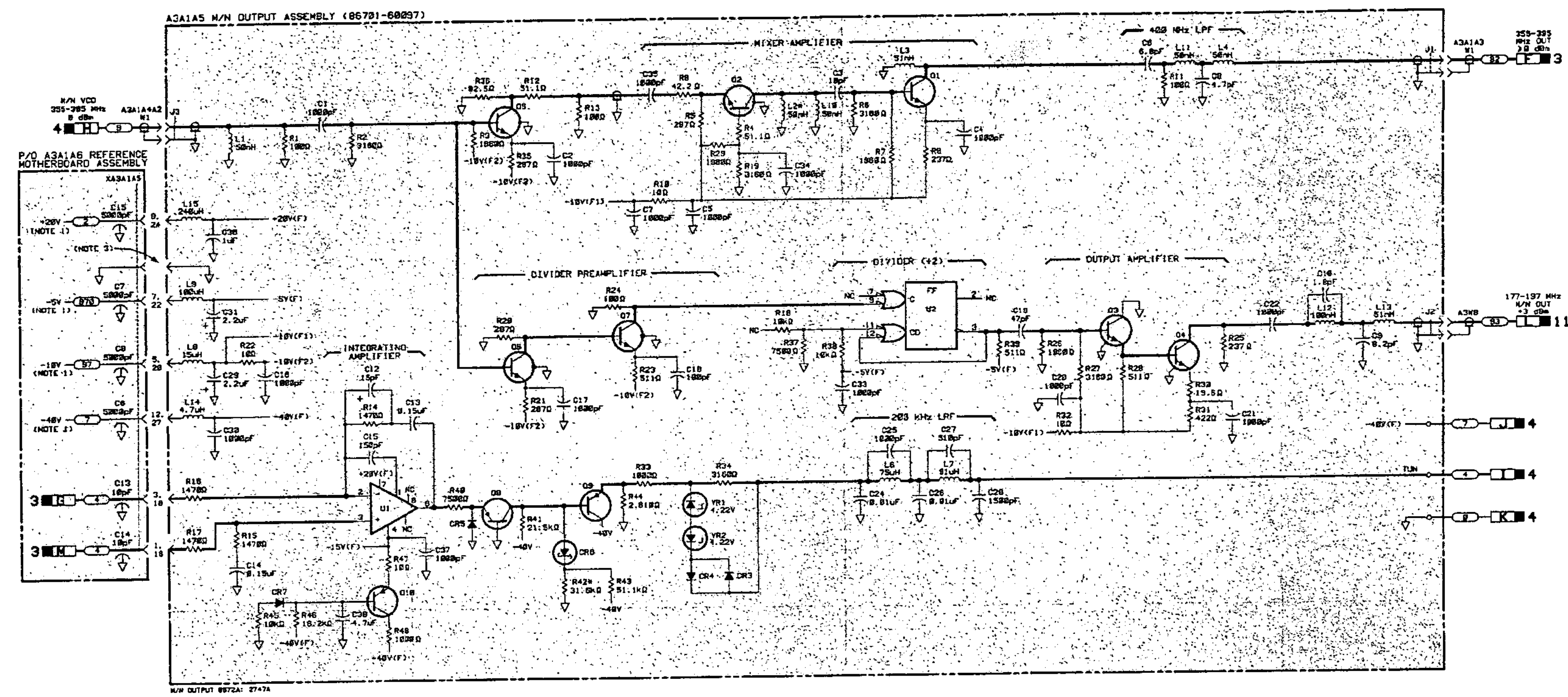


Figure 8-62. A3A1A5 M/N Output Assembly Component and Test Point Locations



NOTES

1. POWER SUPPLY CONNECTIONS TO THE A3A1 ASSEMBLY ARE SHOWN ON SERVICE SHEET 1
2. REFER TO TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
3. MOTHERBOARD GROUND CONNECTIONS ARE AT PINS 2,4,6,8,10,11,13,15,17,19, 21,23,25,26,28,30.
4. ASTERISK(*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.

REFERENCE DESIGNATIONS

A3	A3A1A5
MB	C1-10,12-31, 33-38
A3A1A3	CR3-7
W1	J1,2
A3A1A4A2	L1-4,6-15
W1	Q1-10
	R1-48
	U1,2
	VR1,2
	W1
	A3A1A6
	C6-8,13-15 XA3A1A5

LOGIC LEVELS

LOGIC	TTL	ECL	EECL	CMOS
HIGH(1)	>2V	>-0.5V	>-0.1V	VDD
LOW(0)	<0.8V	<-1.5V	>-0.6V	>0.1V
<=EQUAL TO OR MORE NEGATIVE THAN >=EQUAL TO OR MORE POSITIVE THAN				
INPUT	TTL	ECL	EECL	CMOS
GROUND	LOW(0)	HIGH(1)	HIGH(1)	LOW(0)
OPEN	HIGH(1)	LOW(0)	LOW(0)	X
GROUND - 0V; X=UNDEFINED				

INTEGRATED CIRCUIT VOLTAGES AND GROUND CONNECTIONS

REFERENCE DESIGNATION	PIN NUMBER
U2	-5V - 8 ▽ -1,16

5
A3A1A5

Figure 8-63. M/N Output Assembly Schematic Diagram

Service Sheet 6 20/30 MHz Divider Assembly

References

Overall Block Diagram	Service Sheet BD1
RF Phase Locked Loops Block Diagram	Service Sheet BD3
Electrostatic Discharge (ESD) Precautions	Chapter 8 (Front)
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5
After Service Safety Checks	Chapter 8 (Front)

Principles of Operation

General

The LFS Phase Locked Loop converts tuning information of the four least significant digits (1 MHz through 1 kHz) of the YTO frequency into a frequency between 20 MHz and 30 MHz. (The YTO frequency is the input frequency divided by the Band Number.) This frequency is obtained by dividing the 160—240 MHz VCO output by 8. The 160—240 MHz is fed back to a programmable divider where it is divided by a number N1, to produce 80 kHz. The 10 MHz reference is divided (by 125) to obtain 80 kHz and the two are compared in the phase detector. Phase difference is converted into a VCO TUNE voltage and applied to the VCO.

Detailed Description

The 20/30 divider (A2A5 board) contains a programmable divider and a fixed divider. The programmable divider consists of a divide by 10 or 11 prescaler and a low frequency divider. It divides by N1 which varies between 2000.1 and 3000.0, depending on the four digits of the YTO frequency. The relationship is as follows:

$$N1 = 8(30\ \text{MHz} - \text{D4.D3 D2 D1 MHz})/80\ \text{kHz}$$

where:

D4 = 1 MHz digit of the YTO Frequency
D3 = 100 kHz digit of the YTO Frequency
D2 = 10 kHz digit of the YTO Frequency
D1 = 1 kHz digit of the YTO frequency

If D1 and D2 are zero, the prescaler divides by 11 for 5 of its output cycles and by 10 for the rest, and the low frequency divider counts the programmed number of prescaler output pulses. When D2 is not zero, unit division takes place. This is done by the prescaler, which divides by 11 one less time for each increment of D2. For example, if D2 is 4, the prescaler will divide by 11 four times less. If D1 is not zero, fractional division is done by changing the unit division number over ten 80 kHz cycles. For example, if N1 is 2100.5, the 20/30 divider will divide by 2100 five times and by 2101 five times.

This results in an average N1 of 2100.5 and an average frequency (over ten output cycles) of 80 kHz.

The prescaler U8 divides the 160—240 MHz VCO output by 10 if pin 2 is high and by 11 if it is low. The resulting pulses are counted by the low frequency divider. The count starts with the numbers preset by the 1 MHz and 100 kHz digits and ends at 299. This results in a pulse at the beginning of each 80 kHz cycle. It stays that way until the first time U15A goes low. This clocks a low through U7B which causes the prescaler to divide by 11. When U14 reaches a count of 9, the J input of U7A goes high and is clocked through U7A by the next low going prescaler output. This causes a high to be clocked through U7B which tells the prescaler to divide by 10 until the end of the 80 kHz cycle.

Fractional division depends on the 1 kHz digit. Rate multiplier U12 outputs a number of negative transitions per ten 80 kHz cycles. This number is the value of the 1 kHz digit. Each of these negative transitions causes the prescaler to divide by 11 one less time than programmed by the D2 information.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD3 was used to isolate a malfunction to the 20/30 Divider Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure, if any, in chapter 5. The following information will aid in isolating the defective component.

Equipment

Frequency Counter................	HP 5340A or HP 5343A
Oscilloscope.....................	HP 1980B
Digital Voltmeter (DVM)..........	HP 3455A or HP 3456A

procedures

There are two procedures, the first is used for problems with the 80 kHz reference signal and the second for problems with the ÷N1 signal.

80 kHz Reference Procedure. Use this procedure if the troubleshooting information in service sheet BD3 indicates that the 80 kHz reference signal is not correct.

1. Install A2A5 on an extender board.
2. Connect the DVM to U9 pin 2.

   The DVM should indicate +5 volts.

   If the indication is normal, troubleshoot the ÷125 Counter Q1, U10, U1, and U2.

   If the indication is not correct, U9 is defective.

÷N1 Procedure. Use this procedure if the troubleshooting information in service sheet BD3 indicates that the ÷N1 output is not correct.

1. Remove A2A5 and replace it on a 36-pin extender board.
2. Remove A2A3 and set the test switch to the TEST HIGH FREQ position. Reinstall A2A3. Confirm that the frequency at A2A5J1 is greater than 240 MHz. This signal will be used to test the divider assembly.
3. Set the Signal Generator frequency to 3000.000 MHz. Connect the frequency counter or oscilloscope to A2A5TP5. The frequency should be about 25 MHz at TTL levels. This signal is rich in harmonics (i.e., the sine wave is distorted). If the signal is near 22.7 MHz, the 10/11 prescaler is dividing incorrectly (or its input control at pin 2 is wrong).
4. Ground A2A5TP4 (LSB). The frequency should drop to about 22.7 MHz as the prescaler is switched to divide by 11. If this does not happen, troubleshoot U8 and associated components.
5. Disconnect the ground on TP4 and observe the signal at TP4 on an oscilloscope. Set the frequency to 2999.900 MHz. There should be low true pulses about 0.65 μs wide with a 8 μs spacing, TTL levels.
6. Increase the frequency in 1 kHz steps to 2999.999 MHz. The pulses should become narrower and finally disappear. This pattern is repeated every 100 kHz. The pulse spacing varies with frequency from 12 μs for frequencies ending in 0.000 to 8 μs for frequencies ending 9.9*xx*. If the pulse does not behave properly, troubleshoot the ÷10/11 Controller, the Unit Divide Controller and the Fractional Divide Control.
7. Connect the oscilloscope or frequency counter to TP3. At 3000.000 MHz the frequency should be about 83.3 kHz (period = 1.2 μs; 250 MHz divided by 3000). Change frequency to 2999.999 MHz and TP3 should go to about 125 kHz (period = 8 μs; 250 MHz divided by 2000.1). If both of these frequencies are correct the A2A5 divider assembly is probably functioning properly. Otherwise, troubleshoot the Low Frequency Divider (U14, U13, U11, U3 and U6).
8. As a final check of the dividers, tune in 1 kHz and 10 kHz steps from 3000.000 MHz to 2009.999 MHz to assure that the divider output frequency increases as the frequency is turned higher. If this happens, the divider is functioning normally. Be sure to reset the TEST switch on A2A3 to the NORMAL position.

6

20/30 MHz Divider Assembly A2A5
Schematic Diagram
SERVICE SHEET

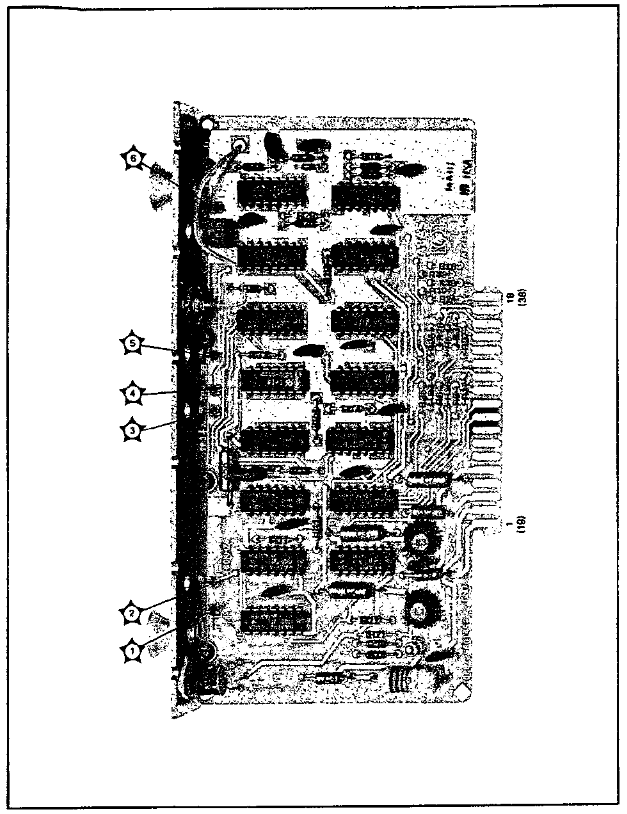
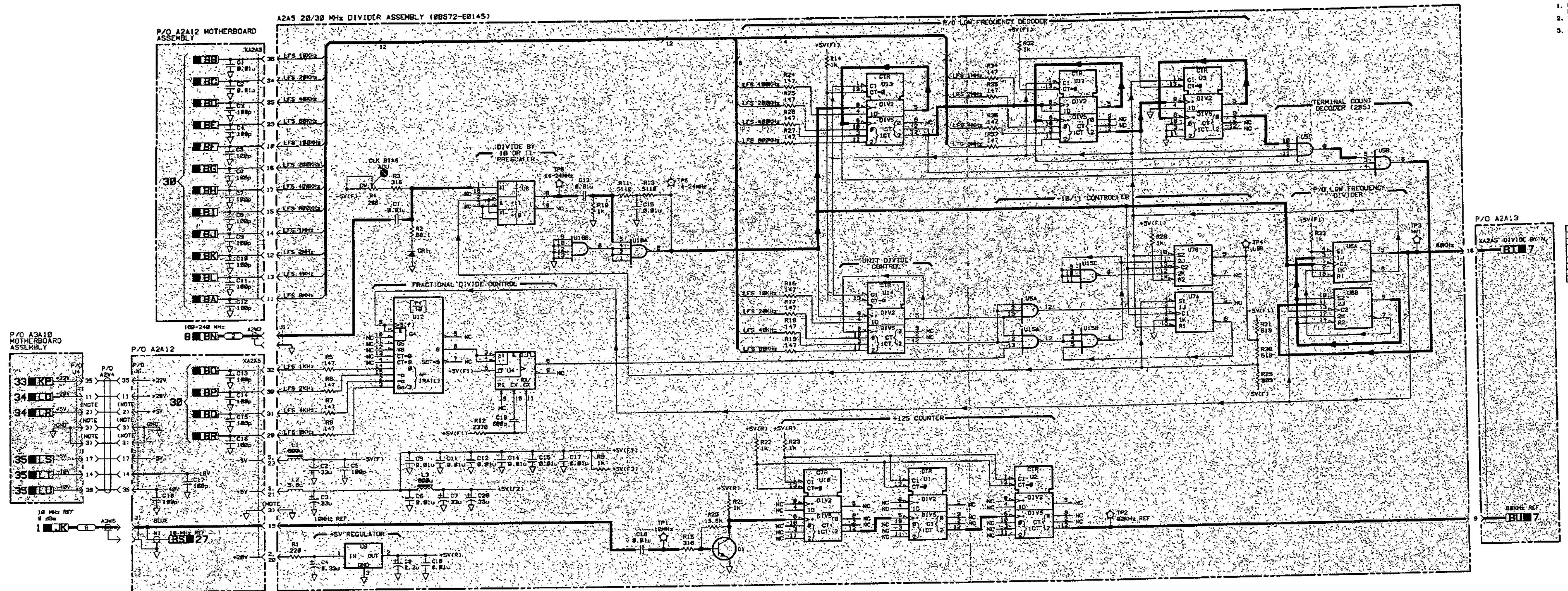


Figure 8-64. A2A5 20/30 MHz Divider Assembly Component, Adjustment and Test Point Locations



NOTES

1. REFER TO TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
2. CONNECTIONS FOR +5V POWER SUPPLY ARE PINS 12,13 AND 32,38.
3. CONNECTIONS FOR GROUND ARE PINS 15,16,40,41.

REFERENCE DESIGNATIONS

A2	A2A12
W2, W4	C1-18 J2, J3 W1 XA2A5
A2A5	A3
C1-20 CR1 J1 L1-3 Q1 R1-37 TP1-6 U1-16	W5
	A3A10
	J4

LOGIC LEVELS

LOGIC	TTL	ECL	EECL	CMOS
HIGH	≥2V	≥-0.5V	≥-0.1V	≈VDD
LOW	≤0.8V	≤-1.5V	≤-0.6V	≤-0.1V
≤ = EQUAL TO OR MORE NEG. THAN				
≥ = EQUAL TO OR MORE POS. THAN				
INPUT	TTL	ECL	EECL	CMOS
GROUND	LOW	HIGH	HIGH	LOW
OPEN	HIGH	LOW	LOW	X
GROUND = 0V; X = UNDEFINED				

INTEGRATED CIRCUIT VOLTAGE, GROUND AND BYPASS CAPACITOR CONNECTIONS

REFERENCE DESIGNATION	BYPASS CAP	PIN NUMBER
U1,2,10		+5V(R) -14, ▽ -7
U3, U5, U11, U13, U14, U15, U16	C9, C12, C14, C15, C17	+5V(F1)-14, ▽ -7
U4	C20	+5V(F1)- 5, +5V(F2)-14, ▽ - 7
U6, U7	C11	+5V(F1)-16, ▽ - 8
U8	C5	▽ - 5, -5V(R) -12
U12		+5V(F2)-16, +5V(F3)-12, ▽ - 8

6
A2A5

Figure 8-65. 20/30 MHz Divider Assembly Schematic Diagram
8-229/8-230

Service Sheet 7 20/30 MHz Phase Detector Assembly

References

Principles of Operation

General

The LFS Phase Locked Loop converts tuning information of the four least significant digits (1 MHz through 1 kHz of the YTO frequency) into a frequency between 20 MHz and 30 MHz. The YTO frequency is the input frequency divided by the Band Number. The frequency between 20 and 30 MHz is obtained by dividing the 160—240 MHz VCO output by 8. The 160—240 MHz is fed back to a programmable divider where it is divided by a number N1, to produce 80 kHz. The 10 MHz reference is divided (by 125) to obtain 80 kHz and the two 80 kHz frequencies are compared in the phase detector. Phase difference is converted into a VCO TUNE voltage and applied to the VCO.

Detailed Description

The Digital Phase Detector compares the REF 80 kHz and ÷N1 80 kHz and uses the phase difference to produce a dc voltage, VCO TUNE, which sets the VCO frequency. When the Phase Locked Loop is unlocked, the Gain Control Logic and Pulse Width Detector (pulse width varies directly with frequency or phase error) circuitry increases the integrating amplifier's gain (and thus increases bandwidth) during unlocked conditions, speeding up the re-lock process. When the Phase Locked Loop is unlocked, the Unlock Detector will pulse the LFS UNLOCKED line high. If the loop remains unlocked, the signal on the LFS UNLOCKED line will be a string of 140 μs pulses.

Flip-flops U3A, B and NAND gate U2C phase compare the two 80 kHz inputs by generating a pulse that represents, by its width, the phase error. Starting in the reset state, the flip-flop's non-inverting output will go high on the trailing edge of the first input pulse. When both U3A and U3B are high, the NAND gate, U2C goes low and resets the flip-flops, restarting the process. If the two 80 kHz inputs are in phase, the pulses at TP1 and TP2 will occur at the same time which, to the integrating amplifier's input, means no change in the VCO TUNE voltage. See figure 8-66. But if a phase difference exists, one of the flip-flops will output a longer pulse which the Integrating Amplifier will translate to a positive or negative dc voltage. Normally, the 80 kHz REF pulse will begin to rise about 20 ns before the ÷N1 pulse.

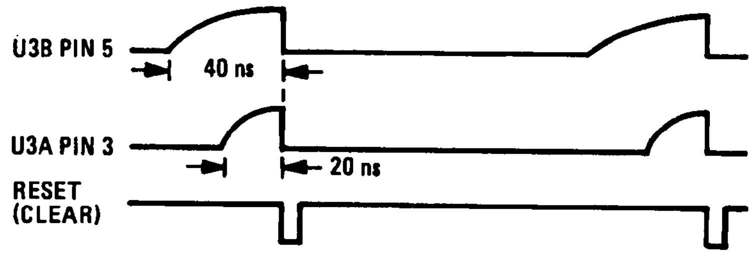


Figure 8-66. Phase Detector Timing Diagram

U5 is an operational amplifier which amplifies and integrates differences between inputs to produce the VCO TUNE voltage. R8, R12, R16 and C9, R11, R13, R20 and C12 determine the gain and integrating time constant, while CR1 and CR2 speed up the integration during fast input changes. VR1 and the voltage divider R27 and R29 act as a clamp to keep VCO TUNE under 14 volts. A linearizing network, CR3, CR4 and associated resistors, modifies the VCO TUNE voltage so that loop bandwidth will be nearly constant for all frequencies, thus yielding a constant phase noise characteristic.

When the loop is out of lock, switches U9C and U9D close which shunts R8 and R12 with R10 and R11 and R13 with R14. This increases the Integrating Amplifier's gain allowing the loop to relock faster.

The 8 kHz notch filter removes the 8 kHz and 16 kHz sidebands produced during fractional division. Higher sidebands are attenuated by the low pass filter in the next stage.

One shot U8, flip-flop U7B and NAND gate U2D activate the switches U9C and D, if the phase detector pulse width exceeds 1.5 μs. When the output of U2D goes high, the one shot will trigger, but normally the input will stay high for only about 20 ns so by the time U8-6 goes high the D input to U7B is low and a low is clocked through to the switches. If a phase error exists for more than about 150 μs, U7B-12 will still be high when the one shot's output pulse goes positive and a high will be clocked through U7B. One shot U4 and NAND Gate U2A signal the front panel indicator and the HP-IB status byte circuitry when the LFS loop is unlocked. During lock periods and brief unlock periods both inputs to U2A are high. When the loop is unlocked for short periods, U2A outputs very short negative pulses which increase to 140 μs for long unlock periods.

Short pulses are attenuated by R21 and C15 but longer ones will trigger U4, the output of which will cause the LFS UNLOCKED line to pulse high. As long as the loop remains unlocked, U4 will be triggered and output a string of 140 μs pulses to the LFS UNLOCKED line via U2A.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD3 was used to isolate a malfunction to the 20/30 MHz Phase Detector. It is also assumed that an attempt has been made to correct the malfunction using the appropriate adjustment procedure, if any, in chapter 5. The following information will aid in isolating the defective component.

Equipment

Frequency Counter................	HP 5340A or HP 5343A
Oscilloscope......................	HP 1980B
Digital Voltmeter (DVM)..........	HP 3455A or HP 3456A

Procedures

Two procedures are provided, one for problems with the VCO TUNE output and the other for problems with the LFS UNLOCKED output.

VCO TUNE Procedure. Use this procedure if the troubleshooting information on service sheet BD3 indicates a problem with the VCO TUNE output.

1. Remove A2A4 and replace it on a 36-pin extender board. Be sure all cables remain connected.
2. Connect the DVM to U1 pin 2.

   The DVM should read +5.0 volts dc.

   If the reading is as indicated, proceed with step 3.

   If the reading is not as indicated, check U1, Q1 and associated components.
3. Connect the oscilloscope to test points TP1 and TP2.

   The waveforms should be as shown on the schematic.

   If the waveforms are as indicated, proceed with step 4.

   If the waveforms are not as indicated, check U3 and associated components.
4. Using the DVM, check the voltage at pins 2 and 3 of U5.

   In both cases the DVM should indicate +0.16 volts dc.

   If the voltages are as indicated, go to step 5

   If the voltages are not as indicated, check U5 and asssociated components.
5. The Gain Control Logic speeds up the phase locking process by extending the loop bandwidth. If the Phase Locked Loop is not locked, there is no way to check this circuit except to see that U7B pin 9 is high and that the same signal appears at pins 11 and 12 and pins 8 and 9 of U9, that is, that U9C and U9D are turned on.

LFS UNLOCKED Procedure. Use this procedure if the Signal Generator seems to be operating normally, but the LFS indicator on A2A7 is off.

1. Connect the DVM to U2A pin 3, then, while observing the DVM display, disconnect the red cable from A2A5J1.

   The DVM should initially indicate less than about 0.5 volt dc, then jump to about 4.5 volts dc when the cable is removed.

   If the DVM indication is correct, the Unlock Detector is functioning normally. Proceed to service sheet 25 to further isolate the problem.

   If the DVM indication is not correct, check U2 and U4.

7

20/30 MHz Phase Detector Assembly A2A4
Schematic Diagram
SERVICE SHEET

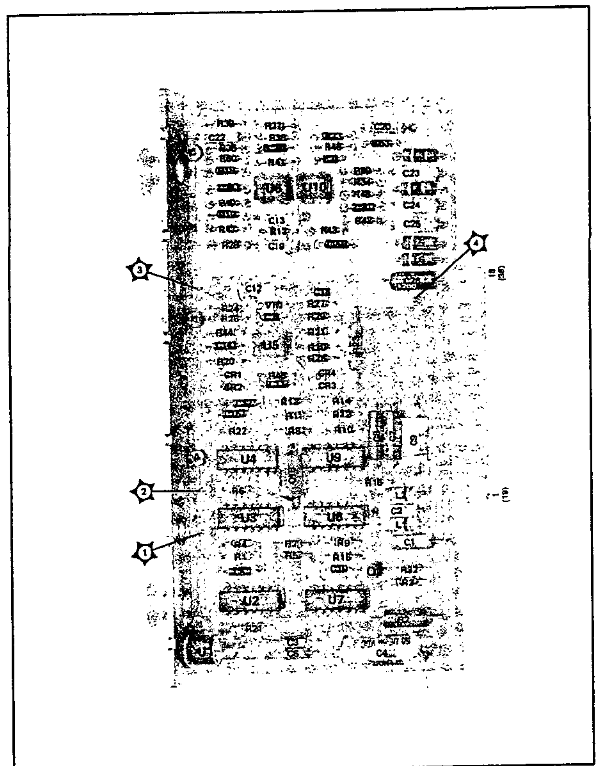


Figure 8-67. A2A4 20/30 MHz Phase Detector Assembly Component and Test Point Locations

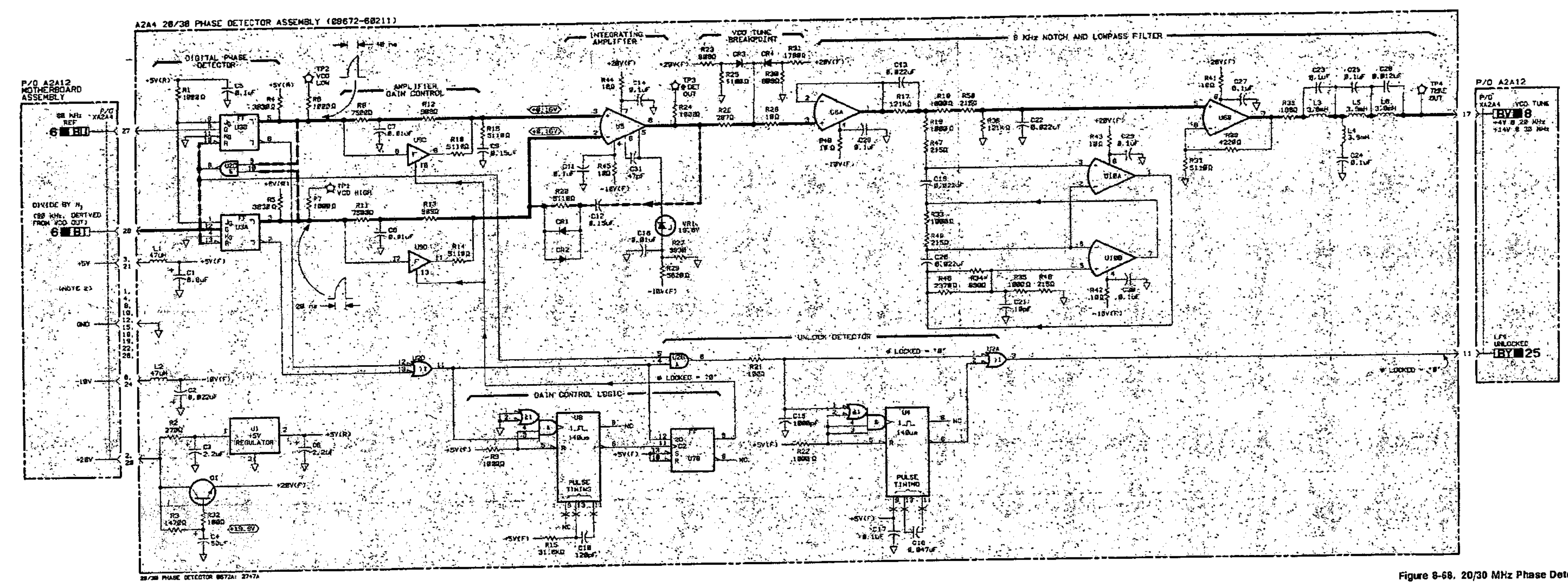


Figure 8-68. 20/30 MHz Phase Detector Assembly Schematic Diagram

NOTES

1. REFER TO TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
2. POWER SUPPLY CONNECTIONS TO THE A2 ASSEMBLY ARE SHOWN ON SERVICE SHEET 5.

* ASTERISK INDICATES FACTORY SELECTED COMPONENT. NOMINAL VALUE SHOWN.

REFERENCE DESIGNATIONS

A2A4	A2A12
C1-31 CR1-4 L1-6 Q1 R1-53 TP1-4 U1-10	XA2A4

LOGIC LEVELS

LOGIC	TTL	ECL	EECL	CMOS
HIGH(1)	≥2V	≥-0.5V	≥-0.1V	≈VDD
LOW(0)	≤0.8V	≤-1.5V	≥-0.6V	≥0.1V
≤=EQUAL TO OR MORE NEGATIVE THAN ≥=EQUAL TO OR MORE POSITIVE THAN				
INPUT	TTL	ECL	EECL	CMOS
GROUND	LOW(0)	HIGH(1)	HIGH(1)	LOW(0)
OPEN	HIGH(1)	LOW(0)	LOW(0)	X
GROUND - 0V; X=UNDEFINED				

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATION	PIN NUMBER
U2,3	+5V(R)-14 ∇ -7
U4,7-9	+5V(F)-14 ∇ -7

7
A2A4

Service Sheet 8 VCO 160—240 MHz Assembly

References

Principles of Operation

General

The LFS Phase Locked Loop converts tuning information of the four least significant digits (1 MHz through 1 kHz on the front panel display) into a frequency between 20 and 30 MHz. This frequency is obtained by dividing the 160—240 MHz voltage controlled oscillator (VCO) output by 8. The 160—240 MHz is fed back to a programmable divider where it is divided by a number, N1, to produce 80 kHz. The 10-MHz reference is divided by 125 to obtain 80 kHz and the two are compared in a phase detector. Phase difference is converted into a VCO TUNE voltage and applied to the VCO.

Detailed Description

The VCO 160—240 MHz Assembly uses a varactor tuned oscillator and dividers to produce a 20—30 MHz signal, which is used in the YTO Summing Phase Locked Loop, and a 160—240 MHz signal which is fed back to the N1 divider. The VCO TUNE voltage, after passing through a low-pass filter, tunes the VCO over its 160—240 MHz range. A power splitter and drivers buffer the VCO output and drive a divider for the 20—30 MHz output and a low pass filter for the 160—240 MHz output.

The oscillator consists of Q1 with the primary of T1 and CR1 through CR4 for the tuned circuit. Feedback is provided through C6. The VCO TUNE voltage is applied through the low-pass filter and switch S1. In the NORM position S1 connects the VCO TUNE voltage to the varactor diodes, but in TEST HIGH FREQ and TEST LOW FREQ, a dc voltage is substituted for the VCO Tune signal that sets the VCO frequency to greater than 240 MHz or less than 160 MHz. Transistor Q1 is biased by the −40 volt supply through ripple filter Q6. RF energy is coupled to the Power Splitter by the one-turn secondary of T1.

Amplifier Q4 buffers the VCO from the two common base drivers Q2 and Q3. Transistor Q5 acts as a ripple filter for the Q2, Q3, and Q4 bias supply. The output of Q2 is filtered and applied to J2 as the

160—240 MHz OUTPUT. The signal at the collector of Q3 is divided by U2, U1A, and U1B, filtered and applied to J1 as the 20/30 MHz output.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD3 was used to isolate a malfunction to the VCO 160—240 MHz Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure, if any, in chapter 5. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter (DVM) .... HP 8455A or HP 3456A
Frequency Counter .... HP 5340A or HP 5343A
Spectrum Analyzer .... HP 8556A/8552B/141T
High Impedance Probe .... HP 1121A

Procedures

There are two procedures provided below, one for problems with the 160—240 MHz output and the second for problems with the 20/30 MHz output.

160—240 MHz Output. Use this procedure if the troubleshooting information in Service Sheet BD3 indicates a problem with the 160—240 MHz output.

1. Remove A2A3, set the Test Switch to TEST HIGH FREQ and replace it on a 36-pin extender board.
2. Using the DVM, check the voltages at the emitters of Q5 and Q6 against the voltages given on the schematic.

   If either voltage is not as indicated on the schematic, check the affected transistor and associated components.

   If both voltages are as indicated, proceed with step 3.
3. Using the high impedance probe, connect the spectrum analyzer to the collector of Q4.

   The spectrum analyzer should show a signal greater than 240 MHz, at about −10 dBm.

   If the signal is as indicated, check Q2 and associated components.

   If the signal is not as indicated, check Q4, Q1 and associated components.

20/30 MHz Output. Use this procedure if the troubleshooting information in service sheet BD3 has indicated a problem with the 20/30 MHz output.

1. Remove A2A3, set the Test Switch to TEST HIGH FREQ and replace A2A3 on a 36-pin extender board.
2. Using the high impedance probe, connect the spectrum analyzer to U2 pin 7.

   The spectrum analyzer should show a signal greater than 240 MHz at a level of about −10 dBm.

   If the signal is as indicated, check U1 and associated components.

   If the signal is not as indicated, check Q3 and associated components.

8

VCO 160—240 MHz Assembly A2A3
Schematic Diagram
SERVICE SHEET

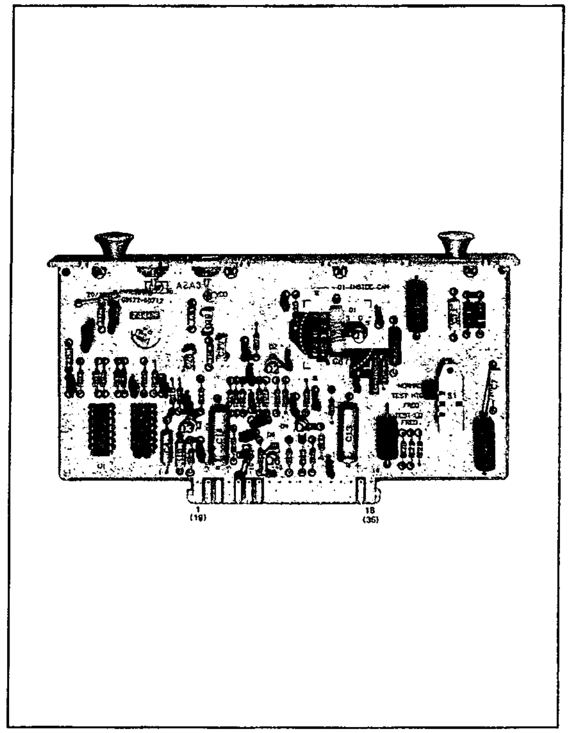
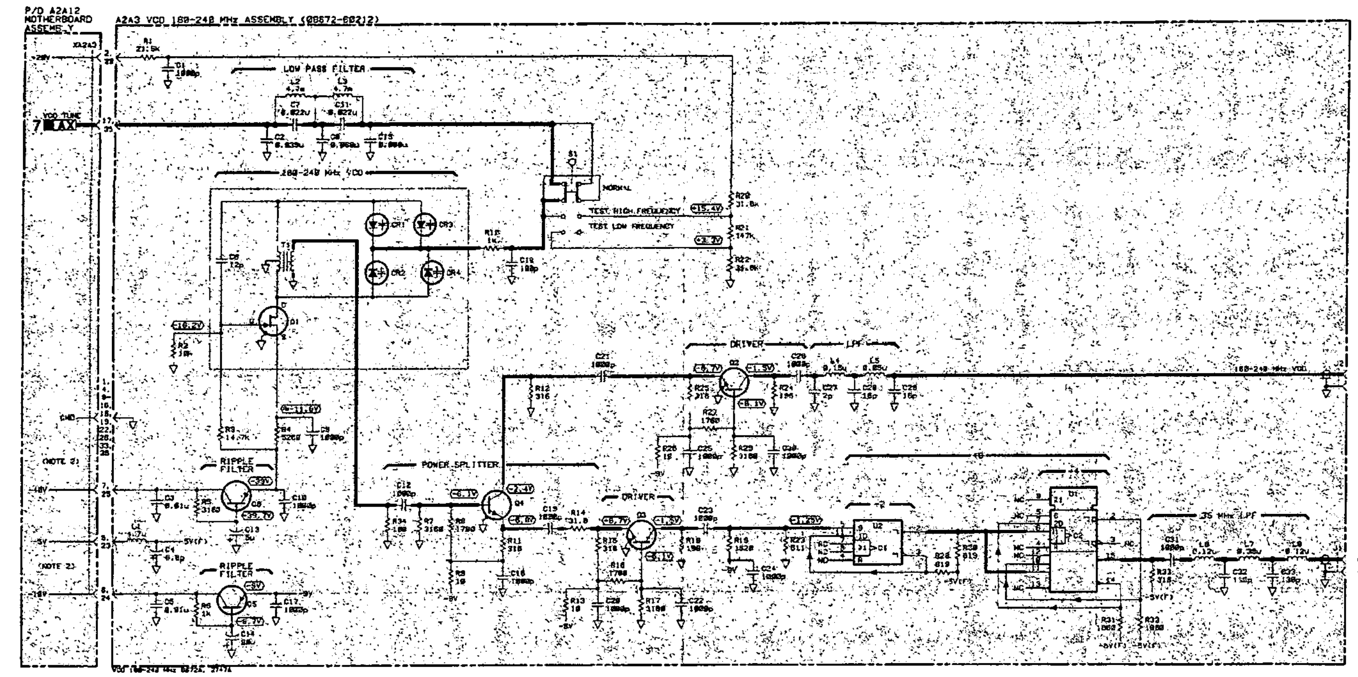


Figure 8-69. A2A3 VCO 160—240 MHz Assembly Component and Test Point Locations



NOTES

1. POWER SUPPLY CONNECTIONS TO THE A2 ASSEMBLY ARE SHOWN ON SHEET 6.

REFERENCE DESIGNATIONS

A2	A2A3
W2 A2A12 XA2A3 A3 W14	C1-33 CR1-4 J1,2 L1-8 Q1-6 R1-34 S1 T1 U1,2

LOGIC LEVELS

LOGIC	TTL	ECL	EECL	CMOS
HIGH(1)	>2V	>-0.5V	>-3.1V	VDD
LOW(0)	<0.8V	<-1.5V	>-3.8V	>0.1V
<=EQUAL TO OR MORE NEGATIVE THAN				
>=EQUAL TO OR MORE POSITIVE THAN				
INPUT	TTL	ECL	EECL	CMOS
GROUND	LOW(0)	HIGH(1)	HIGH(1)	LOW(0)
OPEN	HIGH(1)	LOW(0)	LOW(0)	X
GROUND - 0V; X=UNDEFINED				

160-240 MHz OUTPUT

INTEGRATED CIRCUIT VOLTAGE, GROUND AND BYPASS CAPACITOR CONNECTIONS

REFERENCE DESIGNATION	BYPASS CAP	PIN NUMBER
U1,2		+5V(F)- 8 ▽ -1,16

20/30 MHz OUTPUT 0dBm

8

A2A3

Figure 8-70. VCO 160—240 MHz Assembly Schematic Diagram

Service Sheet 9 Digital-to-Analog Converter Assembly

References

Principles of Operation

General

YTO Summing Phase Locked Loop. The YIG Tuned Oscillator's frequency output is phase-locked: 1) to the difference of the YTO frequency and a selected harmonic of the M/N Phase Locked Loop; and, 2) to the LFS Phase Locked Loop. The YTO is pretuned near the correct harmonic of the M/N Output frequency by the YTO pretune ciruits which consist of the Digital-to-Analog Converter (DAC) and the Main Coil Driver. Once the pretuning is completed, the IF signal (20/30 MHz) from the YTO Loop Sampler is phase compared to the LFS signal, and the resulting error signal tunes the YTO to achieve phase lock. The YTO Frequency is related to the M/N Out frequency and the LFS frequency in the following manner:

$$f_o = (N)(f_{M/N} - f_{LFS})$$

where f_o = YTO output frequency (MHz)

N = N number input to M/N Phase Locked Loop (also the M/N harmonic near to which the YTO loop is pretuned)

$f_{M/N}$ = Phase Locked Loop output frequency (MHz), and

f_{LFS} = Phase Locked Loop output frequency (MHz)

f_{YTO}, N, and $f_{M/N}$ may be looked up in Table 8-8, "Listing of all M and N Numbers and Resulting Frequencies" in service sheet BD3.

Also, f_{LFS} = (30.000 – D4 . D3 D2 D1) MHz

where D4 = Front panel 1 MHz digit

D3 = Front panel 100 kHz digit

D2 = Front panel 10 kHz digit, and

D1 = Front panel 1 kHz digit for YTO frequencies less than 6200 MHz.

YTO Pretune. The digital control inputs to the DAC from the Digital Control Unit (DCU) select the pretune frequency. These inputs are first converted from a digital signal to an analog dc voltage (the YTO Pretune signal). This signal is amplified (in the Main Coil Driver) and output as a tuning current to the YTO.

Notice that the input tuning resolution to the DAC is 1 MHz. If the YTO frequency is within ±10 MHz of the desired frequency (for frequencies less than 6200 MHz) then the pretune circuits are operating properly. Pretuning, however, normally brings the YTO frequency to within 1 or 2 MHz of the desired YTO frequency.

Detailed Discussion

The YTO DAC board has four basic sections: 1) the BCD-to-binary converter; 2) the voltage reference; 3) the digital-to-analog converter; and 4) the summing amplifier.

BCD-to-Binary Converter. The output voltage of the YTO DAC board is controlled by the 14 digital control lines that come onto the board from the controller section. These lines are labeled DAC 1 MHz through DAC 4800 MHz on the schematic. Each line is labeled to reflect the change in output frequency that occurs when it changes state. These lines are weighted in a binary coded decimal (BCD) format. The BCD data is converted to binary format by U3 and U4. U3 and U4 are 256K EPROMs which are used as look-up tables. The BCD lines (DAC 1 MHz — DAC 4800 MHz) are input to U3 and U4 at the address input ports. The binary outputs (B2 through B4096) are connected to the data bus. Each BCD input to U3 and U4 creates a unique set of binary data on the output data lines.

Voltage Reference. The voltage reference generates a stable voltage on which to base the output voltage of the board. This is derived from VR1, a 6.3V temperature compensated Zener diode. U2B and R1 through R5 are used to establish a stable Q-point for VR1. U2B, R4, and R5 generate a fixed voltage of −7.05V at pin 7 of U2B. This, in conjunction with R2, ensures that the current through VR1 is fixed at 7.5 mA. U2A is a buffer for VR1. U2A provides a buffered −6.3V at the voltage reference input port of U5.

Digital-to-Analog Converter. U5 is a CMOS DAC that consists of a resistor network and a series of CMOS switches controlled by the 12 digital inputs (B2 to B4096). The internal switches adjust the resistance seen by the input of U2C, thereby controlling the gain of U2C. This creates a voltage at pin 8 of U2C that is proportional to the digital data input.

Summing Amplifier. The summing amplifier performs four functions: 1) It amplifies the DAC output voltage; 2) sums in an offset voltage; 3) sums the LSB signal (DAC 1 MHz) into the output voltage, and 4) filters out noise from the DAC and the voltage reference.

The overall gain of the amp is set by R8, R9, and R18. R8 is a gain adjustment used to set the output voltage of A3A5 to −3 V/GHz.

R14, R15, and R16 are used to adjust the offset of the overall circuit so that a frequency of 0.0 GHz will result in an output voltage of exactly 0.0V.

R10, R11, R12, and R13 sum the least significant bit from the controller, (DAC 1 MHz), directly into the output amplifier. This is done to achieve 1 MHz resolution at the output of A3A5. DAC U5 has only twelve data input lines, and therefore can switch in only 2 MHz increments. 1 MHz resolution is achieved by weighting the voltage on the DAC 1 MHz to cause a voltage change of 3 mV, and then summing this voltage directly into the output.

Q1, Q2, R20, and C1 form a switchable filter in the summing amp. This filter operates as follows: In normal operation, the current into the base of Q3 is very small. The current through R20 is also very small. The voltage drop across R20 is about 50 mV, so the base-emitter voltages of Q1 and Q2 are not enough to bias them on. R20 and C1 therefore form a low pass filter that attenuates high frequency noise. This filter, in conjunction with the other elements in the summing amplifier's feedback path, gives the summing amplifier a bandwidth of about 150 Hz.

A 150 Hz bandwidth is too narrow for the rapid voltage changes the board must produce during frequency changes. Q1 and Q2 are therefore used to bypass the filter during frequency transitions. A voltage swing at the summing amplifier input will produce a large voltage change at the output of U2D. This will increase the base-emitter voltage of either Q1 or Q2. One of the transistors will turn on, charging C1 up quickly. When the output voltage nears its desired value, the base-emitter voltage will drop causing the transistors to turn off.

R17 and R22 improve the summing amplifier's response to frequency changes. Without R17, U2D would introduce a low frequency pole of about 1 Hz into the open loop response of the circuit. R17 moves the frequency of this pole into the kilohertz range. The low pass filter (R20 and C1) also introduces a 1 Hz pole into the frequency response. R22 adds a zero at 1 kHz to improve the phase margin of the loop. Without this compensation, the summing amplifier would: 1) ring after frequency changes; and 2) exhibit peaking, which would appear as a spurious signal at the output of the Signal Generator.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD4 was used to isolate a malfunction to the Digital-to-Analog Converter Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure in chapter 5. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter (DVM).......... HP 3455A or HP 3456A

Troubleshooting Hints

Procedure

1. Remove A3A5 and replace it on a 36-pin extender board.
2. Begin by checking supply voltages (+5V, +20V, −10V and −40V) at respective filter output.

   If correct, go to step 3.

   If incorrect, make necessary repairs and repeat step 2.
3. If the voltage at A3A5TP4 is not within tolerance, the Voltage Reference section of U2A, U2B, and associated components is suspect. Measure voltages as shown on service sheet 9, make repairs, and verify voltage at TP4.
4. If procedures for BD4 indicate a malfunction of either the BCD to Binary converter (EPROMs U3, U4) or the DAC converter (U5, U2), the following checks aid in isolating the defective component.

   Several test patterns are stored in the EPROMs to check for faulty Address or Data lines.

   Install a shorting clip between A3A5TP1 and TP2, set the Signal Generator frequency as indicated in the following table, and using a logic probe or DVM verify the U3, U4 binary output pattern for each frequency.

Frequency	Binary Output Pattern		
3000	4096 MHz bit →	1010 1010 1010	← 2 MHz bit
3002		0101 0101 0101	
3004		0000 0000 0000	
3006		0111 1111 1111	
3008		1000 0000 0000	
3010		0100 0000 0000	
3012		0010 0000 0000	
3014		0001 0000 0000	
3016		0000 1000 0000	
3018		0000 0100 0000	
3020		0000 0010 0000	
3022		0000 0001 0000	
3024		0000 0000 1000	
3026		0000 0000 0100	
3028		0000 0000 0010	
3030		0000 0000 0001	

If the output patterns are as indicated, the DAC converter U5/U2 or Summing Amplifier section is defective. Proceed to step 5.

If the binary output patterns are not as indicated, replace U3, U4, or both and perform DAC alignment as detailed in chapter 5.

5. To check DAC converter U5 and U2C, make the following voltage measurements at U2C pin 8.

   a. Leave shorting clip connecting A3A5TP1 and TP2. Set Signal Generator to 2000 MHz. Verify voltage at U2C pin 8 is at ground or near ground level. Go to step 5b.

   b. Remove shorting clip and measure voltage at U2C pin 8 for each frequency listed in the following table.

Frequency (MHz)	Voltage at U2C Pin 8 (Vdc)
2000	+1.55
3066	+2.38
4466	+3.42
4049	+3.14
6.119	+4.81

If the voltage at U2C pin 8 is correct for all frequencies in steps 5a and 5b, the DAC converter section is working normally. Go to step 6.

If the voltages measured at U2C pin 8 are all incorrect, the malfunction is most likely in U2C.

If the voltages measured at U2C pin 8 are correct for some frequencies but not others, U5 is defective.

Make repairs and realign the board as detailed in chapter 5.

6. To check the Summing Amplifier section of the DAC Assemly, proceed as follows:

   a. Check the bias on each transistor (Q1, Q2, Q3, and Q4).

      If the bias on these transistors is correct, the amplifier U2D is defective. Make repairs, and realign the DAC Assembly as detailed in chapter 5.

      If the bias on any of these transistors is not correct, replace any that are faulty. Go to the "YTO Pretune Adjustment" procedure in chapter 5 and realign the assembly.

9
Digital-To-Analog Converter
Assembly A3A5
Schematic Diagram
SERVICE SHEET

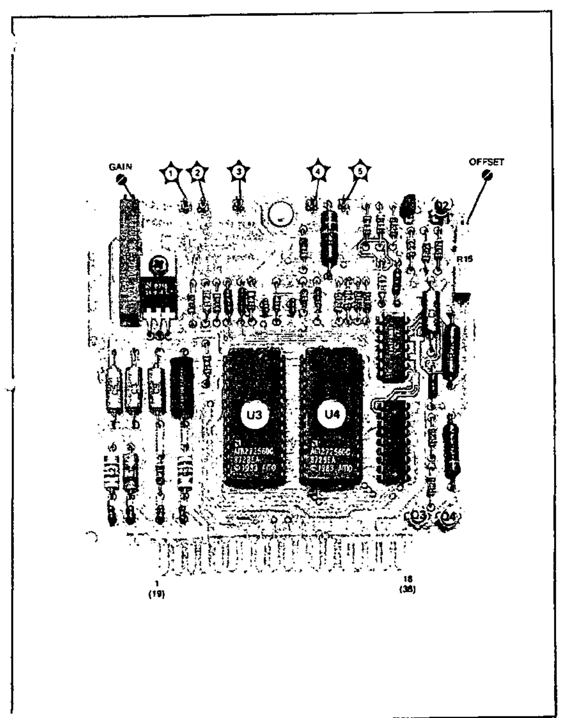
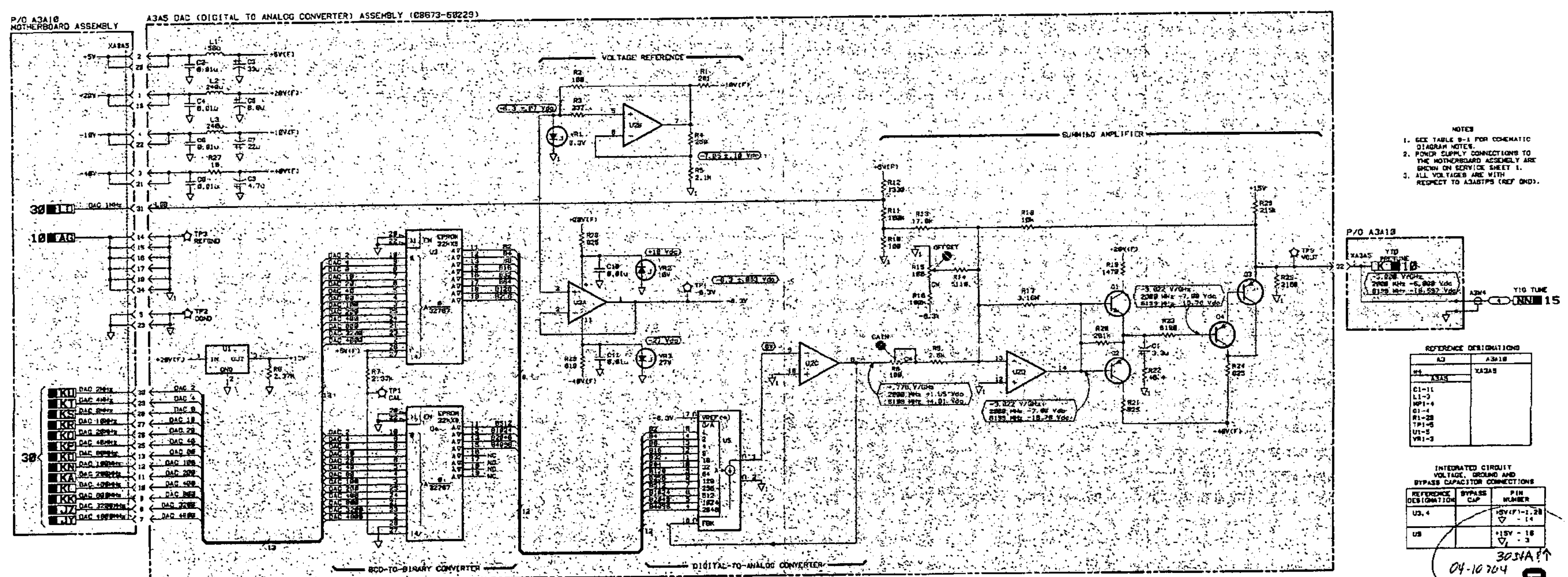


Figure 8-71. A3A5 DAC Assembly Component, Adjustment and Test Point Locations



NOTES

1. SEE TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
2. POWER SUPPLY CONNECTIONS TO THE MOTHERBOARD ASSEMBLY ARE SHOWN ON SERVICE SHEET 1.
3. ALL VOLTAGES ARE WITH RESPECT TO A3A5TP5 (REF GND).

REFERENCE DESIGNATIONS

A3	A3A10
W4	XA3A5
A3A5	
C1-11 L1-3 MP1-4 Q1-4 R1-29 TP1-5 U1-5 VR1-3	

INTEGRATED CIRCUIT VOLTAGE, GROUND AND BYPASS CAPACITOR CONNECTIONS

REFERENCE DESIGNATION	BYPASS CAP	PIN NUMBER
U3, 4		+5V(F)-1,28 ▽ - 14
U5		+15V - 18 ▽1 - 3

30314A↑
04-10704

9
A3A5

Figure 8-72. Digital-To-Analog Converter Assembly Schematic Diagram
8-249/8-250

Service Sheet 10 YTO Driver Assembly

References

Principles of Operation

General

YTO Summing Phase Locked Loop. The YIG Tuned Oscillator's frequency output is phase-locked: 1) to the difference of the YTO frequency and a selected harmonic of the M/N Phase Locked Loop; and, 2) to the LFS Phase Locked Loop. The YTO is pretuned near the correct harmonic of the M/N Output frequency by the YTO pretune ciruits which consist of the Digital-to-Analog Converter (DAC) and the Main Coil Driver. Once the pretuning is completed, the IF signal (20/30 MHz) from the YTO Loop Sampler is phase compared to the LFS signal, and the resulting error signal tunes the YTO to achieve phase lock. The YTO Frequency is related to the M/N Out frequency and the LFS frequency in the following manner:

$$f_o = (N)(f_{M/N} - f_{LFS})$$

where f_o = YTO output frequency (MHz)
N = N number input to M/N Phase Locked Loop (also the M/N harmonic near to which the YTO loop is pretuned)
$f_{M/N}$ = Phase Locked Loop output frequency (MHz), and
f_{LFS} = Phase Locked Loop output frequency (MHz)

f_{YTO}, N, and $f_{M/N}$ may be looked up in Table 8-8, "Listing of all M and N Numbers and Resulting Frequencies" in service sheet BD3.

Also, f_{LFS} = (30.000 − D4 . D3 D2 D1) MHz
where D4 = Front panel 1 MHz digit
D3 = Front panel 100 kHz digit
D2 = Front panel 10 kHz digit, and
D1 = Front panel 1 kHz digit for YTO frequencies less than 6200 MHz.

YTO Pretune. The digital control inputs to the DAC from the Digital Control Unit (DCU) select the pretune frequency. These inputs are first converted from a digital signal to an analog dc voltage (the YTO Pretune signal). This signal is amplified (in the Main Coil Driver) and output as a tuning current to the YTO.

Notice that the input tuning resolution to the DAC is 1 MHz. If the YTO frequency is within ±10 MHz of the desired frequency (for frequencies less than 6200 MHz) then the pretune circuits are operating properly. Pretuning, however, normally brings the YTO frequency to within 1 or 2 MHz of the desired YTO frequency.

Detailed Discussion

The YTO Driver Assembly produces a current in the YTO main coil that is proportional to the sum of the YTO Pretune (DAC output), the YTO TUNE 2 (the low frequency component of the YTO TUNE 1), and an offset voltage.

Coil Driver. The Coil Driver acts in two primary capacities. It provides a summing point for the input currents and it outputs a cur rent to the YTO main coil. It is important to realize that the Coil Driver current flow is supplied through the Sense Resistor (this current is dependent upon the YTO Pretune voltage input) and from the Phase Lock Amplifier. The currents are summed at the Coil Driver's non-inverting output. The total current flows into the non-inverting input and out the inverting output as the YTO Main Coil Drive.

Input Amplifier. The YTO Pretune Voltage is amplified by the Input Amplifier (a discrete component operational amplifier). The output voltage appears at the Coil Driver's non-inverting output and therefore across the Sense Resistor. A portion of this voltage is returned to the Input Amplifier's inverting input. This return voltage is adjustable to allow for variation in the frequency-to-voltage sensitivity of different Oscillators. See figure 8-73. RC network C4 and R10 provide compensation to prevent high frequency oscillation.

The Shaping Network (connected across the Sense Resistor) compensates for the non-linearity of the YTO frequency-to-voltage curve.

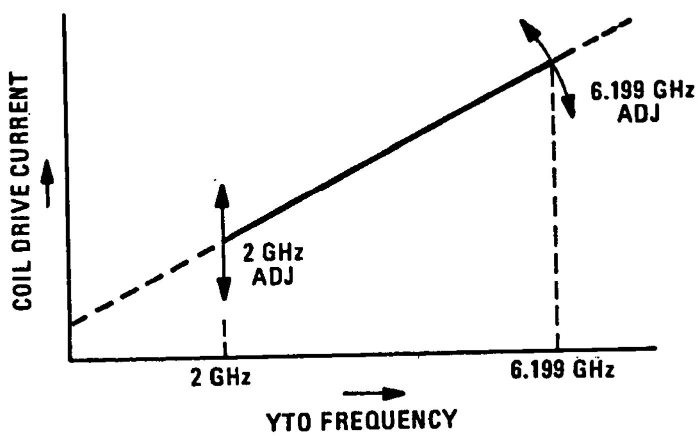


Figure 8-73. YTO Frequency vs. Coil Drive Current

Note

The YTO Main Coil Drive current contributed by the Input Amplifier is equal to the YTO Pretune voltage divided by the sum of R16 (125 ohms) and that portion of R24 (15 ohms) that supplies the feedback voltage to the Input Amplifier through R25. The remaining summed current flows through R30.

The dominant pole of this amplifier (at 0.8 Hz) is set by R11 and C7. They also provide noise filtering. Transistors Q8 and Q12 increase the slew rate of the amplifier by quickly charging or discharging C7 when large changes occur. Current limiter Q13 protects its associated components by removing the drive voltage from Q12 if the current is excessive.

Phase Lock Amplifier. The YTO Tune 2 and Offset voltages are summed in the Phase Lock Amplifier. The YTO Tune 2 signal is the low frequency component of the YTO tuning voltage (YTO Tune 1). The 100-Hz low-pass filter removes the high frequency components of the tuning voltage. The offset voltage is adjusted at 2 GHz (2 GHz Adj) so the YTO Frequency extrapolated to 0 GHz is 0 volt.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD4 was used to isolate a malfunction to the YTO Driver Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure, in chapter 5. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter (DVM).......... HP 3455A or HP 3456A

Procedure

1. Remove A3A6 and replace it on a 30-pin extender board.
2. Using the DVM, measure the voltages at TP1 and TP4.

   The voltage at TP4 should be 2.9 + (0.64 × VTP1).

   If the voltage at TP4 is as indicated, proceed with step 4.

   If the voltage at TP4 is not as indicated, proceed with step 3.
3. Connect the DVM to U1 pin 1.

   The voltage should be +6.2 Vdc.

   If the voltage is as indicated, check U1B and associated components.

   If the voltage is not as indicated, check U1A and associated components.

4. Because of feedback it is difficult to isolate between the Input Amplifier, the Current Limiter, and the Coil Driver. The best way to proceed is to check the voltages on the transistors against the voltages on the schematic. Be sure to press PRESET (3 GHz) to set the Signal Generator Frequency to 3 GHz before proceeding.
5. If a slewing detector problem is suspected, proceed as in step 4 for Q2 and Q3.

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YTO Driver Assembly A3A6
Schematic Diagram
SERVICE SHEET

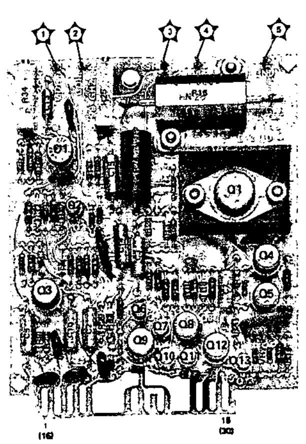
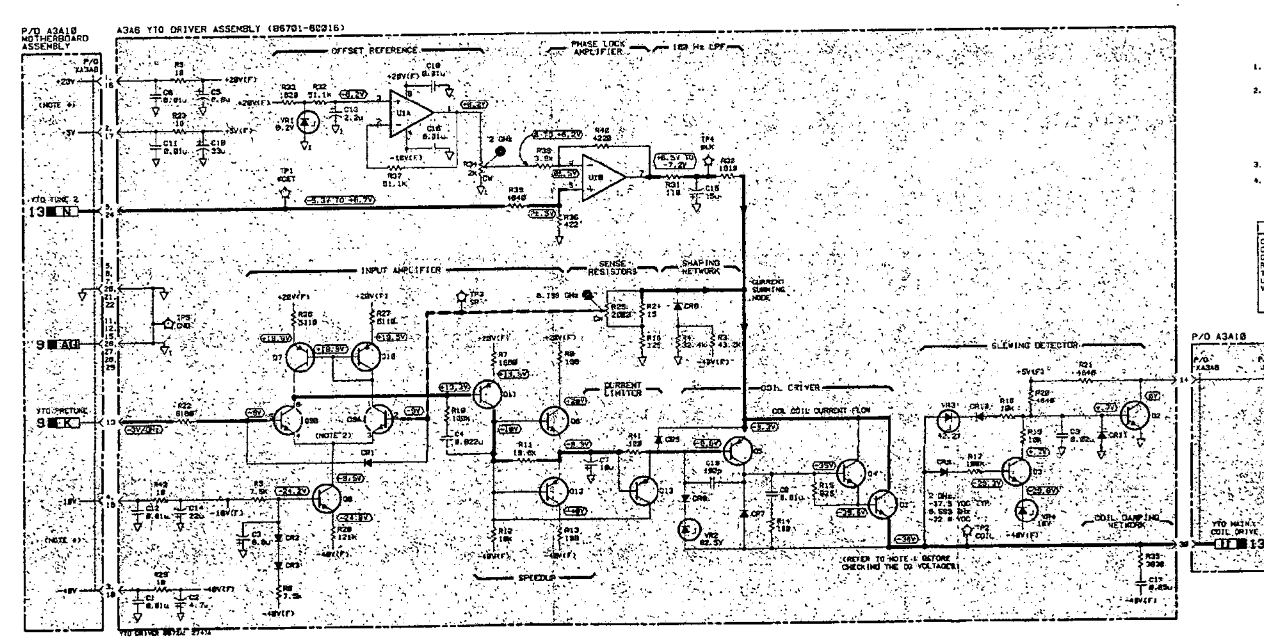


Figure 8-74. A3A8 YTO Driver Assembly Component, Adjustment and Test Point Locations



NOTES

1. THE DC VOLTAGES SHOWN ARE FOR A CARRIER FREQUENCY OF 3 GHz.
2. REFER TO THE FOLLOWING DIAGRAM FOR PIN LOCATIONS.

TOP VIEW

3. SEE TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
4. POWER SUPPLY CONNECTIONS TO THE MOTHERBOARD ASSEMBLY ARE SHOWN ON SERVICE SHEET 1.

REFERENCE DESIGNATIONS

A3A8	A3A10
C1-19 CR1-3,5-11 Q1-13 R3-42 TP1-6 U1 VR1-4	J4 XA3A8
	NO PREFACE
	A2W4
	A2A12
	J3

10
A3A8

Figure 8-75. YTO Driver Assembly Schematic Diagram

Service Sheet 11 YTO Sampler Assembly

References

Principles of Operation

General

The YIG Tuned Oscillator's frequency output is phase-locked: 1) to the difference of the YTO frequency and a selected harmonic of the M/N Phase Locked Loop; and, 2) to the LFS Phase Locked Loop. The YTO is tuned near the correct harmonic of the M/N Output frequency by the YTO pretune circuits which consist of the Digital-to-Analog Converter (DAC) and the Main Coil Driver. Once the pretuning is completed, the IF signal (20/30 MHz) from the YTO Loop Sampler is phase compared to the LFS signal, and the resulting error signal tunes the YTO to achieve phase lock. The YTO Frequency is related to the M/N Out frequency and the LFS frequency in the following manner:

$$f_o = (N)(f_{M/N} - f_{LFS})$$

where
f_o = YTO output frequency (MHz)
N = N number input to M/N Phase Locked Loop (also the M/N harmonic near to which the YTO loop is pretuned)
$f_{M/N}$ = M/N Phase Locked Loop output frequency (MHz), and
f_{LFS} = LFS Phase Locked Loop output frequency (MHz)

f_{YTO}, N, and $f_{M/N}$ may be looked up in Table 8-8, "Listing of all M and N Numbers and Resulting Frequencies" in service sheet BD3.

Also, f_{LFS} = (30.000 − D4 . D3 D2 D1) MHz
where
D4 = Front panel 1 MHz digit
D3 = Front panel 100 kHz digit
D2 = Front panel 10 kHz digit, and
D1 = Front panel 1 kHz digit for YTO frequencies less than 6200 MHz.

Detailed Discussion

The YTO Output signal is mixed with the Nth harmonic of the M/N OUT signal. The difference signal (20/30 MHz) is output to the

YTO Phase Detector where it is phase compared to the LFS Phase Locked Loop Output.

The M/N Phase Locked Loop Signal is matched to the input of the Sampler Drive Amplifier by R40, L1 and C10. This signal is amplified and matched to the Sampler's Harmonic Generator input. The numerous harmonics are mixed with the RF Input signal in the Sampler's Mixer. The outputs are summed and matched to the IF Preamplifier by L10 and R13. The impedance matching throws the IF Amplifier's frequency response off. The de-emphasis network at the output provides compensation that brings the frequency response back to normal. After buffering, the signal passes through a 70-MHz low-pass filter to remove the multitude of unimportant harmonics of the mixing process. The signal is then amplified and output to the YTO Phase Detector. The important signal is the 20 to 30 MHz signal which is to be phase compared with the LFS Loop signal in order to phase lock the YTO Summing Loop.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD4 was used to isolate a malfunction to the YTO Summing Phase Locked Loop Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure, in chapter 5. The following information will aid in isolating the defective component.

Equipment

Spectrum Analyzer......... HP 8556A/HP 8552B/HP 141T
High Impedance Probe...... HP 1121A

Procedure

1. Install the A3A9 assembly in the service position according to the procedure on service sheet A. Remove the cover on the right side of the YTO Phase Locked Loop Assembly to expose the A3A9A5 assembly.
2. Press PRESET (3 GHz), then, using the high impedance probe, connect the spectrum analyzer to the gate of Q4.

   The spectrum analyzer should show a 30-MHz signal at −30 dBm.

   If the signal is as indicated, proceed with step 4.

   If the signal is not as indicated, proceed with step 3.

   Using the high impedance probe, connect the spectrum analyzer to the base of Q6.

   The spectrum analyzer should show a 30-MHz signal at −31 dBm.

   If the signal is as indicated, check Q6, Q5, Q1, and associated components.

If the signal is not as indicated, check Q2, Q4, Q7, and associated components.

3. Using the high impedance probe, connect the spectrum analyzer to the right (non-grounded) side of R9.

   The spectrum analyzer should show a 189-MHz signal at +7 dBm.

   If the signal is as indicated, Sampler U12 is defective.

   If the signal is not as indicated, check Q3, Q8, and associated components.

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P/O Loop Assembly Assembly
A3A9A2, A3A9A5
Schematic Diagram
SERVICE SHEET

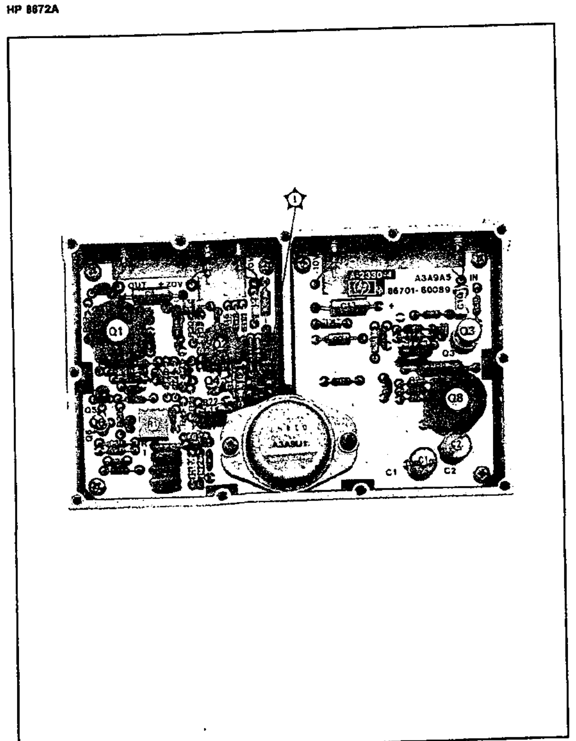
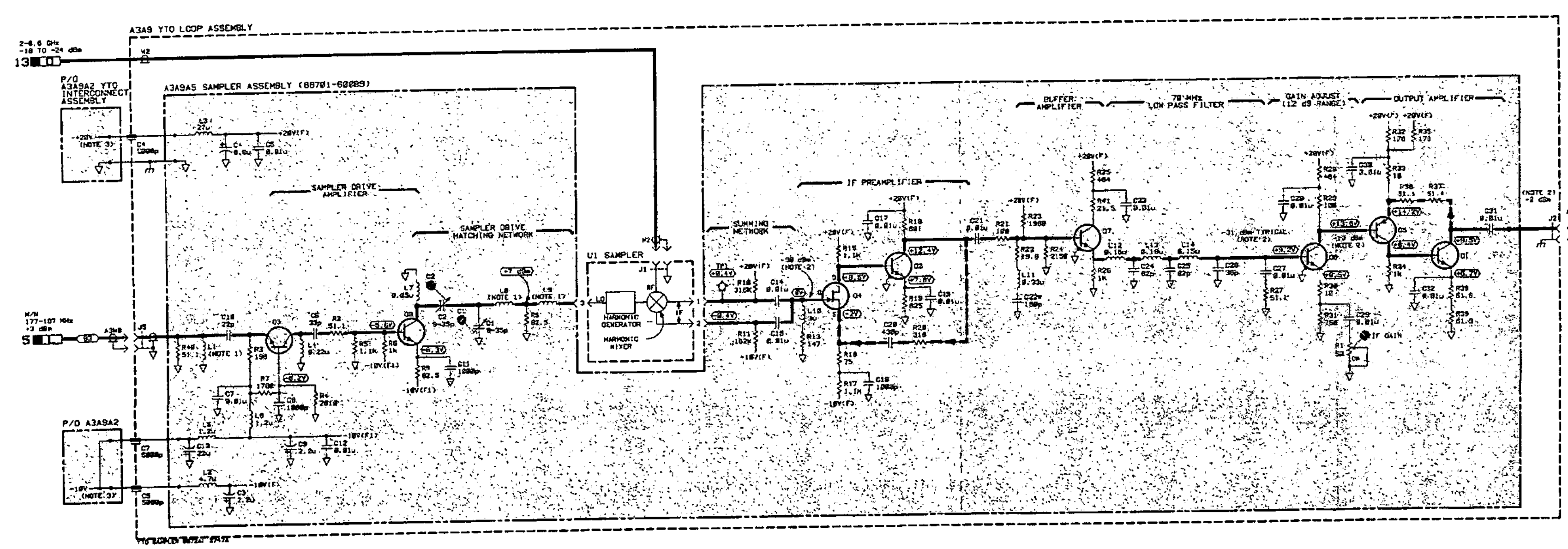


Figure 8-76. A3A9A5 Sampler Assembly Component, Adjustment and Test Point Locations



NOTES
1. A3A9A5L1,8, AND 9 ARE PART OF CIRCUIT BOARD AND ARE NOT REPLACEABLE.
2. TYPICAL IF LEVELS MEASURED WITH A 5k PROBE (50Ω REFERENCE) WITH NORMAL LOAD AT J2.
3. POWER SUPPLY CONNECTIONS TO THE A3A9A2 ASSEMBLY ARE SHOWN ON SERVICE SHEET 12.
4. SEE TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
* ASTERISK INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.

REFERENCE DESIGNATIONS

A3	A3A9A5
W8	C1-32 L1-14 Q1-8 R1-11, 13-41 TP1
A3A9	
C4, 6, 7 J2, 3 U1 W2, 4	

11
A3A9A2, A3A9A5

Figure 8-77. YTO Sampler Assembly Schematic Diagram

Service Sheet 12 YTO Phase Detector Assembly

References

Principles of Operation

General

The YIG Tuned Oscillator's frequency output is phase-locked: 1) to the difference of the YTO frequency and a selected harmonic of the M/N Phase Locked Loop; and, 2) to the LFS Phase Locked Loop. The YTO is tuned near the correct harmonic of the M/N Output frequency by the YTO pretune circuits which consist of the Digital-to-Analog Converter (DAC) and the Main Coil Driver. Once the pretuning is completed, the IF signal (20/30 MHz) from the YTO Loop Sampler is phase compared to the LFS Loop signal, and the resulting error signal tunes the YTO to achieve phase lock. The YTO Frequency is related to the M/N Out frequency and the LFS Phase Locked Loop frequency in the following manner:

$$f_o = (N)(f_{M/N} - f_{LFS})$$

where
- f_o = YTO output frequency (MHz)
- N = N number input to M/N loop (also the M/N harmonic near to which the YTO loop is pretuned)
- $f_{M/N}$ = M/N Phase Locked Loop output frequency (MHz), and
- f_{LFS} = LFS Phase Locked Loop output frequency (MHz)

f_{YTO}, N, and $f_{M/N}$ may be looked up in Table 8-8, "Listing of all M and N Numbers and Resulting Frequencies" in service sheet BD3.

Also, f_{LFS} = (30.000 − D4 . D3 D2 D1) MHz

where
- D4 = Front panel 1 MHz digit
- D3 = Front panel 100 kHz digit
- D2 = Front panel 10 kHz digit, and
- D1 = Front panel 1 kHz digit for YTO frequencies less than 6200 MHz.

Detailed Discussion

YTO Summing Loop FM Circuits. In the Signal Generator's Signal mode of operation, the Phase Detector's error voltage is proportional to the integral of the YTO frequency. In the FM mode, the error voltage is due to the sum of the integrals of the YTO frequency and the frequency deviation. Since the deviation is directly proportional to the modulation drive voltage, the error voltage may be expressed as follows:

$$V_e = \int f_o(t)dt + \int V_{FM}(t)dt$$

where V_e = phase detector's error voltage
$f_o(t)$ = YTO frequency
V_{FM} = FM drive voltage

The result is a cancellation of modulation for FM rates inside the YTO Loop bandwidth (20 kHz). In order to make the YTO Loop response to FM essentially flat, a portion of the FM drive signal is integrated and subtracted from the error voltage output by the Phase Detector. This voltage is adjusted to just cancel the error voltage caused by the FM signal. With this correction, the YTO Loop effectively passes all specified rates to the YTO with little or no degradation. Note that the FM drive signal is added after the loop Integrator and the integrated FM is subtracted from the error voltage just before the Loop Integrator.

YTO Phase Detector Assembly. The Phase/Frequency detector compares the frequency and phase of the Sampler IF signal to the output of the LFS Phase Locked Loop. The resultant error signal is integrated and amplified in the Loop Integrators. The output signal YTO Tune 1 is applied to the YTO coils to achieve phase lock.

During frequency modulation, the integrated FM signal from the A3A7 FM Driver Assembly is subtracted from the phase error signal. The net result is that the loop does not attempt to cancel the modulating signal and the YTO can be modulated at rates within the loop bandwidth.

The IF IN (from the Sampler) and the LFS Phase Locked Loop signal are divided by two and routed to the Phase/Frequency Detector. If the phase of the IF signal leads that of the LFS Phase Locked Loop signal, a negative going pulse appears at U5 pin 12 (TP3). Pin 3 (TP4) remains at a steady dc level (about −0.6 Vdc). If the LFS Phase Locked Loop signal leads, a negative pulse appears at pin 3. In each case the pulse width is proportional to the phase difference between the signals. The outputs are filtered and coupled to the differential amplifier whose output is then applied to the Loop Integrator. The output (YTO Tune 1) tunes the YTO frequency. When FM is applied to the YTO Loop, the Phase/frequency detector discriminates the FM signal. The following expression shows the relationship between modulation index (β), frequency deviation (f_{dev}) and rate of modulation (f_{mod}): $\beta = f_{dev}/f_{mod}$

The detector's practical operating range is approximately 0.5 radians ($\beta = 3.0$). Because of the divider circuits which precede the detector, β is effectively doubled to 6.0.

Overmodulation Detector. The active high outputs of the Phase/Frequency Detector are connected in a wired-or configuration to the Overmodulation Detector. When the present 0-MOD limit (2.5 Vdc minimum at phase detector output) is exceeded, the Divide Selector and the FM Status/Enable retriggerable monostable multivibrators are set.

FM Status/Enable. In the FM mode the FM ON input (high) turns the FM Switch on (Q3 off) which ungrounds the IFM IN (integrated FM input). When overmodulation occurs, and the FM Status/Enable monostable multivibrator is set, then the FM ON input is grounded (through Q1). The FM Switch, however, remains ON due to the high from the FM Status/Enable multivibrator (through CR14 on to the base of Q2 which keeps Q3 off).

Divide Selector. During overmodulation, the Divide Selector monostable multivibrator is also set. The active low output causes the Dividers to divide-by-three. In the divide-by-two mode, the signal that triggered the overmodulation is normally about $\beta = 6$ (or at the Phase/Frequency Detector output, $\beta = 3$). In the divide-by-three mode, the output beta is about 2. Therefore, the loop locks. Back in the normal divide-by-two mode, the Divide Selector will be set again if the loop has false locked on a transient or on an FM sideband, or it will simply remain as is if it has locked on the carrier.

Note

The YTO Loop can lock in either the divide-by-two or divide-by-three modes. In the divide-by-three mode, the loop bandwidth is reduced making it impossible to correctly adjust the YTO Phase Detector (refer to chapter 5).

Unlock Detector. The Unlock Detector compares the YTO TUNE 1 signal to a preset reference. If the voltage swing exceeds ±5 Vdc, a YTO unlock signal is generated. RC network C12/R14 prevents transients from causing an unlock signal.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD4 was used to isolate a malfunction to the YTO Summing Phase Locked Loop Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure, if any, in chapter 5. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter (DVM).......... HP 3455A or 3456A
Test Oscillator.................... HP 8116A

Procedures

There are two procedures provided, the first is for YTO Loop problems, the other is for FM problems.

YTO Loop Procedure. Use this procedure if the procedures in service sheet BD4 indicate a problem with the A3A9A4 portion of the YTO loop.

1. Place A3A9 in the service position using the procedure in service sheet A. Remove the cover from A3A9A4.
2. Press PRESET (3 GHz) and ground A3A6TP1.
3. Connect the oscilloscope to TP2.

   The display should show a signal between 10 and 15 MHz (100 to 66 ns period), and a peak-to-peak amplitude of between 1 and 1.5 volts.

   If the signal is as indicated, proceed with step 5.

   If the signal is not as indicated, proceed with step 4.
4. Connect the oscilloscope to U6 pin 14.

   The display should show a 30 MHz (33 ns period) signal at a peak-to-peak amplitude of between 1 and 1.5 volts.

   If the signal is as indicated, U7 is defective.

   If the signal is not as indicated, U6 is defective.
5. Connect the oscilloscope to TP5.

   The display should show a signal between 10 and 15 MHz (100 to 66 ns period) at a peak-to- peak level of between 1 and 1.5 volts.

   If the display is as indicated, proceed with step 7.

   If the display is not as indicated, proceed with step 6.
6. Connect the oscilloscope to U6 pin 2.

   The display should show a signal greater than 30 MHz (less than 33 ns period) at a peak-to-peak level of 1 to 1.5 volts.

   If the signal is as indicated, U9 is defective.

   If the signal is not as indicated, check U6 and asssociated components.
7. Connect the DVM to Q4 pin 6 then, while observing the DVM display, disconnect the black IF IN cable from A3A9J1

   The DVM should initially indicate about +10.5 Vdc, dropping to about +9.5 Vdc when the cable is removed.

If the indication is correct, replace the black cable and proceed with step 8.

If the indication is not correct, check U5, Q4, Q5, and associated components.

8. Repeat step 7 but remove the green LFS cable from A3A9J3.

   The DVM should initially indicate about +10.5 Vdc, rising to about +11.5 Vdc when the cable is removed.

   If the DVM indication is correct, check U3 and associated components.

   If the indication is not correct, check U5, Q4, Q5, and associated components.

FM Procedure. Use this procedure for FM problems.

1. Set the Signal Generator's FM DEVIATION MHz switch to 10 and the METER MODE switch to FM.

2. Connect a BNC TEE to the Signal Generator's FM INPUT connector. Connnect the output of the test oscillator and the DVM to the BNC TEE. Set the test oscillator to 2 MHz and an amplitude of 0.707 Vrms.

3. If the YTO Loop Assembly, A3A9, is in the service position and the aluminum cover shielding A3A9A4 has been removed, connect the oscilloscope directly to the drain of Q3. (*Otherwise disconnect the white IFM cable, A3W17, from A3A9J4 on the YTO Loop Assembly, A3A9, and connect a BNC TEE to A3A9J4. Connect the oscilloscope and the white IFM cable, A3W17, to the BNC TEE.*) Adjust the oscilloscope for a clear display of the 2 MHz signal. While observing the oscilloscope display, set the FM DEVIATION MHz switch first to 3 and then to OFF.

   The oscilloscope should display a 2 MHz waveform for settings 10 and 3 of 85 mVp and 30 mVp respectively. When the last setting, OFF, is made, the 2 MHz waveform should disappear. (FM DEVIATION MHz settings 1 through 0.03 attenuate the IFM signal too much to view it.)

   If the oscilloscope indication is incorrect for any setting, proceed with step 4.

   If the oscilloscope indication is correct, the FM SWITCH (on A3A9A4) is working. Disconnect the BNC TEE and oscilloscope from A3A9J4 and reconnect the white IFM cable to A3A9J4.

4. Set the DVM to measure dc voltage and connect it to the base of Q2. While observing the DVM display, set the FM DEVIATION MHz switch successively to: OFF, 0.03, 0.1, 0.3, 1, 3, 10.

   Initially the DVM should indicate +0.1 Vdc. Then it should rise to +4.5 Vdc when the second setting, 0.03, is made and remain at that voltage for all succeeding settings.

If the voltages are correct and step 3 above *was not* done, go to FM Overmodulation Procedure.

If the voltages are correct and step 3 above *was* done, go to step 5.

If the voltages are not correct, go to step 6.

5. Connect the DVM to the gate of Q3. Set the FM DEVIATION MHz switch first to OFF and then to 0.03. The DVM should read 0 Volt (Q3 is on) and −8.7 Volts (Q3 is off) in that order.

   If the readings are correct, replace Q3.

   If the readings are not correct, troubleshoot CR1 and Q2.

6. Disconnect the power cord from the Signal Generator. Unsolder feedthrough capacitor A3A9C8 from its wire lead to A3A9A4. Reconnect the power cord to the Signal Generator. Connect the DVM to A3A9C8 and observe the DVM reading as you set the FM DEVIATION MHz switch first to OFF and then to 0.03. The DVM should read 0V and +4.5 Vdc respectively.

   If the indication is correct, go to "FM Overmodulation Procedure".

   If the indication is not correct, troubleshoot the FM ON signal line through A3A9C8 to its origin on SS 21.

FM Overmodulation Procedure

1. Press the Signal Generator's PRESET (3GHz) key and set the FM DEVIATION MHz switch to 10 MHz.

2. Connect a BNC TEE to the Signal Generator's FM INPUT. Connect the DVM and the 50 ohm output of the test oscillator to the BNC TEE.

   Set the test oscillator to 100 kHz and an amplitude of 0.045 Vrms. The OVER MOD light should not be on. Increase the the amplitude of the test oscillator signal to 0.065 Vrms. The OVER MOD light should now be on.

   If the indications are correct, the FM overmodulation circuitry is working.

   If the FM overmodulation circuitry comes on too early or too late, go to chapter 5 to make necessary adjustments.

   If the OVER MOD light stays either on or off, go to step 3.

3. Reduce the test oscillator amplitude to 0 Vrms. Using the oscilloscope, verify that U2 pin 7 and U4B pin 12 are steady state highs (+5 Vdc and +3.7 Vdc respectively) and that U4A pin 13 is a steady state low (0.2 Vdc).

4. Then increase the test oscillator amplitude to 0.1 Vrms. Verify that the output at U2 pin 7 is pulsing at the rate of FM IN (100 kHz) and that U4B pin 12 is pulsing at 5 ms intervals. Verify also

that U4A pin 13 is virtually a steady state high of +4.6 Vdc and the collector of Q1 a steady state low of +0.1 Vdc.

Troubleshoot the first component in the chain that produces the incorrect output.

Note

After repairing the A3A9A4 assembly, perform the YTO Loop Phase Detector Adjustments, the YTO Loop Offset and the FM Overmodulation Adjustments.

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YTO Phase Detector Assembly
A3A9A2, A3A9A4
Schematic Diagram
SERVICE SHEET

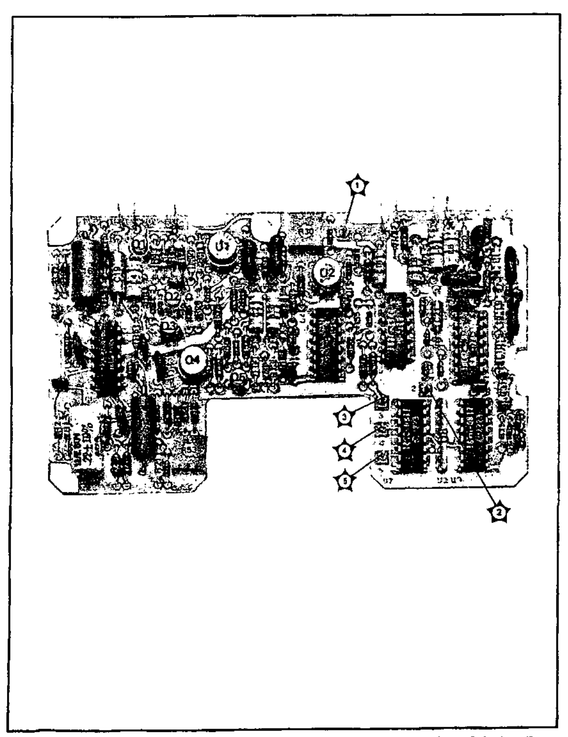
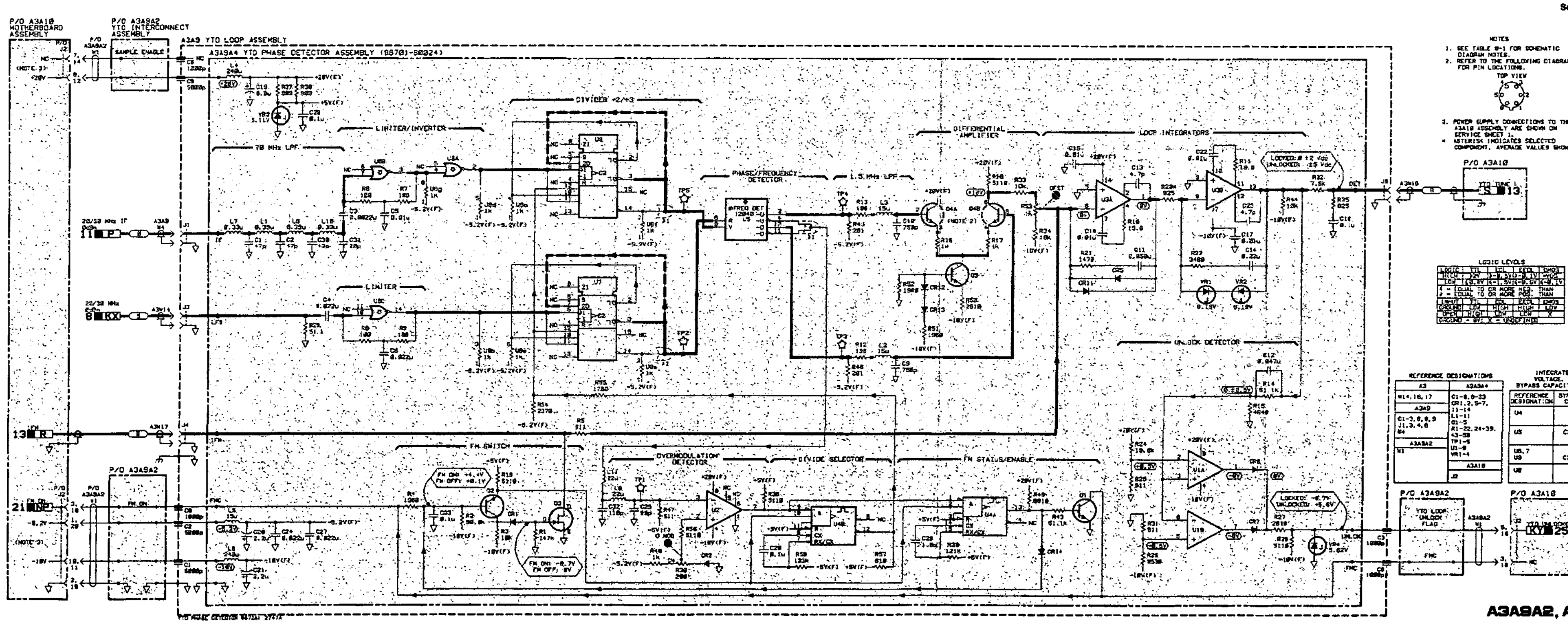


Figure 8-78. A3A9A4 YTO Phase Detector Assembly Component, Adjustment and Test Point Locations



NOTES

1. SEE TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
2. REFER TO THE FOLLOWING DIAGRAM FOR PIN LOCATIONS.

TOP VIEW

3. POWER SUPPLY CONNECTIONS TO THE A3A10 ASSEMBLY ARE SHOWN ON SERVICE SHEET 1.

* ASTERISK INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.

LOGIC LEVELS

LOGIC	TTL	ECL	EECL	CMOS
HIGH	≥2V	≥-0.5V	≥-0.1V	≥VDD
LOW	≤0.8V	≤-1.5V	≤-0.6V	≤0.1V
≤ = EQUAL TO OR MORE NEG. THAN				
≥ = EQUAL TO OR MORE POS. THAN				
INPUT	TTL	ECL	EECL	CMOS
GROUND	LOW	HIGH	HIGH	LOW
OPEN	HIGH	LOW	LOW	X
GROUND = 0V; X = UNDEFINED				

REFERENCE DESIGNATIONS

A3	A3A9A4
W14, 16, 17	C1-6, 8-33 CR1, 2, 5-7, 11-14 L1-11 Q1-5 R1-22, 24-39, 43-58 TP1-5 U1-9 VR1-4
A3A9	
C1-3, 6, 8, 9 J1, 3, 4, 6 W4	
A3A9A2	A3A10
W1	J2

INTEGRATED CIRCUIT VOLTAGE, GROUND AND BYPASS CAPACITOR CONNECTIONS

REFERENCE DESIGNATION	BYPASS CAP	PIN NUMBER
U4		+5V(F) - 14 ⏚ - 7
U5	C27	⏚ - 2, 14 -5.2V(F) - 7
U6, 7 U9	 C24	⏚ - 1, 16 -5.2V(F) - 8
U8		⏚ - 1, 16 -5.2V(F) - 1

12

A3A9A2, A3A9A4

Figure 8-79. YTO Phase Detector Assembly Schematic Diagram

Service Sheet 13 YTO/FM Coil Driver Assembly

References

Principles of Operation

General

The YIG Tuned Oscillator's frequency output is phase-locked: 1) to the difference of the YTO frequency and a selected harmonic of the M/N Phase Locked Loop; and, 2) to the LFS Phase Locked Loop. The YTO is tuned near the correct harmonic of the M/N Output frequency by the YTO pretune circuits which consist of the Digital-to-Analog Converter (DAC) and the Main Coil Driver. Once the pretuning is completed, the IF signal (20/30 MHz) from the YTO Loop Sampler is phase compared to the LFS Loop signal, and the resulting error signal tunes the YTO to achieve phase lock. The YTO Frequency is related to the M/N Out frequency and the LFS Phase Locked Loop frequency in the following manner:

$$f_o = (N)(f_{M/N} - f_{LFS})$$

where f_o = YTO output frequency (MHz)
N = N number input to M/N loop (also the M/N loop harmonic near to which the YTO loop is pretuned)
$f_{M/N}$ = M/N Phase Locked Loop output frequency (MHz), and
f_{LFS} = LFS Phase Locked Loop output frequency (MHz)

f_{YTO}, N, and $f_{M/N}$ may be looked up in Table 8-8, "Listing of all M and N Numbers and Resulting Frequencies" in service sheet BD3.

Also, f_{LFS} = (30.000 − D4 . D3 D2 D1) MHz
where D4 = Front panel 1 MHz digit
D3 = Front panel 100 kHz digit
D2 = Front panel 10 kHz digit, and
D1 = Front panel 1 kHz digit for YTO frequencies less than 6200 MHz.

In the Signal Generator's Signal mode of operation, the Phase Detector's error voltage is proportional to the integral of the YTO frequency. In the FM mode, the error voltage is due to the sum of the integrals of the YTO frequency and the frequency deviation. Since the deviation is directly proportional to the modulation drive voltage, the error voltage may be expressed as follows:

$$V_e = \int f_o(t)dt + \int V_{FM}(t)dt$$

where V_e = phase detector's error voltage
$f_o(t)$ = YTO frequency
V_{FM} = FM drive voltage

The result is a cancellation of modulation for FM rates inside the YTO Loop bandwidth (20 kHz). In order to make the YTO Loop response to FM essentially flat, a portion of the FM drive signal is integrated and subtracted from the error voltage output by the Phase Detector. This voltage is adjusted to just cancel the error voltage caused by the FM signal. With this correction, the YTO Loop effectively passes all specified rates to the YTO with little or no degradation. Note that the FM drive signal is added after the loop Integrator and the integrated FM is subtracted from the error voltage just before the Loop Integrator.

Detailed Description

The FM Driver Assembly performs three major functions. First, it combines and sums the FM drive signal with the high frequency component of the YTO Tune 1 signal. Then this combined signal is amplified, compensated (for frequency response) and converted to an FM coil drive current. The FM drive signal is integrated and coupled to the YTO Phase Detector Assembly, where it is summed with the Phase Detector's error voltage output.

Two minor but extremely important functions are: 1) shifting the YTO frequency to ensure it will pass through the loop capture range and achieve phase lock in the event the loop has become unlocked; and, 2) dividing the YTO tuning voltage (YTO Tune 1) into its high and low frequency components.

Phase Lock and FM Drive Signals. The YTO TUNE 1 signal's high frequency component and the FM drive signal are summed at the input to the FM Coil Driver. The combined signal is amplified and the drive current is applied to the FM coil through an impedance matching network. The Frequency Shaping Network, located in the coil driver's feedback loop and the main FM signal path, compensates for the gradual loss in sensitivity of the FM coil at higher frequencies. The 40 dB attenuator in the FM signal path allows switching between the most sensitive and least sensitive FM ranges.

Integrated FM Signal. The FM input signal is integrated by FM Integrator U3A and associated components. The integrator is followed by the FM Integrator Amplifiers, U3B and U2A. The gain of U3B is switched between 0 dB and 20 dB by the FM 40 dB signal. The gain of U2A can be adjusted by R40. This allows for adjustment of the IFM Signal gain to exactly balance the FM signal discriminated by the YTO Phase Detector.

In the most sensitive FM ranges (1, 3, and 10 MHz/V), the gain of U3B is 20 dB and the attenuation at the output of U2A is 0 dB. In the least sensitive ranges (0.03, 0.1, and 0.3 MHz/V), the gain of

U3B is reduced to unity (0 dB) and the output of U2A is attenuated by 20 dB. This 40 dB change in level, in effect, keeps the gain consistent with the FM drive signal applied to the YTO's FM coil.

YTO Loop Reset. The YTO Loop reset ensures that the YTO Loop acquires phase lock after a frequency transition. When a frequency change occurs in less than 15 ms, the YTO achieves lock and the YTO NRST signal does not affect the YTO TUNE 1 input. If the loop does not achieve lock in less than 15 ms, the YTO UNLOCK signal causes YTO NRST to momentarily go low. The YTO TUNE 1 signal is pulsed to 0V. The result is that the YTO frequency is shifted to another frequency and then tries to return to the pre-pulse frequency. During this transition, the YTO 20/30 MHz IF signal passes through the capture range of the loop phase detector and the loop is locked. If a large frequency change occurs (on the order of 100 MHz), YTO SLEW causes the YTO NRST signal to immediately go low. The YTO output is effectively frequency modulated and the IF signal passes through the loop capture range.

Phase Lock Amplifiers. The YTO TUNE 1 signal is amplified by Q10. The YTO TUNE 2 signal is connected to the A3A6 Main Coil Driver Assembly where all frequencies above 100 Hz are filtered out. The high pass filter (C12, R7, and R53) passes only those components of the signal greater than 100 Hz to the Coil Driver.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1 and BD4 was used to isolate a malfunction to the YTO/FM Coil Driver Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure, if any, in chapter 5. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter (DVM) .... HP 3455A or HP 3456A
Test Oscillator .... HP 8116A
Oscilloscope .... HP 1980B

Procedures

1. Press the PRESET (3 GHz) key. Connect the DVM to A3A6TP1 and disconnect the green cable from LFS connector A3A9J3 on the YTO Loop Assembly. The DVM should indicate about +6.5 Vdc.

   If the indication is correct, replace the green cable and proceed with step 2.

   If the indication is not correct, check Q10, Q7, Q8, Q3, Q1, Q2, and associated components.

2. With the DVM still connected to A3A6TP1, disconnect the black cable from IF connector A3A9J1 on the YTO Loop Assembly. The DVM should indicate about −5 Vdc.

   If the indication is correct, the Phase Lock Amplifiers are working. Replace the black cable and proceed with step 3.

   If the indication is not correct, check Q10, Q7, Q8, Q3, Q1, Q2, and associated components.

3. Set the test oscillator for 2 MHz at minimum output level. Connect the test oscillator's 50 ohm output to the Signal Generator's FM INPUT.

4. Set the Signal Generator's METER MODE switch to FM and the FM DEVIATION MHz switch to 3. Adjust the test oscillator's output level for a full scale reading on the Signal Generator's OUTPUT meter.

5. Connect the oscilloscope to A3A7TP1. The osciloscope display should show a 2 MHz signal at a peak-to-peak level of 4.8V ±15%.

   If the signal is as indicated, the FM Amplifiers and Bias Stabilizer are working. Proceed with step 6.

   If the signal is not as indicated, check Q4, Q6, Q5, U1, and associated components.

6. With the equipment still set up as in steps 3 and 4 and the oscilloscope still connected to A3A7TP1, set the FM DEVIATION MHz switch to 0.1. The signal should drop to 170 mVpp ±15%.

   If the signal changes as indicated, the relay K2 is working. Proceed with step 7.

   If the signal does not change as indicated, check Q13, relay K2 and associated components.

7. Adjust the test oscillator to a frequency of 10 kHz and a full scale reading on the Signal Generator's FM meter scale. Set the Signal Generator's FM DEVIATION MHz switch to 3. (Expect the Signal Generator to overmodulate and to phase unlock.)

8. Connect the oscilloscope to A3A6TP4. The oscilloscope display should show a 10 kHz signal 4.7 Vpp ±15%.

   If the signal is as indicated, the FM Integrator and FM Integrator Amplifiers are working. Proceed with step 10.

   If the signal is not as indicated, proceed with step 9.

9. Connect the oscilloscope to A3A7TP3. The oscilloscope should show a 10 kHz signal 480 mVpp ±15%.

   If the display is as indicated, check U3B, U2, and associated components.

If the display is not as indicated, check U3A, Q11 and associated components.

10. Leave the oscilloscope connected to A3A7TP4 and set the Signal Generator's FM DEVIATION MHz switch to .1. The signal should drop to 130 mVpp ±15%.

    If the signal changes as indicated, Q14 and Q15 are functioning normally.

    If the signal does not change as indicated, check Q14, Q15, and associated components.

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YTO/FM Coil Driver Assembly
A3A7, A3A9A3
Schematic Diagram
SERVICE SHEET

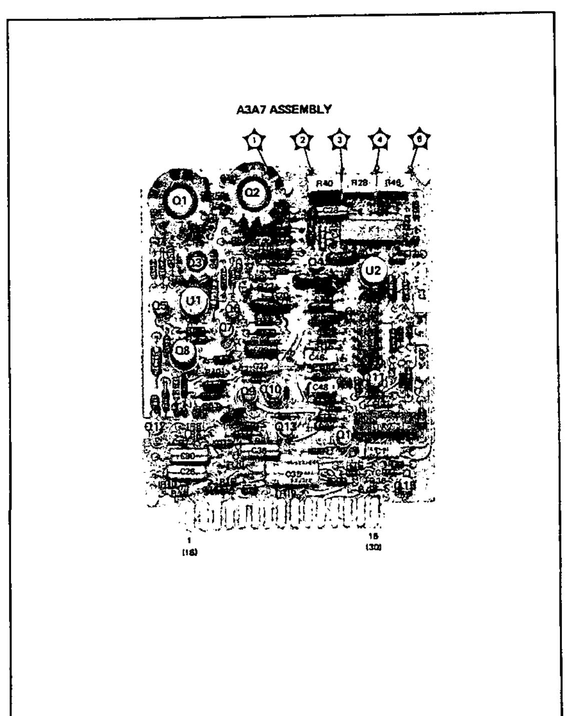
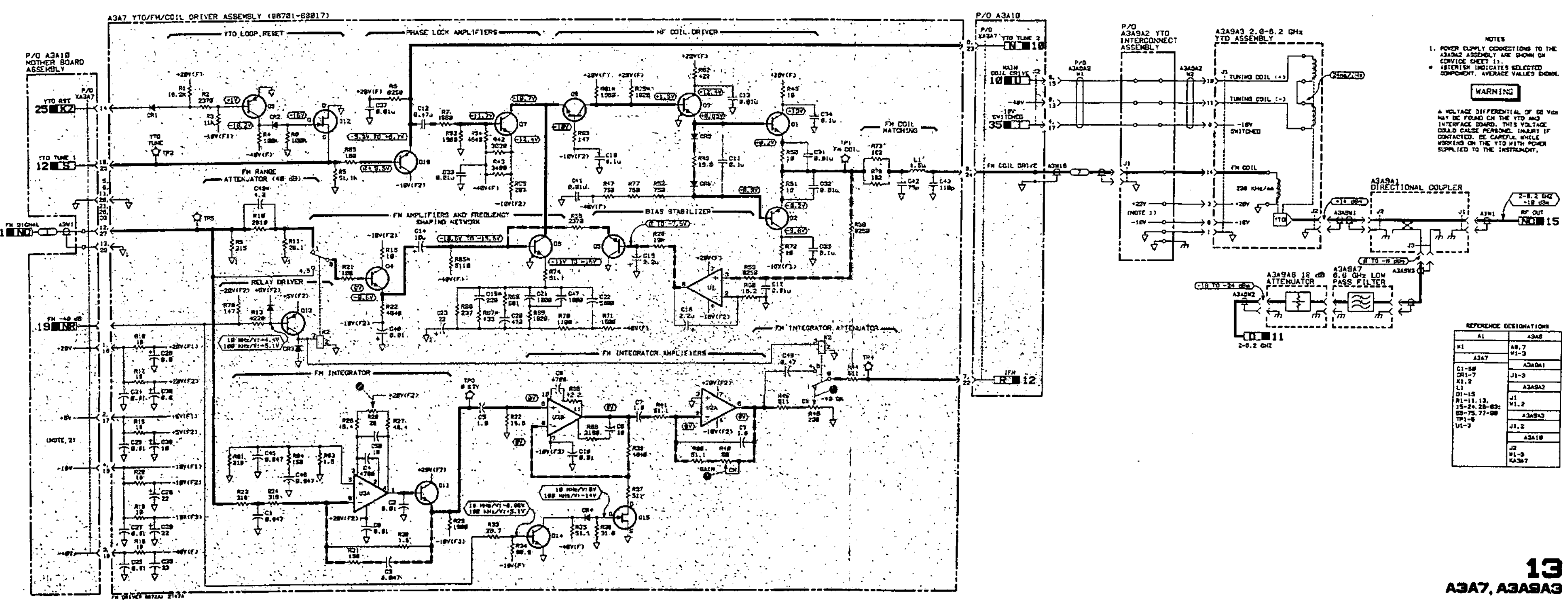


Figure 8-60. A3A7 YTO/FM Driver Assembly Component, Adjustment and Test Point Location



13

A3A7, A3A9A3

Figure 8-61. YTO/FM Coil Driver Assembly Schematic Diagram

Service Sheet 14 RF Amplifier and ALC Assembly

References

Principles of Operation

General

As shown on service sheet BD5 the YTM (Yig-Tuned Multiplier) multiplies the YTO (YIG-Tuned Oscillator) signal by 1, 2, or 3 to produce the desired frequency. The signal is amplified, leveled, and applied to a 10 dB step attenuator for final level selection.

The primary function of the ALC circuitry is to provide accurately calibrated output power over the Signal Generator's 2 to 18 GHz frequency range. In addition, an external ALC input makes it possible to automatically control the level at a remote load.

Detailed Description

This service sheet describes the Amplifier-Modulator in the RF path and the ALC Assembly which is part of the ALC Loop.

RF Path. The A1A12 Amplifier-Modulator Assembly includes a preamplifier, PIN diode modulator to control the signal level, and a power amplifier to amplify the RF signal.

ALC Assembly A1A5. This assembly processes the ALC ERROR voltage and the AM signal, and sums them to produce the ALC MOD voltage and signals for the Unleveled Detector and Level Meter. The ERROR voltage from the ALC detector is applied to an Integrator, U3 which has three possible gains depending on the band of the Synthesizer's output frequency. This is to compensate for the YTM's different transfer characteristic on each band. The output of U3 drives Q2, which along with associated circuitry, is a current source for the PIN diode modulator in A1A12. Q4 and C12 control the ALC Loop's bandwidth. When the Synthesizer is being amplitude modulated, Q4 isolates C12 from ground, thereby widening the bandwidth.

The AM signal is applied to amplifier U7, the gain of which is switched by Q12 and Q13 to select 30% or 100% modulation ranges. This amplifier has a transistor in its feedback path so that the output voltage will be proportional to the log of the input voltage.

This is necessary because the AM signal is summed with the ERROR voltage which is proportional to the log of the ALC detector output. Q6 and associated circuitry form an emitter follower that compensates for high frequency rolloff in the PIN diode modulator of A1A12 caused by shunt capacitance. It does this by increasing the level of the modulating signal as modulation frequency increases.

The Meter Driver circuit converts the ERROR voltage into a meter current proportional to the RF output in dB. The REF VOLTAGE is summed with the ERROR voltage to prevent the meter from indicating incorrectly when the loop is unleveled.

The unleveled detector tells the front panel and the Digital Control Unit (DCU) when the ALC is not able to level the RF signal.

U9 and associated circuity form a power clamp which prevents the YTM sphere squegging by limiting power into the YTM. When the power sense voltage from the ALC detector circuitry exceeds a certain threshold, U9 and CR9 act as a current sink at the base of Q2 to override the integrated error signal from U3. The effect is that power is not allowed to exceed a preset level when operating over the 2 to 6.199999 GHz region.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD5 or BD6 was used to isolate an ALC problem to the circuits shown on this schematic.

Equipment

Power Sensor.................... HP 8481A
Power Meter..................... HP 436A
Digital Voltmeter (DVM).......... HP 3455A or HP 3456A

Procedures

1. Connect the power meter to the Signal Generator's RF OUTPUT connector. Set the Signal Generator to 7 GHz, the RF OUTPUT switch to ON, the RANGE switch to zero dB, the AM switch to OFF, and the FM DEVIATION MHz switch to OFF. Disconnect the blue bias cable, A1W9, from Amplifier-Modulator Assembly A1A12. The power meter should read >+8 dBm and will vary above this level by several dB from 6.2 to 18 GHz.

Note

With the blue bias cable removed, an RF power check may be incorrect if it is made in the first band (2 to 6.199 GHz) at any point in the microwave chain from the YTM to the Signal Generator's RF OUTPUT connector. Disconnecting the blue bias cable in the first band will cause the YTM to squeg at certain frequencies and power to drop sharply.

If the power is correct, the automatic loop control circuitry is not working. Go to step 2.

If the power is not correct, the microwave chain is not working. Return to BD5 to troubleshoot the microwave chain. (Always start troubleshooting at the block diagram level before using a schematic diagram.)

2. Reconnect the blue bias cable using a TEE and connect the DVM to one arm of the TEE.
3. Press the PRESET (3 GHz) key. Set the VERNIER fully clockwise and the RANGE switch to 0 dB. The DVM should indicate about +0.68 Vdc.

   If the voltage is correct but the meter is not indicating full scale, troubleshoot Meter Driver U8 and Q14 (or perform the ALC Adjustments in chapter 5).
4. Tune the frequency above 6.2 GHz. The voltage at the TEE will normally drop to about 0.64 Vdc.
5. Tune the frequency above 12.4 GHz. The voltage will normally remain about 0.64 Vdc.

   If the voltages in steps 3,4 and 5 are correct, go to step 6.

   If the voltages in steps 3, 4 and 5 are not correct, troubleshoot U1, U3, and and Q3. Also, measure the voltage at A1A5TP5. It should be 0 Vdc when the AM switch is OFF. If it is not, troubleshoot U6 and Q7.
6. Set the RF OUTPUT switch to OFF. The UNLVL annunciator should light and the voltage at the TEE should be about +0.9 Vdc.

   If the UNLVL annunciator does not light. troubleshoot U4, U5, and the UNLVL LED.

   If everything is correct to this point, the automatic leveling control is working. Continue with step 7.
7. Disconnect the DVM from the TEE and connect an oscilloscope in its place. Leave the blue cable attached to the TEE and the TEE connected to J3 of the Amplifier-Modulator, A1A12.
8. Connect the test oscillator to the Signal Generator's AM INPUT. Set the AM switch to the 100% range and the test oscillator to 10 kHz at 0.5 Vrms. The modulation signal on the oscilloscope should be about 0.06 Vpp.

   If the signal is correct, go to step 9.

   If the signal is incorrect, troubleshoot the AM ON/OFF selector and the Buffer Amplifier.
9. Set the AM switch to 30%. The signal on the oscilloscope should decrease to 0.02 Vpp.

If the signal is incorrect, troubleshoot the 30% to 100% Range Change Ckt (Q9 through Q13).

If the signals in steps 8 and 9 are correct, the AM circuitry on this assembly is working. Remove the TEE, reconnect the blue cable and disconnect the test oscillator.

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RF Amplifier and ALC Assembly
A1A5, A1A13
Schematic Diagram
SERVICE SHEET

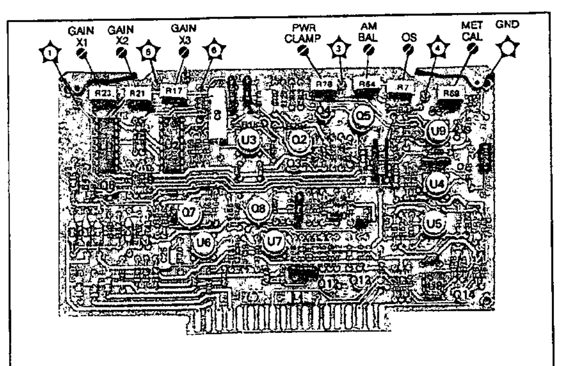


Figure 8-62. A1A5 ALC Assembly Component, Adjustment and Test Point Locations

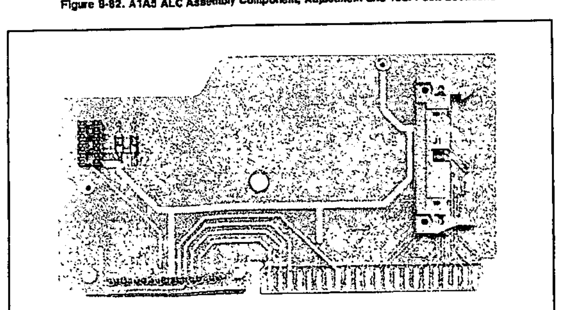
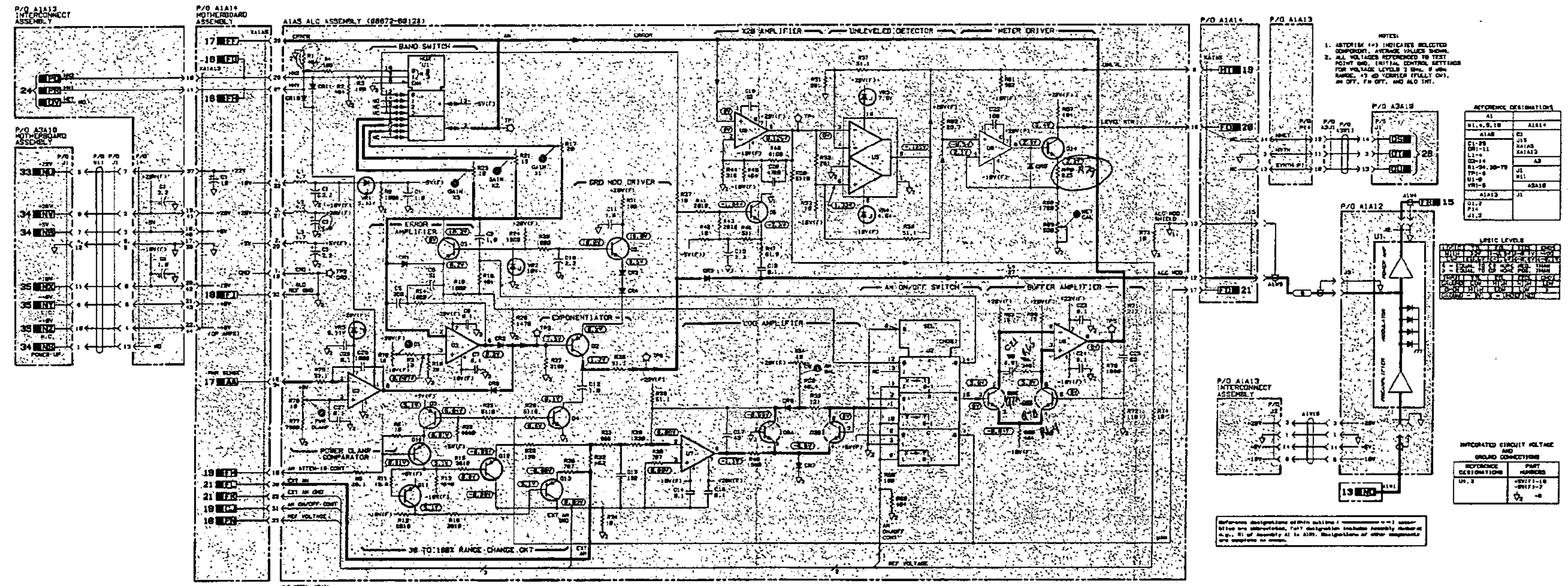


Figure 8-63. A1A13 Interconnect Assembly Component Locations



14
A1A5, A1A3

Figure 8-64. RF Amplifier and P/O ALC Assembly Schematic Diagram
8-285/8-286

Service Sheet 15 YTM Control

References

Principles of Operation

General

As shown on service sheet BD5 the YTM (Yig-Tuned Multiplier) multiplies the YTO (YIG-Tuned Oscillator) signal by 1, 2, or 3 to produce the desired output frequency. Also, the signal is amplified, leveled, and applied to a 10 dB step attenuator for final level selection.

This service sheet describes the Isolator, High Pass Filter, and YIG Tuned Multiplier in the RF path and the YTM Driver Assembly.

RF Path. The Power Amplifier A1A12 (service sheet 14) operates close to saturation and provides a high drive level to the YTM. Isolator (A1AT2) protects the amplifier from reflections from the YTM. The isolator's output goes to a 1.5 GHz High Pass Filter (A1FL1) and then to a Step Recovery Diode (SRD) multiplier. The diode is biased to provide maximum output power at frequencies in the selected harmonic band. The YIG Filter selects the correct harmonic and is tuned over the frequency range by a current ramp generated by the YTM Driver Assembly.

YTM Driver Assembly. This assembly converts the 2 to 6.2 GHz voltage ramp, YTM TUNE, into a 2 to 18 GHz current ramp. The main coil shaping circuit multiplies the YTM TUNE voltage by factors determined by the decoded band information (I1 I2, I3, G2, and G3). This results in a linear ramp voltage which U5, and associated transistors, convert into a current ramp to tune the YIG Fil ter. The YIG Filter is not perfectly linear, so the positive and negative current sources and the Band 3 breakpoint circuit generate compensating currents that are summed with the main current at the emitter of Q1 so the YTM will accurately track the YTO frequency.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD5 was used to isolate a YTM problem to the circuits shown on this schematic.

Equipment

Power Sensor .... HP 8481A
Power Meter .... HP 436A
Digital Voltmeter (DVM) .... HP 3455A or HP 3456A

Procedures

1. Connect the power meter to the YTM output. Tune the Signal Generator frequency from 2 to 18.0 GHz in 100 MHz steps; the power should remain above +9 dBm over the entire range. If the power is correct the YTM and all driving circuits are working properly. At band edges, 6.2 GHz and 12.4 GHz, it is normal to have an abrupt change in power level; if a power change does not occur, the YTM may not be changing bands.
2. If the power is not correct, measure the output of the A1AT2 isolator. It should deliver about +20 dBm from 2 to 6.2 GHz. If the output power is not correct, measure the input power to the Amplifier assembly, which should be >+11 dBm. If the input is incorrect, go to service sheet 14.
3. Connect the voltmeter to the A1A8 SENSE test point. Set the Signal Generator frequency to 2 GHz. The voltage should be about −1 Vdc.
4. Set the Signal Generator frequency to 18 GHz. The voltage should be about −9.9 Vdc. (The change with frequency is about −0.55 V/GHz.)
5. If the output is significantly wrong, measure the tuning voltage at edge connector pin 6. That voltage should be −3.000 V/GHz from 2 to 6.199 GHz. If the tuning voltage is incorrect, go to service sheet 9 to check DAC operation or perform DAC Adjustment procedure.
6. If the output voltage is correct at A1A8 SENSE testpoint, but the YTM output is wrong, troubleshoot to isolate the malfunction to the YTM, Isolator or High Pass Filter.
7. If the input tuning voltage is correct, but the output voltage is wrong, perform the YTM and ALC adjustments. A malfunction on the YTM Driver will generally be seen as a failure to adjust correctly. Use the voltages on the schematic to locate the malfunction. Also use table of voltages on service sheet 16 to be sure all band related inputs to the YTM Driver are functioning correctly.

15

YTM Control Assembly A1A8, A1A3
Schematic Diagram
SERVICE SHEET

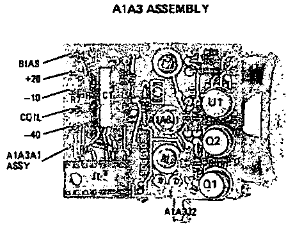


Figure 8-85. A1A3 YTM Assembly Component and Test Point Locations

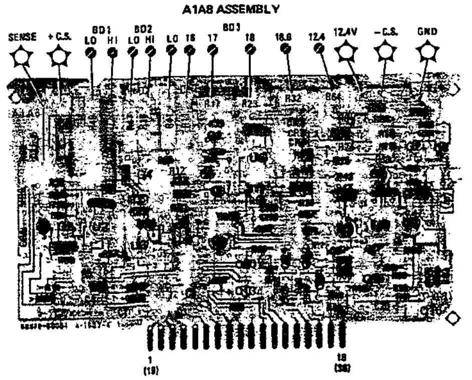
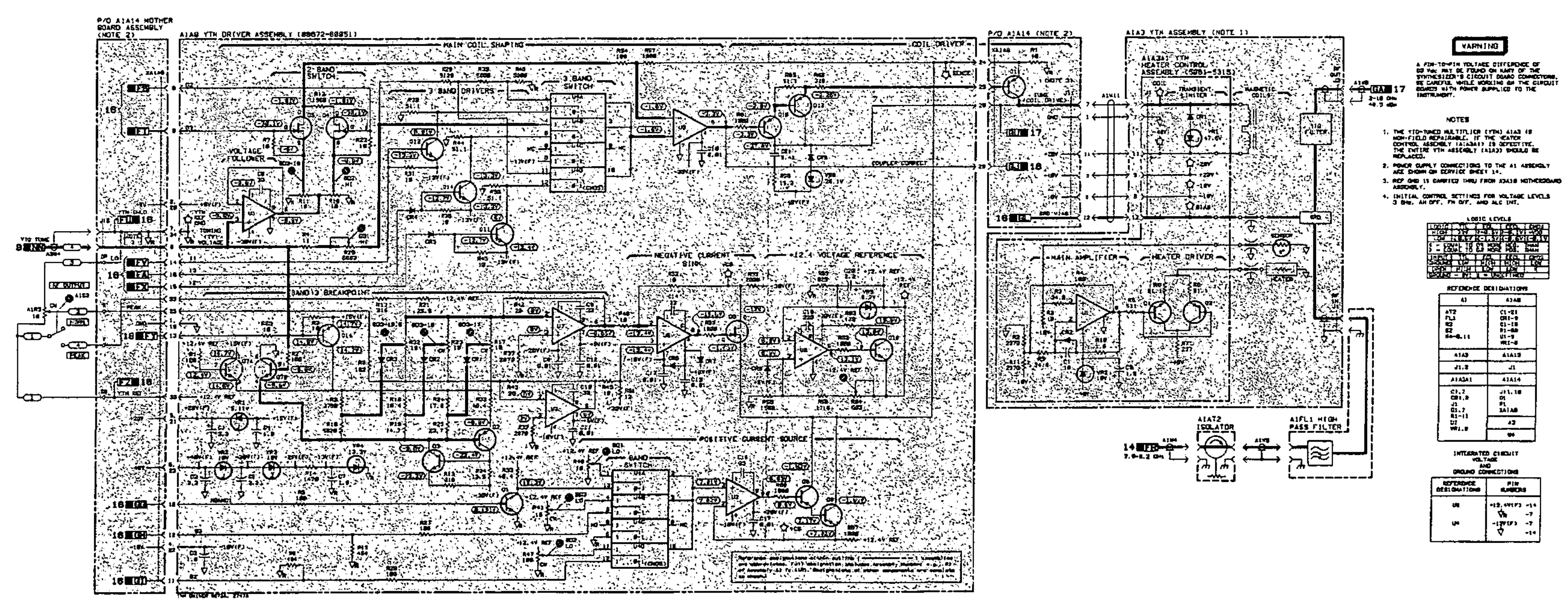


Figure 8-86. A1A8 YTM Driver Assembly Component, Adjustment, and Test Point Locations



15

A1A3, A1A8, A1AT2, A1FL1

Figure 8-87. YTM Control Assembly Schematic Diagram
8-289/8-290

Service Sheet 16 SRD Control Circuits

References

Principles of Operation

General

The YTM (Yig-Tuned Multiplier) multiplies the YTO (YIG-Tuned Oscillator) signal by 1, 2, or 3 to produce the desired output frequency.

This service sheet describes the SRD Bias Assembly which decodes band information and generates an F CORRECT voltage for the ALC circuitry.

SRD Bias Assembly

The coupler correct circuit converts the COUPLER CORRECT voltage, which is derived from the YTM tuning ramp, into a voltage ramp with the proper slope to correct for rolloff of the directional coupler. This ramp, F CORRECT, is then summed with the ERROR voltage in the ALC circuitry. The Band Decode and Logic Level Converters translate the band information, HN1 and HN2, to control signals for the YTM Driver Assembly.

The Bias Correct circuit generates a bias signal for the Step Recovery Diode (SRD) so that the SRD output power will be optimum in the band of the Signal Generator's output frequency.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD5 was used to isolate an SRD bias problem to the circuits shown on this schematic.

Equipment

Digital Voltmeter (DVM) .... HP 3455A or HP 3456A

Procedure

1. Use the following table to troubleshoot the various input and output signals of the SRD Bias assembly. The table shows the relationship between inputs HN1 and HN2 and the various outputs.

	BAND 1 (Vdc)	BAND 2 (Vdc)	BAND 3 (Vdc)
HN1	0.2	5	0.2
HN2	0.2	0.2	5
NBAND2	3.6	0.2	3.6
NBAND3	3.6	3.6	0.2
NBAND1	0.2	3.6	3.6
B2	0.01	12.1	0.01
I2	−12	−29.6	−12
G2	−29.7	−2.7 to −5.7	−29.7
I1	−13.2	−12.6	−12.6
B3	0.02	0.02	12
I3	−12	−12	−29.5
G3	−29.7	−29.7	−4.8 to −7.2
BP	0.04	0.04	14.7
SRD Bias	−6.4	+0.2 to −0.3	−0.2 to +1.0

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SRD Control Circuits
Schematic Diagram
SERVICE SHEET

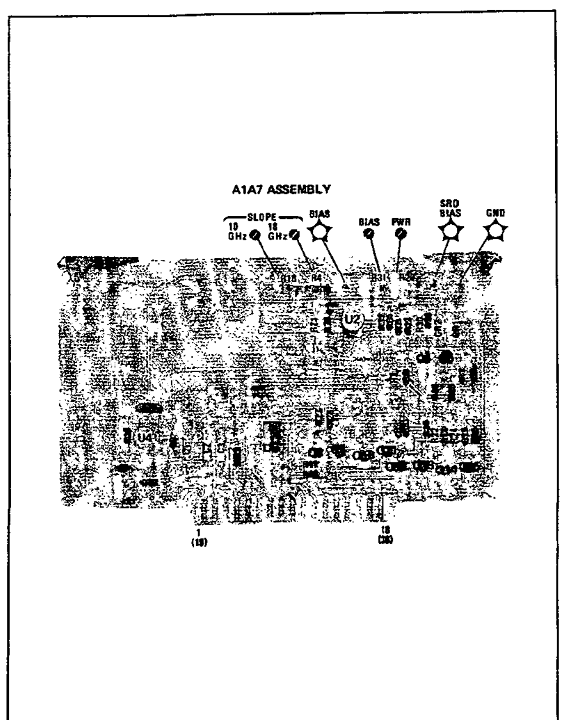
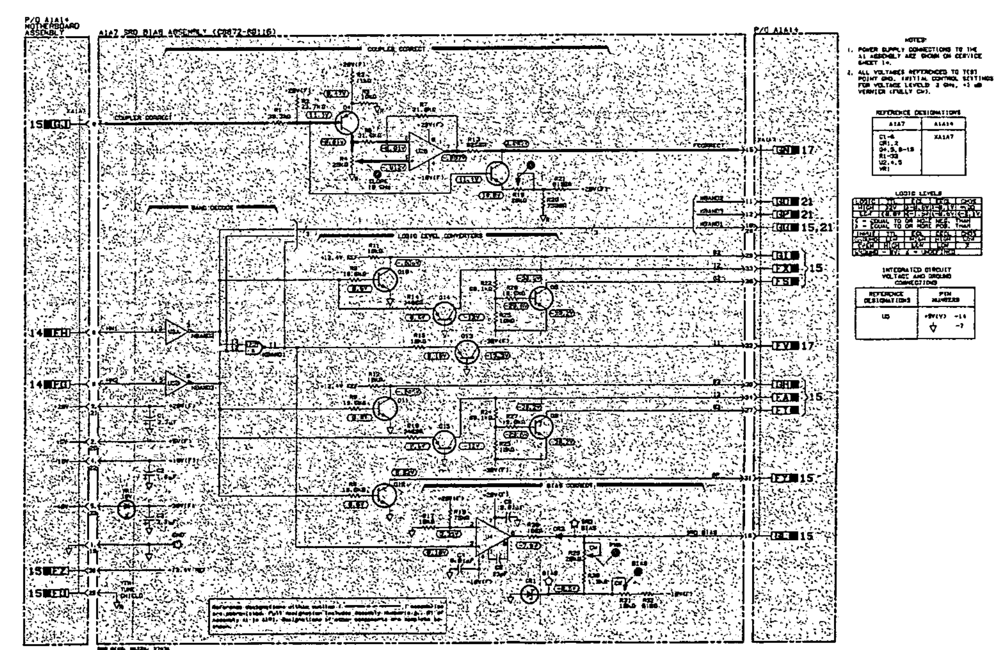


Figure 8-68. A1A7 SRD Bias Assembly Component Locations



16
A1A7

Figure 8-69. SRD Bias Assembly Schematic Diagram

Service Sheet 17 ALC Detector Assembly

References

Principles of Operation

General

The YTO signal is amplified, leveled and applied to a 10 dB step attenuator for final level selection. This service sheet describes the Directional Coupler in the RF path and the Leveling Detector and ALC Detector Assembly which are part of the ALC circuitry.

RF Path

Directional Coupler A1DC1 samples the RF output power and applies it to the Leveling Detector A1CR1. The sampled signal level is low enough that the detector operates in its square law region. As a result, the detected voltage linearly represents the RF power in watts. A logarithmic amplifier in the ALC Detector Assembly is used to obtain a voltage that is linearly proportional to the RF power in dB.

The output level of the directional coupler rolls off with increasing frequency. The detector does not indicate this change in output level with frequency. Therefore, an F CORRECT voltage is applied to the ALC circuitry (see service sheet 16) to provide a constant output level.

ALC Detector Assembly

The Int ALC Log Amplifier converts the output of the Leveling Detector into a dc voltage that is proportional to the RF output in dB. This allows linear voltage control of the output level and for the output level meter scale to read linearly in dB. U6 sums the REF VOLTAGE from the RF Output Level Control Assembly with the logged detector voltage. The resulting ERROR voltage is summed with the AM signal in the ALC Assembly and applied to the PIN modulator.

The Ext ALC Amplifier allows the external ALC circuits to be calibrated for use with an external detector. U5 acts as an absolute value converter so that positive or negative detectors can be used.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD5 or BD6 was used to isolate an ALC Detector problem to the circuits shown on this schematic.

Equipment

Power Sensor	HP 8481A
Power Meter	HP 436A
Digital Voltmeter (DVM)	HP 3455A or 3456A
Power Supply	HP6200B

Procedure

1. Make sure the green output cable from A1CR1 is securely attached. If it is loose, there may be leveling problems at low vernier settings.
2. Set the ALC switch to INT, the AM switch to OFF, the FM DEVIATION switch to OFF, and the RF switch to ON. Disconnect the Leveling Detector (A1CR1) from the Directional Coupler (A1DC1). Measure the power at the coupled arm of A1DC1. It should be >−3.5 dBm from 2 to 18 GHz.

   If sufficient power is not available, perform the YTM and ALC adjustments in chapter 5.
3. With the detector still disconnected, measure the voltage at A1A6TP3. With no leveling input, the voltage should be about −0.6 Vdc. Change the OUTPUT LEVEL RANGE switch to +10 dB. The voltage at TP3 should not change significantly.

   If these voltages are not correct, troubleshoot the internal ALC Log Amplifier log network and buffer amplifier using voltages on the schematic.
4. Set the ALC switch to XTAL. Make sure nothing is connected to the EXT ALC INPUT. The voltage should not change much. Switch to PWR MTR; the voltage should not change.

   If the voltages are incorrect in external leveling, troubleshoot the external ALC Amplifier and Log Amplifier.
5. Connect a low voltage power supply to the EXT ALC INPUT connector. Slowly increase the power supply output from zero to 1 Vdc. The signal at A1A6TP3 should change smoothly from about −0.4 Vdc to +0.13 Vdc.

   If the voltage swing is correct, the external ALC amplifiers and the output buffer amplifier are working properly. To isolate buffer amplifier problems, the signal at TP4 should vary from about −0.08 Vdc to +0.04 Vdc.

6. Set the ALC switch to INT and reconnect the leveling detector. The voltage at TP3 should be about 0.17 Vdc and vary as the VERNIER is varied from about −0.21 Vdc to +0.17 Vdc.

   If the voltage is present but does not vary, go to Service Sheet 18 to continue troubleshooting.

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ALC Detector Assembly A1A6
Schematic Diagram
SERVICE SHEET

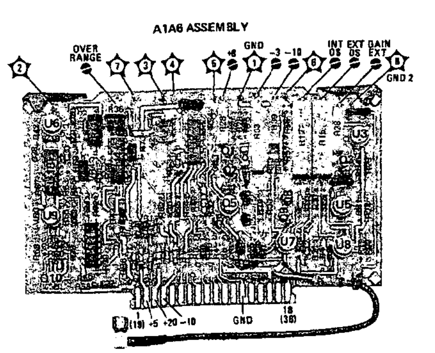
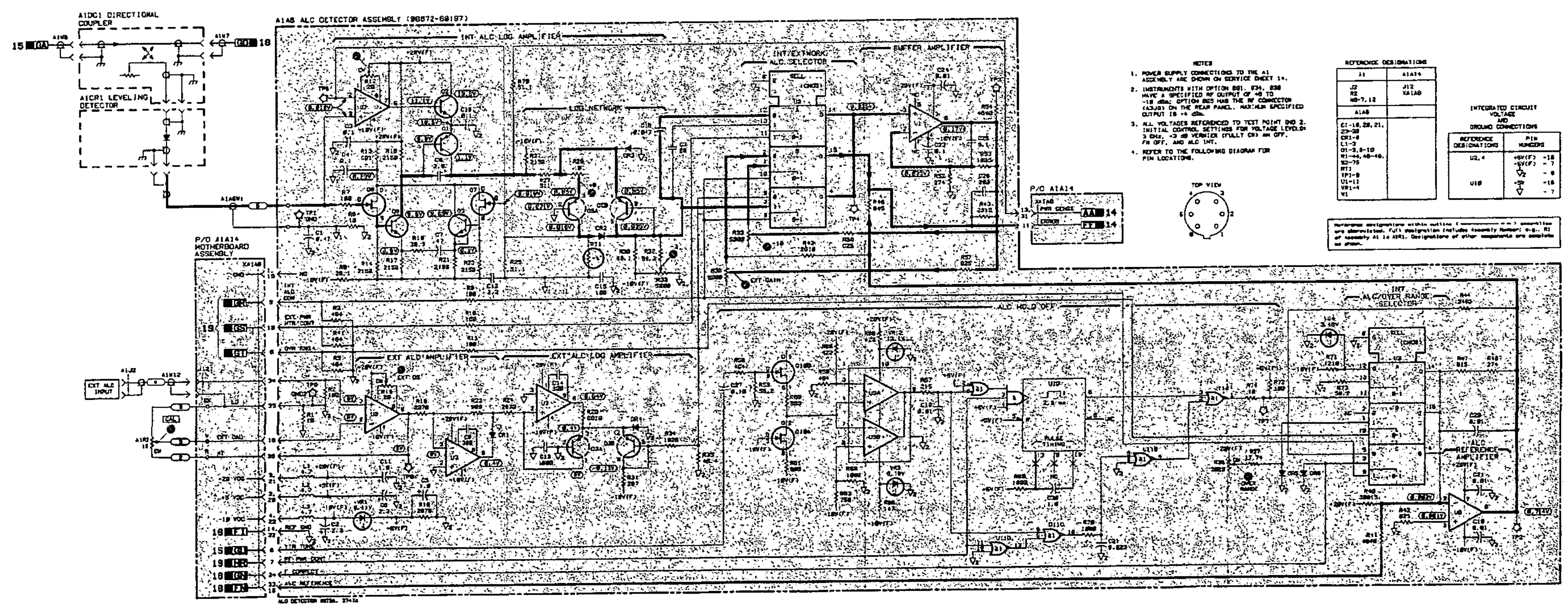


Figure 8-90. A1A6 ALC Detector Assembly Component, Adjustment and Test Point Location



17
A1A6,
A1CR1,
A1DC1

Figure 8-91. ALC Detector Assembly Schematic Diagram
8-299/8-300

Service Sheet 18 RF Output Level Control Assembly

References

Overall Block Diagram	Service Sheet BD1
Microwave Signal Path Block Diagram	Service Sheet BD5
Automatic Level Control (ALC) Block Diagram	Service Sheet 6
Electrostatic Discharge (ESD) Precautions	Chapter 8 (Front)
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5
After Service Safety Checks	Chapter 8 (Front)

Principles of Operation

General

As shown on service sheet BD5 the RF Output Assembly multiplies the YTO signal by 1, 2 or 3 to produce the desired frequency. Also the signal is amplified, leveled and applied to a 10 dB step attenuator for final level selection.

This service sheet describes the Programmable Attenuator in the RF path and the Level Control Assembly, which controls the ALC Loop and the Programmable Attenuator (A1AT1).

RF Path

The programmable attenuator provides 0 to 110 dB of attenuation in 10 dB steps. From the attenuator the RF signal passes directly to the front panel RF OUTPUT connector.

Level Control Assembly

This assembly controls the 10 dB step attenuator, and converts the 1 dB remote level data or the OUTPUT LEVEL VERNIER position into the REF VOLTAGE for the ALC.

The Encode Logic, Signal Buffers, and Solenoid Drivers condition the ATTEN 10 to 80 CONT signals so they can drive the programmable attenuator. In Remote, the D/A converter translates the 1 dB steps coded on the ALC 1 to 8 CONT lines into an analog reference voltage for the ALC Loop. In local, U7 acts as a follower for the voltage from the wiper of the OUTPUT LEVEL VERNIER control.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD5 or BD6 was used to isolate a level control problem to the circuits shown on this schematic.

Equipment

Power Sensor .... HP 8481A
Power Meter .... HP 436A
Digital Voltmeter (DVM) .... HP 3455A or 3456A
Controller .... HP 85B or HP 9826/36A

If the malfunction involves the VERNIER or 1 dB steps, start at step 1. If the problem involves 10 dB steps, start at step 4.

Procedure

1. Connect the voltmeter to DAC test point. Set the ALC switch to INT; make sure the instrument is not in REMOTE. Set the VERNIER fully counterclockwise. The voltmeter should indicate about −6. 5 Vdc. Turn the VERNIER control clockwise while observing the voltage. The amplitude should drop at 0.5 V/dB and should be about 0. 0 Vdc when the VERNIER is fully clockwise.

   If the voltages are correct, the local reference voltage circuitry is working properly. Skip to step 3 to check remote reference voltages.

   If the voltages are incorrect, continue with this procedure.

2. Measure voltages at −6.2 Vdc test point and +6.2 Vdc test point. If the negative voltage is incorrect, the local reference voltage will be incorrect. If the positive voltage is incorrect, the remote reference voltage will be incorrect.

   If both voltages are correct, troubleshoot U7 and Q10-Q15.

3. Execute the following program to check the remote reference voltage at the DAC test point. Observe voltmeter while running the program.

```
10 REMOTE 719
20 FOR V=61 TO 48 STEP-1
30 OUTPUT 719; "L" & CHR$(V)
40 DISP -(V-48)/2 "VDC"
50 WAIT 2! USE 2000 for HP 85B
60 NEXT V
70 END
```

   If the voltages are not correct, troubleshoot the +V Reference and the D/A Converter.

4. Set OUTPUT LEVEL RANGE switch to 0 dB and connect a spectrum analyzer or the power meter to RF OUTPUT connector. Set VERNIER fully clockwise and RF switch ON. The power meter should indicate about +3 dBm.

5. Switch the RANGE switch to −10 dBm. The power meter should indicate −7 dBm.
6. Continue lowering the output range to the limit of the spectrum analyzer or power meter.

   If the power drops in 10 dB steps each time, the A1A10 board and the output attenuator are working properly.

   If the results are incorrect, continue with this procedure.
7. Locate the test points labeled 10, 20, 40, and 80 on A1A10. The signals here are TTL levels. Check them according to the truth table.

	Test Points			
Range	**10**	**20**	**40**	**80**
0 dB	L	L	L	L
−10	H	L	L	L
−20	L	H	L	L
−30	H	H	L	L
−40	L	L	H	L
−50	H	L	H	L
−60	L	H	H	L
−70	H	H	H	L
−80	L	L	H	H
−90	H	L	H	H
−100	L	H	H	H
−110	H	H	H	H

Note that the test point labeled "80" actually controls a second 40 dB attenuator section which is used only at power levels −80 dBm and below.

If the test points do not agree with the truth table, check U6 and if it is working properly, go to service sheet 19 to continue troubleshooting. Otherwise troubleshoot the appropriate solenoid driver.

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RF Output Level Control
A1A10, A1AT1
Schematic Diagram
SERVICE SHEET

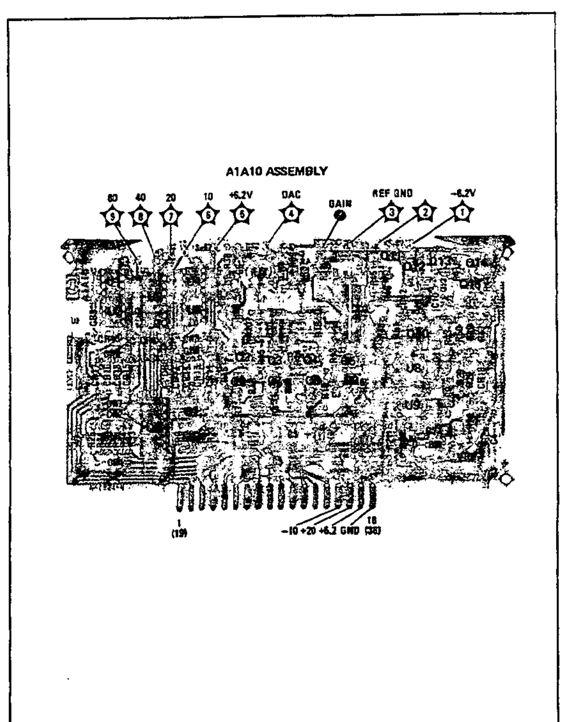
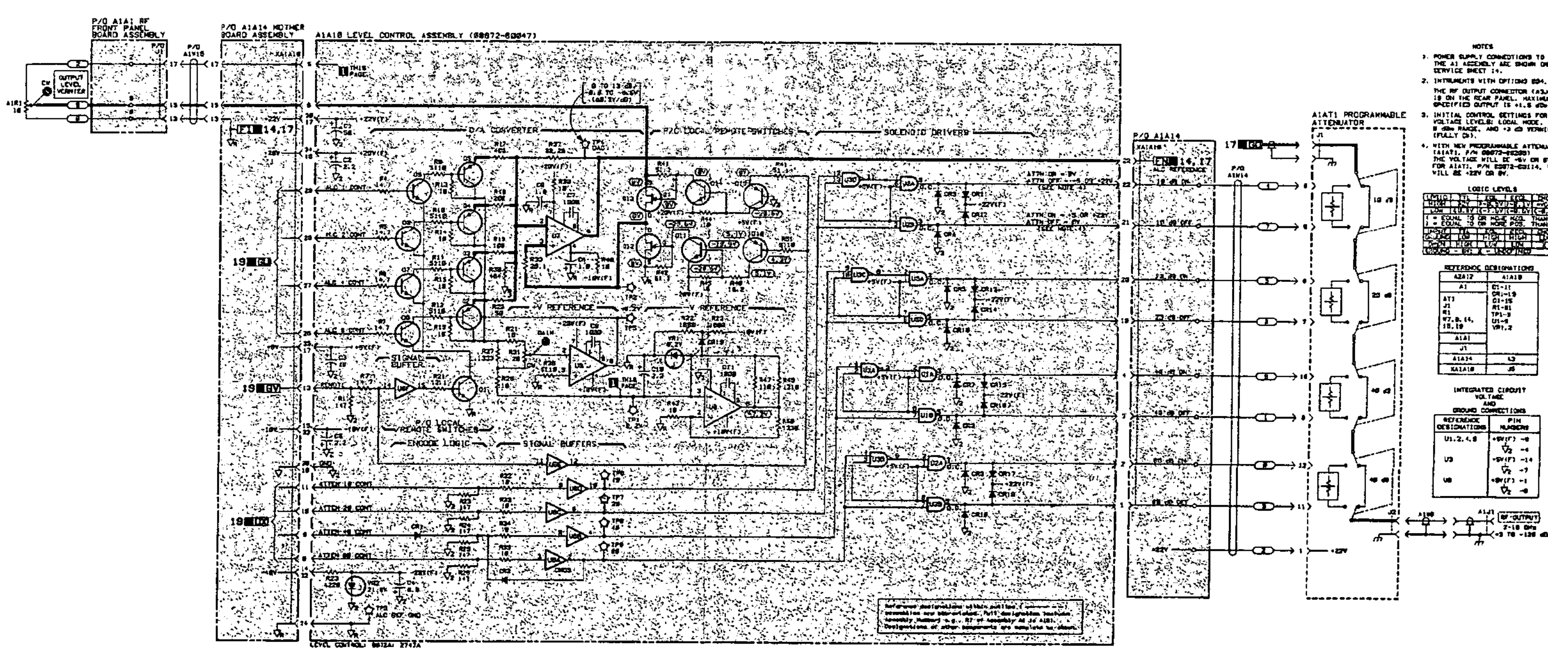


Figure 8-92. A1A10 RF Output Level Control Component Locations



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A1A10, A1A1T

Figure 8-93. RF Output Level Control Schematic Diagram
8-305/8-306

Service Sheet 19 Digital Processor Assembly

References

Overall Block Diagram	Service Sheet BD1
Remote/Local Interface Block Diagram	Service Sheet BD7
Electrostatic Discharge (ESD) Precautions	Chapter 8 (Front)
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5
After Service Safety Checks	Chapter 8 (Front)

Principles of Operation

General

This service sheet describes the Digital Processor Assembly which selects between remote and local configuration information and, if necessary, converts the information into a form useable by the level control circuits and the front panel.

Digital Processor Assembly

The Local/Remote selectors have feedback resistors between the outputs and remote inputs so they will act as latches when first switched from local to remote. This ensures that the instrument's functions assume known configurations after the local to remote transition.

The Range Encoder converts the RANGE switch position into a binary coded decimal value. Priority encoder U7 acts as an octal to binary converter.

Display Decoder, U8, is a ROM with a table that converts the BCD range value into sign and value information for the front panel display.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD 1 and 7 was used to isolate a digital processor problem to the circuits shown on this schematic.

Equipment

Digital Voltmeter (DVM)	HP 3455A or HP 3456A
Controller	HP 85B or HP 9826A/36A

Procedure

In the following procedures once a malfunction has been discovered, use the "Service Sheet 20 Input/Output Tables" in BD7 to aid in troubleshooting the defective circuitry.

1. Make sure the Signal Generator is in local mode at 3 GHz.

2. Rotate the RANGE switch from fully clockwise to fully counterclockwise. The RANGE dB display should indicate from +10 to −110 in 10 dB steps.

   If the indications are incorrect, measure OVERRNG, LED 10, LED 20, LED 40, LED 80, LED 100, HB, and VB plus ATTN 10—80 CONT lines to isolate the malfunction. The lines labeled HB and VB control the horizontal and vertical bars of the + and − signs.

3. Move the ALC switch through its range and observe the annunciators. ALC annunciators corresponding to the switch positions should light. The UNLVL annunciator should come on when the ALC switch is in the XTAL and PWR MTR positions.

4. Set the RF OUTPUT switch to OFF. The RF OFF annunciator should light. The UNLVL and ϕ UNLOCKED annunciators should also come on.

5. Set the AM switch to each of its settings. Corresponding AM status annunciators should light.

6. Set the FM DEVIATION MHz switch to each of its settings. Corresponding FM status annunciators should light.

   If all indications are correct so far, the local portions of A1A11 are working.

   The remaining steps in this procedure require an HP-IB controller.

7. Program "K0", "K1", "K2", "K3", "K4", "K5", "K6", "K7", "K8", "K9", "K:", "K;", "K<", and "K=". The RANGE dB display should go from 0 dB to −130 dB. In the −120 and −130 dB positions, the UNLVL annunciator should light.

   If the results are incorrect, measure REM ATTN 10—80 inputs to A1A11 to isolate the malfunction.

8. Program the remote vernier through its range with "L0" through "L=". The meter should move in 1 dB steps from +3 to −10 dBm.

   If the results are incorrect, measure REM ALC 1—8 lines to A1A11 to isolate the malfunction.

9. Program "K0O3". The output level range should be +10 dB. (The UNLVL annunciator may come on because of inadequate power.)

10. Program "O0". The RF OFF annunciator should light and the RANGE dB display should show 0 dB. The UNLVL and ϕ UNLOCKED annunciators should also be on.

11. Program "O5". The XTAL, UNLVL and RF ON annunciators should light.

12. Program "O=". The PMTR, UNLVL and RF ON annunciators should light.

13. Program "M1", "M2" and "M3". Initially all AM status annunciators should extinguish. Then AM 100% and 30% should light in that order.

    If the indications are incorrect, verify the signals on REM AM ON/OFF and REM AM ATTN 10 lines.

14. Program "N6" through "N0". Initially all FM status annunciators should extinguish. Then FM status annunciators .03, 0.1, 0.3, 1, 3, and 10 should light in that order.

    If the indications are incorrect, verify the REM FM ATTN 10 through 40 lines.

    If all indications through this step are correct, the A1A11 Digital Processor is working.

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Digital Processor A1A11
Schematic Diagram
SERVICE SHEET

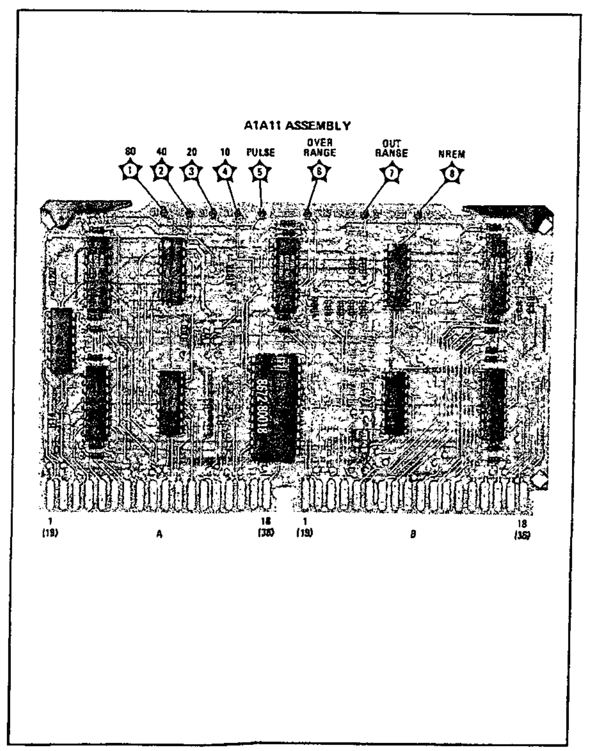
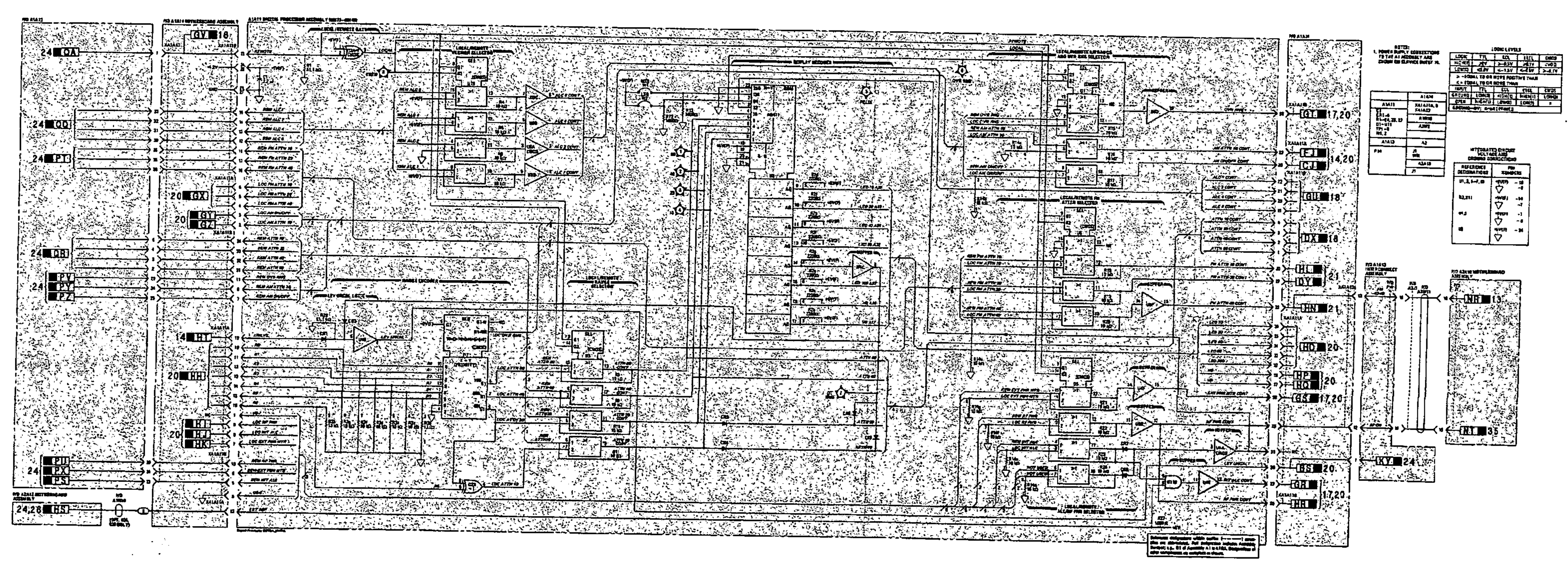


Figure 8-94. A1A11 Digital Processor Assembly Component and Test Point Locations



19
A1A11

Figure 8-95. Digital Processor Schematic Diagram

Service Sheet 20 RF Front Panel Controls and Displays

References

Principles of Operation

General

The RF Output Assembly can attenuate, level and amplitude modulate the YTO signal. The RF Output Assembly can also amplify and attenuate the FM signal before it enters the RF Source Assembly. Further, the RF Output Assembly can indicate its calibrated RF, amplitude and frequency modulated output.

RF Front Panel Controls and Displaysf

The RF Front Panel provides the mechanical switches for selecting the above capabilities. It also provides status annunciators that give the user corresponding information about the operating status of the RF Output Assembly. In addition, it provides a meter to indicate calibrated output.

The RF Front Panel Assembly

The RF Front Panel Assembly, A1A1, transmits all digital information relating to its switch positions directly to the Digital Processor Assembly, A1A11. A1A11 sends the same or decoded digital signals back to the RF Front Panel Assembly either directly or indirectly via Metering Assembly A1A9. The RF Front Panel Panel Assembly then buffers this information and uses it to drive the status annunciator led's. All digital information transmitted from the RF Front Panel Assembly can be overridden by local/remote selectors on A1A11.

Troubleshooting

Use troubleshooting information on Service Sheets BD1 and BD7 to isolate a front panel problem to the circuits shown on this schematic.

Equipment

Digital Voltmeter (DVM) .... HP 3455A or HP 3456A

Procedure

Continue to use the "Service Sheet 20 Input/Output Tables" in BD7 to troubleshoot the defective circuitry.

Mechanical Switch and Status Annunciator Checks

1. Rotate the OUTPUT RANGE switch from fully clockwise to fully counterclockwise. The RANGE dB display should indicate from +10 dB to −110 dB in 10 dB steps. (The last digit should always be zero).

   If the indications are incorrect, go to service sheet 19 unless the problem is in the last digit.

   If the problem is in the last digit, troubleshoot A1DS3 on this schematic.
2. Set the RF OUTPUT switch to OFF. The RF OFF and ALC UNLVL annunciators should light. Set the RF OUTPUT switch to ON. The RF OFF and ALC UNLVL status annunciators should extinguish and the RF ON annunciator should light.
3. Set the ALC switch to INT, XTAL, and then PWR MTR. The ALC INT, XTAL and PMTR status annunciators should light respectively. The UNLVL annunciator should light for the last two settings.
4. Set the AM switch to OFF, 30% and 100%. The 30% and 100% status annunciators should light correspondingly.
5. Switch the FM DEVIATION MHz switch through its range to check the FM annunciators.

Meter Checks

Note

If the meter works for any one of the three meter checks that follow, the meter itself works. Failure can then be isolated to the appropriate meter driver circuitry (AM, FM or level) or to the mechanical Meter Mode switch.

If the meter fails all three meter checks, the meter itself is defective.

Level Meter Check

1. Press the Signal Generator's PRESET (3 GHz) key. Set the RF OUTPUT switch to ON, the VERNIER fully clockwise, and the RANGE to 0 dBm. Set the METER MODE switch to LEVEL. The meter should indicate full scale on the −10 dBm to +3 dBm range.

   If the indication is incorrect, check the power at the Signal Generator's RF OUTPUT connector before proceeding with the remaining meter checks. The minimum power at these settings should be approximately 3 dBm.

AM Meter Check

2. Set the METER MODE switch to AM and the AM switch to 30%. The meter should immediately drop to zero on the 0—1 and 0—3 scales.

   Connect a BNC TEE, test oscillator, and DVM to the Signal Generator's AM INPUT connector. Set the test oscillator to 1 kHz at 0.707 Vrms. The meter should indicate full scale on the 0—1 and 0—3 scales.

   Lower the amplitude of the 1 kHz test oscillator signal to 0.35 Vrms and set the AM switch to 100%. The meter should indicate half scale on the 0—1 and 0—3 scales.

FM Meter Check

3. Set the METER MODE switch to FM. The meter should indicate zero on the 0—1 and 0—3 scales.

   Set the FM DEVIATION MHz switch to 10 and connect the BNC TEE, test oscillator and DVM to the FM INPUT connector. Set the test oscillator to 2 MHz at 0.707 Vrms. The meter should indicate full scale.

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RF Front Panel Controls
Schematic Diagram
SERVICE SHEET

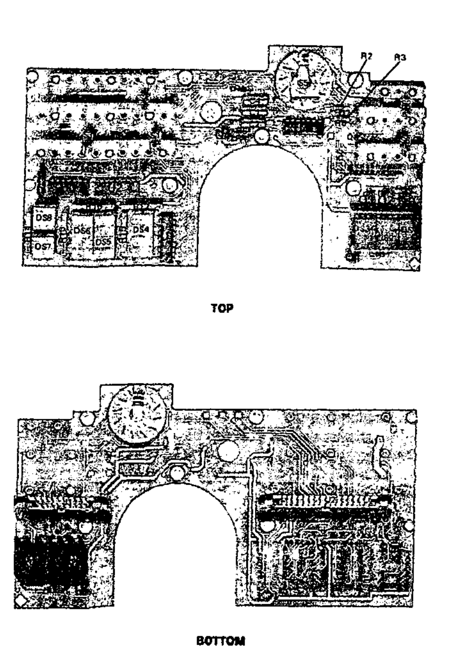


Figure 8-96. A1A1 RF Output Front Panel Assembly Component Locations

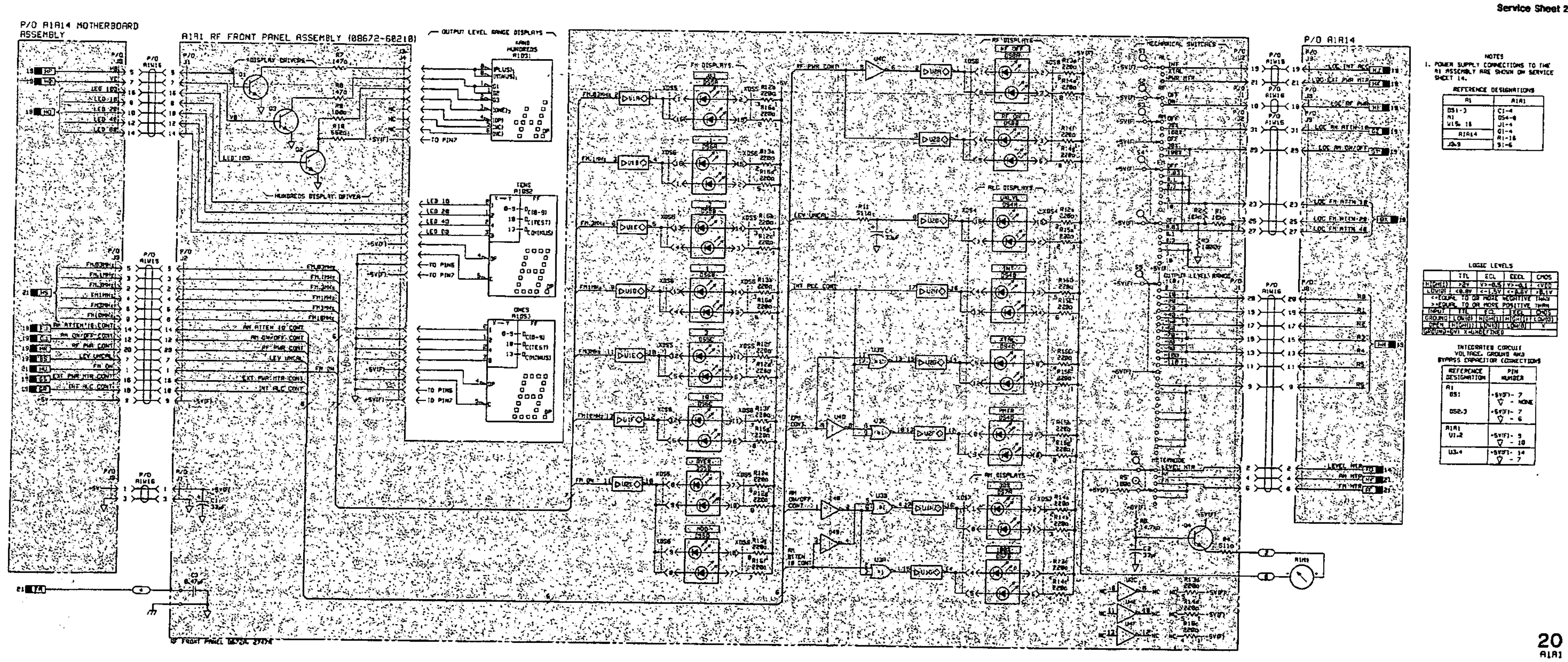
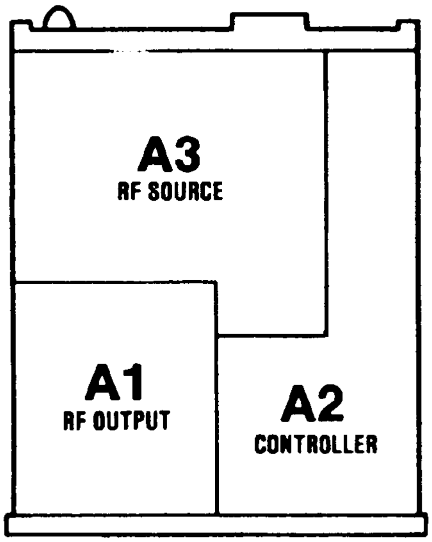


Figure 8-97. RF Front Panel Controls and Displays Schematic Diagram

Index To Service Sheets by Assembly



MAJOR ASSEMBLIES, TOP VIEW

Assembly	Description	Service Sheet
A1A1	RF Front Panel	20
A1A2	Not Assigned	
A1A3	YTM Control	15
A1A4	Not Assigned	
A1A5	RF Amplifier and ALC	14
A1A6	ALC Detector	17
A1A7	SRD Bias Board	16
A1A8	YTM Driver	15
A1A9	Metering Assembly	21
A1A10	RF Output Level Control	18
A1A11	Digital Processor	19
A1A12	Power Amplifier	14
A1A13	Interconnect Assembly	14,19
A1A14	A1 Motherboard	14–20
A2A1	DCU Front Panel	31,32
A2A2	Rotary Pulse Generator	20
A2A3	160–240 MHz VCO	8
A2A4	20/30 MHz Phase Detector	7

Assembly	Description	Service Sheet
A2A5	20/30 MHz Divider	6
A2A6	Not Assigned	
A2A7	HP-IB Interface	24,25
A2A8	Output Register	29,30
A2A9	HP-IB Address	22,23
A2A10	Register 1	26
A2A11	Timing and Control	27,28
A2A12	A2 Mothreboard	6–8, 22–32
A3A1	Reference and M/N	
A3A1A1	Reference Phase Detector	1
A3A1A2	100 MHz VCXO	2
A3A1A3	M/N Phase Detector	3
A3A1A4	M/N VCO	4
A3A1A4A1	VCO Resonator	4
A3A1A4A2	VCO Board	4
A3A1A5	M/N Output	5
A3A1A6	M/N Reference Motherboard	1–3,5
A3A1A7	Reference and M/N Housing	
A3A2	Not Assigned	
A3A3	Positive Regulator	34
A3A4	Negative Regulator	35
A3A5	DAC	9
A3A6	YTO Driver	10
A3A7	YTO/FM Coil Driver	13
A3A8	10 MHz Reference Oscillator	1
A3A9	YTO Loop	11,12
A3A9A1	Directional Coupler	13
A3A9A2	YTO Interconnect	11–13
A3A9A3	2.0–6.6 GHz YTO	13
A3A9A4	YTO Phase Detector	12
A3A9A5	Sampler	11
A3A9A6	18 dB Attenuator	13
A3A9A7	6.2 GHz Low Pass Filter	13
A3A9A8	Preamplifier	13
A3A10	RF Source Motherboard	1,3,4, 6,10,13, 25,30–35
A3A11	Line Module	33
A3A12	Rectifier Assembly	33

Service Sheet 21 Metering Assembly

References

Principles of Operation

General

The Metering Assembly performs the following functions:

- Generates FM ON/OFF CONT signal to the YTO Phase Detector Assembly A3A9A4 (service sheet 12) in response to FM ATTN 10—40 CONT from the Digital Processor Assembly A1A11 (service sheet 19).
- Varies the FM signal level according to the band of the Synthesizer output frequency so that the FM deviation will not be affected by the frequency multiplication in the YIG Tuned Multiplier (YTM).
- Sets the proper FM signal level for the selected deviation range.
- Provides the front panel meter with a current proportional to the modulating AM or FM signal amplitude.
- Generates the FM Overmodulation status signal to the Interface Assembly A2A7 (service sheet 24).

FM Signal Path

The FM signal produces a peak deviation proportional to the peak input signal amplitude. The input signal from the front panel is first applied to the Band Switched Attenuator. The Band Switch Attenuator changes the attenuation of the input signals according to the frequency band of the output signal. This is necessary because the YTM multiplies the FM deviation of the carrier as well as the carrier frequency. For example, if the YTO (YIG Tuned Oscillator) frequency is at 4 GHz with 1 MHz deviation and the output frequency selected is in Band 2, then the output frequency would be 8 GHz with 2 MHz of deviation if the band attenuator were not used. The band attenuator attenuates the modulating signal by factors of 1, 1/2 or 1/3 to maintain constant deviation regardless of the output frequency selected. The three NBAND1—3 signals control the selection of the attenuation.

The output of the Band Switched Attenuator is applied to the FM Amplifier. This amplifier acts as a buffer between the Band Switched Attenuator and the Range Attenuators and provides a means of setting the gain to calibrate FM deviation. The Range Attenuators vary the FM signal amplitude to correspond to the selected FM Range.

The emitter follower following the Range Attenuator acts as a buffer and provides the drive to the input of the FM Driver.

Meter Drivers

The FM Meter Driver is a peak detector that converts the FM signal voltage at its input into a direct current at its output. This current drives the front panel meter to indicate peak FM deviation. The peak detector also provides a dc voltage proportional to peak signal amplitude as an input to the overmodulation detector.

The AM Meter Driver is a peak detector that converts the AM signal voltage at its input to a dc current at its output. The AM Meter scale is calibrated in rms volts. This assumes a sinusoidal input waveform.

FM Overmodulation Detector

The Overmodulation Detector senses excessive deviation and is located on the Metering Assembly. The input to the Overmodulation Detector from the FM Meter Driver Q9 is a dc voltage proportional to FM input signal and hence, proportional to deviation. When the level of this signal exceeds the level established by R34, an overmodulation condition is indicated.

Troubleshooting

General

It is assumed that the troubleshooting information on service sheets BD1, BD4, and BD6 was used to isolate a malfunction to the A1A9 Metering Assembly. It is also assumed that an attempt has been made to correct the malfunction by using the appropriate adjustment procedure, if any, in chapter 5. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter (DVM) .... HP 3455A or HP 3456A
Oscilloscope .... HP 1980B
Test Oscillator .... HP 8116A

Procedures

FM Signal. If from BD4 it is determined that the FM signal at A1A14J17 (on the RF Output Assembly motherboard) is incorrect in only one frequency deviation range, troubleshoot the associated output of the FM Control Decoder, U5, and the Range Attenuator, U3. If the FM signal is incorrect in all ranges, proceed as follows:

1. Connect a BNC TEE to the Signal Generator's FM INPUT connector. Connect the test oscillator and the DVM to the BNC TEE. Set the test oscillator to 100 kHz and 0.707 Vrms.
2. Set the Signal Generator to 3 GHz. Connect the oscilloscope to the base of Q15. Set the FM DEVIATION MHz switch to 10. Note the level of the signal on the oscilloscope. It should be 1 Vpeak.

   Set the Signal Generator to 7 GHz. The observed signal should drop to half the amplitude for 3 GHz.

   Set the Signal Generator to 15 GHz. The observed signal should drop to one third the amplitude for 3 GHz.

   If the signal levels at the base of Q15 are correct, go to step 3.

   If the signal levels at the base of Q15 are not correct, troubleshoot U7 and U6D, E and F.
3. Connect the oscilloscope to U3 pin 16. Press PRESET (3 GHz) and set the Signal Generator to 10 MHz FM DEVIATION. The FM signal should measure 1.6 Vpeak ±5%.

   If the FM signal measures as indicated, go to step 4.

   If the FM signal does not measure as indicated, troubleshoot the FM Amplifier, Q12 through Q15, and associated components.
4. Connect the oscilloscope to the base of Q3. Note the level of the signal on the oscilloscope. It should be 1.6 Vpeak ±5%.

   Set the Signal Generator to 3 MHz FM DEVIATION. The observed signal should drop to 30% of its original value or 0.47 Vpeak (10 dB attenuation).

   Set the Signal Generator to 1 MHz FM DEVIATION. The observed signal should drop to 10% of its original value or 0.16 Vpeak (20 dB attenuation).

   Set the Signal Generator to 0.3 MHz FM DEVIATION. The observed signal should drop to 3% of its original value or 0.048 Vpeak (30 dB attenuation).

   On Metering Assembly A1A9, the attenuation for FM DEVIATION MHz settings 0.1 and 0.03 is identical to that for FM DEVIATION MHz settings 10 and 3 respectively.

   If the FM signal decreases as indicated, troubleshoot the emitter follower: Q3, Q4, Q5 and associated components.

If the FM signal level does not decrease as indicated, troubleshoot the Range Attenuator, U3, FM Control Decoder, U5, and U4 B,C,D.

AM/FM Metering and FM OMOD. The FM metering portion of the Metering Assembly consists of the FM Meter Driver, which can be affected by the FM Overmod Detector and the FM input circuitry. If both the FM meter (on the front panel) and the FM Overmod Detector circuit are not working properly, troubleshoot the FM Meter Driver first. If both the FM Meter Driver and the FM Overmod Detector are not working, troubleshoot the FM input circuitry consisting of CR1, CR2, R4, C5, and C7. If the AM Meter Driver or the FM Meter Driver alone does not work, proceed to the troubleshooting procedure for that driver.

1. Set the METER MODE switch to AM and the AM switch to 30%. Apply 0. 707 Vrms at 1 kHz to the Signal Generator's AM INPUT connector. The meter should indicate full scale on the 0—30 range.

   If the indication is correct, go to step 2.

   If the indication is not correct, troubleshoot the AM Meter Driver circuit.

2. Press the PRESET(3 GHz) key, set the METER MODE switch to FM and the FM DEVIATION MHz switch to 10. Apply 0.707 Vrms at 2 MHz to the Signal Generator's FM INPUT connector. The meter should indicate full scale on the 0—100 scale. (The OMOD MOD annunciator should not come on.)

   If the indication is correct, the AM and FM metering circuits are working.

   If the indication is not correct, troubleshoot the FM Meter Driver circuit.

FM Meter Driver.

1. Set the Signal Generator to .3 MHz FM DEVIATION. Verify that NFM at the base of Q2 is a TTL low.

   If it is correct, go to step 2.

   If it is not correct , troubleshoot U6A-B, U4C and U5.

2. Connect a BNC TEE to the Signal Generator's FM INPUT. Connect the test oscillator and the DVM to the BNC TEE. Set the test oscillator to 0.707 Vrms at 100 kHz.

3. Connect the oscilloscope to the base of Q9 and verify that the dc level varies from 1.5 Vdc to 0 Vdc as the amplitude of the test

oscillator output is varied from 0.707 Vrms to 0 Vrms. (Do not exceed 0.707 Vrms at the FM INPUT.)

If the dc level at Q9 does not change as indicated, go to step 4.

If it does change as indicated, troubleshoot Q9.

4. Connect the oscilloscope probe to the base of Q7 and verify that the negative going pulse width narrows as the amplitude of the test oscillator is varied from 0.707 Vrms to 0 Vrms. Expect a negative pulse of approximately 0.8V.

   If the pulse width narrows as indicated, troubleshoot Q7 and associated components.

   If it does not narrow as indicated, troubleshoot U1B.

FM Overmod Detector. To troubleshoot the FM Overmod Detector, proceed as follows:

1. Set the FM DEVIATION MHz switch to 0.3 MHz.
2. Verify that the signal at U2 pin 6 is a TTL high and the signal at the base of Q2 is a TTL low.

   If the signals are as indicated, go to step 3.

   If the signals are not as indicated, troubleshoot U5, U4C, U6A and B, and U7D.

3. Connect a BNC TEE to the Signal Generator's FM INPUT connector. Connect the test oscillator (use the 50 ohm output) and the DVM to the BNC TEE. Set the test oscillator to 100 kHz and an amplitude of 0.707 Vrms.
4. Increase the amplitude of the test oscillator signal to 0.84 Vrms. The voltage at edge connector pin 16 should be a TTL high. Lower the input voltage to 0.707 Vrms. The voltage at pin 16 should be a TTL low.

   If the voltages are correct, the Overmod Detector is functioning properly.

   If the voltages are not correct, continue with step 5.

5. Connect the DVM to A1A6TP5. Repeat step 4 and verify that the voltages at A1A6TP5 are opposite those at edge connector pin 16.

   If the voltages are opposite, go to step 6.

   If the voltages are not opposite, replace U6C.

6. Attach the oscilloscope to A1A6TP2. Observe that the dc level decreases from 92 Vdc to 0 Vdc as the amplitude of the test oscillator output is decreased from 0.707 Vrms to 0 Vrms.

   If the dc level does not vary as indicated, troubleshoot the FM Meter Driver.

   If the dc level does vary as indicated, replace U2.

AM Meter Driver.

1. Press the PRESET (3 GHz) key. Set the AM switch to 30%. Verify that the NAM signal at the base of Q1 is a TTL low.

   If it is correct, go to step 2.

   If it is not correct, go to service sheet 14 to troubleshoot the NAM line.

2. Connect a BNC TEE to the Signal Generator's AM INPUT. Connect the test oscillator (use the 50 ohm output) and the DVM to the BNC TEE. Set the test oscillator to 0.707 Vrms at 1 kHz.

3. Connect the oscilloscope to the base of Q8 and verify that the dc level varies from 1.5 Vdc to .4 Vdc as the amplitude of the test oscillator output is varied from 0.707 Vrms to 0 Vrms. (Do not exceed 0.707 Vrms at the AM INPUT.)

   If the dc level at Q8 changes as indicated, troubleshoot Q8.

   If it does not change as indicated, go to step 4.

4. Connect the oscilloscope lead to the base of Q6 and observe that the negative going pulse width narrows as the amplitude of the test oscillator signal is decreased from 0.707 Vrms to 0 Vrms. Expect a negative pulse of approximately 0.8V.

   If the pulse width varies as indicated, troubleshoot Q6 and associated components.

   If the pulse width does not vary as indicated, troubleshoot Q1, U1A and associated components.

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Metering Assembly A1A9
Schematic Diagram
SERVICE SHEET

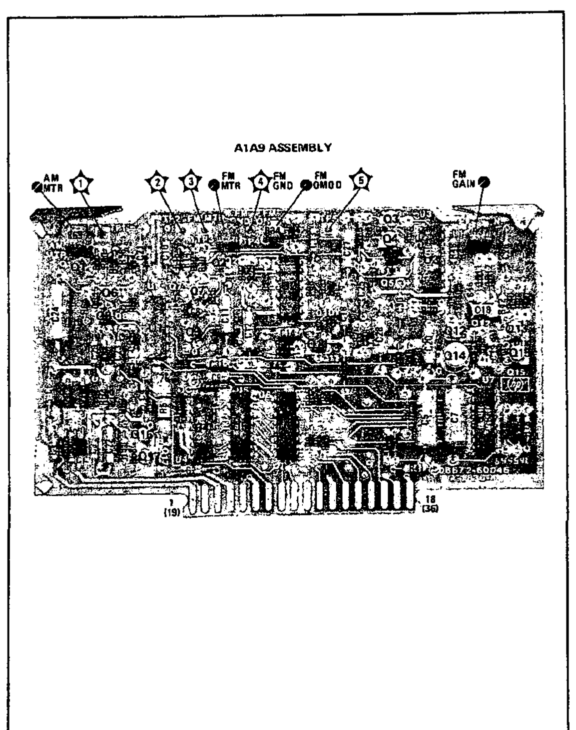
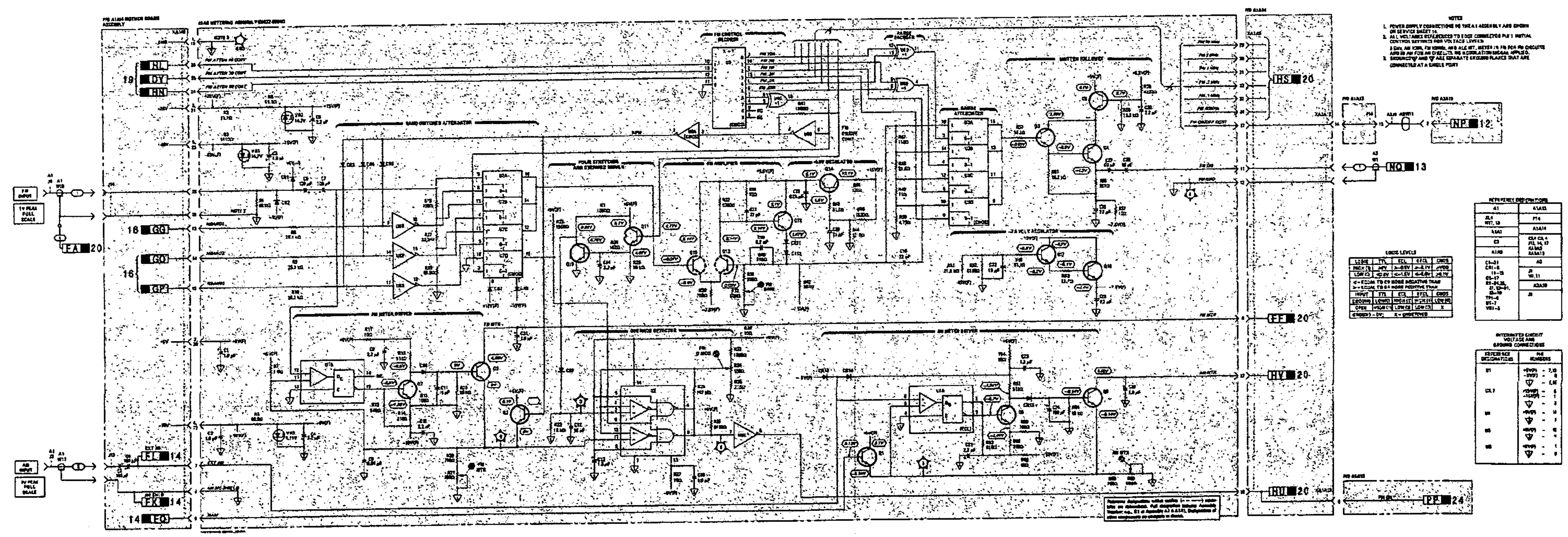


Figure 8-98. A1A9 Metering Assembly Component Locations



21
A1A9

Figure 8-99. Metering Assembly Schematic Diagram
8-325/8-326

Service Sheet 22 P/O HP-IB Address Assembly

References

Principles of Operation

General

The HP-IB Interface converts ASCII characters on the HP-IB data lines into RF Output Assembly program information and output frequency data for the DCU Frequency Control circuitry. Status information concerning instrument operation is converted into the status byte which is sent on the eight HP-IB data lines. The DCU Remote Interface consists of the HP-IB Address (A2A9) and HP-IB Interface (A2A7) assemblies.

The HP-IB Address assembly (A2A9) receives a character from the HP-IB data lines under the control of the three handshake lines. The five HP-IB control lines are then decoded to determine whether the character is an address, a command or a data character. If the character is an address and the address matches the talk or listen switch setting (see address selection in section II [Operating Manual]), the Signal Generator will output the status byte (talk address) or will switch to listen mode in preparation for receiving data characters. If the character received is a command, the Signal Generator will respond to the command if the capability exists (see table 3-5 (Operating Manual) for a listing of commands that can be executed by the Signal Generator). If the character is data and the Signal Generator is in listen mode, the data is passed to the HP-IB Interface assembly for decoding.

The HP-IB Interface assembly (A2A7) determines whether a data character is a program code or an argument. If the character is a program code, the program code is used to select where the argument will be sent (its internal address). If the data character is an argument, it is sent to the current internal address for storage. If the last data character received was also an argument, the current data character will be sent to the next sequential internal address.

HP-IB Address Assembly

Remote Bus Transceivers. The Remote Bus Transceivers enable the Signal Generator to send and receive data over the same data lines. In addition, the logic levels of the data bus are inverted for use by the Signal Generator as high true logic and the data lines are buffered to avoid loading of the data bus by the Signal Generator's internal circuitry.

Data received is routed to the address decoding circuits, command decoders, RF program selectors, and the interface storage register. The control signals are routed to the talk and listen handshake circuits, the command decoders, the address decoding circuits and the status and parallel poll circuit.

Acceptor Handshake. The acceptor handshake is enabled when the Signal Generator is in the listen mode. The sequence is begun with the Not Ready For Data (NRFD) being allowed to go high by the Signal Generator. This indicates to the controller that the Signal Generator is now ready to receive the next character. The controller then indicates that the data character is available by setting the DAta Valid (DAV) line low.

Nand gate U13B provides a 2.5 μs delay before triggering one-shot U20B. U20B supplies a STOR pulse which clocks the serial poll flip-flop on the leading edge, enables the NRSTOR gate (U9B) while high, and clocks the TALK, LISTEN and REMOTE flip-flops.

The trailing edge of NSTOR clocks U5B, which was reset at the same time U20B was triggered. This sets NDONE to a low state after another 2.5 +s delay. The DONE flip-flop is set again after another delay introduced by R11 and C7. This chain of events acts to produce a low NDONE pulse at about 10 +s after the remote data is ready to signify to the controller that the Signal Generator is done with the data.

The NRDY signal is set to a high state whenever an acceptor handshake is in progress or the DCU is busy with a frequency change.

Source Handshake. The source handshake is initiated when the Signal Generator is in talk mode and the ATN bus control line is set true. The listener sets the Not Ready For Data (NRFD) line false to indicate that it is ready for the Signal Generator to place the data on the HP-IB data lines. U20A is triggered to produce a 2 μs wide System Delay State (SDYS) pulse to latch the current instrument status and sets the data valid line (DAV) on the falling edge of the system delay state. When the not data accepted (NDAC) is set true by the listener, U5A is reset and the source handshake is ready to send another character.

Talk, Listen and Remote Decoding. The talk and listen decoding is done using three BCD decoders. The three least significant digits of the HP-IB input data lines are routed to U2 to be decoded. The BCD8 digit is the attention (NATTN) line which is used as the enable for the decoder. When the attention line is set true, one of the 0 to 7 decoded lines is selected by the three HP-IB data lines. Switch S2 selects which of the seven outputs is to be used as part of the instrument address. Switch U3 is used to decode the remainder of the listen address (DI7=0) and U4 is used to decode the remainder of the talk address (DI7=1).

The address decoders are also used to decode the HP-IB bus commands and the additional decoded lines are sent to the bus command decoder. The decoded lines selected by switch S1 and S2 are sent to the Address Decode circuit to produce the talk address (MTA) and the listen address (MLA). Note that the Signal Generator is switched out of the listen mode if the talk address is received and out of the talk mode if the listen address is received.

The store (STOR) pulse generated by the Acceptor Handshake is used to clock the remote, talk and listen flip-flops to set the Signal Generator to the addressed mode.

Troubleshooting

General

It is assumed that the troubleshooting information associated with service sheet BD1 and BD8 was used to isolate the problem to the HP-IB Address assembly or there is a problem involving the processing of an HP-IB bus command. The following troubleshooting procedure will aid in isolating the defective component.

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A
Oscilloscope .... HP 1980B
Controller .... HP 85B, HP 9826A/36A

Procedure

1. Verify that the Signal Generator address is set to 23 octal. See section II (Operating Manual) for information on how to check the address setting.
2. Set the Signal Generator to the following:

   RF OUTPUT .... Off
   RANGE Control .... Fully counterclockwise
   VERNIER .... Fully counterclockwise
   ALC .... set to XTAL
   Frequency .... 3000.000 MHz

3. With the controller, send "P12345678Z1K0072". This will program the Signal Generator to 12345.678 MHz, ALC to INT, RF on and output level to 0 dBm. If the Signal Generator accepts the data string and the front panel shows the correct settings,

most of the remote circuits are working properly. If the Signal Generator does not respond, proceed with step 4. Otherwise, proceed with the checks on service sheet 23.

4. Place the A2A9 assembly on an extender board. Set the Signal Generator to remote with the command 'REMOTE 719' executed on the controller. Measure XA2A9C-24, REMOTE, and verify that it is a CMOS high. If the signal is not correct, troubleshoot the remote flip-flop (U17B) and the Address Select Circuit.

5. Connect the voltmeter to XA2A9-25, ATTN, and verify that the signal is high during the command mode and low during the data mode. If the signal is not correct, troubleshoot the remote flip-flop (U17B) or the acceptor handshake. If signal is correct, continue with step 6.

6. Monitor the handshake operation with an oscilloscope or Bus Analyzer. The handshake should proceed approximately as shown below. The pulse widths are not shown to scale but the rise-fall relationships should be as shown. If the handshake is working correctly, proceed with step 7. Otherwise, troubleshoot the acceptor handshake circuit.

7. Check the DI1 through DI7 data lines to ensure that the data is the same as the data on the HP-IB bus. If the data is correct but the Signal Generator does not respond, troubleshoot A2A7 HP-IB Interface Assembly. Otherwise check the Remote Bus Transceivers and the HP-IB bus itself.

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P/O HP-IB Address Assembly
A2A9 Schematic Diagram
SERVICE SHEET

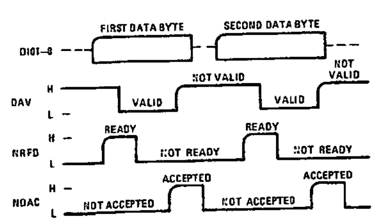


Figure 8-100. HP-IB Handshake Waveforms

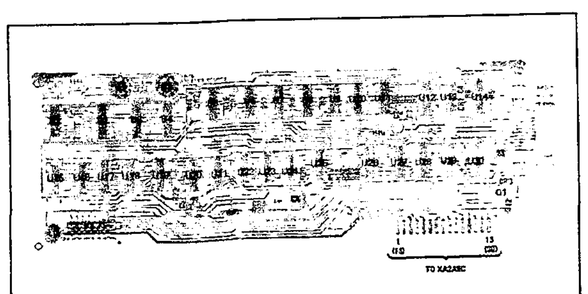
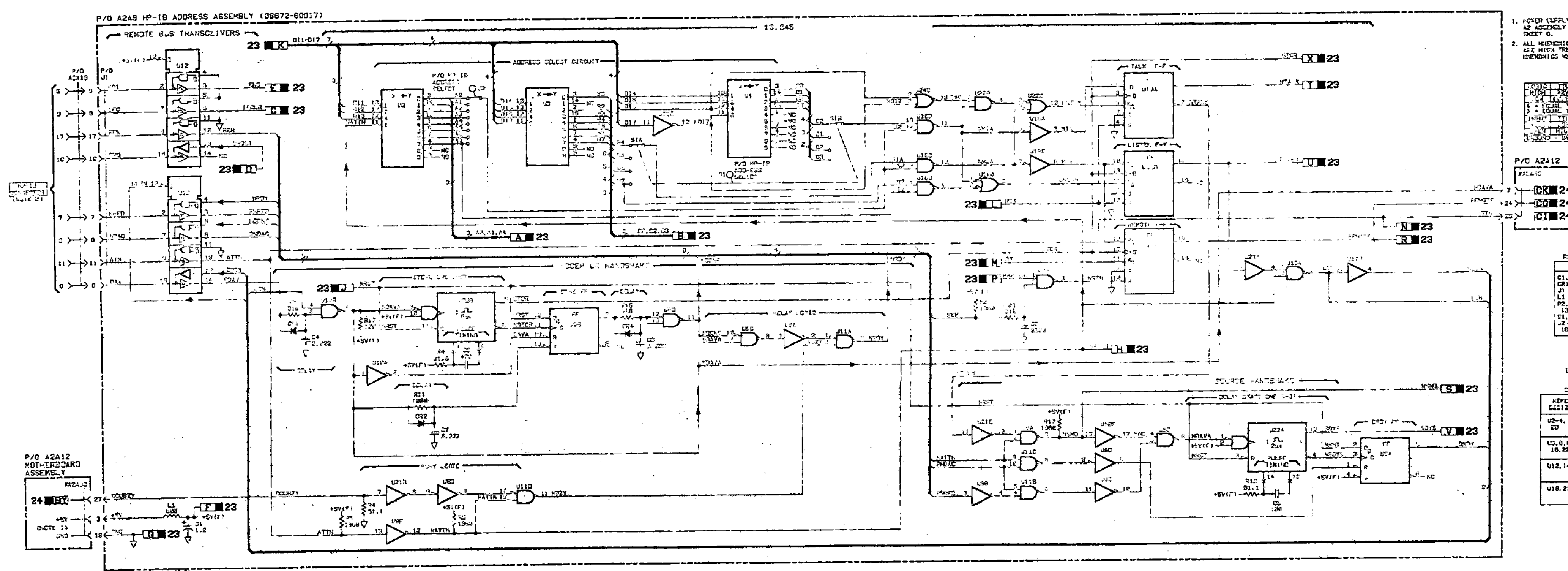


Figure 8-101. A2A9 HP-IB Address Assembly Component Locations



NOTES

1. POWER SUPPLY CONNECTIONS TO THE A2 ASSEMBLY ARE SHOWN ON SERVICE SHEET 6.
2. ALL MNEMONICS ON THIS SERVICE SHEET ARE HIGH TRUE EXCEPT FOR HP-IB MNEMONICS WHICH ARE LOW TRUE.

LOGIC LEVELS

LOGIC	TTL	ECL	PECL	CMOS
HIGH	≥2V	≥-1.5V	≥-3.1V	≈VDD
LOW	≤0.8V	[illegible]	[illegible]	≤-3.1V
≤ = EQUAL TO OR MORE NEG. THAN				
≥ = EQUAL TO OR MORE POS. THAN				
INPUT	TTL	ECL	PECL	CMOS
[illegible]	LOW	HIGH	HIGH	LOW
OPEN	HIGH	LOW	LOW	X
(GROUND = 0V; X = UNDEFINED)				

REFERENCE DESIGNATIONS

A2A9	A2A12
C1, 3–6 CR1, 2, 4 J1 L1 R2, 4, 5, 7–11, 13–15, 17 S1, 2 U2–6, 8–14, 16–22, 24	XA2A9C

INTEGRATED CIRCUIT VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATION	PIN NUMBER
U2–4, 17, 19, 20	+5V(F) -16, ⏚ -8
U5, 6, 8–11, 13, 16, 22	+5V(F) -14, ⏚ -7
U12, 14	+5V(F) -16, ⏚ -1, 8
U18, 21	+5V(F) -1, ⏚ -3

22
P/O A2A9

Figure 8-102. P/O HP-IB Address Assembly Schematic Diagram

Service Sheet 23 P/O HP-IB Address Assembly

References

Principles of Operation

General

The HP-IB Interface converts ASCII characters on the HP-IB data lines into RF Output Assembly program information and output frequency data for the DCU Frequency Control circuitry. Status information concerning instrument operation is converted into the status byte which is sent on the eight HP-IB data lines. The DCU Remote Interface consists of the HP-IB Address (A2A9) and HP-IB Interface (A2A7) assemblies.

The HP-IB Address assembly (A2A9) receives a character from the HP-IB data lines under the control of the 3 handshake lines. The five HP-IB control lines are then decoded to determine whether the character is an address, a command or a data character. If the character is an address and the address matches the talk or listen address switch setting (see address selection in section II [Operating Manual]), the Signal Generator will output the status byte (talk address) or will switch to listen mode in preparation for receiving data characters. If the character received is a command, the Signal Generator will respond to the command if the capability exists (see Table 3-5 for a listing of commands that can be executed by the Signal Generator). If the character is data and the Signal Generator is in listen mode, the data is passed to the HP-IB Interface assembly for decoding.

The HP-IB Interface assembly (A2A7) determines whether a data character is a program code or an argument. If the character is a program code, the program code is used to select where the argument will be sent (its internal address). If the data character is an argument, it is sent to the current internal address for storage. If the last data character received was also an argument, the current data character will be sent to the next sequential internal address.

HP-IB Address Assembly

Remote Bus Transceivers. The Remote Bus Transceivers enable the Signal Generator to send and receive data over the same data lines. In addition, the logic levels of the data bus are inverted for use by the Signal Generator as high true logic and the data lines are buffered to avoid loading of the data bus by the Signal Generator's internal circuitry.

Data received is routed to the address decoding circuits, command decoders, RF program selectors, and the interface storage register. The control signals are routed to the talk and listen handshake circuits, the command decoders, the address decoding circuits and the status and parallel poll circuit. The status byte is sent when the Signal Generator is addressed to talk and when the serial poll command is received.

Bus Command Decoder. The bus command decoder combines signals from the address select circuit and the HP-IB control lines to produce the signals required by the instrument to respond to various HP-IB bus commands. The go to local (GTL), direct clear (DC), serial and parallel poll (SPMS and PPOLL) commands are decoded and routed to the appropriate circuit. A reset signal is also decoded for a power up sequence or interface clear command.

The not remote store (NRSTOR) signal is used to tell the HP-IB Interface assembly that the data on the DI1—DI7 data lines is a program code or argument. This enables the HP-IB Interface to decode the program code or to route the data to the appropriate place in the instrument.

Status Encoder and Parallel Poll. The serial poll is used to send the status byte to the device requesting the serial poll. The SRQ encode circuit combines all of the status bits into a single signal which can be used to detect an error in instrument operation.

The parallel poll circuit places the SRQ bit onto one of the eight HP-IB data lines. The parallel poll is used by a controller to poll several instruments at the same time by setting each instrument's parallel poll response to a unique data line. An alternative to this approach when there are a large number of instruments involved is to set groups of instruments to each data line and then perform serial polls on each instrument once the group is determined from the parallel poll.

Output Data Latches. The individual bits of the status byte are latched when the serial poll is executed and when the source handshake is executed. The only data the Signal Generator can send via the HP-IB data bus is the status byte and the parallel poll response bit.

Troubleshooting

General

It is assumed that the troubleshooting information associated with service sheets BD1 and BD8 was used to isolate the problem to the HP-IB Address assembly or there is a problem involving the processing of an HP-IB bus command. The following troubleshooting procedure will aid in isolating the defective component.

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A
Oscilloscope .... HP 1980B
Controller .... HP 85B, HP 9826A/36A

1. Verify that the Signal Generator address is set to 23 octal. See section II (Operating Manual) for information on how to check the address setting.
2. Perform the HP-IB "Operator's Checks" in section III (Operating Manual). If any problems are noted, troubleshoot the associated circuitry. If the Signal Generator does not respond at all to remote programming, perform the troubleshooting procedures on service sheet 22.

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P/O HP-IB Address Assembly A2A9 Schematic Diagram SERVICE SHEET

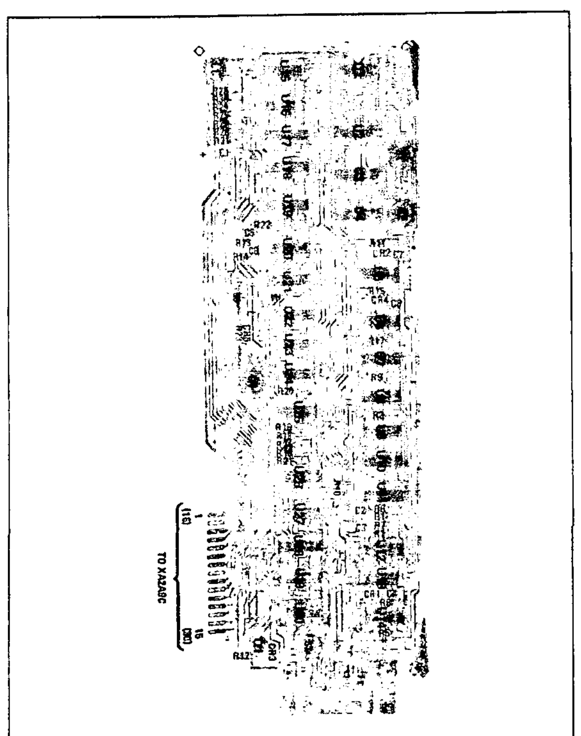


Figure 8-103. A2A9 HP-IB Address Assembly Component Locations

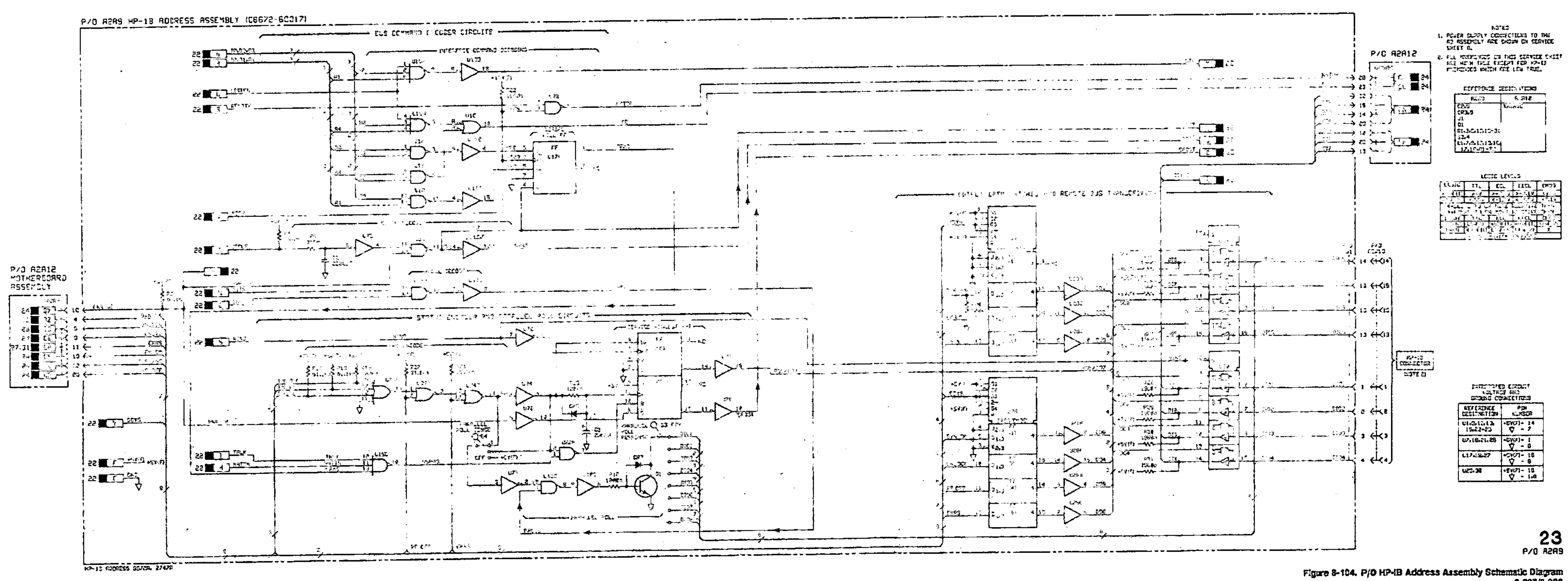


Figure 8-104. P/O HP-IB Address Assembly Schematic Diagram
8-337/8-338

Service Sheet 24 P/O HP-IB Interface Assembly

References

Overall Block Diagram	Service Sheet BD1
DCU HP-IB Interface Block Diagram	Service Sheet BD8
Electrostatic Discharge (ESD) Precautions	Chapter 8 (Front)
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5
After Service Safety Checks	Chapter 8 (Front)

Principles of Operation

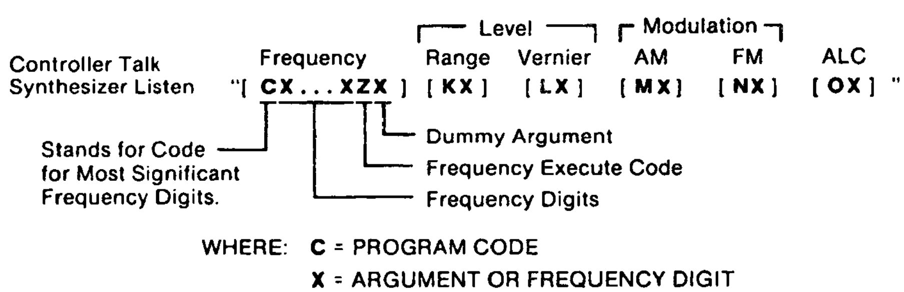
General

The HP-IB Interface converts ASCII data characters on the seven HP-IB data lines into RF Output assembly program information and frequency data. Also, it converts status information from other parts of the Signal Generator into a status byte which it sends to the HP-IB Address assembly.

P/O HP-IB Interface Assembly

The HP-IB Interface assembly decodes program codes and routes the argument to the appropriate assembly. Any character on the bus will appear on the seven data lines (DI1—7) but the HP-IB Interface assembly will only respond when the ATN line is false and an NRSTOR (low going) pulse is received. When these conditions are met, a program string is being sequenced into the Signal Generator. During this sequence, ATN will always be low and a NRSTOR pulse will occur for each character. The characters will be coded as shown in the table on this sheet and the data string format is as follows (see section III [Operating Manual] for complete programming information):

PROGRAM STRING SYNTAX



The data is entered into the Signal Generator in a left to right sequence. When the first data character appears on the data lines, the program code/argument decoder will look at bits D15 to D17 to determine if it is a program code. Then, it will make pin 1 of the internal address counter (U4) high which will parallel load the DI1—4 bits. During this time the NRSTOR pulse is disabling the instruction decoders, but when NRSTOR goes high, U5 and U3 decode the program code. The next character could be another program code in which case the address counter would be reloaded, but normally it will be an argument. This character appears on the bus about 2 μs before the next NRSTOR pulse so it has time to be routed to the frequency register or RF program selector and latched. Then when NRSTOR goes low, the address counter is clocked to serial shift (count up), and the instruction decoders are disabled. This sets the address counter to the next program code in the sequence shown in the table. The new program code will be decoded when NRSTOR goes high. If the next character in the string is an argument rather than a program code, the data will be routed to the next internal address due to the serial shift that occurred in the address counter.

Switching delays are timed by U15 and U16 to allow the Signal Generator to finish processing a character before receiving another one, and to signal the controller via a service request that ALC and output level have not settled.

Troubleshooting

It is assumed that the troubleshooting information service sheets BD1, BD8, and 23 was used to isolate an HP-IB Interface problem to the circuits shown on this schematic. The following information will aid in isolating the defective component.

Equipment

Oscilloscope .... HP 1980B

Procedure

1. If local operation is correct but remote operation is incorrect, continue with this procedure; otherwise go to the service sheet involved with the malfunctioning circuit.

   a. If the problem involves frequency, start with step 2.
   b. If the problem involves RF output, start with step 5.

2. Connect the oscilloscope to A2A7TP1, INTFCLKGO. Program the Signal Generator's center frequency with the program string "P12345678Z1". When the frequency execute command "Z1" is received by the Signal Generator, TP1 should pulse high for a few microseconds. A program loop is useful to generate a string of pulses for this and most of the remaining tests.

3. Observe pulses at U5-14, (INTF CLK1 and U5-15 INTF CLK2) of U5. There should be one INTF CLK1 pulse for each of the left four frequency digit positions (10 GHz to 10 MHz) which are programmed. There can be from zero to four pulses. There should

also be one INTF CLK2 pulse for each of the right four frequency digits (1 MHz to 1 kHz) which are sent. For example if the data string "A2345Z1" is sent,there will be three INTF CLK1 pulses (due to the 2,3 and 4) and one INTF CLK2 pulse (due to the 5).

Troubleshoot U5 and U4 after checking the input data DI1—8 if the pulses are not correct.

4. Program the frequency with the programming string "P12345678Z1". Check the outputs of U3 REM 1000 CLK to REM 1 CLK. The REM 1000 CLK line should pulse once for the 10 GHz digit and once for the 1 MHz digit. The other three lines should perform similarly for their digits.

   If these pulses are correct go to service sheet 25 to troubleshoot the Interface Storage Register.

   If the pulses are incorrect, troubleshoot U3, U4 and associated gates.

5. The following troubleshooting should be performed if there is a remote RF level programming problem. Program "K0L0O1". The outputs of U10 and U11 should all be low and the RF output level should be +3 dBm.

   If the outputs of U10 and U11 are correct but the indicated power is incorrect, go to service sheet 19 to continue troubleshooting.

6. Measure U25A-3 REM ATTN CNTL and U3-3 REM VERNIER CNTL. The appropriate line should pulse high when remote level data is received.

   If the lines do not pulse properly, troubleshoot U3,U4 and the associated gates.

7. The following troubleshooting steps should be performed if the remote problem involves ALC. Program "M000". The outputs of U2,U1 and U9 should all be low and RF should be off.

   If the outputs of U2,U1 and U9 are correct but the front panel indication is incorrect, go to service sheet 19 to continue troubleshooting.

8. Observe the pulses at U3-15 (REM ALC CNTL). A single pulse should occur when remote data for the ALC function is received.

   If the pulse occurs properly but the output data is incorrect,troubleshoot the appropriate RF Program Selector U9.

   If the pulse does not occur,troubleshoot the message decoder,address counter (U4) and the instruction decoder (U3).

MNEMONICS

Mnemonics	Definition	Explanation
DI 1–7	Data In	Data lines from the bus.
ATN	Attention	Low means DI 1–7 carry a program code or argument. High means the Address counter and instruction decoder should ignore the character.
NRSTOR	Not Remote Store	Enables Program code/argument decoder.
DC	Device Clear	Line used to execute a clear message from the controller. See Table 3-5.
INTF CLK	Interface Clock	Tells Data Register 1 into which half to load the next four digits.
INTF REG RST	Interface Register Reset	Resets the remote frequency registers.
NDAV	Not Data Valid	Low means the bus NDAV line is true.
DCU BZY	Digital Control Unit Busy	High while the controller is busy processing a received character.

ASCII CHARACTER CODING

				ASCII Program Codes		Program Code Meaning	Instruction Decoder Outputs	
			DI-7 DI-6 DI-5	1 0 0	1 0 1		Instruction Decoder 2 Output	Instruction Decoder 1 Output
DI-4	DI-3	DI-2	DI-1					
0	0	0	0	@	P	10 GHz	REM 1000 CLK	INTF CLK1
0	0	0	1	A	Q	1 GHz	REM 100 CLK	INTF CLK1
0	0	1	0	B	R	100 MHz	REM 10 CLK	INTF CLK1
0	0	1	1	C	S	10 MHz	REM 1 CLK	INTF REG RST
0	1	0	0	D	T	1 MHz	REM 1000 CLK	INTF CLK2
0	1	0	1	E	U	100 kHz	REM 100 CLK	INTF CLK2
0	1	1	0	F	V	10 kHz	REM 10 CLK	INTF CLK2
0	1	1	1	G	W	1 kHz	REM 1 CLK	INTF CLK2
1	0	0	0	H	X	Not Used		
1	0	0	1	I	Y	Not Used		
1	0	1	0	J	Z	Freq. execute		INTF CLK GO
1	0	1	1	K	[	Output Level		REM ATTN CNTL
1	1	0	0	L	\	Vernier	REM VER CNTL	
1	1	0	1	M	]	AM	REM AM CNTL	
1	1	1	0	N	⌒	FM	REM FM CNTL	
1	1	1	1	O	—	ALC	REM ALC CNTL	

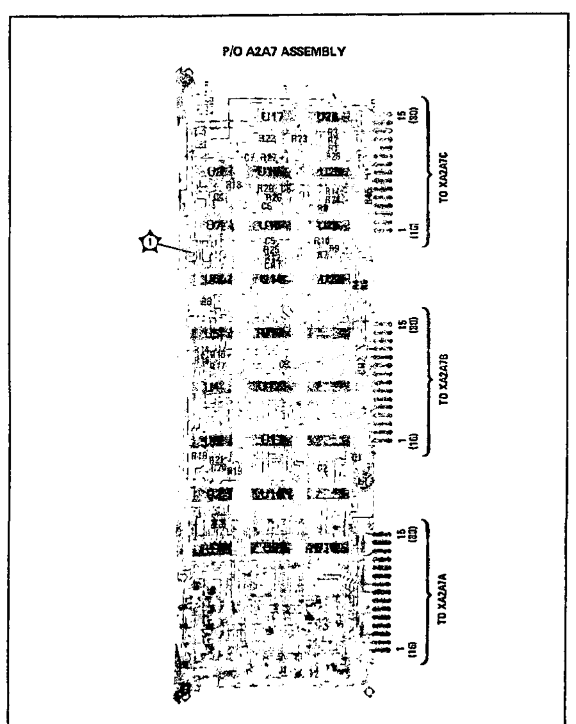


Figure 8-105. A2A7 HP-IB Interface Assembly Component and Test Point Locations

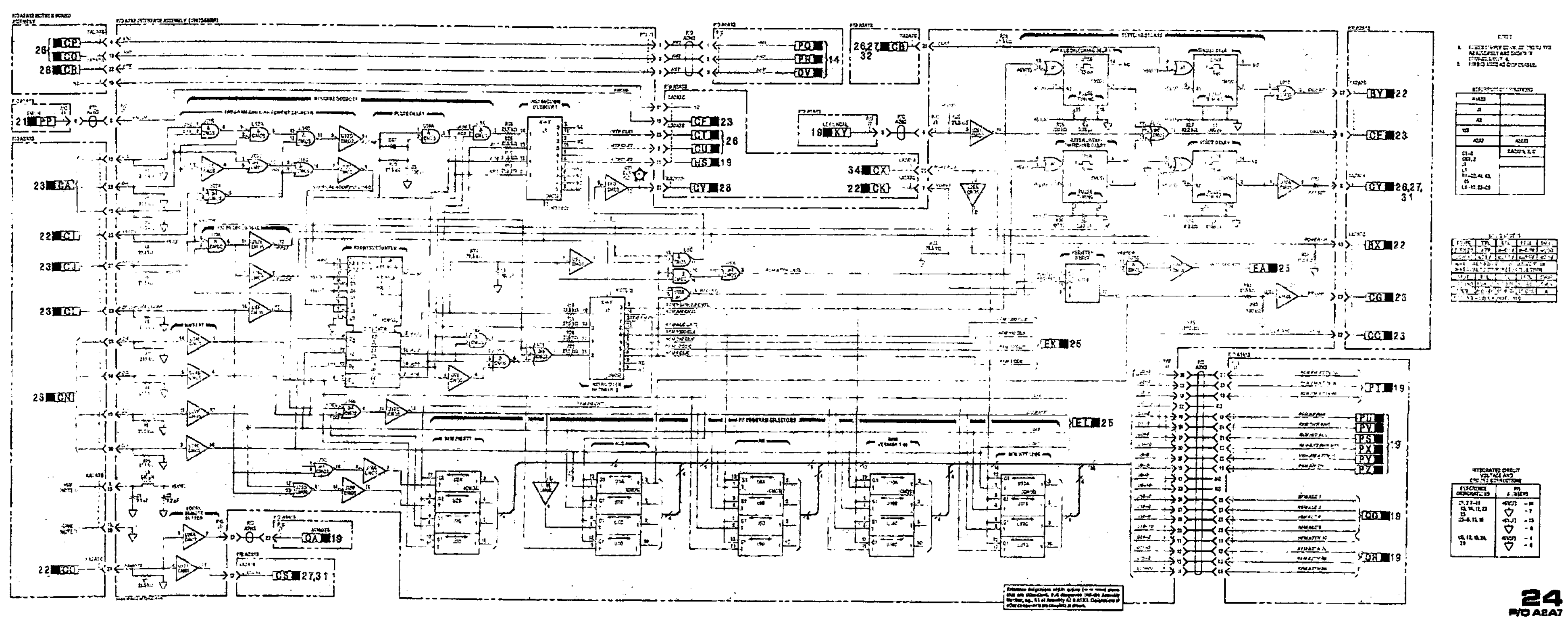


Figure 8-106. P/O HP-IB Interface Assembly Schematic Diagram

Service Sheet 25 P/O HP-IB Interface Assembly

References

Principles of Operation

General

The HP-IB Interface converts ASCII data characters on the seven HP-IB data lines into RF Output assembly program information and frequency data. Also, it converts status information from other parts of the Signal Generator into a status byte which it sends to the HP-IB Address assembly.

P/O HP-IB Interface Assembly

Frequency data on the DI1—4 lines are clocked into the interface frequency register by the remote clocks (REM 1—1000 CLK). This register is loaded in blocks of four digits. Digits in the 10 GHz to 10 MHz block are clocked in first, then when enough time has elapsed for data register 1 to load the information, the interface register reset line (INTF REG RST) goes high and clears the register. Then the 1 MHz through 1 kHz digits are loaded.

The schematic illustrates how the unlock signals from the Signal Generator's phase locked loops drive unlock indicators and are OR'd to make the UNLOCK bit of the status byte.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1, BD7 and 8, or service sheet 24 was used to isolate an HP-IB Interface problem to the circuits shown on this schematic. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A

Procedure

1. Set the Signal Generator to 3 GHz with RF switch ON and rear panel FREQ. STANDARD INT/EXT switch set to INT with jumper cable in place. Observe the phase lock indicators on A2A7. All four indicators should be on and the front panel

ϕ UNLOCKED annunciator should be off. If any of the phase lock indicators are off, measure the unlocked signal from the appropriate phase locked loop. The UNLOCKED lines should all be low as they enter A2A7 for a locked loop.

If the line is low, troubleshoot the lock indicator, otherwise troubleshoot the malfunctioning phase locked loop.

2. This step checks the switching of the phase lock indicators.

   Set rear panel FREQ STANDARD INT/EXT switch to EXT. The REF indicator should go out. Return the switch to INT and the indicator should light.

   Set the front panel RF OUTPUT switch to OFF. The YTO indicator should go out. Return the switch to ON.

   Unplug the blue cable from A3A1A1. The LFS indicator should go out. (This also disables the DCU.) Reconnect the cable. The YTO indicator may also extinguish at this step.

   Unplug the white/red cable at A3A1A5. The M/N indicator should go out. The YTO indicator may also extinguish at this step. Connect the cable. All the lock indicators should be on.

3. Quickly tune the frequency in 100 MHz steps. Measure the voltage at XA2A7A-9, YTO RST. This voltage should go low when the YTO is unlocked.

4. The following steps should only be followed if troubleshooting a frequency related programming problem. Program the following code: "P000". Do not program a frequency execute command at this time. The outputs of U19—U22 should all be low.

   If all are okay, continue with this procedure.

   If the outputs of only one register is wrong, troubleshoot it.

   If the outputs of all registers are the same but incorrect, troubleshoot input lines DI1—4.

5. Program "P1" through "P9" to assure that the outputs of U21 remain correct for all inputs. The data format is BCD.

6. Program "Q1" through "Q9" to assure that the outputs of U20 remain correct for all inputs.

7. Program "R1" through "R9" to assure that the outputs of U22 remain correct for all inputs.

8. Program "S1" through "S9" to assure that the outputs of U19 remain correct for all inputs.

9. Program "P12345678Z1". The front panel frequency display should indicate 12345.678 MHz. The outputs of U19 through U22 should be reset to zero.

   If all is okay through this step, the circuits on this service sheet are working properly.

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P/O HP-IB Interface Assembly A2A7
Schematic Diagram
SERVICE SHEET

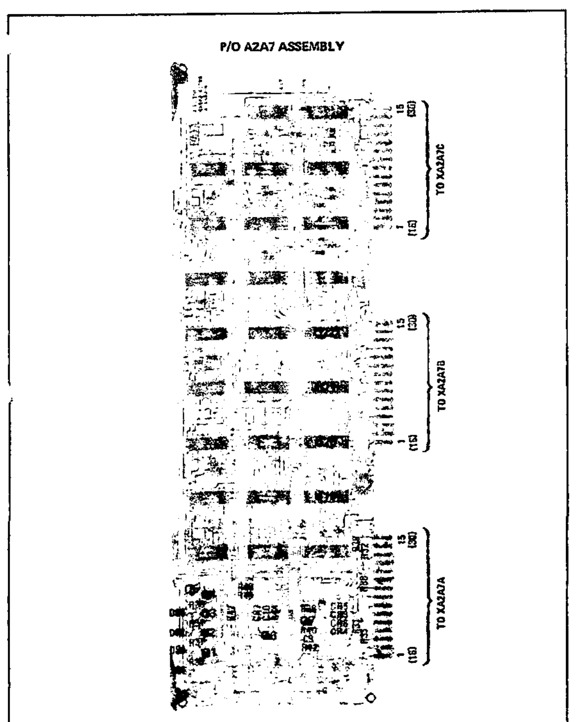
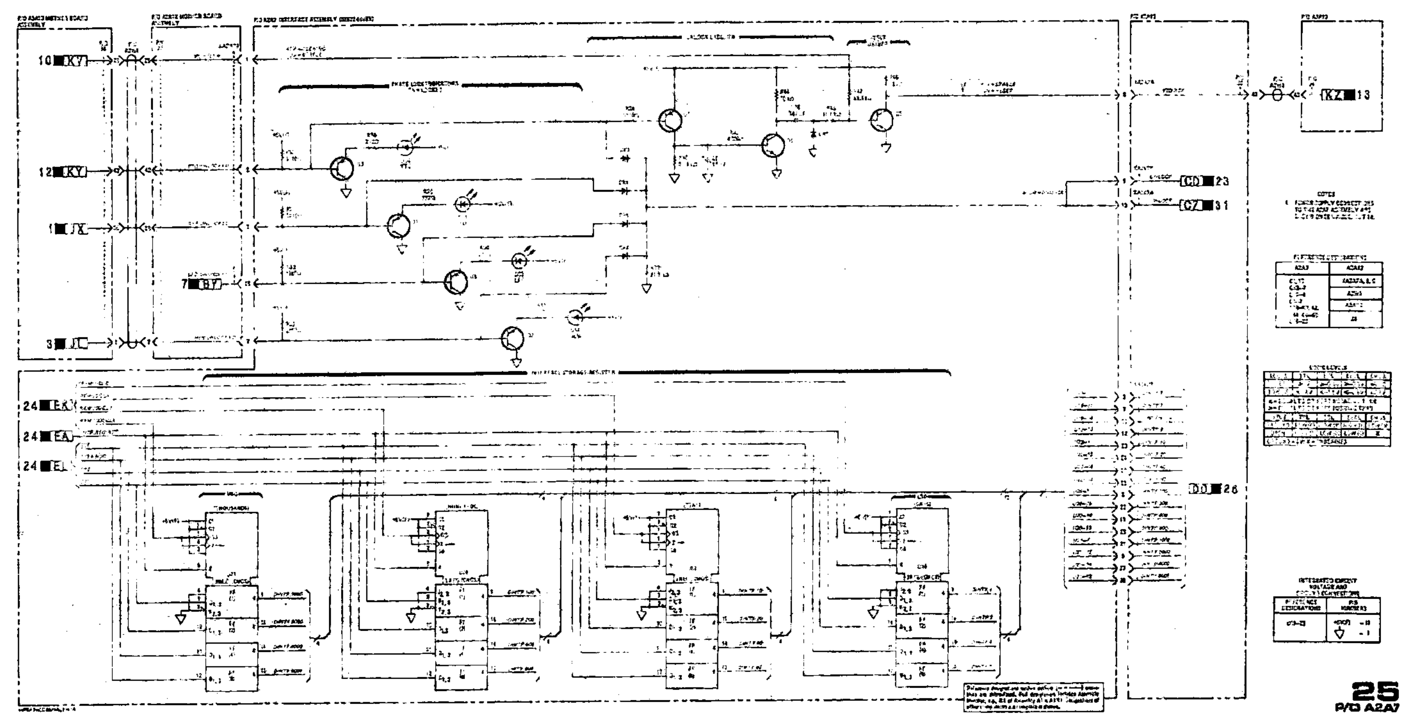


Figure 8-137. P/O A2A7 HP-IB Interface Assembly Component Locations



25
P/O A2A7

Figure 8-138. P/O HP-IB Interface Assembly Schematic Diagram

Service Sheet 26 Register 1 Assembly

References

Principles of Operation

General

The Register 1 Assembly (A2A10) consists of a protected CMOS shift register (DATA REGISTER 1) and circuits for band and error decoding. Data Register 1 stores the Signal Generator's frequency. A battery keeps the register active when Mains power is off. The band and error decoding circuit checks the frequency for out of range errors, tells the divider on the Output Register Assembly (A2A8) whether to divide by 1, 2, or 3, and tells the YIG Tuned Multiplier (YTM) whether to multiply by 1, 2, or 3.

Register 1 Assembly

Shift registers U7—U9 and U19—U23 store the Signal Generator's frequency in a BCD format. The 10 GHz digit is on top and the 1 kHz digit is on the bottom. An extra digit which duplicates the 1 kHz digit is stored in the serial output latch. Nine clock 1 (CLK1) pulses serial shift the frequency out of the register, through the Timing and Control Assembly, into the front panel display and back to Data Register 1. This happens when NGO (Not Go) is true (low). Remote programmed frequencies are parallel shifted into Data Register 1 four digits at a time by INTF CLK1 and 2.

The adder, U15, converts the register's parallel BCD output into a binary address for the first ROM, U14. This ROM and U3 store tables of Harmonic numbers (HN2, HN1) and incorrect frequencies (NERR). Signals from the RF section affect the frequency limits of the instrument. Circuit operation is summarized as follows:

Frequency	HN1	HN2	NERR	BAND
<2000.000 MHz	—	—	Low	Out of range
2000.000 MHz—6199.999 MHz	0	0	High	1
6200.000—12399.998	1	0	High	2
12400.002—18599.997	0	1	High	3
>18600.000 MHz	—	—	Low	Out of range

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and 9 was used to isolate a Register 1 problem to the circuits shown on this schematic. The following information will aid in isolating the defective component:

Equipment

Logic Analyzer .... HP 1630A
Digital Voltmeter .... HP 3455A or HP 3456A
Oscilloscope .... HP 1980B

Procedure

1. Tune the frequency to 12345.678 MHz. If the frequency tunes properly, Register 1 is properly storing and clocking data. If the frequency does not tune properly, skip to step 3.
2. Unplug the Signal Generator for at least one minute. Reapply Mains power. The frequency should be the same as displayed before power was removed.

   If not correct, troubleshoot battery A2BT1 and the charging circuit plus the clock protect circuitry on A2A11 (see service sheet 28).

   If everything is okay so far, skip to step 5.
3. Press the PRESET (3 GHz) pushbutton. Connect the logic analyzer to DR101—8. Use CLK1 to clock the logic analyzer. Set the analyzer to END DISPLAY and trigger on a BCD 3. Rotate the TUNING knob. BCD data for 3 GHz with the three at the bottom of the display should be displayed on the logic analyzer.
4. If the data does not appear to clock out properly, check CLK1 with an oscilloscope. It should be a string of 9 TTL pulses when the TUNING knob is turned or when test point pair A1A11TP1 is shorted together with an alligator clip. If CLK1 is not correct, go to service sheet 27.
5. Observe the HN1 and HN2 lines with a voltmeter. Below 6.2 GHz both lines should be TTL low. Between 6.2 GHz and 12. 399998 GHz HN1 should be high. Above 12.4 GHz HN2 should be high.
6. Tune to the highest possible frequency. It should be 18599. 997 MHz. Then tune to the lowest possible frequency. It should be 2000.000 MHz.

   If either one is incorrect, troubleshoot the frequency limit detection circuitry, U14, U3 and other associated gates.

   If everything has worked properly to this step, A2A10 is working correctly.

Mnemonics

Mnemonics	Definition	Explanation
GO (NGO)	Do a data cycle	Puts the shift registers in the serial shift mode.
CLK 1	Clock 1	Nine pulses occurring during the first half of a data cycle.
DINTF	Data Interface	Frequency information from the HP-IB interface.
INTF CLK1	Interface Clock 1	Shifts the 10 GHz to 10 MHz digits into the top half of Data Register 1.
DR111, 112, 114, 118	Data Register 1 In	Serial input to the register.
DR101, 102, 104, 108	Data Register 1 Out	Serial output of the register.
NERR	Not Error	Low means that an out of range frequency is stored.
LEFT	Data Register 2 shift left	High during the second half of a data cycle.
HN1, 2	Harmonic Number	Tells the divider and YTM the band of the frequency stored in Data Register 1.
Data Cycle = The process of changing the Signal Generator's frequency by adding or subtracting 1 from one of the digits.		

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Register 1 Assembly A2A10
Schematic Diagram
SERVICE SHEET

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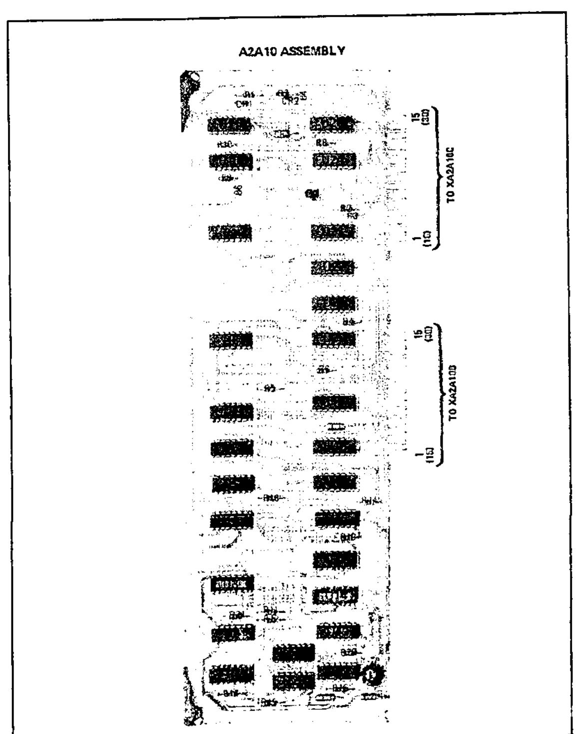
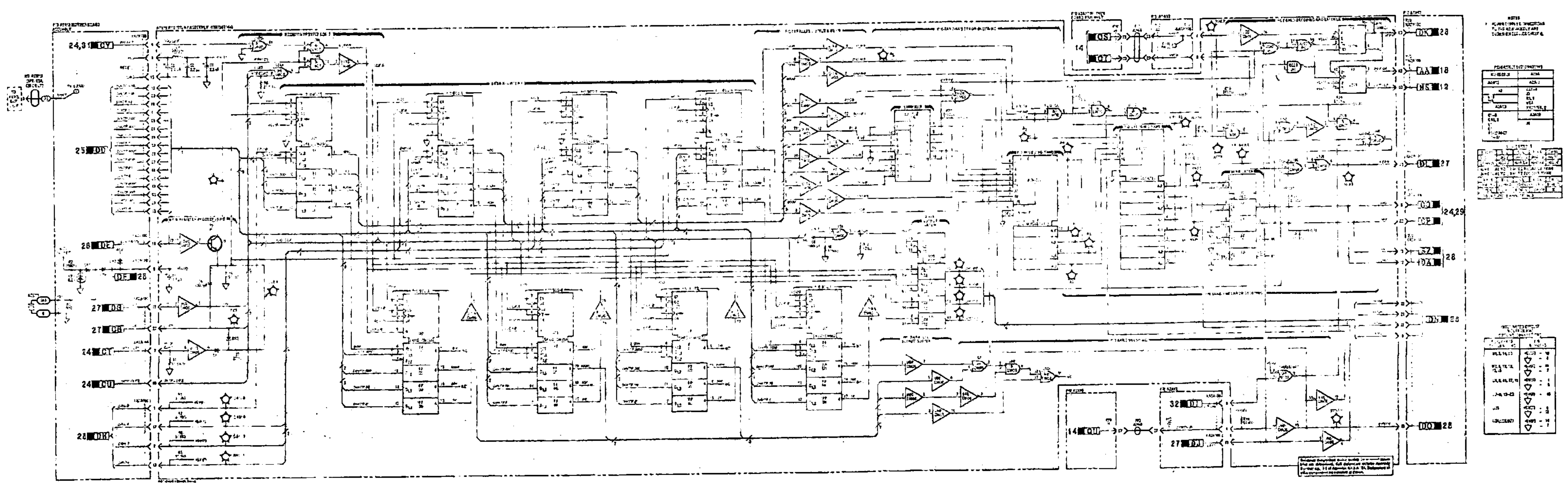


Figure 8-109. A2A10 Register 1 Assembly Component Locations



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A2A10

Figure 8-110. Register 1 Assembly Schematic Diagram
8-353/8-354

Service Sheet 27 P/O Timing and Control Assembly

References

Principles of Operation

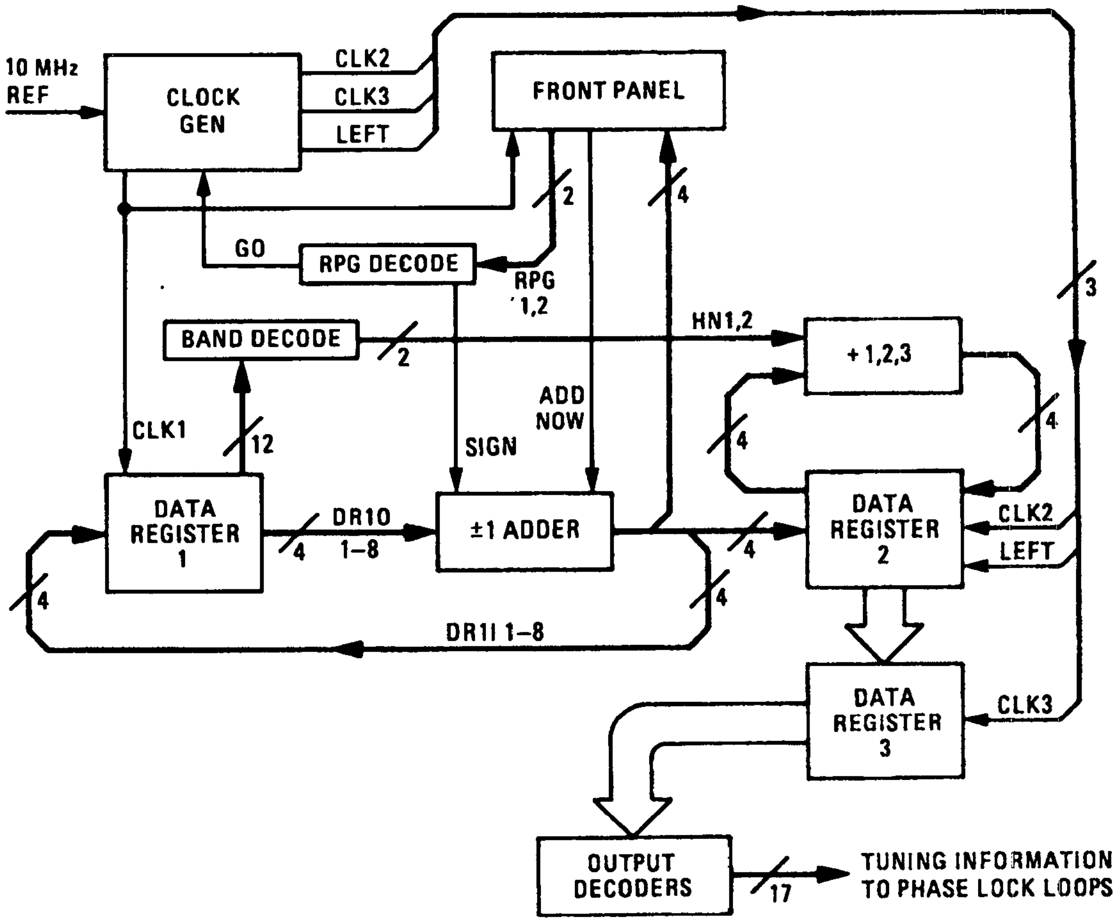
General

The timing and control assembly generates signals that initiate and control *Data Cycles*. A data cycle is the process of changing the Signal Generator's frequency by adding to or subtracting from one of the digits stored in data register 1. The timing and control signals include clocks, tuning direction indicators, and error flags. If at the end of a data cycle an error flag is set, the timing and control assembly will do more data cycles until the error is corrected.

Relation to the Rest of the Instrument

The DCU Frequency Control circuitry (see following block diagram) is static between frequency changes. Tuning information is stored in Register 3 and applied, through output decoders, to the phase locked loops. Since the frequency data is the basis for all future frequency changes, it is stored in the Protected Register (Register 1) and displayed by the front panel.

The frequency (2—18 GHz) is displayed and stored as 8 BCD digits (10 GHz to 1 kHz). The phase locked loops tune from 2—6.2 GHz, which means the frequency must be divided by 1, 2, or 3 before being used to tune the phase locked loops. Frequency changes occur during a Data Cycle which is initiated by turning the TUNING control, pressing the PRESET button, or remotely programming a new frequency. During each data cycle the DCU operates on the frequency stored in Register 1 as follows:



Digital Controller Block Diagram

- In Local when the TUNING control is turned:

  Add ±1 to the digit selected by the resolution key.
  Update the display.
  Divide the new frequency by 1, 2, or 3 (so the phase locked loops will tune from 2—6.2 GHz).
  If a remainder exists, do more data cycles, adding or subtracting one from the least significant digit until the remainder is zero.
  Shift the new frequency data into Register 3.
  Stop!

- In Local when PRESET is pushed:

  Clear Register 1
  Add 3 to the 1 GHz digit
  Update the display
  Divide by 1 in Register 2
  Shift the new frequency data (3 GHz) into Register 3.
  Stop!

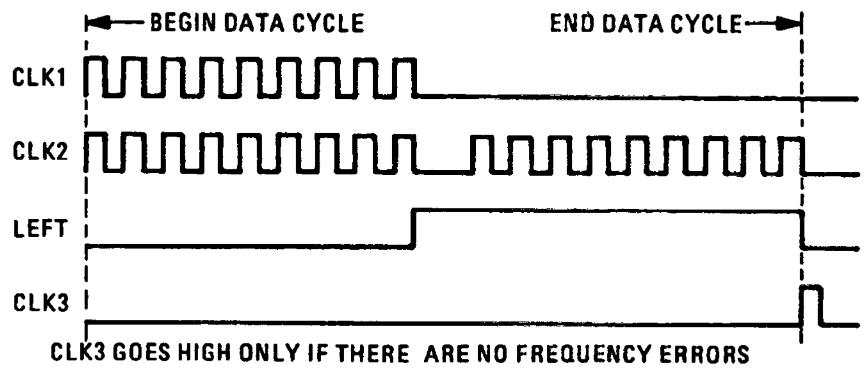
- In remote when a new frequency is programmed:

  Store the new frequency into Register 1.
  Update the display

Divide by 1, 2 or 3
If a remainder exists, do more DATA CYCLES, adding ±1 to the 1 kHz digit until an evenly divisible frequency is obtained.
Stop!

A data cycle begins when the GO line goes true. The clock generator produces timing signals as shown on next panel.

Starting with the 1 kHz digit, CLK1 shifts the frequency data serially out of Register 1 and into the ±1 adder. The adder adds or subtracts 1 from the digit selected by the RESOLUTION keys. The new frequency goes to three places: the front panel display, back into Register 1, and into Register 2. Then LEFT goes high, changing Register 2 to the left shift mode, and the second half of CLK2 serial shifts the data (starting with the 10 GHz digit), through the divider. The divided frequency is shifted back into Register 2. If a remainder exists another data cycle will commence and the 1 kHz digit of the frequency Register 1 will be changed and the division will again occur. This process continues until an evenly divisible frequency is obtained. When the remainder is zero, CLK3 parallel shifts the data into Register 3 where it is decoded and applied to the phase locked loops.



Clock Generator Outputs

P/O Timing and Control Assembly

Clock divider, U14, divides the 10 MHz reference by 16 which results in a stream of 625 kHz pulses. The clock counter counts nine of these pulses during which time they are gated through U5C (clock 1) and U5D (first half of clock 2). At the end of the count U5C is disabled and the clock divider is reset. It stays reset until the end of the time delay measured by C6, R12 and R9 is finished. This accounts for the interval between the two halves of clock 2. U14 starts dividing again and 9 more pulses go through U5D. Clock 3 (CLK3) signals the end of an error free data cycle by going high for a short period when triggered by the negative going edge of LEFT.

The RPG (Rotary Pulse Generator) converts the smooth rotation of the TUNING control into digital information. The DCU interprets this information to determine if the frequency should be increased or decreased. RPG1 and RPG2 are pulses, the frequency of which depend on rotation speed, and the phase relationship depends on rotation direction. If the TUNING control is turned clockwise RPG1 will lead RPG2 and the frequency will increase. The presence of the squarewaves tells the DCU to do data cycles. RPG1's negative edge triggers a one shot composed of C3, and Q6 and associated resistors. This results in a short duration low pulse at U29B pin 6, the trailing edge of which sets GO. The gate, U29B, must be enabled by the Pulse Swallower. This circuit controls the rate of frequency change by varying the number of pulses gated through U29B. If the RPG is turning slowly only every third pulse gets through to set GO, but if turned fast enough every pulse clocks U20B. C8 and C9 store the positive voltage which enables U29B. Q5 opens a discharge path every time GO becomes true. C8 requires three pulses to charge to the on threshold of U29B and is completely discharged every time Q5 conducts. This accounts for the every third pulse setting GO when the RPG is turned slowly. C9, however, charges relatively fast and discharges slowly so it works out that when the RPG is turning fast, a positive voltage will always be applied through CR7 to U29B thus allowing every pulse to gate U20B.

The Error flip-flop gets set when the band and error decoding circuit on the Register 1 assembly detects an incorrect frequency. This will cause the controller to repeat data cycles, modifying the RESOLUTION selected digit (1 kHz by default), until the frequency is in range. This occurs when an attempt has been made to tune below 2.0 GHz or above 18.6 GHz. If, for example, the frequency is 2.0 GHz, the RESOLUTION is 1 MHz, and the RPG is turned counterclockwise; the ±1 adder will subtract 1 MHz resulting in 1.999 GHz. The error circuitry will then cause the adder t o add 1 MHz and thereby return to 2.0 GHz. Register 3 cannot be clocked when there is an error, so the frequency of the loops is unaffected. The process is so rapid that the operator will not be able to see 1.999 GHz on the front panel.

The First Cycle flip-flop tells the DCU whether or not the current data cycle is the first one or succeeding ones used to produce an evenly divisible frequency or correct an error. The XSCC (Excess Cycle Counter) and UPDATE SIGN flip-flop work together to determine whether a frequency to be modified should be increased or decreased.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD9 was used to isolate a Timing and Control problem to the circuits shown on this schematic. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A
Oscilloscope .... HP 1980B

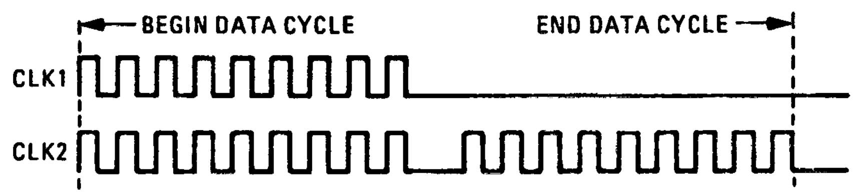
Procedure

This assembly contains several test point pairs which are designed to set certain signals to known conditions. By shorting the pair together with an alligator clip, the line will be set high or low as appropriate.

A2A11TP1	Causes DCU to continually cycle data
A2A11TP2	Suppresses frequency error limits
A2A11TP3	Suppresses operation of the ±1 Adder
A2A11TP4	Suppresses round off
A2A11TP5	Aborts DCU operation

This assembly also contains a manual clock switch. Use this switch by unplugging the blue cable on A3A1A1 to disconnect the DCU clock. (Disconnecting this cable also causes the LFS phase locked loop to unlock but that is not important when troubleshooting the controller.)

1. Connect an alligator clip to test point pair A1A11TP1. Observe CLK1 and CLK2 test points on the oscilloscope. The strings of pulses should be as shown in the figure below (5 μs/div., 2 V/div.). CLK1 consists of a string of 9 pulses. CLK2 consists of two strings of 9 pulses. If the front panel display is working properly, CLK1 must be okay.

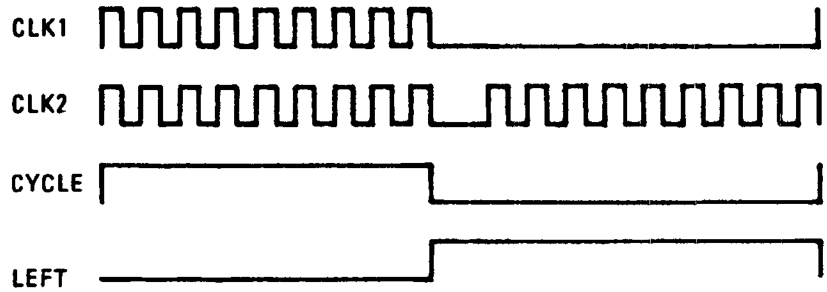


Clock Pulse Waveforms

   If these clock signals are okay, the clock divider, clock counter and clock drivers are okay. Also the RECYCLE flip-flop (U27B) is okay.

2. Attach one oscilloscope probe to XA2A11A-30, NCLK3. Leave the other probe attached to CLK1. The timing relationship of NCLK3 should be as shown in the text.
3. Observe LEFT and CYCLE lines in relationship to CLK1 and CLK2. They should be as shown in the following table.
4. Locate RPG SIGN test point. This point should go high when the TUNING control is turned clockwise and low when turned counterclockwise.

5. Connect the oscilloscope or voltmeter to XA2A11B-1, ERRS. This line should be a CMOS low for all in-range frequencies. If everything is correct so far, turn to service sheet 28.



Clock, Cycle, and Left Timing Relationship

Mnemonics

Mnemonics	Definition	Explanation
NRMDR	Not Remainder	Low means a remainder exists after dividing by 2 or 3.*
NLSDR	Not Least Significant Digit Resolution	Low means the 1 kHz digit RESOLUTION button has been pushed.
UPDATE	Correct band change error	Initiates more data cycles to correct the 1 kHz digit after a band change.
NERR	Not Error	Low means an out-of-range frequency is stored in Data Register 1.
CYCLE SET	Set first cycle flip-flop	High when either INTF CLK GO is true or there is a frequency error and the 1 kHz RESOLUTION button has been pushed.
UPDATE SIGN	Change state of SUBTRACT line	Indicates whether previous round off was an addition or subtraction.
LEFT	Shift left	High during the second half of a data cycle. Causes Data Register 2 to shift left.
CLK1	Clock 1	9 pulses during the first half of a data cycle. Each pulse corresponds to a frequency digit.
CLK 2	Clock 2	18 pulses: 9 during the first half of a data cycle and 9 during the second half.
CLK 3	Clock 3	1 pulse at the end of an error free data cycle.
GO	Do a data cycle	Leading (positive going) edge triggers a data cycle. Stays high until the data cycle is finished.
XSCC NXSCC	Excess Cycle Generator	XSCC and NXSCC are two bits used to tally the extra data cycles done to obtain an evenly divisible frequency.
RPG SIGN	Rotary Pulse Generator Sign	Indicates tuning direction. High is clockwise, low is counterclockwise.
SUBTRACT	Subtract 1 from the RESOLUTION selected digit	Tells the ± Adder whether to add or subtract. High = subtract Low = add

*Should always be false (high) after the data cycle is completed.
Data Cycle = The process of cycling frequency data through the various registers and the ± Adder, usually for the purpose of changing frequency.

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P/O Timing and Control Assembly
A2A11 Schematic Diagram
SERVICE SHEET

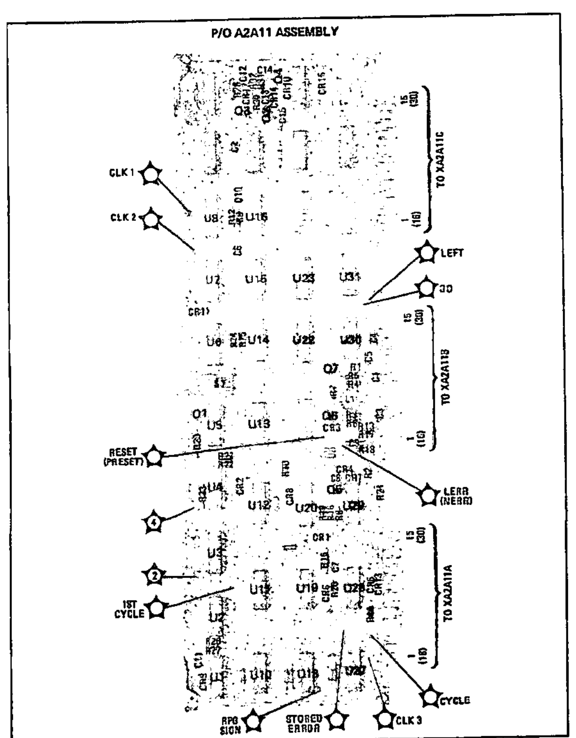

Figure 8-111. P/O A2A11 Timing and Control Assembly Component Locations

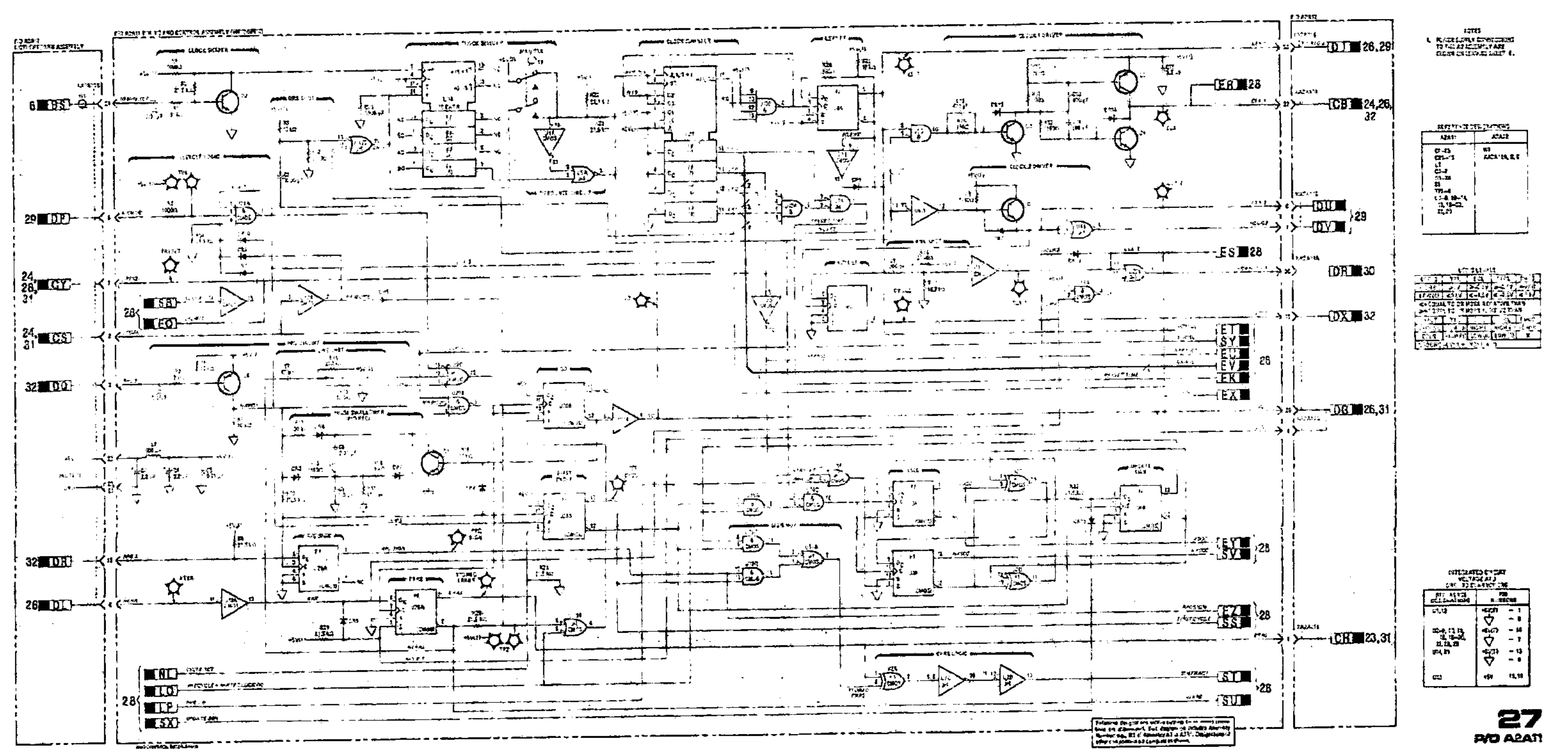

Figure 8-112. P/O Timing and Control Assembly Schematic Diagram

Service Sheet 28 P/O Timing and Control Assembly

References

Principles of Operation

General

The timing and control assembly generates signals that initiate and control *Data Cycles*. A data cycle is the process of changing the Signal Generator's frequency by adding or subtracting 1 from one of the digits stored in data register 1. The timing and control signals include clocks, tuning direction indicators, and error flags. If at the end of a data cycle an error flag is set, the timing and control assembly will do more data cycles until the error is corrected.

This part of the Timing and Control Assembly consists of the Band Change Detector, ±1 Adder and the Offset Adder. The Band Change Detector translates harmonic number and excess cycle information into control signals for the Error and RPG Sign Logic. The ±1 Adder modifies the appropriate frequency digit to set a new frequency or correct an error. The Offset Adder is used to add an IF offset in special instruments. The frequency data for standard instruments is not changed by the Offset Adder.

P/O Timing and Control Assembly

The ±1 Adder, U33, performs the operation indicated by the SUBTRACT line when the ±1 Bit line goes high. For example:

If SUBTRACT line is low:

Add 1	DR10	8	4	2	1	
Y input		0	1	0	1	=5
Z input		0	0	0	1	=1
Y + Z		0	1	1	0	= 5 + 1 = 6

If SUBTRACT is high:

Subtract 1					
Y input	0	1	0	1	=5
Z input	1	1	1	1	=15
Y + Z	0	1	0	0	=5 − 1 = 4

If the sum is 10 an illegal BCD 1010 will result so it must be converted to binary 0000 with a carry of one. U17D pin 11 goes Low when this is necessary. This Low does two things. First, it is clocked through U9B by a delayed CLK1 from the Double Clock circuit — it keeps the Adder Enable flip-flop set. Second, it changes the number at the Adder's B input to 7. A new sum, 16 or binary 0000 with a carry, results. Note that this happens within the period of one CLK1 pulse. The carry is added to the next digit. A similar process performs subtraction with borrow.

The OR gates at the ±1 Adder's output add 3 to the 1 GHz digit when the PRESET key is pushed. Pin 13 of U32D and pin 1 of 32A go high when the 1 GHz digit leaves the ±1 Adder.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1, BD9, and service sheet 27 was used to isolate a Timing and Control problem to the circuits shown on this schematic. The following information will aid in isolating the defective component.

Equipment

Logic Analyzer .... HP 1630A

Procedure

1. Observe the front panel frequency display and press the PRESET (3 GHz) key. If the frequency is displayed correctly (3000.000 MHz) the DR111, 112, 114, 118 lines from the ±1 Adder (U33) are probably okay. If the frequency is not displayed properly, check the CLK1 line on service sheet 27 or check the data entering the display.

Note

An open pin on the front panel display data input will cause that pin to float high. A continuously lighted segment is an indication of this problem.

2. Connect the logic analyzer to DR111, 112, 114, 118 and DR211, 212, 214, 218 lines. Use CLK1 to clock the analyzer. Rotate the RPG to cause the data to circulate. The DR1 and DR2 data should be identical for standard instruments.

   If they are different, troubleshoot the Offset Adder.

3. Press the least significant digit (1 kHz) RESOLUTION key. Rotate the TUNING knob clockwise. Observe DR111, 112, 114,

118 on the logic analyzer. The data is displayed least significant digit first and should increase as the frequency is increased. Tune each digit from 0 to 9 to ensure that none of the DR1 lines are stuck high or low.

If the frequency does not change, troubleshoot the ±1 Adder circuitry.

4. Note the center frequency and unplug the Signal Generator from power Mains. Wait at least one minute and reconnect Mains. The center frequency should not have changed.

   If the frequency has changed, troubleshoot the clock protect circuitry (U27A) and the battery or charger circuit on service sheet 26.

5. Tune the frequency above 6.2 GHz and then tune the least significant digit. Between 6.2 and 12.4 GHz, the minimum step size should be 2 kHz; above 12.4 GHz, the minimum step should be 3 kHz.

   If the instrument turned on correctly in step 4 and rounds off properly above 6.2 GHz, the recycle circuitry and the excess cycle counter circuitry on service sheet 27 are working properly.

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P/O Timing and Control Assembly
A2A11 Schematic Diagram
SERVICE SHEET

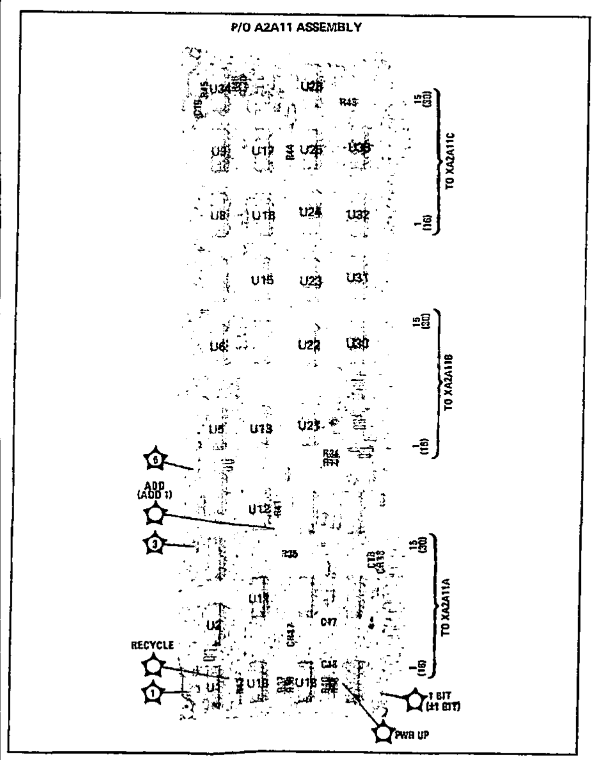


Figure 8-113. A2A11 Timing and Control Assembly Component and Test Point Locations

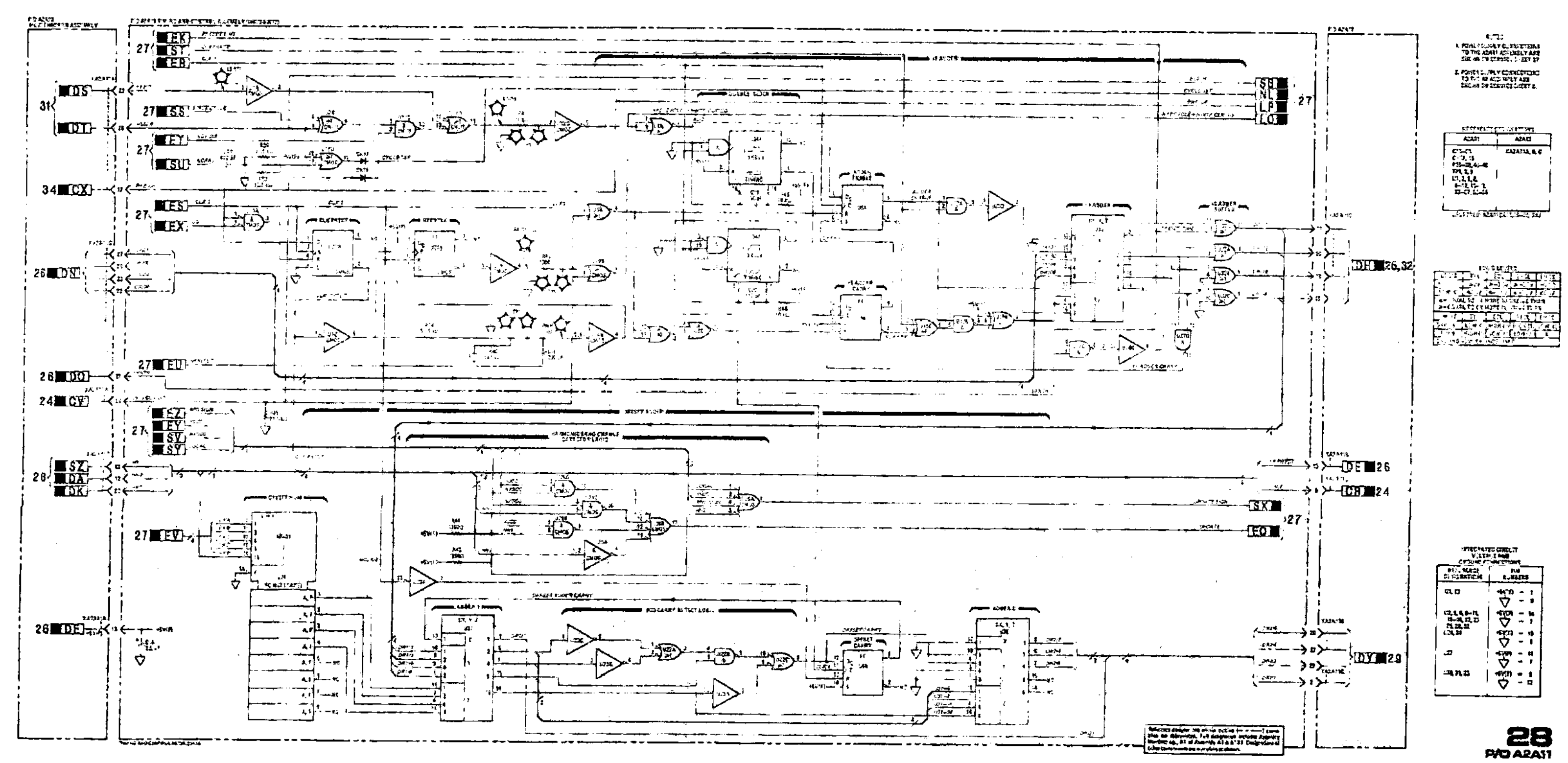


Figure 8-114. P/O Timing and Control Assembly Schematic Diagram

Service Sheet 29 P/O Output Register Assembly

References

Principles of Operation

General

The Output Register Assembly consists of Data Register 2, Data Register 3, a Digital Divider, and the DAC and M/N Decoder. service sheet 29 covers the Digital Divider and Data Register 2 and service sheet 30 covers the rest. Additionally, service sheet 29 shows the Logic Test Circuit which is used as a logic probe.

Data Register 2 accepts frequency data from the ±1 Adder in a right shift mode during the first half of CLK2. Then LEFT goes true and the second half of CLK2 left shifts the data through the digital divider and back into Register 2.

The digital divider, controlled by HN1 and HN2, divides the frequency by 1, 2, or 3 so that the DAC, and M and N information will always tune the YTO from 2 to 6.2 GHz.

P/O Output Register Assembly

Register 2 consists of shift registers U1, 2, 3, 6, 7, 11, 15, 16 and 23. U23 serves a dual purpose: it stores the GHz digit and steers the data. During right shift the LEFT Line is low to enable data to flow from the ±1 Adder. When LEFT goes high during the second half of CLK1, data flows from the 100 MHz flip-flops, through the two inputs of U23 and to the digital divider.

The ROM's U24 and U25, contain division tables. Each digit, starting with the most significant, enters both ROM's as a dividend (address). U24 feeds the quotient back to Register 2. U25 puts the remainder into U8 where it is clocked back to the ROM's as part of the next dividend. If a remainder exists after the last digit, the NRMDR line will be low (true) and cause the timing and control circuitry to start another data cycle.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1, BD9 and service sheet 28 was used to isolate an Output Register problem to the circuits shown on this schematic. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A
Logic Analyzer .... HP 1630A

Procedure

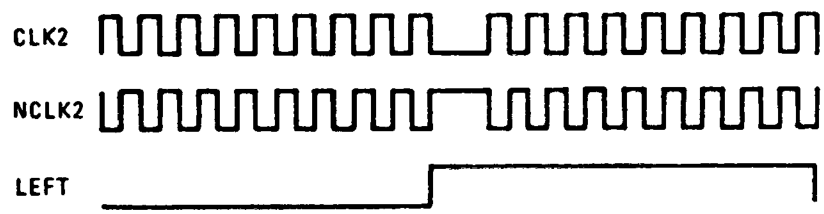
1. Install A2A8 on an extender board or on the Output Register Test Board (HP Part Number 11712-60001).
2. Set the Signal Generator frequency as shown in the following table. The edge connector pins with arrows should be measured with the voltmeter or the data can be observed on the output register test board. By checking all four frequencies, each output line will be cycled high and low.

Frequency	A Front	A Rear	B Front	B Rear	C Front	C Rear
6169.696	L	H	H	L	X	X
3696.969	H	L	L	H	X	X
5990.000	X	X	X	X	H	L
3640.000	X	X	X	X	L	H

3. Check the input data by connecting the logic analyzer to DR2I 1—8 lines and to CLK1. Set the analyzer to END DISPLAY. Set the frequency to 12345.678 MHz and set the logic analyzer to trigger on the "1". Connect an alligator clip to test point pair A1A11TP1. If the input data is correct, continue with this procedure. Otherwise go to service sheet 28 to continue troubleshooting. The data is clocked in least significant digit first; the last nine characters on the logic analyzer display should be:

1000	0110	0011
1000	0101	0101
0111	0010	0001

4. Check input lines CLK2, NCLK2 and LEFT with an oscilloscope. These lines should be as shown below. Trigger the oscilloscope on CLK1 for these measurements.



Mnemonics

Mnemonics	Definition	Explanation
HN1 HN2	Harmonic Number	Tells the digital divider whether to divide by 1, 2, or 3. $\frac{1}{2}$ HN1 HN2 1 0 0 2 1 0 3 0 1
CLK2	Clock 2	Two sets of nine pulses. Each pulse within a set corresponds to a frequency digit.
LEFT	Shift Left	When low, Register 2 shifts right. When high, Register 2 shifts left.
DR2I 1—8	Data Register 2 In	Binary coded decimal digits to Data Register 2.
NRMDR	Not Remainder	Low means that a remainder exists after division.
Data Cycle = The process of cycling frequency data through the various registers and the ±1 Adder, usually for the purpose of changing frequency.		

5. Check input lines HN1 and HN2. These lines set the divide number for the harmonic bands. If either line is malfunctioning, go to service sheet 26 to continue troubleshooting.

Frequency (MHz)	HN1	HN2
2000—6199.999	L	L
6200—12399	H	L
12400—18599	L	H

6. If all the input lines are correct, trace back from the incorrect output(s) discovered in step 2 to isolate the malfunction to a particular part. Note that the output of Register 2 should not

be over 6199.999 MHz after CLK2 has finished clocking the data through the divider.

7. To check the divider, connect the logic analyzer to the outputs of U24. Depending on the harmonic band selected (see step 5) the output of U24 should be the selected frequency divided by 1, 2, or 3.

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P/O Output Register Assembly

A2A8 Schematic Diagram

SERVICE SHEET

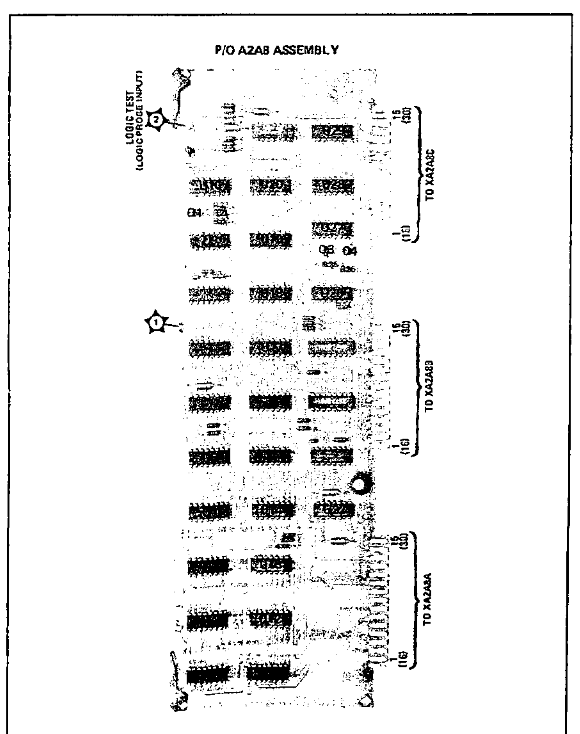

Figure 8-115. P/O A2A8 Output Register Assembly Component and Test Point Locations

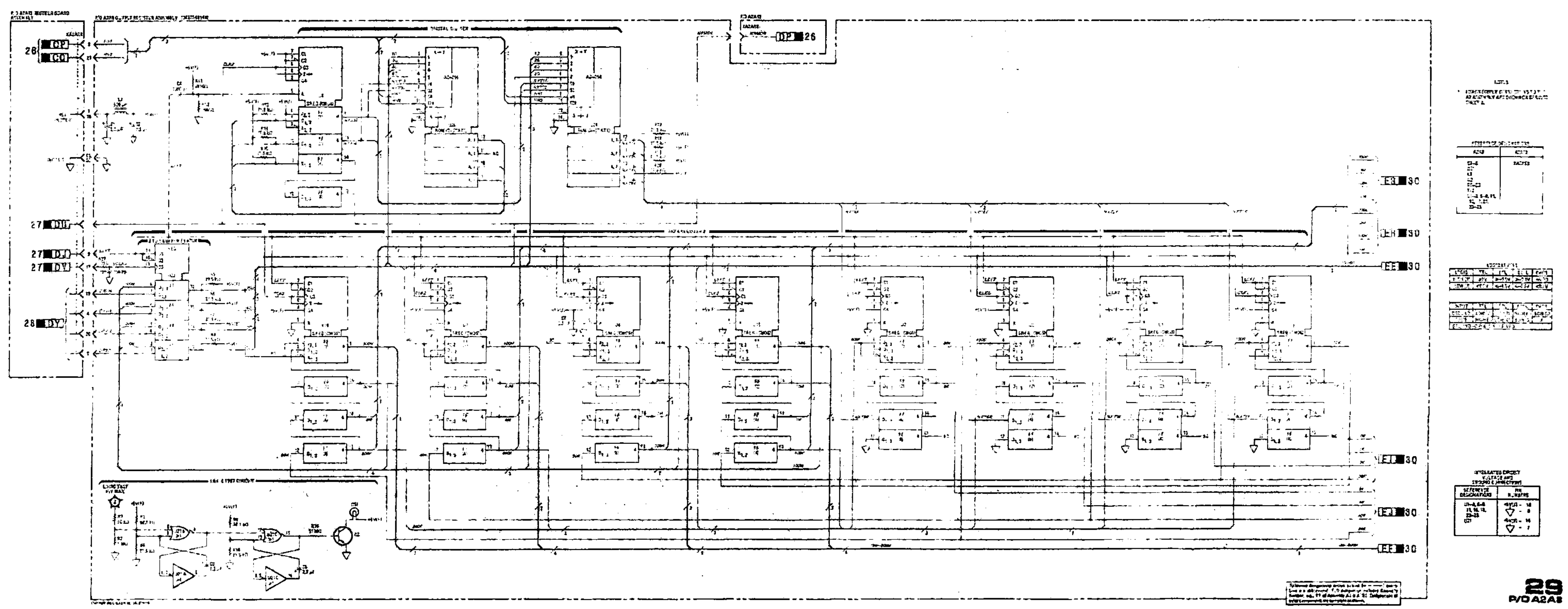

Figure 8-116. P/O Output Register Assembly Schematic Diagram

Service Sheet 30 P/O Output Register Assembly

References

Principles of Operation

P/O Output Register

This part of the output register assembly consists of Data Register 3 and the DAC and M/N Decoder circuits. CLK3, a single pulse at the end of the data cycle, parallel loads Register 3 with the frequency data from Register 2. From here the 1 kHz through 8 MHz digit information goes directly to the LFS phase locked loop. The DAC and M/N Decoder translates the remaining digits into tuning information for the YTO summing phase locked loop. The outputs relate to the YIG Tuned Oscillator (YTO) frequency as follows:

DAC 1—3200 MHz: round down to nearest 10 MHz. Note that the DAC 100 MHz through DAC 3200 MHz bits are effectively in binary.

M and N: look up the frequency in table 8-8 and convert M and N to binary.

Troubleshooting

Troubleshooting is covered on service sheet 29.

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P/O Output Register Assembly
A2A3 Schematic Diagram
SERVICE SHEET

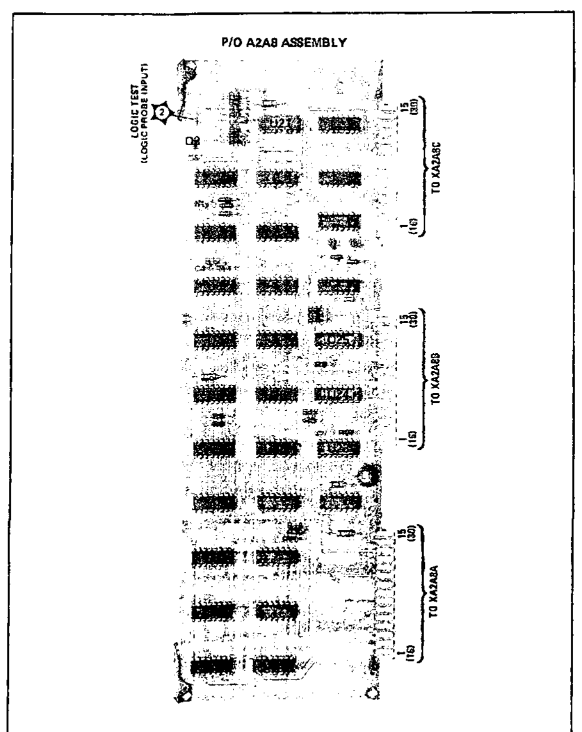
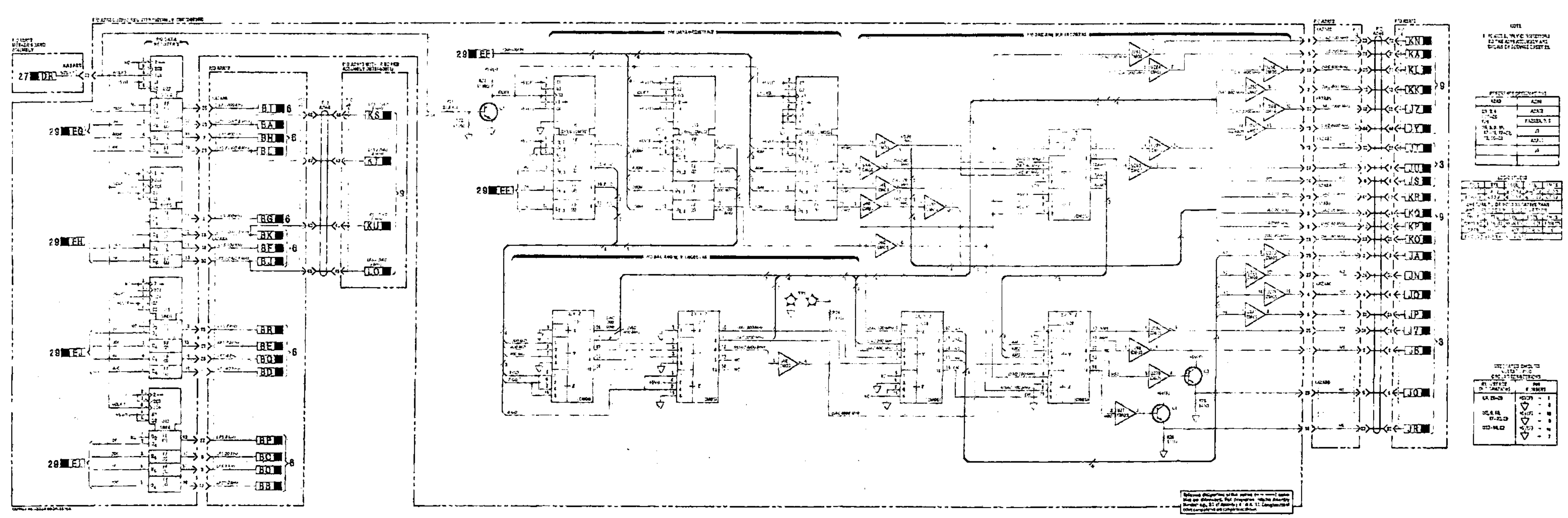


Figure 8-117. P/O A2A8 Output Register Assembly Component and Test Point Locations



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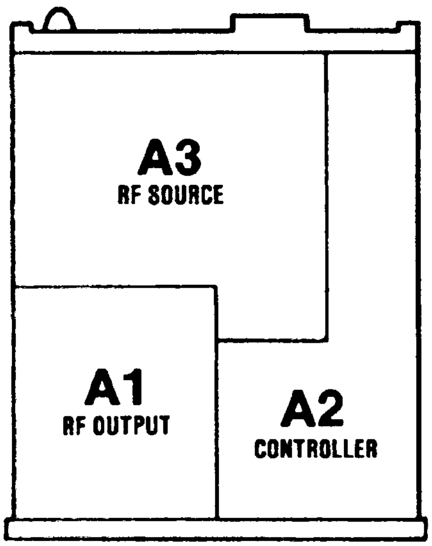
P/O A2A8

Figure 8-118. P/O Output Register Assembly Schematic Diagram
8-379/8-380

Index To Service Sheets by Assembly



MAJOR ASSEMBLIES, TOP VIEW

Service Sheet 31 P/O DCU Front Panel Assembly

References

Principles of Operation

General

The DCU front panel (A2A1) consists of the power switch, frequency controls and indicators, and status annunciators.

This portion of the A2A1 Assembly contains status annunciators, frequency resolution indicators and the ±1 Bit control circuitry. The LED drivers and status indicators show, by front panel lights, the following conditions: REMOTE, ϕ UNLOCKED, EXT REF, and frequency OUT OF RNG. When the instrument is first turned on or the HOLD button is pressed, the tuning resolution circuits will disable the Signal Generator tuning. If one of the FREQUENCY RESOLUTION keys is pressed, the FREQUENCY RESOLUTION indicators and LED drivers will indicate the selected resolution corresponding to the button that was pressed and load that information into the resolution register. The ±1 Bit output of this register tells the ±1 Adder (located on A2A11) on which digit to operate.

P/O DCU Front Panel Board Assembly

Pin 2 of the Resolution Register U10 goes high when the appropriate digit is clocked through the ±1 Adder by CLK1. The desired resolution, selected by switches S3 through S6 and latched by U6, is clocked into U10 by the inverted GO line. When GO changes level, U10 becomes a serial register and the selected resolution is shifted through by CLK1. Three supporting circuits are significant. Diode CR1 clocks U6 when the LOCAL line goes low (that is, when the instrument switches to remote). This causes the lows at U6's D inputs to appear at U10, thus disabling the ±1 Adder. U7A and associated capacitor and resistors debounce the FREQUENCY RESOLUTION keys. Inverter Buffer, U2, drives the FREQUENCY RESOLUTION INDICATOR circuitry, ensuring that the selected resolution light and any higher significant digit lights are on.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1 and BD7 was used to isolate a front panel problem to the circuits shown on this schematic. The following information will aid in isolating the defective component.

Equipment

Oscilloscope .... HP 1980B
Controller .... HP 85B or HP 9826/36A

Procedure

1. Set the LINE switch to ON. Press the PRESET (3 GHz) key. Push the right hand (least significant digit) FREQUENCY RESOLUTION key. All four FREQUENCY RESOLUTION indicators should light. Rotate the TUNING knob clockwise and counterclockwise. The frequency should change in 1 kHz steps. If the FREQUENCY RESOLUTION indicators and the FREQUENCY MHz display don't change as indicated, skip to step 9.
2. Press the next FREQUENCY RESOLUTION key. The least significant FREQUENCY RESOLUTION indicator should extinguish. The frequency should tune in 10 kHz steps when the TUNING knob is turned.
3. Press the next FREQUENCY RESOLUTION key. The 10 kHz resolution indicator should extinguish. The frequency should tune in 1 MHz steps.
4. Press the most significant FREQUENCY RESOLUTION key. Only the most significant resolution indicator should remain lighted. The frequency should tune in 100 MHz steps.
5. Press the HOLD key. The remaining FREQUENCY RESOLUTION indicator should extinguish and the frequency should not change when the TUNING knob is turned. If everything is correct so far, the tuning circuits on this service sheet are working. Otherwise, skip to step 9.
6. Set the rear panel FREQ STANDARD INT/EXT switch to EXT. The EXT REF and ϕ UNLOCKED annunciators should light. Return the switch to INT.
7. Using the HP-IB code below, program the Signal Generator to 40 GHz (out of range). The REMOTE and OUT OF RNG LED's should light.

   ```
   OUTPUT 719;"P4Z1"
   ```

   If everything is correct through this step, the circuits on Service Sheet 31 are working.
8. Return the Signal Generator to local operation and press PRESET (3 GHz).

Note

When the Signal Generator is returned to local with an out-of-range frequency displayed, it will begin to search in 1 kHz steps until an in-range frequency is reached. If one of the FREQUENCY RESOLUTION keys is pressed, the instrument will search in the resolution selected.

9. If the frequency tunes but one or more of the FREQUENCY RESOLUTION indicators does not light, troubleshoot U2, the LED's and their drivers.

10. If the frequency display does not tune, the problem may be in any of several places including:

    - A2A11 Timing and Control Assembly (Service Sheet 11)
    - Reference Phase Locked Loop (service sheet 1)
    - Rotary Pulse Generator (service sheet 31)
    - Register 1 (service sheet 26)
    - Resolution Register (this service sheet)

    To check the resolution register, connect test point pair A2A11TP1 together with an alligator clip to continuously generate clock signals. Compare the signal at A2A1U10 pin 2 with CLK1 (clock 1) as each FREQUENCY RESOLUTION key is pressed. U10 pin 2 should go high along with the clock 1 cycle corresponding to the digit selected by a FREQUENCY RESOLUTION key.

    If these pulses are correct, the circuits on service sheet 31 are working.

    If the pulses are not correct or not present, check A2A1U10 pin 10 for the presence of CLK1 before troubleshooting U6, U10 and U7.

Mnemonics

Mnemonics	Definition	Explanation
GO	Start Data Cycle	True when the RPG is turned, PRESET is pushed, or a new frequency is remote programmed.
ERRS	Error Store	An out of range frequency is stored in Data Register 1.
NLSDR	Not Least Significant Digit Range	True (low) indicates the 1 kHz FREQUENCY RESOLUTION key was pressed.
±1 BIT	Add now	Tells the ±1 Adder that the digit now at its input is the one selected by a FREQUENCY RESOLUTION key.
CLK1	Clock 1	Nine pulses occurring during the first half of a data cycle. Each pulse corresponds to a frequency digit.
Data Cycle = The process of cycling frequency data through the various registers and the ±1 Adder, usually for the purpose of changing frequency.		

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P/O DCU Front Panel Assembly
A2A1 Schematic Diagram
SERVICE SHEET

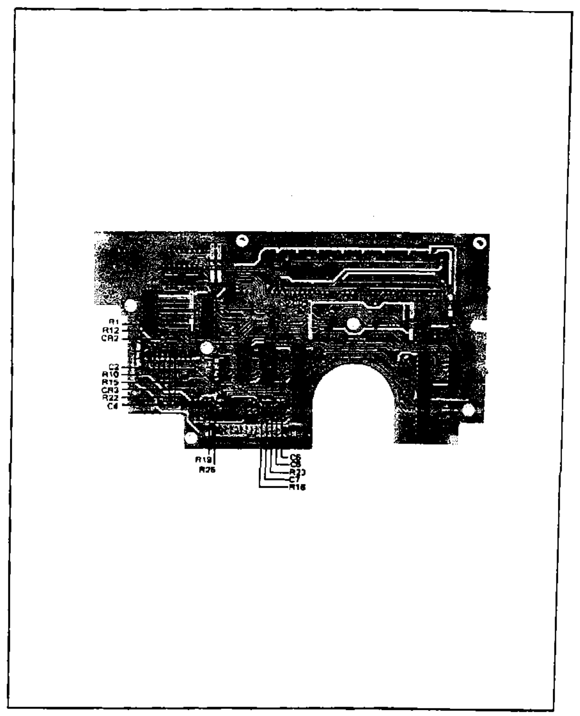

Figure 8-119. P/O A2A1 DCU Front Panel Assembly Component Locations

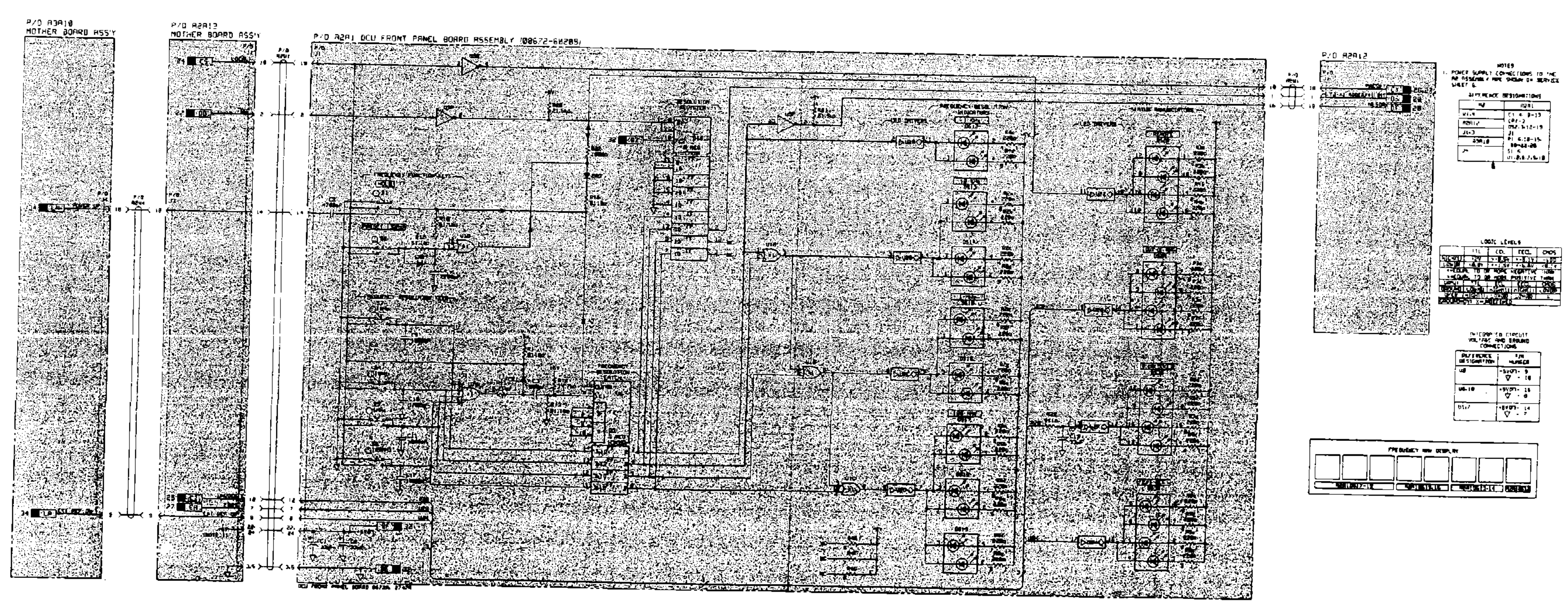

Figure 8-120. P/O DCU Front Panel Assembly Schematic Diagram

Service Sheet 32 P/O DCU Front Panel Assembly

References

Overall Block Diagram	Service Sheet BD1
Remote/Local Interface Block Diagram	Service Sheet BD7
Power Supplies Block Diagram	Service Sheet 10
Electrostatic Discharge (ESD) Precautions	Chapter 8 (Front)
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5
After Service Safety Checks	Chapter 8 (Front)

Principles of Operation

General

The DCU front panel (A2A1) consists of the line (power) switch, frequency controls and indicators, and status annunciators.

This part of the A2A1 assembly contains the FREQUENCY MHz display circuits, the oven temperature comparator, the LINE (on-standby) switch, and the TUNING Rotary Pulse Generator (RPG).

P/O DCU Front Panel Board Assembly

Decoder/displays A2DS12 through A2DS19 display the Signal Generator's output frequency. The display is updated during the first half of each data cycle. As each digit, starting with 1 kHz, appears on the DR111, 112, 114, 118 lines, the strobe latch, U5, sequentially latches the data in the associated display. U5 is clocked by CLK1 which is delayed by R23, C5, U9C and U9E. The delay allows the data lines to settle.

The four digits on the left (A2DS12—A2DS15) have leading zeroes blanked by U4 and associated components. Blanking is done sequentially starting with A2DS12 but a display blanks only when the blanking input stays high thus ensuring that only leading zeroes are blanked. NOR gate U7B indicates zeroes by outputting a high level. This signal is clocked through U4 by CLK1 (undelayed) and applied to A2DS12. When a non-zero digit appears at U7B, the low at the output is clocked through U4. At the next CLK1 pulse, U4 is reset by U3C.

The OVEN annunciator comes on when the 10 MHz Reference Oscillator oven is below normal temperature. An analog voltage inversely proportional to the temperature is applied to the inverting input of U8 by the OVEN MON line. When the voltage goes above 17V, the output swings negative turning on A2DS1A and putting a low on the OVN OK line.

The RPG outputs pulses on lines RPG1 and RPG2 when the TUNING knob is turned. Tuning direction is indicated by the phase relationship of the pulses. When the TUNING knob is turned clockwise, RPG1 leads RPG2.

Troubleshooting

It is assumed that the troubleshooting information on service sheets BD1, BD7, BD10 and service sheet 31 was used to isolate a Front Panel problem to the circuits shown on this schematic. The following information will aid in isolating the defective component:

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A
Oscilloscope .... HP 1980B

Procedure

1. Press the PRESET (3 GHz) key. The display should indicate exactly 3000.000 MHz. If the display is correct, CLK1 is correct and all the displays are properly receiving data.

Note

A floating data input on display will be interpreted and displayed as a logic high.

2. Set the frequency to 2345.678 MHz. If the frequency cannot be changed, go to step 7. Disconnect the 10 MHz clock signal (blue cable) from A3A1A1. Select 1 kHz tuning resolution.
3. Turn the TUNING knob clockwise.
4. Use the manual clock switch on A2A11 to generate clock pulses. The display should progress in this manner:

Clock Pulse	Display
1	99999.999
2	77777.779
3	66666.679
4	55555.679
5	44445.679
6	33345.679
7	22345.679
8	02345.679
9	2345.679

Generate nine (9) more clock pulses to complete the controller cycle. The display should not change during the latter nine pulses.

If the display readings are correct, go to step 5.

If the data does not clock in properly, check the input data (DR111, 112, 114 118) with the voltmeter to ensure it is correct. If the input data is correct, troubleshoot U5, U4 and

A2DS12emdash;19 If the input data is not correct, go to service sheet 28 to continue troubleshooting.

5. Set the instrument to STANDBY. The STANDBY annunciator should light.
6. Unplug the instrument for 1 to 2 minutes. Reconnect the power Mains. The OVEN COLD and STANDBY annunciators should both come on.

   If neither comes on, suspect a burned out LED (OVEN COLD LED A2A1DS1A), Oven Temperature Comparator A2A1U8, or a defective Reference Oscillator, A3A8.

   If everything is correct through this step, the A2A1 and A2A3 assemblies are working.
7. Swing open the controller front panel (requires removal of four screws) to gain access to the outputs of the A2A2 Rotary Pulse Generator (RPG). Observe the outputs (RPG2 and RPG1) on the oscilloscope. When tuning clockwise the TTL pulses of RPG1 should occur before RPG2 pulses and when tuning counterclockwise RPG2 should occur before RPG1. If the pulses occur properly, the RPG is working and troubleshooting should proceed to service sheet 27.

Mnemonics

Mnemonics	Definition	Explanation
CLK1	Clock 1	Nine pulses during the first half of the data cycle. Each pulse coincides with a frequency digit.
CYCLE	One data cycle	Low during the first half of the data cycle, high during the second half.
DR111, 112 DR114, 118	Data Register 1 In	Four lines that carry frequency information sequentially by digit in BCD format.
Data Cycle = The process of cycling frequency data through the various registers and the ±1 Adder, usually for the purpose of changing frequency.		

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P/O DCU Front Panel Assembly
A2A1, A2A2 Schematic Diagram
SERVICE SHEET

HP 8572A

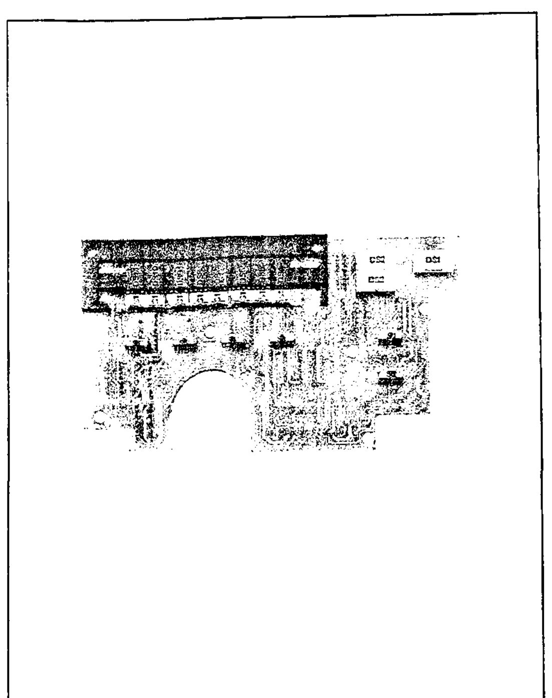
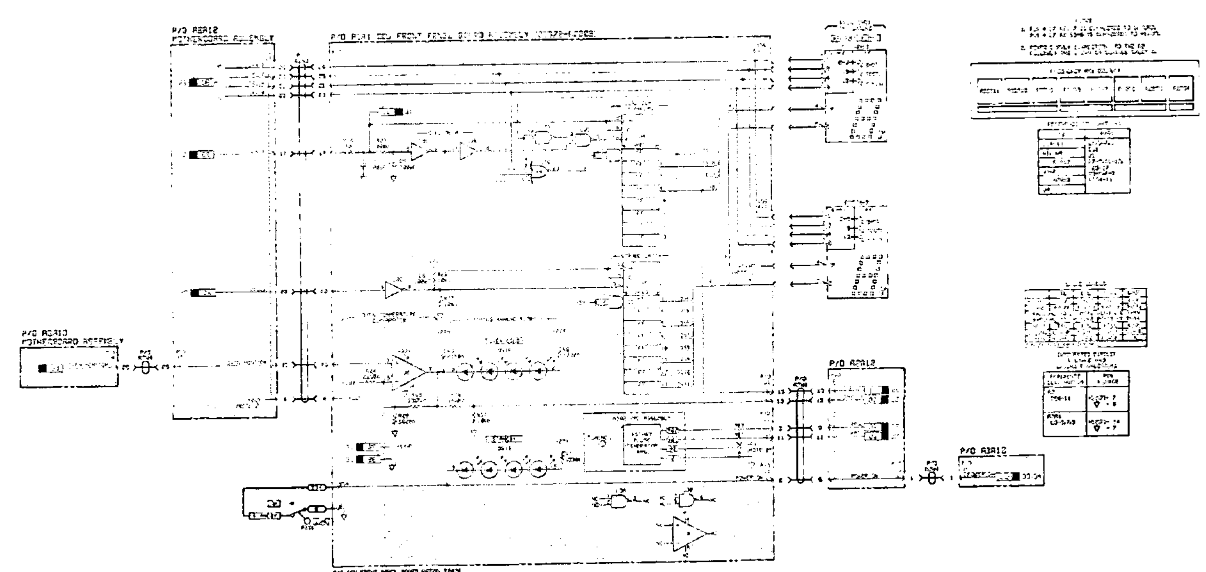


Figure 8-121. P/O A2A1 DCU Front Panel Assembly Component Locations



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P/O A2A1, A2A2

Figure 8-122. P/O DCU Front Panel Assembly Schematic Diagram

Service Sheet 33 Rectifier Assembly

References

Principles of Operation

General

If the power cable W6 is connected between the line (mains) power outlet and the A3A11 Line Module, primary ac power is connected to transformer A3T1 and fan relay A3A10K1. A line voltage selector matches the line voltage to the transformer primary. When the front panel LINE switch is set to ON, 120 Vac is connected to the cooling fan A3B1.

The secondary ac voltages from the transformer are always present on the rectifier circuit board if the line voltage is connected to the Signal Generator. The four inputs are rectified and filtered before being output to the regulator circuits.

+22 Volt Regulator

The +22V Regulator supplies power to the Reference Oscillator's heater circuit any time the instrument is connected to the line voltage, to maintain operating temperature. This keeps the instrument ready to operate immediately after the LINE switch is set to ON.

The unregulated +20V is also used to supply power to the +22V Regulator. A3A12U1 is a monolithic 18 volt regulator that has the common terminal raised +4 Vdc above ground. If the regulated output exceeds +25 Vdc, the overvoltage protection circuit shorts the output to ground which causes the regulator to limit its output current. This action efectively turns the Signal Generator off. If the primary power fuse A3F1 does not burn out, the instrument must be disconnected from the line voltage to reset the overvoltage protection circuit.

Input Overvoltage Protection

If the input voltage on the unregulated −40V line exceeds 82.5 Vdc (measured from −40V Unreg to −40V Return), the overvoltage protection circuit will short circuit the −40V input causing primary power fuse A3F1 to burn out. The intent of this circuit is to protect the instrument if 220 or 240 Vac is input with the Line Voltage

Selector set for 100 or 120 Vac. If this occurs, change the fuse to correct value and orient the Line Voltage Selector so the line voltage is correctly matched to the transformer.

Troubleshooting

It is assumed that the troubleshooting information on service sheet BD1 and BD10 was used to isolate a malfunction to the A3A12 Rectifier Assembly. It is also assumed that an attempt was made to correct the malfunction by using the appropriate adjustment procedure in chapter 5. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A

Procedure

To troubleshoot the Rectifier Assembly proceed as follows:

1. Connect the instrument to the line (Mains) power.
2. LED A3A12DS1 should be on.
3. Verify that the voltage at A3A12TP1 is +22.0 ±0.1 Vdc.
4. Disconnect the power cable from the line power.

   Install the assembly on an extender board and reconnect the instrument to the line power.

Caution

To prevent damage to the power supplies, measure the following voltages with a voltmeter that has a floating common terminal.

5. Measure voltages between edge connector pins as shown below:

Negative Pin	Positive Pin	Voltage Range
5	6	27—35 Vdc
15	17	15—21 Vdc
1	3	48—60 Vdc
7	10	10—14 Vdc

6. If any of the voltages are incorrect, check the ac input voltages from the power transformer. The voltages should be as shown on the schematic.
7. The transformer output may be checked with no load by removing the A3A12 assembly.

Note

With A3A12 removed the fan will run continuously in both STBY and ON. After repairing the A3A12 assembly, perform the "Power Supply Adjustments" in chapter 5. Also, perform the performance tests (if any) that led to the power supply repair.

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Rectifier Assembly A3A10, A3A11, A3A12 Schematic Diagram
SERVICE SHEET

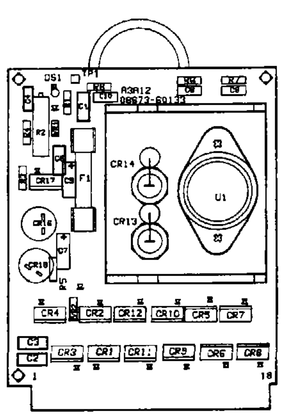
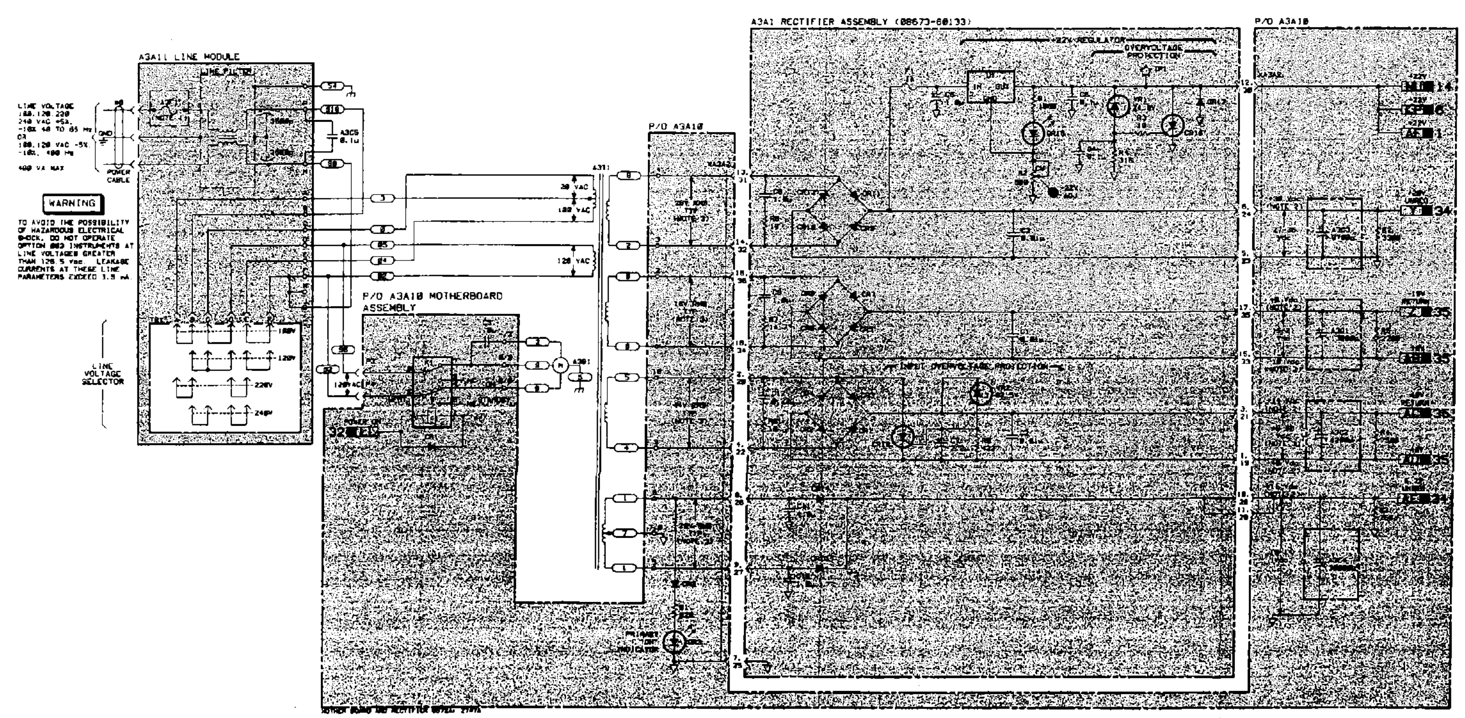


Figure 8-123. P/O A3A12 Rectifier Assembly Component, Adjustment and Test Point Locations



WARNING

SECONDARY ac VOLTAGES OF GREATER THAN 30 Vac AND RECTIFIED dc VOLTAGES OF GREATER THAN 60 Vdc ARE ALWAYS PRESENT ON THIS ASSEMBLY WHEN THE INSTRUMENT IS CONNECTED TO THE LINE VOLTAGE.
THESE VOLTAGES COULD CAUSE PERSONAL INJURY IF CONTACTED. BE CAREFUL WHILE WORKING ON THESE CIRCUIT BOARDS WITH POWER SUPPLIED TO THE INSTRUMENT.
IF THIS CIRCUIT BOARD IS PLACED ON AN EXTENDER BOARD, THE POSSIBILITY OF COMING IN CONTACT WITH THE SECONDARY ac VOLTAGES (>30 Vac) OR RECTIFIED dc VOLTAGES (>60 Vdc) IS GREATLY INCREASED. THESE VOLTAGES COULD CAUSE PERSONAL INJURY IF CONTACTED. BE CAREFUL WHILE WORKING WITH THIS CIRCUIT BOARD WITH POWER SUPPLIED. WORK WITH ONE HAND. DO NOT TOUCH THE EXTENDER BOARD.

CAUTION

DO NOT REMOVE OR INSERT POWER SUPPLY BOARDS WITH THE POWER CABLE CONNECTED. DAMAGE TO THE INSTRUMENT MAY OCCUR.

NOTES

1. 3A 100/120 VAC
   1.5A 220/240 VAC.
2. MEASURED WITH RESPECT TO CHASSIS GROUND.
3. USE VOLTMETER WITH FLOATING COMMON.
4. REFER TO TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.

REFERENCE DESIGNATIONS

NO PREFIX	A3A10
W1	DS1,7 CR1-3 K1 P3,4 R1-8 XA3A2
A3	
S1 C1-5 F1 T1	
A3A1	A3A11
C1-12 CR1-10 F1 R1-5 TP1 U1 VR1,2	TB1

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A3A1, A3A10, A3A11

Figure 8-124. Rectifier Assembly Schematic Diagram

Service Sheet 34 Positive Regulator Assembly

References

Overall Block Diagram	Service Sheet BD1
Power Supplies Block Diagram	Service Sheet 10
Electrostatic Discharge (ESD) Precautions	Chapter 8 (Front)
Disassembly Procedures	Service Sheet A
Interior Views	Service Sheet B
Replaceable Parts List	Chapter 6
Illustrated Parts Breakdown (IPB)	Chapter 6
Post Repair Adjustments	Chapter 5
After Service Safety Checks	Chapter 8 (Front)

Principles of Operation

General

The +20V Regulator provides a reference voltage for all regulated supplies other than the +22V supply. If, for any reason, the +20V supply is turned off, all the power supplies on the A3A3 and A3A4 Assemblies will also be off. This effectively turns off the instrument. Under normal circumstances the +20V Regulator is turned on or off with the front panel LINE switch.

+20V Regulator

A3A3Q2 and Q3 form a current source to bias A3Q3. The output voltage is divided by A3A3R9, R50 and R10 and coupled to the inverting input of A3A3U3. The other input to A3A3U3 is the reference voltage from A3A3VR2. The divided voltage is adjustable and sets the output voltage level.

When current flow through the +20V Regulator gets too high the voltage drop across A3A3R3 will equal that across A3A3R4, and A3A3Q4 will begin to conduct. The output of A3A3U3 will go more positive, which will turn A3A3Q4 on harder. This will shunt the bias current source away from A3A3Q3 and reduce the current drive of A3A3Q3, and limit the current available from the supply.

If the output voltage of the +20V Regulator reaches +23 Vdc, the overvoltage protection circuit shorts the output to ground. This causes the current limiter to turn the regulator off.

Front Panel Shutdown

The front panel LINE switch in the STBY position causes the Power On input to A3A3U1A to be 0V. This turns on A3A3Q8, which turns the +20V Regulator off. In the LINE switch ON position, the input voltage is approximately +22 Vdc which turns A3A3Q8 off.

Thermal Shutdown

This circuit operates much like the Front Panel Shutdown. At normal operating temperatures (less than 55°C) the value of thermistor A3A3RT1 is much greater than the 107 ohms of A3A3R53. Therefore, the voltage at the inverting input of A3A3U1B is more positive than the non-inverting input. This causes A3A3Q1 to be turned off. At temperatures exceeding 85°C, the resistance of RT1 drops below 107 ohms which causes A3A3Q1 to turn on. Even though the instrument is effectively turned off, the fan will continue to run to cool the instrument. The instrument will not return to normal operation until the internal temperature drops to +55°C or less.

+5.2V Regulator

The operation of this circuit is much like that of the +20V Regulator. The reference voltage is provided by the +20V supply and a separate fuse is provided for further protection.

Power Up/Down Detector

This circuit outputs a Power Up/Down voltage (+5V or 0V) when the instrument is turned on or off. This lets the last frequency displayed before turn-off to be restored at turn-on.

Reference Oscillator Power Supply

A rear panel switch controls power supplied to the A3A8 Reference Oscillator Assembly. When the FREQUENCY STANDARD INT/EXT switch is set to EXT, the Reference A3A3Q9 is turned on, which turns off A3A3Q10, shutting down the +11V supply. When the switch is set to INT, A3A3Q9 is turned off, and A3A3Q10 is turned on, so that +11V is turned on.

Troubleshooting

It is assumed that the troubleshooting information on service sheet BD1 and BD10 was used to isolate a malfunction to the A3A3 Positive Regulator Assembly. It is also assumed that an attempt was made to correct the malfunction by using the appropriate adjustment procedure in Section V. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A

Procedure

To troubleshoot the Positive Regulator Assembly proceed as follows:

1. Connect the line (Mains) power to the instrument and set the LINE switch to ON. Set rear panel FREQUENCY STANDARD INT/EXT switch to INT.
2. Observe the LED on the A3A3 Assembly. The two red LEDs (+20V and +5.2V indicators) should be on and the yellow LED (Thermal Shutdown indicator) should be off.

3. Set the LINE switch to STBY. The +20V and +5.2V indicators should turn off.
4. Set the LINE switch to ON and measure the following regulator output voltages.

Regulator	Test Point	Line Switch Position ON	STANDBY
+20V*	A3A3TP5	+20.000 ±0.001 Vdc	0V
+11V	A3A3TP6	+11 ±1.1 Vdc	0V
+5.2V	A3A3TP2	+5.2 ±0.1 Vdc	0V
*The +20V supply is the reference for all other except the +22V supply. If the +20V supply is incorrect, all other supplies except the +22V supply will probably be incorrect.			

5. While measuring the +11V supply, switch the FREQUENCY STANDARD INT/EXT switch to EXT. The supply should go to 0V. Set the FREQUENCY STANDARD INT/EXT switch to INT.
6. If the output voltages are incorrect, measure the following input voltages.

Input Voltage	Test Point	Line Switch Position ON	STANDBY
+20V UNREG	A3A3TP4	≈32 Vdc	≈35 Vdc
+5.2V UNREG	A3A3TP1	≈12 Vdc	≈14 Vdc

Connect voltmeter common lead to chassis ground for these measurements.

Caution

DO NOT remove or install power supply boards with the power cable connected. Instrument damage may occur.

7. If the output voltages are incorrect and input voltages are correct, check the fuses before continuing. Use the voltages noted on the schematic to continue troubleshooting.
8. To test the Thermal Shutdown circuit, ground A3A3U1B-13. The yellow LED (Thermal Shutdown Indicator) should light and the 5 red LEDs on A3A3 and A3A4 assemblies should turn off. The front panel should turn off and the fan should continue to run. When the ground is removed the instrument should return to normal operation.
9. If the power supply problem is associated with the negative regulator circuits, refer to service sheet 35.

Troubleshooting Line Related Spurious Signals

Note

This procedure is not part of the normal troubleshooting information. This procedure normally follows failure of the Power Line Related Spurious Performance Test.

High line related spurious signals can be caused by many different things; some ingenuity may be required to isolate the more subtle causes such as ground loops and externally inducted vibrations. The following procedure suggests items to check when trying to isolate a line spurious problem.

1. With a sensitive oscilloscope, observe the power supply ripple on each of the positive and negative supplies. The +20V, +11V, −10V, and −40V supplies should have ripple less than 300 μV while the +22V, 5.2V, and −5.2V should have ripple less than 1 mV. Power supply induced ripple will generally be twice the line frequency plus harmonics (e.g., 120, 240, 360 Hz, etc., for a 60 Hz line). If one or more supplies has excessive ripple, check the filter capacitors.
2. If any of the circuit boards were removed and reinstalled, line related spurious signals can increase if the board position in the socket was changed or if ground contact resistance increased. Remove the board, clean the edge connector contact and reinsert the board. When reinserting the board, push it as far as possible toward one end of the edge connector socket and thoroughly tighten any screws holding the board in place.
3. Fan induced spurious signals will generally be 3 to 5 Hz below line frequency. A loose circuit board (covers not properly tightened) can vibrate more than normal and may increase fan related spurious signals. The 10 MHz Reference Oscillator is also sensitive to vibration. Check the reference to make sure the rubber shock mounts are in good condition and the reference oscillator is properly mounted in them. An out of balance fan or one with defective bearings can generate much vibration. To isolate the origin, turn off the instrument and insert an insulated tool to prevent the fan from turning. Then turn on the instrument and see if the spurious signals have decreased. Do not operate the instrument longer than a few minutes with the fan disabled.
4. Apparent line related spurious signals can be caused by external instruments connected to the FM input when the FM deviation range is set to 10 MHz. A high level hum signal can cause significant FM sidebands even though the FM input is high pass filtered on the wide deviation ranges.

5. Bad ground connections and ground loops can occasionally cause spurious signal problems. Make sure the A1 and A2 modules are fully seated on their connectors and that all coax cables and circuit boards are properly seated in their connectors.

Note

After repairing the A3A3 assembly, perform the "Power Supply Adjustments" in chapter 5. Also, perform the performance tests (if any) that led to the power supply repair.

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Positive Regulator Assembly
A3A3 Schematic Diagram
SERVICE SHEET

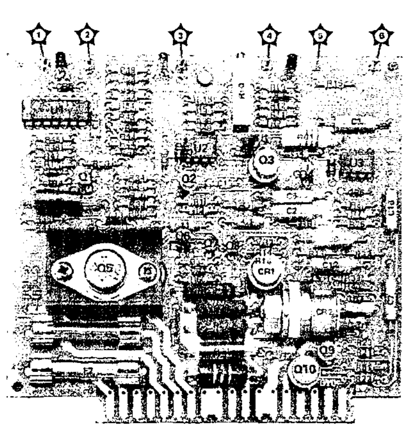
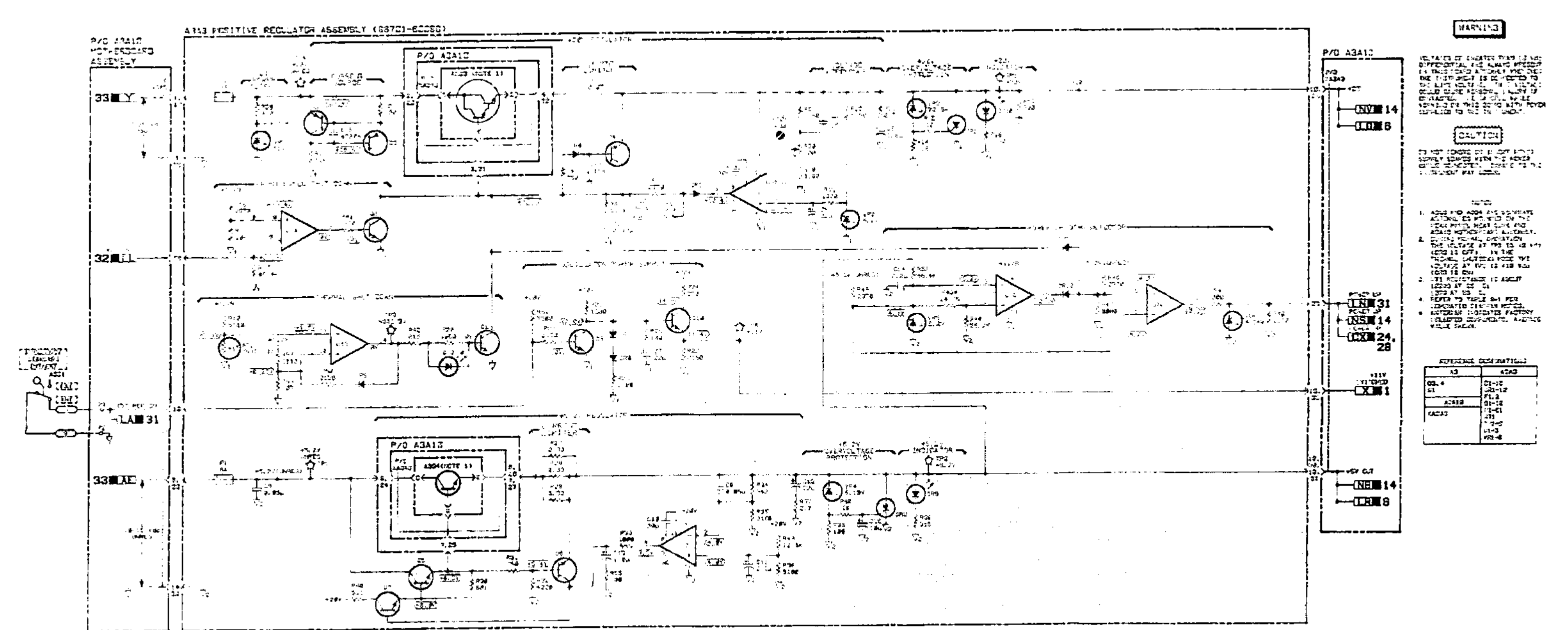


Figure 8-125. A3A3 Positive Regulator Assembly Component and Test Point Locations



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A3A3

Figure 8-126. Positive Regulator Assembly Schematic Diagram

Service Sheet 35 Negative Regulator Assembly

References

Principles of Operation

General

The negative regulators are all controlled by the +20V Regulator output. The −10V Regulator and the −40V Regulator operate like the positive regulators. The only difference in the −5.2V Regulator is that the regulation occurs in the negative leg of the supply. Each supply has current limiting and overvoltage protection, and each is fused. The fuse in the −10V Unreg line, A3A4F3, is for the −10V and −5.2V Regulators. Note that there is an additional fuse for the −5.2V Regulator.

−10V Regulator

When the Signal Generator is turned on, +20V is applied to A3A4U2. The −10V output goes more negative until the voltage at the non-inverting input of A3A4U2 is 0 Vdc. When current flow through A3Q1 exceeds normal operation, the voltage drop across A3A4R1 and A3A4R23 will equal that across A3A4R2 and A3A4CR1. Then A3A4Q1 will begin conducting. The output of A3A4U2 will go more positive. This turns A3A4Q1 on harder and reduces the bias on A3Q1 which limits the current available from the −10V supply.

+5.2V Regulator

The operation of this circuit is much like that of the −10V Regulator. The main difference is that the regulation is in the negative leg of the supply. Because it takes a feedback voltage of the opposite sense to control regulation, the +20V to −5.2V voltage divider is applied to the inverting input of U1.

+40V Regulator

The regulating action of this circuit is like that of the −10V Regulator. The differences in component values are due to the difference in voltage and current requirements.

−10V Switch

The RF OUTPUT switch (on the front panel of the Signal Generator) controls the −10V SWITCH. This voltage is the supply voltage for the A3A9A3 YIG Tuned Oscillator Assembly.

Troubleshooting

It is assumed that the troubleshooting information on service sheet BD10 and BD9 was used to isolate a malfunction to the A3A4 Negative Regulator Assembly. It is also assumed that an attempt was made to correct the malfunction by using the appropriate adjustment procedure in chapter 5. The following information will aid in isolating the defective component.

Equipment

Digital Voltmeter .... HP 3455A or HP 3456A

Procedure

Caution

DO NOT remove or install power supply boards with the power cable connected. Damage to the instrument's internal circuitry may occur.

To troubleshoot the Negative Regulator Assembly, proceed as follows:

1. Connect the line (Mains) power to the Signal Generator and set the LINE switch to ON.
2. Observe the three red indicators on the A3A4 Assembly. All should be on unless the instrument is in thermal shutdown.

Caution

To avoid damage to the power supply circuits, disconnect the power cable from the line voltage before removing or replacing any power supply circuit board.

3. Measure the following regulator output voltages. If any of the voltages are incorrect, go to step 4. If all the voltages are incorrect, place the A3A4 assembly on on extender board and measure the +20V input at pin 9 of the edge connector.

Regulator	Test Point	Output Voltage
−40V	A3A4TP1	−39.0 to −40.6 Vdc
−10V	A3A4TP4	−10.0 ±0.2 Vdc
−5.2V	A3A4TP5	−5.2 ±0.1 Vdc

Caution

To avoid damage to the power supply circuits, measure the voltages of step 4 with a voltmeter that has a floating common.

4. Check the fuses for the two supplies shown and measure the input voltages to the regulators. They should be as indicated in the table below.
5. Measure the output voltage at edge connector pin 14. With the front panel RF switch ON, the voltage should measure about −10 Vdc; with the front panel RF switch OFF, the voltage should be approximately +0.5 Vdc.
6. If the input voltages are correct but the output voltages are incorrect, use the voltages on the schematic to isolate the bad component.

Note

After the A3A4 assembly is repaired, perform the "Power Supply Adjustments" in chapter 5. Also, perform the performance tests (if any) that led to the power supply repair.

Input Voltage	Test Point (Positive)	Test Point (Negative)	Line Switch Position ON	Line Switch Position OFF
−10V UNREG	A3A4TP3	A3A4TP4	≈19 Vdc	≈22 Vdc
−40V UNREG	A3A4TP2	A3A4TP1	≈57 Vdc	≈63 Vdc

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Negative Regulator Assembly
A3A4 Schematic Diagram
SERVICE SHEET

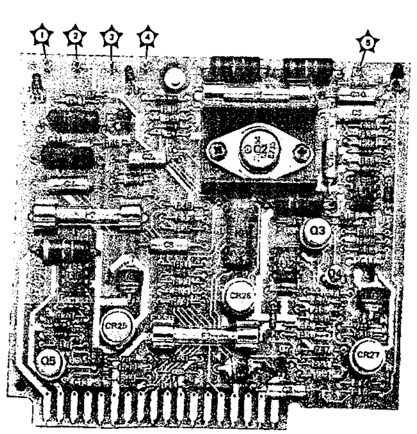
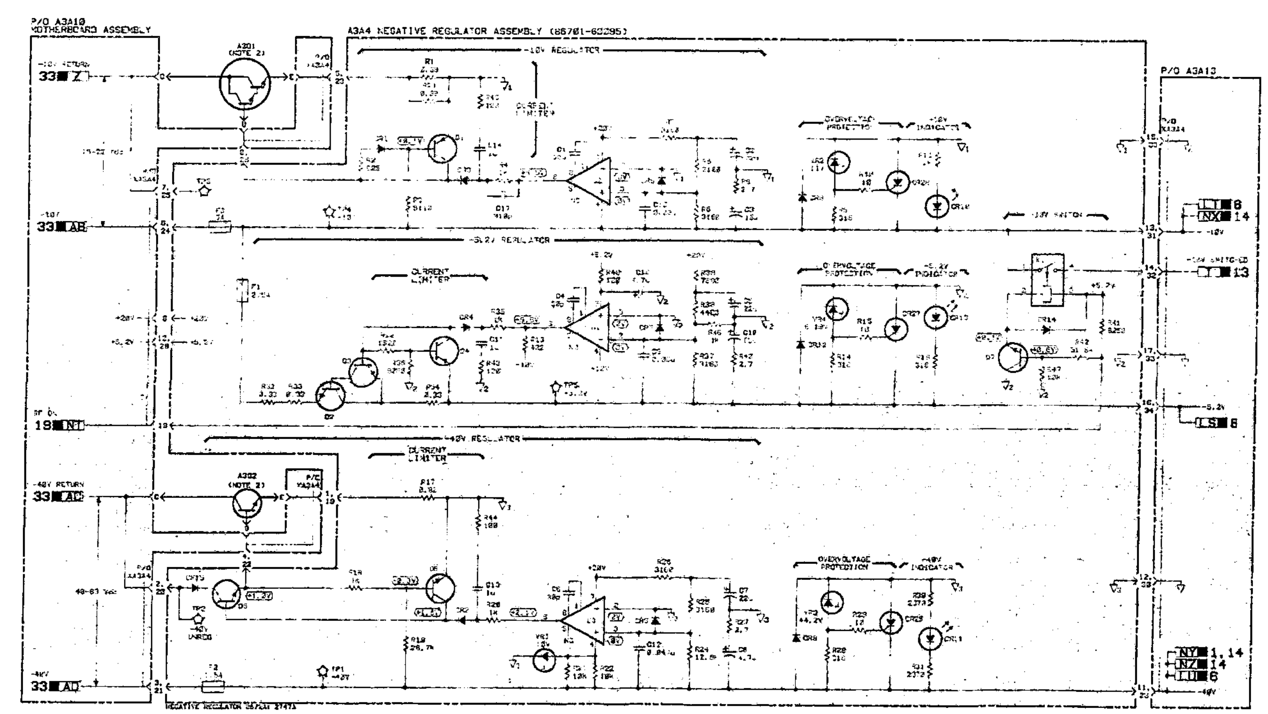


Figure 8-127. A3A4 Negative Regulator Assembly Component Locations



WARNING

DC VOLTAGES OF >60 Vdc DIFFERENTIAL ARE ALWAYS PRESENT ON THIS BOARD WHENEVER THE INSTRUMENT IS CONNECTED TO THE LINE VOLTAGE. THIS VOLTAGE COULD CAUSE PERSONAL INJURY IF CONTACTED. BE CAREFUL WHILE WORKING ON THIS CIRCUIT WITH THE LINE VOLTAGE CONNECTED. IF THIS CIRCUIT BOARD IS PLACED ON AN EXTENDER BOARD, THE POSSIBILITY OF COMING IN CONTACT WITH 60 Vdc DIFFERENTIAL IS GREATLY INCREASED. THIS COULD CAUSE PERSONAL INJURY IF CONTACTED. BE CAREFUL WHILE WORKING WITH THIS CIRCUIT BOARD WITH POWER SUPPLIED. WORK WITH ONE HAND. DO NOT TOUCH THE EXTENDER BOARD.

CAUTION

DO NOT REMOVE OR INSERT POWER SUPPLY BOARDS WITH THE POWER CABLE CONNECTED. DAMAGE TO THE INSTRUMENT MAY OCCUR.

NOTES

1. SEE TABLE 8-1 FOR SCHEMATIC DIAGRAM NOTES.
2. A3Q1 AND A3Q2 ARE MOUNTED ON THE REAR PANEL HEAT SINK AND A3A13 MOTHER BOARD ASSEMBLY.

REFERENCE DESIGNATIONS

A3	A3A4
Q1,2	C1-17 CR1-15, 25-27 F1-3 K1 Q1-7 R1-48 TP1-5 U1-3 VR1-4
A3A10	
XA3A4	

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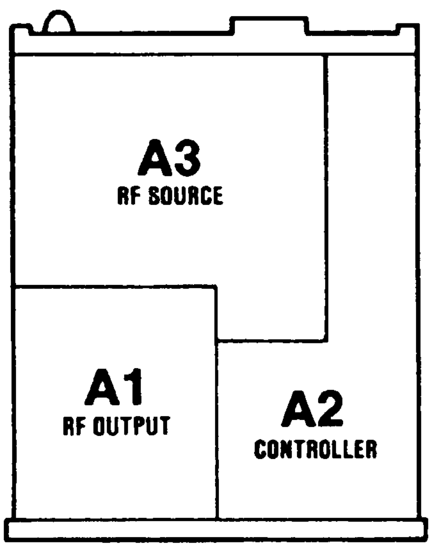
A3A4

Figure 8-128. Negative Regulator Assembly Schematic Diagram

Index To Service Sheets by Assembly



MAJOR ASSEMBLIES, TOP VIEW

Assembly	Description	Service Sheet
A1A1	RF Front Panel	20
A1A2	Not Assigned	
A1A3	YTM Control	15
A1A4	Not Assigned	
A1A5	RF Amplifier and ALC	14
A1A6	ALC Detector	17
A1A7	SRD Bias Board	16
A1A8	YTM Driver	15
A1A9	Metering Assembly	21
A1A10	RF Output Level Control	18
A1A11	Digital Processor	19
A1A12	Power Amplifier	14
A1A13	Interconnect Assembly	14,19
A1A14	A1 Motherboard	14–20
A2A1	DCU Front Panel	31,32
A2A2	Rotary Pulse Generator	20
A2A3	160–240 MHz VCO	8
A2A4	20/30 MHz Phase Detector	7

Assembly	Description	Service Sheet
A2A5	20/30 MHz Divider	6
A2A6	Not Assigned	
A2A7	HP-IB Interface	24,25
A2A8	Output Register	29,30
A2A9	HP-IB Address	22,23
A2A10	Register 1	26
A2A11	Timing and Control	27,28
A2A12	A2 Mothreboard	6–8, 22–32
A3A1	Reference and M/N	
A3A1A1	Reference Phase Detector	1
A3A1A2	100 MHz VCXO	2
A3A1A3	M/N Phase Detector	3
A3A1A4	M/N VCO	4
A3A1A4A1	VCO Resonator	4
A3A1A4A2	VCO Board	4
A3A1A5	M/N Output	5
A3A1A6	M/N Reference Motherboard	1–3,5
A3A1A7	Reference and M/N Housing	
A3A2	Not Assigned	
A3A3	Positive Regulator	34
A3A4	Negative Regulator	35
A3A5	DAC	9
A3A6	YTO Driver	10
A3A7	YTO/FM Coil Driver	13
A3A8	10 MHz Reference Oscillator	1
A3A9	YTO Loop	11,12
A3A9A1	Directional Coupler	13
A3A9A2	YTO Interconnect	11–13
A3A9A3	2.0-6.6 GHz YTO	13
A3A9A4	YTO Phase Detector	12
A3A9A5	Sampler	11
A3A9A6	18 dB Attenuator	13
A3A9A7	6.2 GHz Low Pass Filter	13
A3A9A8	Preamplifier	13
A3A10	RF Source Motherboard	1,3,4, 6,10,13, 25,30–35
A3A11	Line Module	33
A3A12	Rectifier Assembly	33

Service Sheet A Disassembly and Reassembly

Procedures

Warnings

Disassembly procedures should be performed only by service trained persons who are aware of the potential shock hazard of working on an instrument with protective covers removed.

A pin-to-pin voltage difference of 60 Vdc may be found on many of the Signal Generator's circuit board connectors.

If a circuit board is placed on an extender board, the possibility of coming in contact with 60 Vdc is greatly increased. This voltage could cause personal injury if contacted.

To avoid hazardous electrical shock, the line (mains) power cable should be disconnected before attempting to perform any disassembly procedures.

Battery Replacement

To replace the battery pack, follow the steps listed below:

1. Remove top cover.
2. Grasp the top of the battery holder's clip and pull forward until it slips off.
3. Grasp the battery pack on both sides with your fingers and pull straight out.
4. Position the new battery pack so the metal strips press against the flexible contacts of the battery holder.
5. Note that the bottom of the battery holder clip has a single bend; the top has a double bend. Hook the bottom end under the battery holder and snap the top end in place.

Top and Bottom Cover Removal and Replacement

To remove the covers proceed as follows:

1. Place the instrument with the appropriate cover up.
2. Remove the appropriate rear panel standoffs.
3. Unscrew the captive screw at the middle of the rear edge of the cover. This is a captive screw, and will cause the cover to pull away from the front frame.
4. Slide the cover to the rear and remove.
5. For replacement, follow the above steps in reverse order.

Power Transformer A3T1

To remove the power transformer, proceed as follows:

1. Place the instrument on its right side and remove covers, left handle and side cover.
2. Remove the bottom motherboard insulator by removing the five nylon screws, one near each corner and one near the center.
3. Free the Line Module A3A11 from the rear of the unit. Slide the line module out of the chassis sufficiently far to expose the solder terminals.
4. Unsolder the leads from the transformer to the line module.
5. Unsolder the transformer leads from the A3 motherboard terminals.
6. Refer to figure 8-129 for the following steps.
7. Remove the two screws securing the transformer to the A3 motherboard.
8. Remove the eight screws securing the transformer to the side rails.
9. Remove the transformer.
10. For replacement, follow the above steps in reverse order.

Filter Capacitors A3C1—4

To remove a capacitor, proceed as follows:

1. Remove the bottom cover.
2. Refer to Figure 8-129 for the following steps.
3. For removal of A3C1 only, remove the five nylon screws securing the bottom motherboard insulator to the A3 motherboard. One screw is near each corner, and one near the center.
4. Remove the two screws securing the capacitor to the A3 motherboard. Remove the top capacitor support (for A3C1—3 only) or loosen the capacitor clamp for A3C4.
5. Remove the capacitor.
6. For replacement, follow the above steps in reverse order.

RF and DCU Front Panels

To remove the RF and/or DCU front panels, proceed as follows:

1. Remove the top and bottom covers.
2. Turn the instrument upside down.
3. Remove the Pozidriv screws from the bottom edge of the front frame. On the DCU front panel there are two screws; on the RF

front panel there is only one, near the center of the instrument. Do not remove the center screws holding the center divider.

4. Turn the instrument right side up and remove the plastic trim strip from the top of the front frame.
5. Remove the two Pozidriv screws from the top edge of the front frame. There are two screws holding each panel.
6. Carefully pull the front panel outward to clear the frame.
7. If the front panel assembly is to be completely removed, disconnect cables an d wiring as necessary, then remove the two Pozidriv screws from the hinge and re move the panel.
8. To install a front panel assembly, reverse the procedure.

A1A12 RF Amplifier-Modulator

To remove the A1A12 RF Amplifier, proceed as follows:

1. Remove the top and bottom covers.
2. Refer to figure 8-130. Disconnect A1W1 semi-rigid cable from the input of the amplifier. Disconnect A1W9 modulator cable (blue) from the amplifier. Loosen A1W4 (SMA elbow) at the output of the amplifier.
3. Disconnect the ribbon cable from the amplifier assembly.
4. Turn the instrument on its side and, while holding the amplifier, remove the two screws from the amplifier bracket. Slide the assembly to the right to disconnect the SMA elbow and lift it out.
5. To install the A1A12 Amplifier assembly, reverse the above procedure.

A1A2 Isolator

To remove the A1AT2 Isolator, proceed as follows:

1. Remove the top and bottom covers.
2. Disconnect A1CR1 Crystal Detector from A1DC1 Directional Coupler. Remove the detector and lay it aside.
3. Disconnect Filter A1FL1 from YTM A1A3. Disconnect semi- rigid cable A1W5 from the isolator and remove filter and cable.
4. To remove the filter, simply remove the cable. To remove the isolator, continue.
5. Turn the instrument on its side and remove the four nuts holding the isolator bracket, while holding the isolator. Slide the assembly forward to disconnect the SMA elbow and lift it out.
6. To install the filter or isolator, reverse the above procedure.

A1A3 YTM and A1FL1 High Pass Filter Removal

The following procedure explains how the YTM (YIG-Tuned Multipler) and filter are removed.

1. Remove the top and bottom covers.
2. Remove the RF cover from the A1 Assembly.
3. Open the RF front panel.
4. Set the instrument on its right side.
5. Remove the two Pozidriv screws that secure the YTM.
6. Set the instrument with its top up.
7. Remove the semi-rigid coaxial cable connector at the A1AT2 Isolator output.
8. Disconnect semi-rigid cable A1W6 at the YTM output.
9. Loosen the connector of the same cable at the Directional Coupler input. Rotate the cable up and away from the YTM. Tighten the connector slightly to hold the cable in place.
10. Tip the front of the YTM up. Reach through the front panel opening and remov e the screw that holds the cable clamp.
11. To remove the flat ribbon cable connector, push the red tabs back and pull the connector straight up.
12. Pass the YTM and High Pass Filter out through the front panel opening.

A1AT1 Programmable Attenuator Removal

The following procedure explains how to remove the Attenuator.

1. Remove the instrument's top cover.
2. Remove the left side cover.
3. Disconnect the semi-rigid coaxial cable at the Attenuator's input and output.
4. Remove semi-rigid coaxial cable A1W7 that is connected to the A1DC1 Directional Coupler.
5. Remove the two panhead Pozidriv screws through the left side frame that secure the Attenuator.

Note While removing the Attenuator, avoid moving or wrinkling the surrounding rubberized RF shield.

6. Remove the large gray cable from its clamp. The clamp is located above the Attenuator at the rear of the A1 RF Output Assembly.
7. Slide the rear of the Attenuator up. Be careful not to put excessive pressure on the gray cable's connector.

8. Continue to slide the Attenuator up and out of the A1 Assembly.
9. To remove the gray cable's connector from the Attenuator, press on the top and bottom of the connector (close to Attenuator) and pull it away.
10. To replace the attenuator, make sure the conductive rubber shield is in place and smooth, and that the holes for mounting the Attenuator are aligned with the holes in the bracket. Then reverse the above procedure to complete the installation.

A1 Assembly Removal

To remove the A1 RF Output Assembly from the instrument, follow the steps listed below:

1. Remove the top cover.
2. Disconnect the A1W1 from A1A12J1; loosen the cable at A3A9A1J1. Rotate the cable up and away from the A1 Assembly.
3. Remove the RF cover from the A1 Assembly.
4. Remove the A1A7 and A1A8 boards.
5. Set the instrument on its right side with the A1 Assembly up.
6. Remove the front frame top trim strip.
7. Remove the two Pozidriv screws from the top of the front frame.
8. Remove the Pozidriv screw from the bottom of the front frame.
9. Remove the two Pozidriv screws from the left side handle. Lift the handle's end pieces from the side cover. Push the side cover toward the rear of the instrument and remove it.
10. Remove the six Pozidriv screws that secure the A1 Assembly to the siderail. Remove the two Pozidriv screws that secure the A1 and A2 Assemblies to the center rail.
11. Pull forward on the brace in the A1 Assembly and it should start to slide out of the instrument. Place the two coaxial cables so they clear the A1 Assembly.

YTO Assembly

To place the YTO Assembly in the service position, proceed as follows:

1. Remove the top and bottom covers.
2. Turn the instrument on its right side.
3. Remove the two screws securing the bottom of the assembly. These screws are accessible through the holes marked =A= in the A3 Motherboard.
4. Turn the instrument upright.

5. Refer to figure 8-131 for the following steps.
6. Remove the screw near directional coupler A3A9A1, which secures the YTO Assembly deck to the center divider.
7. Disconnect the semi-rigid cable A1W1 from A3A9A1J1. Loosen the cable at amplifier A1A12 and rotate it up and away from the YTO Assembly.
8. Lift the assembly out until it is clear. Rotate the back of the assembly up and forward, then hook it over the DCU divider as shown in the figure. Secure the assembly with the captive Service Support Screw as shown.

10 MHz Reference Oscillator

To remove the A3A8 10 MHz Reference Oscillator, proceed as follows:

1. Remove the top and bottom covers.
2. Place the YTO Assembly in the service position.
3. Refer to figures 8-132 through 8-134 for the following steps.
4. Remove the two screws which secure the Support Mount bracket to the center divider.
5. Remove the flexible cable A3W2 from the Reference Oscillator.
6. Remove cable A3A8W1 from A3A10J3.
7. Remove the Reference Oscillator.
8. For replacement, follow the above steps in reverse order.

Fan Removal and Replacement

To remove the fan from the Signal Generator, follow the steps listed:

Warning

The fan and fan relay always have 120 Vac across the terminals if the instrument is connected to the Mains (line) voltage. BE SURE the instrument is disconnected before removing the fan.

1. Remove the bottom cover.
2. Remove two Pozidriv screws from the fan cowl and remove the cowl.
3. Turn the instrument upside down. Remove the clear plastic protective cover from the bottom by removing the five white nylon screws.
4. Remove the plastic clamp holding the three wires going to the fan from the Motherboard.
5. Unsolder the two black wires from the Motherboard. Remove the screw from the ground wire.
6. Pull the three wires out of the rear frame going to the fan.

7. Remove the four nuts and lockwashers from the fan mounting bracket.
8. Carefully remove the fan from the mounting bracket.
9. Before replacing the fan, check to see that the magnetic shield is securely in place on the blade side of the fan motor.
10. Reassemble the fan in the reverse order. When tightening the four nuts and lockwashers, be careful that the four rubber shock mounts do not twist with the nuts as they are tightened. Be sure the wires go around the outside of the fan strut (away from the fan blade).

Warning

BE SURE to replace the A3 Assembly's bottom protective plastic cover before replacing the bottom cover. This cover is intended to provide protection from electrical shock when the bottom cover is removed.

11. Replace the cable clamp and MAKE SURE that the plastic protective cover is replaced before replacing the bottom cover.

Rear Panel Removal

To remove the rear panel for access to the Line Module (A3A11), fan relay (A3K1), transistor (A3Q1—A3Q4), and the rear panel coax connectors, follow the steps listed below:

1. Remove the top cover.
2. Remove the two Pozidriv screws from the top of the rear frame and the three screws from over the heat sink (see figures 6-12 and 8-132).
3. Push the top of the panel outward. The transistors (A3Q1—A3Q4) can be replaced by removing the two Pozidriv screws holding them in place.

A3A1 M/N Assembly Removal

To remove the A3A1 Assembly, follow the steps listed below:

1. Remove the top and bottom covers.
2. Set the instrument on its right side.
3. Remove the five coaxial cables from the A3A1 Assembly to free it from the other assemblies.
4. Remove the eight Pozidriv screws labeled B from the Motherboard, noting the sizes of each. These screws can be removed without removing the protective cover from the bottom of the instrument.
5. Hold the A3A1 Assembly while removing the last screw. Then lift the assembly away from the Motherboard.

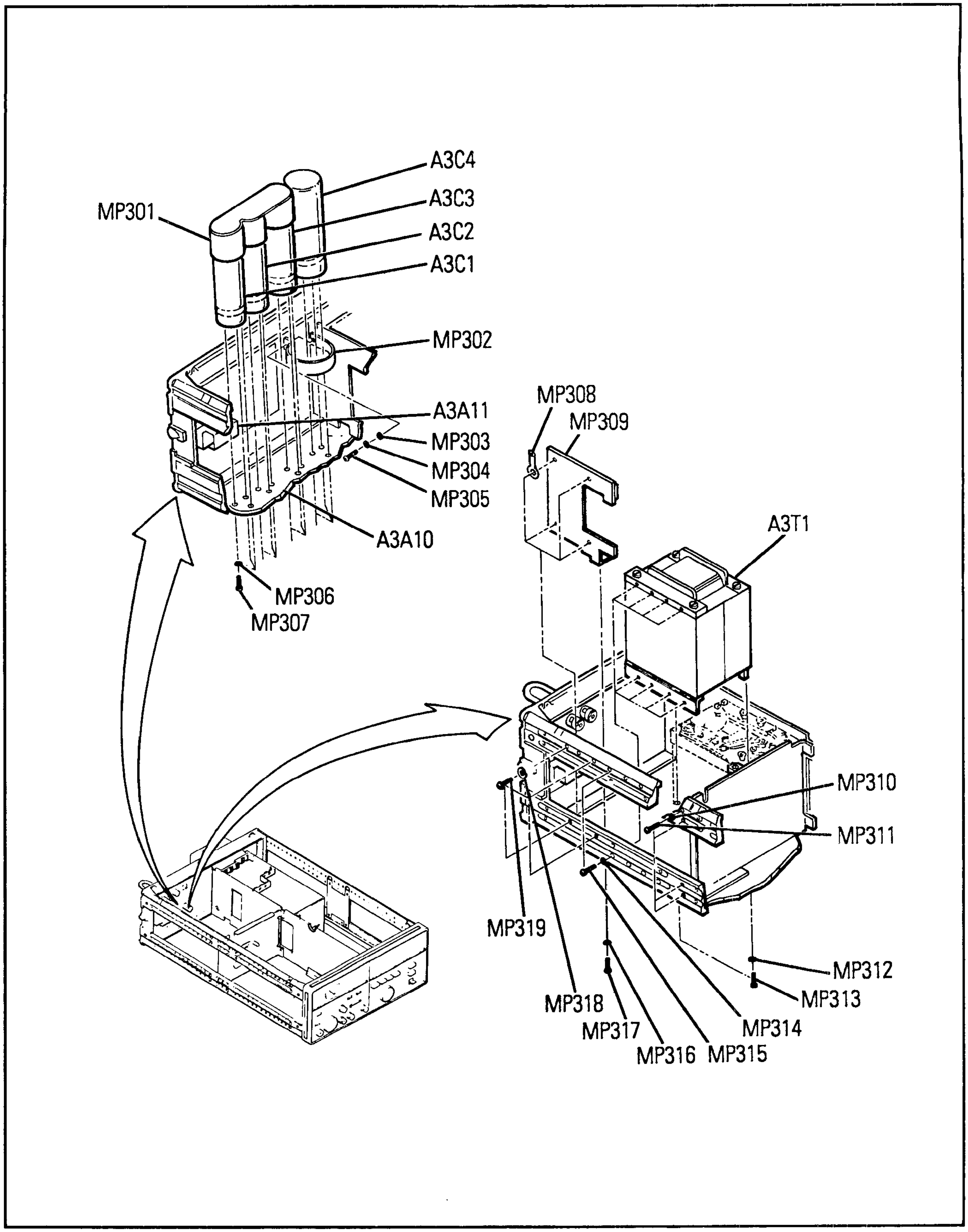


Figure 8-129. Transformer and Filter Capacitor Removal

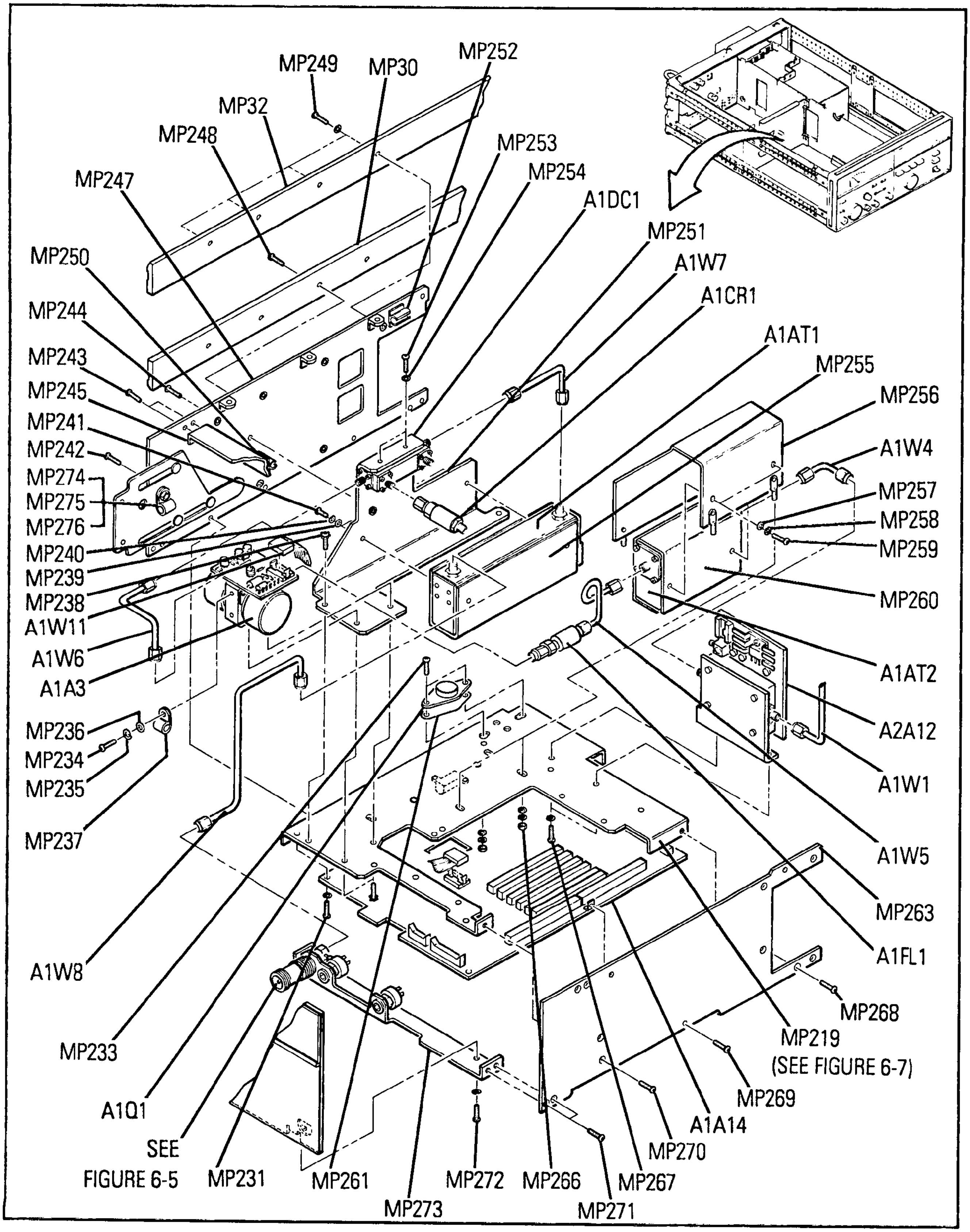


Figure 8-130. A1 RF Output Assembly, Amplifier, Attenuator and YTM

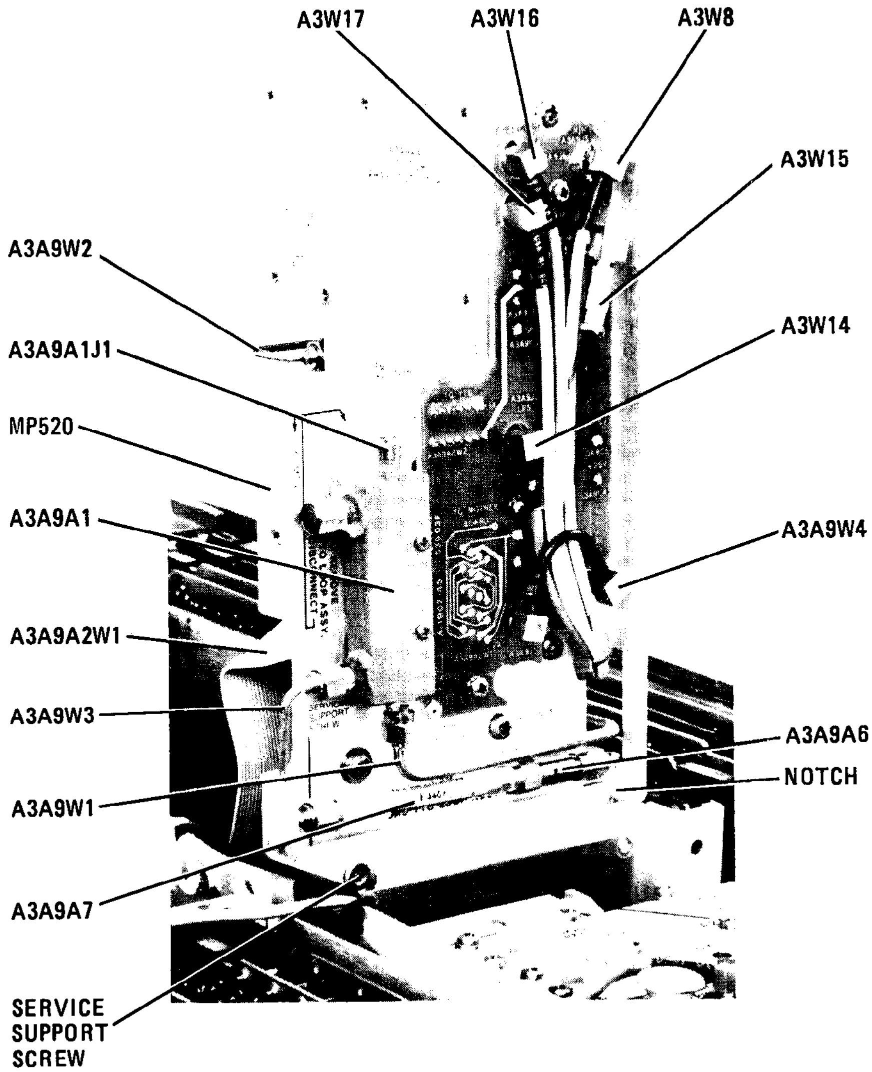


Figure 8-131. YTO Assembly In Service Position

Service Sheet B Internal Views

Introduction

Figures 8-132 through 8-134 provide internal views as an aid in servicing, disassembly and reassembly as well as assembly and component locations.

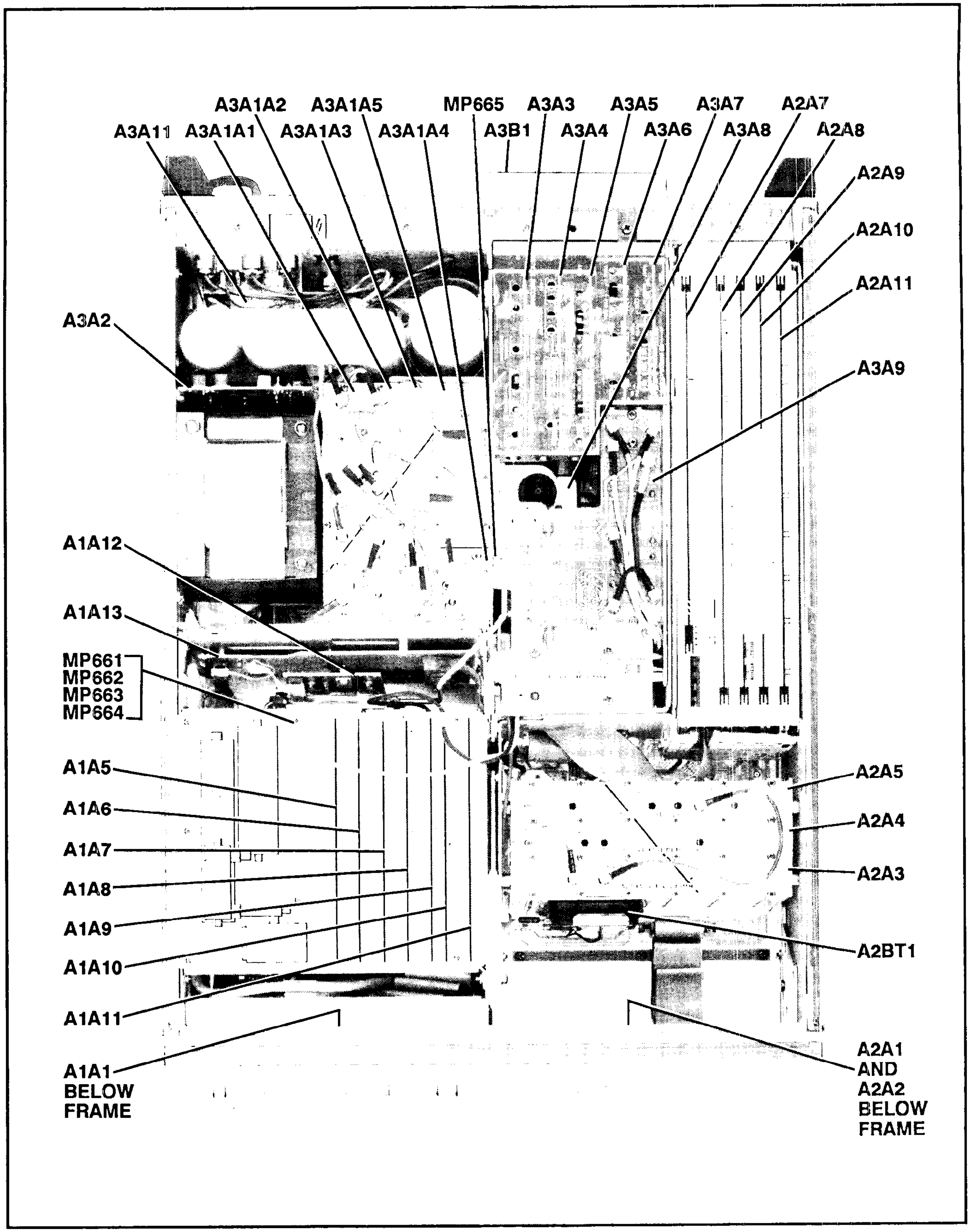


Figure 8-132. Top View, Assembly Location

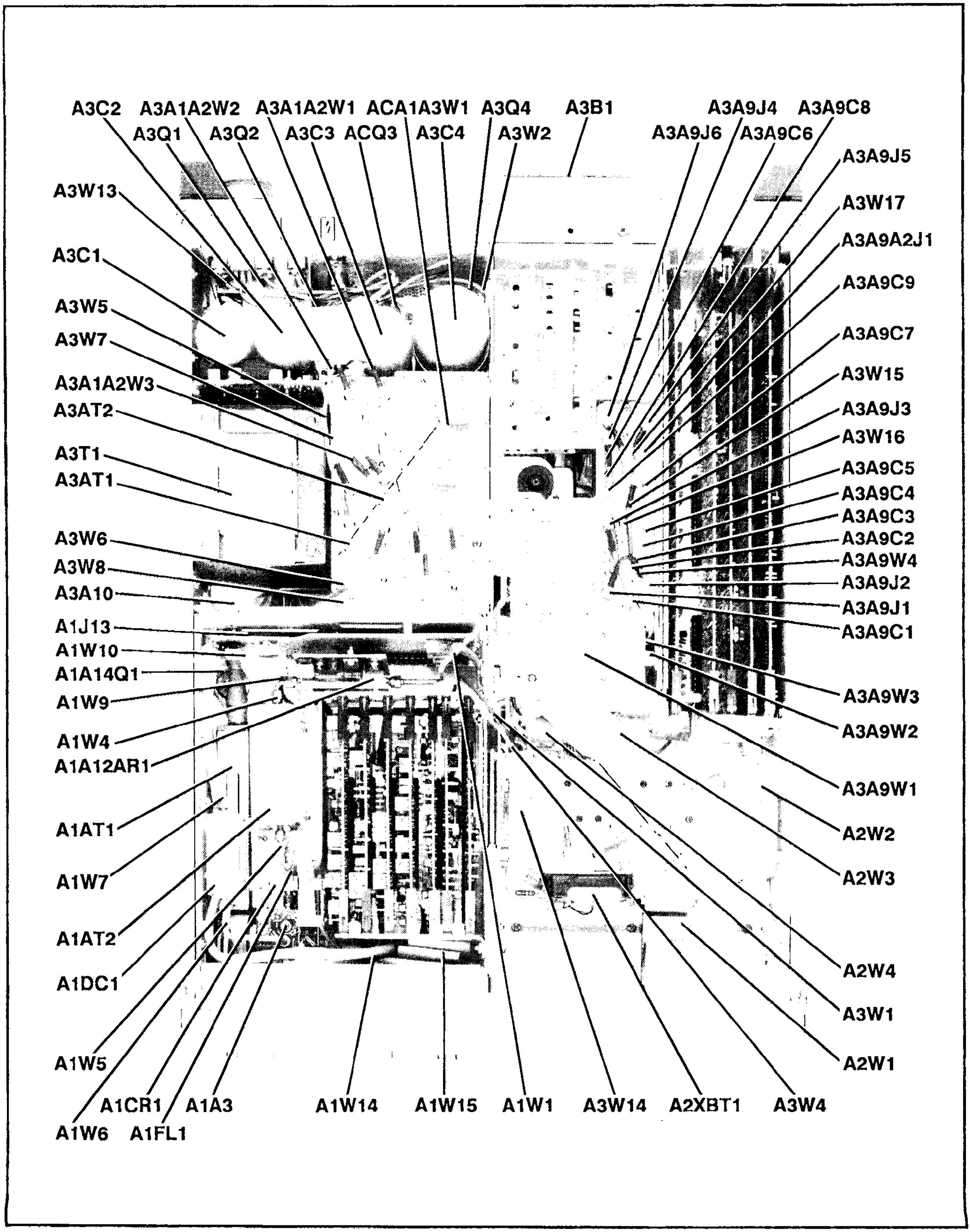
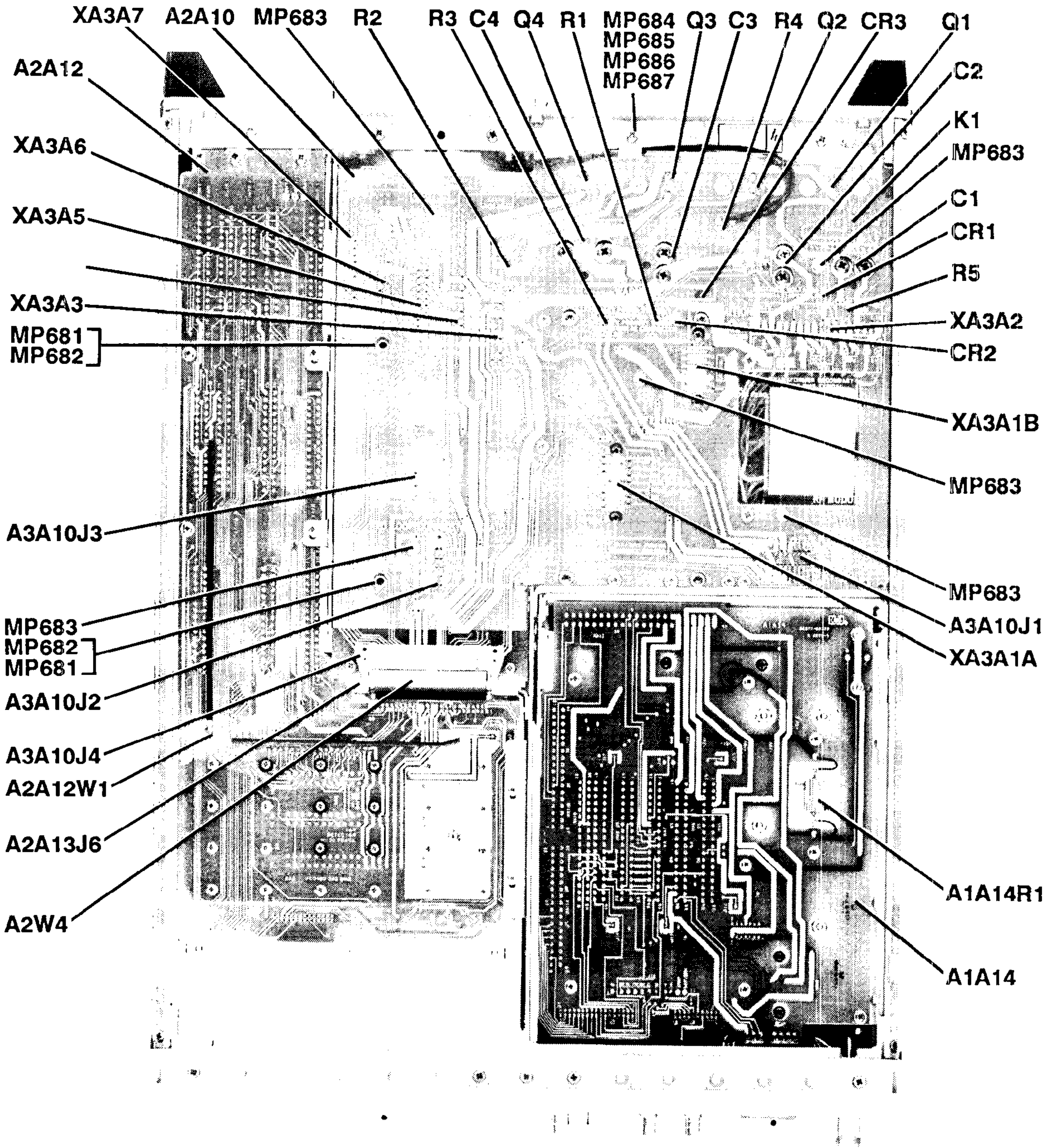


Figure 8-133. Top View, Component Location, Covers Removed



NOTE: SOME COMPONENTS ARE LOCATED ON OPPOSITE SIDE OF BOARD

Figure 8-134. Bottom View, Component Location