HP 3588A Service Manual

Serial Number 3005A00647 and greater.

Manual Backdating adapts this manual
to instruments with earlier serial numbers.

HEWLETT
PACKARD

HP Part Number: 03588-90017
Microfiche Part Number: 03588-90217
Printed in U.S.A.

Print Date: February 1995

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SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure the safety features are maintained.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

Warning

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

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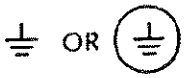
SAFETY SYMBOLS

General Definitions of Safety Symbols Used On Equipment or In Manuals.

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked.)



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.

Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.

Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.

Alternating current (power line.)

Direct current (power line.)

Alternating or direct current (power line.)

Warning

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which if not correctly performed or adhered to, could result in injury or death to personnel.

Caution

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, condition 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.

Note

The NOTE sign denotes important information. It calls attention to procedure, practice, condition or the like, which is essential to highlight.

Table of Contents

Section III Manual Backdating

Section IV Circuit Descriptions

Section I

Adjustments

Introduction

This section contains the adjustment procedures for the HP 3588A Spectrum Analyzer. Use these adjustments if the analyzer does not meet its specifications or if instructed in section V, "Service," to perform these adjustments. These adjustments are not required for routine maintenance. Table 1-1 lists all the adjustments.

The top cover must be removed to perform all adjustments except "1. Oven Shutdown" and "16. Oven Frequency." For information on top cover removal, see "Disassembly/Assembly" in section II, "Replaceable Parts."

Note

Allow the HP 3588A Spectrum Analyzer to warm up for at least an hour. This is critical for adjustment "2. 80 MHz Reference VCXO." Analyzers with the oven option (option 001) must cool off for at least 8 hours before doing adjustment "1. Oven Shutdown" and warm up for at least 48 hours before doing adjustment "16. Oven Frequency."

During many of these adjustment procedures, an adjustment message appears on the screen. The instructions on the screen are not as complete as the instructions in this manual. When an adjustment message appears on the screen, continue to follow the instructions in this manual. Failure to follow the instructions in this manual may result in an incorrect adjustment, which would appear as a hardware failure.

Table 1-1. Adjustments

Adjustment Procedure	Assembly	Component
1. Oven Shutdown	A91	R2
2. 80 MHz Reference VCXO	A31	C6, R13
3. 300 MHz Reference VCO	A32	L506, L508
4. Interpolation VCO	A51	L101
5. Single Loop Control Voltage Clamps	A52	R423, R422
6. 100 kHz and API Spurs	A52	R416, R518, R521, R533
7. Sum VCO Filter	A21	L106, L107
8. Multiple Loop Control Voltage Clamps	A23	R463, R461
9. Step VCO Filter	A24	L506, 507
10. Pretune Offset and Slope	A23	R452, R457
11. ADC Gain, Offset, and Reference	A62	R407, R405, R431
12. Second IF Bandpass Filter	A61	L3-L6, L8-L10, C30, R11
13. Source Bandpass Filter	A42	CAV ADJ 1-CAV ADJ4
14. First IF Bandpass Filter	A12	CAV ADJ 1-CAV ADJ4
15. Autorange Thresholds and 1 Meg Ohm Flatness	A11	C413, R624, R626
16. Oven Frequency	A91	U3, R12
17. Calibrator Flatness and Level	A31	R322, C330
18. Display	Display	VR31-VR34, VR41, VR42, VR64, VR67, L403

Note

If an assembly is replaced, see table 5-2 for required adjustments and performance tests.

Safety Considerations

Although the HP 3588A Spectrum Analyzer is designed in accordance with international safety standards, this manual contains information, cautions, and warnings that must be followed to ensure safe operation and to keep the unit in safe condition. Adjustments in this section are performed with power applied and protective covers removed. These adjustments must be performed by trained service personnel who are aware of the hazards involved (such as fire and electrical shock).

Warning

Any interruption of the protective (grounding) conductor inside or outside the unit, or disconnection of the protective earth terminal can expose operators to potentially dangerous voltages.
Under no circumstances should an operator remove any covers, screws, shields or in any other way access the interior of the HP 3588A Spectrum Analyzer. There are no operator controls inside the analyzer.

Equipment Required

See chapter 1, "General Information," in the *HP 3588A Performance Test Guide* for tables listing recommended test equipment. Any equipment which meets the critical specifications given in the tables may be substituted for the recommended model.

Remote Operation

Adjustments can be set up using the remote operation capability of the HP 3588A Spectrum Analyzer. See table 1-2 for a list of adjustments and corresponding HP-IB codes. See the *HP 3588A HP-IB Programming Reference* for general information on remote operation.

Table 1-2. HP-IB Codes to Set Up Adjustments

Adjustments	HP-IB Codes
4. Interpolation VCO	DIAG:FRAC:VCO:ADJ
5. Single Loop Control Voltage Clamps	DIAG:FRAC:SLO:CHIG DIAG:FRAC:SLO:CLOW
6. 100 kHz and API Spurs	DIAG:FRAC:SPUR:NULL DIAG:FRAC:SPUR:API:ONE DIAG:FRAC:SPUR:API:TWO DIAG:FRAC:SPUR:API:FOUR
7. Sum VCO Filter	DIAG:FRAC:SUMV:LPF
8. Multiple Loop Control Voltage Clamps	DIAG:FRAC:MLO:CHIG DIAG:FRAC:MLO:CLOW
9. Step VCO Filter	DIAG:FRAC:SVCO:LPF
10. Pretune Offset and Slope	DIAG:FRAC:PRET:OFFS DIAG:FRAC:PRET:SLOP
11. ADC Gain, Offset, and Reference	DIAG:ADJ:ADC:GAIN DIAG:ADJ:ADC:OFFS
12. Second IF Bandpass Filter	DIAG:REC:TWO:ONE DIAG:REC:TWO:TWO DIAG:REC:TWO:THR DIAG:REC:TWO:FOUR DIAG:REC:TWO:FIVE
13. Source Bandpass Filter	DIAG:ADJ:SOUR:RES
14. First IF Bandpass Filter	DIAG:REC:HRES
15. Autorange Thresholds and 1 Meg Ohm Flatness	DIAG:REC:MOHM:FLAT DIAG:REC:RANG:UP DIAG:REC:RANG:DOWN
17. Calibrator Flatness and Level	DIAG:CAL:EREF DIAG:CAL:FLAT DIAG:CAL:HFR DIAG:CAL:LEV
18. Display	TEST:DISP:PATT

1. Oven Shutdown

This procedure adjusts the heater shutdown trip point on the optional A91 Fan Power/Oven assembly. When the oven is cold, the heater shutdown circuit disconnects the oven output from the rear panel output connector. After the oven has been on long enough for the frequency to be stable, the heater shutdown circuit connects the oven output to the rear panel output connector.

Equipment Required: Spectrum Analyzer
BNC Cable

Note

The HP 3588A Spectrum Analyzer must be off for at least 8 hours before this adjustment is made. Once power is applied, the adjustment **MUST** be completed within **FIVE MINUTES.**

1. Remove the screw on the oven-adjustment cover. Lift the screw side of the oven-adjustment cover and tilt back to the open position.
2. Connect the spectrum analyzer to the OVEN REF OUT connector (located on rear panel) using a BNC cable.
3. Set the spectrum analyzer as follows:

Center Frequency	10 MHz
Frequency Span	1 MHz
Reference Level	– 60 dBm

4. Set the power switch to ON (I), then check that the amplitude of the 10 MHz signal is approximately – 70 dBm or lower (oven is cold).
5. Change the reference level on the spectrum analyzer to 10 dBm.
6. Turn OVEN SHUTDOWN (A91 R2) counterclockwise until the amplitude of the 10 MHz signal is > 0 dBm. Then turn OVEN SHUTDOWN clockwise until the amplitude of the signal just returns to approximately – 70 dBm and turn an additional 10 degrees clockwise.
7. Return the oven-adjustment cover and screw, and rear panel jumper (OVEN REF OUT to EXT REF IN) to their original positions.

2. 80 MHz Reference VCXO

This procedure adjusts the control voltage for the 80 MHz reference VCXO on the A31 Reference/Calibrator assembly. The 80 MHz reference is the primary frequency reference for the analyzer.

Equipment Required:
- Frequency Counter
- BNC(m)-to-SMB(f) Cable
- Flat-Edge Adjustment Tool

Note

Before doing this adjustment, make sure the HP 3588A Spectrum Analyzer has been ON (I) for approximately one hour to allow the 80 MHz reference VCXO to reach a stable operating temperature.

1. Disconnect the rear panel jumper (OVEN REF OUT to EXT REF IN) on analyzers with the optional oven.
2. Disconnect the cable from A31 J3, and connect the frequency counter to A31 J3 using a BNC-to-SMB cable.
3. Adjust FREQ ADJ FINE (A31 R13) to the center of its adjustment range.
4. Adjust FREQ ADJ CRS (A31 C6) for 10 MHz ± 10 Hz using the flat-edge adjustment tool in the service kit.
5. Adjust FREQ ADJ FINE for 10 MHz ± 1 Hz.
6. Disconnect the frequency counter from A31 J3, and reconnect the cable from A61 J2 to A31 J3.
7. Reconnect the rear panel jumper on analyzers with the optional oven.

3. 300 MHz Reference VCO

This procedure adjusts the control voltage for the 300 MHz reference VCO on the A32 300 MHz assembly. The 300 MHz reference is the high-frequency reference for the analyzer.

Equipment Required: Digital Multimeter
Extender Board
Extender Cable

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A32 300 MHz assembly, and place the assembly on an extender board.
2. Reconnect A32 J1 to A31 J9 using an extender cable.
3. Connect the multimeter's input terminal to A32 TP400 (see figure 1-1) and its ground terminal to chassis ground.

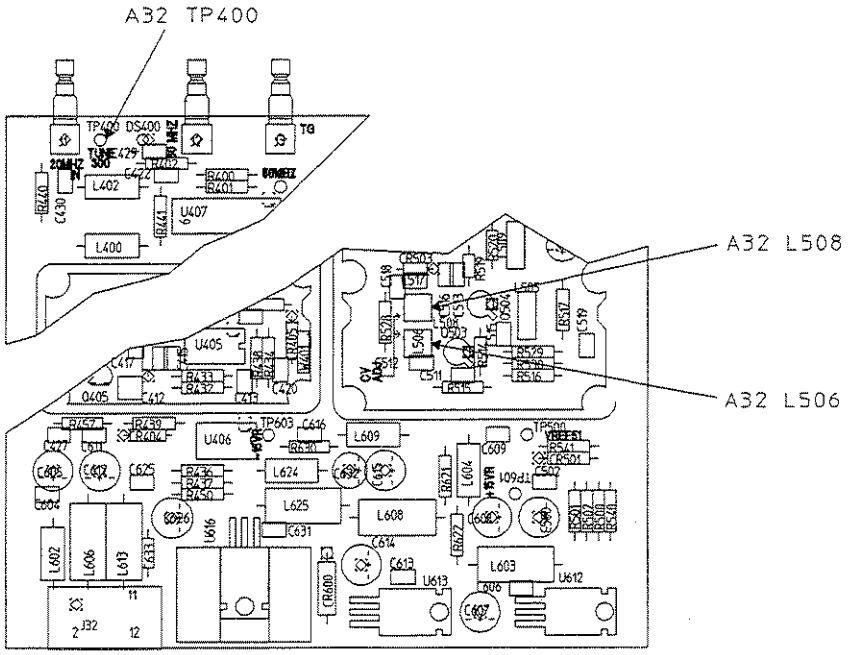


Figure 1-1. A32 300 MHz Component Locator

4. Set the power switch to ON (I). Through the holes in shield can, alternately adjust A32 L506 and L508 for -7.00 ± 0.25V.

5. Set the power switch to STANDBY (⏻). Place the 300 MHz assembly into the card nest and replace the screws.

6. Reconnect the following using original cables:

   A32 J1 to A31 J9
   A32 J2 to A33 J1
   A32 J3 to A42 J3
   A32 J4 to A23 J2
   A32 J5 to A13 J1

4. Interpolation VCO

This procedure adjusts the frequency range of the interpolation VCO on the A51 Interpolation VCO assembly.

Equipment Required: Frequency Counter
Extender Board
BNC(m)-to-SMB(f) Cable

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A51 Interpolation VCO assembly, and remove the assembly from the card nest.
2. Move the jumper on A51 J101 to its test position (see figure 1-2). Place the assembly on an extender board.

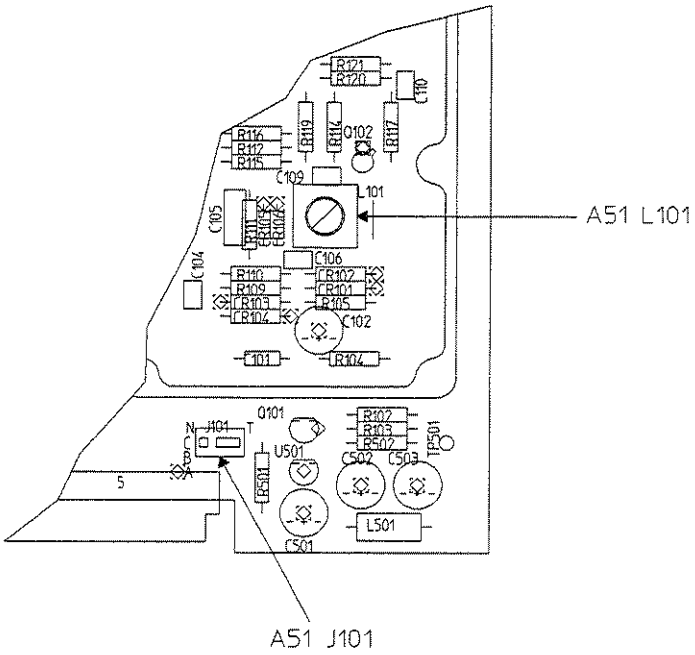


Figure 1-2. A51 Interpolation VCO Component Locator

3. Connect the frequency counter to A51 J4 using a BNC-to-SMB cable.

4. Set the power switch to ON (|), then press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [LOCAL OSC]
   [INTRPL VCO]

5. Through the hole in the shield can, adjust A51 L101 for 55 ± 0.5 MHz using a plastic tuning tool.

6. Set the power switch to STANDBY (⏻). Move the jumper back to its normal position, and place the Interpolation VCO assembly into the card nest. Replace the screws.

7. Reconnect the following using original cables:

   A51 J1 to A22 J3
   A51 J2 to A21 J1
   A51 J3 to A52 J1
   A51 J4 (no connection)

5. Single Loop Control Voltage Clamps

This procedure adjusts the upper and lower out-of-limit voltages on the A52 Fractional-N assembly. The single loop control voltage is compared to the out-of-limit voltages. If the control voltage exceeds either the upper or lower out-of-limit voltage, the control voltage is clamped to the out-of-limit voltage.

Equipment Required: Frequency Counter
BNC(m)-to-SMB(f) Cable

1. Set the power switch to ON (|).
2. Disconnect the cable from A21 J3, and connect the frequency counter to A21 J3 using a BNC-to-SMB cable.
3. Press the following keys:
   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [LOCAL OSC]
   [SNGL LOOP CLAMPS
   [SNGL LOOP CLAMP-HI]
4. Disconnect the cable from A51 J3.
5. Adjust H.F.LIMIT (A52 R423) for 470 ± 2 MHz. If H.F.LIMIT cannot be adjusted to 470 ± 2 MHz, disconnect and reconnect A51 J3 until the loop unlocks and H.F.LIMIT can be adjusted.
6. Reconnect the cable from A51 J3 to A52 J1.
7. Press the [SNGL LOOP CLAMP-LOW] softkey.
8. Disconnect the cable from A52 J2.
9. Adjust L.F.LIMIT (A52 R422) for 290 ± 2 MHz.
10. Disconnect the frequency counter from A21 J3.
11. Reconnect A21 J3 to A12 J1 and A52 J2 to A33 J4.

6. 100 kHz and API Spurs

This procedure attenuates the 100 kHz sample and hold spur, and the API spurs on the A52 Fractional-N assembly.

Equipment Required:

Spectrum Analyzer
Extender Board
Extender Cables
BNC(m)-to-SMB(f) Cable
BNC Cable

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A52 Fractional-N assembly, and place the assembly on an extender board.

Caution

To avoid damaging the cables connected to A33 J5 and J6, disconnect and position the cables away from the A52 Fractional-N assembly before removing or inserting the A52 Fractional-N assembly.

2. Reconnect the following using extender cables:

   A52 J1 to A51 J3
   A52 J2 to A33 J4
   A62 J1 to A33 J3
   A62 J2 to A31 J8

3. Disconnect the cable from A21 J2, and connect the spectrum analyzer to A21 J2 using a BNC-to-SMB cable. Connect the spectrum analyzer's 10 MHz reference output to EXT REF IN (on rear panel) using a BNC cable.

4. Press the [**Preset**] hardkey, then set the spectrum analyzer as follows:

Center Frequency	400 MHz
Frequency Span	500 kHz
Reference Level	10 dBm
Res BW	10 kHz
Video BW	1 kHz

5. Set the power switch to ON (I), then press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [LOCAL OSC]
   [SPURS]

[100 kHz]

6. Adjust A52 R416 (see figure 1- 3) for a minimum spur level at approximately 400.2 MHz (figure 1-4 shows the spurs out of adjustment).

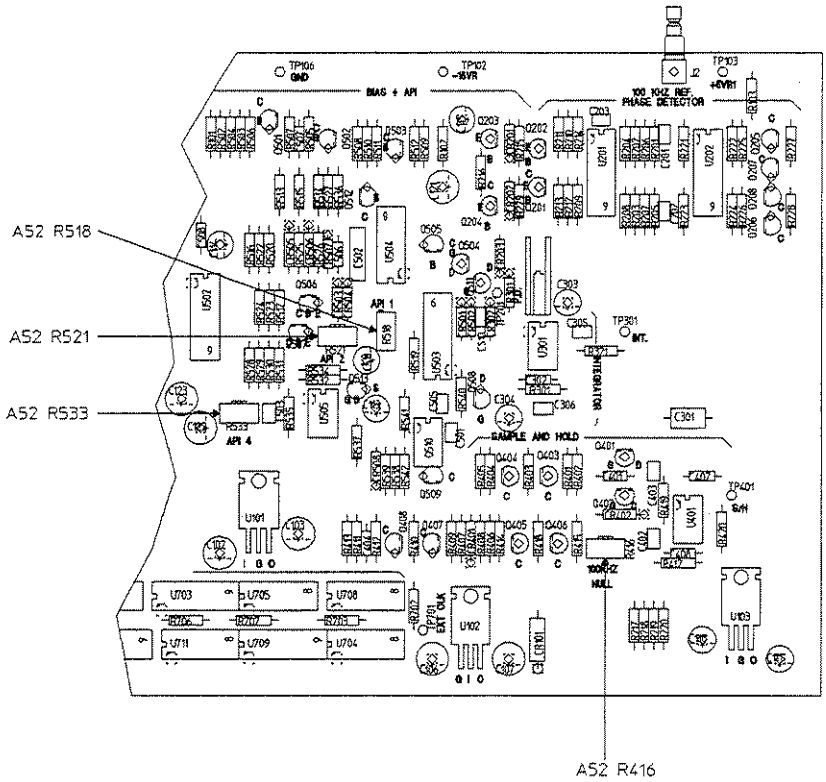


Figure 1-3. A52 Fractional-N Component Locator

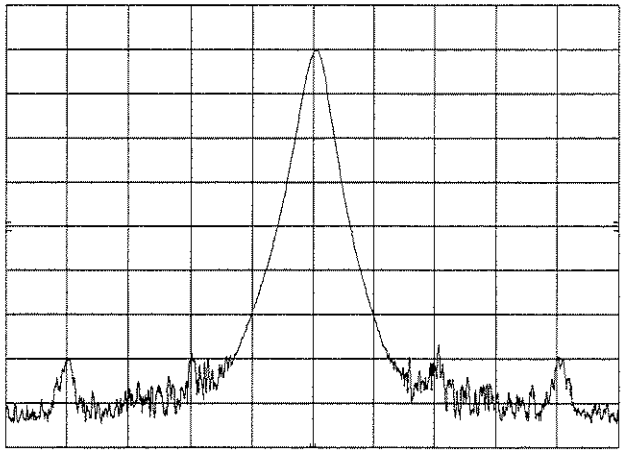


Figure 1-4. Spurs Out of Adjustment

7. Set the spectrum analyzer as follows:

Center Frequency	400.03 MHz
Frequency Span	25 kHz
Res BW	300 Hz
Video BW	300 Hz
Sweeptime	1 sec

8. Press the [API 1] softkey.
9. Adjust API 1 (A52 R518) for a minimum spur level at 400.033 MHz.
10. Change the spectrum analyzer's center frequency to 400.003 MHz.
11. Press the [API 2] softkey.
12. Adjust API 2 (A52 R521) for a minimum spur level at 400.006 MHz.
13. Change the spectrum analyzer's center frequency to 400.0001 MHz.
14. Press the [API 4] softkey.
15. Adjust API 4 (A52 R533) for a minimum spur level at 400.00303 MHz.
16. Set the power switch to STANDBY (⏻). Place the Fractional-N assembly into the card nest, and replace the screws.
17. Reconnect the following using original cables:

    A52 J1 to A51 J3
    A52 J2 to A33 J4
    A62 J1 to A33 J3
    A62 J2 to A31 J8
    A21 J2 to A42 J2
    A33 J5 to TRIG OUT (white cable)
    A33 J6 to EXT TRIG (black cable)

7. Sum VCO Filter

This procedure adjusts the low pass filter on the A21 Sum VCO assembly. This filter improves spectral purity of the VCO.

Equipment Required:

- Spectrum Analyzer
- Extender Board
- Extender Cable
- BNC(m)-to-SMB(f) Cable

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A21 Sum VCO assembly, and place the assembly on an extender board.
2. Reconnect A21 J1 to A51 J2 using an extender cable. (A11 J2 to A31 J1 may be left unconnected.)
3. Connect the spectrum analyzer to A21 J2 using a BNC-to-SMB cable.
4. Set the power switch to ON (I), then press the following keys:
   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [LOCAL OSC]
   [SUM VCO LOW PASS]
5. Press the [**Preset**] hardkey, then set the spectrum analyzer as follows:

Center Frequency	380 MHz
Frequency Span	200 MHz
Reference Level	– 5 dBm
dB per Division	1 dB
Maximum Hold	On

6. Through the holes in the shield can, alternately adjust A21 L106 and L107 (see figure 1-5) for a flatness (maximum amplitude minus minimum amplitude) of less than 3 dB(p-p). During this adjustment, periodically clear the spectrum analyzer's maximum hold function.

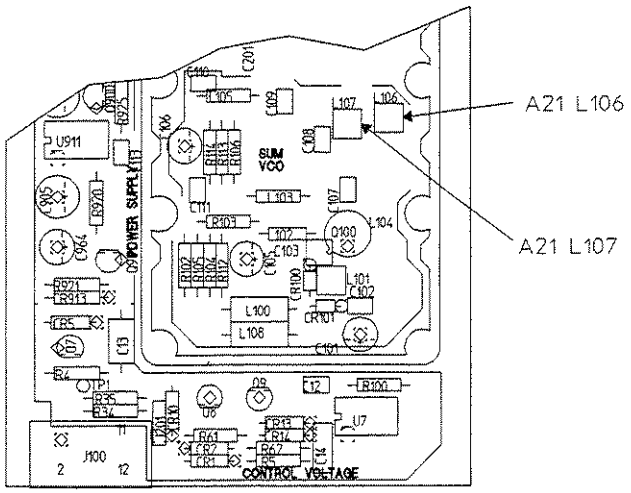


Figure 1-5. A21 Sum VCO Component Locator

7. Set the power switch to STANDBY (⏻). Place the Sum VCO assembly into the card nest, and replace the screws.

8. Reconnect the following using original cables:

   A21 J1 to A51 J2
   A21 J2 to A42 J2
   A21 J3 to A12 J1
   A21 J4 to A22 J1
   A11 J2 to A31 J1

8. Multiple Loop Control Voltage Clamps

This procedure adjusts the upper and lower out-of-limit voltages on the A23 Step Phase Detector assembly. The multiple loop control voltage is compared to the out-of-limit voltages. If the control voltage exceeds either the upper or lower out-of-limit voltage, the control voltage is clamped to the out-of-limit voltage.

Equipment Required: Frequency Counter
BNC(m)-to-SMB(f) Cable

1. Set the power switch to ON (|).
2. Disconnect the cables from A23 J3 and from A24 J1.
3. Connect the frequency counter to A24 J1 using a BNC-to-SMB cable.
4. Press the following keys:
   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [LOCAL OSC]
   [MULT LOOP CLAMPS]
   [MULT LOOP CLAMP-LOW]
5. Adjust STEP OOL_L (A23 R461) for 297 ± 0.5 MHz.
6. Reconnect the cable from A23 J3 to A31 J4.
7. Disconnect the cable from A23 J1.
8. Press the [MULT LOOP CLAMP-HI] softkey.
9. Adjust STEP OOL_H (A23 R463) for 470 ± 0.5 MHz.
10. Disconnect the frequency counter from A24 J1.
11. Reconnect A23 J1 to A24 J3 and A24 J1 to A22 J2.
12. Press the [**Preset**] hardkey to exit the adjustment mode.

9. Step VCO Filter

This procedure adjusts the low pass filter on the A24 Step VCO assembly. This filter improves the spectral purity of the VCO.

Equipment Required:

- Spectrum Analyzer
- Extender Board
- Extender Cable
- BNC(m)-to-SMB(f) Cable

1. Connect the spectrum analyzer to A24 J2 using a BNC-to-SMB cable.

2. Set the power switch to ON (|), then press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [LOCAL OSC]
   [STEP VCO LOW PASS]

3. Press the [**Preset**] hardkey, then set the spectrum analyzer as follows:

Center Frequency	380 MHz
Frequency Span	200 MHz
Reference Level	– 20 dBm
dB per Division	1 dB
Maximum Hold	On

4. If the flatness (maximum amplitude minus minimum amplitude) of the displayed signal is less than 3 dB(p-p), the step VCO filter is within tolerance and should not be adjusted. Disconnect the spectrum analyzer from A24 J2.

5. If the flatness (maximum amplitude minus minimum amplitude) of the displayed signal is larger than 3 dB(p-p), do the following:

   a. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A24 Step VCO assembly, and place the assembly on an extender board.

   b. Reconnect A24 J3 to A23 J1 using an extender cable.

   c. Reconnect the spectrum analyzer to A24 J2 using a BNC-to-SMB cable.

d. Set the power switch to ON (I), then press the following keys:

[**Spcl Fctn**]
[ ] (second softkey from bottom)
– 99
[ ] (second softkey from bottom)
[SERVICE FUNCTIONS]
[ADJUSTMTS]
[LOCAL OSC]
[STEP VCO LOW PASS]

e. Through the holes in the shield can, alternately adjust A24 L506 and L507 (see figure 1-6) for a flatness (maximum amplitude minus minimum amplitude) of less than 3 dB(p-p). During this adjustment, periodically clear the spectrum analyzer's maximum hold function.

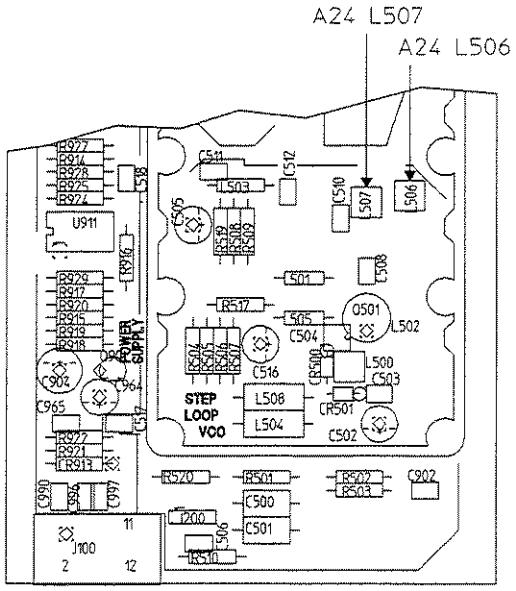


Figure 1-6. A24 Step VCO Component Locator

f. Set the power switch to STANDBY (⏻). Place the Step VCO assembly into the card nest, and replace the screws.

g. Reconnect the following using original cables:

A24 J1 to A22 J2
A24 J2 (no connection)
A24 J3 to A23 J1

10. Pretune Offset and Slope

This procedure adjusts the pretune offset and slope on the A23 Step Phase Detector assembly. Pretune offset is added to the control voltage, then amplified by pretune slope. The resulting voltage coarsely adjusts the sum VCO's frequency to ensure that the sum loop can phase lock.

Equipment Required: Frequency Counter
BNC(m)-to-SMB(f) Cable

1. Set the power switch to ON (|).
2. Disconnect the cables from A22 J3 and from A21 J3.
3. Connect the frequency counter to A21 J3 using a BNC-to-SMB cable.
4. Press the following keys:
   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [LOCAL OSC]
5. Press the [PRETUNE OFFSET] softkey.
6. Adjust PRETUNE OFFSET (A23 R452) for 450 ± 0.5 MHz.
7. Press the [PRETUNE SLOPE] softkey.
8. Adjust PRETUNE SLOPE (A23 R457) for 306 ± 0.5 MHz.

Note

If PRETUNE SLOPE cannot be adjusted for 306 ± 0.5 MHz, adjust either A21 L101 (see figure 1-5) or A24 L500 (see figure 1-6). Adjusting A21 L101 clockwise or A24 L500 counterclockwise reduces the frequency.

9. Repeat steps 5 through 8 until both PRETUNE OFFSET and PRETUNE SLOPE are within tolerance without adjustment.

10. Press the following keys:

    [**Preset**]
    [**Sweep**]
        [SWEEP AUTO **MAN**]
        [MANUAL FREQ]
        30
        [MHz]

11. The counter readout should be 336 ± 1 MHz. If the counter readout is not within tolerance, do the following:

    a. Press the following keys:

    [**Spcl Fctn**]
        [SERVICE FUNCTIONS]
        [ADJUSTMTS]
        [LOCAL OSC]
        [PRETUNE SLOPE]

    b. Adjust PRETUNE SLOPE (A23 R457) for 305.6 ± 0.1 MHz.

    c. Repeat steps 5 through 11 until all are within tolerance without adjustment.

    d. Press the [**Preset**] hardkey to exit the adjustment mode.

12. Disconnect the frequency counter from A21 J3.

13. Reconnect A21 J3 to A12 J1 and A22 J3 to A51 J1.

11. ADC Gain, Offset, and Reference

This procedure adjusts the second-pass gain, the first-pass offset, and the reference voltage for the ADC on the A62 ADC/Digital Filter assembly.

Equipment Required:

- Oscilloscope
- 1:1 Oscilloscope Probe
- Synthesizer
- Extender Board
- Extender Cables
- BNC(m)-to-SMB(f) Cable
- Capacitive Load
- BNC Cable

Note

Although a digital oscilloscope is listed in the recommended equipment list, this adjustment may be easier using an analog oscilloscope.

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A62 ADC/Digital Filter assembly, and place the assembly on an extender board.
2. Reconnect A62 J1 to A33 J3 and A62 J2 to A31 J8 using extender cables. Reconnect the fast bus cable to A62 J5 using the fast bus extender cable.
3. Connect the oscilloscope to A62 TP400 (see figure 1-7) using a capacitive load and a 1:1 oscilloscope probe. Connect the probe ground clip to TP 505 (AGND).

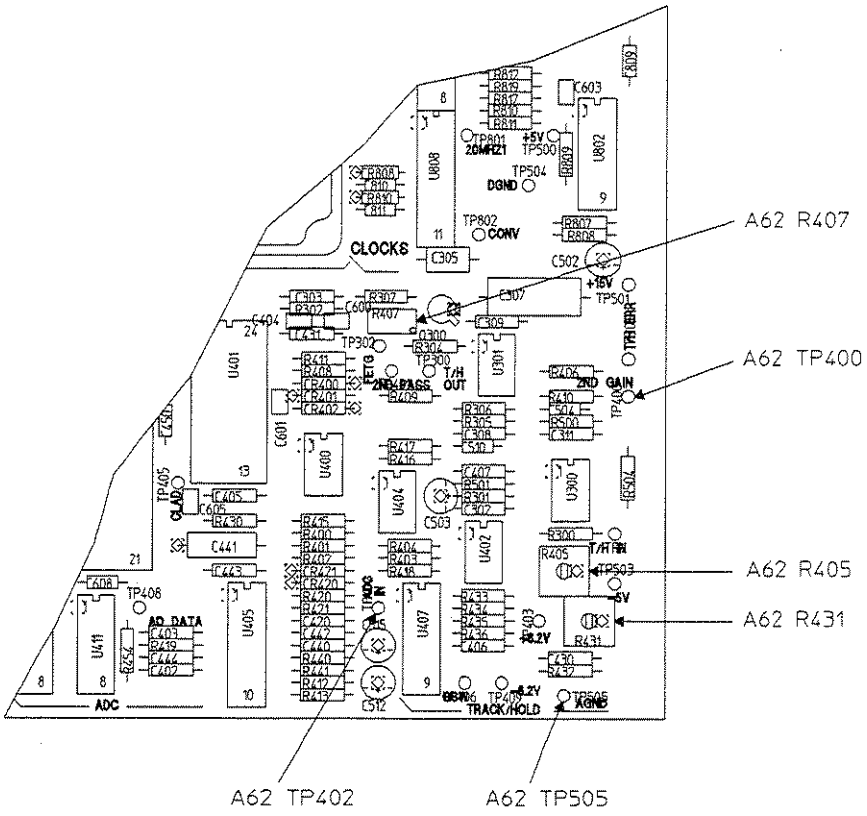


Figure 1-7. A 62 ADC/Digital Filter Component Locator

4. Connect the synthesizer to A62 J3 using a BNC-to-SMB cable.

Note A 50Ω termination is required for synthesizers with 50Ω output impedance.

---

5. Connect the synthesizer's synchronous output to either the oscilloscope's channel 2 input or external trigger input using a BNC cable.

6. Set the synthesizer as follows:

Function	Sine Wave
Frequency	1 kHz
Amplitude	10 mVrms

7. Set the oscilloscope as follows:

Channel 1	Volts/Div	20 mV/div
	Offset	0V
	Coupling	1 MΩ ac
Channel 2	Volts/Div	500 mV/div
	Offset	0V
	Coupling	1 MΩ ac
Time Base	Time/Div	1.0 ms/div
	Sweep	Triggered
Trigger	Level	500 mV
	Slope	Positive
	Mode	Edge
	Source	Channel 2 or Ext Trigger
Display	Mode	Repetitive
	Averaging	On
	No. of Avg	8
	Screen	Single

8. Set the power switch to ON (I), then press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [ADC]
   [ADC 2ND PASS GAIN]

9. Adjust A62 R407 for a flat trace on the oscilloscope display.

10. Remove the capacitive load from the oscilloscope, and connect the oscilloscope probe to A62 TP402.

11. Change the set up for the oscilloscope as follows:

Channel 1	Volts/Div	100 mV/div
	Coupling	1 MΩ dc
Channel 2	Coupling	1 MΩ dc
Time Base	Time/Div	500 μs/div
Display	Averaging	Off
	Persistence	2.00s

12. Increase the synthesizer's amplitude to 400 mVrms.

13. Press the [ADC OFFSET & REFERNC] softkey.

14. The oscilloscope display should look like figure 1-8. The following describes the signals shown on the oscilloscope display:
    - A straight, horizontal line in the upper half of the display.
    - A sine wave in the lower half of the display.
    - A "noisy" flat trace at the center of the sine wave.

    If the oscilloscope display does not look like figure 1-8, do the following:

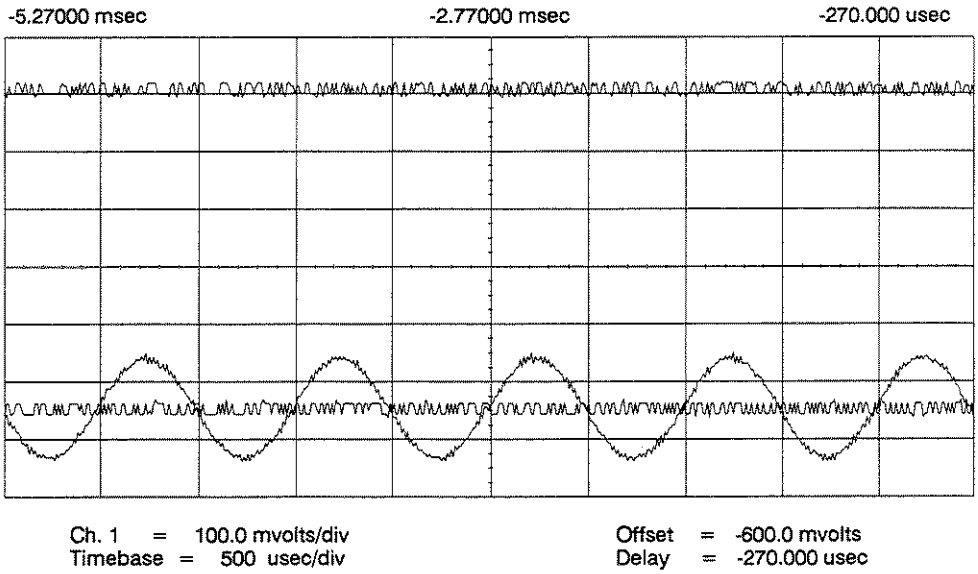


Figure 1-8. R431 and R405 Correctly Adjusted

a. If the oscilloscope display looks like figure 1-9, adjust A62 R431 for a flat "noisy" trace as shown in figure 1-10.

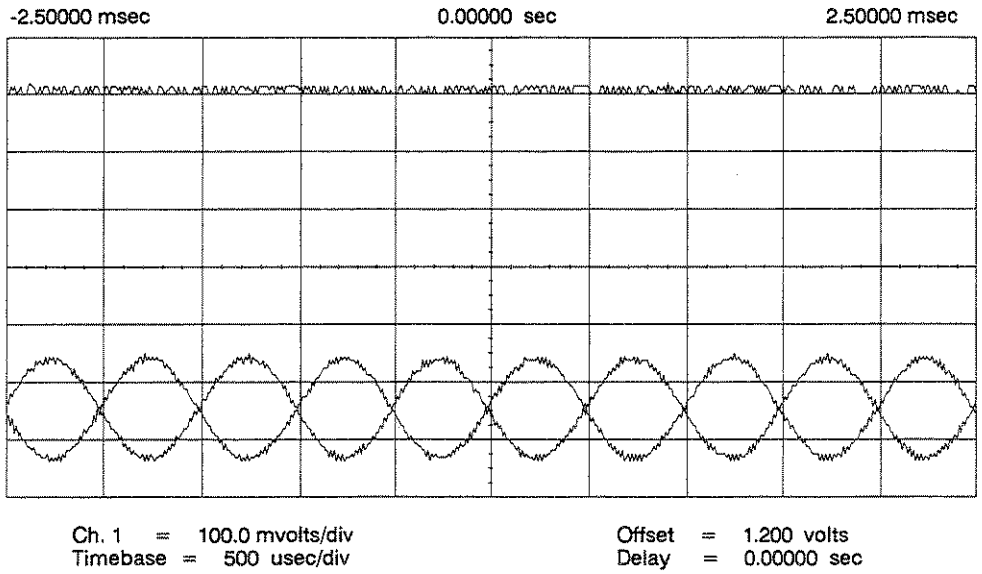


Figure 1-9. R431 and R405 Incorrectly Adjusted

b. If the oscilloscope display looks like figure 1-10, adjust A62 R405 to position the flat trace at the center of the sine wave trace as shown in figure 1-8.

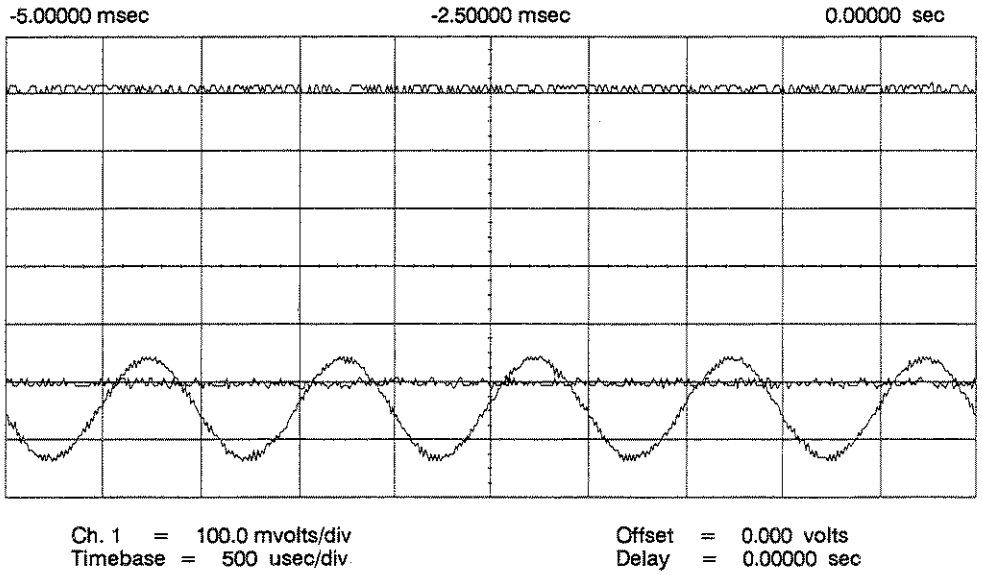


Figure 1-10. R405 Incorrectly Adjusted

15. Set the power switch to STANDBY (⏻). Place the ADC/Digital Filter assembly into the card nest, and replace the screws.

16. Reconnect the following using original cables:

    A62 J1 to A33 J3
    A62 J2 to A31 J8
    A62 J3 to A61 J3

12. Second IF Bandpass Filter

This procedure adjusts the second IF bandpass filter on the A61 IF assembly. This 10.1875 MHz bandpass filter attenuates signals outside the passband.

Equipment Required:

- Spectrum Analyzer
- Extender Board
- Extender Cables
- BNC Cable
- SMB(m)-to-SMB(m) Adapter

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A61 IF assembly, and place the assembly on an extender board.
2. Reconnect the following using extender cables (connecting A61 J1 to A13 J3 requires using two extender cables and an adapter):
   - A61 J1 to A13 J3
   - A61 J2 to A31 J3
   - A61 J3 to A62 J3
3. Set the power switch to ON (I), then press the following keys:
   - [**Spcl Fctn**]
   - [ ] (second softkey from bottom)
   - **– 99**
   - [ ] (second softkey from bottom)
   - [SERVICE FUNCTIONS]
   - [ADJUSTMTS]
   - [RECEIVER IF]
   - [2nd IF1]

Note

During this adjustment, the reference level automatically changes when the signal reaches the top or bottom of the displayed range. The analyzer beeps to indicate that the reference level changed.

4. Adjust A61 L3, L4, L5, L6, L8, L9, and L10 from the circuit side of the board (see figure 1-11 for component location) for a maximum **Man** readout (approximately – 20 dBm). Continue adjusting until no further improvement can be made.

Note

If the signal is below the displayed range, continue to adjust. The signal is not seen when the filter is too far out of adjustment.

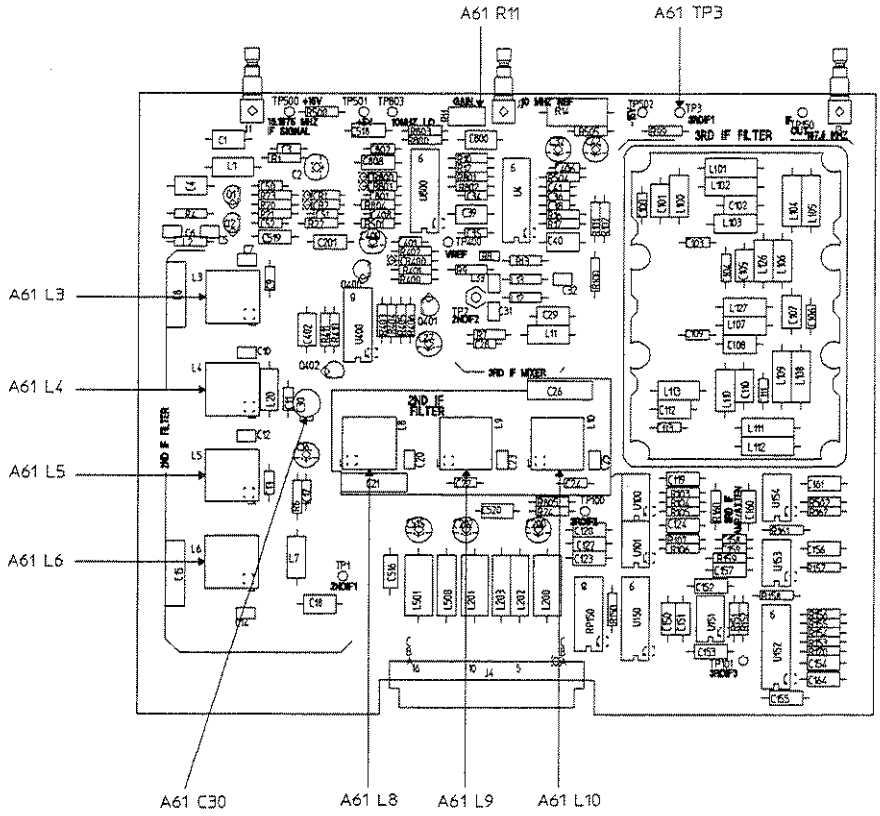


Figure 1-11. A61 IF Component Locator

5. Press the [2nd IF2] softkey.
6. Connect REF OUT (10 MHz) on the rear panel to INPUT on the front panel using a BNC cable.
7. Adjust A61 C30 for a minimum **Man** readout.
8. Press the [2nd IF3] softkey.
9. Alternately adjust A61 L4 and L5 for a maximum **Man** readout.
10. Press the [2nd IF4] softkey.

11. Alternately adjust A61 L4 and L5 to center the peak and equalize the level of the sides (see figure 1-12).

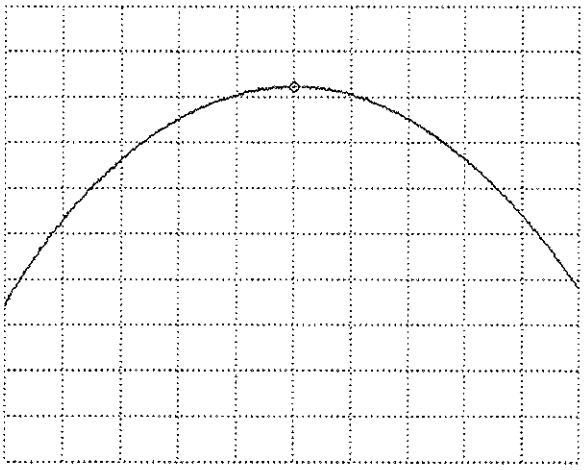


Figure 1-12. Second IF Adjustment

12. Set the spectrum analyzer as follows:

Input	1 MΩ
Center Frequency	187.5 kHz
Span	10 kHz
Scale	0 dBV

13. Connect the spectrum analyzer to A61 TP3 using a 1:1 oscilloscope probe.

14. Press the [2nd IF5] softkey.

15. Adjust A61 R11 for -32.0 ± 0.1 dBV.

16. Set the power switch to STANDBY (⏻). Place the IF assembly into the card nest, and replace the screws.

17. Reconnect the following using original cables:

    A61 J1 to A13 J3
    A61 J2 to A31 J3
    A61 J3 to A62 J3

13. Source Bandpass Filter

This procedure adjusts the four cavity helical resonator filter on the A42 Source Conversion assembly. This 310.1875 MHz bandpass filter attenuates signals outside of its narrow passband.

Equipment Required: Extender Board
Extender Cables

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A42 Source Conversion assembly, and remove the assembly from the card nest.

Caution 

To avoid damaging the cables connected to A33 J5 and J6, disconnect and position the cables away from the A42 Source Conversion assembly before removing or inserting the A42 Source Conversion assembly.

2. Remove the shield can covering A42 W202 and W203 (see figure 1-13). Move A42 W201, W202, and W203 to their test positions.

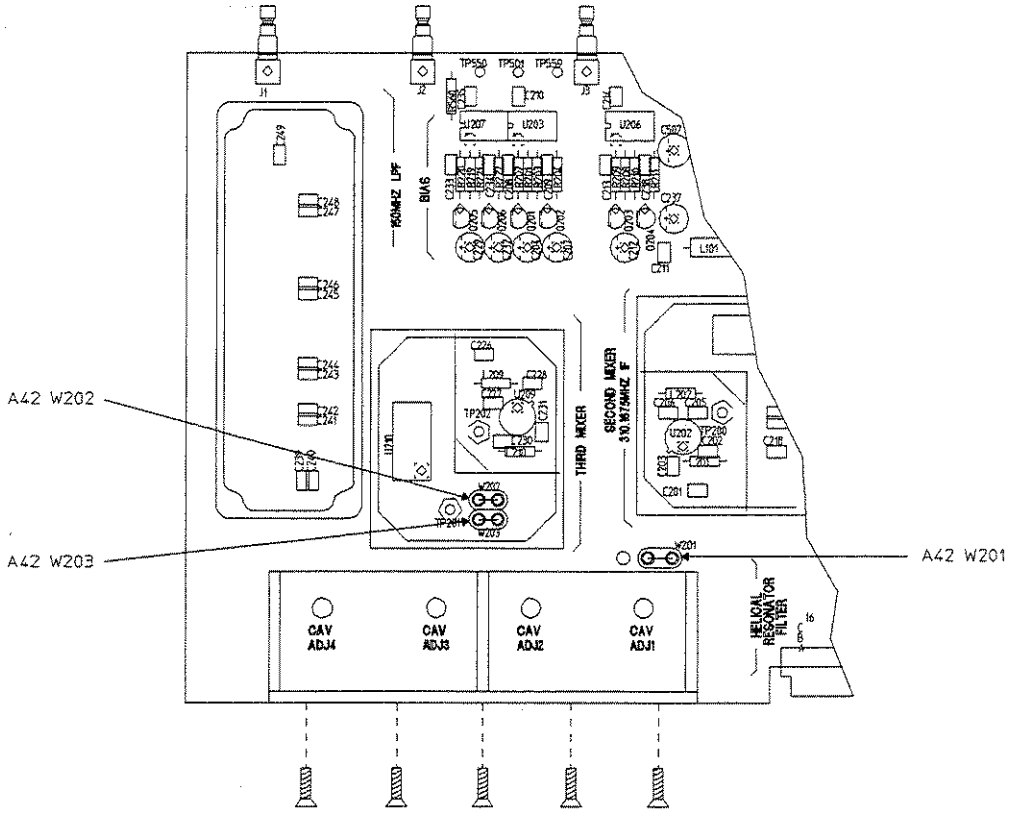


Figure 1-13. A42 Source Conversion Component Locator

3. Remove the plate covering the helix cavity. Then using a ball driver hex tool, turn all four tuning screws (CAV ADJ 1, 2, 3, and 4) clockwise until the screws just contact the helix structure inside the cavity (see caution below). Replace the plate covering the helix cavity.

Caution

The helix structure will be damaged if the tuning screws are turned in too far. Be careful to only turn the screws until they just touch the helix structure inside the cavity.

---

4. Place the A42 Source Conversion assembly on an extender board.

5. Reconnect the following using extender cables:

   A42 J1 to A41 J3
   A42 J2 to A21 J2
   A42 J3 to A32 J3
   A42 J4 to A31 J5
   A42 J6 to A33 J2
   A52 J2 to A33 J4
   A62 J1 to A33 J3

6. Set the power switch to ON (I), then press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [SOURCE]
   [HELICAL RESONATOR]

Note

During this adjustment, the reference level automatically changes when the signal reaches the top or bottom of the displayed range. The analyzer beeps to indicate that the reference level changed.

---

7. Adjust CAV ADJ 1 counterclockwise for a maximum signal level.
8. Adjust CAV ADJ 2 counterclockwise for a minimum signal level. (The minimum level should be about 15 dB smaller than the maximum level achieved in the previous step.)
9. Adjust CAV ADJ 3 counterclockwise for a maximum signal level.
10. Adjust CAV ADJ 4 counterclockwise for a minimum signal level.
11. Set the power switch to STANDBY (⏻). Return W201, W202, and W203 to their original positions. Replace the shield can.
12. Place the Source Conversion assembly into the card nest, and replace the screws.
13. Reconnect the following using original cables:

    A42 J1 to A41 J3
    A42 J2 to A21 J2
    A42 J3 to A32 J3
    A42 J4 to A31 J5
    A42 J6 to A33 J2
    A52 J2 to A33 J4
    A62 J1 to A33 J3
    A33 J5 to TRIG OUT (white cable)
    A33 J6 to EXT TRIG (black cable)

14. First IF Bandpass Filter

This procedure adjusts the four cavity helical resonator filter on the A12 First Conversion assembly. This 310.1875 MHz bandpass filter attenuates signals outside of its narrow passband.

Equipment Required: Extender Board
Extender Cables

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A12 First Conversion assembly, and remove the assembly from the card nest.

2. Move A12 W801, W802, and W803 to their test positions (see figure 1-14).

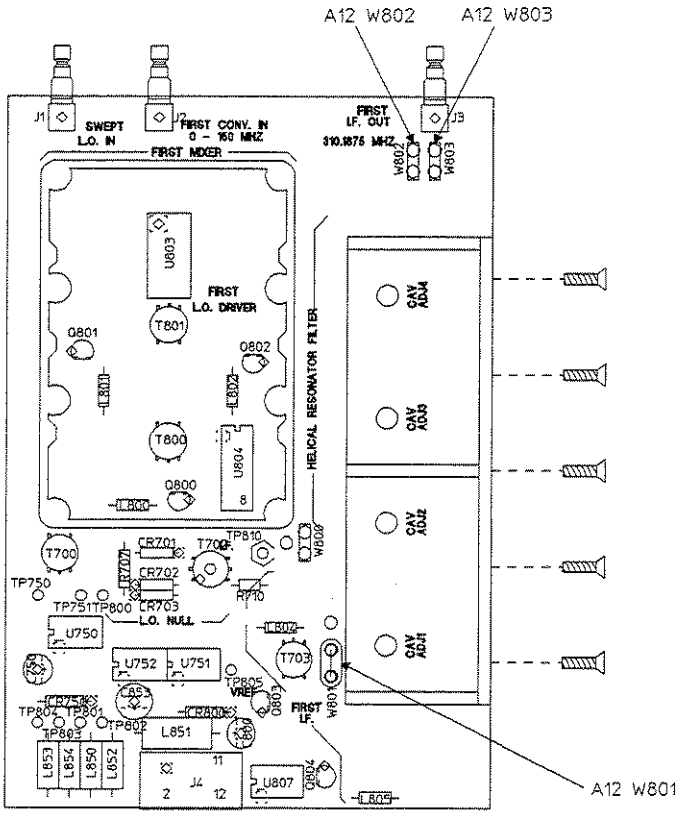


Figure 1-14. A12 First Conversion Component Locator

3. Remove the plate covering the helix cavity. Then using a ball driver hex tool, turn all four tuning screws (CAV ADJ 1, 2, 3, and 4) clockwise until the screws just contact the helix structure inside the cavity (see caution below). Replace the plate covering the helix cavity.

Caution

The helix structure will be damaged if the tuning screws are turned in too far. Be careful to only turn the screws until they just touch the helix structure inside the cavity.

---

4. Place the assembly on an extender board.
5. Reconnect the following using extender cables:

   A12 J1 to A21 J3
   A12 J2 to A11 J3
   A12 J3 to A13 J2

6. Set the power switch to ON (|), then press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [RECEIVER IF]
   [HELICAL RESONATOR]

Note

During this adjustment, the reference level automatically changes when the signal reaches the top or bottom of the displayed range. The analyzer beeps to indicate that the reference level changed.

---

7. Adjust CAV ADJ 1 counterclockwise for a maximum signal level.
8. Adjust CAV ADJ 2 counterclockwise for a minimum signal level. (The minimum level should be about 15 dB smaller than the maximum level achieved in the previous step.)
9. Adjust CAV ADJ 3 counterclockwise for a maximum signal level.
10. Adjust CAV ADJ 4 counterclockwise for a minimum signal level.

11. Set the power switch to STANDBY (⏻). Return W801, W802, and W803 to their original positions.

12. Place the First Conversion assembly into the card nest, and replace the screws.

13. Reconnect the following using original cables:

    A12 J1 to A21 J3
    A12 J2 to A11 J3
    A12 J3 to A13 J2

15. Autorange Threshold Adjustment

Equipment Required:
Frequency Synthesizer
Extender Board
Extender Cables
BNC(m) to SMB(f) Cable
SMB(m) to SMB(m) Adapter

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A11 Input assembly, and remove the assembly from the cardnest
2. Using the BNC-to-SMB cable and adapter, connect the frequency synthesizer to A11 J4 (SMB connector at the bottom of the A11 assembly). Place the assembly on an extender board.
3. Turn A11 R626 fully counterclockwise.
4. Reconnect the following using extender cables:

   A11 J1 to A41 J1
   A11 J2 to A31 J1
   A11 J3 to A12 J2

5. Set the power switch to ON (I), wait for the calibration to complete, then press the following keys:

   [**Spcl Fctn**]
   [AUTO CAL OFF]
   [**Range/Input**]
   [RANGE]
   – 20
   [dBm]

6. Set the frequency synthesizer for a 10 MHz, – 18.5 dBm sine wave output.
7. Adjust A11 R624 so that A11 CR606 just lights up, indicating that the upper threshold trip point was reached. (Turn A11 R624 counterclockwise to light A11 CR606.)
8. Change the frequency synthesizer amplitude to – 31.5 dBm.
9. Adjust A11 R626 so that A11 CR607 just lights up, indicating that the lower threshold trip point was reached. (Turn A11 R626 clockwise to light A11 CR607.)
10. Set the power switch to STANDBY (⏻). Place the A11 Input assembly into the cardnest, and replace the screws.
11. Reconnect the following using the original cables:

    A11 J1 to A41 J1
    A11 J2 to A31 J1
    A11 J3 to A12 J2

16. 1 Meg Ohm Flatness

This procedure adjusts the flatness of the frequency response of the 1 MΩ buffer on the A11 Input assembly.

Equipment Required:

Extender Board
Extender Cables
Small Adjustment Tool
50Ω Feedthrough Termination
BNC(m)-to-SMB(f) Cable
SMB(m)-to-SMB(m) Adapter

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A11 Input assembly, and remove the assembly from the card nest.
2. Connect the 50Ω feedthrough termination to the SOURCE connector. Using the BNC-to-SMB cable and adapter, connect the feedthrough termination to A11 J4 (SMB connector at bottom of A11 Input assembly). Place the assembly on an extender board.
3. Reconnect the following using extender cables:

   A11 J1 to A41 J1
   A11 J2 to A31 J1
   A11 J3 to A12 J2

4. Set the power switch to ON (I), then press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [ADJUSTMTS]
   [RECEIVER INPUT]
   [1 MOHM FLATNESS]

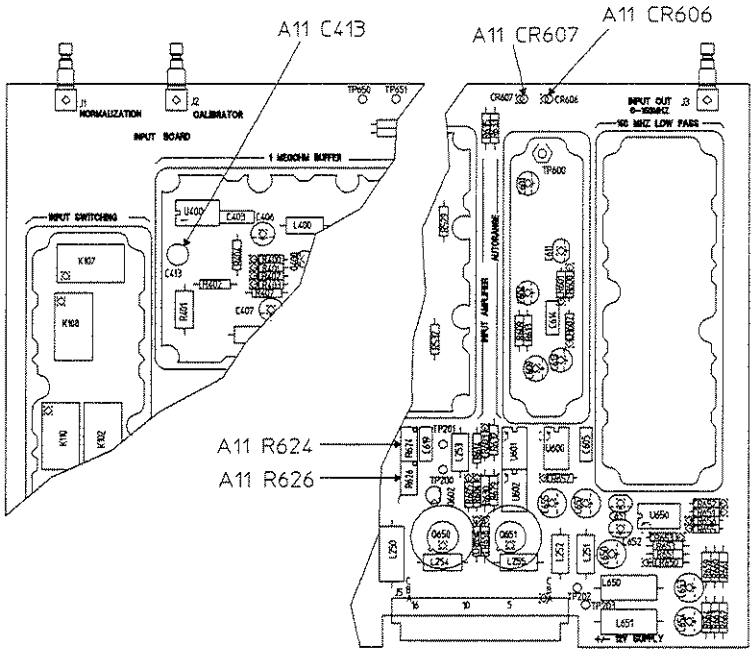


Figure 1-15. A11 Input Component Locator

5. Using the small adjustment tool in the service kit, adjust A11 C413 through a hole in the shield can so the displayed waveforms are as close as possible without the ends crossing (see figure 1-16).

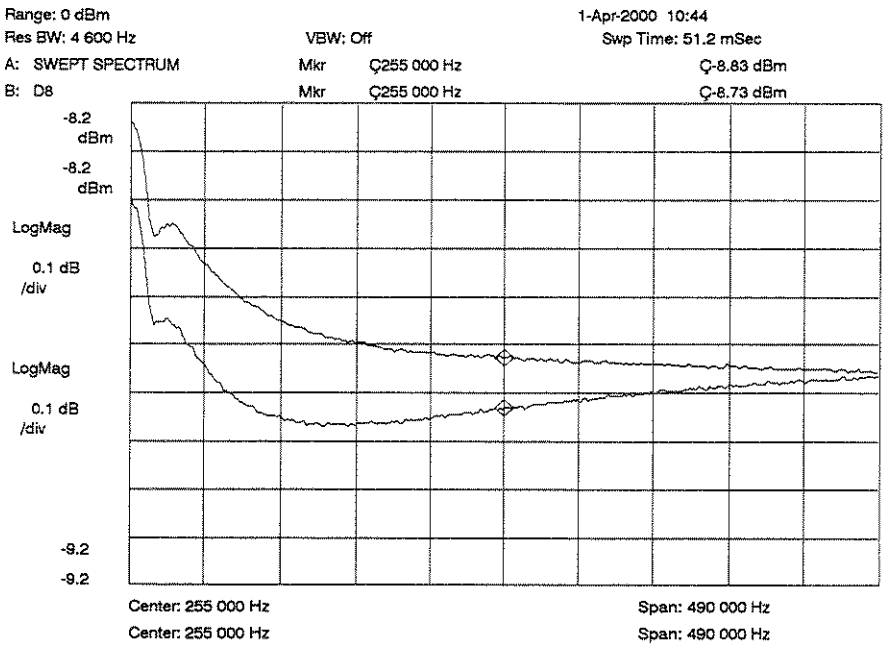


Figure 1-16. 1 Meg Ohm Flatness Adjustment

6. Set the power switch to STANDBY (⏻). Place the Input assembly into the card nest, and replace the screws.

7. Reconnect the following using original cables:

   A11 J1 to A41 J1
   A11 J2 to A31 J1
   A11 J3 to A12 J2

17. Oven Frequency

This procedure adjusts the frequency of option 001, A91 Fan Power/Oven assembly. The A91 Fan Power/Oven assembly provides the HP 3588A Spectrum Analyzer with an absolute frequency reference.

Equipment Required:

- Oscilloscope
- Frequency Standard
- BNC Cable

Note

The HP 3588A Spectrum Analyzer must be warmed up for at least 48 hours before this adjustment is made.

1. Remove the screw on the oven-adjustment cover. Lift the screw side of the oven-adjustment cover and tilt back to the open position.
2. Connect the frequency standard's output to the oscilloscope's external trigger (make sure the frequency standard is properly terminated).
3. Connect OVEN REF OUT (located on the rear panel) to the oscilloscope's channel 1 input.
4. Adjust FINE FREQUENCY ADJUST (A91 R12) to the center of its adjustment range.
5. Set the oscilloscope as follows:

Channel 1	Volts/Div	500 mV/div
	Offset	0V
	Coupling	1 MΩ ac
Timebase	Time/Div	50 ns/div
	Sweep	Triggered
Trigger	Level	0V
	Slope	Positive
	Mode	Edge
	Source	External Trigger
Display	Mode	Repetitive
	Averaging	Off
	Persistence	500 ms
	Screen	Single

6. Remove the oven screw and adjust COARSE FREQUENCY ADJUST (A91 U3) for a stable (not moving) display on the oscilloscope.
7. Change the oscilloscope timebase to 10 ns per division.
8. Adjust FINE FREQUENCY ADJUST for a stable (not moving) display on the oscilloscope.
9. Return the oven screw, oven-adjustment cover and screw, and rear panel jumper (OVEN REF OUT to EXT REF IN) to their original positions.

18. Calibrator Flatness and Level

This procedure adjusts the level and flatness of the calibration signal on the A31 Reference/Calibrator assembly.

Equipment Required:
- Milliwatt Power Meter (recommended) or Power Meter (alternate)
- BNC Cable
- N(f)-to-BNC(f) Adapter

Note

This adjustment can be done with either a milliwatt power meter or a standard power meter. For best accuracy, use the milliwatt power meter.

1. Connect the power meter to the SOURCE connector (located on front panel) using the N-to-BNC adapter and BNC cable.

Note

If you are using a standard power meter, set its calibration factor for 300 kHz to improve the accuracy of this adjustment.

2. Press the following keys:
   - [**Spcl Fctn**]
   - [ ] (second softkey from bottom)
   - **−99**
   - [ ] (second softkey from bottom)
   - [SERVICE FUNCTIONS]
   - [ADJUSTMTS]
   - [CALIBRATR]
   - [CAL LEVEL]
3. After the message appears on the screen, press the [SRCE DAC ATTEN] softkey and adjust the attenuation level for a 0 dBm ± 0.01 dB readout on the power meter.
4. Press the [NEXT STEP] softkey.
5. Disconnect the BNC cable from the power meter and connect to the INPUT connector (SOURCE connected to INPUT).
6. After the **Man** readout is stable, press the [NEXT STEP] softkey.

7. While monitoring the **Man** readout, adjust CAL LEVEL (A31 R322) for the value indicated in the message on the display.
8. Disconnect the BNC cable from the INPUT connector and reconnect to the power meter (SOURCE connected to power meter).

Note

If you are using a standard power meter, set its calibration factor for 120 MHz to improve the accuracy of this adjustment.

---

9. Press the [CAL FLATNESS] softkey.
10. After the message appears on the screen, press the [SRCE DAC ATTEN] softkey and adjust the attenuation level for a 0 dBm ± 0.01 dB readout on the power meter.
11. Press the [NEXT STEP] softkey.
12. Disconnect the BNC cable from the power meter and reconnect to the INPUT connector (SOURCE connected to INPUT).
13. After the **Man** readout is stable, press the [NEXT STEP] softkey.
14. While monitoring the **Man** readout, adjust CAL FLAT (A31 C330) for the value indicated in the message on the display.
15. Disconnect the cable connected between the SOURCE connector and INPUT connector.
16. Press the [**Preset**] hardkey to exit the adjustment mode.

19. Display

This procedure adjusts the focus, intensity, and alignment of the Display assembly.

Equipment Required: None

Note

If the Display assembly needs to be adjusted, adjust only the components that apply to the problem.

1. Press the following keys to view the test pattern:

   [Spcl Fctn]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [SELF TEST]
   [FUNCTIONL TESTS]
   [DISPLAY]
   [TEST PATTERN]

2. Compare the test pattern to figure 1-17 and adjust as indicated in table 1-3.

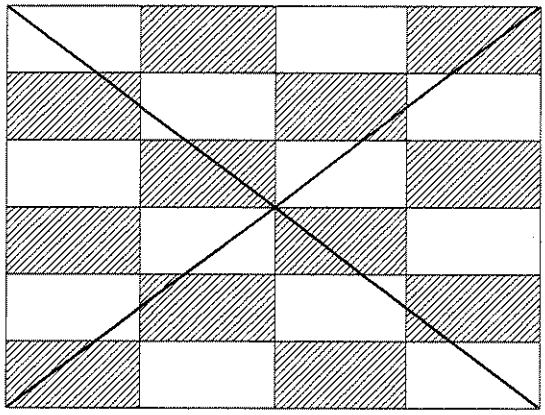


Figure 1-17. Center Portion of Display Test Pattern

Table 1-3. Display Adjustments

Adjustment Name	Adjust for...
Focus	Optimum focus
Brightness	Optimum intensity
Horizontal Width †	Test pattern width of 6.89 ± 0.06 inches (175 ± 1.5 mm)
Vertical Hold	Vertically stable display
Vertical Linearity	Uniform height of blocks in test pattern
Vertical Position	Vertically centered test pattern
Vertical Size	Test pattern height of 4.92 ± 0.06 inches (128 ± 1.5 mm)
Horizontal Position	Horizontally centered test pattern
Horizontal Hold	Horizontally stable display

† Adjust using non-metallic hexagonal tuning tool.

Note

If Vertical Linearity is adjusted, check Vertical Size and Vertical Position, and adjust if necessary.

3. Press the [**Preset**] hardkey to exit the adjustment mode.

Section II

Replaceable Parts

Introduction

This section contains information for ordering replacement parts for the HP 3588A Spectrum Analyzer. This section also contains illustrations showing how to disassembly and assembly the analyzer. These illustrations also show reference designator numbers for the hardware.

Replacement parts are listed in the following three tables:

- Assemblies
- Cables
- Hardware

Caution

Many of the parts listed in this section are static sensitive. Use the appropriate precautions when removing, handling, and installing all parts to avoid unnecessary damage.

Ordering Information

Note

See the final pages in the back of this manual for a list of Hewlett-Packard sales and service office locations and addresses.

Ordering Non-Listed Parts

To order a part that is NOT listed in the replaceable parts tables, indicate the instrument model number, instrument serial number, description and function of the part, and the quantity of the part required. Address the order to the nearest Hewlett-Packard sales and service office.

Direct Mail Order System

Within the U.S.A., Hewlett-Packard can supply parts through a direct mail order system. Advantages of the Direct Mail Order System are:

- Direct ordering and shipment from the HP Parts Center.
- No maximum or minimum on any mail order. There is a minimum order for parts ordered through a local HP sales and service office when the orders require billing and invoicing.
- Transportation charges are prepaid. A small handling charge is added to each order.
- No invoicing. A check or money order must accompany each order.
- Mail order forms and specific ordering information are available through your local Hewlett-Packard sales and service office.

Table 2-1. Abbreviations Used

Abbreviations			
Ag	silver	Ne	neon
Al	aluminum	NO	normally open
A	ampere(s)	NPO	negative positive zero (zero temperature coefficient)
Au	gold		
cer	ceramic	ns	nanosecond(s) = 10^{-9} seconds
coef	coefficient	nsr	not separately replaceable
com	common	obd	order by description
conn	connection	OD	outside diameter
dep	deposited	p	peak
DPDT	double-pole double-throw	pc	printed circuit
DPST	double-pole single-throw	pF	picofarad(s) 10^{-12} farads
elect	electrolytic	piv	peak inverse voltage
encap	encapsulated	p/o	part of
F	farad(s)	pos	position(s)
FET	field effect transistor	poly	polystyrene
fxd	fixed	pot	potentiometer
GaAs*	gallium arsenide	p-p	peak-to-peak
GHz	gigahertz = 10^{+9} hertz	ppm	parts per million
Gd	guard(ed)	prec	precision (temperature coefficient long term stability and/or tolerance)
Ge	germanium		
gnd	ground(ed)	R	resistor
H	henry(ies)	Rh	rhodium
Hg	mercury	rms	root-mean-square
Hz	hertz (cycle(s) per second)	rot	rotary
ID	inside diameter	Se	selenium
impg	impregnated	sect	section(s)
incd	incandescent	Si	silicon
ins	insulation(ed)	sl	slide
kΩ	kilohm(s) = 10^{+3} ohms	SPDT	single-pole double-throw
kHz	kilohertz = 10^{+3} hertz	SPST	single-pole single-throw
L	inductor	Ta	tantalum
lin	linear taper	TC	temperature coefficient
log	logarithmic taper	TiO_2	titanium dioxide
mA	milliampere(s) = 10^{-3} amperes	tog	toggle
MHz	megahertz = 10^{+6} hertz	tol	tolerance
MΩ	megohms(s) = 10^{+6} ohms	trim	trimmer
met flm	metal film	TSTR	transistor
mfr	manufacturer	V	volt(s)
ms	microsecond	vacw	alternating current working voltage
mtg	mounting	var	variable
mV	millivolt(s) = 10^{-6} volts	vdcw	direct current working voltage
μF	microfarad(s)	W	watts
μs	microsecond(s)	w/	with
μV	microvolt(s) = 10^{-6} volts	wiv	working inverse voltage
my	Mylar®	w/o	without
nA	nanoampere(s) = 10^{-9} amperes	ww	wirewound
NC	normally closed		

* optimum value selected at factory average value shown (part may be omitted)
**no standard type assigned selected or special type
® Dupont de Nemours

Table 2-1. Abbreviations Used (continued)

Designators			
A	assembly	Q	transistor
B	motor	QCR	transistor-diode
BT	battery	R	resistor
C	capacitor	RT	thermistor
CR	diode or thyristor	S	switch
DL	delay line	T	transformer
DS	lamp	TB	terminal board
E	misc electronic part	TC	thermocouple
F	fuse	TP	test point
FL	filter	TS	terminal strip
HR	heater	U	microcircuit
IC	integrated circuit	V	vacuum tube
J	jack	W	cable jumper
K	relay	X	socket
L	inductor	XDS	lampholder
M	meter	XF	fuseholder
MP	mechanical part	Y	crystal
P	plug	Z	network

Table 2-2. Manufacturers' Code Numbers

Mfr No.	Mfr Name	Address
01075	ITT Pomona Electronics	Pomona, CA 91766
01125	Lewis Screw Co	Chicago, IL 60609
01440	Pool Machine Co Inc	Denver, CO 80223
01642	Sons Tool Inc	Woodville, WI 55412
01808	Small Parts Inc	Costa Mesa, CA 92626
03316	Specialty Connector Co	Franklin, IN 46131
03480	Heyco Molded Products	Kentworth, NJ 07033
05030	Barry Div Barry Wright Corp	Watertown, MA 02172
05502	Connor Springs and Mfg Co	San Francisco, CA 94101
05791	Griffith Rubber Mills	Portland, OR 97210
06915	Pan Asian Paper Product Mfg	Pinang, MA
06916	Sony Corp	Toyko, JP
08709	Panasonic Industrial Co	Secaucus, NJ 07094
08891	Power Conversion Inc	Mt Vernon, NY 10551
09328	Dreefs Switch Inc	Waukegan, IL 60087
09441	Applied Engineering Product Co	Hamdem CT 06514
09655	Chomerics Shielding Technology	Carson, CA 90749
12136	Solitec Inc	Santa Clara, CA 95054
28480	Hewlett-Packard Company	Palo Alto, CA 94304
30817	Instrument Specialties Co Inc	Del Water Gap, PA 07424
34785	Dek Inc	Chicago, IL 60185
3U116	TRW Electronic Components Group	Marshall, IL 62441
46384	Penn Engineering and Mfg Corp	Doylestown, PA 18901
73734	Federal Screw Products Co	Chicago, IL 60618
75915	Littelfuse Inc	Des Plaines, IL 60016
76381	3M Co	St Paul, MN 55144
83486	Elco Industries Inc	Rockford, IL 61125

Assemblies

To order an assembly listed in table 2-3, quote the Hewlett-Packard part number, the check digit (CD), indicate the quantity required, and address the order to the nearest Hewlett-Packard sales and service office. The check digit verifies that an order has been transmitted correctly, ensuring accurate and timely processing of the order. The first time a part is listed in the table, the quantity column lists the total quantity of the part used in the analyzer. See table 2-2 for a table listing the manufacturers' code numbers and the corresponding names and addresses.

Table 2-3. Assemblies

Ref.Des.	HP Part Number	CD	Qty	Description	Mfr. Code	Mfr. Part Number
A11	03588-69511	3	1	EXCHANGE PCBD ASSY-INPUT †	28480	03588-69511
A12	03588-69512	4	1	EXCHANGE PCBD ASSY-FIRST CONVERSION †	28480	03588-69512
A13	03588-69513	5	1	EXCHANGE PCBD ASSY-SECOND CONVERSION †	28480	03588-69513
A21	03588-69521	5	1	EXCHANGE PCBD ASSY-SUM VCO †	28480	03588-69521
A22	03588-69522	6	1	EXCHANGE PCBD ASSY-SUM PHASE DETECTOR †	28480	03588-69522
A23	03588-69523	7	1	EXCHANGE PCBD ASSY-STEP PHASE DETECTOR †	28480	03588-69523
A24	03588-69524	8	1	EXCHANGE PCBD ASSY-STEP VCO †	28480	03588-69524
A31	03588-69531	7	1	EXCHANGE PCBD ASSY-REFERENCE/CALIBRATOR †	28480	03588-69531
A32	03588-69532	8	1	EXCHANGE PCBD ASSY-300 MHz †	28480	03588-69532
A33	03588-69533	9	1	EXCHANGE PCBD ASSY-TRIGGER †	28480	03588-69533
A41	03588-69541	9	1	EXCHANGE PCBD ASSY-SOURCE AMPLIFIER †	28480	03588-69541
A42	03588-69542	0	1	EXCHANGE PCBD ASSY-SOURCE CONVERSION †	28480	03588-69542
A51	03588-69551	1	1	EXCHANGE PCBD ASSY-INTERPOLATION VCO †	28480	03588-69551
A52	03588-69552	2	1	EXCHANGE PCBD ASSY-FRACTIONAL-N †	28480	03588-69552
A61	03588-69561	3	1	EXCHANGE PCBD ASSY-IF †	28480	03588-69561
A62	03588-69562	4	1	EXCHANGE PCBD ASSY-ADC/DIGITAL FILTER †	28480	03588-69562
A81	35672-69581	7	1	EXCHANGE PCBD ASSY-CPU ‡	28480	35672-69581
A87	35672-69587	3	1	EXCHANGE PCBD ASSY-MEMORY ‡‡	28480	35672-69587
A88	35672-69588	4	1	EXCHANGE PCBD ASSY-EXPANDED MEMORY OPT 003 ‡‡	28480	35672-69588
A90	03588-66590	2	1	PCBD ASSY-FAN POWER	28480	03588-66590
A91	03588-66591	9	1	PCBD ASSY-OVEN/FAN POWER OPT 001 †	28480	03588-66591
A99	03588-66599	1	1	PCBD ASSY-MOTHERBOARD	28480	03588-66599
MP805	5080-8600	7	1	EXCHANGE DISK DRIVE 3.5" FLEXIBLE Δ	06916	MP-F52W-30
MP841	35672-67501	7	1	POWER SUPPLY CUSTOM 180W-7 OUTPTS	3U116	095-10097-00
MP842	35672-69301	9	1	DISPLAY 9" RASTER GRN 576X400	08709	TR-94S1A
MP859	03588-60214	1	1	FRONT PANEL ASSY (INCLUDES KEYBOARD) Δ	28480	03588-60214
	03561-68501	8	1	FAN-ASSY	28480	03561-68501

† After replacing the assembly, see table 5-2 for required adjustments and performance tests.

‡ See "Replacing the CPU Assembly."

‡ ‡ See "Replacing the Memory Assembly."

Δ See section 3, "Manual Backdating."

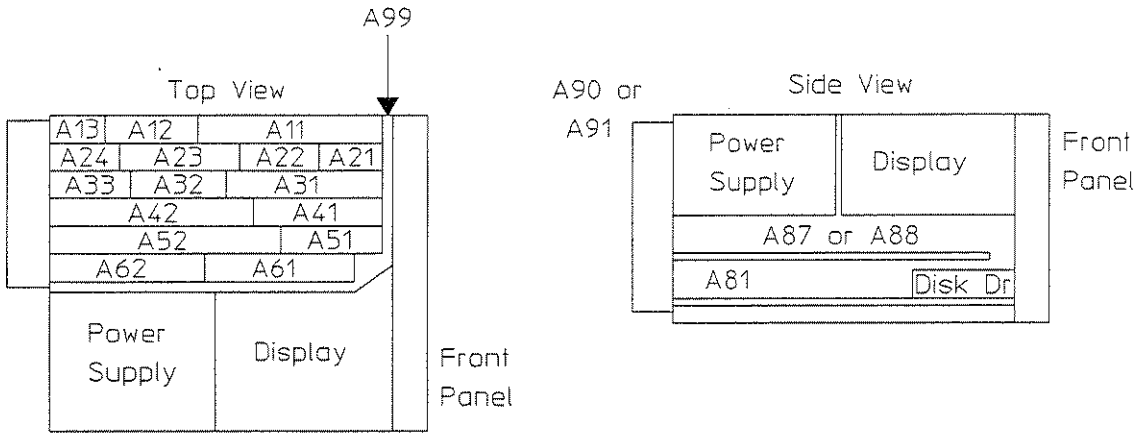


Figure 2-1. Assembly Locations

Replacing the CPU Assembly

The analyzer's serial number and IBASIC option are stored in EEPROM on the CPU assembly. Therefore, when the CPU assembly is replaced, IBASIC must be reinstalled and the analyzer's serial number must be entered in EEPROM. For information on loading IBASIC, see *Using Instrument BASIC with the HP 3588A*. To store the analyzer's serial number, use the HP-IB command, SYST:EEROM:SNUM *'serial number'*.

For example, if your computer has HP BASIC and the analyzer's HP-IB address is set to 19, enter the following command:

```
OUTPUT 719;"SYST:EEROM:SNUM 'serial number'"
```

Replacing the Memory Assembly

The HP-IB address may need to be reset after replacing the Memory assembly or battery. Press the following keys to reset the HP-IB address:

[Local/HP-IB]
[SYSTEM CONTROLLR]
[ANALYZER ADDRESS]
11
[ENTER]

Cables

To order a part listed in table 2-4, quote the Hewlett-Packard part number, the check digit (CD), indicate the quantity required, and address the order to the nearest Hewlett-Packard sales and service office. The check digit verifies that an order has been transmitted correctly, ensuring accurate and timely processing of the order. The first time a part is listed in the table, the quantity column lists the total quantity of the part used in the analyzer. See table 2-2 for a table listing the manufacturers' code numbers and the corresponding names and addresses.

Table 2-4. Cables

Ref.Des.	HP Part Number	CD	Qty	Description	Mfr. Code	Mfr. Part Number
MP701	03586-61677	4	4	CBL-ASM CXL FSMB/FSMB 265MM BLUE	28480	03586-61677
MP703	03577-61621	7	2	CBL-ASM CXL FSMB/FSMB 220MM WHITE	28480	03577-61621
MP705	03577-61622	8	1	CBL-ASM CXL FSMB/FSMB 160MM YELLOW	28480	03577-61622
MP706	03577-61641	1	6	CBL-ASM CXL FSMB/FSMB 135MM ORANGE	28480	03577-61641
MP712	03585-61602	4	10	CBL-ASM CXL FSMB/FSMB 76MM RED	28480	03585-61602
MP723	03585-61605	7	2	CBL-ASM CXL FSMB/FSMB 330MM GREEN	28480	03585-61605
MP725	03585-61606	8	1	CBL-ASM CXL FSMB/FSMB 406MM BLUE	28480	03585-61606
MP765	03588-61602	7	1	EXT TRIG CBL-ASMCXLMBNC/FHSH 200 MM BLACK	28480	03588-61602
MP766	03588-61603	8	1	TRIG OUT CBL-ASMCXLMBNC/FHSG 200MM WHITE	28480	03588-61603
MP767	03588-61604	9	1	EXT REF IN CBL-ASMCXLMBNC/MSMB 578MM BLUE	28480	03588-61604
MP768	03588-61605	0	1	REF OUT CBL-ASMCXLMBNC/MSMB 478MM GREEN	28480	03588-61605
MP770	03588-61660	7	1	SOURCE CBL-ASM RGD MBNC/MSMB	09441	
MP771	03588-61670	9	1	INPUT CBL-ASM RGD MBNC/MSMB	09441	
MP773	03588-61699	2	1	W12 MOTHER BRD PWR CBL-ASM RBN FSKT/FSKT 360MM GY	L1624	
MP817	35660-61611	4	1	W11 FAST BUS CABLE-ASM RBN FHDR/FHDR 350MM GY	76381	
MP836	35672-61601	6	1	W1 MEMORY CABLE-ASM RBN FHDR/FHDR 40MM GY	76381	
MP837	35672-61602	7	1	W2 CPU POWER CABLE-ASM RBN FHDR/FHDR 290MM GY	76381	
MP838	35672-61603	8	1	W3 DISPLAY CABLE-ASM RBN FHDR/FHDR 325MM GY	76381	
MP839	35672-61604	9	1	W4 DISK DRIVE CABLE-ASM RBN FHDR/FHDR 35MM GY	76381	
MP840	35672-61605	0	1	W5 FRONT-PANEL CABLE-ASM RBN FHDR/FHDR 450MM GY	76381	
MP861	03588-61607	2	1	CBL-ASM CXL FSMB/FSMB 85MM BLACK	28480	03588-61607
MP862	03588-61608	3	1	CBL-ASM CXL FSMB/FSMB 270MM GRAY	28480	03588-61608
MP877	35672-61617	4	1	W7 POWER ON/OFF CABLE-ASM JKT FCRP/FHSG 615MM GY	28480	35672-61607
	03588-61606	1	1	FAN/OVEN POWER CBL-ASMDSCFHSG/STRP 494MM ML	28480	03588-61606
	03588-61696	9	1	POWER PROBE CBL-ASMDSCFCON/CRMP 65MM ML	28480	03588-61696
	8120-6495	3	1	SWITCH/CABLE ASSEMBLY	28480	8120-6495

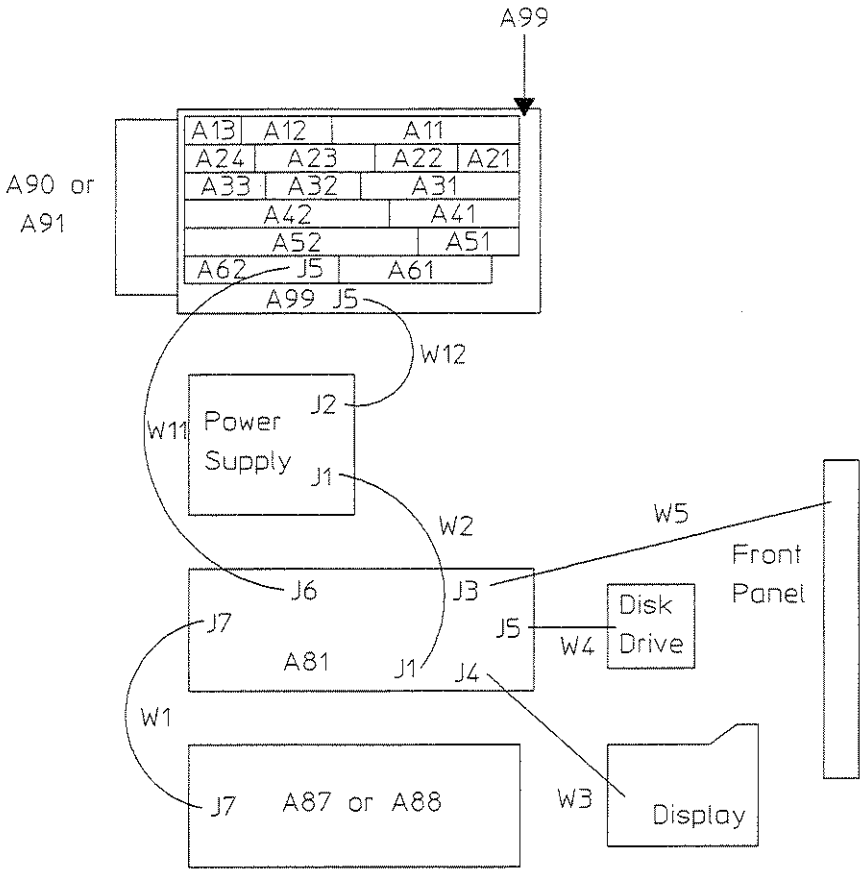


Figure 2-2. Cable Locations

Hardware

To order a part listed in table 2-5, quote the Hewlett-Packard part number, the check digit (CD), indicate the quantity required, and address the order to the nearest Hewlett-Packard sales and service office. The check digit verifies that an order has been transmitted correctly, ensuring accurate and timely processing of the order. The first time a part is listed in the table, the quantity column lists the total quantity of the part used in the analyzer. See table 2-2 for a table listing the manufacturers' code numbers and the corresponding names and addresses. For hardware reference designator numbers, see the disassembly/assembly illustrations following this table.

Table 2-5. Hardware

Ref.Des.	HP Part Number	CD	Qty	Description	Mfr. Code	Mfr. Part Number
MP700	0340-0881	7	1	GROMMET-SNAP BUSHING SHORTY	03480	2850 BLK (B-875-750)
MP729	03588-00219	4	1	SHTF BRKT-FOOT AL	28480	03588-00219
MP730	03588-01204	9	1	STMP BE/CU GROUND BRKT	28480	03588-01204
MP731	03588-01206	1	2	SHTF BRKT-CONN AL	28480	03588-01206
MP733	03588-04101	1	1	SHTF HOUSING-INPUT	28480	03588-04101
MP751	03588-21703	5	2	BSHG-BRASS 5MM ID 3.2MM THK	05791	
MP753	03588-23201	2	2	MCHD CONNECTOR GUIDE	28480	03588-23201
MP763	03588-60101	9	1	CARD SUPPORT ASSY	28480	03588-60101
MP764	03588-60201	0	1	SHTF ASSY-RR PNL/FAN HSNG ALSK	28480	03588-60201
MP806	1400-0611	0	2	CLAMP-FL-CA 1-WD	76381	3484-1000
MP809	1400-1122	0	2	CLAMP-CABLE .187-DIA .735-WD NYL	34785	021-0188
MP810	1460-1345	5	2	TILT STAND SST	05502	
MP812	1520-0247	2	1	MOLD FAN MOUNT	05030	FM-450-1
		8	1			
MP818	35672-00211	6	1	SHTF PNL-REAR ALSK	28480	35672-00211
MP819	35672-01202	7	2	MCHD SS STRAP SS-HANDLE	28480	35672-01202
MP821	35672-01211	8	1	SHTF BRKT-DISK DRIVE AL	28480	35672-01211
MP822	35672-04111	3	1	SHTF COVER AL	28480	35672-04111
MP823	35672-21703	5	4	MCHD RETAINER SS-HANDLE	28480	35672-21703
MP828	35672-41201	0	2	MOLD VINYL EXTRUSION-HANDLE	12136	35672-41201
MP831	35672-45004	9	4	MOLD ENDCAP-HANDLE	28480	35672-45004
MP835	35672-60111	1	1	SHTF ASSY-CHASSIS AL	28480	35672-60111
MP843	5041-8801	8	2	MOLD FOOT II +	28480	5041-8801
MP845	5041-8822	3	2	MOLD FOOT-NON SKID II +	28480	5041-8822
MP848	8160-0634	4	2	STMP BE/CU GROUND STRIP	30817	0097-0611-17
MP850	8160-0636	6	3	STMP GROUND STRIP BE/CU .156H	30817	0786-0162-00
MP852	1250-2275	7	2	BNC FEED THRU SERIES RESISTOR	01075	4391-25
MP854	03588-01210	7	2	SHTF BRKT-CSS TO WALL AL	01642	
MP854	0380-1630	0	2	SPACER-PRESS-IN 10.00 MM LG; 3.6 MM ID	46384	KFSE-3.6-10
MP857	03588-34311	4	1	OVRL ASSY-DRS PLT PLCR Δ	22670	

Δ See section 3, "Manual Backdating."

Table 2-5. Hardware (continued)

Ref.Des.	HP Part Number	CD	Qty	Description	Mfr. Code	Mfr. Part Number
MP863	0400-0002	2	1	GROMMET-RND .188-IN-ID .312-IN-GRV-OD	73734	1656
MP864	0400-0009	9	2	GROMMET-RND .125-IN-ID .25-IN-GRV-OD	01808	G250
MP873	5060-0467	6	1	CON-LF PROBE POWER 3PIN	28480	5060-0467
MP874	1400-1356	2	2	CLP-CABLE .469-.562DIA NYLON	06915	
MP879	8160-0329	4	1	RFI STRIP MNL/NPRN .375-IN-WD .25-IN-THK	09655	01-0401-0888
MP880	8160-0636	6		STMP GROUND STRIP BE/CU .156H	30817	0786-0162-00
MP882	8160-0683	3	3	SPRING FILTER GROUNDING STRIP	30817	0097-551-17-X
	03588-00604	1	4	SHTF SHIELD-WALL BTM AL	01642	
	03588-00605	2	4	SHTF SHIELD-WALL TOP AL	01642	
	03588-40607	8	3	CSTG-FILTER CANTOP	28480	03588-40607
	03588-40608	9	3	CSTG-FILTER CANBTM	28480	03588-40608
	35660-40601	8	2	CSTG SHIELD CAN (TOP) AL	01440	
	35660-40602	9	2	CSTG SHIELD CAN (BOTTOM) AL	OBV87	35660-40602
	0380-0003	9	1	SPCR-RD .18ID.25D .12LG BRSNI	28480	0380-0003
	6960-0041	1	1	PLUG-HOLE FL-HD FOR .5-D-HOLE NYL	03480	2643 (BLACK)
	03588-40605	6	1	CSTG-RF SHIELDTOP	28480	03588-40605
	03588-40606	7	1	CSTG-RF SHIELDBTM	28480	03588-40606
	03588-04111	3	1	A11 SHTF ASSY-COVER TOP ALSK	28480	03588-04111
	03588-04112	4	1	A12 SHTF ASSY-COVER TOP	28480	03588-04112
	03588-04113	5	1	A13 SHTF ASSY-COVER TOP	28480	03588-04113
	03588-04121	5	1	A21 SHTF ASSY-COVER TOP	28480	03588-04121
	03588-04122	6	1	A22 SHTF ASSY-COVER TOP	28480	03588-04122
	03588-04123	7	1	A23 SHTF ASSY-COVER TOP	28480	03588-04123
	03588-04124	8	1	A24 SHTF ASSY-COVER TOP	28480	03588-04124
	03588-04131	7	1	A31 SHTF ASSY-COVER TOP ALSK	28480	03588-04131
	03588-04132	8	1	A32 SHTF ASSY-COVER TOP ALSK	28480	03588-04132
	03588-04133	9	1	A33 SHTF ASSY-COVER TOP ALSK	28480	03588-04133
	03588-04141	9	1	A41 SHTF ASSY-COVER TOP ALSK	28480	03588-04141
	03588-04142	0	1	A42 SHTF ASSY-COVER TOP ALSK	28480	03588-04142
	03588-04151	1	1	A51 SHTF ASSY-COVER TOP ALSK	28480	03588-04151
	03588-04152	2	1	A52 SHTF ASSY-COVER TOP ALSK	28480	03588-04152
	03588-04161	3	1	A61 SHTF ASSY-COVER TOP ALSK	28480	03588-04161
	03588-04162	4	1	A62 SHTF ASSY-COVER TOP ALSK	28480	03588-04162
	03588-05002	3	11	A11 HANDLE-BAIL	05502	
	03588-05002	3		A12 HANDLE-BAIL	05502	
	03588-05001	2	4	A13 HANDLE-BAIL	05502	
	03588-05001	2		A21 HANDLE-BAIL	05502	
	03588-05001	2		A22 HANDLE-BAIL	05502	
	03588-05002	3		A23 HANDLE-BAIL	05502	
	03588-05001	2		A24 HANDLE-BAIL	05502	

Table 2-5. Hardware (continued)

Ref.Des.	HP Part Number	CD	Qty	Description	Mfr. Code	Mfr. Part Number
	03588-05002	3		A31 HANDLE-BAIL	05502	
	03588-05002	3		A32 HANDLE-BAIL	05502	
	03588-05002	3		A33 HANDLE-BAIL	05502	
	03588-05002	3		A41 HANDLE-BAIL	05502	
	03588-05002	3		A42 HANDLE-BAIL	05502	
	03588-05002	3		A51 HANDLE-BAIL	05502	
	03588-05002	3		A52 HANDLE-BAIL	05502	
	03588-05002	3		A61 HANDLE-BAIL	05502	
	03588-05003	4	1	A62 HANDLE-BAIL	05502	
	1420-0336	8	1	BATTERY	08891	T06/46
	5061-2819	8	1	BLANK PLASTIC DISK FOR TRANSPORTATION		
	2110-0056	3	1	6A 250V FAST ACTING FUSE	75915	312 006
	2110-0003	0	1	3A 250V FAST ACTING FUSE	75915	312 003
	35672-05011	4	3	FRONT PANEL MOUNTING CLIP	28480	35672-05011
	03588-47401	4	1	MOLD KNOB-RPG II+	28480	03588-47401
	0570-1378	6	14	SCREEN SCREWS	83486	276-000-0000-7N
	35672-49301	7	1	LNZ-CURVED RFI WINDOW	09655	
	03588-04103	3	1	SHTF CVR-OVEN TWEAK ALSK	28480	3588-04103
	7204-0009	0	1	SHT-AL 1.0MM/.040TK AA5052-	28480	7204-0009
	0515-1954	8	11	SCR-MCH M4.0 20MMLG PHPZ SSTWX	01125	13149-437
	7204-0003	4		SHT-AL 1.6MM/.063TK AA5052-	28480	7204-0003
	0590-1368	6	2	PEM PRESS-IN NUT	46384	CLS-M3-2
	1250-2062	1	1	OVEN BNC CONNECTOR	03316	28JR175-9
	1250-1499	5	1	COAX BNC(M) TO COAX BNC(M)	03316	28AU100-1
	0515-0456	3	3	TOP COVER SCREWS M4X16MMLG	28480	0515-0456
	8160-0683	3	2	SPRING GROUND CLIP	28480	8160-0683
	03588-80401	4	1	LABEL-CABLING (OVER CRT)	28480	03588-80401
	1252-0268	8	1	HP-IB CONNECTOR	28480	1252-0268
	1000-0888	5	1	RPG	28480	1000-0888
	0590-1196	8	1	PEM CENTER/REAR FRAME P/O 35672-66501	28480	0590-1196

Disassembly/Assembly

Use the following illustrations to disassemble and assemble the HP 3588A Spectrum Analyzer.

Warning

Disconnect the power cord from the rear panel before disassembly or assembly of the HP 3588A Spectrum Analyzer.

Caution

Do not connect or disconnect ribbon cables from circuit assemblies with the line power turned ON (I).
To protect circuits from static discharge, remove or replace HP 3588A Spectrum Analyzer assemblies only at static-protected work stations.

Warning

When replacing the handle assemblies, be careful to position properly and attach firmly. If improperly attached, the handles could come off when lifting the analyzer, causing personal injury.

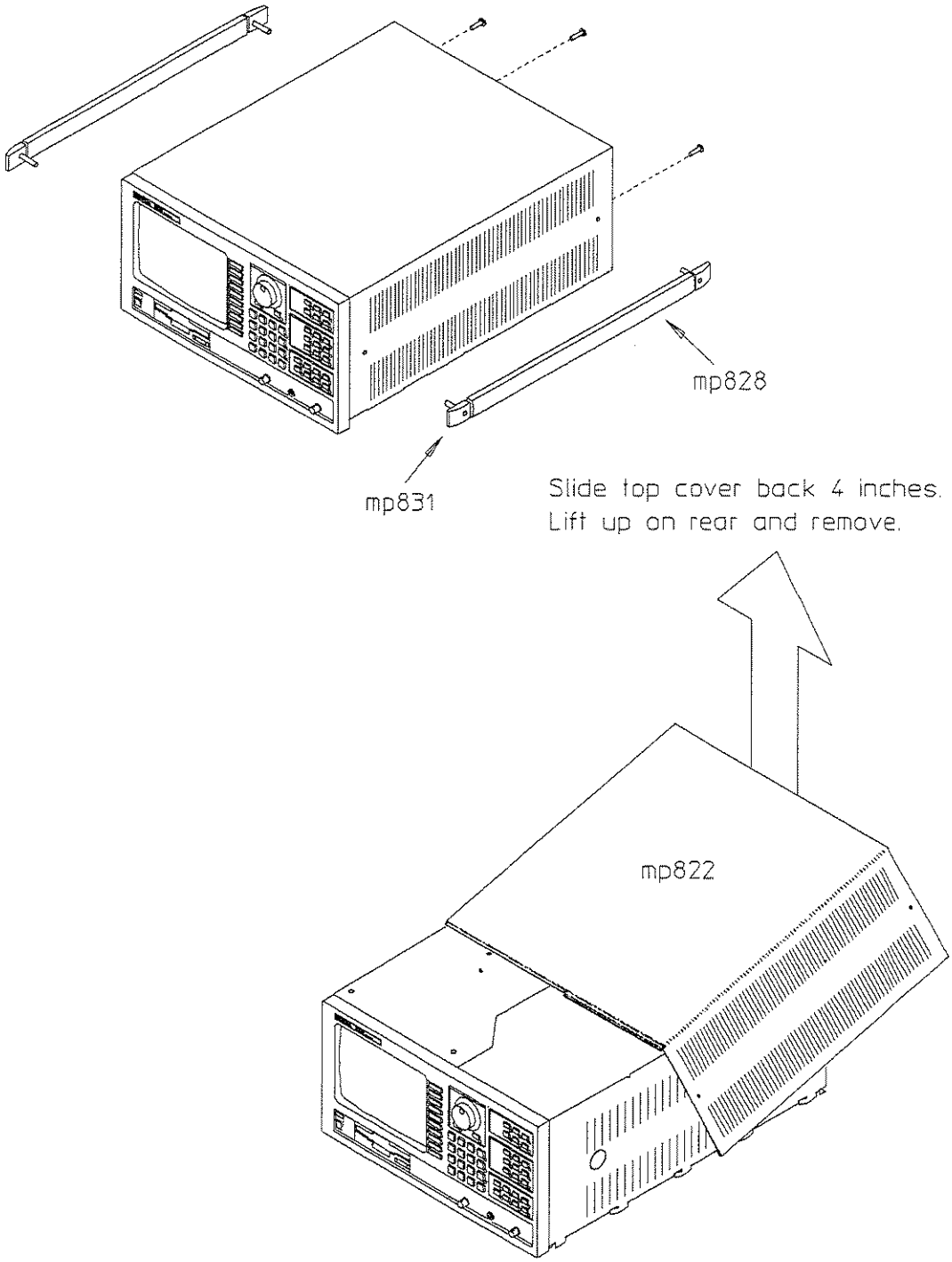


Figure 2-3. Top Cover

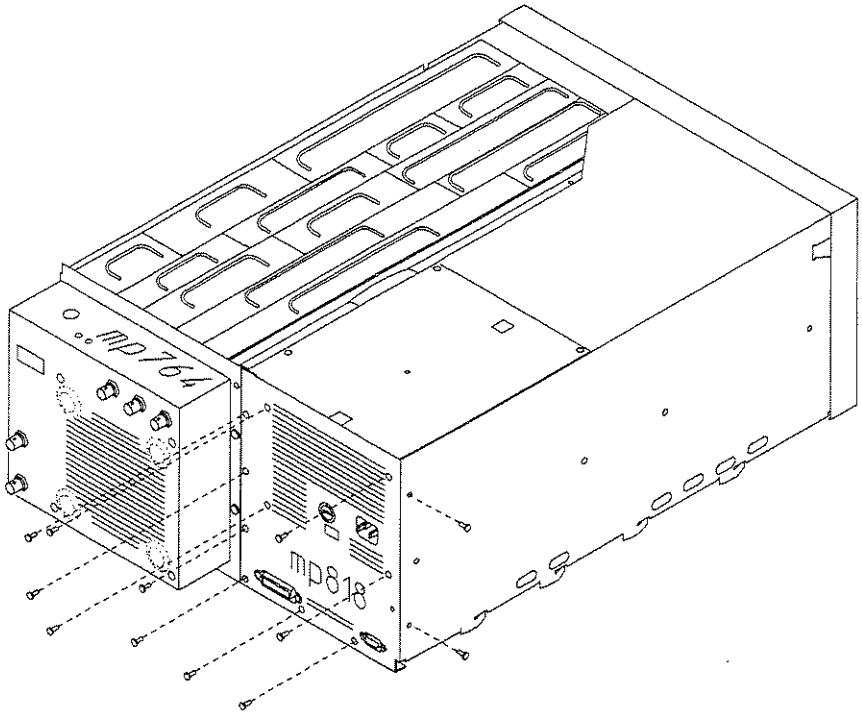


Figure 2-4. Rear Panel

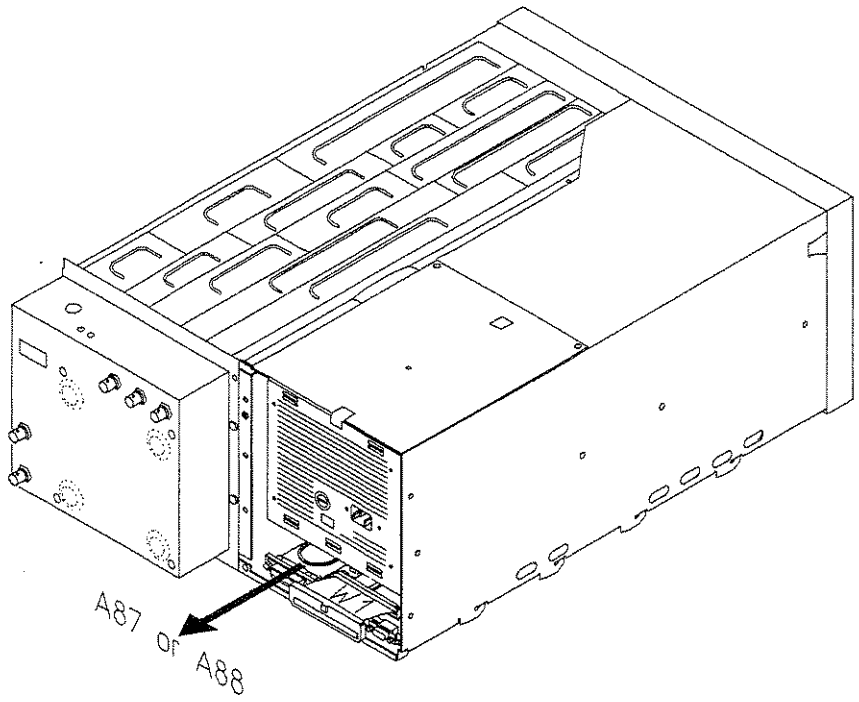


Figure 2-5. Memory

Caution

Do NOT remove the 3 screws that are marked with an X on the illustration. The Power Supply assembly will be damaged if the center screw is removed.
Do NOT remove the earth ground (green/yellow wire) from the Power Supply assembly or the analyzer's chassis.

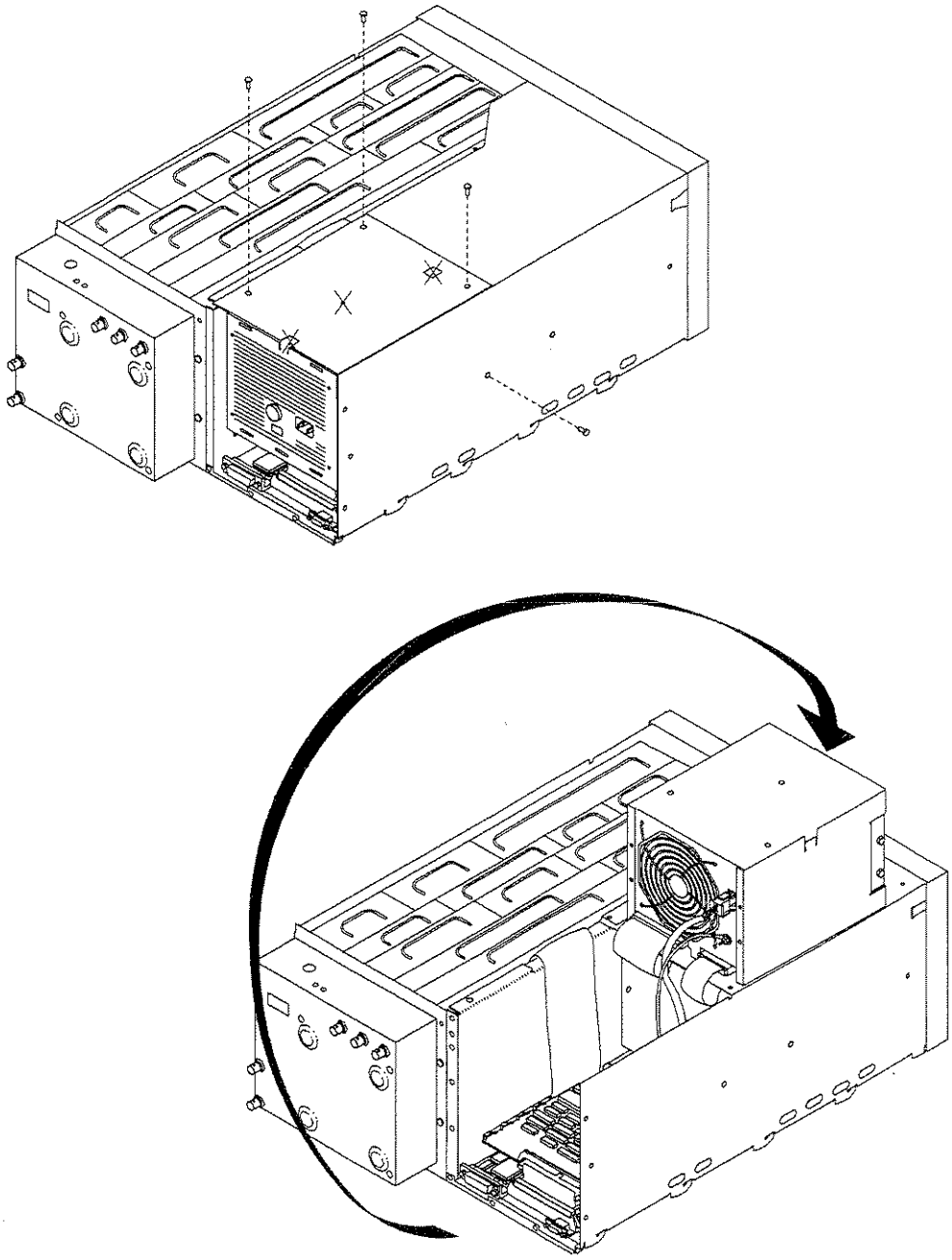


Figure 2-6. Power Supply

Note

Follow these steps when replacing the Front Panel assembly:
Connect the power cable and front-panel cable to the Front Panel assembly.
With the top of the Front Panel assembly tilted away from the analyzer, align the 3 plastic flanges (on the bottom of the Front Panel assembly) with the slots in the chassis.
Align the BNC dress plate with the BNC connectors.
Align the disk drive slot on the Front Panel assembly with the disk drive bezel.
Push the top of the Front Panel assembly back, snapping the 3 clips into place.

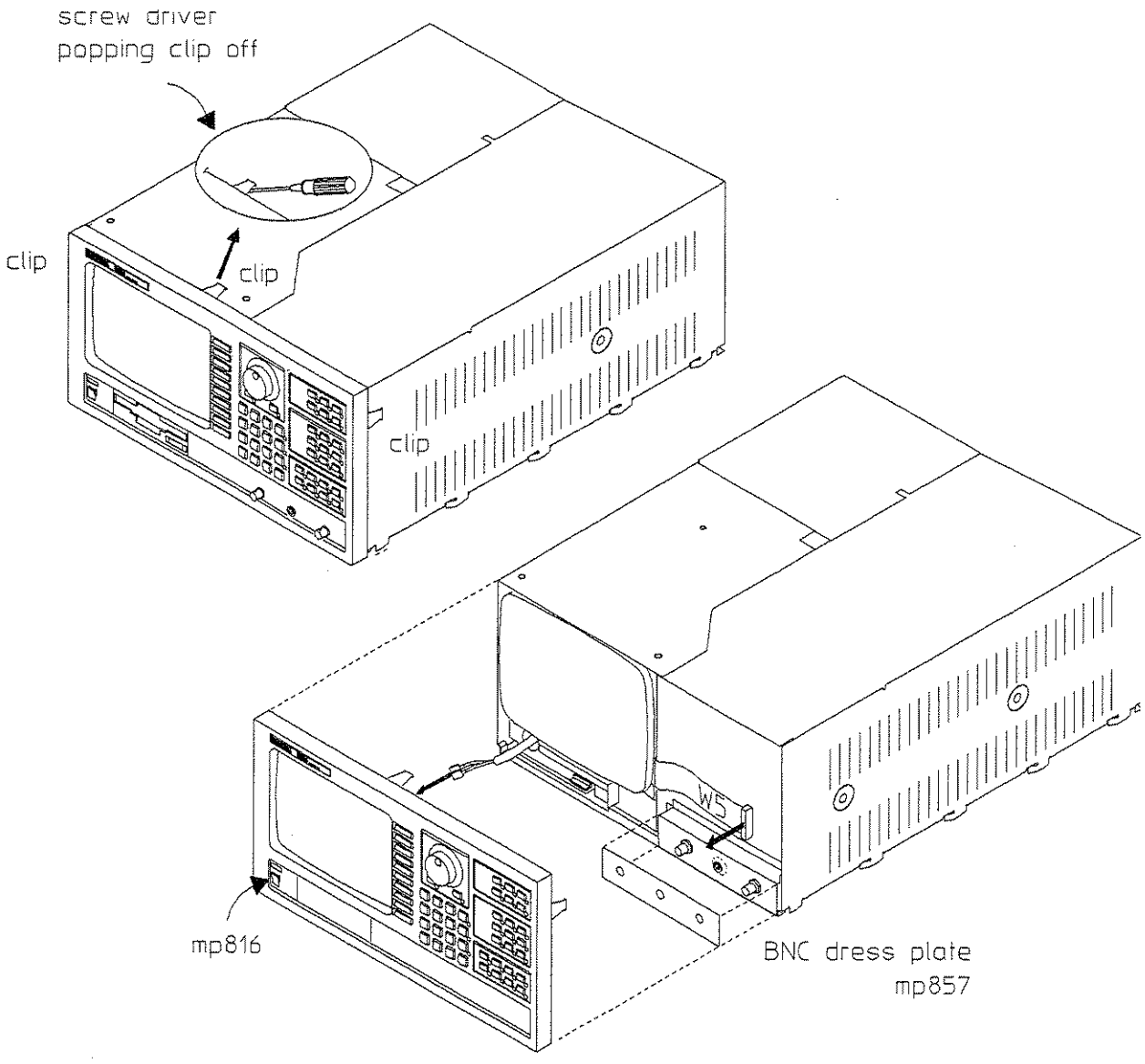


Figure 2-7. Front Panel

Note

When reinstalling the CPU assembly, connect the display cable before placing the CPU assembly in position.

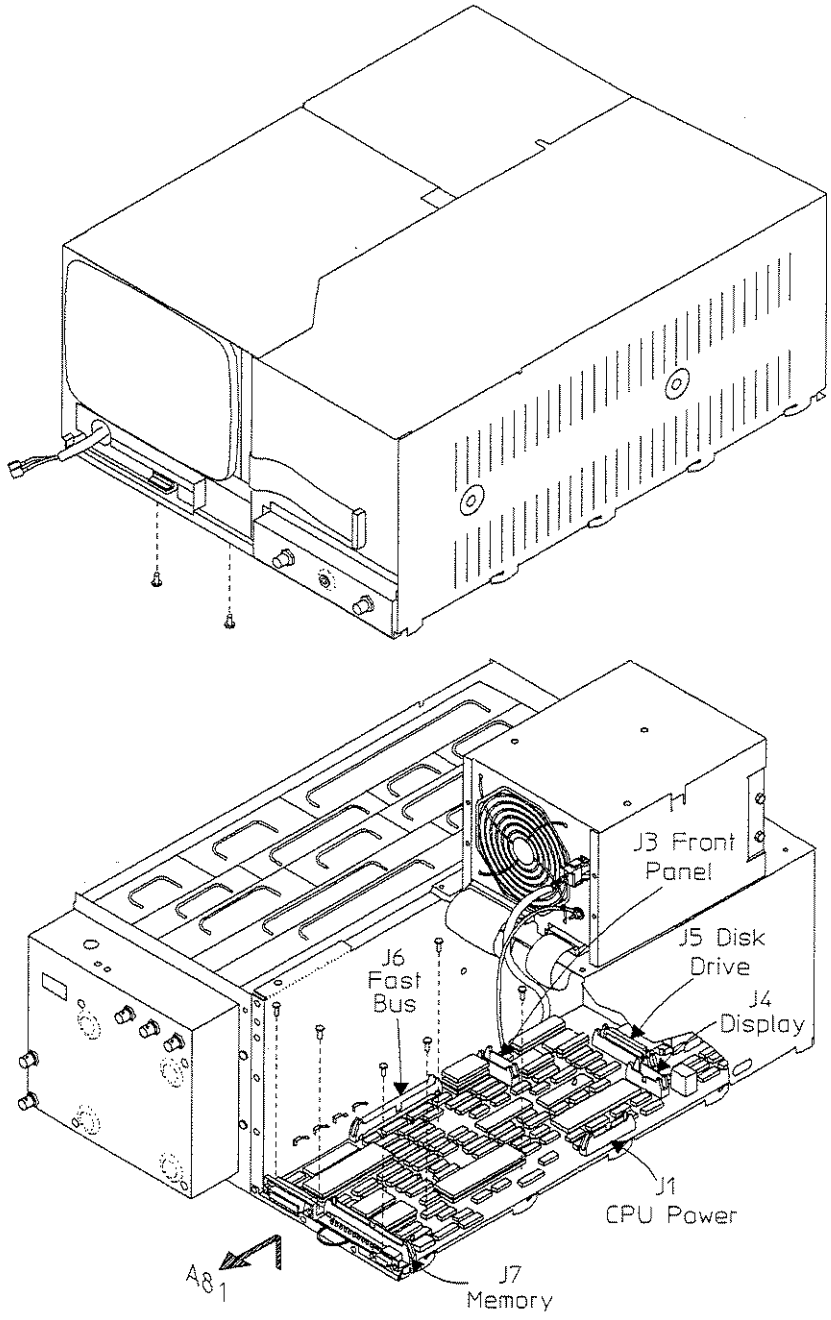


Figure 2-8. CPU

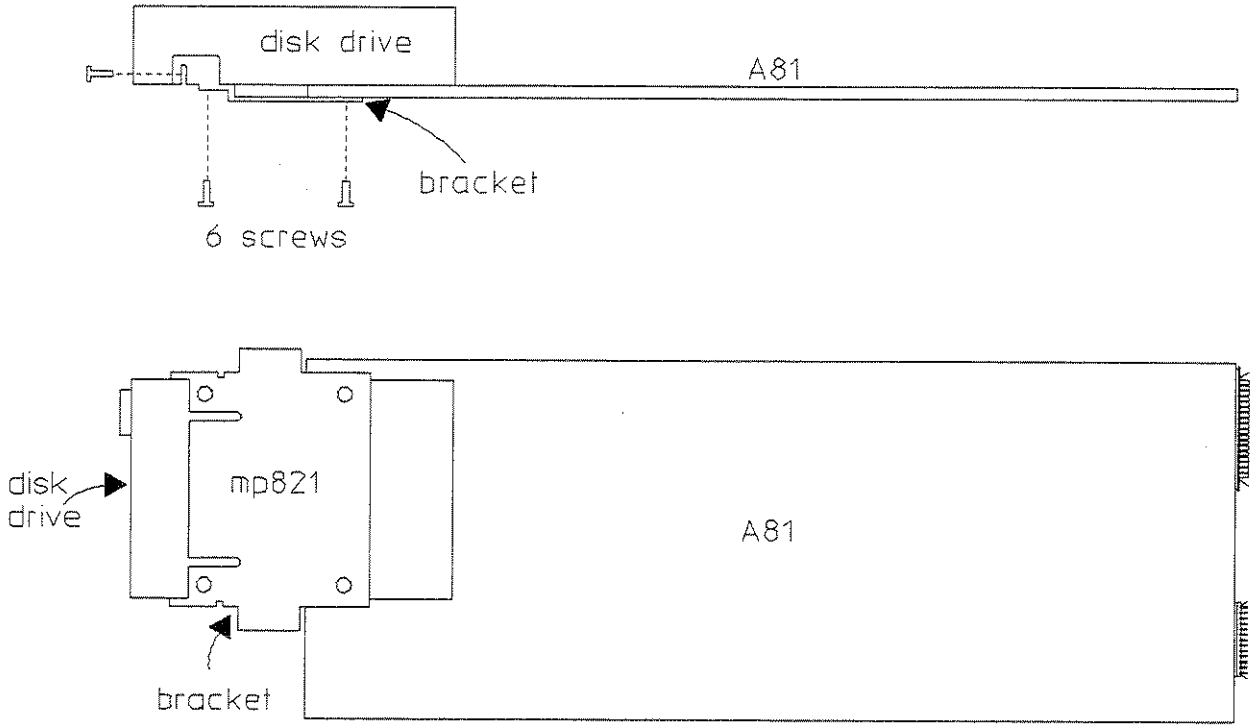


Figure 2-9. Disk Drive

Caution When replacing the Display assembly, be careful to keep the front-panel cable flat against the inside center wall.

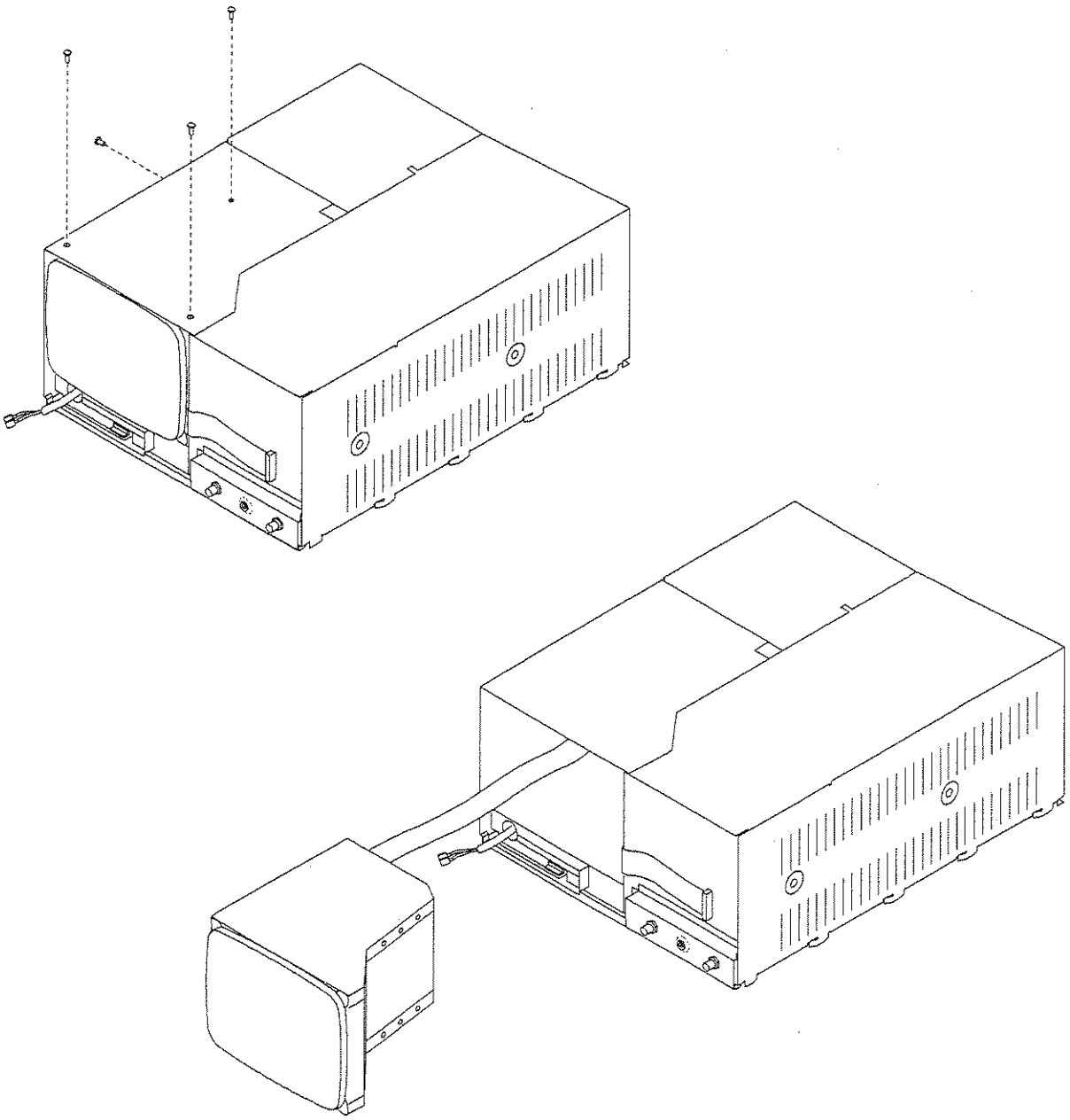


Figure 2-10. Display

Caution

Before positioning the fan/oven housing against the chassis, connect the cable from the motherboard to the assembly, and carefully route the cable from the motherboard around the fan and the RF cables through the slots in the chassis.

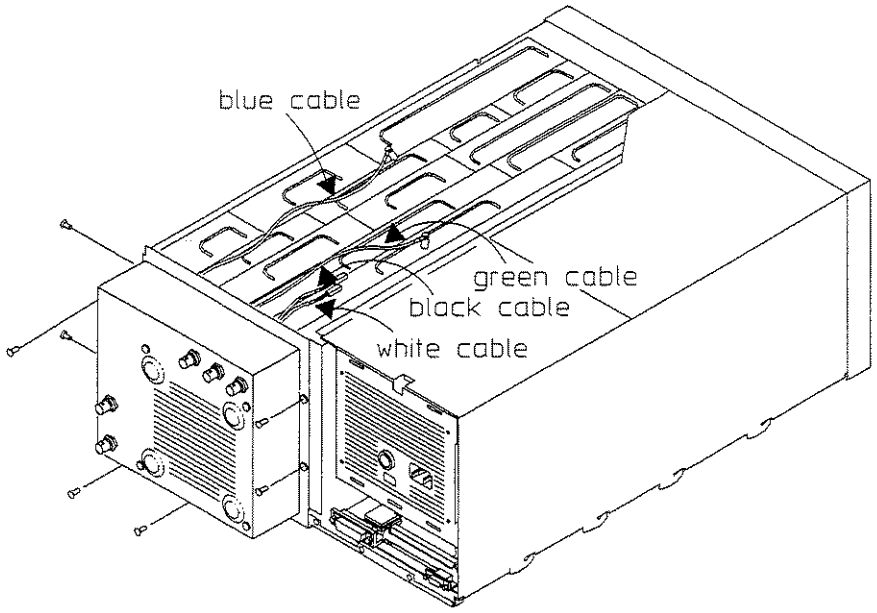


Figure 2-11. Fan/Oven Housing

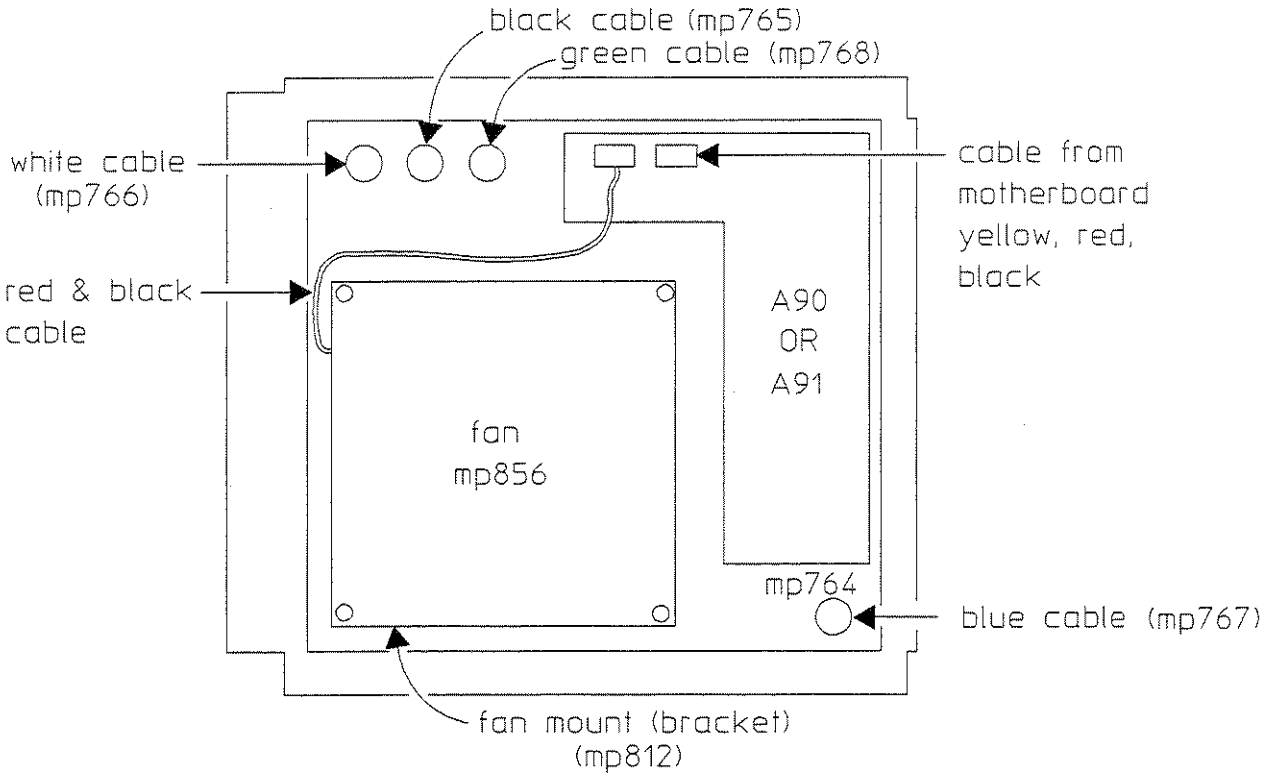


Figure 2-12. Fan/Oven

Note Connect motherboard power cable before placing card nest in chassis.

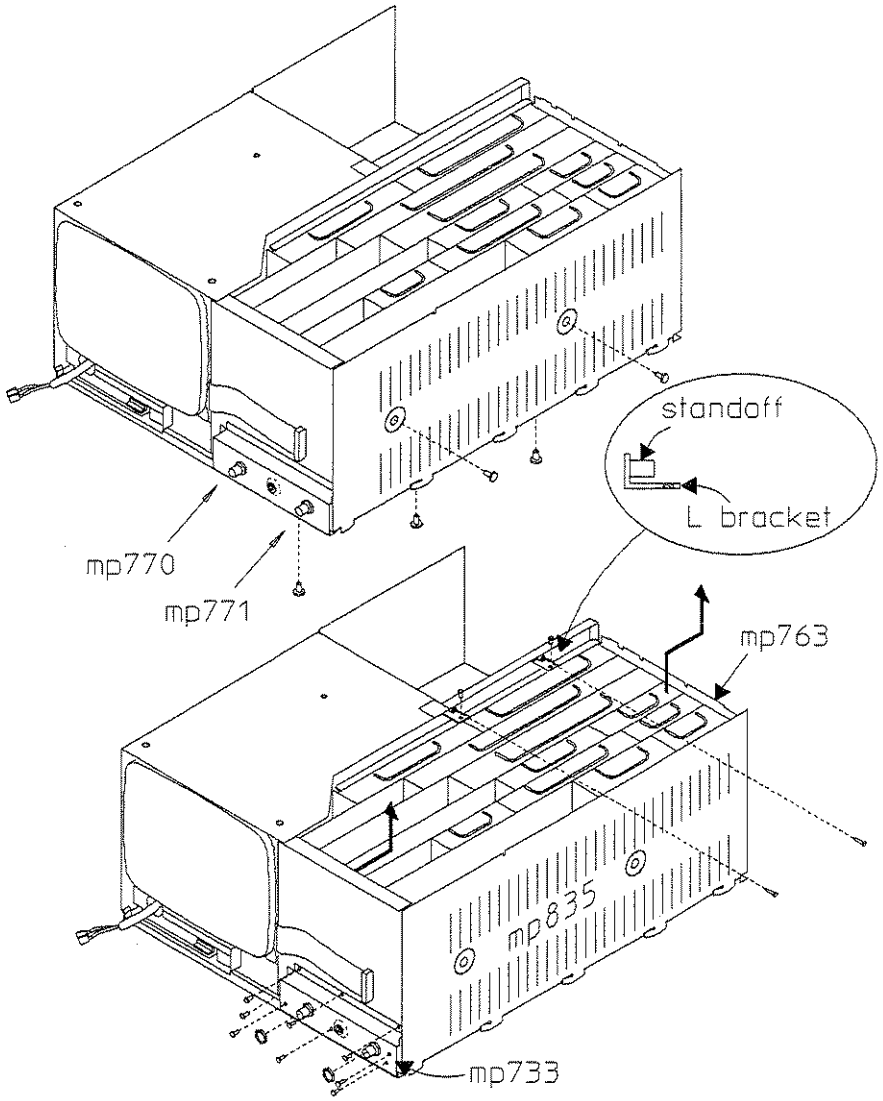


Figure 2-13. Card Nest

Section III

Manual Backdating

Introduction

This section provides information necessary to modify this manual for instruments that differ from those currently being produced. The information in this section documents earlier instrument configurations and associated servicing procedures.

With the information provided in this section, this manual can be corrected so that it applies to any earlier version or configuration of the instrument. To adapt this manual to your instrument, see table 3-1 and make all the changes listed opposite your instrument serial number. Later versions of the instrument are documented in the Manual Changes Supplement.

Manual Changes Supplement

As Hewlett-Packard continues to improve the performance of the HP 3588A, corrections and modifications to the manual may be required. Required changes are documented by a yellow Manual Changes supplement and/or revised pages. To keep the manual up-to-date, periodically request the most recent supplement, available from the nearest Hewlett-Packard sales and service office (for office locations, see the listing at the back of this manual).

Manual Changes Instructions

Table 3-1. Manual Changes

Instrument Serial Number	Make Manual Changes
3005A00100 to 3005A00647	A

Change A

Page 2-6, Table 2-3. Assemblies:

Change the HP part number for MP859 to 03588-60204.

Page 2-10, Table 2-5. Hardware:

Change the part number for MP857 to 03588-34301 and add MP834, Mold Disk Eject Button, HP part number 35672-47401.

Section IV

Circuit Descriptions

Introduction

This section contains the overall instrument description and individual assembly descriptions for the HP 3588A Spectrum Analyzer. The overall instrument description lists the assemblies in the HP 3588A and describes the instrument's overall block diagram. The assembly descriptions give additional information for each assembly. This section also contains the following:

- Voltage and signal distribution tables
- Signal descriptions
- Calibration routine descriptions
- Power-on and preset states

Overall Instrument Description

The HP 3588A Spectrum Analyzer is a high performance, 10 Hz to 150 MHz, synthesized spectrum analyzer offering swept spectrum and narrow-band zoom measurements. Swept spectrum mode uses digital IF filters that allow increased measurement speed (up to four times faster than conventional swept-tuned analyzers for comparable measurements) with no additional amplitude error or resolution loss. Narrow-band zoom uses an implementation of the Fast Fourier Transform to provide even faster measurements (up to 350 times faster than conventional swept-tuned analyzers for comparable measurements) with even greater resolving power. Narrow-band zoom mode can be used for spans of 40 kHz and less.

The HP 3588A Spectrum Analyzer also has a built-in source with programmable amplitude that allows scalar network measurements. Measurements can be saved using the optional internal 3.5-inch flexible disk drive or the internal non-volatile memory. Plots and prints of the measurements can be made directly to HP-IB printers and plotters. The HP 3588A Spectrum Analyzer also supports the HP Instrument BASIC programming language (IBASIC).

Overall Block Diagram

Figure 4-1 shows the overall block diagram for the analyzer. Each block in the diagram represents a functional block in the instrument. The assembly (or assemblies) that performs the function is listed in the block.

The **Input/Conversion** and **IF/ADC** together function as the analyzer's receiver. Input/Conversion prepares the input signal for analog-to-digital conversion. Figure 4-2 shows the signal flow to and from each assembly in the Input/Conversion block. The IF further prepares the input signal and then the ADC converts the signal from analog to digital. Figure 4-3 shows the signal flow to and from each assembly in the IF/ADC block.

The **Sum/Step Loop** and **Fractional-N** together function as the analyzer's local oscillator. The Sum/Step Loop provides the Fractional-N, Input/Conversion, and Source blocks with a signal that can sweep from 310.1875 to 460.1875 MHz. Figure 4-4 shows the signal flow to and from each assembly in the Sum/Step Loop block. The Fractional-N provides the Sum/Step Loop block with a signal that can sweep from 3 to 11 MHz and the single loop control voltage. Figure 4-5 shows the signal flow to and from each assembly in the Fractional-N block.

The **Frequency Reference** provides both high and low frequency reference signals, a sweep synchronization signal, a trigger signal, and a precision amplitude signal for calibration. Figure 4-6 shows the signal flow to and from each assembly in the Frequency Reference block.

The **Source** provides the tracking source output for the analyzer. Its frequency tracks the tuned receiver frequency, providing an output signal that can sweep from 10 Hz to 150 MHz. Its amplitude can be adjusted from +10 to –59.9 dBm. The Source also provides the normalization signal to the Input/Conversion block and the calibration signal to the Frequency Reference block. Figure 4-7 shows the signal flow to and from each assembly in the Source block.

The optional **Oven** provides a stable 10 MHz frequency reference. A BNC-to-BNC jumper from OVEN REF OUT to EXT REF IN (on the rear panel) connects this signal to the Frequency Reference block.

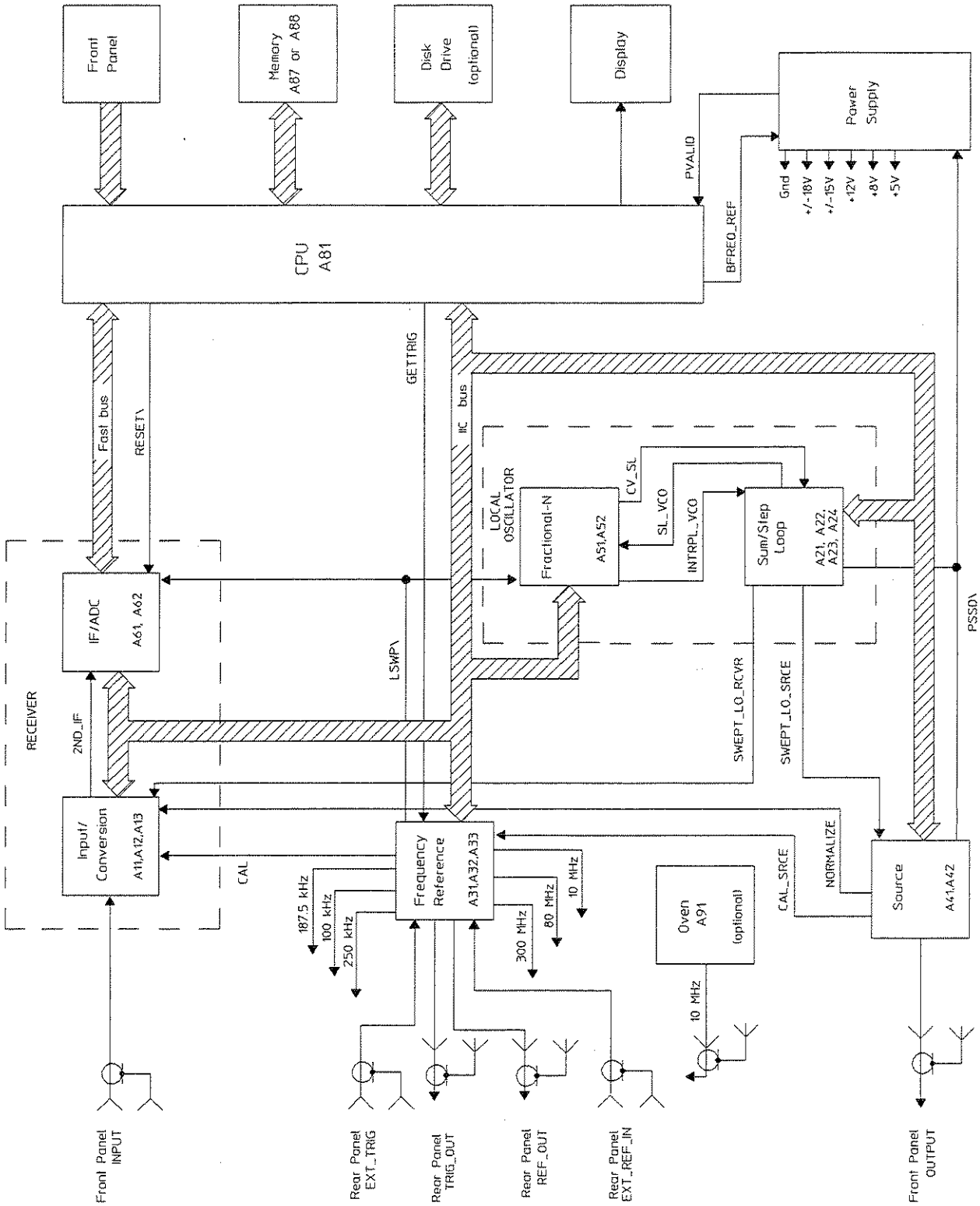


Figure 4-1. Overall Block Diagram

The **CPU** controls the analyzer. The following is a partial list of the operations it performs:

- Configures the assemblies
- Controls the Disk Drive assembly
- Controls the Display assembly
- Controls the HP-IB interface
- Initiates the power-up sequence and calibration routine
- Processes digital data from the ADC/Digital Filter assembly
- Computes the Fast Fourier Transform (FFT)
- Monitors for a front panel keystroke
- Monitors the assemblies for overloads or other error conditions
- Runs the self tests

The optional **Disk Drive** stores and retrieves information on 3.5-inch flexible disks.

The **Memory** contains RAM, NVRAM, and ROM for the CPU. The RAM is dynamic and all refresh circuitry is located with the RAM.

The **Display** offers a view of the processed data. It is controlled by the CPU. See the description of the Display Controller for the "A81 CPU" later in this section for further details.

The **Front Panel** allows interaction with the analyzer. It consists of hardkeys, softkeys, an RPG, an Inter-IC (IIC) interface, and a plastic diffuser-screen for the Display.

The **Power Supply** provides the dc voltages shown in figure 4-1. See "Voltage and Signal Distribution" later in this section for further information.

Assemblies

The HP 3588A Spectrum Analyzer consists of the assemblies shown below.

- A11 Input
- A12 First Conversion
- A13 Second Conversion
- A21 Sum VCO
- A22 Sum Phase Detector
- A23 Step Phase Detector
- A24 Step VCO
- A31 Reference/Calibrator
- A32 300 MHz
- A33 Trigger
- A41 Source Amplifier
- A42 Source Conversion
- A51 Interpolation VCO
- A52 Fractional-N
- A61 IF
- A62 ADC/Digital Filter
- A81 CPU
- A87 Memory
- A88 Expanded Memory (optional)
- A90 Fan Power
- A91 Fan Power/Oven (optional)
- A99 Motherboard
- Power Supply
- Disk Drive
- Display
- Front Panel

Note

In this section, the block diagrams show the connector numbers for signals routed through RF cables. The block diagrams do *not* show connector numbers for signals routed through the Motherboard assembly.

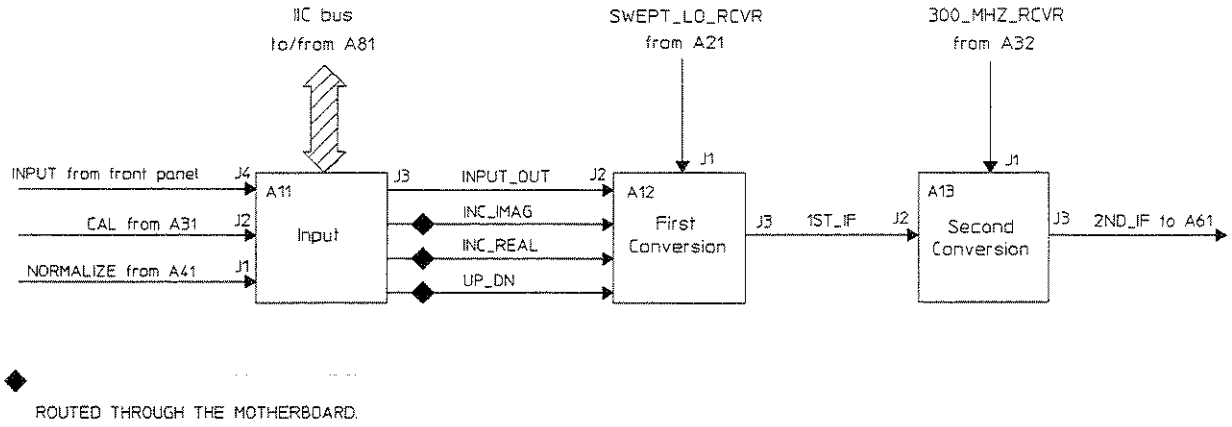


Figure 4-2. Input Conversion Block Diagram

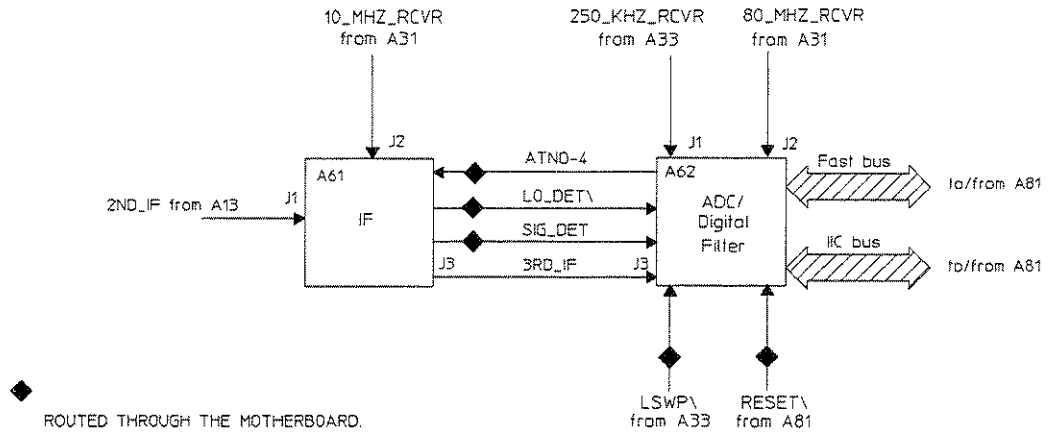


Figure 4-3. IF/ADC Block Diagram

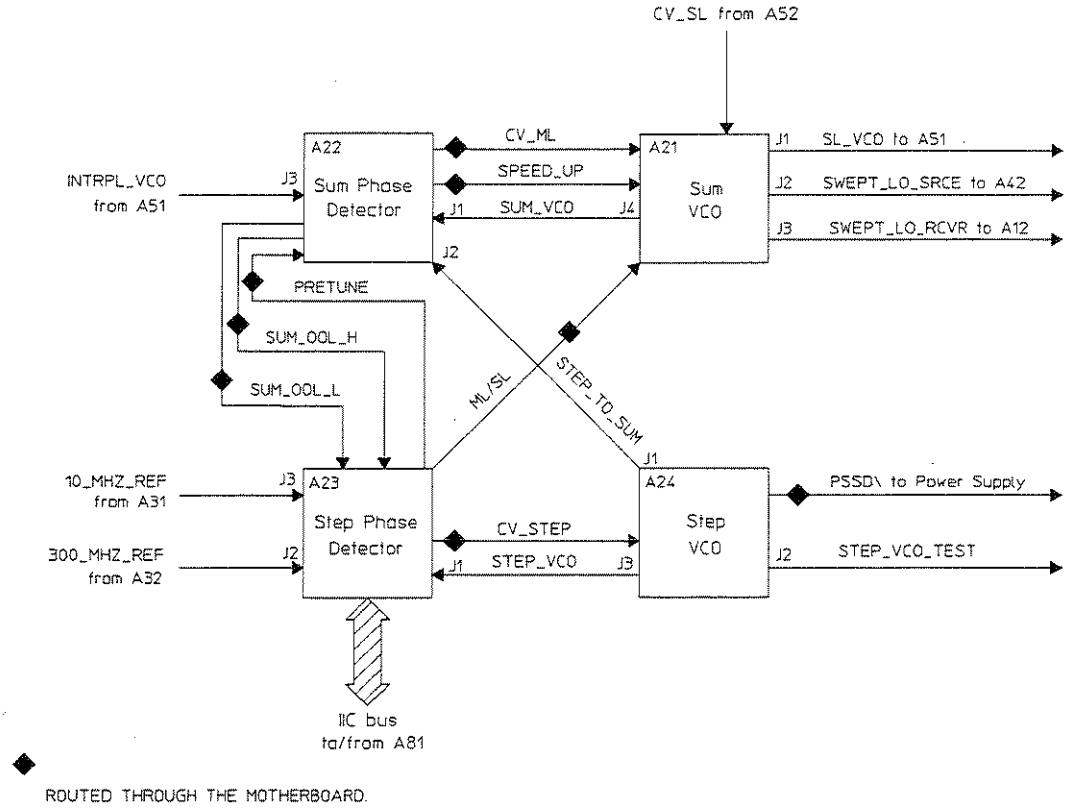


Figure 4-4. Sum and Step Loop Block Diagram

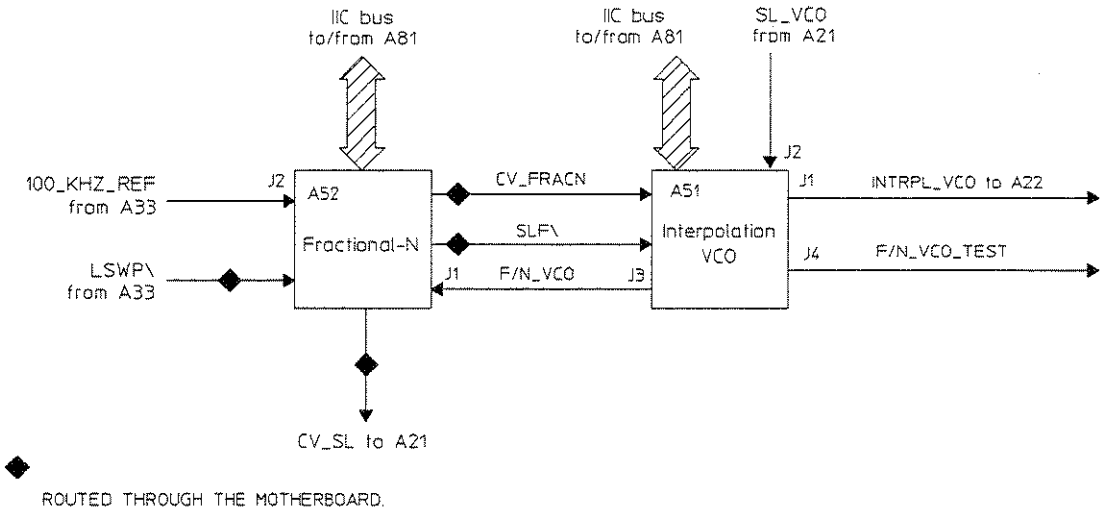


Figure 4-5. Fractional-N Block Diagram

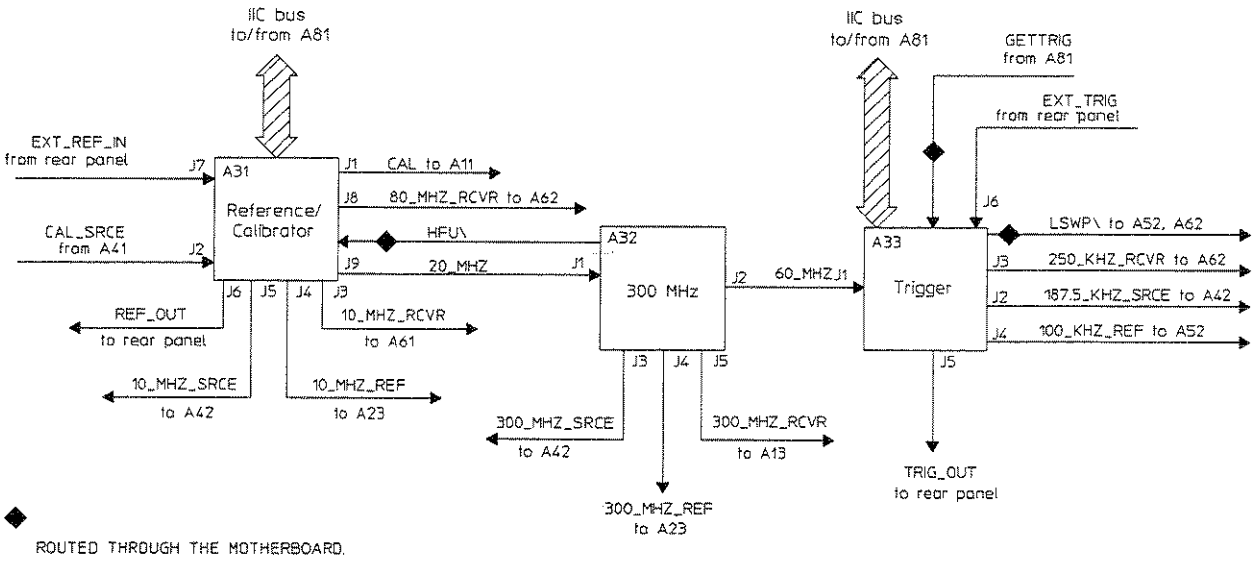


Figure 4-6. Frequency Reference Block Diagram

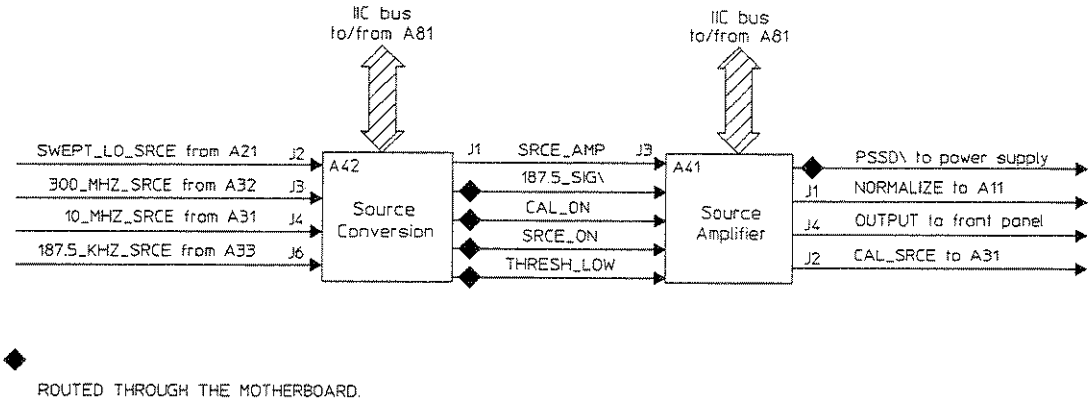


Figure 4-7. Source Block Diagram

A11 Input

The Input assembly is the first of five assemblies that condition the input signal before it is sent to the CPU assembly in digital form. The input signal can be a signal (10 Hz to 150 MHz) that is connected to the front-panel input connector, the normalization signal from the Source Amplifier assembly, or the calibration signal from the Reference/Calibrator assembly. Figure 4-8 shows the Input assembly's block diagram.

The **Input Switching** circuit selects either the signal connected to the front-panel input connector, the calibration signal from the Reference/Calibrator assembly, or the normalization signal from the Source Amplifier assembly. It then routes the selected signal to either the 50Ω or the 1 MΩ input impedance path.

The **1M Ohm Buffer** provides a 1 MΩ impedance path for the input signal. This circuit conditions the input signal using a 20 dB attenuator pad, a flatness service adjustment, and a 1MΩ input amplifier. Its maximum input level is –13 dBV and its output impedance is 50Ω.

The **50 Ohm Attenuator** provides a 50Ω impedance path for the input signal. This circuit attenuates the input signal using one 10 dB and two 20 dB attenuator pads. Its maximum input level is +20 dBm and its output impedance is 50Ω.

The **Input Amplifier** increases the input signal's amplitude by 5 dB and provides 50Ω output impedance to both the 150 MHz Low Pass Filter and the Autorange Detector.

The **150 MHz Low Pass Filter** attenuates signals greater than 150 MHz.

The **Autorange Detection** circuit compares the input signal to a service adjustable "range up" and "range down" threshold. The CPU assembly monitors the result of this comparison and then sets the 50Ω attenuators so the largest signal amplitude is at a level that displays maximum dynamic range.

The **Overload Protection** circuit monitors the 50Ω impedance path. If an overload occurs, this circuit causes the relays in Input Switching to disconnect the input signal.

The **IIC Interface** provides the interface between the CPU assembly and the Input assembly, and it provides the control lines that null local oscillator feedthrough on the First Conversion assembly. It also interrupts the CPU assembly if a range up, range down, or overload condition is detected.

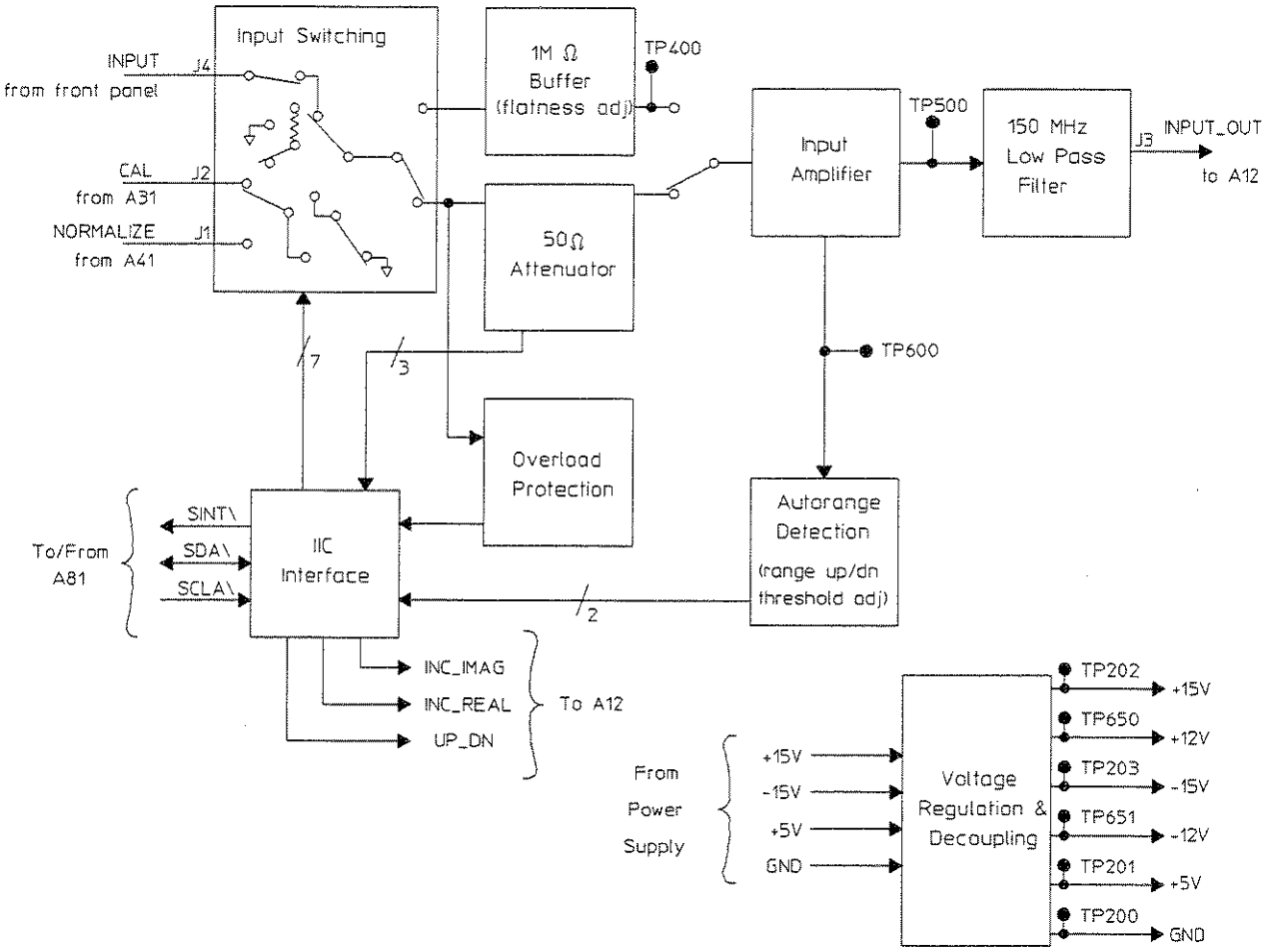


Figure 4-8. A11 Input Block Diagram

A12 First Conversion

The First Conversion assembly is the second of five assemblies that condition the input signal. This assembly mixes the swept LO signal with the signal from the Input assembly. The resulting 310.1875 MHz signal is routed to the Second Conversion assembly. Figure 4-9 shows the First Conversion assembly's block diagram.

The **First Conversion Mixer/Driver** first increases the amplitude of the swept LO signal (310.1875 to 460.1875 MHz) to +17 dBm at the mixer input. It then mixes the swept signal with the input signal. At the output of this circuit, a bandpass diplexer attenuates signals away from the 310.1875 MHz IF signal.

The **LO Feedthrough Cancellation** circuit generates a signal that reduces LO feedthrough. During calibration, LO feedthrough is measured and the information is sent to the CPU assembly. The CPU assembly then adjusts the amplitude and phase of the LO feedthrough cancellation signal using three control lines from the Input assembly.

The **First IF Amplifier** increases the amplitude of the 310.1875 MHz signal by approximately 15 dB. Between this circuit's two gain stages, it adds the LO feedthrough cancellation signal to the input signal. At the output of this circuit, a low pass filter attenuates signals greater than 350 MHz.

The **First IF Bandpass Filter** (a service adjustable helical resonator filter) attenuates signals out of the passband centered at 310.1875 MHz.

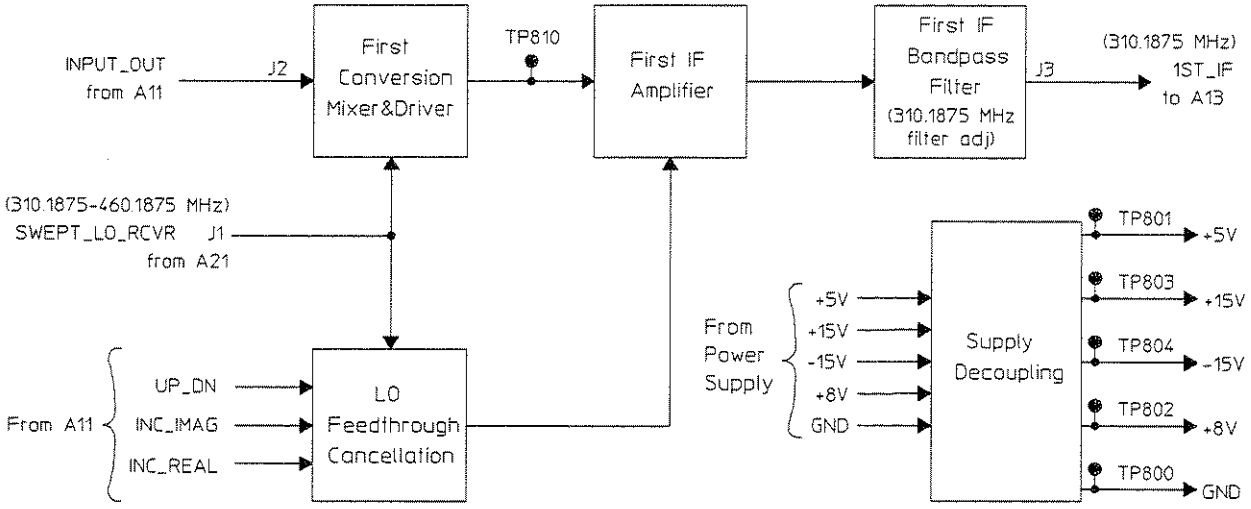


Figure 4-9. A12 First Conversion Block Diagram

A13 Second Conversion

The Second Conversion assembly is the third of five assemblies that condition the input signal. This assembly mixes a 300 MHz frequency reference with the 310.1875 MHz signal from the First Conversion assembly. The resulting 10.1875 MHz signal is routed to the IF assembly. Figure 4-10 shows the Second Conversion assembly's block diagram.

The **350 MHz Low Pass Filter** attenuates signals greater than 350 MHz.

The **Second Conversion Mixer/Driver** increases the amplitude of the 300 MHz reference signal to +17 dBm at the mixer input. It then mixes the reference signal with the 310.1875 MHz IF signal.

The **12 MHz Low Pass Filter** attenuates signals above the 10.1875 MHz second IF frequency.

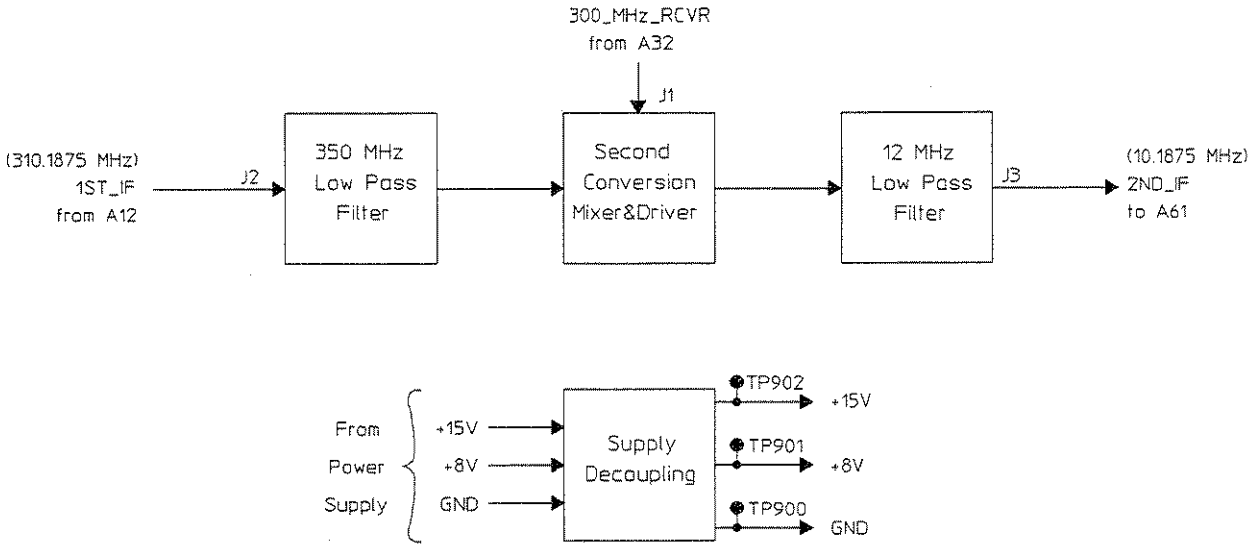


Figure 4-10. A13 Second Conversion Block Diagram

A21 Sum VCO

The Sum VCO assembly is one of six assemblies that together function as the analyzer's local oscillator. This assembly is used when the local oscillator operates in either single loop mode or multiple loop mode (see figures 4-12 and 4-13). The Sum VCO assembly provides four signals that can sweep from 310.1875 to 460.1875 MHz. Two of these signals provide feedback — one to close the single loop mode's single loop and another to close the multiple loop mode's sum loop. The other two signals provide the swept LO signal for the First Conversion assembly and the Source Conversion assembly. Figure 4-11 shows the Sum VCO assembly's block diagram.

In single loop mode, the **Control Voltage Switch** connects the single loop control voltage to the Sum Loop VCO. In multiple loop mode, this switch connects the multiple loop control voltage to the Sum Loop VCO. If multiple loop mode's sum loop is unlocked, the Out of Lock Detector on the Sum Phase Detector assembly provides a control line to this circuit that speeds up the sum loop's settling time. The IIC Interface on the Step Phase Detector assembly provides the control line that selects multiple or single loop mode. This switch also provides the control line for the Single Loop Bias Shutdown Switch.

The **Sum Loop VCO** generates a signal that can sweep from 310.1875 to 460.1875 MHz. The multiple or single loop control voltage controls the VCO's frequency. This circuit also contains two service adjustments — one to improve the spectral purity of the VCO and the other to improve the tracking of the sum loop VCO and step loop VCO to each other.

The **Sum Loop Buffers** route the swept signal through four buffered signal paths that are current biased by the **Amplifier Current Sources**.

In multiple loop mode, the **Single Loop Bias Shutdown Switch** turns off the current biasing for the single loop VCO signal path.

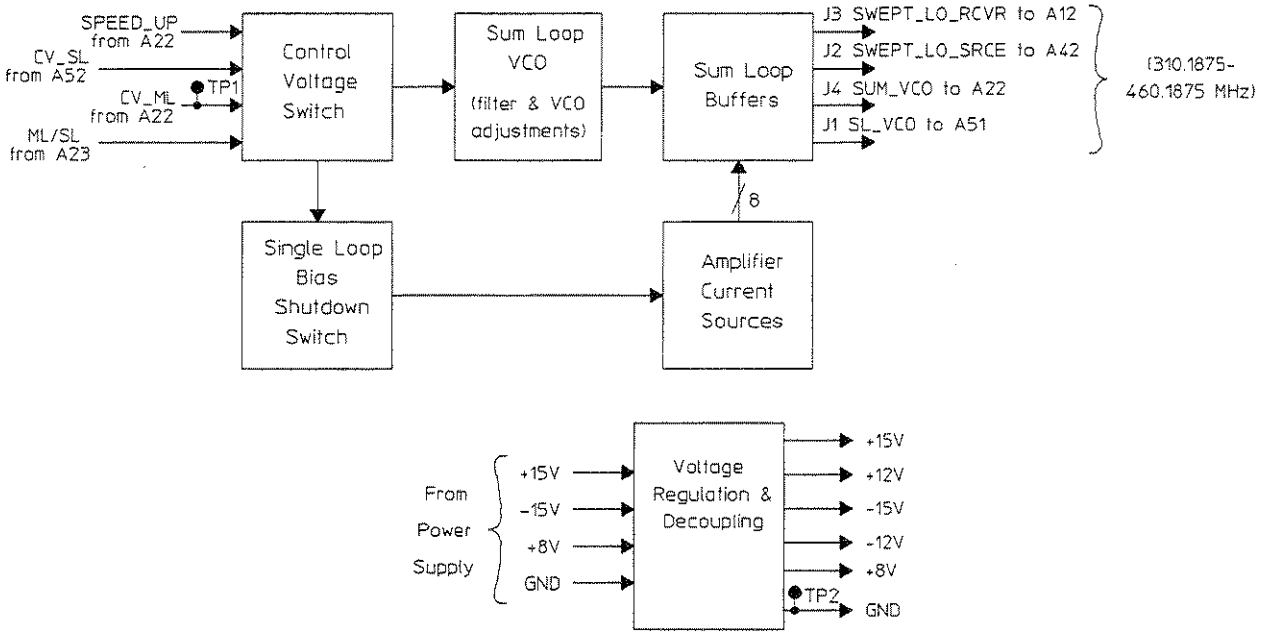


Figure 4-11. A21 Sum VCO Block Diagram

Note

The analyzer's local oscillator operates in either single loop mode or multiple loop mode. The CPU assembly selects which mode based on the frequency span, resolution bandwidth, and sweep time of the measurement. Single loop mode allows the fastest sweep time, and multiple loop mode provides better phase noise and spurious performance. Therefore, the local oscillator uses multiple loop mode for all narrow-band zoom measurements and for swept spectrum measurements with slow sweep time, narrow frequency span, and narrow resolution bandwidth, and single loop mode for all other swept spectrum measurements.

In single loop mode, the local oscillator uses one PLL (phase-locked loop) — single loop (see figure 4-12). In multiple loop mode, the local oscillator uses three PLLs — step loop, interpolation loop, and sum loop (see figure 4-13).

In the single loop, the feedback signal (SL_VCO) is divided by ten. The resulting signal (F/N_VCO) is then divided down to 100 kHz. The phases of the divided signal and the 100 kHz reference signal (100_KHZ_REF) are compared and integrated by the integrator. The output voltage of the integrator becomes the control voltage (CV_SL) for the sum VCO. The output of the sum VCO is routed to three signal paths — one provides feedback (SL_VCO) for the single loop, and the other two provide the swept LO for the source and receiver (SWEPT_LO_SRCE and SWEPT_LO_RCVR).

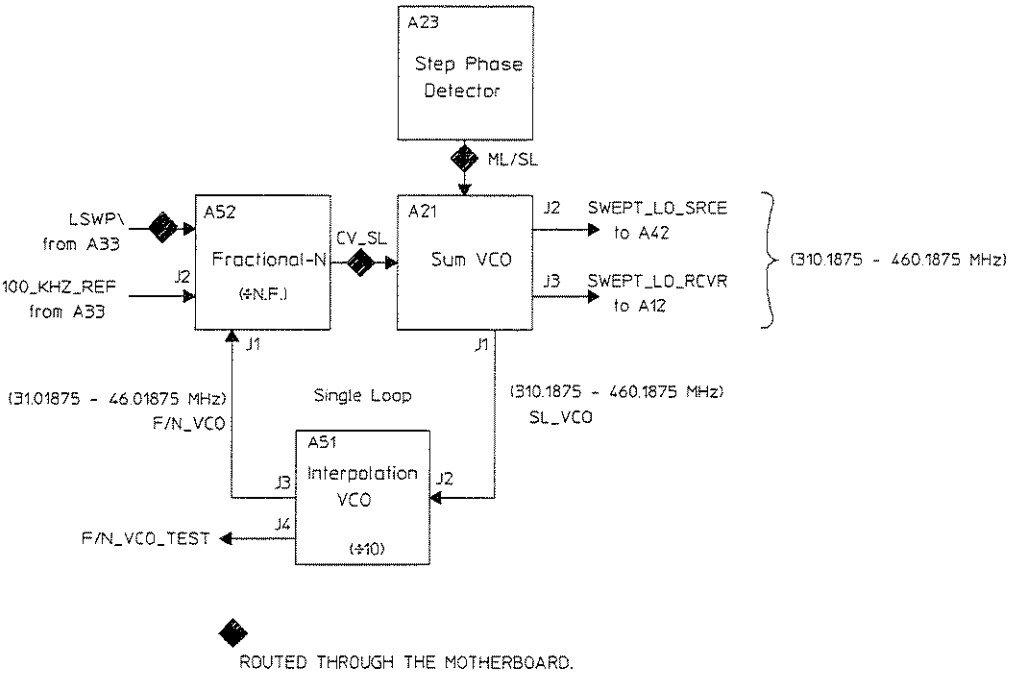


Figure 4-12. Local Oscillator in Single Loop Mode

Note

In the interpolation loop (see figure 4-13), the feedback signal (F/N_VCO) is divided down to 100 kHz. The phases of the divided feedback signal and the 100 kHz reference signal (100_KHZ_REF) are then compared, and integrated by the integrator. The output voltage of the integrator becomes the control voltage (CV_FRACN) for the interpolation VCO. The output of the interpolation VCO is routed to two signal paths — one provides feedback (F/N_VCO) to close the interpolation loop, and the other provides a signal that is divided by 5 or 10, then sent to the sum loop for fine frequency tuning (INTRPL_VCO).

In the step loop, the feedback signal (STEP_VCO) is mixed with the 300 MHz frequency reference (300_MHZ_REF). The difference frequency is divided down to 2 or 5 MHz. The 10 MHz frequency reference (10_MHZ_REF) is also divided down to 2 or 5 MHz. The phases of the two signals are compared, and integrated by the integrator. The output voltage of the integrator becomes the control voltage (CV_STEP) for the step VCO and the pretune voltage (PRETUNE) for the sum loop. The output of the step VCO is routed to two signal paths — one provides feedback (STEP_VCO) to close the step loop, and the other provides the sum loop with a phase reference (STEP_TO_SUM).

In the sum loop, the feedback signal (SUM_VCO) is mixed with the step signal (STEP_TO_SUM). The phases of the difference frequency and the interpolation VCO (INTRPL_VCO) are then compared, and integrated by the integrator. Pretune voltage (PRETUNE) is added to the output voltage of the integrator (to ensure that the sum loop can phase lock), and the resulting voltage becomes the control voltage (CV_ML) for the sum VCO. The output of the sum VCO is routed to three signal paths — one provides feedback to close the sum loop (SUM_VCO), and the other two provide the swept LO for the source and receiver (SWEPT_LO_SRCE and SWEPT_LO_RCVR).

The divide by numbers and frequencies that generate the lower swept LO frequencies (310.1875 to 341 MHz) are labeled **L**. The divide by numbers and frequencies that generate the higher swept LO frequencies (341 to 460.1875 MHz) are labeled **H**. See table 4-1 for a matrix of frequencies when the local oscillator is in multiple loop mode.

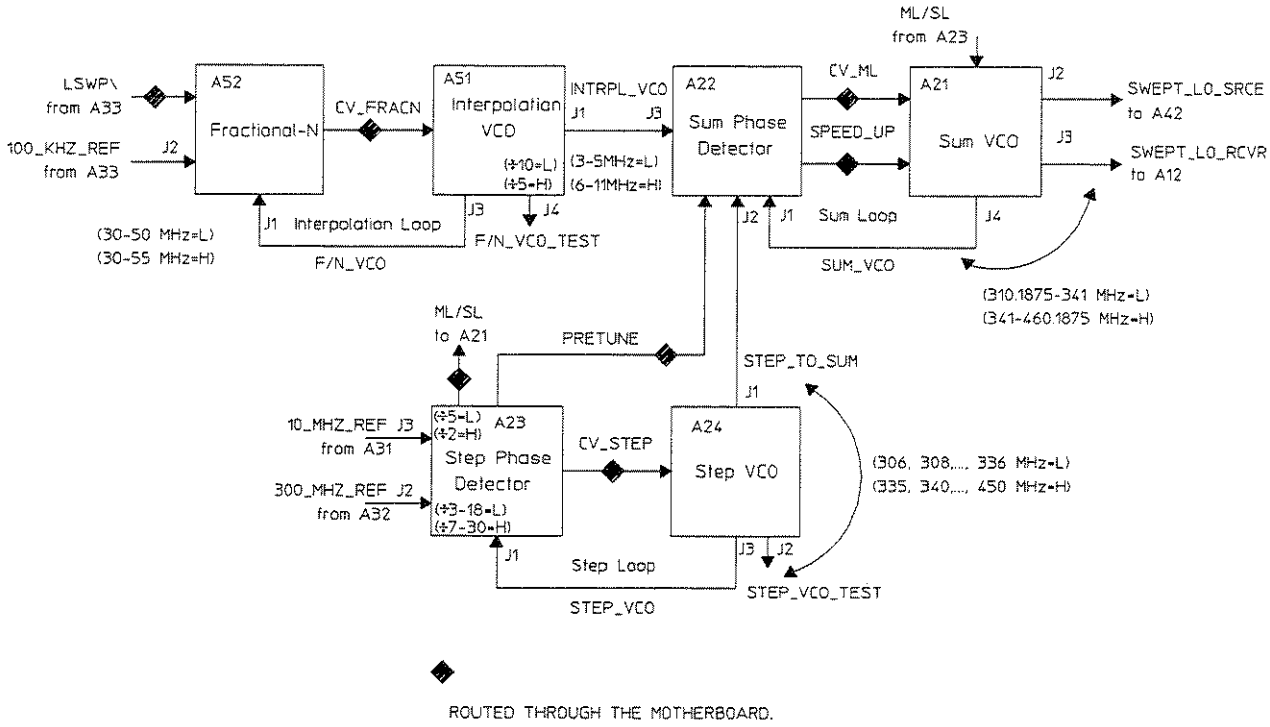


Figure 4-13. Local Oscillator in Multiple Loop Mode

Table 4-1. Multiple Loop Mode Frequency Matrix

Measurement Freq		Sum VCO		Step VCO		F/N VCO		Intrpl VCO	
Start ≥ (MHz)	Stop < (MHz)	Start (MHz)	Stop (MHz)	Freq (MHz)	Divide By N	Start (MHz)	Stop (MHz)	Start (MHz)	Stop (MHz)
0.0	0.8125	310.1875	311.0	306	3	41.875	50.0	4.1875	5.0
0.8125	2.8125	311.0	313.0	308	4	30.0	50.0	3.0	5.0
2.8125	4.8125	313.0	315.0	310	5	30.0	50.0	3.0	5.0
4.8125	6.8125	315.0	317.0	312	6	30.0	50.0	3.0	5.0
6.8125	8.8125	317.0	319.0	314	7	30.0	50.0	3.0	5.0
8.8125	10.8125	319.0	321.0	316	8	30.0	50.0	3.0	5.0
10.8125	12.8125	321.0	323.0	318	9	30.0	50.0	3.0	5.0
12.8125	14.8125	323.0	325.0	320	10	30.0	50.0	3.0	5.0
14.8125	16.8125	325.0	327.0	322	11	30.0	50.0	3.0	5.0
16.8125	18.8125	327.0	329.0	324	12	30.0	50.0	3.0	5.0
18.8125	20.8125	329.0	331.0	326	13	30.0	50.0	3.0	5.0
20.8125	22.8125	331.0	333.0	328	14	30.0	50.0	3.0	5.0
22.8125	24.8125	333.0	335.0	330	15	30.0	50.0	3.0	5.0
24.8125	26.8125	335.0	337.0	332	16	30.0	50.0	3.0	5.0
26.8125	28.8125	337.0	339.0	334	17	30.0	50.0	3.0	5.0
28.8125	30.8125	339.0	341.0	336	18	30.0	50.0	3.0	5.0
30.8125	35.8125	341.0	346.0	335	7	30.0	55.0	6.0	11.0
35.8125	40.8125	346.0	351.0	340	8	30.0	55.0	6.0	11.0
40.8125	45.8125	351.0	356.0	345	9	30.0	55.0	6.0	11.0
45.8125	50.8125	356.0	361.0	350	10	30.0	55.0	6.0	11.0
50.8125	55.8125	361.0	366.0	355	11	30.0	55.0	6.0	11.0
55.8125	60.8125	366.0	371.0	360	12	30.0	55.0	6.0	11.0
60.8125	65.8125	371.0	376.0	365	13	30.0	55.0	6.0	11.0
65.8125	70.8125	376.0	381.0	370	14	30.0	55.0	6.0	11.0
70.8125	75.8125	381.0	386.0	375	15	30.0	55.0	6.0	11.0
75.8125	80.8125	386.0	391.0	380	16	30.0	55.0	6.0	11.0
80.8125	85.8125	391.0	396.0	385	17	30.0	55.0	6.0	11.0
85.8125	90.8125	396.0	401.0	390	18	30.0	55.0	6.0	11.0
90.8125	95.8125	401.0	406.0	395	19	30.0	55.0	6.0	11.0
95.8125	100.8125	406.0	411.0	400	20	30.0	55.0	6.0	11.0
100.8125	105.8125	411.0	416.0	405	21	30.0	55.0	6.0	11.0
105.8125	110.8125	416.0	421.0	410	22	30.0	55.0	6.0	11.0
110.8125	115.8125	421.0	426.0	415	23	30.0	55.0	6.0	11.0
115.8125	120.8125	426.0	431.0	420	24	30.0	55.0	6.0	11.0
120.8125	125.8125	431.0	436.0	425	25	30.0	55.0	6.0	11.0
125.8125	130.8125	436.0	441.0	430	26	30.0	55.0	6.0	11.0
130.8125	135.8125	441.0	446.0	435	27	30.0	55.0	6.0	11.0
135.8125	140.8125	446.0	451.0	440	28	30.0	55.0	6.0	11.0
140.8125	145.8125	451.0	456.0	445	29	30.0	55.0	6.0	11.0
145.8125	150.0	456.0	460.1875	450	30	30.0	50.9375	6.0	10.1875

A22 Sum Phase Detector

The Sum Phase Detector assembly is one of six assemblies that together function as the analyzer's local oscillator. This assembly is used only when the local oscillator operates in multiple loop mode (see figure 4-13). The Sum Phase Detector assembly generates the multiple loop control voltage for the sum loop. If the control voltage is out of range, this assembly clamps the voltage and tells the CPU assembly. Figure 4-14 shows the Sum Phase Detector assembly's block diagram.

The **Offset Mixer** mixes the sum VCO signal with the step signal. When the sum VCO signal sweeps from 310.1875 to 341 MHz, the step signal steps from 306 to 336 MHz in 2 MHz increments. When the sum VCO signal sweeps from 341 to 460.1875 MHz, the step signal steps from 335 to 450 MHz in 5 MHz increments.

The **Sum Loop Phase Detector** compares the phase of the signal from the Offset Mixer to the phase of the interpolation VCO and generates a voltage relative to the phase difference. When the sum VCO signal is in the range from 310.1875 to 341 MHz, the interpolation signal sweeps from 3 to 5 MHz, and when the sum VCO signal is in the range from 341 to 460.1875 MHz, the interpolation signal sweeps from 6 to 11 MHz.

The **Sum Loop Integrator** integrates the phase difference of the two signals. To ensure that the sum loop can phase lock, pretune voltage is added to the output of the integrator. This voltage provides the control voltage for the multiple loop.

The **Out-of-Lock Detector** clamps the output of the integrator (before the pretune voltage is added) if the amplitude is not within the range of –0.6 to +0.15V. It then tells the CPU assembly that the amplitude is too high or too low, which means the sum loop is unlocked. The Out-of-Lock Detector also provides a control signal, which speeds up the sum loop's settling time when the sum loop is unlocked.

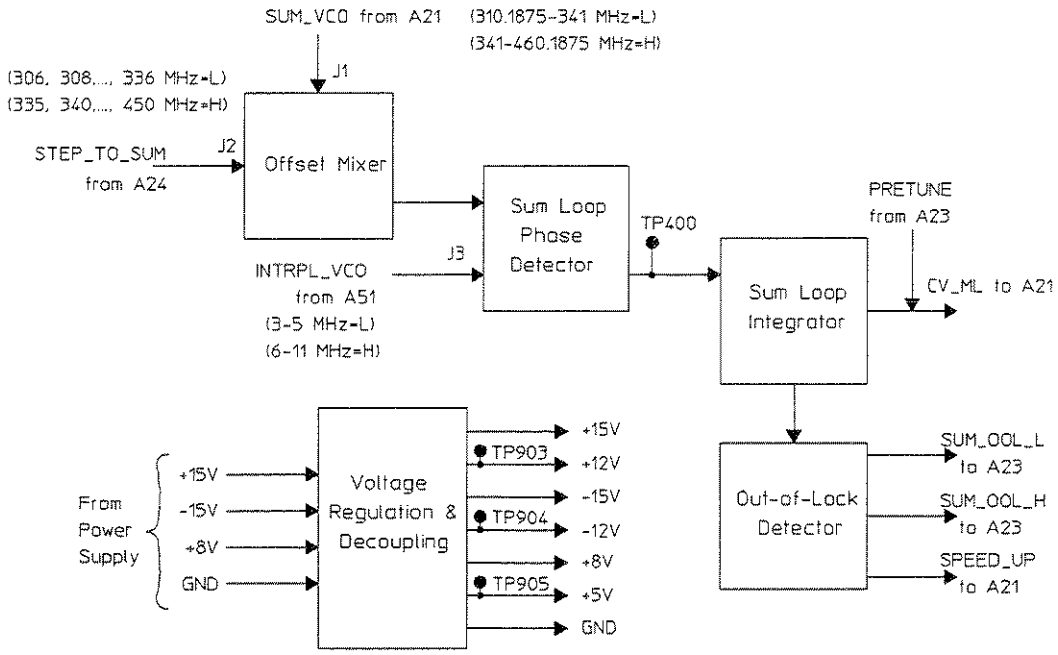


Figure 4-14. A22 Sum Phase Detector Block Diagram

A23 Step Phase Detector

The Step Phase Detector assembly is one of six assemblies that together function as the analyzer's local oscillator. This assembly is used when the local oscillator operates in either single loop mode or multiple loop mode (see figures 4-12 and 4-13). In single loop mode, the Step Phase Detector assembly provides only the loop mode control line. In multiple loop mode, this assembly provides the loop mode control line, the control voltage for the step loop, and the pretune voltage for the sum loop. Figure 4-15 shows the Step Phase Detector assembly's block diagram.

The **Step Loop Offset Mixer** mixes the 300 MHz frequency reference with the stepped VCO signal. It then filters and amplifies the resulting 6 to 150 MHz difference frequency.

The **Divide-by-N Counter** produces either a 2 or 5 MHz signal by dividing the 6 to 150 MHz difference frequency with a number between 3 and 30. When the step VCO signal steps from 306 to 336 MHz in 2 MHz increments, this circuit divides by a number (between 3 and 18) that produces a 2 MHz signal. When the step VCO signal steps from 335 to 450 MHz in 5 MHz increments, this circuit divides by a number (between 7 and 30) that produces a 5 MHz signal.

The **Step Size Divider** divides the 10 MHz frequency reference by 5 when the Divide-by-N Counter selects a number that produces a 2 MHz signal, or by 2 when the Divide-by-N Counter selects a number that produces a 5 MHz signal.

The **Step Loop Phase Detector** compares the phase of the signal from the Step Size Divider to the phase of the signal from the Divide-by-N Counter. It then generates a voltage proportional to the phase difference.

The **Step Loop Integrator** amplifies and integrates the phase difference voltage, creating the step loop control voltage.

The **VCO Clamps** compare the control voltage to service adjustable out-of-limit voltages. This circuit clamps the control voltage if its amplitude is not within the approximate range of –2 to +7V. It also tells the CPU assembly that the amplitude is too high or too low, which means the step loop is unlocked.

The **Pretune** circuit adds a service adjustable dc offset level to the control voltage, then amplifies it by a service adjustable gain. The resulting voltage coarsely adjusts the sum VCO's frequency to ensure that the sum loop can phase lock.

The **IIC Interface** provides the interface between the CPU assembly and the Step Phase Detector assembly, and it provides the loop mode control line to the Sum VCO assembly. It also interrupts the CPU assembly if either the sum loop or the step loop is unlocked.

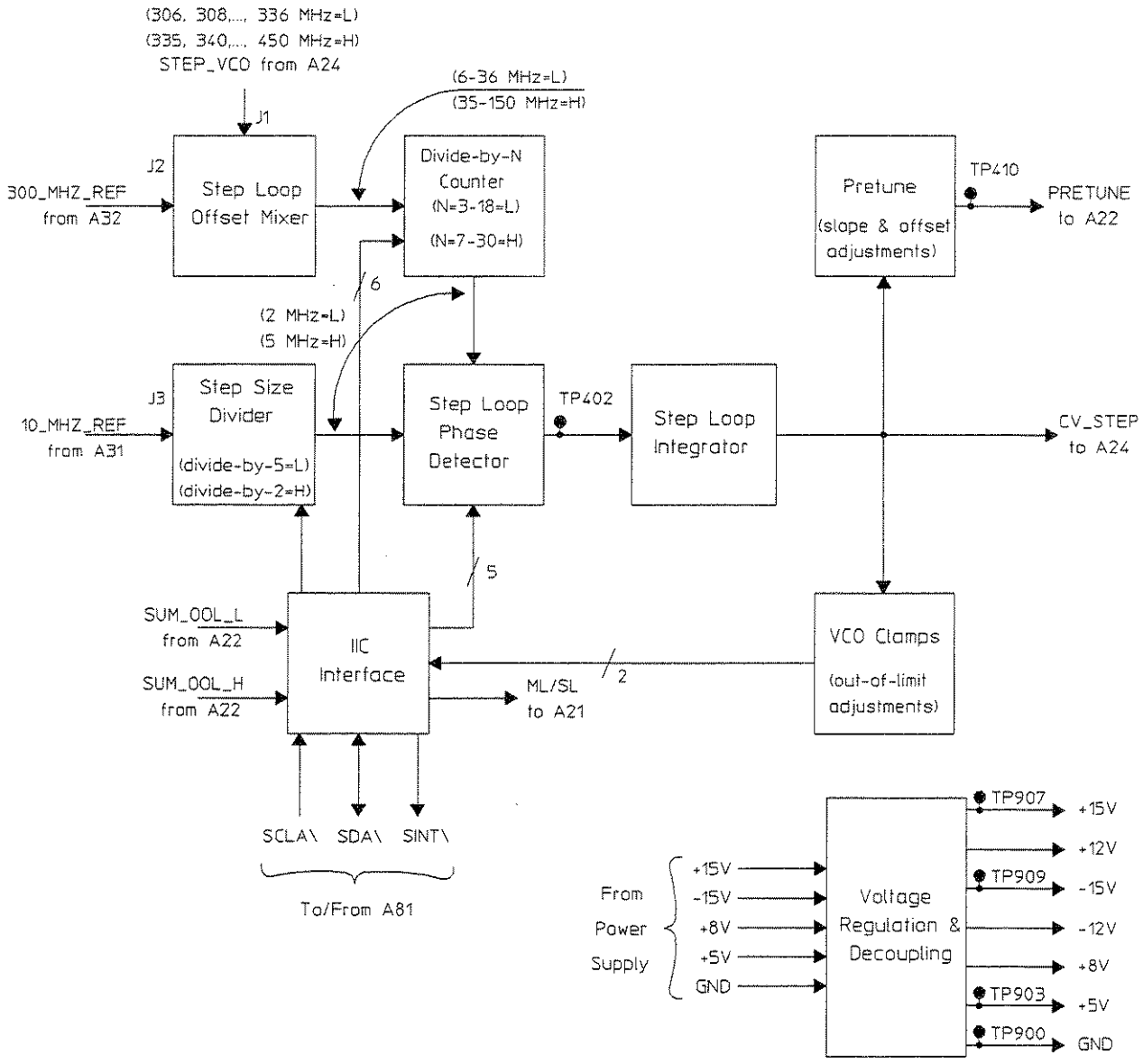


Figure 4-15. A23 Step Phase Detector

A24 Step VCO

The Step VCO assembly is one of six assemblies that together function as the analyzer's local oscillator. This assembly is used only when the local oscillator operates in multiple loop mode (see figure 4-13). The Step VCO assembly generates a 306 to 450 MHz signal that provides feedback for the step loop and an offset frequency reference for the sum loop. Figure 4-16 shows the Step VCO assembly's block diagram.

The **Step Loop VCO** generates a signal that steps from 306 to 336 MHz in 2 MHz increments or from 335 to 450 MHz in 5 MHz increments. In single loop mode, this VCO generates a 306 MHz signal even though the signal is not used. The step loop control voltage controls the VCO's frequency. This circuit also contains two service adjustments — one to improve the spectral purity of the VCO and the other to improve the tracking of the sum loop VCO and step loop VCO to each other.

The **Step Loop Buffers** route the signal into three separate signal paths that filter and amplify each signal. One signal provides feedback to close the step loop. Another signal provides an offset frequency reference for the sum loop. The third signal provides a test port to check the sum loop.

The **Thermal Switch** shuts down the Power Supply assembly if it senses an over-temperature condition.

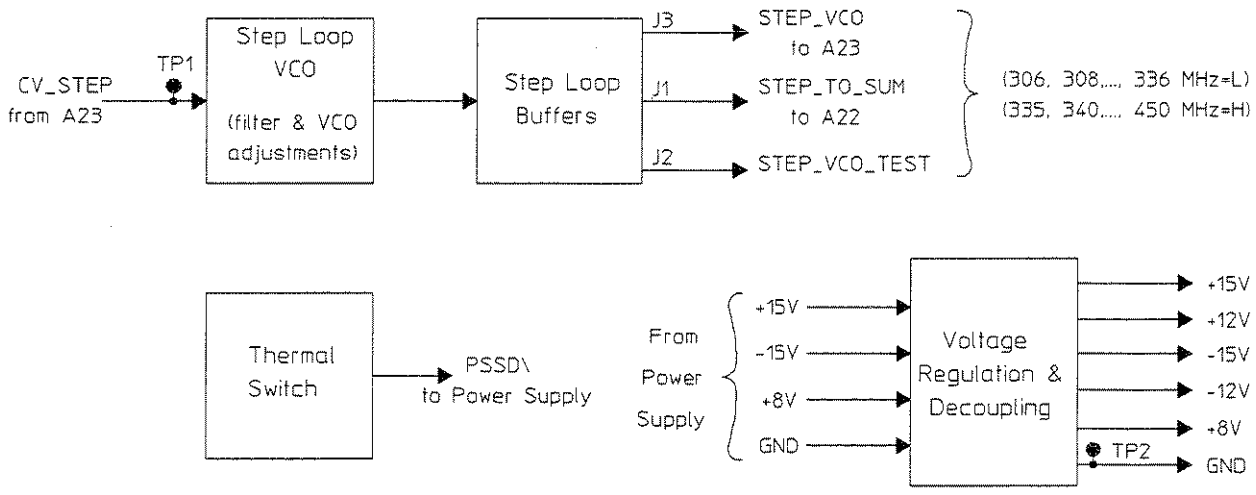


Figure 4-16. A24 Step VCO Block Diagram

A31 Reference/Calibrator

The Reference/Calibrator assembly provides three frequency references (80, 20, and 10 MHz) to various assemblies. It also provides a precision amplitude calibration signal to the Input assembly. This precision amplitude calibration signal is actually one of two signals — a precision leveled signal derived from the Source Amplifier assembly or a precision leveled fixed 10 MHz frequency reference. Figure 4-17 shows the Reference/Calibrator assembly's block diagram.

The **80 MHz VCXO** generates an 80 MHz signal, which is the analyzer's primary frequency reference. When an external frequency reference is present, feedback phase-locks the 80 MHz VCXO to the external reference. A service adjustment is provided to adjust the VCXO's frequency.

The **Divide-by-4** circuit divides the 80 MHz signal down to 20 MHz. The **Divide-by-2** circuit divides the 20 MHz signal down to 10 MHz.

The **Input Protection/Signal Conditioning** circuit limits and conditions the external frequency reference. The optional Fan Power/Oven assembly can supply the external frequency reference if a rear panel BNC-to-BNC jumper connects the oven output to the external frequency reference input.

The **External Reference Detector** detects the presence of the external reference, and tells both Tune Enable/Loop Filter/Integrator and the CPU assembly.

The **Sampling Phase Detector** compares the phase of the signal from the Divide-by-2 with the phase of the signal from Input Protection/Signal Conditioning and generates a voltage equal to the phase difference. This circuit can phase lock to an external frequency reference of 1, 2, 5, or 10 MHz.

The **Tune Enable/Loop Filter/Integrator** amplifies and filters the phase-difference voltage from the Sampling Phase Detector. It then routes the voltage to the 80 MHz VCXO as feedback to close the external reference phase-locked loop (PLL). If an external reference is not present, this circuit opens the PLL and routes zero volts to the 80 MHz VCXO. If the Beatnote Detector indicates that the loop is unlocked, this circuit selects a wider loop bandwidth in an attempt to lock.

The **Beatnote Detector** monitors the feedback voltage to the 80 MHz VCXO. If the feedback voltage is either too high or too low (approx ± 10V), indicating that the external reference PLL is unlocked, this circuit tells the Tune Enable/Loop Filter/Integrator and the CPU assembly.

During swept mode calibration, **Swept Cal** amplifies and conditions the swept 200 kHz to 150 MHz, approximate –11 dBm signal to a square wave with a –3 dBm fundamental. During fixed mode calibration, **Fixed 10 MHz Cal** conditions the 10 MHz signal to a square wave with a –3 dBm fundamental.

The **Precision Square Wave Generator** attenuates and conditions the –3 dBm swept or fixed calibration signal to a square wave with a –20 dBm precision amplitude fundamental. This circuit contains both a flatness and a level service adjustment.

The **IIC Interface** provides the interface between the CPU assembly and the Reference/Calibrator assembly. It also interrupts the CPU assembly if the Beatnote Detector indicates that the external reference PLL is unlocked or if the high frequency PLL on the 300 MHz assembly is unlocked.

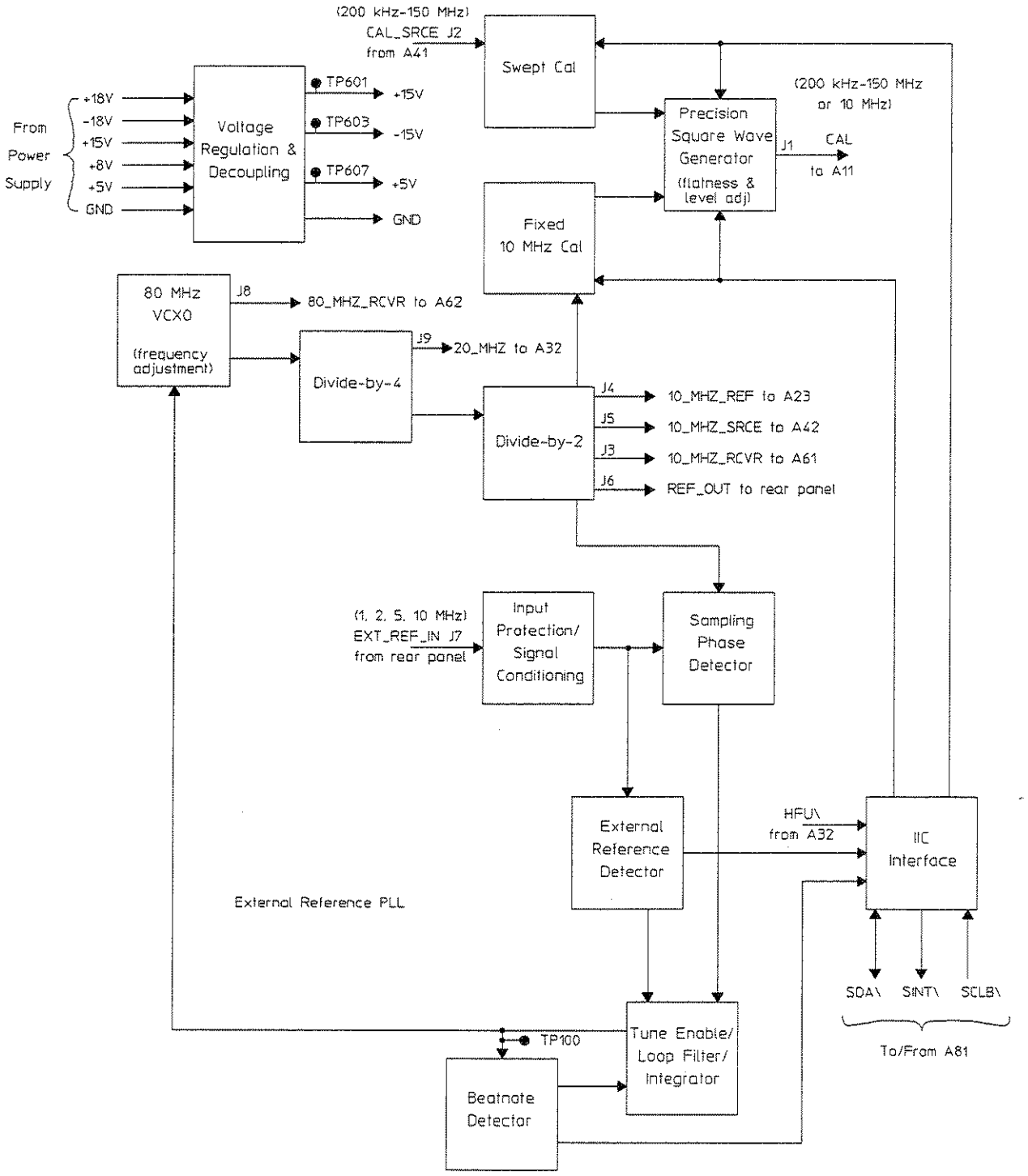


Figure 4-17. A31 Reference/Calibrator Block Diagram

A32 300 MHz

The 300 MHz assembly provides high-frequency references to various assemblies. The high-frequency references are 300 MHz and 60 MHz. These frequency references are phase locked to the Reference/Calibrator assembly at 20 MHz. Figure 4-18 shows the 300 MHz assembly's block diagram.

The **300 MHz VCO** generates a 300 MHz signal. A service adjustment sets the frequency of this VCO. Feedback from the Loop Filter/Integrator adjusts the frequency to keep this VCO phase locked with the 20 MHz reference signal.

The **300 MHz Amplifier** routes the 300 MHz signal to four signal paths and amplifies each signal.

The **Divide-by-5** circuit divides the 300 MHz signal down to 60 MHz and routes the signal to two signal paths. The **Divide-by-3** circuit divides the 60 MHz signal down to 20 MHz.

The **Digital Phase Detector** compares the phase of the 20 MHz signal to the 20 MHz reference signal and generates a voltage equal to the phase difference.

The **Loop Filter/Integrator** filters the phase difference voltage and sends it to the 300 MHz VCO as the control voltage.

The **PLL Unlocked Detector** monitors the voltage from the Loop Filter/Integrator. If the voltage goes too high or too low, the high-frequency PLL unlocks and the Reference/Calibrator assembly interrupts the CPU assembly.

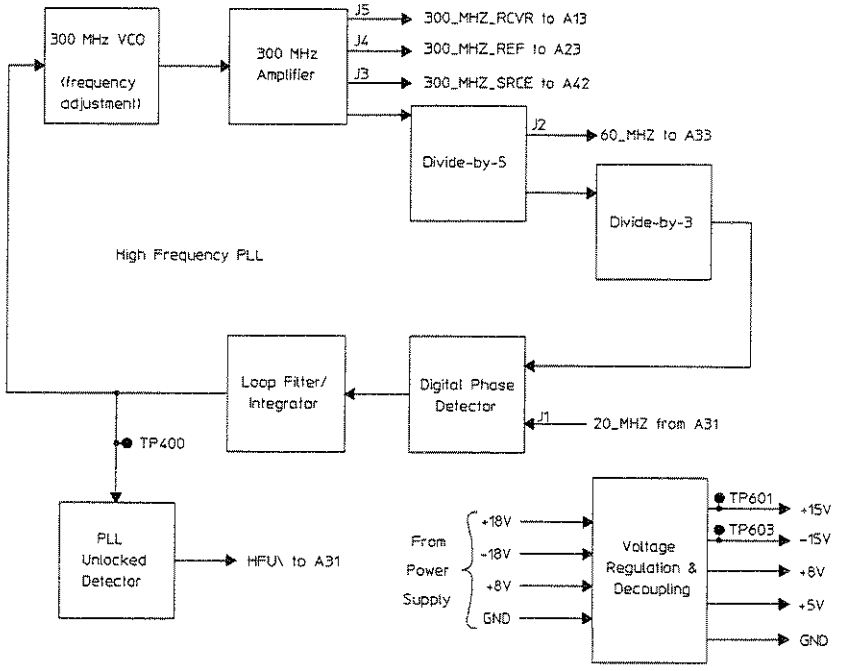


Figure 4-18. A32 300 MHz Block Diagram

A33 Trigger

The Trigger assembly provides low-frequency reference signals, the sweep synchronization signal (LSWP\), and the trigger signal. The low frequency reference signals are 100 kHz, 187.5 kHz, and 250 kHz. Figure 4-19 shows the Trigger assembly's block diagram.

The **Divide-by-4** circuit divides the 60 MHz signal down to 15 MHz. The **Divide-by-10** circuit divides the 15 MHz signal down to 1.5 MHz.

The **Clock Synchronization** circuit resets all low-frequency references at instrument power-up and provides the 1.5 MHz signal as a common clock.

The **Divide-by-6** circuit divides the 1.5 MHz signal down to a 250 kHz, TTL-level signal. The **Divide-by-8** circuit divides the 1.5 MHz signal down to a 187.5 kHz, 600 mVp-p, ac-coupled square wave. The **Divide-by-15** circuit reduces the 1.5 MHz signal to a 100 kHz, 1 Vp-p pulse, with an approximate 1% duty cycle.

The **Divide-by-2^n** circuit divides the 100 kHz signal by 2^n, generating the Slow Clock. The CPU assembly provides the decimating number **n**.

The **Trigger Logic** circuit selects internal trigger, external trigger, or HP-IB trigger (GETTRIG). Internal trigger is self-enabling. External trigger and HP-IB trigger, however, must be enabled by the CPU assembly.

When the selected trigger occurs, Trigger Logic holds the trigger and, after receiving a negative edge from the Slow Clock, outputs it as the sweep synchronization signal (LSWP\). Following a change in resolution bandwidth or an instrument power-up or preset, the negative edge of the sweep synchronization signal resets the phase of the digital filters on the ADC/Digital Filter assembly. On subsequent negative edges, the sweep synchronization signal is the sweep signal for the analyzer. The sweep synchronization signal is also sent to the rear panel as the trigger output.

The **IIC Interface** provides the interface between the CPU assembly and the Trigger assembly.

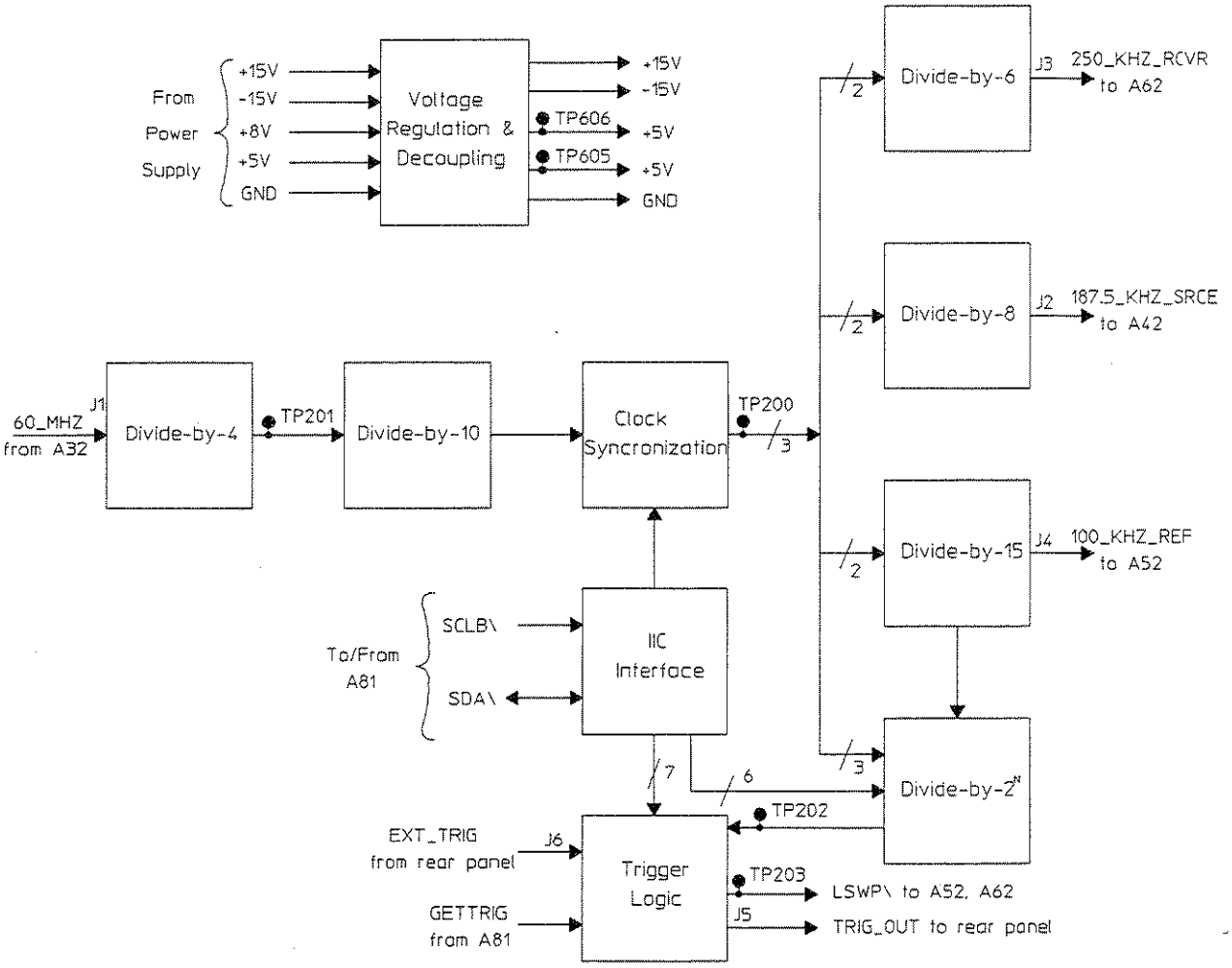


Figure 4-19. A33 Trigger Block Diagram

A41 Source Amplifier

The Source Amplifier assembly is one of two assemblies that together function as the analyzer's source. This assembly amplifies the signal generated by the Source Conversion assembly. It then routes this signal to either the Front Panel assembly, the Input assembly, or the Reference/Calibrator assembly. The output of the Source Amplifier assembly can sweep from 10 Hz to 150 MHz and its amplitude can be adjusted from +10 to –59.9 dBm. Figure 4-20 shows the Source Amplifier assembly's block diagram.

The two **20 dB Amplifiers** and the one **15 dB Amplifier** provide 55 dB of gain to the signal from the Source Conversion assembly.

The **DC Servo** provides feedback to drive the dc voltage to zero volts at the output of the 15 dB Amplifier.

The **Attenuator** provides from 0 to 50 dB of attenuation, in 10 dB increments.

The **Output Switching** circuit routes the source signal to either the front panel or the Input assembly (for normalized measurements). During calibration, this circuit also routes the source signal to the Reference/Calibrator assembly.

The **Overload Detector/Threshold Set** monitors the voltage at the output of the Source Amplifier assembly. If the voltage exceeds the threshold set by the Source Conversion assembly, this circuit tells the IIC Interface, which in turn, disconnects the output from the front panel and interrupts the CPU assembly.

The **IIC Interface** provides the interface between the CPU assembly and the Source Amplifier assembly. It also provides control logic for the signals from the Source Conversion assembly.

The **Thermal Switch** shuts down the Power Supply assembly if it senses an over-temperature condition.

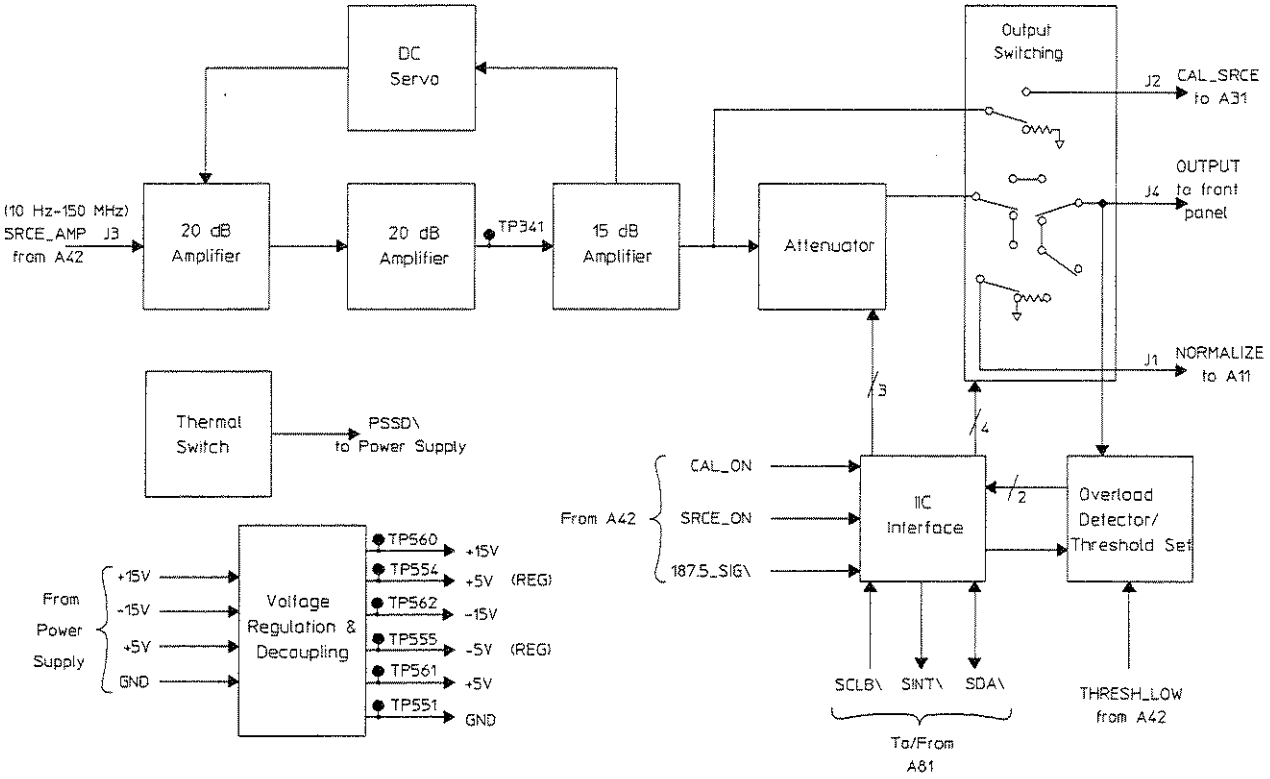


Figure 4-20. A41 Source Amplifier Block Diagram

A42 Source Conversion

The Source Conversion assembly is one of two assemblies that together function as the analyzer's source. The Source Conversion assembly generates the source signal, and the Source Amplifier assembly provides the final amplification for the source signal. Figure 4-21 shows the Source Conversion assembly's block diagram.

The **187.5 kHz Limiter** limits the amplitude of the 187.5 kHz square wave, providing the Gilbert Cell Multiplier with a constant-amplitude square wave. It also provides the dc bias voltage to the Gilbert Cell Multiplier.

The **187.5 kHz Detector** can check for the presence of the signal in one of two places — either at the input of the 187.5 kHz Limiter or the output of the Gilbert Cell Multiplier.

The **Amplitude Control** circuit converts digital data to the differential control signal.

The **Gilbert Cell Multiplier** generates a 187.5 kHz square wave with an amplitude proportional to the amplitude of the differential control signal. The square wave amplitude may be controlled over a 19.9 dB range.

The **190 kHz Low Pass Filter** attenuates signals above 190 kHz (harmonic energy of the 187.5 kHz square wave).

The **10 MHz Limiter/First Mixer** limits the amplitude of the 10 MHz reference signal. It then mixes the 10 MHz signal with the 187.5 kHz signal, producing a 10.1875 MHz signal.

The **10.1875 MHz Filter/Amplifier** filters and amplifies the 10.1875 MHz signal.

The **300 MHz LO Driver** amplifies the 300 MHz reference to +7 dBm at the input to the second mixer.

The **Second Mixer** mixes the 300 MHz signal with the 10.1875 MHz signal, producing a 310.1875 MHz signal.

The **310.1875 MHz Filter/Amplifier** filters and amplifies the 310.1875 MHz signal. This circuit contains a service-adjustable helical resonator filter.

The **LO Driver** amplifies the swept LO signal to +7 dBm at the input of the Third Mixer.

The **Third Mixer** mixes the swept LO signal (310.1875 to 460.1875 MHz) with the 310.1875 MHz signal, producing a frequency that tracks the tuned receiver frequency.

The **150 MHz Low Pass Filter** attenuates all signals above 150 MHz and routes the 10 Hz to 150 MHz swept signal to the Source Amplifier assembly.

The **IIC Interface** provides control lines from the CPU assembly to both the Source Conversion assembly and the Source Amplifier assembly.

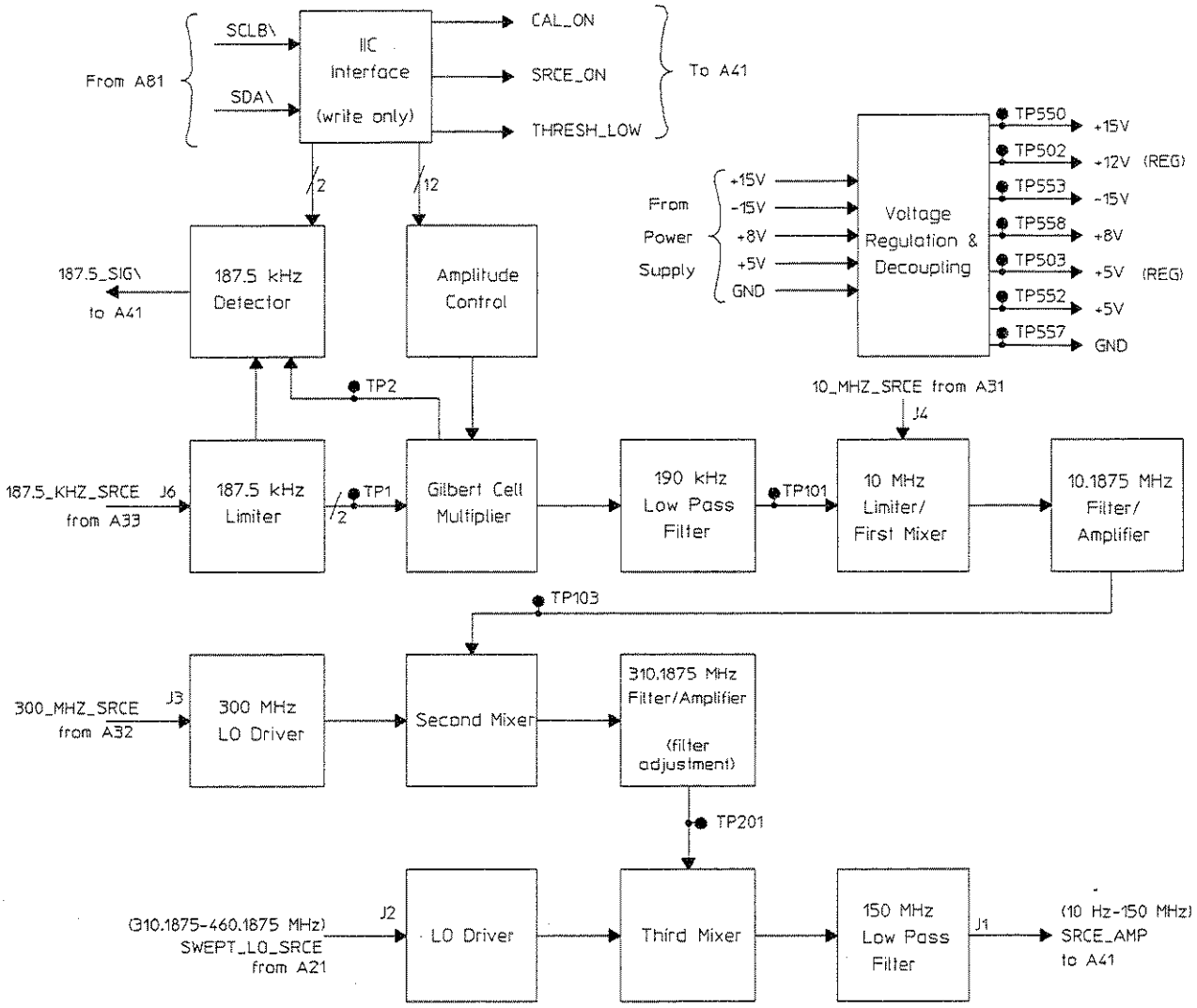


Figure 4-21. A42 Source Conversion Block Diagram

A51 Interpolation VCO

The Interpolation VCO assembly is one of six assemblies that together function as the analyzer's local oscillator. This assembly is used when the local oscillator operates in either single loop mode or multiple loop mode (see figures 4-12 and 4-13). In multiple loop mode, this assembly provides the interpolation VCO and feedback to close the interpolation loop. In single loop mode, this assembly provides feedback to close the single loop. Figure 4-22 shows the Interpolation VCO assembly's block diagram.

In multiple loop mode, the **Interpolation VCO** generates a signal that sweeps from 30 to 50 MHz or from 30 to 55 MHz. The fractional-N control voltage determines the frequency. There's also a service adjustment to control the frequency range. In single loop mode, this VCO is disabled.

The **VCO Buffer Amplifier** conditions the signal and routes it through two signal paths.

The **Divide-by-10/Divide-by-5** circuit divides the signal from the VCO Buffer by 10 or 5. For output frequencies lower than 341 MHz, the VCO sweeps from 30 to 50 MHz and this circuit divides it by 10 (providing a 3 to 5 MHz signal). For output frequencies higher than 341 MHz, the VCO sweeps from 30 to 55 MHz and this circuit divides it by 5 (providing a 6 to 11 MHz signal).

In single loop mode, the **Divide-by-10** circuit divides the single loop VCO signal by 10, resulting in a 31 to 46 MHz signal. In multiple loop mode, this circuit is disabled.

In single loop mode, the **Single/Multiple Loop Switch** sends the signal from the Divide-by-10 to the Fractional-N assembly to close the single PLL. In multiple loop mode, this circuit sends the signal from the VCO Buffer Amplifier to the Fractional-N assembly to close the interpolation PLL.

The **Control Voltage Detector** monitors the amplitude of the fractional-N control voltage, in both multiple and single loop mode. The fractional-N control voltage is the same as the single loop control voltage that is sent to the Sum VCO assembly, except the single loop control voltage is clamped. Therefore, checking the fractional-N control voltage is essentially the same as checking the single loop control voltage.

The **IIC Interface** provides the interface between the CPU assembly and the Interpolation VCO assembly. This circuit interrupts the CPU assembly if the control voltage (from the Control Voltage Detector) is too high or too low — a situation that will occur if the interpolation loop or the single loop is unlocked. The IIC Interface also interrupts the CPU assembly if the fractional-N signal on the Fractional-N assembly reaches the end of its sweep.

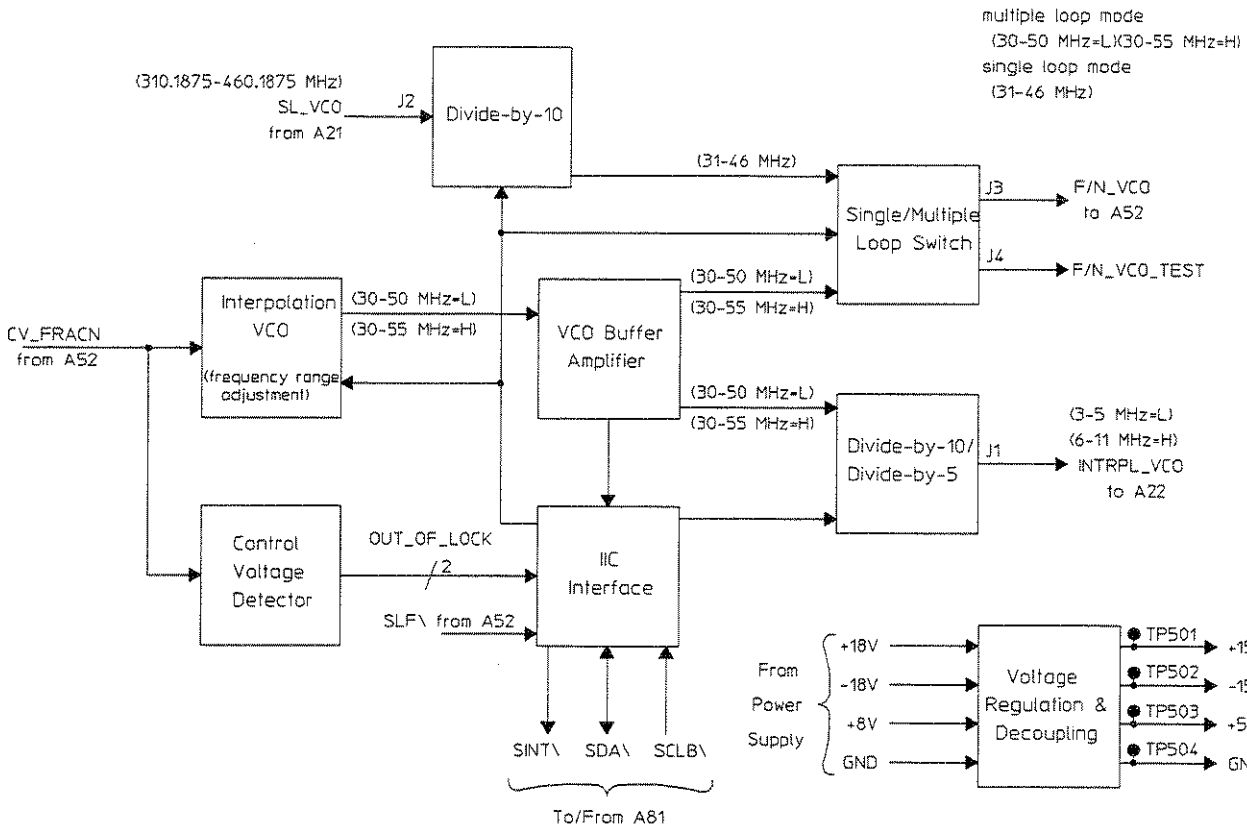


Figure 4-22. A51 Interpolation VCO Block Diagram

A52 Fractional-N

The Fractional-N assembly is one of six assemblies that together function as the analyzer's local oscillator. This assembly is used when the local oscillator operates in either multiple loop mode or single loop mode (see figures 4-12 and 4-13). In single loop mode, this assembly provides the control voltage for the single loop. In multiple loop mode, this assembly provides the control voltage for the interpolation loop. Figure 4-23 shows the Fractional-N assembly's block diagram.

The **Divide-by-N** circuit divides the fractional-N VCO signal down to 100 kHz.

The **Phase Comparator** compares the signal from the Divide-by-N with the 100 kHz reference signal and generates a pulse equal to the phase difference.

The **Integrator** and **Sample and Hold** circuits convert the phase-difference pulses to a dc voltage. A service adjustment minimizes the 100 kHz sample and hold spur.

The **API** (Analog Phase Interpolation) **Current Control** discharges the Integrator to help maintain a steady dc state. There are also service adjustments to minimize API spurs.

The **Multiple Loop Buffer** conditions the dc voltage and provides it as the control voltage for the interpolation loop.

The **Single Loop Buffer** conditions the dc voltage and provides it as the control voltage for the single loop. The Single Loop Buffer also clamps the control voltage if its amplitude is not within the approximate range of –2 to +7V. A service adjustment sets the range of the voltage clamps.

The **Fractional-N** integrated circuit controls the Divide-by-N, API Current Control, and Sample and Hold. The negative edge of the sweep synchronization signal (LSWP\) causes this circuit to start a sweep. If this circuit reaches the end of its frequency sweep, the IIC Interface on the Interpolation VCO assembly can interrupt the CPU assembly.

The **IIC Interface** provides the interface between the CPU assembly and the Fractional-N assembly. After a change in resolution bandwidth or an instrument preset, the IIC Interface also routes the LSWP\ signal to the Fractional-N circuit.

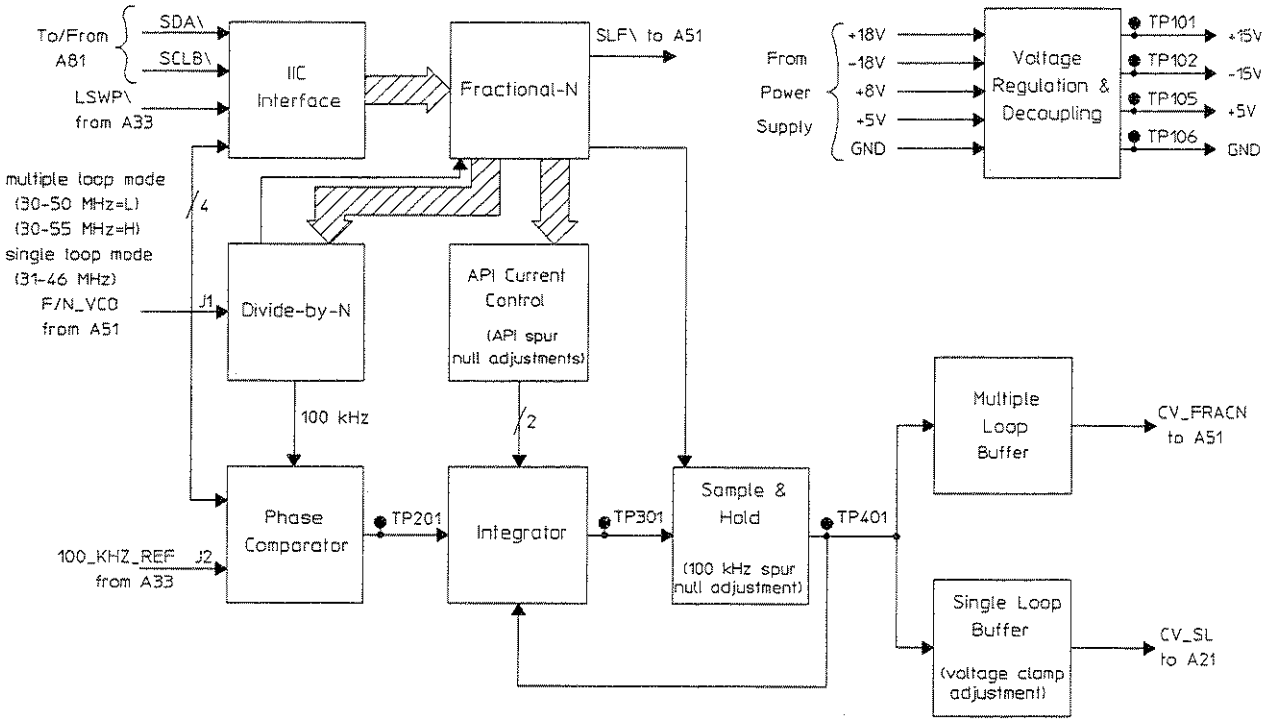


Figure 4-23. A52 Fractional-N Block Diagram

A61 IF

The IF assembly is the fourth of five assemblies that condition the input signal. This assembly converts the output of the Second Frequency Conversion assembly to the third IF signal. Figure 4-24 shows the IF assembly's block diagram.

The **Second IF Amplifier/Filter** amplifies and filters the second IF signal. Also, the analyzer's internal self-test routines use this circuit to detect if the second IF signal is approximately 15 dB over full scale. The filter in this circuit is service-adjustable.

The **10 MHz Reference Receiver** buffers the 10 MHz reference signal. If the 10 MHz reference signal is not present, the Fault Detector on the ADC/Digital Filter assembly interrupts the CPU assembly.

The **Third Conversion Mixer** mixes the second IF signal with the 10 MHz reference signal. This circuit contains a service adjustment to set the gain of the second IF signal.

The **Third IF Filter** then amplifies and filters the resulting 187.5 kHz signal.

The **Third IF Amplifier/Attenuator** amplifies and, under CPU control, subsequently attenuates the signal so that the maximum signal possible (without causing an overload) is available at the analog-to-digital converter (ADC) on the ADC/Digital Filter assembly.

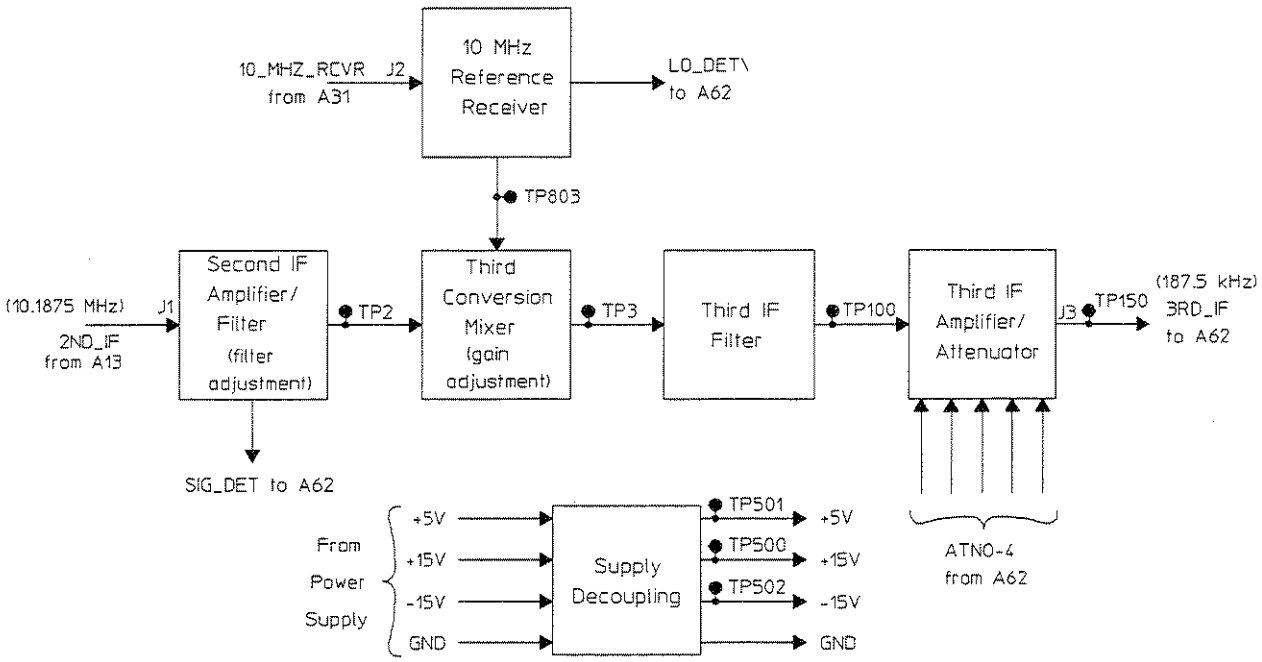


Figure 4-24. A61 IF Block Diagram

A62 ADC/Digital Filter

The ADC/Digital Filter assembly is the last of five assemblies to condition the input signal. This assembly converts the output of the IF assembly to digital data. The digital data is then digitally filtered and detected, then sent to the CPU assembly over the fast bus. Figure 4-25 shows the ADC/Digital Filter assembly's block diagram.

The **Track and Hold** circuit holds a voltage sample of the 187.5 kHz IF signal for the period of time required by the ADC to digitize the voltage.

The **ADC** circuit converts the voltage to a 13-bit digital word at a 250 kHz sample rate. After a complete conversion cycle, the ADC serially transfers the digital word to the Digital Filter.

The ADC circuit converts the voltage to a 13-bit digital word by passing the signal through an 8-bit A/D converter twice. On the first pass, the voltage is divided by four, then level shifted. Then dither (noise) is added to increase the accuracy of the analog-to-digital conversion. The 8-bit A/D converter converts the voltage to an 8-bit digital word. This first-pass word is converted back to a voltage and compared with the original voltage. A difference voltage is generated and converted to an 8-bit word. The second-pass word is added to the first-pass word, resulting in a 13-bit digital word that represents the IF signal.

The ADC circuits contain three service adjustments — one to null dc offset, one to set the reference voltage, and one to match the gain between the two conversion passes.

The **Digital Filter** circuit digitally mixes the 13-bit word with a 62.5 kHz sine wave and a 62.5 kHz cosine wave. (The 62.5 kHz signals result from dividing the 250 kHz sample clock by four.) The result of this digital mixing is two data streams — one representing the real part of the IF signal and the other representing the imaginary part of the IF signal. This circuit also provides the final resolution bandwidth filtering for each data stream.

The **Detector** sends the data streams from the Digital Filter to the CPU assembly over the fast bus. The Detector also squares the output of both digital filters, adds the squared values together, and sends the result to the CPU assembly.

The **Reset Receivers** buffer the reset signal and the sweep synchronization signal. The reset signal (RESET\) resets the ADC, Digital Filter, and Detector. The sweep synchronization signal (LSWP\) resets the phase of the gate arrays in the Digital Filter and the Detector.

The **Sample Clock Receiver** buffers the 250 kHz reference signal and sends it to the ADC as the sample rate.

The **20 MHz Clock** divides the 80 MHz reference signal by four, creating two 20 MHz signals in quadrature (90 degree phase relationship). These signals provide the clock signals for the ADC, Digital Filter, Detector and the external clock signal for the CPU assembly. The external clock signal is sent to the CPU assembly over the fast bus. If this external clock signal is not present, the fast bus is disabled.

The **Fault Detection** circuit detects the presence of the 10 MHz reference and the input signal at the IF assembly. It also detects the presence of the 250 kHz reference and the 20 MHz clocks. This information is sent to the IIC Interface.

The **IIC Interface** provides the interface between the CPU assembly and the ADC/Digital Filter assembly. It also provides the interface between the CPU assembly and the IF assembly. If the 10 MHz reference, 250 kHz reference, or 20 MHz clock is not present, the IIC Interface interrupts the CPU assembly.

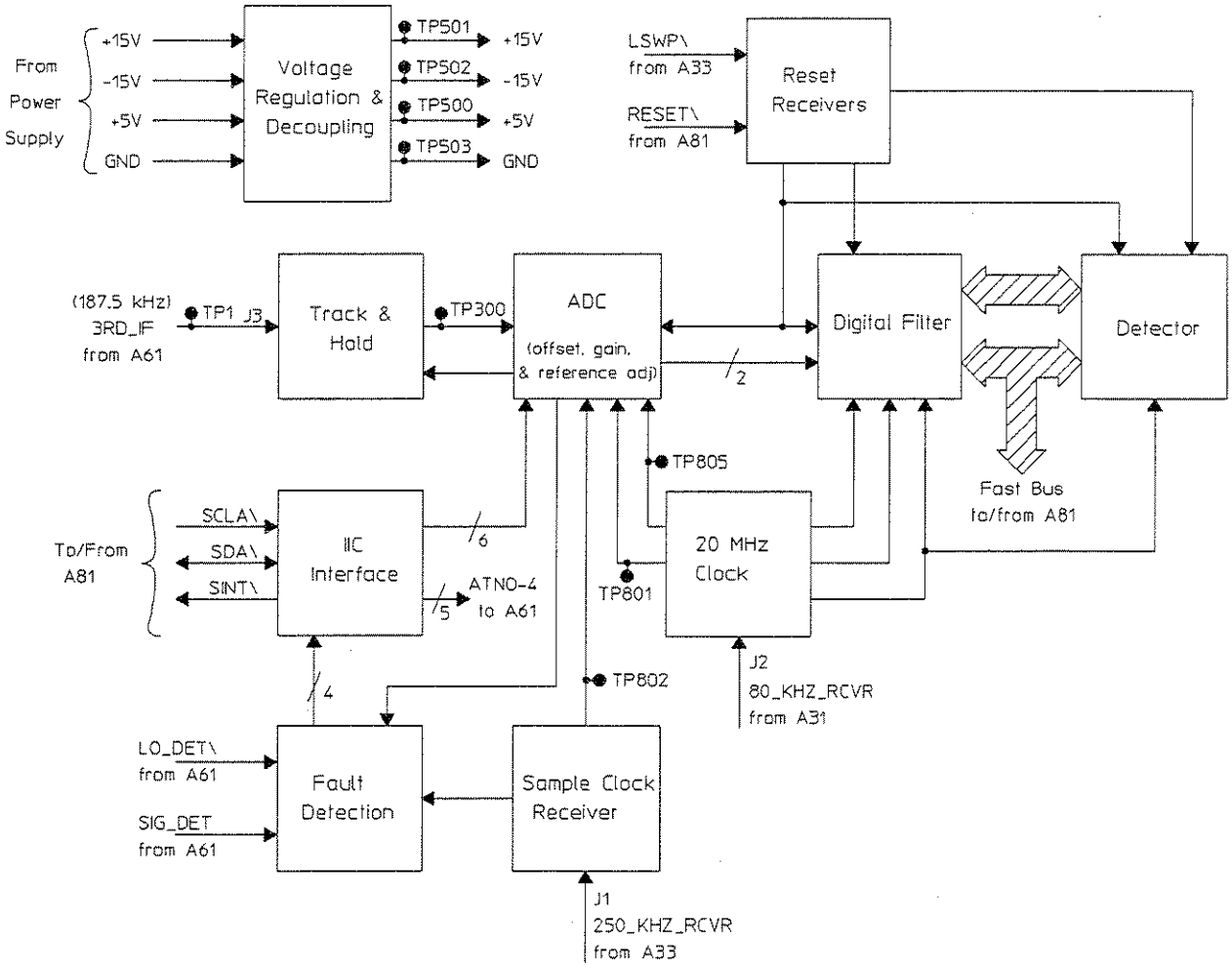


Figure 4-25. A62 ADC/Digital Filter Block Diagram

A81 CPU

The CPU assembly controls the entire analyzer. It performs multiple tasks, such as:

- Initiating the power-up sequence and calibration routines
- Capturing front panel keystrokes
- Configuring the measurement hardware
- Processing input data from the ADC/Digital Filter assembly
- Controlling the display
- Monitoring the hardware for faults or overloads
- Running the self tests
- Handling all data transfers for the fast bus, HP-IB, and Disk Drive assembly

Figure 4-26 shows the CPU assembly's block diagram. Figure 4-27 shows the CPU interface's block diagram.

The **MPU** (Microprocessor) controls the processor address bus and the buffered processor data bus. At power-up, this circuit initializes the analyzer from the information stored in the Monitor ROM. This circuit also processes interrupts from the Interrupt Handler and synchronizes data transfers on the processor data bus with the Data Transfer Handler. The MPU also has access to battery-backed-up SRAM on the Memory assembly. This allows the CPU assembly to store and update information such as the analyzer's address, default disk, and peripheral addresses.

The **DMA** (Direct Memory Access) **Controller** handles all DMA data transfers and controls the fast bus that connects the ADC/Digital Filter assembly to the CPU assembly. When a DMA data transfer occurs, the DMA Controller circuit takes control of the processor address and data busses. When the DMA data transfer is finished, the DMA Controller returns control of the busses to the MPU. Throughput from the ADC/Digital Filter assembly to the Memory assembly or to the Disk Drive assembly are examples of DMA data transfers.

The **TMS320** relieves the MPU of math intensive-tasks by supplying the computational power needed for accurate, high-speed signal processing operations — for example, windowing and Fast Fourier Transform (FFT) for the analyzer's narrow-band zoom mode. The TMS320 is a high speed (40 MHz) math co-processor that performs complex mathematical operations. It works as a slave co-processor to the MPU (68000), and it has its own Program RAM and Data RAM. This arrangement leaves the MPU free to perform other functions while the TMS320 performs math-intensive operations.

The **Interrupt Handler** processes interrupts for the MPU. It sets the interrupt priority level and returns an interrupt acknowledge to the circuit that generated the interrupt. If the MFP controller causes an interrupt, the MPU reads a status byte from the MFP controller to determine the circuit that caused the interrupt.

The **Data Transfer Handler** synchronizes data transfers in the analyzer with the MPU. When a data transfer occurs, the Data Transfer Handler notifies the MPU when the transfer is complete.

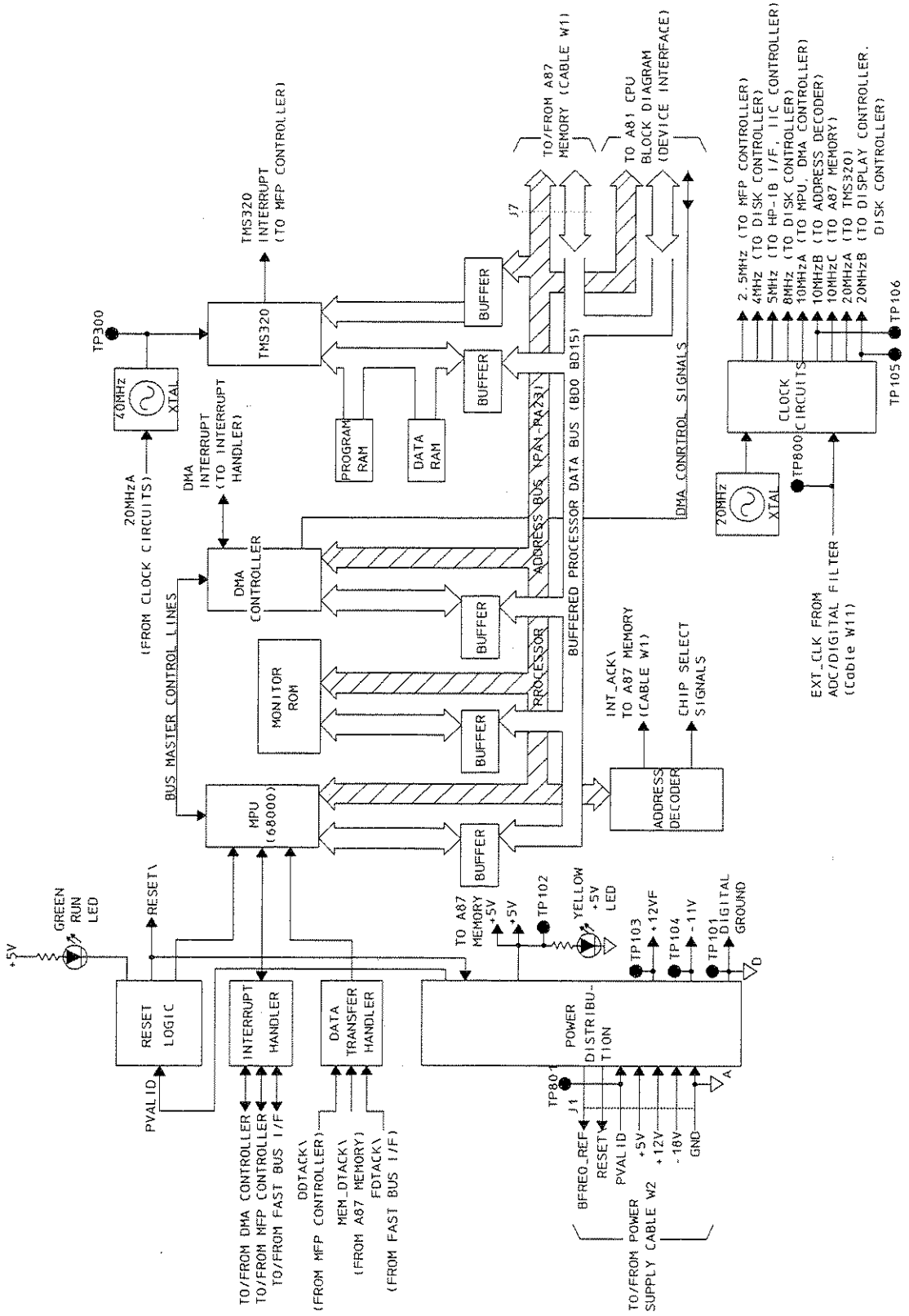


Figure 4-26. A81 CPU Block Diagram

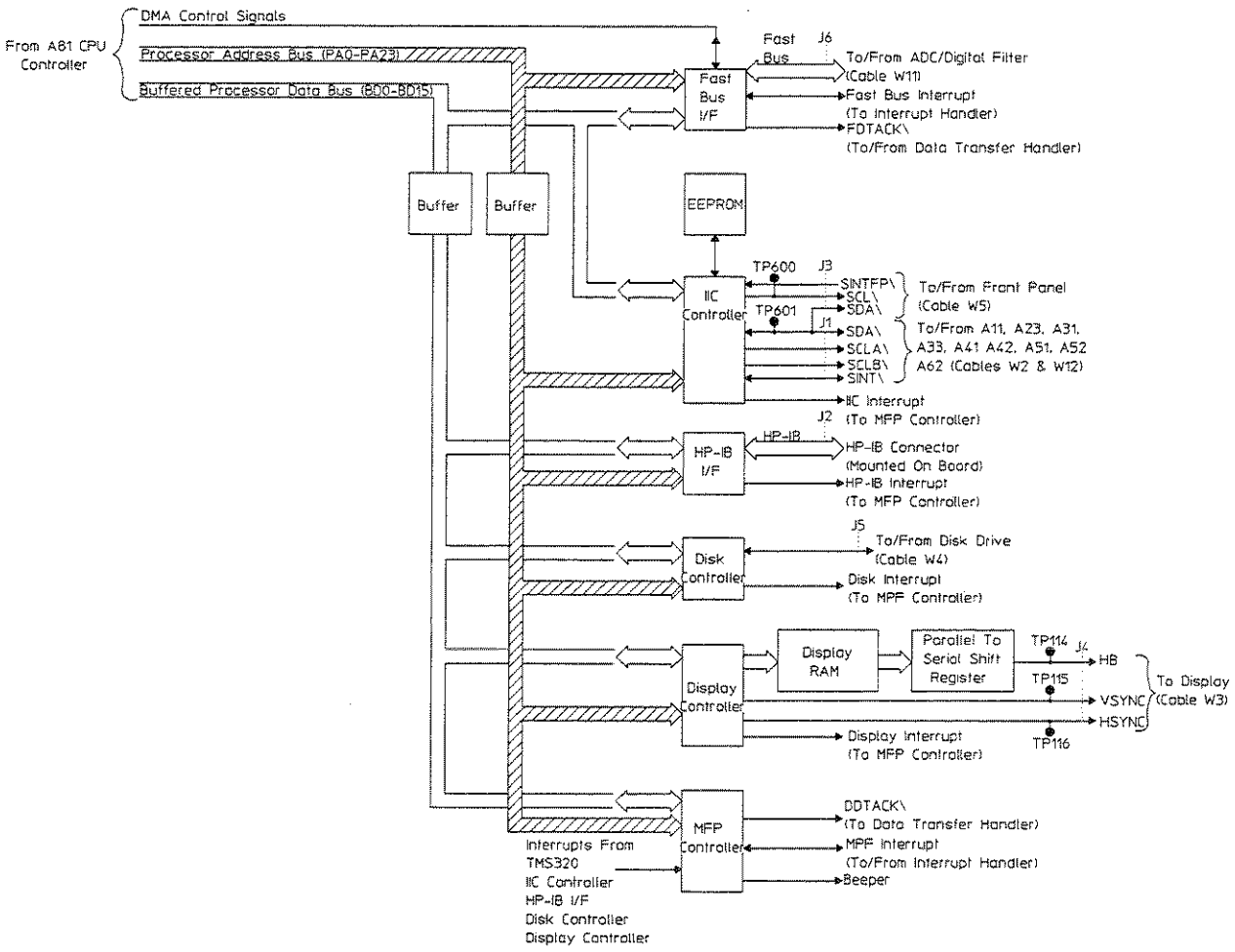


Figure 4-27. A81 CPU Interface Block Diagram

The **Clock Circuits** provide the clocks for the CPU, Disk Drive, and Memory assemblies. If the external clock from the ADC/Digital Filter assembly is present, this circuit synchronizes the CPU assembly with the rest of the analyzer.

The **MFP** (Multiple-Function Peripheral) **Controller** handles interrupts and handshaking during data transfers for the following circuits:

- TMS320
- IIC Controller
- HP-IB Interface
- Disk Controller
- Display Controller

Interrupts from these circuits are sent to the MFP Controller. When the MFP Controller receives an interrupt, it interrupts the Interrupt Handler, which in turn interrupts the MPU. The MPU then reads a status byte from the MFP Controller to determine the cause of the interrupt. The MFP Controller also tells the Data Transfer Handler if any data transfers occurred for these circuits.

The **Reset Logic** puts the analyzer into a known state (see figure 4-28). A reset occurs at power up (PVALID from the Power Supply assembly goes high), when the reset switch SW101 (located on the CPU assembly) is pressed, or when the MPU receives a reset instruction.

A low-to-high transition on pin 18 of the MPU causes the MPU to execute its reset routine (stored in ROM). When the MPU completes its reset routine, it forces RST\ high (notice that pin 18, RST\, of the MPU is bidirectional). This in turn forces RESET\ high, which tells the other assemblies that the reset routine is finished.

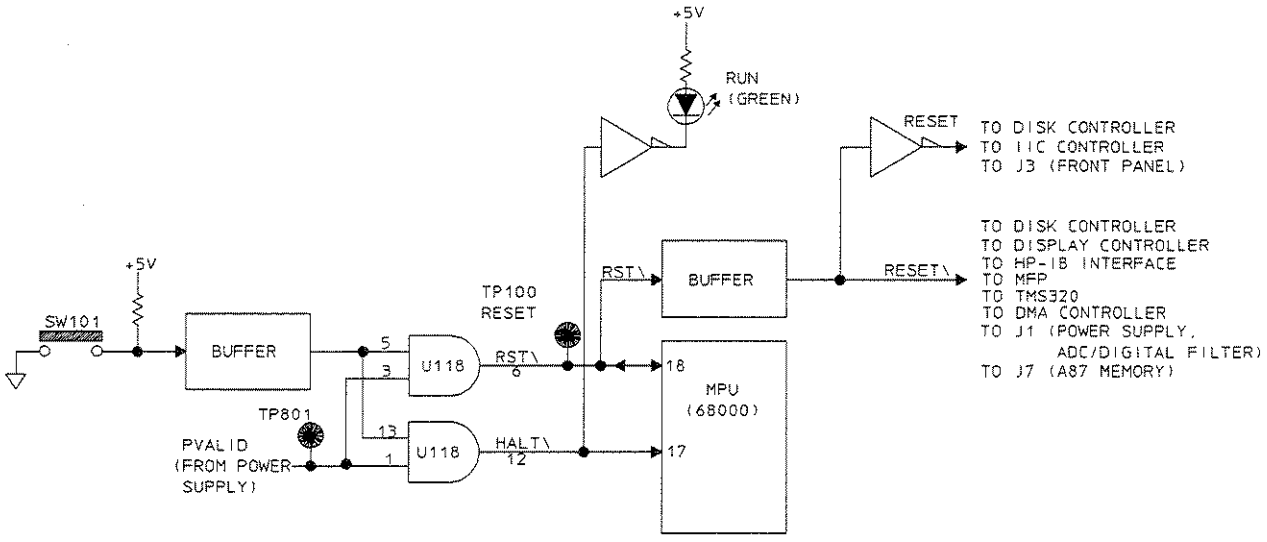


Figure 4-28. Reset Logic

The **Fast Bus Interface** connects the CPU assembly to the fast bus. All data transfers between the ADC/Digital Filter assembly and the CPU assembly occur over the fast bus. The fast-bus address lines (FA0 through FA5) and data lines (FD0 through FD15) are simply extensions of the processor address and data busses. This allows fast DMA transfers between the two assemblies. See "W11 Fast Bus Cable Signals" (later in this section) for a description of the fast bus signals.

The **IIC** (Inter-IC) **Controller** manages the IIC bus. It allows direct communication between the CPU assembly and the following assemblies via the IIC bus:

- Front Panel
- Input
- Step Phase Detector
- Reference/Calibrator
- Trigger
- Source Amplifier
- Source Conversion
- Interpolation VCO
- Fractional-N
- ADC/Digital Filter
- Memory

All of these assemblies appear as slaves to the IIC Controller. The IIC Controller has access to an EEPROM, which allows the CPU assembly to store information such as the analyzer's serial number and IBASIC option. If the CPU assembly is replaced, the analyzer's serial number and IBASIC option must be stored in EEPROM on the new assembly (see "Replacing CPU Assembly" in section II). The IIC Controller also has access to a battery backed real-time clock on the Memory assembly.

The IIC bus consists of the following six signal lines:

- SCL\ (serial clock)
- SCLA\ (serial clock)
- SCLB\ (serial clock)
- SDA\ (serial data)
- SINT\ (serial interrupt)
- SINTFP\ (serial interrupt for Front Panel assembly)

Pull-up resistors connect these signals to logic high (all six lines are open collector or open drain). See "W5 Front Panel Cable Signals" and "W12 Motherboard Power Cable Signals" (later in this section) for descriptions of the IIC signals.

The **HP-IB Interface** allows the analyzer to communicate with other devices such as plotters, printers, or a host computer via an HP-IB cable. This circuit handles all HP-IB functions for the analyzer. The analyzer's HP-IB connector is located on the CPU assembly.

The **Disk Controller** allows the analyzer to store or retrieve data from the optional internal 3.5-inch flexible Disk Drive assembly. It provides all the control signals necessary to operate the Disk Drive assembly. The Disk Controller performs the following functions:

- Turns on the disk drive motor
- Selects the disk drive head
- Turns on the disk drive LED
- Selects a track on the flexible disk
- Writes or reads serial data from the flexible disk

The Disk Controller puts data on the flexible disk in a bit stream that consists of data and clock bits. When data is read from the disk, this circuit separates the data bits from the clock bits, converts the serial data bits to an 8-bit parallel word, and puts the data word on the processor data bus. The operation is reversed when data is written to the disk.

The **Display Controller** positions information on the analyzer's display. The Display Controller takes parallel data from the processor data bus and places the data in display RAM (four 64K × 4-bit RAM chips). One bit in display RAM corresponds to one pixel on the display. The data in display RAM is then sent to a parallel-to-serial shift register. The shift register continuously updates the display with the contents of display RAM. The Display Controller also supplies the horizontal and vertical sync signals for the display, and it determines if the data on the display is full bright or half bright.

A87 Memory and A88 Expanded Memory

The Memory assembly provides the CPU assembly with ROM, dynamic RAM, static RAM, and a real-time clock (see figure 4-29). The Memory assembly also provides battery backup for the static RAM and real-time clock. Memory is divided into 16-bit words. To access a memory location, the CPU assembly puts the address of the desired 16-bit word on the processor address bus. The CPU assembly can then read from (or write to) this memory location.

The optional Expanded Memory assembly replaces the Memory assembly, plus provides an additional two megabytes of RAM.

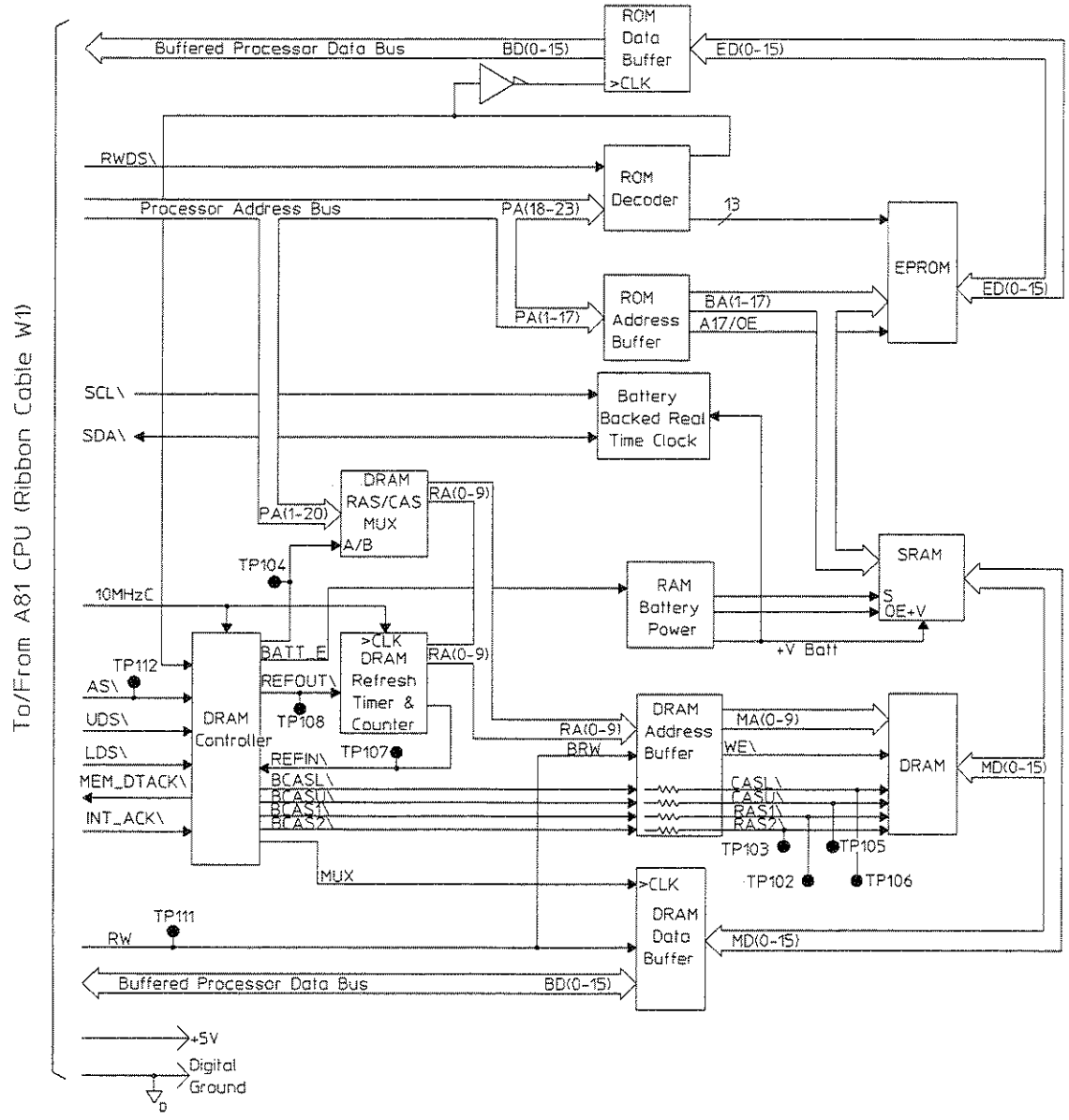


Figure 4-29. Memory and Expanded Memory Block Diagram

A90 Fan Power and A91 Fan Power/Oven

The Fan Power assembly provides power to the fan, which cools the card-nest side of the analyzer.

The optional Fan Power/Oven assembly provides power to the fan, which cools the card-nest side of the analyzer, and provides a stable 10 MHz frequency reference to the rear panel (OVEN REF OUT). During the oven warm-up cycle, oven reference output is disabled and the analyzer uses its internal crystal reference. When the oven reaches the proper operating temperature (about 10 minutes after power-up), oven reference output is automatically enabled. A BNC-to-BNC jumper connects the OVEN REF OUT connector to the EXT REF IN connector on the rear panel.

A99 Motherboard

The Motherboard assembly provides a common point of contact for voltage and signal distribution. This assembly filters some voltages and signals, and also provides power for the active probe connector on the front panel (+15V and –13V, derived from the analyzer's ± 15V supply). See "Motherboard Signals" (later in this section) for a list of all signals that are distributed via the Motherboard assembly.

Front Panel

The Front Panel assembly sends information to the analyzer. This assembly consists of all the keys on the instrument's front panel (except for the power switch), the RPG, and an IIC interface. When a front panel key is pressed or the RPG is turned, the IIC interface interrupts the CPU assembly. The CPU assembly then addresses the IIC interface and reads an 8-bit frame of data from the IIC bus to determine which key was pressed (for information about the IIC bus, see the description of the IIC Controller in the "CPU Assembly" earlier in this section).

Power Supply

The Power Supply assembly is a switching power supply that provides the voltages for all the assemblies in the analyzer. See "Voltage and Signal Distribution" (later in this section) for a list of these voltages and the assemblies that use each voltage.

Disk Drive

The optional internal Disk Drive assembly stores and retrieves information from 3.5-inch flexible disks. This assembly is mounted on (and controlled by) the CPU assembly. See the description of the Disk Controller in the "CPU Assembly" (earlier in this section) for further details.

Display

The Display assembly shows processed data sent by the CPU assembly. See the description of the Display Controller for the "CPU Assembly" (earlier in this section) for further details.

Voltage and Signal Distribution

This section shows where the signals and voltages are used in the analyzer. See figure 4-30 for assembly locations, and figure 4-31 for ribbon cable connections.

Assemblies

A11 Input
A12 First Conversion
A13 Second Conversion
A21 Sum VCO
A22 Sum Phase Detector
A23 Step Phase Detector
A24 Step VCO
A31 Reference/Calibrator
A32 300 MHz
A33 Trigger
A41 Source Amplifier
A42 Source Conversion
A51 Interpolation VCO
A52 Fractional-N
A61 IF
A62 ADC/Digital Filter
A81 CPU
A87 Memory
A88 Expanded Memory
A90 Fan Power
A91 Fan Power/Oven
A99 Motherboard

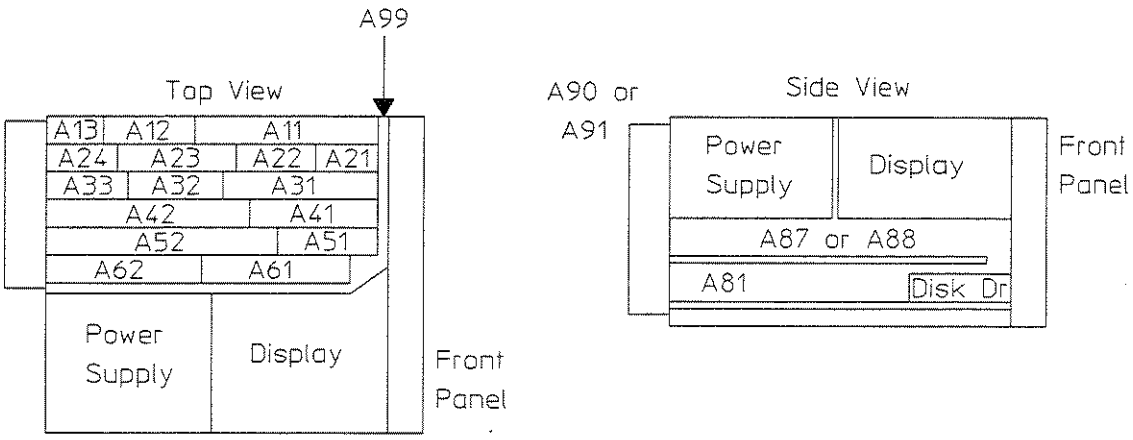


Figure 4-30. Assembly Locations

Cables

W1 Memory
W2 CPU Power
W3 Display
W4 Disk Drive
W5 Front Panel
W11 Fast Bus
W12 Motherboard Power

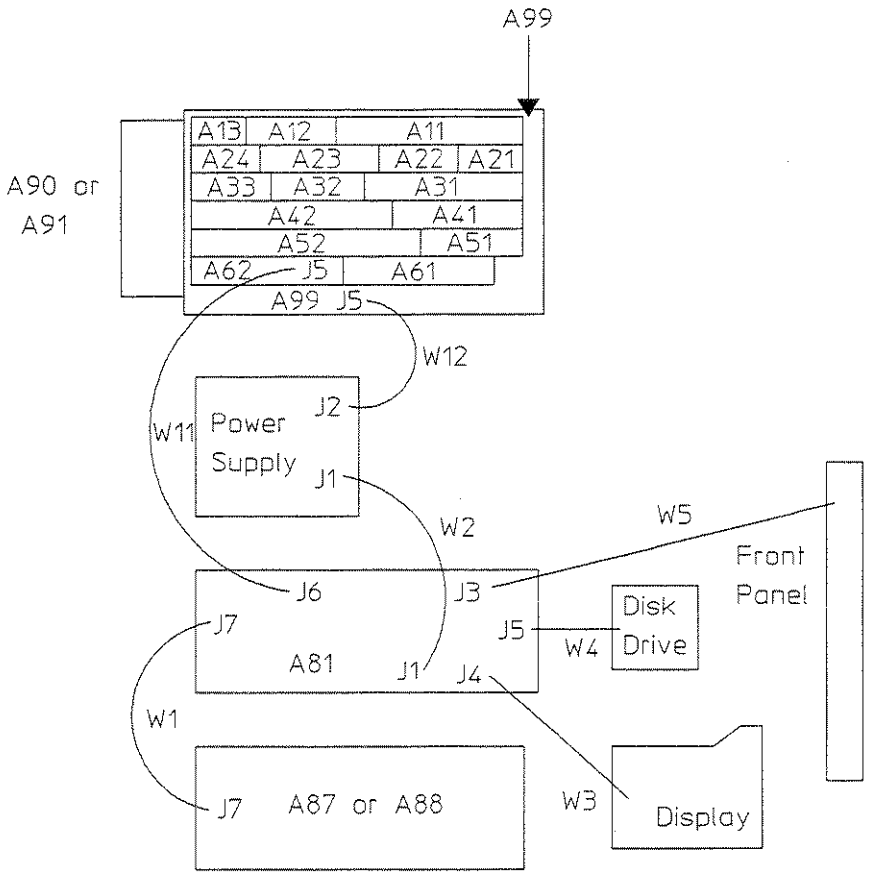


Figure 4-31. Ribbon Cable Connections

Note Signals with a mnemonic that ends with a "\" are active low.

Table 4-2 shows the power supply voltages used by each assembly in the analyzer. In addition, the table also shows the path taken by these voltages and the location of individual test points. Some assemblies use the power supply voltages as supplied by the Power Supply assembly. However, most assemblies contain voltage regulation and voltage decoupling circuits to provide additional regulation and decoupling for their own use.

Table 4-2. Power Supply Voltage Distribution

From	Path	To	Voltages							
			+18V	+15V	+12V	+8V	+5V	–15V	–18V	Gnd
Pwr Supply J1	W2	A81 J1			√		TP102		√	TP101
	W2/A81/W1	A87/A88 J7					TP100			TP101
	W2/A81/W3	Display			√		√			√
	W2/A81/W4	Disk Drive			√		√			√
	W2/A81/W5	Front Panel					√			√
Pwr Supply J2	W12	A99 J5	√	√		√	√	√	√	√
	W12/A99	A11 J5		TP202			TP201	TP203		TP200
		A12 J4		TP803		TP802	TP801	TP804		TP800
		A13 J4		TP901		TP900				TP903
		A21 J100		√		√		√		√
		A22 J100		√		√		√		√
		A23 J100		TP907		√	TP903	TP909		TP900
		A24 J100		√		√		√		√
		A31 J10	√	√		√	√		√	√
		A32 J32	√			√	√		√	√
		A33 J7		√		√	√	√		√
		A41 J41		TP560			TP561	TP562		TP551
		A42 J42		TP550		TP558	TP552	TP553		TP559
		A51 J5	√			√			√	TP504
		A52 J3	√			√	√		√	TP106
		A61 J4		TP500			TP501	TP502		√
		A62 J4		TP501			TP500	TP502		TP504
		A90/91 J3							√	√
		A91 J2	√						√	√
		Probe Power		√				√ †		√

† A circuit on the Motherboard assembly reduces this voltage to –13V.

Table 4-3 lists the pin numbers of the voltages and signals at the power supply connectors, J1 (connects to CPU) and J2 (connects to Motherboard). For a description of these signals, see "W2 CPU Power Cable Signals" and "W12 Motherboard Power Cable Signals" later in this section. For voltage tolerances and troubleshooting information, see "Initial Verification" in section V, "Service."

Table 4-3. Power Supply Connectors J1 and J2

Signal Name	J1 Pin(s)	J2 Pin(s)
PSSD\	—	50
LSWP\†	—	37
BFREQ_REF	3	—
PVALID	13	—
SDA\‡	15	11
SCLB\‡	17	9
SCLA\‡	19	7
RESET\‡	21	5
SINT\‡	23	3
GETTRIG‡	25	1
+5V	5-10	15-20
+8V	—	45-49
+12V	1,2,4	—
+15V	—	41, 42
–15V	—	27, 29
+18V	—	33
–18V	26	23
Gnd	11,12-24 (even)	2-12 (even), 13, 14, 21, 22, 24-26, 28, 30-32, 34-36, 38-40, 43, 44

† This signal is not used by the Power Supply assembly.

‡ This signal passes directly from J1 to J2 and is not used by the Power Supply assembly.

Tables 4-4 through 4-10 list signals routed through ribbon cables. These tables show several things — which assembly generates each signal, which assemblies use the signals, if a signal is bidirectional, and if a signal is not connected to an assembly.

Table 4-4. Memory Cable

Signal Name	Pin(s)	A81J7	A87/A88 J7
PA1 — PA23	1-23	S	●
BD0 — BD15	25-40	↔	↔
UDS\	44	S	●
LDS\	46	S	●
AS\	48	S	●
INT_ACK\	50	S	●
RW	52	S	●
MEM_DTACK\	54	●	S
RWDS\	56	S	●
AS_DEL	58	S	●
10MHZ	60	S	●
SCL\	62	S	●
SDA\	64	S	●
+5V	42,45,49,53,57,61	●	●
Gnd	24,41,43,47,51,55, 59,63	●	●

S This assembly is the source of the signal.
● This assembly uses the signal.
↔ This signal is bidirectional.
– This assembly does not use this signal.

Table 4-5. W2 CPU Power Cable

Signal Name	Pin(s)	A81J1	PwrJ1
BFREQ_REF	3	S	●
PVALID	13	●	S
SDA\	15	↔	—
SCLB\	17	S	—
SCLA\	19	S	—
RESET\	21	S	—
SINT\	23	●	—
GETTRIG	25	S	—
+5V	5-10	●	S
+12V	1,2,4	●	S
–18V	26	●	S
Gnd	11,12,14,16,18,20, 22,24	●	●

S This assembly is the source of the signal.
● This assembly uses the signal.
↔ This signal is bidirectional.
– This assembly does not use this signal.

Table 4-6. W3 Display Cable

Signal Name	Pin(s)	A81J4	Display
HSYNC	5	S	●
VSYNC	7	S	●
HB	13	S	●
FB	15	S	●
+12V	9,11	●	●
+5V	10	●	●
Gnd	4,6,8,12,14,16	●	●
Not Used	1-3	—	—

S This assembly is the source of the signal.
● This assembly uses the signal.
↔ This signal is bidirectional.
— This assembly does not use this signal.

Table 4-7. W4 Disk Drive Cable

Signal Name	Pin(s)	A81J5	Disk Drive
DCR\	1	S	●
DISK_CHANGE\	2	●	S
IN_USE\	4	S	●
DRIVE_SELECT_3	6	S	●
INDEX\	8	●	S
DRIVE_SELECT_0	10	S	●
DRIVE_SELECT_1	12	S	●
DISK_IN\	13	●	S
DRIVE_SELECT_2	14	S	●
MOTOR_ON\	16	S	●
DIRECTION	18	S	●
STEP\	20	S	●
WRITE_DATA\	22	S	●
WRITE_GATE\	24	S	●
T00\	26	●	S
WRITE_PROT\	28	●	S
READ_DATA\	30	●	S
HEAD_SELECT	32	S	●
DISK_READY\	34	●	S
+5V	3,5,7,9,11	●	●
+12V	29,31,33	●	●
Gnd	15,17,19,21,23,25, 27	●	●

S This assembly is the source of the signal.
● This assembly uses the signal.
↔ This signal is bidirectional.
— This assembly does not use this signal.

Table 4-8. W5 Front Panel Cable

Signal Name	Pin(s)	A81J3	Front Panel
RESET	5	S	●
SINTFP\	7	●	S
SDA\	13	↔	↔
SCL\	15	S	●
+5V	10	●	●
Gnd	6,8,12,14,16	●	●
Not Used	1,2,3,4,9,11	—	—

S This assembly is the source of the signal.
● This assembly uses the signal.
↔ This signal is bidirectional.
— This assembly does not use this signal.

Table 4-9. W11 Fast Bus Cable

Signal Name	Pin(s)	A81J6	A62J5
FD0 — FD15	1-31 (odd)	↔	↔
FA1 — FA5	33-41 (odd)	S	●
FIRQ\	43	●	S
FRW	45	S	●
SELA\	47	S	●
SELS\	49	S	●
FDTACK\	51	●	S
ECLK	53	S	—
REQ0\	55	●	S
ACK0\	57	S	●
PCL0\	59	●	S
DTC\	61	●	S
EXT_CLK	63	●	S
Gnd	2-64 (even)	●	●

S This assembly is the source of the signal.
● This assembly uses the signal.
↔ This signal is bidirectional.
— This assembly does not use this signal.

Table 4-10. W12 Motherboard Power Cable

Signal Name	PWRJ2 Pin(s)	Power Supply	A99J5 Pin(s)	Motherboard
PSSD\	50	•	1	S
LSWP\	37	—	14	S
SDA\	11	—	40	⇔
SCLB\	9	—	42	•
SCLA\	7	—	44	•
RESET\	5	—	46	•
SINT\	3	—	48	S
GETTRIG	1	—	50	•
+8V	45-49	S	2-6	•
+15V	41, 42	S	9,10	•
+18V	33	S	18	•
–15V	27, 29	S	22, 24	•
–18V	23	S	28	•
+5V	15-20	S	31-36	•
Gnd	2-12(even), 13, 14, 21, 22, 24-26, 28, 30-32, 34-36, 38-40, 43, 44	S	7, 8, 11-13, 15-17, 19-21, 23, 25-27, 29, 30, 37, 38, 39-49(odd)	•

S This assembly is the source of the signal.
• This assembly uses the signal.
⇔ This signal is bidirectional.
– This assembly does not use this signal.

Table 4-11 lists all signals routed through RF cables. The table shows where the cables are connected and which assembly generates the signal.

Table 4-12 lists all signals routed through the Motherboard. The table shows the first place a signal appears or could appear on the Motherboard.

Table 4-13 lists voltages routed through the Motherboard (see table 4-2 for a complete list of assemblies using each voltage).

Table 4-14 lists signals at the HP-IB connector (A81 J2).

Table 4-11. RF Cables †

Signal Name	Assembly & Connectors																Cable Color
	A11	A12	A13	A21	A22	A23	A24	A31	A32	A33	A41	A42	A51	A52	A61	A62	Rear Panel	
100_KHZ_REF										**J4**				J2				red
187.5_KHZ_SRCE										**J2**		J6						red
250_KHZ_RCVR										**J3**						J1		orange
10_MHZ_RCVR								**J3**							J2			yellow
10_MHZ_REF						J3		**J4**										blue
10_MHZ_SRCE								**J5**				J4						green
20_MHZ								**J9**	J1									red
60_MHZ									**J2**	J1								orange
80_MHZ_RCVR								**J8**								J2		green
300_MHZ_RCVR			J1						**J5**									orange
300_MHZ_REF						J2			**J4**									red
300_MHZ_SRCE									**J3**			J3						red
1ST_IF		**J3**	J2															red
2ND_IF			**J3**												J1			lt blue
3RD_IF															**J3**	J3		white
CAL	J2							**J1**										red
CAL_SRCE								J2			**J2**							red
EXT_REF_IN								J7									**EXT REF IN**	blue
EXT_TRIG										J6							**EXT TRIG**	black
F/N_VCO													**J3**	J1				orange
INPUT_OUT	**J3**	J2																black
INTRPL_VCO					J3								**J1**					white
NORMALIZE	J1										**J1**							orange
REF_OUT								**J6**									REF OUT	lt green
SL_VCO				**J1**									J2					orange
SRCE_AMP											J3	**J1**						red
STEP_TO_SUM					J2		**J1**											blue
STEP_VCO						J1	**J3**											blue
SUM_VCO				**J4**	J1													red
SWEPT_LO_RCVR		J1		**J3**														gray
SWEPT_LO_SRCE				**J2**								J2						blue
TRIG_OUT										**J5**							TRIG OUT	white

† The signal source is shown in boldface type.

Table 4-12. Motherboard Signals †

Signal Name	Assembly Using Signal															
	PWR	A11	A12	A21	A22	A23	A24	A31	A32	A33	A41	A42	A51	A52	A61	A62
	Motherboard Connector															
	J5	J11	J12	J21	J22	J23	J24	J31	J32	J33	J41	J42	J51	J52	J61	J62
	Connector Pin Number															
187.5_SIG\											1A	**16A**				
ATN0															1A	**16A**
ATN1															1B	**16B**
ATN2															1C	**16C**
ATN3															2A	**15A**
ATN4															2B	**15B**
CAL_ON											2A	**15A**				
CV_FRACN													1B	**16B**		
CV_ML				11	**9**											
CV_SL				12										**16A**		
CV_STEP						**1B**	11									
GETTRIG	**50**									11						
HFU\								11	**12**							
INC_IMAG		**1A**	8													
INC_REAL		**3A**	11													
LO_DET\															**3B**	14B
LSWP\	14									**12**				1A		1B
ML/SL				8		**2B**										
PRETUNE					11	**1C**										
PSSD\	1						**8**				**3B**					
RESET\	**46**															2C
SCLA\	**44**	15A				16C										2A
SCLB\	**42**							9		9	15B 16A 16C	2B 3A 3C	15B 16A 16C	1B 3A 3C		
SDA\	**40**	**16B**				**15A**		**12**		**8**	**16B**	3B	**16B**	**3B**		**3B**
SIG_DET															**3C**	14C
SINT\	48	**14A**				**15C**		**8**			**14A**		**14A**			**1A**
SLF\													3B	**14B**		
SPEED_UP				7	**7**											
SRCE_ON											1B	**16B**				
SUM_OOL_H					**12**	2A										
SUM_OOL_L					**10**	1A										
THRESH_LO											2B	**15B**				
UP_DN		**2A**	12													

† The first place on the Motherboard that the signal appears (or could appear) is shown in boldface type.

Table 4-13. Motherboard Voltages

Voltage	Assembly Using Voltage																		
	PWR	A11	A12	A13	A21	A22	A23	A24	A31	A32	A33	A41	A42	A51	A52	A61	A62	A90/91	P PWR
	Motherboard Connector																		
	J5	J11	J12	J13	J21	J22	J23	J24	J31	J32	J33	J41	J42	J51	J52	J61	J62	W1	W2
	Connector Pin Number or Wire Color																		
+18V	18								1	1				7A 7B 7C	7A 7B 7C			Red	
+15V	9 10	4A 4B 4C	1	1	1	1	4A 4B 4C	1	3		1	4A 4B 4C	4A 4B 4C			4A 4B 4C	4A 4B 4C		Red
+8V	2-6		5 6	5 6	5 6	5 6	10A 10B 10C	5 6	5 6	5 6	5 6		10A 10B 10C	10A 10B 10C	10A 10B 10C				
+5V	31- 36	12A 12B 12C	10				12A 12B 12C		10	10	10	12A 12B 12C	12A 12B 12C		12A 12B 12C	12A 12B 12C	12A 12B 12C		
−15V	22 24	5A 5B 5C	2		2	2	5A 5B 5C	2			2	5A 5B 5C	5A 5B 5C			5A 5B 5C	5A 5B 5C		Yel†
−18V	28								2	2				8A 8B 8C	8A 8B 8C			Yel	
Gnd	7-8 11- 13 15- 17 19- 21 23 25- 27 29 30 37- 39 41 43 45 47 49	6A 6B 6C 9A 9B 9C 11A 11B 11C 13A 13B 13C	4 7 9	4 7 9	4 9	4	3A 3B 3C 6A 6B 6C 9A 9B 9C 11A 11B 11C 13A 13B 13C	4 7 9 12	4 7	4 7	4 7	6A 6B 6C 9A 9B 9C 11A 11B 11C 13A 13B 13C	6A 6B 6C 9A 9B 9C 11A 11B 11C 13A 13B 13C	1A 1C 2A 2B 2C 3A 3C 6A 6B 6C 9A 9B 9C 11A 11B 11C 13A 13B 13C	6A 6B 6C 9A 9B 9C 11A 11B 11C 13A 13B 13C 14A 14C 15A 15B 15C 16C	6A 6B 6C 9A 9B 9C 11A 11B 11C 13A 13B 13C	6A 6B 6C 9A 9B 9C 11A 11B 11C 13A 13B 13C	Blk	Blk

† A circuit on the Motherboard reduces this voltage to −13V before it is routed to the front panel for probe power.

Table 4-14. HP-IB Connnector (A81 J2)

Signal Name	Pin	Signal Name	Pin
DIO1	1	DIO5	13
DIO2	2	DIO6	14
DIO3	3	DIO7	15
DIO4	4	DIO8	16
EOI	5	REN	17
DAV	6	GND6	18
NRFD	7	GND7	19
NDAC	8	GND8	20
IFC	9	GND9	21
SRQ\	10	GND10	22
ATN	11	GND11	23
Shield	12	Logic Gnd	24

W1 Memory Cable Signals

Note Signals with a mnemonic that ends with a "\" are active low.

10MHZ	10 MHz Clock — This is a 50% duty cycle, 10 MHz clock. It refreshes the dynamic RAM and synchronizes data transfers on the Memory assembly.
AS_DEL	Delayed Address Strobe — This is a delayed version of AS\ (Address Strobe). A high on this line generates a data transfer acknowledge for memory that requires 1 or more wait states.
AS\	Address Strobe — This line pulses low when a valid address is on the processor address bus (PA1 — PA23).
BD0 — BD15	Buffered Data Bus — This is the buffered processor data bus from the CPU assembly. It is further buffered on the Memory assembly. Most data transfers between the two assemblies occur on this bus.
INT_ACK\	Interrupt Acknowledge — This line goes low when the CPU assembly receives an interrupt. A low on this line prevents the Memory assembly from starting another memory cycle.
LDS\	Lower Data Strobe — During a write cycle, this line pulses low when valid data is on BD0 through BD7. During a read cycle, this line pulses low when data should be placed onto BD0 through BD7.
MEM_DTACK\	Memory Data Transfer Acknowledge — This line pulses low after the Memory assembly places RAM or ROM data on the Buffered Data Bus.
PA1 — PA23	Processor Address Bus — This is the processor address bus from the CPU assembly. It is buffered on the Memory assembly.

RW	Read/Write — This line is high when the current memory cycle is a read. It goes low when the current memory cycle is a write.
RWDS\	Read/Write & Data Strobe — A low on this line synchronizes access to ROM. This signal goes low during a read cycle when the upper or lower data strobe goes low.
SCL\	Serial Clock — This is the serial clock for the IIC bus. The IIC controller on the CPU assembly generates this clock to synchronize the transfer of data on the IIC bus.
SDA\	This is the IIC bus bidirectional data line. This line transmits real-time clock data between the CPU assembly and the Memory assembly in 8-bit frames. The IIC controller on the CPU assembly controls data transfers on the IIC bus.
UDS\	Upper Data Strobe — During a write cycle, this line goes low when data is valid on BD8 — BD15. During a read cycle, this line goes low when data should be placed onto BD8 — BD15.

W2 CPU Power Cable Signals

Note

GETTRIG, SCLA\, SCLB\, SINT\, SDA\, and RESET\ are not used by the Power Supply assembly. Instead, these signals are routed between the CPU assembly and the Motherboard assembly by the CPU power cable, the Power Supply assembly, and the motherboard power cable. LSWP\ is present on the motherboard power cable but is not used by either the Power Supply assembly or the CPU assembly.

BFREQ_REF	Buffered Frequency Reference — This is a 50% duty cycle, 35.714 kHz clock generated by the CPU assembly to reduce noise and ripple from the Power Supply assembly. The Power Supply assembly phase locks its switching frequency to this clock.
GETTRIG	Group Execute Trigger — This is the group-execute trigger line from the HP-IB interface on the CPU assembly. When the analyzer is under HP-IB control, the Trigger assembly uses this line to trigger the analyzer.
PVALID	Power Valid — This line is high when the +5V supply from the Power Supply assembly is stabilized.
RESET\	System Reset — A low on this line resets the digital logic on the ADC/Digital Filter assembly. This line pulses low during power-up and power-down, when the processor is externally reset, and when the processor executes the RESET instruction.
SCLA\	Serial Clock A — This is a serial clock for the IIC bus. The IIC controller on the CPU assembly generates this clock to synchronize the transfer of data on the IIC bus.
SCLB\	Serial Clock B — This is another serial clock for the IIC bus. The IIC controller on the CPU assembly generates this clock to synchronize the transfer of data on the IIC bus.
SDA\	Serial Data — This is the IIC bus bidirectional data line. This line transmits data to or from the CPU assembly in 8-bit frames. The IIC controller on the CPU assembly controls data transfers on the IIC bus.
SINT\	Serial Interrupt — This is the IIC bus interrupt line. A low on this line interrupts the CPU assembly.

W3 Display Cable Signals

FB	Full Bright — A high on this line sets the Display assembly's electron beam to full bright.
HB	Half Bright — A high on this line sets the Display assembly's electron beam to half bright.
HSYNC	Horizontal Synchronization — A high on this line causes the Display assembly to do a horizontal retrace.
VSYNC	Vertical Synchronization — A high on this line causes the Display assembly to do a vertical retrace.

W4 Disk Drive Cable Signals

DCR\	Disk Change Reset — A low on this line resets DISK_CHANGE\. This line goes low when DISK_READY\ is low.
DIRECTION	Direction — This line sets the direction for the disk head. A high on this line sets the direction away from the spindle. A low on this line sets the direction toward the spindle.
DISK_CHANGE\	Disk Change — This line goes low when a flexible disk is removed from the Disk Drive assembly. This line remains low until a flexible disk is installed and either DCR\ or STEP\ goes low.
DISK_IN\	Disk In — This line goes low when a flexible disk is inserted in the Disk Drive assembly.
DISK_READY\	Disk Ready — This line goes low when a flexible disk is inserted and the index period of the disk motor is stable. A low on this line causes DCR\ to go low, which resets DISK_CHANGE\.
DRIVE_SELECT 0, 1, 2, 3	Drive Select — A low on DRIVE_SELECT 0 selects the Disk Drive assembly. DRIVE_SELECT 0 is connected to ground and DRIVE_SELECT 1, 2 and 3 are connected to +5V.

HEAD_SELECT	Head Select — A low on this line selects the lower disk drive head. A high on this line selects the upper disk drive head.
INDEX\	Index — This line pulses low with each revolution of the flexible disk.
IN_USE\	In Use — A low on this line turns on the disk drive LED. This line is low during disk access.
MOTOR_ON\	Motor On — A low on this line turns on the disk drive motor. This line goes low when a flexible disk is inserted.
READ_DATA\	Read Data — This line pulses low for each bit detected on the flexible disk.
STEP\	Step — A low on this line moves the disk drive head. When STEP\ and DIRECTION are low, the head moves toward the disk spindle. When STEP\ is low and DIRECTION is high, the head moves away from the disk spindle.
T00\	Track 00 — This line is low when the head is positioned over track 0 on the flexible disk.
WRITE_DATA\	Write Data — When WRITE_GATE\ is low, a low pulse on this line writes a bit to the disk.
WRITE_GATE\	Write Gate — When this line is low, information may be written to the Disk Drive assembly under control of the WRITE_DATA\ line.
WRITE_PROT\	Write Protect — This line is low when a write-protected disk is installed in the Disk Drive assembly.

W5 Front Panel Cable Signals

RESET — System Reset — A high on this line resets the digital logic on the Front Panel assembly. This line pulses high during power-up and power-down, when the processor is externally reset, and when the processor executes the RESET instruction.

SCL\ — Serial Clock — This is the serial clock for the front panel IIC bus. The IIC controller on the CPU assembly generates this clock to synchronize the transfer of data from the Front Panel assembly.

SDA\ — Serial Data — This is the front panel IIC bus. When a front panel key is pressed or the RPG is turned, SINTFP\ interrupts the CPU assembly and this line transmits data to the CPU assembly in 8-bit frames.

SINTFP\ — Serial Interrupt from the Front Panel — A low on this line interrupts the CPU assembly. This line goes low when a front-panel key is pressed or when the RPG is turned.

W11 Fast Bus Cable Signals

ACK0\ — DMA Acknowledge — This line pulses low in response to a low on REQ0\ when the CPU assembly is ready for data.

DTC\ — Data Transfer Complete — This line goes low after the CPU assembly successfully reads the data from the ADC/Digital Filter assembly. When this line goes low, PCL0\ goes high to prevent the CPU assembly from trying another read cycle until the ADC/Digital Filter assembly is ready.

ECLK — Enable Clock — This is a 60% duty cycle, 1 MHz clock. The ADC/Digital Filter assembly does not use this clock or route it to any other assembly.

EXT_CLK — External Clock — This is a TTL level, 20 MHz clock that locks the system clock to the reference clock. It synchronizes the CPU assembly with the rest of the instrument.

FA1 — FA5 — Fast Bus Address Lines — These lines are a buffered form of the CPU assembly's processor address bus. The CPU assembly uses these lines to address different circuits on the ADC/Digital Filter assembly.

FD0 — FD15	Fast Bus Data Lines — These bidirectional data lines are an extension of the CPU assembly's buffered processor data bus.
FDTACK\	Fast Bus Data Transfer Acknowledge — A low on this line terminates asynchronous bus cycles.
FIRQ\	Fast Bus Interrupt Request — A low on this line interrupts the CPU assembly.
FRW	Fast Bus Read/Write — This line is high during a read cycle and low during a write cycle. This line is an extension of the read/write line (RW).
PCL0\	DMA Programmable Control Line — This line goes low in response to a low on ACK0\ when the ADC/Digital Filter assembly is ready to send data. This line goes high when DTC\ goes low.
REQ0\	DMA Request — This line goes low after the ADC/Digital Filter assembly collects a block of data and is ready to have the CPU assembly read the data.
SELA\	Asynchronous Select — A low on this line enables asynchronous circuits on the ADC/Digital Filter assembly.
SELS\	Synchronous Select — This line is low when a synchronous bus cycle is in operation. The ADC/Digital Filter assembly does not use this line or route it to any other assembly.

W12 Motherboard Power Cable Signals

Note

GETTRIG, SCLA\, SCLB\, SINT\, SDA\, and RESET\ are not used by the Power Supply assembly. Instead, these signals are routed between the CPU assembly and Motherboard assembly by the CPU power cable, the Power Supply assembly, and the motherboard power cable.

GETTRIG — Group Execute Trigger — This is the group execute trigger line from the HP-IB interface on the CPU assembly. When the analyzer is under HP-IB control, the Trigger assembly uses this line to trigger the analyzer.

PSSD\ — Power Supply Shut Down — A short circuit to ground on this line forces all Power Supply output voltages to zero. This line is normally an open circuit, but becomes a short circuit to ground if the analyzer's internal temperature becomes excessive.

RESET\ — System Reset — A low on this line resets the digital logic on the ADC/Digital Filter assembly. This signal is pulsed low during power-up and power-down, when the processor is externally reset, and when the processor executes the RESET instruction.

SCLA\ — Serial Clock A — This is the serial clock for the IIC bus. The IIC controller on the CPU assembly generates this clock. This clock synchronizes the transfer of data on the IIC bus.

SCLB\ — Serial Clock B — This is another serial clock for the IIC bus. The IIC controller on the CPU assembly generates this clock. This clock synchronizes the transfer of data on the IIC bus.

SDA\ — Serial Data — This is the IIC bus bidirectional data line. This line transmits data to or from the CPU assembly in 8-bit frames. The IIC controller on the CPU assembly controls data transfers on the IIC bus.

SINT\ — Serial Interrupt — This is the IIC bus interrupt line. A low on this line interrupts the CPU assembly.

RF Cable Signals

100_KHZ_REF — 100 kHz Reference — This is a 100 kHz, 1 Vp-p, approximate 1% duty cycle pulse. This signal provides a phase reference for the Fractional-N assembly.

187.5_KHZ_SRCE — 187.5 kHz to Source — This is a 187.5 kHz, 600 mVp-p, ac-coupled square wave. The Source Conversion assembly mixes this signal with 10_MHZ_SRCE.

250_KHZ_RCVR — 250 kHz to Receiver — This is a 250 kHz, TTL-level signal. The ADC on the ADC/Digital Filter assembly samples on the rising edge of this signal.

10_MHZ_RCVR — 10 MHz to Receiver — This is a 10 MHz, –2 dBm, ac-coupled sine wave. The IF assembly mixes this signal with 2ND_IF.

10_MHZ_REF — 10 MHz Reference — This is a 10 MHz, –2 dBm, ac-coupled sine wave. This signal is divided by 5 or 2, then used as a phase reference on the Step Phase Detector assembly.

10_MHZ_SRCE — 10 MHz to Source — This is a 10 MHz, –2 dBm, ac-coupled sine wave. The Source Conversion assembly mixes this signal with 187.5_KHZ_SRCE.

20_MHZ — 20 MHz — This is a 20 MHz, ECL level, ac-coupled square wave. This signal provides the 300 MHz assembly with a phase reference.

60_MHZ — 60 MHz — This is a 60 MHz, ECL level, ac-coupled signal. The Trigger assembly divides this signal to generate 250_KHZ_RCVR, 187.5_KHZ_SRCE, and 100_KHZ_REF.

80_MHZ_RCVR — 80 MHz to Receiver — This is an 80 MHz, 50% duty cycle, ECL level signal. The ADC/Digital Filter assembly divides this signal by four to generate 20 MHz clock signals.

300_MHZ_RCVR — 300 MHz to Receiver — This is a 300 MHz, 0 dBm, ac-coupled sine wave. The Second Conversion assembly mixes this signal with 1ST_IF.

300_MHZ_REF — 300 MHz Reference — This is a 300 MHz, –2 dBm, ac-coupled sine wave. The Step Phase Detector assembly mixes this signal with STEP_VCO.

300_MHZ_SRCE — 300 MHz to Source — This is a 300 MHz, –10 dBm, ac-coupled sine wave. The Source Conversion assembly mixes this signal with a 10.1875 MHz signal.

1ST_IF — First Intermediate Frequency — This is a 310.1875 MHz signal with a nominal full-scale amplitude of –30 dBm. This signal is the input signal for the Second Conversion assembly.

2ND_IF — Second Intermediate Frequency — This is a 10.1875 MHz signal with a nominal full-scale amplitude of –37 dBm signal. This signal is the input signal for the IF assembly.

3RD_IF — Third Intermediate Frequency — This is a 187.5 kHz signal with a nominal full-scale amplitude of 3 dBV. This signal is the input signal for the ADC/Digital Filter assembly.

CAL — Calibration — This is a square wave with a –20 dBm precision-amplitude fundamental. The Reference/Calibrator assembly attenuates either CAL_SRCE or a fixed 10 MHz signal. The calibration and self-test routines use this signal at various times.

CAL_SRCE — Calibration Source — During calibration of the input path, this is a 200 kHz to 150 MHz, approximate –11 dBm signal. The Source Amplifier assembly routes this signal to the Reference/Calibrator assembly. The calibration, adjustment-setup, and self-test routines use this signal path at various times.

EXT_REF_IN — External Reference — This is the analyzer's external reference input from the optional Fan Power/Oven assembly or an external source. The signal can be a 1 MHz, 2 MHz, 5 MHz, or 10 MHz sine or square wave with an amplitude between 5 dBm and +10 dBm. This signal is routed from a BNC connector on the rear panel.

EXT_TRIG — External Trigger — This is the analyzer's external trigger input. When the CPU assembly enables external trigger mode, a TTL low on this line triggers the analyzer. This signal is routed from a BNC connector on the rear panel.

F/N_VCO — Fractional-N Voltage Controlled Oscillator — When the local oscillator is operating in single loop mode, this is a 31 to 46 MHz, dc-coupled, ECL level, square wave derived from dividing SL_VCO by 10. In multiple loop mode, this is a 30 to 55 MHz, dc-coupled, ECL level, square wave controlled by CV_FRACN. The Fractional-N assembly divides this signal down to 100 kHz.

Note

For information on the local oscillator's single and multiple loop modes, see figures 4-12 and 4-13.

INPUT_OUT — Input Out — This signal's frequency range is 10 Hz to 150 MHz and its full-scale amplitude is approximately –28 dBm ± 1 dB. This signal is the input signal after it is buffered or attenuated, then amplified and filtered. This signal is the input signal for the First Conversion assembly.

INTRPL_VCO — Interpolation Voltage Controlled Oscillator — This is either a 3 to 5 MHz or a 6 to 11 MHz, ac-coupled, ECL level, square wave. The frequency range depends on whether F/N_VCO is divided by ten or by five. The Sum Phase Detector uses this signal for a phase comparison. This signal is only present when the local oscillator is operating in multiple loop mode.

NORMALIZE — Normalize — The analyzer's calibration and self-test routines use this signal path at various times. During calibration of the source, this is a 300 kHz signal routed to the Input assembly.

REF_OUT — Reference Out — This is a 10 MHz, 50% duty cycle, ECL level, ac-coupled sine wave derived by dividing 20_MHZ by two. This signal is routed to a BNC connector on the rear panel.

SL_VCO — Single Loop Voltage Controlled Oscillator — This signal can sweep from 310.1875 to 460.1875 MHz. It is a +3 dBm signal controlled by CV_SL. The Interpolation VCO assembly divides this signal by 10 and routes it to the Fractional-N assembly as F/N_VCO. This signal is only present when the local oscillator is operating in single loop mode.

SRCE_AMP — Source Amplifier — This is a 10 Hz to 150 MHz, –41 to –60.9 dBm signal. This signal is the input for the Source Amplifier.

STEP_TO_SUM — Step to Sum Voltage Controlled Oscillator — When the local oscillator is operating in multiple loop mode, this is a 306 to 450 MHz, –8 dBm signal controlled by CV_STEP. This signal steps from 306 to 336 MHz in 2 MHz steps and from 335 to 450 MHz in 5 MHz steps. The Sum Phase Detector mixes this signal with SUM_VCO. When the local oscillator is operating in single loop mode, this is a 306 MHz signal that is not used.

STEP_VCO — Step Voltage Controlled Oscillator — When the local oscillator is operating in multiple loop mode, this is a 306 to 450 MHz, +10 dBm signal controlled by CV_STEP. This signal steps from 306 to 336 MHz in 2 MHz steps and from 335 to 450 MHz in 5 MHz steps. The Step Phase Detector mixes this signal with 300_MHZ_REF. When the local oscillator is operating in single loop mode, this is a 306 MHz signal that is not used.

SUM_VCO — Sum Voltage Controlled Oscillator — This signal can sweep from 310.1875 to 460.1875 MHz. Its amplitude is typically +8 dBm, and it is controlled by CV_ML. The Sum Phase Detector mixes this signal with STEP_TO_SUM. This signal is only used when the local oscillator is operating in multiple loop mode.

SWEPT_LO_RCVR Swept Local Oscillator to Receiver — This signal can sweep from 310.1875 to 460.1875 MHz. When the local oscillator is operating in single loop mode, this signal is controlled by CV_SL, and in multiple loop mode, this signal is controlled by CV_ML. This signal's amplitude is typically +4 dBm. The First Conversion assembly mixes this signal with INPUT_OUT.

SWEPT_LO_SRCE Swept Local Oscillator to Source — This signal can sweep from 310.1875 to 460.1875 MHz. When the local oscillator is operating in multiple loop mode, this signal is controlled by CV_SL, and in multiple loop mode, this signal is controlled by CV_ML. This signal's amplitude is typically –10 dBm. The Source Conversion assembly mixes this signal with 310.1875 MHz.

TRIG_OUT Trigger Output — If the trigger is in slave mode, this is a buffered version of EXT_TRIG; otherwise, this is a buffered version of LSWP\. This signal is routed to a BNC connector on the rear panel.

Motherboard Signals

187.5_SIG\ — 187.5 kHz Signal — This line is used during self tests and disabled during normal operation. This line goes low if the 187.5 kHz reference is present when a self test checks for the presence of the reference. This line also goes low if the output of the gilbert cell multiplier is present when a self test checks for the presence of the output.

ATN0 — ATN4 — Attenuator Control — These lines provide attenuator control for the IF assembly.

CAL_ON — Calibration Path Enable — A high on this line enables the calibration path from the Source Amplifier assembly to the Reference/Calibrator assembly.

CV_FRACN — Control Voltage to Fractional-N — This is the control voltage for the Interpolation VCO assembly. Its amplitude is between approximately –3V and +11.5V. This signal is only used when the local oscillator is operating in multiple loop mode.

Note

For information on the local oscillator's single and multiple loop modes, see figures 4-12 and 4-13.

CV_ML — Control Voltage Multiple Loop — This is the control voltage for the Sum VCO assembly. Its amplitude is between approximately –2V and +7V. This signal is only used when the local oscillator is operating in multiple loop mode.

CV_SL — Control Voltage Single Loop — This is the control voltage for the Sum VCO assembly. Its amplitude is between approximately –2 and +7V. This signal is only used when the local oscillator is operating in single loop mode.

CV_STEP — Control Voltage Step — This is the control voltage for the Step VCO assembly. When the local oscillator is operating in multiple loop mode, this signal's level is between approximately –2V and +7V. When the local oscillator is operating in single loop mode, this signal's level is approximately +7V.

GETTRIG — Group Execute Trigger — This is the group execute trigger from the HP-IB interface on the CPU assembly. When the analyzer is under HP-IB control, the Trigger assembly uses this line to trigger the analyzer.

HFU\	High Frequency Unlocked — This line is low when the 300 MHz phase-lock loop on the 300 MHz assembly is unlocked. A low on this line forces SINT\ low.
INC_IMAG	Increment Imaginary — This is the increment pulse for local oscillator feedthrough null imaginary axis control. UP_DN sets the increment direction. INC_IMAG, INC_REAL, and UP_DN interact to null the local oscillator feedthrough circuit on the First Conversion assembly.
INC_REAL	Increment Real — This is the increment pulse for local oscillator feedthrough null real axis control. UP_DN sets the increment direction. INC_IMAG, INC_REAL, and UP_DN interact to null the local oscillator feedthrough circuit on the First Conversion assembly.
LO_DET\	Local Oscillator Detector — This line is low when the 10 MHz reference is not present on the IF assembly. A low on this line forces SINT\ low.
LSWP\	Sweep Synchronization — This is the TTL sweep synchronization signal. After a change in resolution bandwidth or an instrument preset, the negative edge of this signal resets the digital filters on the ADC/Digital Filter assembly. On subsequent negative edges, this signal is the sweep signal for the analyzer.
ML/SL	Multiple Loop/Single Loop — This line is low when the local oscillator is in multiple loop mode and high when the local oscillator is in single loop mode. This line controls a switch on the Sum VCO assembly.
PRETUNE	Pretune — This signal coarsely adjusts the sum VCO. It is a scaled version of CV_STEP. When the local oscillator is operating in multiple loop mode, this signal's amplitude is between –2V and +7V. This voltage is added to the output of the integrator on the Sum Phase Detector assembly and becomes CV_ML. When the local oscillator is operating in single loop mode, this signal's amplitude is about +7V.
PSSD\	Power Supply Shut Down — A short circuit to ground on this line forces all Power Supply output voltages to zero. This line is normally an open circuit, but becomes a short circuit to ground if the analyzer's internal temperature becomes excessive.
RESET\	System Reset — A low on this line resets the digital logic on the ADC/Digital Filter assembly. This line is pulsed low during power-up and power-down, when the processor is externally reset, and when the processor executes the RESET instruction.
SCLA\	Serial Clock A — This is a serial clock for the IIC bus. The IIC controller on the CPU assembly generates this clock. This clock synchronizes the transfer of data on the IIC bus.

SCLB\	Serial Clock B — This is another serial clock for the IIC bus. The IIC controller on the CPU assembly generates this clock. This clock synchronizes the transfer of data on the IIC bus.
SDA\	Serial Data — This is the IIC bus bidirectional data line. This line transmits data to or from the CPU assembly in 8-bit frames. The IIC controller on the CPU assembly controls data transfers on the IIC bus.
SIG_DET	Signal Detection — This line is high when the signal at the 10.1875 MHz input of the IF assembly is approximately 15 dB over full scale.
SINT\	Serial Interrupt — This is the IIC bus interrupt line. A low on this line interrupts the CPU assembly.
SLF\	Sweep Limit Flag — This line goes low if the fractional-N integrated circuit on the ADC/Digital Filter assembly reaches the end of its frequency sweep. A low on this line can force SINT\ low.
SPEED_UP	Speed Up — When the sum loop is unlocked, this line is +15V and it speeds up the settling time of the sum loop. When the sum loop is locked, this line is –15V. This line controls a switch on the Sum VCO assembly. This line is only used when the local oscillator is operating in multiple loop mode.
SRCE_ON	Source On — This line is high when the source is on and low when the source is off.
SUM_OOL_H	Sum Out of Lock High — This line is high when the sum loop is unlocked because the frequency of the sum loop circuit is too high.
SUM_OOL_L	Sum Out of Lock Low — This line is high when the sum loop is unlocked because the frequency of the sum loop circuit is too low.
THRESH_LOW	Threshold Low — This line sets the overload detector threshold for the Source Amplifier assembly.
UP_DN	Up or Down — This line sets the increment direction for INC_IMAG and INC_REAL. When this line is low the increment direction is down. When this line is high the increment direction is up. INC_IMAG, INC_REAL, and UP_DN interact to null the local oscillator feedthrough circuit on the First Conversion assembly.

HP-IB Connector Signals

Note

The descriptions that follow for the HP-IB lines are general descriptions only. For a detailed description of how the analyzer interprets the HP-IB lines, see the *HP 3588A HP-IB Programming Reference*.

ATN	Attention — This line is controlled by the controller in charge. When this line is low, the DIO lines contain interface commands. When this line is high, the DIO lines contain data.
DAV	Data Valid — This line goes high when valid data is on the bus. This line is controlled by the HP-IB controller.
DIO1 — DIO8	Data Input/Output — These are inverted data lines that conform to IEEE specification IEEE-488. When ATN is low, these lines contain interface commands. When ATN is high, these lines contain data.
EOI	End or Identify — If ATN is high, a high on this line marks the end of a message block. If ATN is low, a high on this line requests a parallel poll.
IFC	Interface Clear — This line goes high to set the interface system to a known state. The system controller becomes the controller in charge.
NDAC	Not Data Accepted — This line goes high when the DIO lines have been latched by the acceptor.
NRFD	Not Ready for Data — This line goes high when the acceptor is ready for more data.
REN	Remote Enable — This line is high when the HP-IB has control, and low when the Front Panel assembly has control.
SRQ\	Service Request — This line is low when a device on the HP-IB needs service.

Calibration Routine

The calibration routine minimizes the receiver's LO feedthrough, and also provides amplitude correction for both the receiver and the source. The receiver's amplitude corrections are stored in memory as vectors. All measurements are multiplied by these vectors before being displayed (the vectors become part of the measurement). The calibration routine occurs immediately following the power-on tests and periodically afterwards to compensate for any drift. To manually start the calibration routine, press the [**Spcl Fctn**] hardkey followed by the [SINGLE CAL] softkey.

First, the calibration routine nulls the receiver's LO feedthrough. The receiver measures the LO feedthrough (response at 0 Hz input frequency) and sends the results to the CPU assembly. The CPU then sends control data to the Input assembly. The Input assembly decodes the control data and sends three control lines to the First Conversion assembly (see figure 4-32). These control lines adjust the real and imaginary components of the LO feedthrough cancellation signal. The LO cancellation signal then is added to the LO feedthrough. This process continues until a satisfactory null is achieved.

The calibration routine then produces amplitude correction for the IF assembly's attenuators. The calibrator generates a 10 MHz square wave with a –20 dBm precision-amplitude fundamental. This signal is sent to the receiver through the CAL path. Measurements are taken for all 32 attenuator settings, and the results are stored in memory.

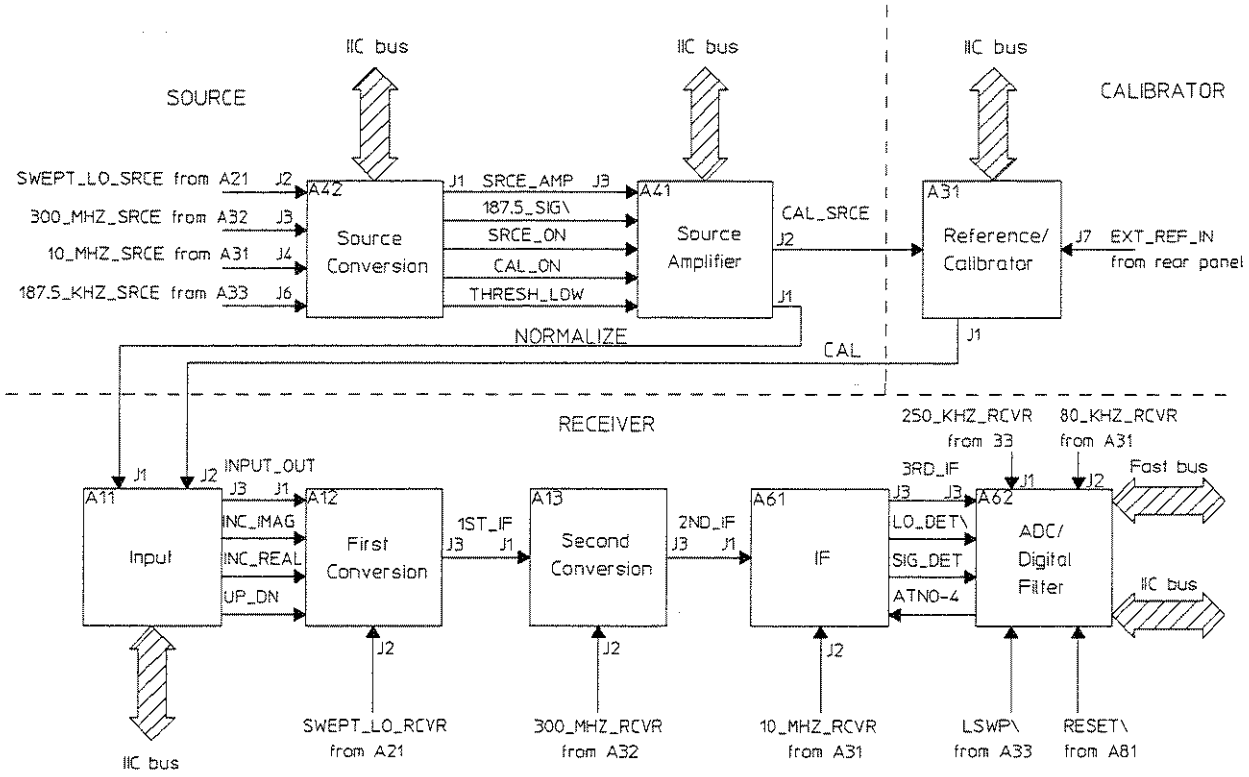


Figure 4-32. Calibration Block Diagram

Next, the calibration routine produces correction curves for the Input assembly's input paths. The source generates a swept 200 kHz to 150 MHz signal. This swept signal is sent to the calibrator through the CAL_SRCE path. The calibrator uses the swept signal to generate a swept 200 kHz to 150 MHz square wave with a –20 dBm precision-amplitude fundamental. This precision signal is sent to the receiver through the CAL path. Measurements are taken with the signal routed through the Input assembly's 50Ω input path (for all attenuators) and through the 1 MΩ input path. The measurement results are stored in memory as vectors.

The calibration routine then produces a correction curve for the shape of the 3rd IF filter. This correction curve is used in only narrow-band zoom measurements. The calibrator generates a 10 MHz square wave with a –20 dBm precision-amplitude fundamental. This precision signal is sent to the receiver through the CAL path. As the local oscillator sweeps, tracing out the shape of the 3rd IF, measurements are taken. The measurement result is stored in memory as a vector.

Last, the calibration routine produces amplitude correction data for the source. The source generates a 300 kHz signal. This signal is sent to the receiver through the NORMALIZE path. The receiver measures the signal at two different amplitudes and sends the measurement results to the CPU assembly. The CPU assembly then uses the measurement results to calculate the correction data for the source.

Calibration Error Message

Calibration correction vectors are compared with a set of maximum allowable error vectors. If any correction vector exceeds the maximum allowable error, the **Calibration failure** error message is displayed on the screen (for approximately 5 seconds) and placed in the Fault Log. To view the Fault Log, press the following keys:

[**Spcl Fctn**]
[ ] (second softkey from bottom)
– 99
[ ] (second softkey from bottom)
[SERVICE FUNCTIONS]
[FAULT LOG]

Note

Pressing the [**Spcl Fctn**] hardkey followed by the second softkey from the bottom, [+/–], [**9**], [**9**], and the second softkey from the bottom, enables and displays the [SERVICE FUNCTIONS] softkey. The [SERVICE FUNCTIONS] softkey remains enabled until power to the analyzer is removed.

Calibration Correction Curves

The calibration correction curves can be viewed for any input range or frequency span in the 50Ω input path. Calibration fails if a correction curve for the 50Ω input path varies by more than ± 10 dB from 0 dBV^2. Figure 4-33 shows a typical calibration curve for the following instrument set up:

[**Preset**]
[**Range/Input**]
[AUTORANGE ON **OFF**]
[RANGE] (any range from –20 to +20 dBm)
[**Meas Type**]
[LOW DIST ON OFF] (low distortion mode can be on or off)
[**Scale**]
[REF TRACK ON **OFF**]
[REFERENCE LEVEL]
6.5
[dBm]
[VERTICAL /DIV]
1
[dB]
[**Spcl Fctn**]
[AUTO CAL ON **OFF**]
[ ] (second softkey from bottom)
– 99
[ ] (second softkey from bottom)
[SERVICE FUNCTIONS]
[CAL OPTIONS]
[CAL TRC **ON** OFF]
[IF ATTEN ON OFF] (IF attenuation corrections can be on or off)
[IF SHAPE ON OFF] (IF shape corrections can be on or off)
[SOURCE ON OFF] (source corrections can be on or off)

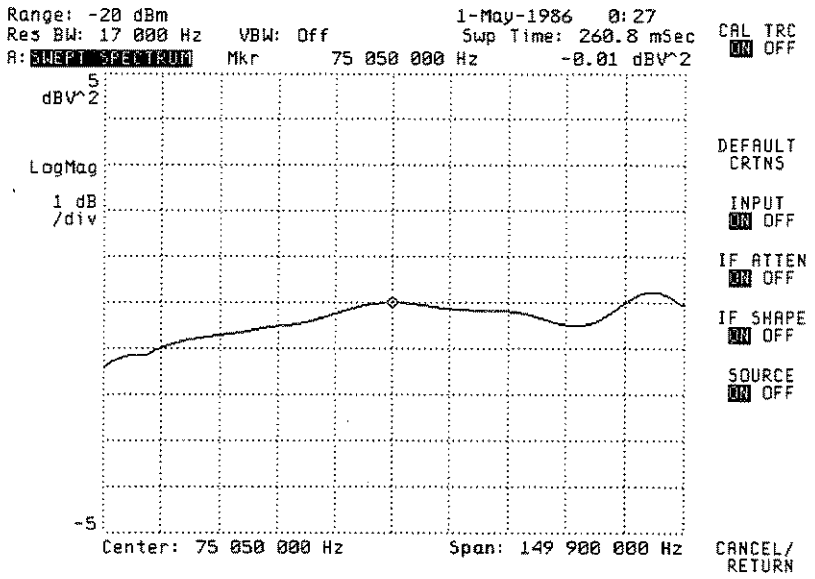


Figure 4-33. Typical 50 Ohm Input Calibration Curve

The calibration correction curves can be viewed for any frequency span in the 1 MΩ input path. Calibration fails if a correction curve for the 1 MΩ input path, from 10 Hz to 40 MHz, varies by more than ± 10 dB from 0 dBV^2. Figure 4-34 shows a typical calibration curve for the following instrument set up:

[**Preset**]
[**Range/Input**]
[1 MEGOHM]
[**Freq**]
[STOP]
40
[MHz]
[**Scale**]
[REF TRACK ON **OFF**]
[REFERENCE LEVEL]
5
[dBm]
[VERTICAL /DIV]
1
[dB]

[**Spcl Fctn**]
[AUTO CAL ON **OFF**]
[ ] (second softkey from bottom)
– 99
[ ] (second softkey from bottom)
[SERVICE FUNCTIONS]
[CAL OPTIONS]
[CAL TRC **ON** OFF]
[IF ATTEN ON OFF] (IF attenuation corrections can be on or off)
[IF SHAPE ON OFF] (IF shape corrections can be on or off)
[SOURCE ON OFF] (source corrections can be on or off)

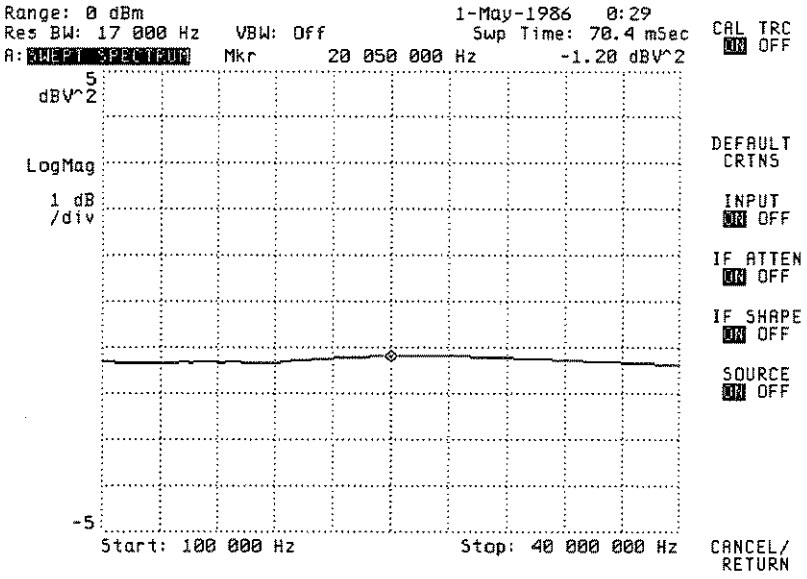


Figure 4-34. Typical 1 Meg Ohm Input Calibration Curve

Fault Log Messages

250 kHz Sample Clock failure	This error message occurs if a circuit on the ADC/Digital Filter assembly does not detect the 250 kHz reference signal from the Trigger assembly.
10 MHz third LO failure	This error message occurs if a circuit on the IF assembly does not detect the 10 MHz reference signal from the Reference/Calibrator assembly.
80 MHz clock failure	This error message occurs if a circuit on the ADC/Digital Filter assembly does not detect the 20 MHz clock signals. The 20 MHz clock signals are derived from dividing the 80 MHz reference signal by four. Since the Reference/Calibrator assembly's 80 MHz reference is the analyzer's primary frequency reference, many failures occur if the 80 MHz reference is not present.
300 MHz Ref Unlocked	This error message occurs if the control voltage for the 300 MHz VCO is too high or too low, indicating that the 300 MHz VCO is unlocked. Since the 300 MHz VCO is the analyzer's high frequency reference, many failures occur if it is unlocked. If the primary frequency reference from the Reference/Calibrator assembly is not present, the 300 MHz VCO unlocks.
Calibration failure	This error message occurs if the calibration routine generates correction vectors that exceed the maximum allowable error vectors.
Detector Gate Array DMA over-run	This error message occurs if the ADC/Digital Filter assembly's detector gate array detects an acknowledge signal from the CPU assembly's DMA controller when a request is not pending.
Detector Gate Array illegal input	This error message occurs if the ADC/Digital Filter assembly's digital filter gate array sends data to the detector gate array in an illegal format.
Filter Gate Array always busy	This error message occurs if the ADC/Digital Filter assembly's gate array takes too long to change out of "run" mode.
Filter Gate Array input over-sample	This error message occurs if the ADC/Digital Filter assembly's sample time is too short.
Frac N unlocked - frequency too high	This error message occurs if a circuit on the Interpolation VCO assembly detects that the amplitude of the fractional-N control voltage is too low (frequency too high). The fractional-N control voltage is monitored when the local oscillator is in multiple loop mode or single loop mode even though the Interpolation VCO is not used in single loop mode. Since the fractional-N control voltage is the same as the single loop control voltage, checking the fractional-N control voltage is essentially the same as checking the single loop control voltage.

Frac N unlocked - frequency too low	This error message occurs if a circuit on the Interpolation VCO assembly detects that the amplitude of the fractional-N control voltage is too high (frequency too low). The fractional-N control voltage is monitored when the local oscillator is in multiple loop mode or single loop mode even though the Interpolation VCO is not used in single loop mode. Since the fractional-N control voltage is the same as the single loop control voltage, checking the fractional-N control voltage is essentially the same as checking the single loop control voltage.
I2C: No Device Acknowledge	This error message occurs if the CPU assembly's IIC controller does not sense the acknowledge part of the formal handshake used to transmit data over the IIC bus.
I2C: Timeout	This error message occurs if the CPU assembly's IIC controller takes too long to tell the MPU that it is ready for a new command.
Input Tripped	This error message occurs if an overload occurs in the Input assembly's 50Ω impedance path. When this occurs, relays disconnect the input signal from the front panel.
LSWEEP timed-out	This error message occurs if the ADC/Digital Filter assembly does not sense an LSWP\ signal from the Trigger assembly during the time expected.
Power-on ROM Checksum error	This error message occurs if a power-on test detects a ROM checksum error.
Power-on test failure	This error message occurs if a power-on test fails.
Source Tripped	This error message occurs if the voltage at the output of the Source Amplifier assembly exceeds the threshold set by the Source Conversion assembly. When this occurs, the source output is disconnected from the front panel.
Step Loop unlocked	This error message occurs if a circuit on the Step Phase Detector assembly detects that the step loop control voltage is too high or too low, indicating that the step loop is unlocked. The control voltage is clamped to service adjustable limits when the step loop is unlocked.
Sum Loop unlocked	This error message occurs if a circuit on the Sum Phase Detector assembly detects that the amplitude of the integrator output is too high or too low, indicating that the sum loop is unlocked. The integrator output is clamped when the sum loop is unlocked.

Power-On and Preset States

The analyzer is in a known state after power up or after pressing the [**Preset**] key. Pressing the [**Preset**] key resets the analyzer as close to the power-on state as possible. To view the power-on state, press [**Format**] [SETUP STATE] immediately after power up or after pressing the [**Preset**] key. States that are reset by power up, but not by pressing the [**Preset**] key, are listed in "Power-On States" later in this section. States that are stored in battery-backed-up SRAM are listed in "Nonvolatile States" later in this section.

Note

The following lists only the power-on and preset state values that are NOT displayed after pressing [**Format**] [SETUP STATE].

[**Disk Util**]
[FORMAT DISK]
[FORMAT OPTION] 0
[INTRLEAVE FACTOR] 1
[CATALOG ON **OFF**]

[**Format**]
[SINGLE]
[GRATICULE **ON** OFF]

[**Freq**]
[STEP SIZE **AUTO** USER]
[USER STEP SIZE] 1 kHz
[SIGNL TRK ON **OFF**]

[**Local/HP-IB**]
[ECHO ON **OFF**]

[**Marker**]
[MARKER X ENTRY] 75.05 MHz
[OFFSET ON **OFF**]
[MARKER **ON** OFF]

[**Marker Fctn**]
[PEAK TRK ON **OFF**]
[FREQ CNTR ON **OFF**]
[NOISE LVL ON **OFF**]
[LIMIT TEST]
[LINES ON **OFF**]
[TEST EVAL ON **OFF**]
[FAIL BEEP ON **OFF**]
[ABSOLUTE LIMIT]

[**Meas Type**]
[PEAK DET **ON** OFF]

[Plot/Print]
[DEFINE PLOT]
[DEFINE PLOT PENS]
[TRACE A PEN] 2
[TRACE B PEN] 3
[MARKER A PEN] 5
[MARKER B PEN] 6
[ALPHA PEN] 4
[GRATICULE PEN] 1
[TRACE A LINE TYPE] [SOLID]
[TRACE B LINE TYPE] [SOLID]
[PLOT SPEED] [FAST (50 cm/s)]
[PAGE EJCT **ON** OFF]

[Range/Input]
[1 MEG REF IMPEDANCE] 50Ω

[Res BW]
[HI ACCRCY ZOOM]

[Save/Recall]
[CATALOG ON **OFF**]

[Scale]
[VERTICAL /DIV] 10 dB
[REF TRACK **ON** OFF]
[REFERENCE LEVEL] –20 dBm

[Source]
[AMPLITUDE STEP] 0.1 dBm
[COUPLE TO INPUT Z]

[Spcl Fctn]
[AUTO CAL **ON** OFF]
[BEEPER **ON** OFF]
[PRFM TESTS]
[SRCE 10dB IN **OUT**]
[SRCE 20dB A IN **OUT**]
[SRCE 20dB B IN **OUT**]
[SRCE DAC ATTEN] 0 dB

[Sweep]
[MANUAL FREQ] 75.05 MHz
[SAMPLE TIME] 4 μs
[OVERSWEEP **ON** OFF]

[Trace Type]
[LOG MAGNITUDE]

[Trace Data]
[INPUT SPECTRUM]

Power-On States

The following lists states that are reset only during power-on. Pressing the [**Preset**] key does not reset the following to the power-on state.

[**User Define**] [UTILITIES]
[MEMORY SIZE] 8192
[SCRATCH] [SCRATCH]
[RENUMBER] [START LINE #] 10
[RENUMBER] [INCREMENT] 10
[SECURE] [START LINE #] 1
[SECURE] [END LINE #] 32766

Nonvolatile States

The analyzer's serial number and IBASIC option are stored in EEPROM on the CPU assembly. If the CPU assembly is replaced, the analyzer's serial number and IBASIC option must be stored in EEPROM on the new assembly. See "Replacing CPU Assembly" in section II, "Replaceable Parts."

The following lists user-accessible states that are stored in battery-backed-up SRAM on the Memory assembly. These states are NOT reset during power-on or by pressing the [**Preset**] key.

[**Disk Util**] [DEFAULT DISK]
[NON-VOL RAM DISK] or [VOLATILE RAM DISK]
or [INTERNAL DISK] or [ROM DISK]

[**Local/HP-IB**] [SYSTEM CONTROLLR] or [ADDRESSBL ONLY]
[ANALYZER ADDRESS]
[PERIPHERL ADDRESSES]
[PLOTTER ADDRESS]
[PRINTER ADDRESS]

[**SAVE/RECALL**] [DEFAULT DISK]
[NON-VOL RAM DISK] or [VOLATILE RAM DISK]
or [INTERNAL DISK] or [ROM DISK]

[**Special Fctn**] [TIME HHMM]
[DATE MMDDYY]

Section V

Service

Introduction

This section contains troubleshooting tests that isolate failures to the assembly. These tests include initial verification, power-on test, self tests, and tests for miscellaneous failures and failing performance tests. This section also contains self-test descriptions and HP-IB command list.

Safety Considerations

The HP 3588A Spectrum Analyzer is a Safety Class 1 instrument (provided with a protective earth terminal). Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings that must be followed to ensure safe operation and retain the HP 3588A Spectrum Analyzer in safe operating condition. Service must be performed by trained service personnel who are aware of the hazards involved (such as fire and electrical shock).

Warning

Any interruption of the protective (grounding) conductor inside or outside the analyzer, or disconnection of the protective earth terminal can expose operators to potentially dangerous voltages.
Under no circumstances should an operator remove any covers, screws, shields or in any other way access the interior of the HP 3588A Spectrum Analyzer. There are no operator controls inside the analyzer.
Only fuses with the required current rating and of the specified type should be used for replacement. The use of repaired fuses or short circuiting the fuse holder is not permitted. Whenever it is likely that the protection offered by the fuse has been impaired, the analyzer must be made inoperative and secured against any unintended operation.
When power is removed from the analyzer, +11000 volts are present in the CRT for approximately 3 seconds. Be extremely careful when working in proximity to this area during this time. The high voltage can cause serious personal injury if contacted.

Caution 

Do not connect or disconnect ribbon cables with the power switch set to ON (I). Power transients caused by connecting or disconnecting a cable can damage circuit assemblies.

Equipment Required

See chapter 1, "General Information," in the *HP 3588A Performance Test Guide* for a table of recommended equipment for troubleshooting. Any equipment which meets the critical specifications given in the table may be substituted for the recommended model.

How to Use This Section

Use the following steps to isolate failures to the assembly. See the disassembly/assembly illustrations in section II, "Replaceable Parts," to determine how to disassemble and assemble the analyzer.

1. Review "Safety Considerations" and "Troubleshooting Hints."
2. Determine which troubleshooting test to start with by comparing your analyzer's symptoms to the symptoms in "Choosing a Troubleshooting Test."
3. Follow the recommended troubleshooting procedure until you locate the faulty assembly.
4. Replace the faulty assembly, and do the required adjustments and tests listed in "What to Do After an Assembly Is Replaced."

Troubleshooting Hints

- Incorrect bias supply voltages can cause false diagnostic messages. In most troubleshooting procedures, the power supply voltages are not checked through the motherboard. If you suspect incorrect supply voltages to an assembly, use table 4-13 on page 4-59 and an extender board to check the voltages at the assembly.
- Cables can cause intermittent hardware failures.
- Noise or spikes in the power supply can cause the analyzer to fail.
- Measurements in this section are only approximate (usually ± 1 dB or 10%) unless stated otherwise.
- Use chassis ground for all measurements in this section unless stated otherwise.
- Logic levels in this section are either TTL level high or TTL level low unless stated otherwise. Toggling signal levels continually change from one TTL level to the other.

Choosing a Troubleshooting Test

Use table 5-1 to determine which troubleshooting test to begin with. Test 1. Initial Verification checks the basics: power supply voltages, reset signals, and clocks. It then uses tests 2 through 8 to further isolate the failure. Test 9. Self Test runs all the analyzer's self tests. It then uses tests 10 through 32 to further isolate the failure. Test 33. Memory Battery checks the battery on the Memory assembly. Test 34. Fan Power determines if the fan is faulty. Test 35. Trigger determines the cause of HP-IB trigger and external trigger failures.

Note

If you abort a self test before the self test is finished, the analyzer may fail its calibration routine. To prevent this from happening press [**Preset**] or cycle power after you abort the self test.

The troubleshooting tests in this section assume only one independent failure. Multiple failures can cause false results.

Table 5-1. Troubleshooting Guide

Symptom	Troubleshooting Test
Screen blank Screen defective After power-on, >3 minutes before keys active No response when key is pressed Incorrect response when key is pressed	Test 1. Initial Verification
Calibration fails Performance test fails Local oscillator unlocked Intermittent failure HP-IB fails	Test 9. Self Test
Nonvolatile states not saved after power cycled	Test 33. Memory Battery
Fan not running	Test 34. Fan Power
HP-IB trigger fails External trigger fails	Test 35. Trigger

What to Do After an Assembly Is Replaced

After replacing an assembly, do the following:

1. Reinstall all assemblies and cables that were removed during troubleshooting.
2. On the CPU assembly, check that SW100 pin 4 is set to 1 and all other pins are set to zero (see figure 5-1).
3. Do the required adjustments listed in table 5-2 (the adjustments are in section I of this manual).
4. Do Test 9. Self Test in this section.
5. Do the required performance tests listed in table 5-2 (the performance tests are in chapter 3 of the *HP 3588A Performance Test Guide*).

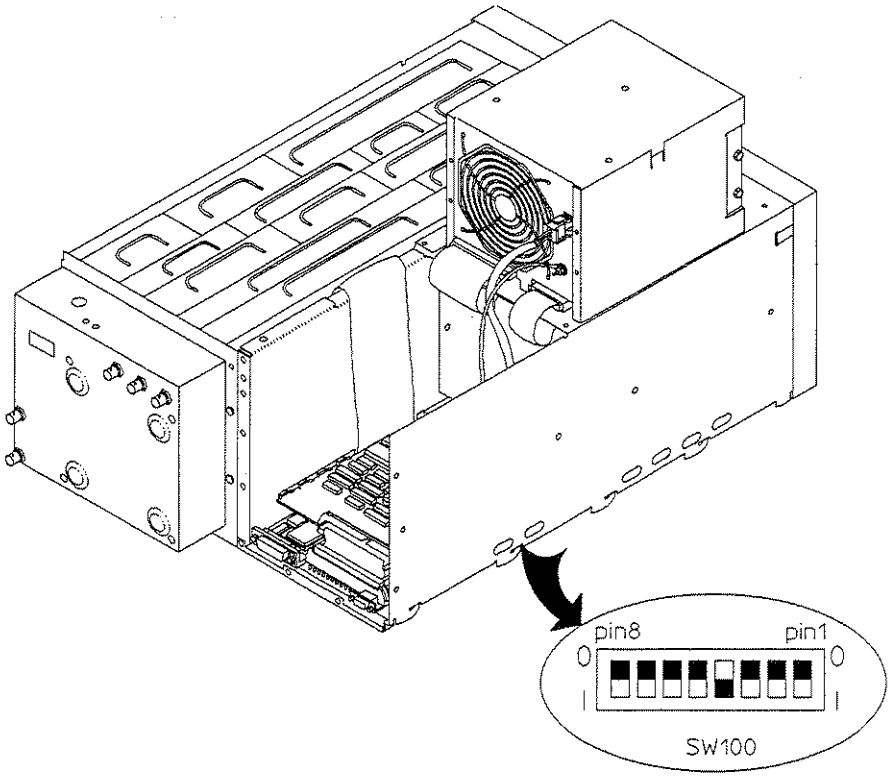


Figure 5-1. Normal Setting for A81 SW100

Table 5-2. Required Adjustments and Performance Tests

Assembly Replaced	Adjustments	Performance Tests
A11 Input	15. Second IF Bandpass Filter	1. Local Oscillator Feedthrough 3. Residual Responses 4. Noise Level 8. Input Harmonic Distortion 9. Intermodulation Distortion 11. Frequency Response 12. Reference Level Accuracy 13. Log Scale Accuracy 15. Input Return Loss
A12 First Conversion	12. Second IF Bandpass Filter 14. First IF Bandpass Filter	1. Local Oscillation Feedthrough 3. Residual Responses 4. Noise Level 7. Image Responses 8. Input Harmonic Distortion 9. Intermodulation Distortion 12. Reference Level Accuracy 13. Log Scale Accuracy
A13 Second Conversion	12. Second IF Bandpass Filter	3. Residual Responses 12. Reference Level Accuracy 13. Log Scale Accuracy
A21 Sum VCO	4. Interpolation VCO 5. Single Loop Control Voltage Clamps 6. 100 kHz and API Spurs 7. Sum VCO Filter 8. Multiple Loop Control Voltage Clamps 9. Step VCO Filter 10. Pretune Offset and Slope	2. Phase Noise 6. Spurious Responses
A22 Sum Phase Detector	4. Interpolation VCO 5. Single Loop Control Voltage Clamps 6. 100 kHz and API Spurs 7. Sum VCO Filter 8. Multiple Loop Control Voltage Clamps 9. Step VCO Filter 10. Pretune Offset and Slope	2. Phase Noise 6. Spurious Responses
A23 Step Phase Detector	4. Interpolation VCO 5. Single Loop Control Voltage Clamps 6. 100 kHz and API Spurs 7. Sum VCO Filter 8. Multiple Loop Control Voltage Clamps 9. Step VCO Filter 10. Pretune Offset and Slope	2. Phase Noise 6. Spurious Responses
A24 Step VCO	4. Interpolation VCO 5. Single Loop Control Voltage Clamps 6. 100 kHz and API Spurs 7. Sum VCO Filter 8. Multiple Loop Control Voltage Clamps 9. Step VCO Filter 10. Pretune Offset and Slope	2. Phase Noise 6. Spurious Responses
A31 Reference/Calibrator	2. 80 MHz Reference VCXO 3. 300 MHz Reference VCO 17. Calibrator Flatness and Level	2. Phase Noise 5. Frequency Accuracy 11. Frequency Response

Table 5-2. Required Adjustments and Performance Tests (continued)

Assembly Replaced	Adjustments	Performance Tests
A32 300 MHz	3. 300 MHz Reference VCO	2. Phase Noise
A33 Trigger		2. Phase Noise
A41 Source Amplifier		10. Source Amplitude Accuracy and Frequency Response 14. Source Dynamic Accuracy 16. Source Return Loss 17. Source Harmonic Distortion 19. Source Noise
A42 Source Conversion	13. Source Bandpass Filter	10. Source Amplitude Accuracy and Frequency Response 14. Source Dynamic Accuracy 18. Source Spurious Responses
A51 Interpolation VCO	4. Interpolation VCO 5. Single Loop Control Voltage Clamps 6. 100 kHz and API Spurs 7. Sum VCO Filter 8. Multiple Loop Control Voltage Clamps 9. Step VCO Filter 10. Pretune Offset and Slope	2. Phase Noise 6. Spurious Responses
A52 Fractional-N	4. Interpolation VCO 5. Single Loop Control Voltage Clamps 6. 100 kHz and API Spurs 7. Sum VCO Filter 8. Multiple Loop Control Voltage Clamps 9. Step VCO Filter 10. Pretune Offset and Slope	2. Phase Noise 6. Spurious Responses
A61 IF	12. Second IF Bandpass Filter	3. Residual Responses 4. Noise Level 7. Image Responses 9. Intermodulation Distortion 12. Reference Level Accuracy 13. Log Scale Accuracy
A62 ADC/Digital Filter	11. ADC Gain, Offset, and Reference	4. Noise Level 12. Reference Level Accuracy 13. Log Scale Accuracy
A81 CPU		
A87 Memory		
A88 Expanded Memory		
A90 Fan Power		
A91 Fan Power/Oven	1. Oven Shutdown 16. Oven Frequency	2. Phase Noise 5. Frequency Accuracy
A99 Motherboard		
Power Supply		
Disk Drive		
Display		
Front Panel		

Initial Verification

Before starting Test 1. Initial Verification, check that the voltage selector switch on the rear of the analyzer is set for the local line voltage. Also check that the correct line fuse is installed in the rear panel fuse holder. For information on the voltage selector switch and the line fuse, see chapter 2, "Installation," in the *HP 3588A Performance Test Guide*.

Test 1. Initial Verification

Use this test to check signals that are vital to the operation of the analyzer.

1. If the graticule appears after power-on but there is no response when keys are pressed, do the following:

   a. Set the power switch to STANDBY (⏻).

   b. Set the power switch to ON (|) and as soon as the graticule appears, disable the calibration routine by pressing the following keys:

      [ ] second softkey from the bottom
      [ ] second softkey from the bottom
      [**Spcl Fctn**]
      [AUTO CAL ON **OFF**]

   c. If the keys responded correctly, go to Test 10. All Locks Analyzer.

2. Set the power switch to STANDBY (⏻) and disconnect the power cord from the rear panel. Remove the top cover, place the Power Supply assembly in its test position, and remove the Memory assembly (see figures 2-3 through 2-6 in section II, "Replaceable Parts").

Caution 

Do NOT remove earth ground (green/yellow wire) from the Power Supply assembly or the analyzer's chassis.

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3. Disconnect the CPU power cable (W2) from J1 on the CPU assembly. Disconnect the motherboard power cable (W12) from J2 on the Power Supply assembly (see figure 5-2).

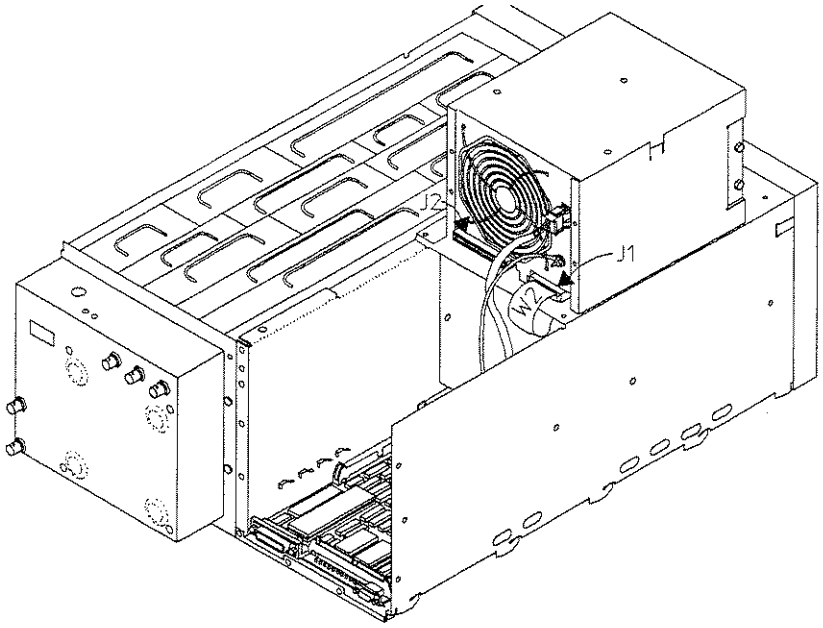


Figure 5-2. Connecting Test Board

4. Connect the power supply test board (from the service kit) to the CPU power cable (W2) and to J2 on the Power Supply assembly. Be careful not to short the test board to the analyzer's chassis.

Warning **The power supply test board dissipates high power from the Power Supply assembly. Be careful of the heat from the shield.**

---

5. Connect the power cord and set the power switch to ON (I). Check the voltages in table 5-3. There are no adjustments in the Power Supply assembly; therefore, if any of the voltages are incorrect replace the entire assembly.

Warning **To assure shock protection for the user, reattach the earth ground (green/yellow wire) from the supply to the instrument chassis.**

Table 5-3. Test Board Nominal Voltage Values

Test Location	Nominal Voltage	Minimum Voltage	Maximum Voltage	Ripple Tolerance
TP1	+8.4V	+7.9V	+10.5V	84 mVpp
TP2	+15V	+14.55V	+15.45V	30 mVpp
TP3	+18V	+18V	+27V	180 mVpp
TP4	–15V	–14.55V	–15.45V	30 mVpp
TP5	–18V	–18V	–27V	180 mVpp
TP6	+12V	+11.4V	+12.6V	120 mVpp
TP7	+5.1V	+4.84V	+5.36V	51 mVpp

6. Set the power switch to STANDBY (⏻). Disconnect the power supply test board. Reconnect the CPU power cable (W2) to J1 on the CPU assembly and the motherboard power cable (W12) to the Power Supply assembly. Replace the Memory assembly.

7. Set the power switch to ON (I). Check the voltages in table 5-4 (see figure 5-3).

Table 5-4. Initial Verification Nominal Voltage Values

Test Location	Signal Name	Nominal Voltage	Minimum Voltage	Maximum Voltage
A81 TP102	+5V	+5.1V	+4.845V	+5.355V
A81 TP103	+12V	+12V	+11.4V	+12.6V
A81 TP104	–11V	–11V	–10.45V	–11.55V

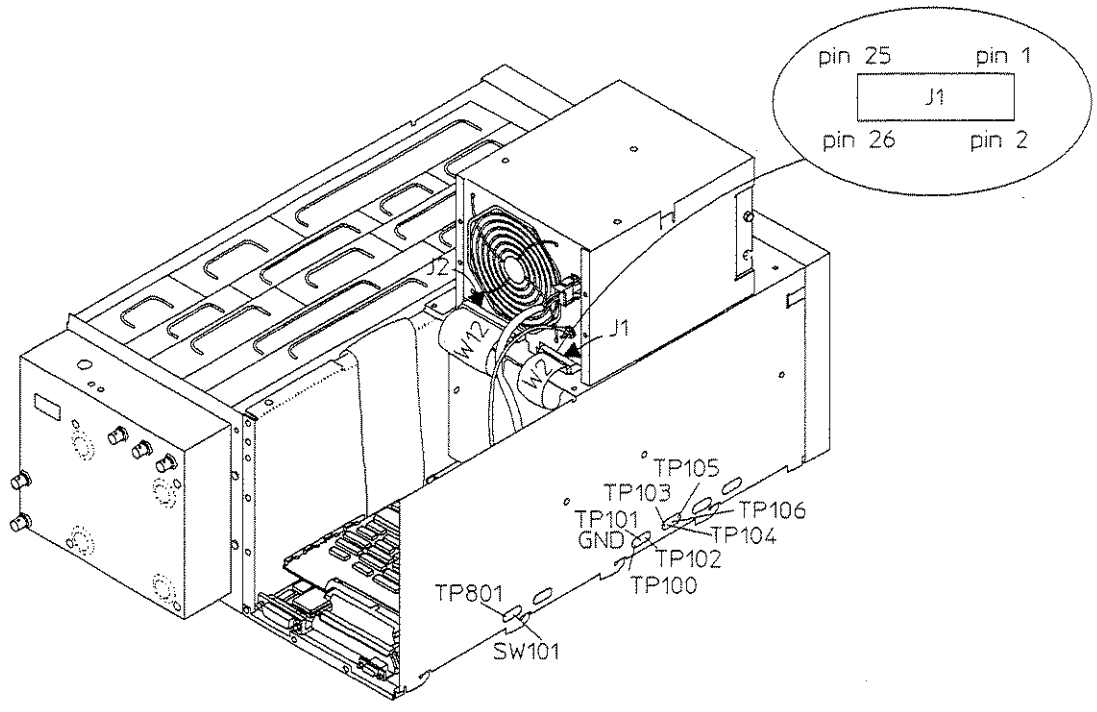


Figure 5-3. Initial Verification Test Locations

8. If the voltages are correct, go to step 9. If the voltages are incorrect, do the following:

   a. Set the power switch to STANDBY (⏻). Remove the Memory assembly.

   b. Disconnect all cables from the CPU assembly except the CPU power cable (W2). Disconnect the motherboard power cable (W12) from the Power Supply assembly.

   c. Set the power switch to ON (I). Check the voltages in table 5-4. If the voltages are incorrect, the CPU assembly is probably faulty.

   d. If the voltages are correct, set the power switch to STANDBY (⏻), reconnect one cable, set the power switch to ON (I), and check the voltages in table 5-4 again. Repeat this step until the faulty assembly or assemblies are located.

   e. If the failure occurs when the motherboard power cable (W12) is reconnected, set the power switch to STANDBY (⏻), remove one assembly from the card nest, set the power switch to ON (I), and check the voltages in table 5-4. If the voltages are still incorrect, repeat this step until the faulty assembly is located.

Note

Table 4-2, Power Supply Voltage Distribution, lists which assemblies use each voltage. Use the table to determine which assembly could be causing the failure.

Note

Both the A24 Step VCO assembly and the A41 Source Amplifier assembly have over-temperature protection circuits. These circuits force the power supply output voltages to zero if the analyzer's internal temperature becomes excessive. Before replacing either of these assemblies, make sure both fans are working properly and that the air flow is not restricted (cooling air enters from both sides and exhausts through the rear panel).

---

9. On the CPU assembly, attach a logic probe to TP100 (RST\).

10. While monitoring TP100, press SW101 (reset switch). If the logic level at TP 100 went from high to low, go to step 11. If the logic level at TP100 did not go from high to low, do the following:

    a. Set the power switch to STANDBY (⏻). Disconnect the CPU power cable (W2) from J1 on the Power Supply assembly.

    b. Set the power switch to ON (|). With a logic probe, check J1 pin 13 (PVALID) on the Power Supply assembly for a TTL logic high (see figure 5-3). If the signal is incorrect, the Power Supply assembly is faulty.

    c. Set the power switch to STANDBY (⏻). Reconnect the CPU power cable. On the CPU assembly, attach a logic probe to TP100, and attach a jumper to TP801 (PVALID).

    d. Set the power switch to ON (|). While monitoring TP100, momentarily connect TP801 to chassis ground. If the logic level at TP100 did not go from high to low, the CPU assembly is probably faulty.

11. Using an oscilloscope and a 10:1 probe, check the clock signals in figure 5-4.

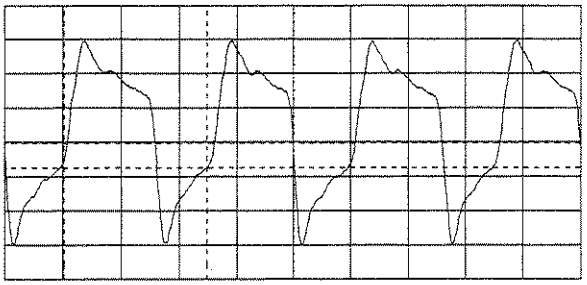
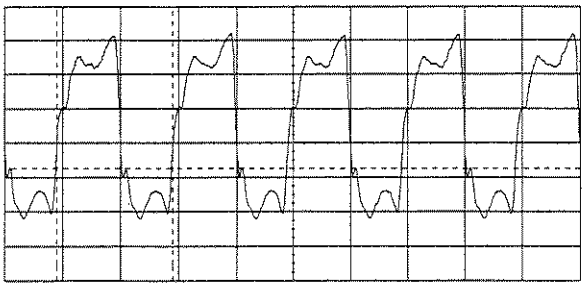
Oscilloscope Setup	Parameters	Waveform
Connect CH1 to A81 TP105 Connect GND to A81 TP101 CH1 V/div 200 mV/div CH1 Coupling dc Time/div 20 ns/div Trigger CH1	Time Duty Cycle	 **20 MHz (A81 OUT)**
Connect CH1 to A81 TP106 CH1 V/div 200 mV/div CH1 Coupling dc Time/div 50 ns/div Trigger CH1	Time Duty Cycle	 **10 MHz (A81 OUT)**

Figure 5-4. A81 CPU Clock Signals

12. Using an oscilloscope and a 10:1 resistive divider probe with input capacitance of <0.7 pF and input resistance of 500Ω, check the following signal in figure 5-5 .

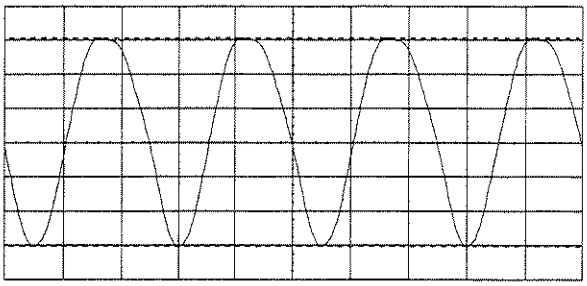
Oscilloscope Setup	Parameters	Waveform
Connect CH1 to A31 J8 Input Impedance 50Ω CH1 V/div 10 mV/div CH1 Coupling dc Time/div 5 ns/div Trigger CH1	Time Duty Cycle	 80 MHz (A31 OUT)

Figure 5-5. 80 MHz Reference Signal

13. If the clock signals are correct, go to Test 2. Power-on.

14. Set the power switch to STANDBY (⏻). Disconnect the fast bus cable (W11) from J5 on the A62 ADC/Digital Filter assembly.

15. Set the power switch to ON (|). Check the signals in figure 5-5 again. If the signals are now correct, the ADC/Digital Filter assembly's EXT_CLK signal is probably faulty. If the signals are still incorrect, the CPU assembly is probably faulty.

Troubleshooting Using the Power-On Test

Note Test 1. Initial Verification must be done before the power-on test messages are valid.

Use the power-on test when the screen is defective, when the analyzer does not respond correctly to the keyboard, or when it takes more than 3 minutes for the keyboard to become active. Any of the following conditions may cause a power-on failure:

- A defective CPU or Memory assembly.
- A defective assembly connected to the CPU assembly causing a bus failure.
- A defective cable between the CPU assembly and another assembly.
- A defective control line.

Test 2. Power-on

If Test 1. Initial Verification did not detect any problems, use this test to continue troubleshooting. This test points you to one of the following tests:

- Test 3. CPU, Memory, and Buses
- Test 5. Display
- Test 6. IIC Bus
- Test 7. Fast Bus

Note The Power Supply assembly is in its test position.

1. Set the power switch to STANDBY (⏻). On the CPU assembly, set SW100 pin 6 to one and pin 4 to zero. Check that the other pins are set to zero (see figure 5-6).

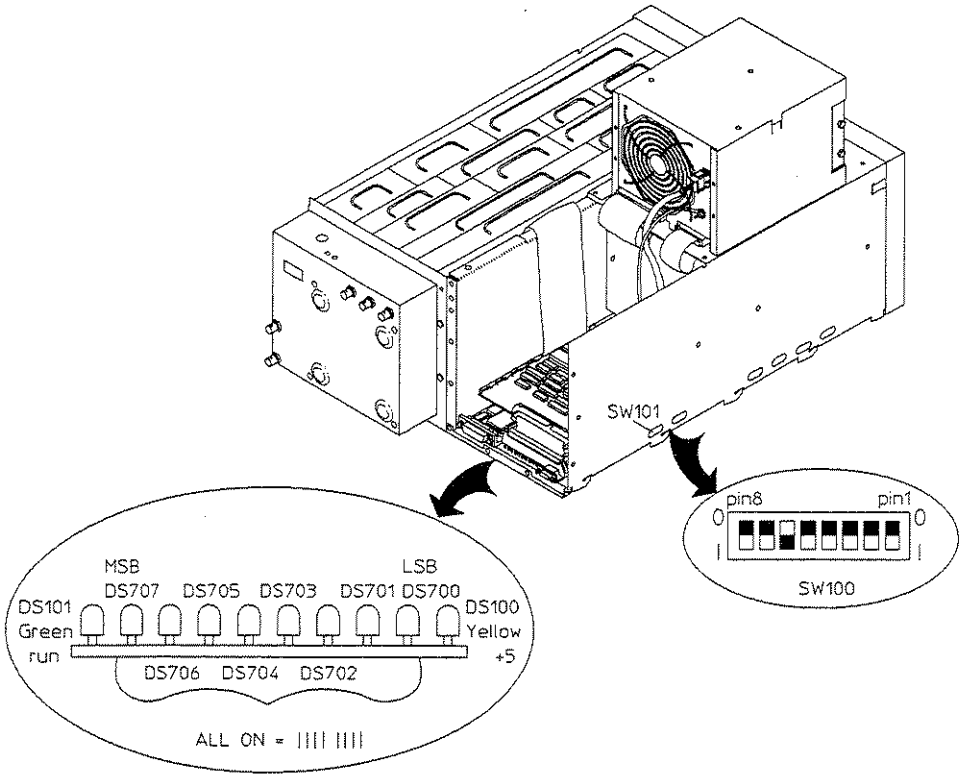


Figure 5-6. Power-on Test LEDs

2. Set the power switch to ON (I). On the CPU assembly, press SW101 (reset switch) while watching the power-on test LEDs (see figure 5-6). The power-on test LEDs pass sequence occurs if the LEDs respond as follows:
   - All power-on test LEDs are on momentarily.
   - DS100 (yellow, +5 LED) remains on as long as power is applied to the assembly.
   - DS101 (green, run LED) comes on as soon as SW101 is released.
   - DS707 through DS700 sequence through the codes listed in the table 5-5.

Table 5-5. Power-on Test Pass Sequence

Binary 0 = LED off 1 = LED on (DS707) (DS700)	Hexadecimal	~Time LEDs Visible	Description
1111 1111 0000 0000	FF 00	200 ms on 200 ms off	A81 flashes LEDs
0000 0101	05	*	starting A81 test
1001 0000	90	*	A81 monitor ROM test
0000 1000	08	*	starting A81 display controller test
1111 0000	F0	5s	starting A87 program ROM test
0000 1011	0B	*	get RAM size
0000 1111	0F	30 - 45s	starting A87 RAM test
1000 0000	80	6s	starting A87 RAM refresh test
0000 0000	00	Remain off	clear LEDs

* When no failure occurs, these codes appear for only a very short time and probably won't be visible.

3. If a failure occurs in the core assemblies or on the buses, the power-on test pauses and LEDs DS707 through DS700 show a fail code for approximately 10 seconds. Compare your power-on test results to table 5-6 and follow the recommended troubleshooting test.

Table 5-6. Power-on Test Results

LEDs Sequence Results	Troubleshooting Test
LEDs show a fail code. A81 DS101 (green run LED) is off.	Test 3. CPU, Memory, and Buses
LEDs pass sequence occurs, but the screen is defective.	Test 5. Display
LEDs pass sequence occurs, but it takes more than 3 minutes before the keys are active. LEDs pass sequence occurs and screen appears normal, but keys do not function.	Test 6. IIC Bus

Note

See table 5-29 on page 5-92 for binary to hexadecimal conversion. For a complete list of the power-on test messages, see table 5-30 on page 5-93.

Test 3. CPU, Memory, and Buses

Use this test to isolate the failure when the power-on test LEDs show a fail code.

Note

The Power Supply assembly is in its test position. On the CPU assembly, SW100 pin 6 is set to one and all other pins are set to zero.

---

1. Set the power switch to STANDBY (⏻). Remove the Memory assembly.
2. Disconnect the display cable (W3), front-panel cable (W5), and fast bus cable (W11) from J4, J3 and J6 on the CPU assembly. Disconnect the motherboard power cable (W12) from J2 on the Power Supply assembly.

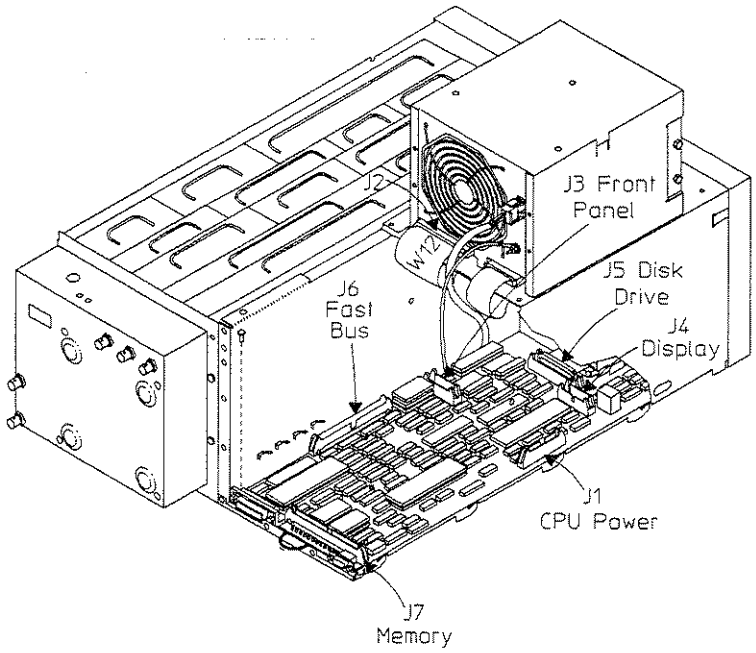


Figure 5-7. Cable Locations

3. Set the power switch to ON (I). On the CPU assembly, press SW101 (reset switch) while monitoring the power-on test LEDs (see figure 5-6). The LEDs display fail code hexadecimal F3 (1111 0011) for 10 seconds, then flash hexadecimal 0F. If the LEDs do not respond correctly, the CPU assembly is faulty.

4. Set the power switch to STANDBY (⏻). Reconnect the Memory assembly with the assembly upside-down and outside the chassis. Be careful not to short the pins on back of the assembly.
5. Set the power switch to ON (I). Press SW101 while monitoring the power-on test LEDs.
6. If the LEDs pass sequence does not occur, go to Test 4. Memory.
7. Set the power switch to STANDBY (⏻). Connect the display cable (W3) to J4 on the CPU assembly.
8. Set SW100 pin 6 to zero and pin 4 to one. All other pins are set to zero.
9. Set the power switch to ON (I). Press SW101 while monitoring the power-on test LEDs.
10. The LEDs pass sequence occurs and Testing Memory... is displayed on the screen. About 15 seconds after pressing SW101, the LEDs show fail code hexadecimal A1 (10100001). If the analyzer did not respond correctly, go to Test 5. Display.
11. Set the power switch to STANDBY (⏻). Connect the front-panel cable (W5) to J3 on the CPU assembly and the motherboard power cable (W12) to J2 on the Power Supply assembly.
12. Set the power switch to ON (I). Press SW101 while monitoring the power-on test LEDs.
13. If the LEDs show a fail code other than hexadecimal A1, go to Test 6. IIC Bus.
14. Set the power switch to STANDBY (⏻). Connect the fast bus cable (W11) to J6 on the CPU assembly.
15. Set the power switch to ON (I), and monitor the power-on test LEDs.
16. If the LEDs show fail code hexadecimal A1, go to Test 7. Fast Bus.
17. If the failure still is not isolated, go to Test 6. IIC Bus.

Test 4. Memory

Use this test to separate Memory assembly failures from CPU assembly failures.

Note

The Power Supply assembly is in its test position. The motherboard power cable (W12) is disconnected from J2 on the Power Supply assembly. The Memory assembly is upside-down and outside the chassis. On the CPU assembly, the display cable (W3), front-panel cable (W5), and the fast bus cable (W11) are disconnected. Also, SW100 pin 6 is set to one and all other pins are set to zero.

---

1. Set the power switch to STANDBY (⏻). Disconnect the memory cable (W1) from J7 on the CPU assembly.
2. Set the power switch to ON (I). Using a logic probe, check that the signals listed in table 5-7 are toggling (see figure 5-8). If the signals are toggling, the Memory assembly is probably faulty.

Table 5-7. Memory Signals

Test Location	Signal Name	In/Out
A81 TP107	AS	A81 Out
A81 TP108	UDS	A81 Out
A81 TP109	LDS	A81 Out
A81 TP110	RW	A81 Out

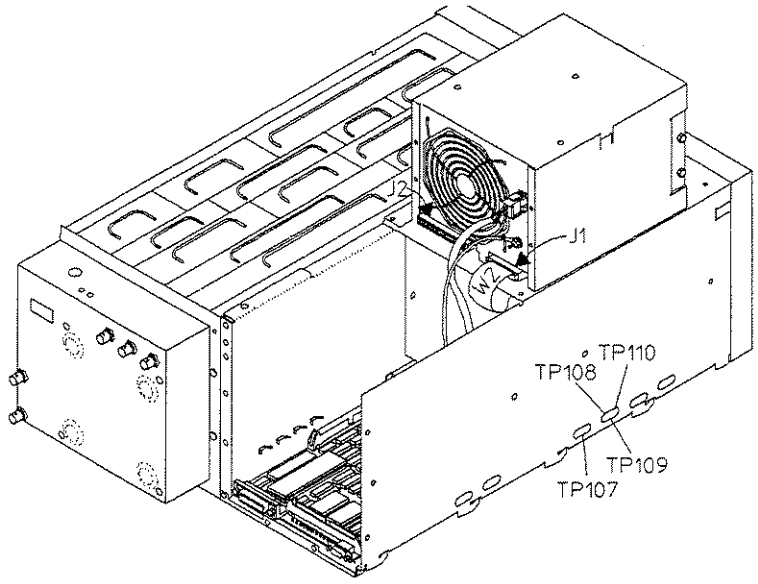


Figure 5-8. Memory Test Locations

Test 5. Display

Use this test to separate Display assembly failures from CPU assembly failures.

Note

The Power Supply assembly is in its test position. The motherboard power cable (W12) is disconnected from J2 on the Power Supply assembly. The Memory assembly is upside-down and outside the chassis. On the CPU assembly, the front-panel cable (W5) and the fast bus cable (W11) are disconnected. Also, SW100 pin 6 is set to one and all other pins are set to zero.

---

1. Set the power switch to ON (I). Using an oscilloscope and 10:1 probes, check the signals in figure 5-9 (see figure 5-10).

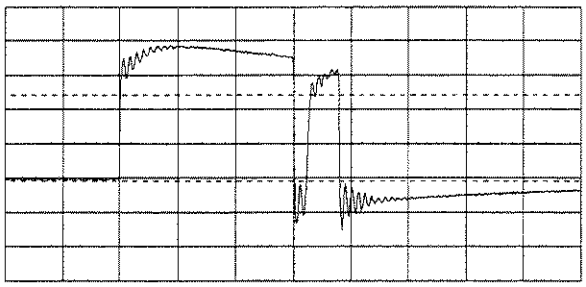
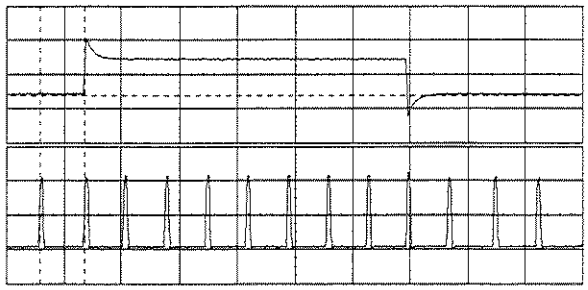
Oscilloscope Setup	Parameters	Waveform
Connect CH1 to A81 TP114 CH1 V/div 800 mV/div CH1 Coupling dc Time/div 1 ms/div Trigger CH1	Active TTL Levels	 HB (A81 OUT)
Connect CH1 to A81 TP115 Connect CH2 to A81 TP116 CH1 V/div 200 mV/div CH2 V/div 200 mV/div CH1 Coupling dc CH2 Coupling dc Time/div 50 μs/div Trigger CH1	Time Time Relationship Duty Cycle	 VSYNC & HSYNC (A81 OUT)

Figure 5-9. Display Signals

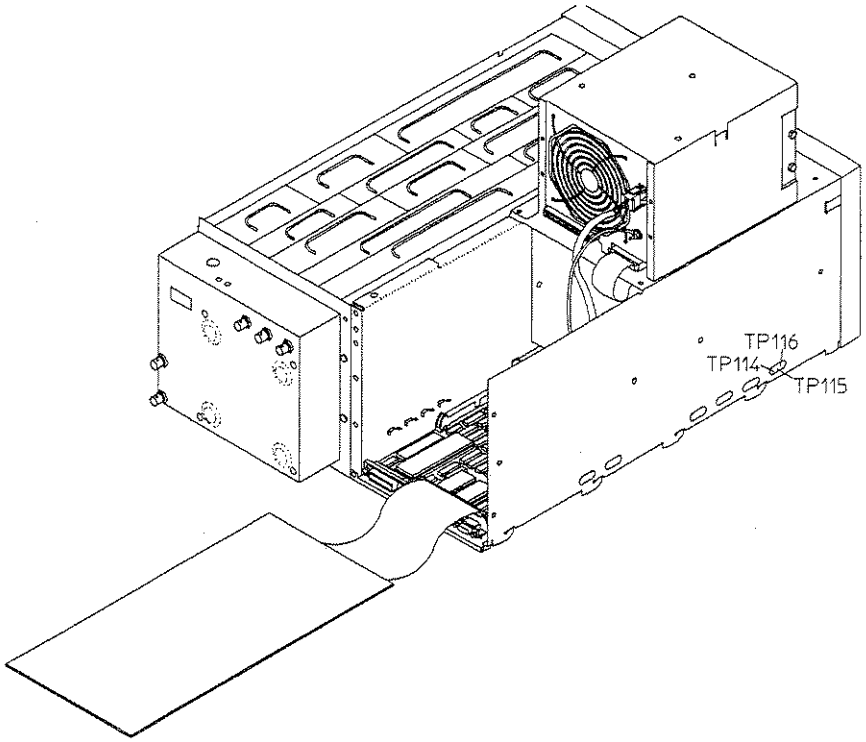


Figure 5-10. Display Controller Test Locations

2. If the signals are incorrect, do the following:

   a. Set the power switch to STANDBY (⏻). Disconnect the display cable (W3) from J4 on the CPU assembly.

   b. Set the power switch to ON (I). Check the signals again. If all the signals are now correct, the Display assembly is probably faulty.

3. Compare your screen to the typical symptoms listed in table 5-8.

Table 5-8. Display Test Troubleshooting Guide

Symptom	Probable Cause
Vertical and horizontal scanning is occurring. Part of information is missing, for example only half letters. Blocks of information are missing. Information on the screen is scrambled or mixed up. Vertical or horizontal stripes appear across the screen.	DRAM sub-block is failing on the CPU assembly.
Screen is blank. Screen is tilted, compressed, or distorted. Line across the screen.	Display assembly is failing.

Note

Before replacing the Display assembly, try the adjustments in section I, "Adjustments."

4. If the failure still is not isolated, check the CPU assembly's control signals in Test 8. Control Lines.

Test 6. IIC Bus (Inter-IC Bus)

Use this test to isolate IIC bus failures to one of the following assemblies:

- Front Panel
- A11 Input
- A23 Step Phase Detector
- A31 Reference/Calibrator
- A33 Trigger
- A41 Source Amplifier
- A42 Source Conversion
- A51 Interpolation VCO
- A52 Fractional-N
- A62 ADC/Digital Filter
- A81 CPU

Note

The Power Supply assembly is in its test position. The Memory assembly is upside-down and outside the chassis. On the CPU assembly, the fast bus cable (W11) is disconnected. Also, SW100 pin 4 is set to one and all other pins are set to zero.

---

1. Set the power switch to STANDBY (⏻). Connect the fast bus cable (W11) to the CPU assembly.
2. Disconnect the front-panel cable (W5) from J3 on the CPU assembly and the motherboard power cable (W12) from J2 on the Power Supply assembly.
3. On the CPU assembly, attach a logic probe to TP600 (IIC Serial Clock).
4. Set the power switch to ON (|). Press SW101 (reset switch) while monitoring TP600 (SCL) and the power-on test LEDs (see figure 5-11). If the CPU assembly is operating correctly, the TTL logic level at TP600 toggles once when 00 is displayed and again when A1 is displayed.
5. Attach the logic probe to TP601 (IIC Serial Data). Press SW101 while monitoring TP601 (SDA) and the power-on test LEDs. If the CPU assembly is operating correctly, the logic level at TP601 toggles once as SW101 is released (when 00 is displayed) and again when A1 is displayed.
6. Set the power switch to STANDBY (⏻). Connect the front-panel cable (W5) to J3 on the CPU assembly.

7. Set the power switch to ON (I). Repeat steps 3, 4, and 5 to check that the front panel is not causing the failure.

8. Set the power switch to STANDBY (⏻). Connect the motherboard power cable (W12) to J2 on the Power Supply assembly.

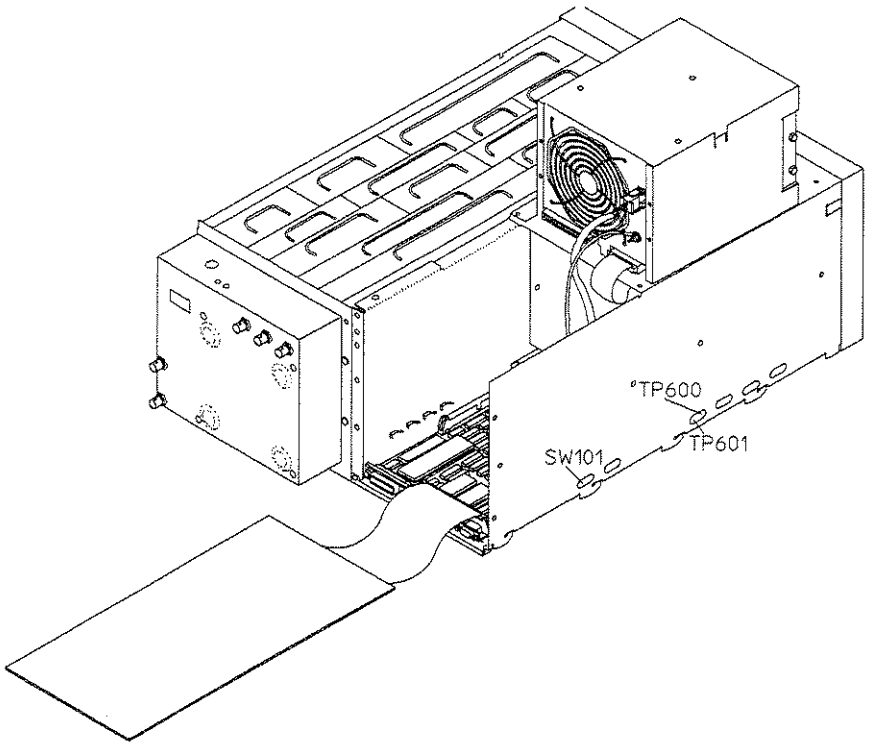


Figure 5-11. IIC Bus Test Locations

9. Set the power switch to ON (I). Press any key. If the analyzer did not respond, do the following:

   a. Set the power switch to STANDBY (⏻) and remove one of the following assemblies:

      A11 Input
      A23 Step Phase Detector
      A31 Reference/Calibrator
      A33 Trigger
      A41 Source Amplifier
      A42 Source Conversion
      A51 Interpolation VCO
      A52 Fractional-N

   b. Set the power switch to ON (I), then press any key. If the analyzer responds, the assembly just removed is probably faulty.

Note

Press a key before the calibration routine starts. The calibration routine may lock the front panel when an assembly is removed.

c. If the analyzer did not respond, repeat steps a and b until the faulty assembly is located.

10. If the failure still is not isolated, go to Test 7. Fast Bus.

Test 7. Fast Bus

Use this test to isolate fast bus failures to the CPU assembly, the ADC/Digital Filter assembly, or the fast bus cable.

Note

The Power Supply assembly is in its test position. The Memory assembly is upside-down and outside the chassis. On the CPU assembly, SW100 pin 4 is set to one and all other pins are set to zero. The motherboard power cable (W12) is disconnected from the Power Supply assembly.

---

1. Set the power switch to STANDBY (⏻). Disconnect the fast bus cable (W11) from J5 on the ADC/Digital Filter assembly.
2. On the CPU assembly, set SW100 pin 6 to one (see figure 5-12).
3. Set the power switch to ON (I). The screen displays Fast Bus Diagnostic Test .... Also the power-on test LEDs alternately flash hexadecimal AA (DS707, DS705, DS703, and DS701 are on) and hexadecimal 55 (DS706, DS704, DS702, and DS700 are on). If the analyzer did not respond correctly, the CPU assembly is probably faulty.
4. Using a logic probe, check the signals in table 5-9 at the fast bus cable. If the signals are correct, the ADC/Digital Filter assembly is probably faulty.
5. If any of the signals are incorrect, disconnect the fast bus cable from the CPU assembly. Check the failing signals at J6 on the CPU assembly. If the signals are still incorrect, the CPU assembly is faulty.

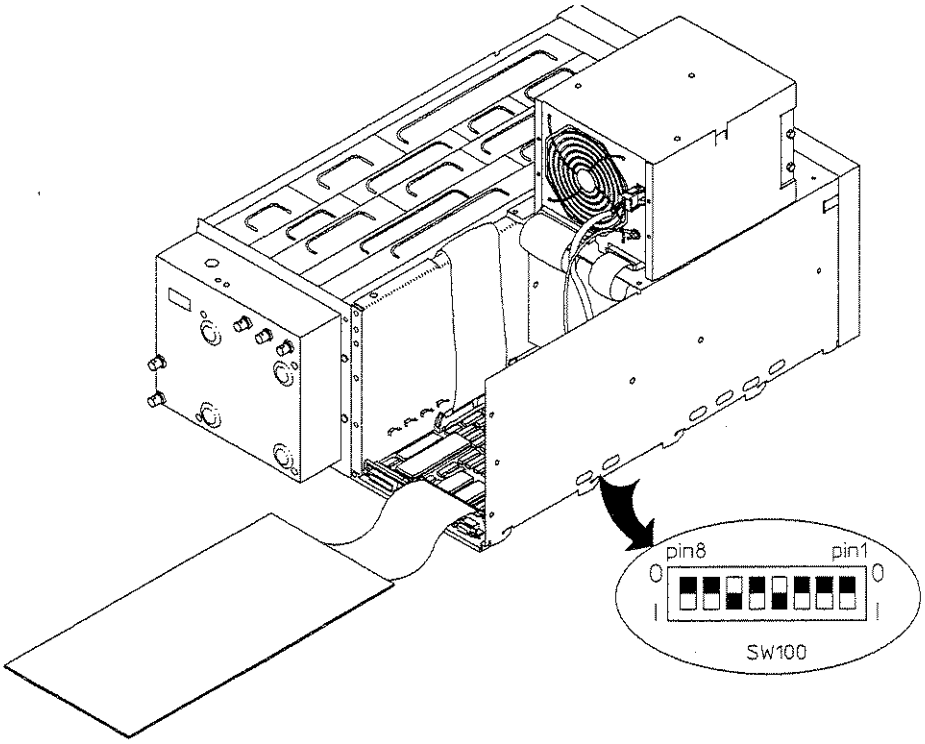


Figure 5-12. Switch Setting for Fast Bus Test

Table 5-9. Fast Bus Lines

Pin	Signal Name	TTL Logic State In Test Mode
1 to 31 odd	FD0 - FD15	Toggling
33 to 41 odd	FA1 - FA5	Toggling
43	FIRQ\	High
45	FRW	Toggling
47	SELA\	High
49	SELS\	Toggling
51	FDTACK\	High
53	ECLK	Toggling
55	REQ\	High
57	ACK0\	High
59	PCL0\	High
61	DTC\	High
63	EXT_CLK	High
2 to 64 even	GND	Low

Test 8. Control Lines

Control line failures can cause false error codes and multiple failure messages. Table 5-10 lists the active state for each control line. The assembly listed in the table as the "Probable Faulty Assembly" is listed with the assumption that no other assembly is loading the line.

1. Set the power switch to STANDBY (⏻). Reinstall all assemblies and cables that were removed during troubleshooting. On the CPU assembly, check that SW100 pin 4 is set to one and all others are set to zero (0000 1000).

2. Set the power switch to ON (I). Check the signals in table 5-10 with a logic probe or oscilloscope (see figure 5-13).

Table 5-10. Data and Control Lines

Test Location	Signal Name	In/Out	Logic Level During Power-on	Logic Level After Power-on	Probable Faulty Assembly
A81 TP107	AS\	A81 Out	Toggling	Toggling	A81
A81 TP108	UDS\	A81 Out	Toggling	Toggling	A81
A81 TP109	LDS\	A81 Out	Toggling	Toggling	A81
A81 TP110	FRW	A81 Out	Toggling	Toggling	A81
A81 TP111	DTACK	A62, A87	Toggling	Toggling	A62, A81, A87
A81 TP112	BGACK\	A81 Internal	High	Toggling	A81
A81 TP113	BERR\	A81 Internal	Toggle once	High	Any
A87 TP102	RAS1\	A87 Internal	Toggling	Toggling	A87
A87 TP103	RAS2\	A87 Internal	Toggling	Toggling	A87
A87 TP104	MUX\	A87 Internal	Toggling	Toggling	A87
A87 TP105	CASU\	A87 Internal	Toggling	Toggling	A87
A87 TP106	CASL\	A87 Internal	Toggling	Toggling	A87
A87 TP107	REFIN\	A87 Internal	Toggling	Toggling	A87
A87 TP108	REFOUT\	A87 Internal	Toggling	Toggling	A87
A87 TP109	ROMSEL\	A87 Internal	High	Toggling	A87
A87 TP110	MEM_DTACK\	A87 Out	Toggling	Toggling	A87
A87 TP111	RW	A81 Out	Toggling	Toggling	A81
A87 TP113	DS	A87 Internal	Toggling	Toggling	A87
A81 TP600	SCL	A81 Out	High	Toggling	A81

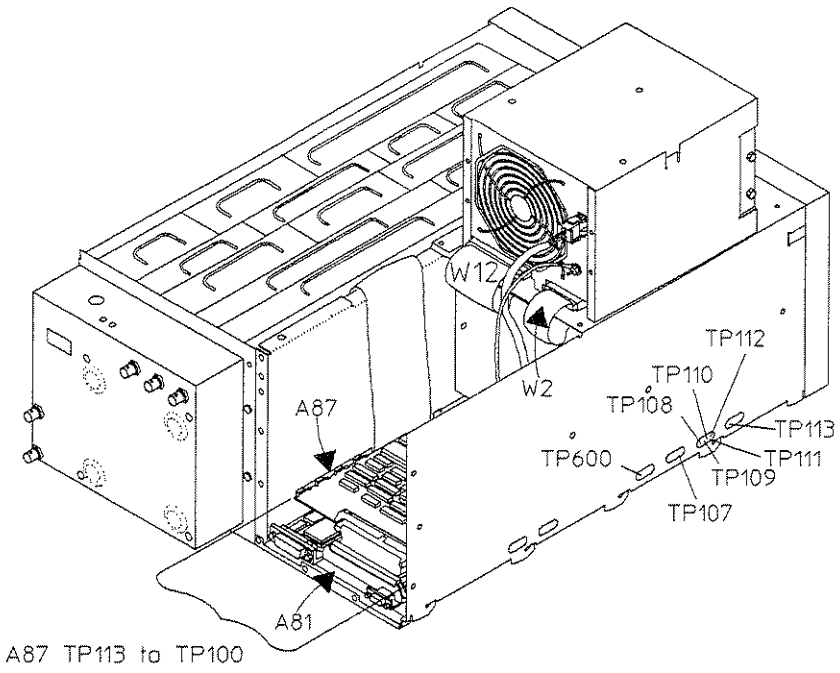


Figure 5-13. Control Lines Test Location

Troubleshooting Using the Self Tests

Use the self tests when one of the following occurs:

- Calibration fails
- Performance test fails
- Local oscillator unlocked
- Failure is intermittent
- HP-IB fails

Test 9. Self Test thoroughly exercises the digital and analog circuits in the analyzer. However, some circuits are not tested, but they are used and can cause tests to fail. Other circuits are neither tested nor used. If you suspect that one of these circuits is faulty, see table 5-11 and follow the recommended troubleshooting test.

Table 5-11. Circuits Not Tested by Test 9. Self Test

Used But Not Tested:	Troubleshooting Test
Power Supply assembly	Test 1. Initial Verification
Ribbon cable	Test 3. CPU, Memory, and Buses
Control lines	Test 8. Control Lines
Not Used or Tested:	
HP-IB connector	Test 12. HP-IB/RS-232
Source BNC connector and last relay	Test 14. Source
Input protection circuits Input BNC and first relay	Test 18. Input Conversion
Rear panel oven output Rear panel reference output Rear panel reference input	Test 21. Reference
Memory battery Real-time clock	Test 33. Memory Battery
Rear panel fan	Test 34. Fan Power
Rear panel external trigger Rear panel trigger output	Test 35. Trigger

Test 9. Self Test

Use this test if the analyzer fails a calibration or performance test.

1. Disconnect all cables connected to the front panel, and set the power switch to STANDBY (⏻). Remove the top cover (see the disassembly/assembly illustrations in section II, "Replaceable Parts").
2. Set the power switch to ON (|).
3. If a disk drive failure is suspected, install a LIF disk in the disk drive. If a disk drive failure is not suspected, do not install a disk in the disk drive.

Note

The analyzer uses Logical Interchange Format (LIF), option 0-4. This is the same format used by the Series 200/300 BASIC system. To format a disk, press the following keys:
[**Disk Util**]
[FORMAT DISK]
It takes about 1.5 minutes to format a disk.

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4. Press the following keys:

[**Spcl Fctn**]
[ ] (second softkey from bottom)
– 99
[ ] (second softkey from bottom)
[SERVICE FUNCTIONS]
[SELF TEST]
[FUNCTIONL TESTS]
[ALL]

Note

With a disk in the disk drive, this test takes approximately 22 minutes.
Without a disk in the disk drive, this test takes approximately 2 minutes. Also, the disk drive self tests respond with the message, test ABORTED.

---

5. When the tests have finished running, press the following keys:

   [**Spcl Fctn**]
   [SERVICE FUNCTIONS]
   [SELF TEST]
   [TEST LOG]

Note

To print the test log to a HP-IB printer, press the analyzer keys as follows:
[**Local/HP-IB**]
[SYSTEM CONTROLLR]
[**Spcl Fctn**]
[SERVICE FUNCTIONS]
[SELF TEST]
[TEST LOG]
[**Plot/Print**]
[PRINT ALL]

---

6. If the analyzer did not complete the tests (analyzer locks up), go to Test 10. ALL Locks Analyzer.

7. If the analyzer completes the tests, compare table 5-12 to the analyzer's test log. If the analyzer's test log matches more than one entry on the table, use the entry closest to the beginning of the table. The table lists the probable faulty assembly or assemblies and any recommended adjustment or troubleshooting procedure to do before replacing the assembly. If both an adjustment and a test are recommended, do the adjustment first.

Note

For the complete list of assemblies used in each self test, see table 5-31 on page 5-95. For additional information on the self tests, see "Self Test Descriptions" at the end of this section.

---

8. If the analyzer passed all but the Quick confidence self test, see table 5-27 in "Troubleshooting Failing Performance Tests."

9. If the problem is intermittent and the analyzer passed all self tests, go to Test 22. Intermittent Failures.

Table 5-12. Self-Test Troubleshooting Guide

Failing Self Test	Probable Faulty Assembly	Adjustment	Troubleshooting Test
Processor	A81 CPU		Test 3. CPU, Memory, and Buses
ROM	A87/A88 Memory		Test 3. CPU, Memory, and Buses
RAM	A87/A88 Memory		Test 3. CPU, Memory, and Buses
Interrupt	A81 CPU		Test 3. CPU, Memory, and Buses
Mult fctn peripheral	A81 CPU		
Display digital	A81 CPU		
DMA	A81 CPU		
Math coprocssor	A81 CPU		
HP-IB	A81 CPU A87/A88 Memory		Test 33. Memory Battery
Disk controller	A81 CPU		
IIC bus	see test log		Test 6. IIC Bus
Fast bus	A81 CPU A62 ADC/Digital Filter		Test 7. Fast Bus
Front panel	Front Panel		
Disk motor [MOTOR]	A81 CPU Disk Drive		Test 11. Disk Drive
Disk restore [RESTORE]	A81 CPU Disk Drive		Test 11. Disk Drive
Disk random seek [RANDOM SEEK]	A81 CPU Disk Drive		Test 11. Disk Drive
Disk sector seek [SEEK SECTOR]	A81 CPU Disk Drive		Test 11. Disk Drive
Disk read [READ]	A81 CPU Disk Drive		Test 11. Disk Drive
Disk read/write [READ/WRITE]	A81 CPU Disk Drive		Test 11. Disk Drive
Disk read/write all [READ/WRITE ALL]	A81 CPU Disk Drive		Test 11. Disk Drive
Digital filter gate array	A62 ADC/Digital Filter A32 300 MHz A33 Trigger		Test 13. Digital Filter
Detector gate array	A62 ADC/Digital Filter A33 Trigger		Test 13. Digital Filter
Source 187.5 kHz [187.5 kHz REFERENCE]	A42 Source Conversion A33 Trigger		Test 14. Source
Source gilbert cell [GILBERT CELL]	A42 Source Conversion		Test 14. Source

Table 5-12. Self-Test Troubleshooting Guide (continued)

Failing Self Test	Probable Faulty Assembly	Adjustment	Troubleshooting Test
Mult loop tuning range	A51 Interpolation VCO A52 Fractional-N A33 Trigger	4. Interpolation VCO	Test 16. Interpolation Loop
Single loop tuning range	A 21 Sum VCO A51 Interpolation VCO A52 Fractional-N A23 Step Phase Detector	5. Single Loop Control Voltage Clamps	Test 17. Single Loop
"Local Oscillator Unlocked" message displayed	A51 Interpolation VCO A52 Fractional-N A21 Sum VCO A22 Sum Phase Detector A23 Step Phase Detector A24 Step VCO		Test 15. Local Oscillator
Source output level [OUTPUT CKTS]	A41 Source Amplifier A42 Source Conversion A21 Sum VCO A22 Sum Phase Detector A23 Step Phase Detector A24 Step VCO A31 Reference/Calibrator A32 300 MHz	10. Pretune Offset and Slope 13. Source Bandpass Filter	Test 14. Source
Receiver 2nd If [2ND IF LEVEL]	A61 IF A11 Input A12 First Conversion A13 Second Conversion A21 Sum VCO A32 300 MHz A41 Source Amplifier	14. First IF Bandpass Filter	Test 18. Input Conversion
Receiver ADC [ADC]	A62 ADC/Digital Filter A24 Step VCO A31 Reference/Calibrator A51 Interpolation VCO A61 IF	3. 300 MHz Reference VCO 12. Second IF Bandpass Filter 11. ADC Gain, Offset, and Reference	Test 18. Input Conversion
Post divider	A51 Interpolation VCO A21 Sum VCO		Test 19. Sum Loop
Receiver autorange [AUTO RNG TRIP PTS]	A11 Input A41 Source Conversion	15. Autorange Thresholds and 1 Meg Ohm Flatness 17. Calibrator Flatness and Level	Test 18. Input Conversion
Receiver 10 MHz [10 MHz LOCAL OSC]	A31 Reference/Calibrator A32 300 MHz A33 Trigger A21 Sum VCO A22 Sum Phase Detector A23 Step Phase Detector A24 Step VCO A51 Interpolation VCO A52 Fractional-N	3. 300 MHz Reference VCO 14. First IF Bandpass Filter 12. Second IF Bandpass Filter	Test 21. Reference
Source flatness [FLATNESS]	A41 Source Amplifier A42 Source Conversion		Test 14. Source

Table 5-12. Self-Test Troubleshooting Guide (continued)

Failing Self Test	Probable Faulty Assembly	Adjustment	Troubleshooting Test
Quick confidence		3. 300 MHz Reference VCO 5. Single Loop Control Voltage Clamps 10. Pretune Offset and Slope 13. Source Bandpass Filter 14. First IF Bandpass Filter 12. Second IF Bandpass Filter 11. ADC Gain, Offset, and Reference	See "Troubleshooting Failing Performance Tests"

Test 10. ALL Locks Analyzer

Use this test to continue troubleshooting if the analyzer locked up while running the functional test ALL.

1. Set the power switch to ON (I) and as soon as the graticule appears, disable the calibration routine by pressing the following keys:

   [ ] (second softkey from bottom)
   [ ] (second softkey from bottom)
   [**Spcl Fctn**]
   [AUTO CAL ON **OFF**]

2. Press the following keys (allow enough time for each test to complete before pressing the next key) until a test fails or the analyzer locks up:

Note

A failure may cause the self tests to run very slow. Wait one minute before assuming the analyzer is locked up.

[ ] (second softkey from bottom)
– 99
[ ] (second softkey from bottom)
[SERVICE FUNCTIONS]
[SELF TEST]
[TEST LOG]
[CANCEL/RETURN]
[FUNCTIONL TESTS]
[CPU]
[PROCESSOR]
[ROM]
[RAM]
[INTERRUPT]
[MULT FCTN PERIPHERL]
[DISPLAY DGTL HW]
[**Spcl Fctn**]
[SERVICE FUNCTIONS]
[SELF TEST]
[TEST LOG]
[CANCEL/RETURN]
[FUNCTIONL TESTS]
[DMA]
[MATH COPROCSSR]
[I/O]
[HP-IB]
[HP-IB FUNC TEST]
[ABORT/RETURN]

[INTERNAL DISK]
[DISK CONTROLLR]
[ABORT/RETURN]
[IIC BUS]
[FAST BUS]
[FRONT PANEL]
[ABORT/RETURN]
[RECEIVER]
[DIGITAL FILTER]
[DETECTOR]
[ABORT/RETURN]
[SOURCE]
[187.5 kHz REFERENCE]
[GILBERT CELL]
[ABORT/RETURN]
[LOCAL OSC]
[MULT-LOOP TUN RANGE]
[SNGL LOOP TUN RANGE]
[ABORT/RETURN]
[SOURCE]
[OUTPUT CKTS]
[ABORT/RETURN]
[RECEIVER]
[2ND IF LEVEL]
[ADC]
[ABORT/RETURN]
[LOCAL OSC]
[POST DIVIDER]
[ABORT/RETURN]
[RECEIVER]
[AUTO RNG TRIP PTS]
[10 MHz LOCAL OSC]
[ABORT/RETURN]
[SOURCE]
[FLATNESS]
[ABORT/RETURN]
[ABORT/RETURN]
[QUICK CONF TEST]

3. Locate the test that failed or locked up the analyzer in table 5-12. The table lists the probable faulty assembly and any recommended adjustment or troubleshooting procedure to do before replacing the assembly.

Test 11. Disk Drive

Use this test to isolate disk drive failures to the CPU assembly, the Disk Drive assembly, or the flexible disk.

Note

The assembly uses Logical Interchange Format (LIF), option 0-4. This is the same format used by the Series 200/300 BASIC system. To format a disk, press the following keys:

[**Disk Util**]
  [DEFAULT DISK]
  [INTERNAL DISK]
  [CANCEL/RETURN]
  [FORMAT DISK]

It takes about 1.5 minutes to format a disk.

---

1. Set the power switch to ON (I). Insert a formatted disk into the Disk Drive assembly and press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [SELF TEST]
   [TEST LOG]
   [CANCEL/RETURN]
   [FUNCTIONL TESTS]
   [I/O]
   [INTERNAL DISK]
   [ALL]

Note

This test takes about 20 minutes to complete if there are no failures.

---

2. If the Motor and Restore self tests pass and the Random Seek and Read self tests fail, the flexible disk is probably unformatted or faulty. If this occurs, use a different formatted disk and repeat step 1 to see if the error clears. Following is the typical error message when the disk is unformatted or faulty:

   Seek to n went to n
   rd data verify err sctr n
   Where n is a sector number from 1 to 2464.

3. If the Disk Controller self test fails, the Disk Drive assembly or the CPU's disk drive controller is probably faulty. Before replacing the Disk Drive assembly, do the following to verify that the CPU's disk drive controller is operating correctly:

   a. Disconnect the power cord from the rear panel and place the Power Supply assembly in its test position. Remove the Memory assembly. See the disassembly/assembly illustrations in section II, "Replaceable Parts."

   b. With the Memory assembly upside-down and outside the chassis, connect the memory cable. Be careful not to short the pins on back of the assembly.

   c. Disconnect the disk drive cable (W4).

   d. Connect the power cord and set the power switch to ON (|). Press the analyzer keys as follows:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [SELF TEST]
   [TEST LOG]
   [CANCEL/RETURN]
   [LOOP MODE **ON** OFF]
   [FUNCTIONL TESTS]
   [I/O]
   [INTERNAL DISK]
   [ALL]

e. Using a logic probe, check that the TTL signals in table 5-13 are toggling (see figure 5-14 for test locations).

Table 5-13. Disk Drive Control Signals

Test Location	Signal Name	In/Out
A81 U500(19)	8 MHz	A81 Internal
A81 U500(21)	1 MHz	A81 Internal
A81 U500(28)	DS0	A81 Internal
A81 U500(29)	DS1	A81 Internal
A81 U500(22)	DW	A81 Internal
A81 U501(5)	MOTOR_ON\	A81 Out
A81 U501(12)	WRITE_DATA\	A81 Out

f. After checking the signals, press the following keys:

[ABORT/RETURN]
[ABORT/RETURN]
[ABORT/RETURN]
[LOOP MODE ON **OFF**]

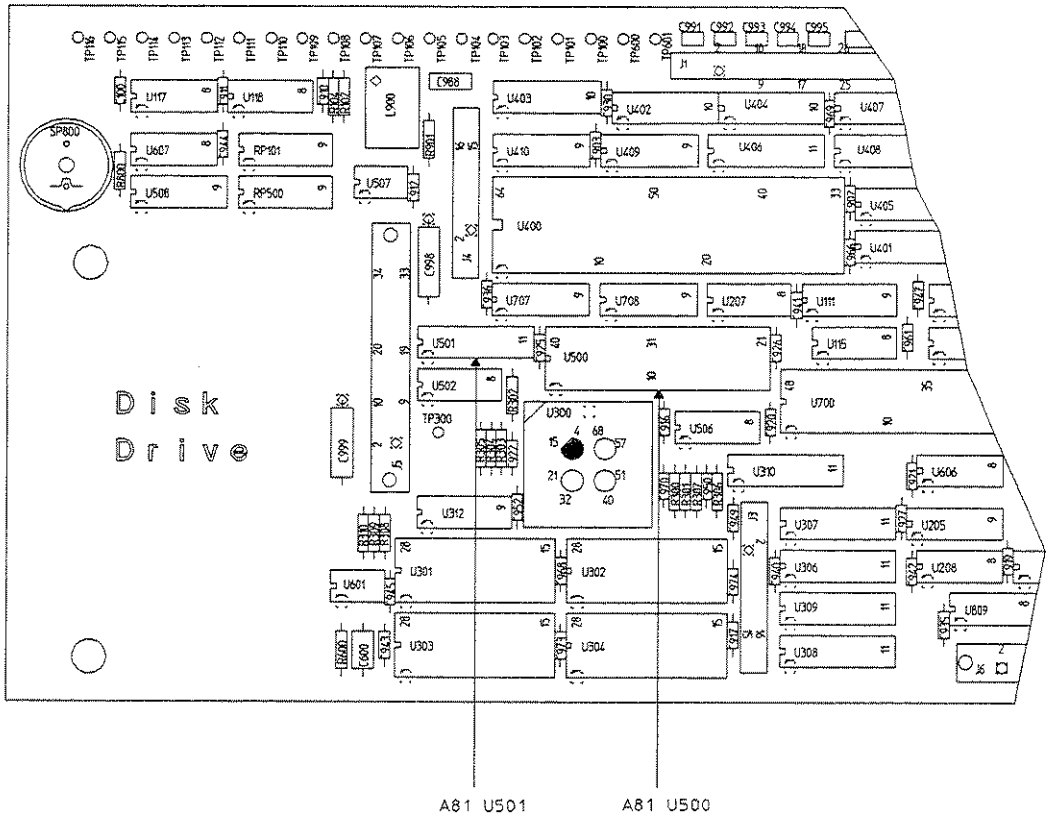

Figure 5-14. Disk Drive Controller Test Locations

Test 12. HP-IB/RS-232

Use this test to separate HP-IB sub-block failures from HP-IB connector failures.

Note The HP 3588A Spectrum Analyzer has an RS-232 connector, but it does not function.

---

1. Set the power switch to STANDBY (⏻) and remove the top cover (see the disassembly/assembly illustrations in section II, "Replaceable Parts").
2. Set the power switch to ON (|), then press the following keys:
   [Spcl Fctn]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [SELF TEST]
   [FUNCTIONL TESTS]
   [I/O]
   [HP-IB]
   [HP-IB FUNC TEST]
3. If the HP-IB self test fails, the HP-IB sub-block on the CPU assembly is probably faulty.
4. Press the [HP-IB CONNECTOR] softkey.
5. Using a small jumper, short each HP-IB connector pin to the HP-IB connector ground while watching the display. When a pin is grounded, the corresponding pin in the display should have a dot in it. If this test fails, the HP-IB connector is probably faulty.

Note When pin 11 is grounded, the display should have a dot in ATN and may also have a dot in NDAC.

Test 13. Digital Filter

Use this test if the receiver is suspected of failing and all self tests listed before the Digital filter gate array in table 5-12 passed.

1. Using a spectrum analyzer (with frequency span set to ≤ 1 MHz) or an oscilloscope, check the signals in table 5-14 in the order listed. At the first incorrect signal, go to step 6.

Table 5-14. ADC/Digital Filter Frequency Reference

Test Location	Frequency	Amplitude	Output Impedance	Probable Faulty Assembly
A31 J8	80 MHz	– 5 dBm (ECL)	50Ω	A31 Reference/Calibrator
A32 J2	60 MHz	– 2.5 dBm (ECL)	50Ω	A32 300 MHz
A33 J3	250 kHz	3.3 Vp-p (TTL)	1 MΩ	A33 Trigger

2. Set the power switch to STANDBY (⏻), and reconnect all cables.
3. Set the power switch to ON (I), and check that A62 DS804 (LSWP – yellow LED) is on and briefly blinking off.
4. If the LED is not blinking and the message dma ok using internal test mode was included in the self-test message, the A33 Trigger assembly is probably faulty. If the message was not included, the A62 Digital/Filter assembly is probably faulty. Before replacing an assembly, go to step 6 to check the voltages at the connector.
5. If the LED is blinking, the A62 ADC/Digital Filter assembly is probably faulty. Do the next step before replacing the assembly.
6. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector:
   a. Set the power switch to STANDBY (⏻). Remove the suspected assembly and place an extender board in the card nest.
   b. Set the power switch to ON (I), then check the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Test 14. Source

Use this test when the source is suspected of failing and all self tests listed before Source 187.5 kHz in table 5-12 passed.

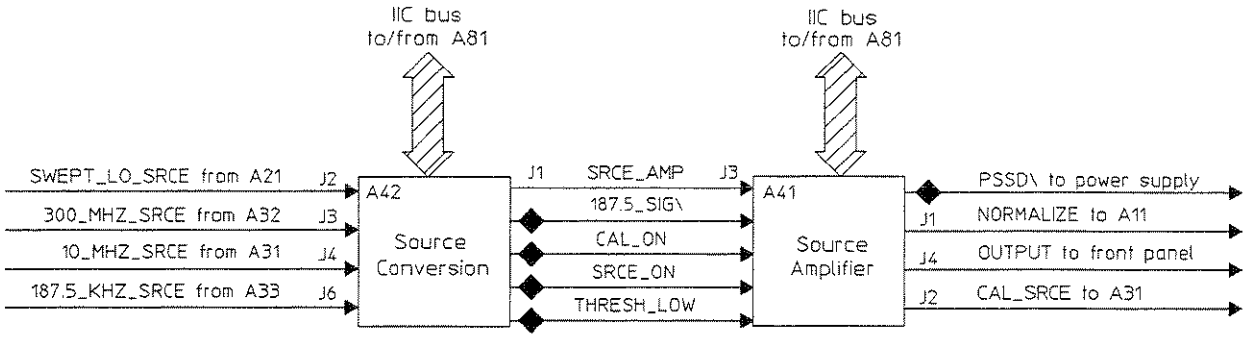

Figure 5-15. Source Block Diagram

Note

If a particular amplitude or frequency is failing, set the HP 3588A Spectrum Analyzer to the failing amplitude or frequency.

---

1. Press the following keys:

   [**Preset**]
   [**Sweep**]
   [SWEEP AUTO **MAN**]
   [MANUAL FREQ]
   10 (or to the failing frequency)
   [MHz]
   [**Source**]
   [SOURCE **ON** OFF]
   [SOURCE AMPLITUDE]
   10 (or to the failing amplitude)
   [dBm]

2. Set the spectrum analyzer as follows:

Center Frequency	10 MHz (or to the failing frequency)
Frequency Span	1 MHz
Input Impedance	50Ω

3. Connect the spectrum analyzer to A42 J1 using a BNC-to-SMB cable and compare the amplitude to table 5-15.

Table 5-15. Amplitude Settings and A42 J1 Amplitudes

Amplitude Setting (dBm)	A42 J1 Amplitude (dBm ± 3 dB)
10, 0, – 10, – 20, – 30, – 40	– 41
9, – 1, – 11, – 21, – 31, – 41	– 42
8, – 2, – 12, – 22, – 32, – 42	– 43
7, – 3, – 13, – 23, – 33, – 43	– 44
6, – 4, – 14, – 24, – 34, – 44	– 45
5, – 5, – 15, – 25, – 35, – 45	– 46
4, – 6, – 16, – 26, – 36, – 46	– 47
3, – 7, – 17, – 27, – 37, – 47	– 48
2, – 8, – 18, – 28, – 38, – 48	– 49
1, – 9, – 19, – 29, – 39, – 49	– 50
– 50	– 51
– 51	– 52
– 52	– 53
– 53	– 54
– 54	– 55
– 55	– 56
– 56	– 57
– 57	– 58
– 58	– 59
– 59	– 60
– 59.9	– 61

4. If the amplitude at A42 J1 is correct, do the following:

   a. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A41 Source Amplifier assembly, and place an extender board in the card nest.

   b. Set the power switch to ON (I), and press the following keys:
   [**Source**]
   [SOURCE **ON** OFF]

c. Check that pin 16B (SRCE_ON) on the extender board is a TTL level high. If pin 16B is a TTL high, the A41 Source Amplifier assembly is probably faulty. If pin 16B is not a TTL high, the A42 Source Conversion assembly is probably faulty. Before replacing the assembly, go to step 6 to check the voltages at the connector.

5. If the amplitude at A42 J1 is incorrect, do the following:

   a. Press the [**Preset**] hardkey.

   b. Using a spectrum analyzer (with frequency span set to ≤ 1 MHz) or an oscilloscope, check the signals in table 5-16 in the order listed. At the first incorrect signal, go to step 6 if a probable faulty assembly is listed or to the recommended troubleshooting test.

Table 5-16. Source Reference Frequencies

Test Location	Frequency	Amplitude	Output Impedance	Probable Faulty Assembly or Troubleshooting Test
A31 J4	10 MHz	– 3 dBm (ECL)	50Ω	A31 Reference/Calibrator
A31 J5	10 MHz	– 3 dBm (ECL)	50Ω	A31 Reference/Calibrator
A31 J9	20 MHz	– 3 dBm (ECL)	50Ω	A31 Reference/Calibrator
A32 J3	300 MHz	– 10 dBm	50Ω	A32 300 MHz
A32 J4	300 MHz	– 2 dBm	50Ω	A32 300 MHz
A33 J2	187.5 kHz	600 mVp-p square wave	50Ω	A33 Trigger
A21 J2	310.1875 to 460.1875 MHz	– 10 dBm	50Ω	Test 17. Single Loop

   c. If all the signals are correct, the A42 Source Conversion assembly is probably faulty. Before replacing the assembly, do the next step.

6. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector:

   a. Set the power switch to STANDBY (⏻). Remove the screw at each end of the suspected assembly. Remove the assembly and place an extender board in the card nest.

   b. Set the power switch to ON (I), then measure the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Test 15. Local Oscillator

Use this test when the "Local Oscillator Unlock" message appears on the screen and the following self tests passed:

- Digital filter gate array
- Detector gate array
- Mult loop tuning range
- Single loop tuning range

Note

The following procedure checks frequencies with a spectrum analyzer. However, if the failure mode requires more exact frequency measurements, use a frequency counter with $\pm 25 \times 10^{-3}$ Hz frequency accuracy.

---

1. Press the following keys:

   [**Preset**]
   [**Freq**]
   [FULL SPAN]
   [**Sweep**]
   [SWEEP AUTO **MAN**]
   [MANUAL FREQ]
   0
   [Hz]

2. Using a spectrum analyzer with 50Ω input impedance, set its span to 50 MHz and connect to A51 J4. The signal at A51 J4 should be 41.875 MHz, – 24 dBm ± 3 dB. If the signal is incorrect, go to Test 16. Interpolation Loop.

3. Press the following keys:

   [**Sweep**]
   [MANUAL FREQ]
   50
   [MHz]

4. Connect the spectrum analyzer to A24 J2. The signal at A24 J2 should be 350 MHz, – 24 dBm ± 5 dB. If the signal at A24 J2 is incorrect, go to Test 20. Step Loop.

5. Connect the spectrum analyzer to A21 J3. The signal at A21 J3 should be 360.1875 MHz, 4 dBm ± 3 dB. If the signal at A21 J3 is incorrect, go to Test 19. Sum Loop.

Test 16. Interpolation Loop

Use this test when the local oscillator's interpolation loop is suspected of failing and the following self tests passed:

- Digital filter gate array
- Detector gate array

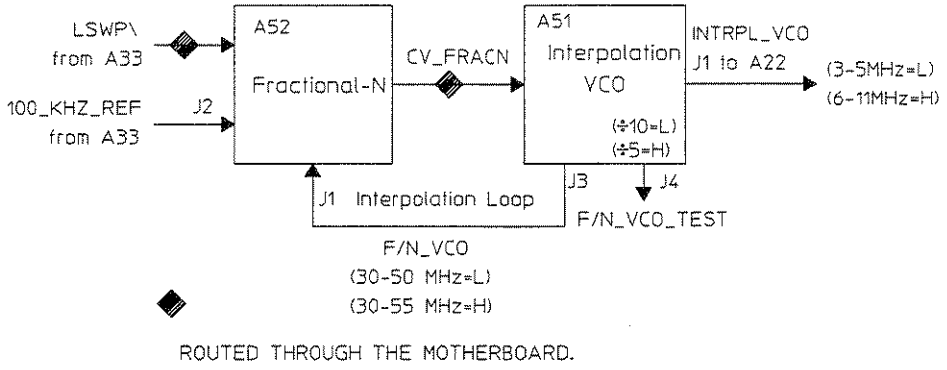

Figure 5-16. Local Oscillator Interpolation Loop

1. Using an oscilloscope with a 50Ω input impedance, check that A33 J4 is a 100 kHz, TTL pulse.
2. If the signal at A33 J4 is incorrect, the A33 Trigger assembly is probably faulty. Before replacing the assembly, go to step 12 to check the voltages at the connector.
3. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A51 Interpolation VCO assembly, and remove the assembly. Move A51 J101 to its test position, and place the assembly on an extender board.
4. Set the power switch to ON (I), then press the following keys:

   [**Freq**]
   [FULL SPAN]
   [**Sweep**]
   [SWEEP AUTO **MAN**]
   [MANUAL FREQ]
   0
   [Hz]

5. Using a spectrum analyzer with 50Ω input impedance and the frequency span set to 50 MHz, check that A51 J4 is 55 MHz ± 0.5 MHz with an output level of – 24 dBm ± 3 dB.

6. If the signal at A51 J4 is incorrect, the A51 Interpolation VCO assembly is probably faulty. Before replacing the assembly, go to step 12 to check the voltages at the connector.

7. Set the power switch to STANDBY (⏻). Remove the test jumper and connect a ± 10 Vdc supply to the center pin of A51 J101.

8. Connect a spectrum analyzer to A51 J4. Set it to a start frequency of 30 MHz and stop frequency of 55 MHz.

9. Set the power switch to ON (I), then press the following keys:

   [**Freq**]
   [FULL SPAN]
   [**Sweep**]
   [SWEEP AUTO **MAN**]
   [MANUAL FREQ]
   0
   [Hz]

10. Vary the dc voltage from +10V to 0V while monitoring A51 J4. The frequency should vary between 30 MHz and 55 MHz as the dc voltage is varied. The output level should be – 24 dBm ± 3 dB.

11. If the signal at A51 J4 is correct, the A52 Fractional-N assembly is probably faulty. If the signal at A51 J4 is incorrect, the A51 Interpolation VCO assembly is probably faulty. Before replacing the assembly, go to step 12 to check the voltages at the connector.

12. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector:

    a. Set the power switch to STANDBY (⏻). Remove the suspected assembly and place an extender board in the card nest.

    b. Set the power switch to ON (I), then check the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Test 17. Single Loop

Use this test when the local oscillator is suspected of failing in single loop mode and the following self tests passed:

- Digital filter gate array
- Detector gate array
- Mult loop tuning range

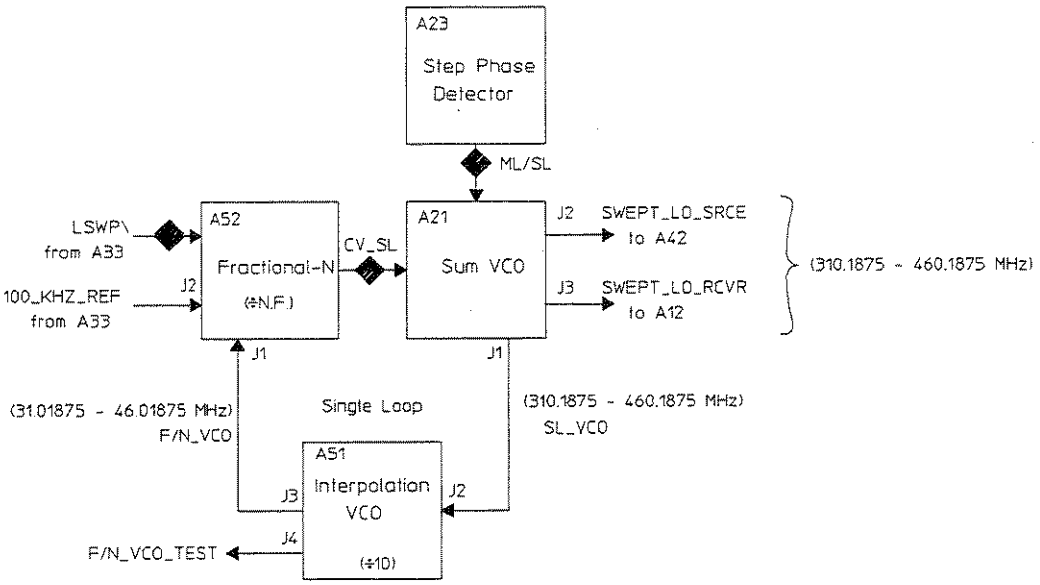

Figure 5-17. Local Oscillator in Single Loop Mode

1. Press the [Preset] key, then check the signals in table 5-17 using a spectrum analyzer.

Table 5-17. Single Loop Output Frequencies

Test Location	Frequency	Amplitude (± 3 dBm)	Output Impedance
A21 J2	310 to 460 MHz	– 10 dBm	50Ω
A21 J3	310 to 460 MHz	+4 dBm	50Ω
A51 J4	31 to 46 MHz	– 24 dBm	50Ω

2. If all the signals are correct, the local oscillator is operating correctly in single loop mode. Go to Test 19. Sum Loop.

3. If the signal at A51 J4 is 31 to 46 MHz, but the signal at A21 J2 or A21 J3 is incorrect, the A21 Sum VCO assembly is probably faulty. Before replacing the assembly, go to step 16 to check the loop mode control signal.

4. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A21 Sum VCO assembly, and remove the assembly. Move A21 J201 to its test position, and place the assembly on an extender board.

5. Set the power switch to ON (|). Check the signals in table 5-18 using a spectrum analyzer with the frequency span set to 50 MHz.

Table 5-18. Single Loop Output Frequencies in Test Mode

Test Location	Frequency (± 10 MHz)	Amplitude (± 3 dBm)	Output Impedance	Probable Faulty Assembly
A21 J1	445 MHz	+3 dBm	50Ω	A21 Sum VCO
A21 J2	445 MHz	− 10 dBm	50Ω	A21 Sum VCO
A21 J3	445 MHz	+4 dBm	50Ω	A21 Sum VCO

6. If a signal is incorrect, go to step 16 to check the loop mode control signal.

7. Set the power switch to STANDBY (⏻). Remove the jumper from A21 J201, and connect a ± 10 Vdc supply to the center pin of A21 J201.

8. Connect a spectrum analyzer to A21 J1 and set its frequency span for 300 to 470 MHz.

9. Set the power switch to ON (|). While monitoring A21 J1, vary the dc voltage from +7V to − 1V. The signal at A21 J1 should vary between 310 and 460 MHz as the dc voltage is varied.

10. If the signal is correct, check that A21 J2 and A21 J3 vary between 310 and 460 MHz as the dc voltage is varied. The amplitudes should be the same as listed in the previous table.

11. If the signal at A21 J1, J2, or J3 is incorrect, the A21 Sum VCO assembly is probably faulty. Before replacing the assembly, go to step 16 to check the loop mode control signal.

12. Using an extender cable, connect A21 J1 to A51 J2.

13. Connect the spectrum analyzer to A51 J4 and change its start frequency to 30 MHz and its stop frequency to 50 MHz.

14. Vary the dc voltage while monitoring A51 J4. The signal should vary between 31 and 46 MHz as the dc voltage is varied. The output level should be − 24 dBm ± 3 dB.

15. If the signal at A51 J4 is correct, the A52 Fractional-N assembly is probably faulty. If the signal is incorrect, the A51 Interpolation VCO assembly is probably faulty. Before replacing the assembly, go to step 17 to check the voltages at the connector.

16. Before replacing the A21 Sum VCO assembly, do the following:

    a. Set the power switch to STANDBY (⏻). Remove the screws at each end of the A21 Sum VCO assembly and remove the assembly. Place an extender board in the card nest.

    b. Set the power switch to ON (I), then check that A21 J100 pin 8 (ML/SL) is a TTL level high. If it is not, the A23 Step Phase Detector assembly is probably faulty. Before replacing the assembly, do the next step.

17. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector:

    a. Set the power switch to STANDBY (⏻). Remove the suspected assembly and place an extender board in the card nest.

    b. Set the power switch to ON (I), then check the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Test 18. Input Conversion

Use this test when the receiver is suspected of failing and all self tests listed before the Receiver 2nd If in table 5-12 passed.

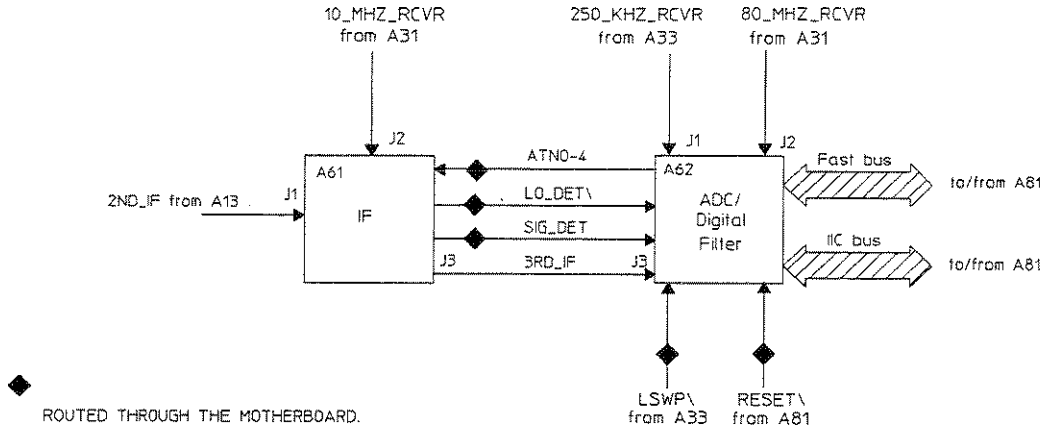

Figure 5-18. IF/ADC Block Diagram

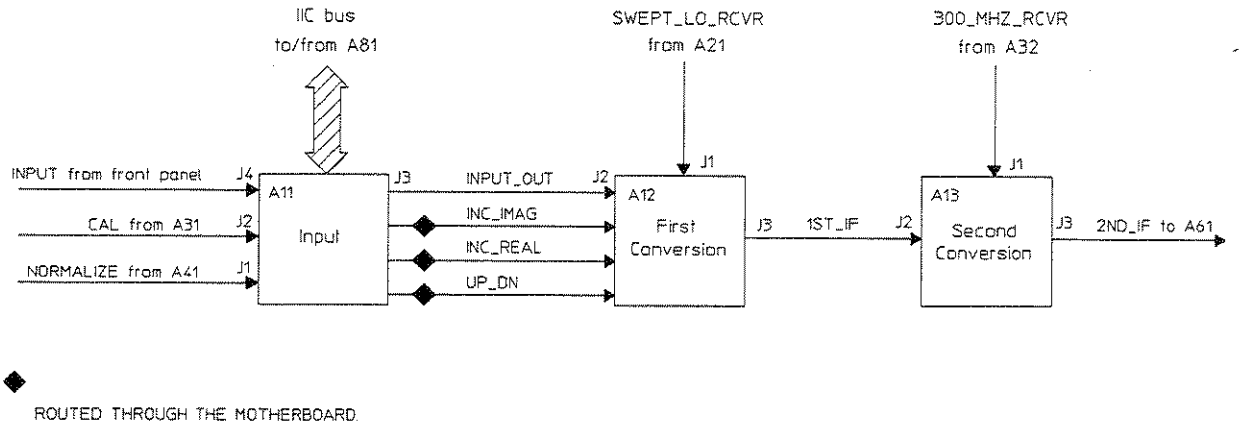

Figure 5-19. Input Conversion Block Diagram

1. Connect the signal generator to the front panel INPUT connector using a BNC cable.

2. Set the signal generator as follows:

Frequency	10 MHz
Amplitude	– 20 dBm

3. Press the following keys:

[**Preset**]
[**Spcl Fctn**]
[AUTO CAL ON **OFF**]
[**Range/Input**]
[RANGE]
– 20
[dBm]
[**Sweep**]
[SWEEP AUTO **MAN**]
[MANUAL FREQ]
10
[MHz]

4. Check the signals in table 5-19 using a spectrum analyzer with the frequency span set to ≤ 1 MHz. After checking a signal, reconnect the disconnected cable before checking the next signal. At the first incorrect signal, go to the recommended test or to step 34 if an assembly is listed as faulty.

Table 5-19. Input Conversion References and Signals

Test Location	Frequency	Amplitude (± 3 dB)	Output Impedance	Probable Faulty Assembly or Next Test
A11 J3	10 MHz	– 28 dBm	50Ω	A11 Input
A21 J3	320.1875 MHz	4 dBm	50Ω	Test 19. Sum Loop
A12 J3	310.1875 MHz	– 30 dBm	50Ω	A12 First Conversion
A32 J5	300 MHz	0 dBm	50Ω	A32 300 MHz
A13 J3	10.1875 MHz	– 37 dBm	50Ω	A13 Second Conversion
A31 J3	10 MHz	– 3 dBm	50Ω	A31 Reference/Calibrator
A61 J3	187.5 kHz	+7 dBm	50Ω	Step 20
A51 J1	4.1875 MHz	– 5 dBm	50Ω	A51 Interpolation VCO

5. If the signals in step 4 were correct and the Reciever 2nd IF self test passed, go to step 25.

6. Change the signal generator's amplitude to 0 dBm.

7. Press the following keys:

[**Range/Input**]
[1 MEGOHM]

8. Connect the spectrum analyzer to A11 J3. The signal at A11 J3 should be 10 MHz, – 28 dBm ± 3 dB. If the signal is incorrect, the A11 Input assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

9. Press the following keys:

   [**Range/Input**]
   [50 OHMS]
   [RANGE]
   – 10
   [dBm]

10. Change the signal generator's amplitude to – 10 dBm.

11. The signal at A11 J3 should be 10 MHz, – 28 dBm ± 3 dB. If the signal is incorrect, the A11 Input assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

12. Change the signal generator's amplitude to 10 dBm.

13. Press the following keys:

    [RANGE]
    10
    [dBm]

14. The signal at A11 J3 should be 10 MHz, – 28 dBm ± 3 dB. If the signal is incorrect, the A11 Input assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

15. Change the signal generator's amplitude to 5 dBm.

16. Connect the spectrum analyzer to A61 J3 and reconnect A11 J3 to A12 J2 using the original cable.

17. Press the following keys:

    [**Spcl Fctn**]
    [ ] (second softkey from bottom)
    – 99
    [ ] (second softkey from bottom)
    [SERVICE FUNCTIONS]
    [SPCL TEST MODES]
    [IF ATTEN]
    16
    [dB]

18. Adjust the signal generator's amplitude for a spectrum analyzer readout of 6.00 dBm ± 0.05 dB at 187.5 kHz (spectrum analyzer's frequency span is 20 kHz).

19. Press the following keys:

    [IF ATTEN]
    15
    [dB]

20. The spectrum analyzer should now read 7.0 dBm ± 0.3 dB. If the signal at A61J3 is correct, go to step 21. If the signal at A61J3 is incorrect, do the following to check the A31 10 MHz Cal signal:

    a. Press the folowing keys:
    [**Preset**]
    [**Spcl Fctn**]
    [PRFM TESTS]
    [CALIBRATR TO INPUT]

    b. Check the signal at A31 J1 for 10 MHz, − 20 dBm ± 3 dB using a spectrum analyzer. If the signal is incorrect, the A31 Reference/Calibrator assembly is probably faulty, go to step 34 to check the voltages at the connector.

21. Do the following to check the attenuator control from the A62 ADC/Digital Filter assembly:

    a. Set the power switch to STANDBY (⏻). Remove the screws at each end of the A61 IF assembly and remove the assembly. Place an extender board in the card nest.

    b. Set the power switch to ON (I), then press the following keys:
    [**Range**]
    [AUTORANGE ON **OFF**]
    [**Spcl Fctn**]
    [ ] (second softkey from bottom)
    − 99
    [ ] (second softkey from bottom)
    [AUTO CAL ON **OFF**]
    [SERVICE FUNCTIONS]
    [SPCL TEST MODES]
    [IF ATTEN]
    0
    [dB]

    c. Check that pins 1A, 1B, 1C, 2A, and 2B on the extender board are a TTL level low. If they are incorrect, the A62 ADC/Digital Filter assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

    d. Press the following keys:
    [IF ATTEN]
    31
    [dB]

    e. Check that pins 1A, 1B, 1C, 2A, and 2B on the extender board are a TTL level high. If they are incorrect, the A62 ADC/Digital Filter assembly is probably faulty. If they are correct,

the A61 IF assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

22. Disconnect the cable connecting the signal generator to the INPUT connector.

23. Press the following keys:

    [**Preset**]
    [**Range/Input**]
        [AUTORANGE ON **OFF**]
    [**Spcl Fctn**]
        [AUTO CAL ON **OFF**]
        [SERVICE FUNCTIONS]
        [SPCL TEST MODES]
        [RECEIVER INPUT]
        [CONNCT TO SOURCE]
    [**Sweep**]
        [SWEEP AUTO **MAN**]
        [MANUAL FREQ]
        10
        [MHz]

24. Connect the spectrum analyzer to A41 J1 and reconnect A61 J3 to A62 J3 using the original cable.

25. The signal at A41 J1 should be 10 MHz, – 10 dBm ± 3 dB. If the signal is incorrect, the A41 Source Amplifier assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

26. Press the following keys:

    [**Preset**]
    [**Spcl Fctn**]
        [ ]
        – 99
        [ ]
        [AUTO CAL ON **OFF**]
        [SERVICE FUNCTIONS]
        [SPCL TEST MODES]
        [RECEIVER INPUT]
        [CONNCT TO CALIBRATR]

27. Connect the spectrum analyzer to A31 J1 and reconnect A41 J1 to A11 J1 using the original cable.

28. The signal at A31 J1 should be 10 MHz, – 20 dBm ± 3 dB. If the signal is incorrect, the A31 Reference/Calibrator assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

29. Press the following keys:

    [CANCEL/RETURN]
    [CALIBRATR SWPT]

30. Connect the spectrum analyzer to A41 J2 and reconnect A31 J1 to A11 J2 using the original cable.

31. The signal at A41 J2 should be 200 kHz to 150 MHz, – 12 dBm. If the signal is incorrect, the A41 Source Amplifier assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

32. Connect the spectrum analyzer to A31 J1 and reconnect A41 J2 to A31 J2 using the original cable.

33. The signal at A31 J1 should be 200 kHz to 150 MHz, – 20 dBm. If the signal is incorrect, the A31 Reference/Calibrator assembly is probably faulty. Before replacing the assembly, go to step 34 to check the voltages at the connector.

34. If all the signals in the previous steps are correct, the A62 ADC/Digital Filter assembly is probably faulty. Do the next step before replacing the assembly.

35. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector:

    a. Set the power switch to STANDBY (⏻). Remove the screw at each end of the suspected assembly. Remove the assembly and place an extender board in the card nest.

    b. Set the power switch to ON (I), then measure the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Test 19. Sum Loop

Use this test when the local oscillator is suspected of failing in multiple loop mode and the following self tests passed.

- Digital filter gate array
- Detector gate array
- Mult loop tuning range

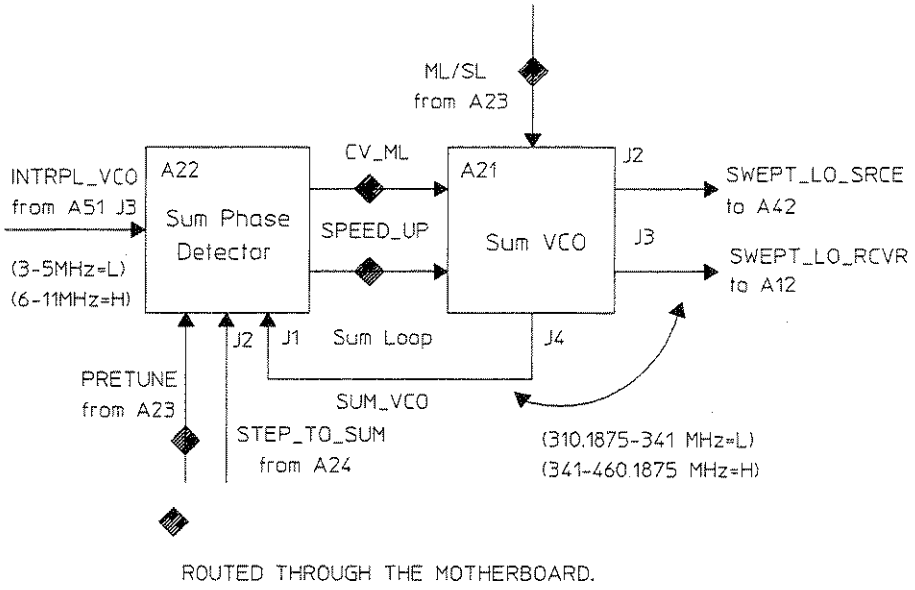

Figure 5-20. Local Oscillator Sum Loop

1. Set the power switch to ON (I), then press the following keys:

   [Spcl Fctn]
   [SINGLE CAL]
   [AUTO CAL ON **OFF**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [SPCL TEST MODES]
   [LOCAL OSC CONFIG]
   [LOCAL OSC SNGL **MULT**]

2. Using a spectrum analyzer, check the signals in table 5-20 in the order listed. At the first incorrect signal, go to the recommended test or to step 14 if an assembly is listed as faulty.

Table 5-20. Sum Loop Reference Frequencies

Test Location	Frequency	Amplitude (± 3 dB)	Output Impedance	Probable Faulty Assembly or Next Test
A24 J2	306 to 450 MHz	– 24 dBm	50Ω	Test 20. Step Loop
A24 J1	306 to 450 MHz	– 8 dBm	50Ω	A24 Step VCO
A51 J1	3 to 11 MHz[1]	– 3 dBm (ECL)	50Ω	A51 Interpolation VCO

[1] There is a noticeable jump in the sweep between 5 and 6 MHz as the signal changes between 'L' and 'H' settings. This occurs at an input frequency of approximately 30.8125 MHz.

3. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A22 Sum Phase Detector assembly, and lift the assembly up about one inch.

4. Remove the screw at each end of the A21 Sum VCO, and place the assembly on an extender board.

5. Connect a ± 10V dc supply to A21 CVML (ground is at TP2).

6. Set the spectrum analyzer's frequency span to 300 MHz to 470 MHz and connect its 50Ω input to A21 J4.

7. Set the power switch to ON (I), then press the following keys:

   [**Spcl Fctn**]
   [SINGLE CAL]
   [AUTO CAL ON **OFF**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [SPCL TEST MODES]
   [LOCAL OSC CONFIG]
   [LOCAL OSC SNGL **MULT**]

8. Vary the dc voltage from +7V to – 1V while monitoring A21 J4. The frequency should vary between 310 MHz to 460 MHz as the dc voltage is varied. The output level should be +8 dBm ± 3 dB.

9. If the signal at A21 J4 is correct, the A22 Sum Phase Detector assembly is probably faulty. Before replacing the assembly, go to step 14 to check the voltages at the connector. If the signal at A21 J4 is incorrect, the A21 Sum VCO assembly is probably faulty. Before replacing the assembly, go to step 13 to check control signals.

10. Remove the dc supply from A21 TP1.

11. Set the power switch to STANDBY (⏻), then push the A22 Sum Phase Detector assembly back into the card nest.

12. Set the power switch to ON (I), then press the following keys:

    [**Spcl Fctn**]
    [SINGLE CAL]
    [AUTO CAL ON **OFF**]
    [ ] (second softkey from bottom)
    – 99
    [ ] (second softkey from bottom)
    [SERVICE FUNCTIONS]
    [SPCL TEST MODES]
    [LOCAL OSC CONFIG]
    [LOCAL OSC SNGL **MULT**]

13. Before replacing the A21 Sum VCO assembly, check the signals in table 5-21.

Table 5-21. Sum Loop Control Signals

Signal Name	Test Location	Amplitude	Probable Faulty Assembly
ML/SL	A21 J100 pin 8	TTL Low	A23 Step Phase Detector
SPEED-UP	A21 J100 pin 7	TTL Low[1]	A22 Sum Phase Detector

[1] The signal occasionally pulses high. In manual sweep the signal is always low.

14. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector:

    a. Set the power switch to STANDBY (⏻). Remove the suspected assembly and place an extender board in the card nest.

    b. Set the power switch to ON (I), then check the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Test 20. Step Loop

Use this test when the local oscillator is suspected of failing in multiple loop mode and the following self tests passed.

- Digital filter gate array
- Detector gate array
- Mult loop tuning range

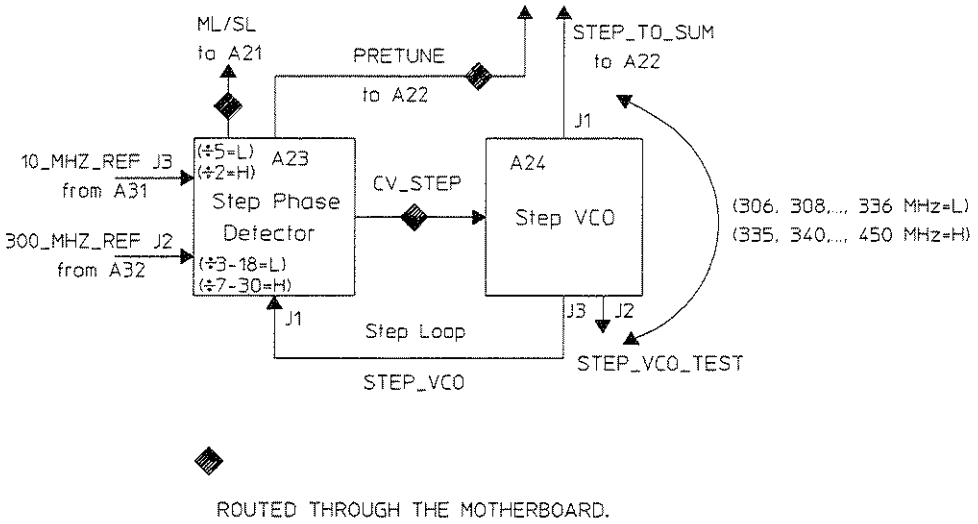

Figure 5-21. Local Oscillator Step Loop

1. Using a spectrum analyzer with the frequency span set to ≤ 1 MHz, check the signals in table 5-22 in the order listed. At the first incorrect signal, go to step 10.

Table 5-22. Step Loop Reference Frequencies

Test Location	Frequency	Amplitude (± 3 dB)	Output Impedance	Probable Faulty Assembly
A31 J9	20 MHz	– 3 dBm (ECL)	50Ω	A31 Reference/Calibrator
A31 J4	10 MHz	– 3 dBm (ECL)	50Ω	A31 Reference/Calibrator
A32 J4	300 MHz	– 2 dBm	50Ω	A32 300 MHz

2. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A24 Step VCO assembly, and remove the assembly. Move A24 J200 to its test position, and place the assembly on an extender board.

3. Set the power switch to ON (I), then press the following keys:

   [**Freq**]
   [FULL SPAN]
   [**Sweep**]
   [SWEEP AUTO **MAN**]
   [MANUAL FREQ]
   0
   [Hz]

4. Using a spectrum analyzer with 50Ω input impedance and the frequency span set to 50 MHz, check that A24 J3 is about 450 MHz ± 40 MHz and its output level is about +10 dBm ± 5 dB.

5. If the signal at A24 J3 is incorrect, the A24 Step VCO assembly is probably faulty. Before replacing the assembly, go to step 10 to check the voltages at the connector.

6. Set the power switch to STANDBY (⏻). Remove the test jumper and connect a ± 10V dc supply to the center pin of A24 J200.

7. Set the spectrum analyzer's frequency span to 300 MHz to 470 MHz and connect its 50Ω input to A24 J3.

8. Set the power switch to ON (I). Vary the dc voltage from +7V to – 1V while monitoring A24 J3. The frequency should vary between 306 MHz and 450 MHz as the dc voltage is varied. The output level should be +10 dBm ± 5 dB.

9. If the signal at A24 J3 is correct, the A23 Step Phase Detector assembly is probably faulty. If the signal at A24 J3 is incorrect, the A24 Step VCO assembly is probably faulty. Do the next step before replacing the assembly.

10. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector.

    a. Set the power switch to STANDBY (⏻). Remove the suspected assembly and place an extender board in the card nest.

    b. Set the power switch to ON (I), then check the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Test 21. Reference

Use this test when reference signals are suspected of failing and the following self tests passed:

- Receiver 2nd If
- Receiver ADC
- Post divider
- Receiver autorange

Note

The following procedure checks frequencies with a spectrum analyzer. However, if the failure mode requires more exact frequency measurements, use a frequency counter with $\pm 25 \times 10^{-3}$ Hz frequency accuracy.

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1. If the analyzer has option 001 (Precision Frequency Reference), do the following:

   a. Remove the rear panel jumper connecting OVEN REF OUT to EXT REF IN.

   b. Connect the spectrum analyzer's 50Ω input to OVEN REF OUT and check that it is 10 MHz, +3 dBm ± 3 dB. If the signal is incorrect, do the following:

      i. Set the power switch to STANDBY (⏻), and disconnect the power cord from the rear panel. Remove the rear panel and fan/oven housing (see figures 2-4 and 2-11 in section II, "Replaceable Parts").

      ii. Disconnect the connector with the yellow, red, and black wires from the A91 Fan Power/Oven assembly (see figure 2-12).

      iii. Set the power switch to ON (|). Check that the voltage at the yellow wire is − 18 ± 2V and the voltage at the red wire is +18 ± 2V. If either voltage is incorrect, the motherboard or the wire is probably faulty. If the voltages are correct, the A91 Fan Power/Oven assembly is probably faulty.

2. Set the synthesizer as follows:

Frequency	10 MHz
Amplitude	5 dBm

3. Connect the synthesizer to the rear panel EXT REF IN connector.

4. Using a spectrum analyzer with the frequency span set to ≤ 1 MHz, check the signals in table 5-23 in the order listed. At the first incorrect signal, go to step 15.

Table 5-23. Reference/Calibrator Signals

Test Location	Frequency	Amplitude (± 3 dB)	Output Impedance	Probable Faulty Assembly
A31 J8	80 MHz	– 5 dBm	50Ω	A31 Reference/Calibrator †
A31 J6	10 MHz	+3 dBm	50Ω	A31 Reference/Calibrator
A31 J9	20 MHz	– 3 dBm	50Ω	A31 Reference/Calibrator

† Before replacing this assembly, check adjustment 2. 80 MHz Reference VCXO.

5. Repeatedly check the signals in table 5-23 but set the synthesizer's frequency to 1 MHz, then 2 MHz, and finally 5 MHz.

Note

The analyzer may not be able to lock to a low frequency signal connected to EXT REF IN.

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6. Again check the signals in table 5-23 but set the synthesizer's amplitude to – 5 dBm, then to +10 dBm.
7. Disconnect the synthesizer from the EXT REF IN connector and on analyzer's with option 001, reconnect the rear panel jumper (EXT REF IN to OVEN REF OUT).
8. Using a BNC cable, connect REF OUT to the spectrum analyzer's 10 MHz reference input.
9. Press the following keys:

   [**Spcl Fctn**]
   [PRFM TESTS]
   [CALIBRATR TO INPUT]

10. Using a spectrum analyzer with the frequency span set to ≤ 1 MHz, check the signals in table 5-24 in the order listed. At the first incorrect signal, go to step 15.

Table 5-24. 300 MHz, Calibrator and Trigger Signals

Test Location	Frequency	Amplitude (± 3 dB)	Output Impedance	Probable Faulty Assembly
A32 J4	300 MHz	– 2 dBm	50Ω	A32 300 MHz
A32 J5	300 MHz	0 dBm	50Ω	A32 300 MHz
A31 J1	10 MHz	– 20 dBm	50Ω	A31 Reference/Calibrator
A32 J2	60 MHz	– 3 dBm	50Ω	A32 300 MHz
A33 J3	250 kHz	13 dBm	50Ω	A33 Trigger

11. Press the following keys:

    [**Preset**]
    [**Freq**]
        [FULL SPAN]
    [**Sweep**]
        [SWEEP AUTO **MAN**]

12. For each of the following manual frequencies in table 5-25, set [MANUAL FREQ] to the frequency in the table and check the signal at A21 J3 using a spectrum analyzer.

Table 5-25. Sum VCO Frequencies

Manual Frequency	A21 J3 Frequency	A21 J3 Amplitude
0 Hz	310.1875 MHz	+4 dBm ± 3 dB
30.8125 MHz	341.0 MHz	+4 dBm ± 3 dB
150 MHz	460.1875 MHz	+4 dBm ± 3 dB

13. If the frequency at A21 J3 was incorrect for all manual frequencies, go to Test 17. Single Loop.

14. If the frequency at A21 J3 was correct for some manual frequencies and incorrect for others, do the following:

    a. Set [MANUAL FREQ] to a frequency that produced an incorrect frequency at A21 J3.

    b. In table 4-1 on page 4-18, locate the manual frequency in the Measurement Freq column. (Table 4-1 lists the frequencies of the different loops for all measurement frequencies.)

    c. Check the frequency of A51 J1 and compare to the Intrpl VCO frequency in table 4-1.

    d. If the frequency at A51 J1 is incorrect, go to Test 16. Interpolation Loop.

    e. Check the frequency of A24 J2 and A24 J1, and compare to the Step VCO frequency in table 4-1.

    f. If the frequency at A24 J2 or A24 J1 is incorrect, go to Test 20. Step Loop.

15. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector.

    a. Set the power switch to STANDBY (⏻). Remove the suspected assembly and place an extender board in the card nest.

    b. Set the power switch to ON (I), then check the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Test 22. Intermittent Failures

Use this test to isolate intermittent failures to the assembly.

1. Check the common reasons for intermittent failures in table 5-26. If it's possible that your intermittent failure is caused by one of the common reasons given in the table, then follow the recommended troubleshooting procedure.

Table 5-26. Common Reasons for Intermittent Failures

Common Reasons	Troubleshooting Procedure
Loose screws and cables	Check that the screws in the analyzer are tight and that the cables are firmly in their sockets. This is especially important since grounding for the analyzer depends on the cables and screws.
Power supply voltages	Check for correct power-supply voltages. See Test 1. Initial Verification
Out-of-adjustment	Do the adjustments for the analyzer in section I
Air flow restricted	The analyzer cools by drawing air from both side and blowing it out the back panel. Check that the air flow was not restricted in these areas when the failure occurred.
External voltage	Verify that the line voltage is within the electrical specification for the analyzer. See chapter 2 in the *HP 3588A Performance Test Guide*.

Caution

Do not install a disk in the Disk Drive assembly. Running the disk in loop mode will wear out the disk drive head.

2. Set the power switch to ON (I), then press the following keys:

   [**Spcl Fctn**]
   [ ] (second softkey from bottom)
   – 99
   [ ] (second softkey from bottom)
   [SERVICE FUNCTIONS]
   [SELF TEST]
   [LOOP MODE **ON** OFF]
   [FUNCTIONL TESTS]
   [ALL]

3. After this test detects a failure, press the following keys:

   [ABORT/RETURN]
   [LOOP MODE ON **OFF**]

4. Compare table 5-12 on page 5-33 to the test log. If the analyzer's test log matches more than one entry on the table, use the entry closest to the beginning of the table. The table lists the probable faulty assembly or assemblies and any recommended adjustment or troubleshooting procedure to do before replacing the assembly. If both an adjustment and a test are recommended, do the adjustment first.

Note

All pass, fail, and abort messages are displayed on the test log along with the number of times a test passes, fails, or aborts.

When loop mode is activated, the analyzer continually repeats a test until power is cycled or loop mode is aborted by pressing [ABORT/RETURN]. If the power is cycled, the information in the test log is lost.

During some tests the keyboard is not active and loop mode cannot be aborted. If this occurs, wait for the test to finish.

If you abort a self test before the self test is finished, the analyzer may fail its calibration routine. To prevent this from happening, press [**Preset**] or cycle power after you abort a self test.

To run a specific self test in loop mode, press the analyzer keys as follows and then select the self test:

[**Preset**]
[**Spcl Fctn**]
  [SERVICE FUNCTIONS]
  [SELF TEST]
  [LOOP MODE **ON** OFF]
  [FUNCTIONL TESTS]

Troubleshooting Failing Performance Tests

Note

With the exception of the Quick Confidence test, all functional self tests in Test 9. Self Test must pass before table 5-27 is valid.

Use table 5-27 to determine which assembly is causing a performance test to fail. The table lists the assembly or assemblies most likely to cause the failure. In some cases, the failure can be isolated to one assembly based on the exact failure. When the cause of the failure cannot be isolated to one assembly, an additional test is provided to help isolate the faulty assembly. Multiple probable faulty assemblies are listed in order of probability.

Table 5-27. Failing Perf. Test Troubleshooting Guide

Failing Performance Test	Probable Faulty Assembly (in order of probability)	Troubleshooting Test
1. Local Oscillator Feedthrough	A12 First Conversion A11 Input	Test 23. Local Oscillator Feedthrough
2. Phase Noise	A51 Interpolation VCO A52 Fractional-N A21 Sum VCO A22 Sum Phase Detector A23 Step Phase Detector A24 Step VCO A31 Reference/Calibrator A32 300 MHz A33 Trigger A91 Fan Power/Oven	Test 24. Phase Noise
3. Residual Responses	A12 First Conversion A13 Second Conversion A11 Input A61 IF	Test 25. Residual Responses
4. Noise Level	A61 IF A62 ADC/Digital Filter A12 First Conversion A11 Input A13 Second Conversion	Test 26. Noise Level
5. Frequency Accuracy	A31 Reference Calibrator A91 Fan Power/Oven	Test 27. Frequency Accuracy
6. Spurious Responses	A52 Fractional-N A51 Interpolation VCO A22 Sum Phase Detector A21 Sum VCO A24 Step VCO A23 Step Phase Detector	Test 28. Spurious Responses

Table 5-27. Failing Perf. Test Troubleshooting Guide (continued)

Failing Performance Test	Probable Faulty Assembly (in order of probability)	Troubleshooting Test
7. Image Responses 40.85956 MHz fails 60.85956 MHz fails 61.35956 MHz fails	 A12 First Conversion A61 IF A61 IF	
8. Input Harmonic Distortion	A11 Input A12 First Conversion	Test 29. Input Harmonic Distortion
9. Intermodulation Distortion	A61 IF A12 First Conversion A11 Input	Test 30. Intermodulation Distortion
10. Source Amplitude Accuracy and Frequency Response	A42 Source Conversion A41 Source Amplifier	Test 31. Source Amplitude Accuracy and Frequency Response
11. Input Amplitude Accuracy and Flatness	A31 Reference/Calibrator [1] A11 Input [2]	
12. Reference Level Accuracy	A11 Input [3]	
13. Log Scale Accuracy	A62 ADC/Digital Filter [4]	Test 32. Log Scale Accuracy
14. Source Dynamic Accuracy DAC attenuation fails pad attenuation fails	 A42 Source Conversion A41 Source Amplifier	
15. Input Return Loss	A11 Input	
16. Source Return Loss	A41 Source Amplifier	
17. Source Harmonic Distortion	A41 Source Amplifier	
18. Source Spurious Responses	A42 Source Conversion [5]	
19. Source Noise	A41 Source Amplifier [5]	

1 Provided performance test 10 (Source Amplitude Accuracy and Frequency Response) passed.

2 Provided performance test 10 (Source Amplitude Accuracy and Frequency Response) passed and failures only occurred in the 1 MΩ input impedance path.

3 If all ranges failed, the following assemblies could cause the failure:
A12 First Conversion
A13 Second Conversion
A61 IF
A62 ADC/Digital Filter

4 Use the recommended test to verify that the A62 ADC/Digital Filter assembly is faulty and not one of the following assemblies:
A61 IF
A13 Second Conversion
A12 First Conversion
A11 Input

5 Provided the receiver passed all performance tests.

Test 23. Local Oscillator Feedthrough

Use this test to determine if the A11 Input assembly or the A12 First Conversion assembly is causing the Local Oscillator Feedthrough performance test to fail.

Note If local oscillator feedthrough null passes the Quick Confidence test and fails the performance test, the A12 First Conversion assembly is probably faulty.

---

1. Set the power switch to STANDBY (⏻). Remove the screw at each end of the A11 Input assembly, and place the assembly on an extender board.
2. Reconnect the following using extender cables:
   A11 J1 to A41 J1
   A11 J2 to A31 J1
   A11 J3 to A12 J2
3. Set the power switch to ON (I). Using an oscilloscope, monitor J11 pin 1A (INC_IMAG), pin 3A (INC_REAL), and pin 2A (UP_DN). During the calibration routine, narrow pulses are on pins 1A and 3A, and the signal on pin 2A toggles between high and low TTL levels.

Note The calibration routine occurs during power up. To repeat the calibration routine, press the following keys:
[**Spcl Fctn**]
[SINGLE CAL]

---

4. If the signals are correct, the A12 First Conversion assembly if probably faulty. If the signals are incorrect, the A11 Input assembly is probably faulty.

Test 24. Phase Noise

Use this test to determine which of the following assemblies is causing the Phase Noise performance test to fail:

- A51 Interpolation VCO
- A52 Fractional-N
- A21 Sum VCO
- A22 Sum Phase Detector
- A23 Step Phase Detector
- A24 Step VCO
- A31 Reference/Calibrator
- A32 300 MHz
- A33 Trigger
- A91 Fan Power/Oven

Note

If you have the optional A91 Fan Power/Oven assembly, remove the rear panel jumper (OVEN REF OUT to EXT REF IN), and repeat the Phase Noise performance test. If the test now passes, the A91 Fan Power/Oven assembly is probably faulty.

---

1. Set the signal generator for a 10 MHz, – 20 dBm signal and connect to the front panel INPUT connector.
2. Press the following keys:

[**Preset**]
[**Spcl Fctn**]
[SINGLE CAL]
[AUTO CAL ON **OFF**]
[**Sweep**]
[OVERSWEEP ON **OFF**]
[**Freq**]
[CENTER]
10
[MHz]
[SPAN]
5
[kHz]
[**Marker**]
[MARKER X ENTRY]
10.001
[MHz]
[**Marker Fctn**]
[NOISE LEVEL **ON** OFF]

3. Record the **Mkr** readout (dBm/Hz).

4. Change the signal generator's frequency to 100 MHz.

5. Press the following keys:

   [NOISE LEVEL ON **OFF**]
   [**Freq**]
   [CENTER]
   100
   [MHz]
   [**Marker**]
   [MARKER X ENTRY]
   100.001
   [MHz]
   [**Marker Fctn**]
   [NOISE LEVEL **ON** OFF]

6. If the **Mkr** readout is more than approximately 10 dB above the level recorded in step 3, then the A31 Reference/Calibrator assembly is probably faulty.

7. Set a spectrum analyzer's center frequency to 300 MHz and connect to A32 J4. If the noise level is > -95 dBc/Hz for offsets >1 kHz, the A32 300 MHz assembly is probably faulty.

8. Connect an oscilloscope to A33 J4. The signal should be a 100 kHz, 1 Vp-p, approximate 1% duty cycle pulse. If the signal is not correct, the A33 Trigger assembly is probably faulty.

9. Reconnect the following using original cables.

   A31 J4 to A23 J3
   A32 J4 to A23 J2
   A33 J4 to A52 J2

10. Press the following keys:

    [NOISE LEVEL ON **OFF**]
    [**Spcl Fctn**]
    [PRFM TESTS]
    [CALIBRATR TO INPUT]
    [**Freq**]
    [CENTER]
    10
    [MHz]
    [**Spcl Fctn**]
    [ ] (second softkey from bottom)
    – 99
    [ ] (second softkey from bottom)
    [SERVICE FUNCTIONS]
    [SPCL TEST MODES]
    [LOCAL OSC CONFIG]
    [LOCAL OSC **SNGL** MULT]
    [**Marker**]
    [MKR --> PEAK]
    [ZERO OFFSET]
    [MARKER X ENTRY]
    10.001
    [MHz]
    [**Marker Fctn**]
    [NOISE LEVEL **ON** OFF]

11. Phase noise fails in single loop mode if the Δ **Mkr** readout is > – 105 dB/Hz. If single loop phase noise is failing, the A21 Sum VCO assembly or the A52 Fractional-N assembly is probably faulty.

12. Press the following keys:

    [**Preset**]
    [**Sweep**]
    [SWEEP AUTO **MAN**]
    [MANUAL FREQ]
    10
    [MHz]

13. Set the spectrum analyzer's center frequency to 316 MHz and connect to A24 J2. Measure and record the noise level at offsets >1 kHz.

14. Press the following keys:

    [MANUAL FREQ]
    100
    [MHz]

15. Change the spectrum analyzer's center frequency to 400 MHz and measure the noise level for offsets >1 kHz. If the noise level changed when the frequency changed, the A23 Step Phase Detector assembly or the A24 Step VCO assembly is probably faulty.

16. Change the spectrum analyzer's center frequency to 10.1875 MHz and connect to A51 J1. If the noise level is > – 110 dBc/Hz for offset frequencies >100 Hz, the A51 Interpolation VCO assembly is probably faulty.

17. Reconnect A51 J1 to A22 J3.

18. Change the spectrum analyzer's center frequency to 410.1875 MHz and span to 5 kHz. Connect the spectrum analyzer to A21 J3. If the shape of the noise peaks excessively (>5 dB), the A22 Sum Phase Detector assembly is probably faulty.

Test 25. Residual Responses

Use this test to determine which of the following assemblies is causing the Residual Responses performance test to fail:

- A12 First Conversion
- A13 Second Conversion
- A11 Input
- A61 IF

1. Press the following keys:

   [**Preset**]
   [**Spcl Fctn**]
   [SINGLE CAL]
   [AUTO CAL ON **OFF**]
   [**Range/Input**]
   [RANGE]
   –20
   [dBm]
   [**Meas Type**]
   [NARROW BAND ZOOM]
   [**Avg/Pk Hld**]
   [VIDEO AVERAGE]
   [**Freq**]
   [SPAN]
   36.0625
   [Hz]
   [CENTER] (to failing frequency)

2. After measurment averaging is complete (10 averages), press the following keys:

   [**Marker**]
   [ZERO OFFSET]

3. Disconnect the cable connected to A11 J3 and press [**Meas Restart**]. After measurement averaging is complete, the Δ **Mkr** readout should be > – 2 dB. If the readout dropped more than approximately 4 dB when A11 J3 is disconnected, the A11 Input assembly is probably faulty.

4. Disconnect the cable connected to A12 J3 and press [**Meas Restart**]. After measurement averaging is complete, the Δ **Mkr** readout should be > – 2 dB. If the readout drops more than approximately 4 dB when A12 J3 is disconnected, the A12 First Conversion assembly is probably faulty.

5. Disconnect the cable connected to A13 J3 and press [**Meas Restart**]. After measurement averaging is complete, the Δ **Mkr** readout should be > – 2 dB. If the readout drops more than approximately 4 dB when A13 J3 is disconnected, the A13 Second Conversion assembly is probably faulty. If the readout is correct, A61 IF assembly is probably faulty.

Test 26. Noise Level

Use this test to determine which of the following assemblies is causing the Noise Level performance test to fail:

- A61 IF
- A62 ADC/Digital Filter
- A12 First Conversion
- A11 Input
- A13 Second Conversion

Note

The A11 Input assembly dominates the low frequency noise level. Therefore, if the failing frequencies are below 30 kHz, the A11 Input assembly is probably faulty.

If failures only occurred using the 1 MΩ input impedance, the A11 Input assembly is probably faulty.

---

1. Press the following keys:

[**Preset**]
[**Spcl Fctn**]
[SINGLE CAL]
[AUTO CAL ON **OFF**]
[**Range/Input**]
[RANGE]
–20
[dBm]
[**Freq**]
[ZERO SPAN]
[**Marker Fctn**]
[NOISE LVL **ON** OFF]
[**Meas Type**]
[LOW DIST ON OFF] (to distortion mode of failing frequency)
[**Res BW**]
[RES BW] (to resolution bandwidth of failing frequency)
[**Freq**]
[CENTER] (to failing frequency)
[**Marker**]
[ZERO OFFSET]

2. Disconnect the cable connected to A11 J3. The Δ **Mkr** readout should be > – 2 dB/Hz. If the readout dropped more than approximately 4 dB when A11 J3 is disconnected, the A11 Input assembly is probably faulty.

3. Disconnect the cable connected to A12 J3. The Δ **Mkr** readout should be > – 2 dB/Hz. If the readout drops more than approximately 4 dB when A12 J3 is disconnected, the A12 First Conversion assembly is probably faulty.

4. Disconnect the cable connected to A13 J3. The Δ **Mkr** readout should be > – 2 dB/Hz. If the readout drops more than approximately 4 dB when A13 J3 is disconnected, the A13 Second Conversion assembly is probably faulty.

5. Disconnect the cable connected to A61 J3 and terminate A62 J3 into 50Ω. The Δ **Mkr** readout should be > – 4 dB/Hz. If the readout drops more than approximately 6 dB when A61 J3 is disconnected, the A61 IF assembly is probably faulty. If the readout is correct, A62 ADC/Digital Filter assembly is probably faulty.

Test 27. Frequency Accuracy

Use this test to determine if the A31 Reference/Calibrator assembly or the optional A91 Fan Power/Oven assembly is causing the Frequency Accuracy performance test to fail.

Note

If the frequency accuracy performance test failed without option 001, the A31 Reference/Calibrator assembly is probably faulty.

The calculated frequency specification is based on the number of months since the last frequency adjustment. If unsure of the date, do the adjustment and repeat the performance test. If the performance test is done immediately after the adjustment, use zero for the number of months, otherwise use one.

---

1. Remove the rear panel jumper (OVEN REF OUT to EXT REF IN) and connect OVEN REF OUT to a frequency counter.
2. Divide the lower and upper frequency limit specifications calculated in the performance test by ten and compare to OVEN REF OUT.
3. If OVEN REF OUT is within specification, the A31 Reference/Calibrator assembly is probably faulty. If OVEN REF OUT is not within specification, the A91 Fan Power/Oven assembly is probably faulty.

Test 28. Spurious Responses

Table 5-28 lists spur types and the assembly or assemblies most likely to cause the failure.

If the A52 Fractional-N assembly is listed as the probable faulty assembly but the performance test still fails after replacing the assembly and doing the required adjustments (see table 5-2), the probable faulty assembly is listed below in order of probability:

- A51 Interpolation VCO
- A21 Sum VCO
- A22 Sum Phase Detector
- A24 Step VCO
- A23 Step Phase Detector

If the A22 Sum Phase Detector assembly is listed as the probable faulty assembly but the performance test still fails after replacing the assembly, the probable faulty assembly is listed below in order of probability:

- A21 Sum VCO
- A24 Step VCO
- A23 Step Phase Detector
- A52 Fractional-N
- A51 Interpolation VCO

Table 5-28. Spur Types

Source Frequency (MHz)	Spur Frequency (MHz)	Spur Type	Probable Faulty Assembly
7.8125	10.8428	sum reference	A22 Sum Phase Detector A21 Sum VCO
9.8125	9.8248	step comb	A22 Sum Phase Detector
149.8125	149.8248	step comb	A22 Sum Phase Detector
95.81274	95.81254	API 1	A52 Fractional-N †
95.8149	95.8129	API 1	A52 Fractional-N †
100.79274	100.79254	API 1	A52 Fractional-N †
100.7949	100.7929	API 1	A52 Fractional-N †
100.79454	100.79254	API 2	A52 Fractional-N †
100.794504	100.792504	API 3	A52 Fractional-N
100.7945004	100.7925004	API 4	A52 Fractional-N †
1.8125	4.81373	3 MHz sideband on sum loop	A22 Sum Phase Detector A21 Sum VCO
7.81496	4.81373	3 MHz sideband on sum loop	A22 Sum Phase Detector A21 Sum VCO
144.8125	144.822623	10.123 kHz sideband on signal	A22 Sum Phase Detector A21 Sum VCO
144.832746	144.822623	10.123 kHz sideband on signal	A22 Sum Phase Detector A21 Sum VCO
89.9125	89.8125	100 kHz sideband	A52 Fractional-N †

† Before replacing the A52 Fractional-N assembly, go to section I and do adjustment 6. 100 kHz and API Spurs. Do not try to adjust the spurs using the performance test setup. The setup in the performance test is not the same as the setup for the adjustment. After replacing the assembly, do adjustment 6. 100 kHz and API Spurs before repeating the performance test.

Test 29. Input Harmonic Distortion

Use this test to determine if the A11 Input assembly or the A12 First Conversion assembly is causing the Input Harmonic Distortion performance test to fail.

Note

If failures only occurred in the 1 MΩ input impedance path, the A11 Input assembly is probably faulty.
If failures only occurred with low distortion mode on or off, but not both, the A11 Input assembly is probably faulty.

---

1. Press the following keys:

   [**Preset**]
   [**Spcl Fctn**]
   [SINGLE CAL]
   [AUTO CAL ON **OFF**]
   [**Range/Input**]
   [RANGE]
   0
   [dBm]
   [**Res BW**]
   [RES BW]
   4.5
   [Hz]
   [**Sweep**]
   [SWEEP AUTO **MAN**]
   [**Avg/Pk Hld**]
   [VIDEO AVERAGE]
   [**Meas Type**]
   [LOW DIST ON OFF] (to failing mode)

2. Connect the test equipment as shown in figure 5-22.

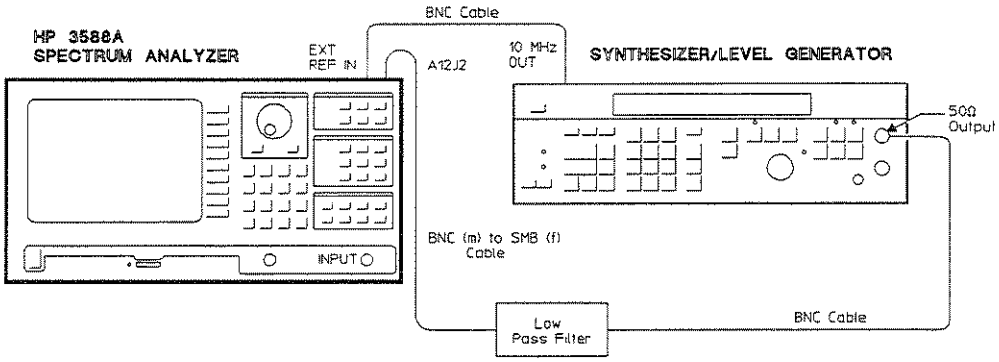

Figure 5-22. Troubleshooting Input Harmonic Distortion

3. Set the synthesizer/level generator as follows:

Amplitude	–28 dBm
Frequency	(to fundamental frequency of failing harmonic)

4. Press the following keys:

[Sweep]
[MANUAL FREQ] (to fundamental frequency of failing harmonic)
[Marker]
[ZERO OFFSET]
[Sweep]
[MANUAL FREQ] (to failing harmonic)

5. If the Δ **Man** readout is now within specification, the A11 Input assembly is probably faulty. If the Δ **Man** readout is still failing, the A12 First Conversion assembly is probably faulty.

Test 30. Intermodulation Distortion

Use this test to determine which of the following assemblies is causing the Intermodulation Distortion performance test to fail:

- A61 IF
- A12 First Conversion
- A11 Input

Note

If failures only occurred using the 1 MΩ input impedance path or the 50Ω input impedance path, but not both, the A11 Input assembly is probably faulty.
If failures only occurred at 23.634734 MHz or 23.640148 MHz, the A61 IF assembly is probably faulty.

---

1. Press the following keys:

   [**Preset**]
   [**Spcl Fctn**]
   [SINGLE CAL]
   [AUTO CAL ON **OFF**]
   [**Range/Input**]
   [RANGE]
   –20
   [dBm]
   [**Freq**]
   [FULL SPAN]
   [**Res BW**]
   [RES BW]
   1.1
   [Hz]
   [**Sweep**]
   [SWEEP AUTO **MAN**]
   [MANUAL FREQ]
   23.634466

2. Connect the test equipment as shown in figure 5-23.

3. Set the signal generator's frequency to 23.634466 MHz, and adjust its amplitude for a **Man** readout of –26.0 dBm ± 0.1 dB (approximately –27 dBm).

4. Press the following keys:

   [**Sweep**]

5. [MANUAL FREQ] (to source frequency of failing frequency)

6. Set the synthesizer/level generator's frequency to the source frequency of the failing frequency, and adjust its amplitude for a **Man** readout of –26.0 dBm ± 0.1 dB (approximately –27 dBm).

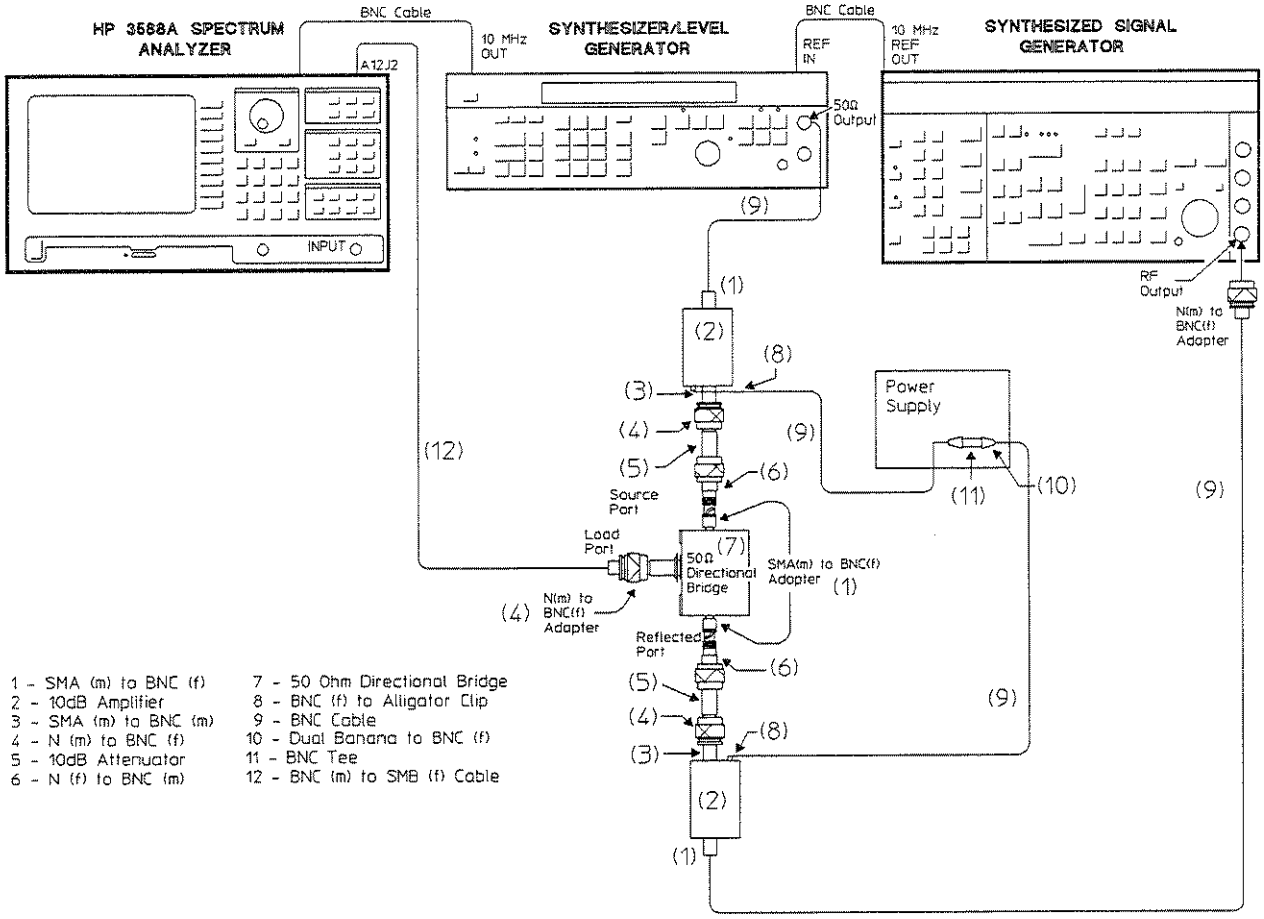

Figure 5-23. Troubleshooting Intermodulation Distortion

7. Press the following keys:

   [Marker]

   [ZERO OFFSET]

   [Avg/Pk Hld]

   [VIDEO AVERAGE]

   [Sweep]

   [MANUAL FREQ] (to failing frequency)

8. If the **Δ Man** readout is now within specification, the A11 Input assembly is probably faulty. If the **Δ Man** readout is still failing, the A12 First Conversion assembly is probably faulty.

Test 31. Source Amplitude Accuracy and Frequency Response

Use this test to determine if the A42 Source Conversion assembly or the A41 Source Amplifier assembly is causing the Source Amplitude Accuracy and Frequency Response performance test to fail.

Note

If the Source Dynamic Accuracy performance test also fails, the A42 Source Conversion assembly is probably faulty.

Before replacing the A42 Source Conversion assembly, check the Source Bandpass Filter adjustment.

---

1. Connect A42 J1 to the front panel INPUT connector using an SMB-to-BNC cable.
2. Press the following keys:

   [**Preset**]
   [**Source**]
   [SOURCE **ON** OFF]
   [**Scale**]
   [REFERENCE LEVEL]
   – 36
   [dBm]
   [VERTICAL/DIV]
   1
   [dB]

3. The signal's amplitude should be – 41 dBm ± 3 dB, and its flatness should be ± 1 dB relative to the amplitude at 300 kHz. If the signal is correct, the A41 Source Amplifier is probably faulty. If the signal is incorrect, the A42 Source Conversion assembly is probably faulty. Before replacing the A42 Source Conversion assembly, check the Source Bandpass Filter adjustment.

Test 32. Log Scale Accuracy

If the Log Scale Accuracy performance test fails, the most likely cause is the A62 ADC/Digital Filter assembly. Use this test to verify that the A62 ADC/Digital Filter assembly is faulty and not one of the following:

- A61 IF
- A13 Second Conversion
- A12 First Conversion
- A11 Input

Note

Before replacing the A62 ADC/Digital Filter assembly, check the ADC Gain, Offset, and Reference adjustment.

---

1. Connect the 50Ω feedthrough termination to the multimeter using the adapter.
2. Measure the resistance of the feedthrough termination and enter as the reference impedance for dBm operation (RES). Then set the multimeter's function to ac volts (most accurate mode). For an HP 3458A Digital Multimeter, press the following keys:

blue shift key	Reset
OHM	
blue shift key	S
Menu Scroll ⇓	(until SMATH is shown)
10 (RES)	ENTER
ACV	
blue shift key	S
Menu Scroll ⇓	(until SETACV is shown)
3 (SYNC)	ENTER

Note

If your digital multimeter does not have dBm math capability, record the resistance of the feedthrough termination (RES) for later calculations.

---

3. Connect the test equipment as shown in figure 5-24.

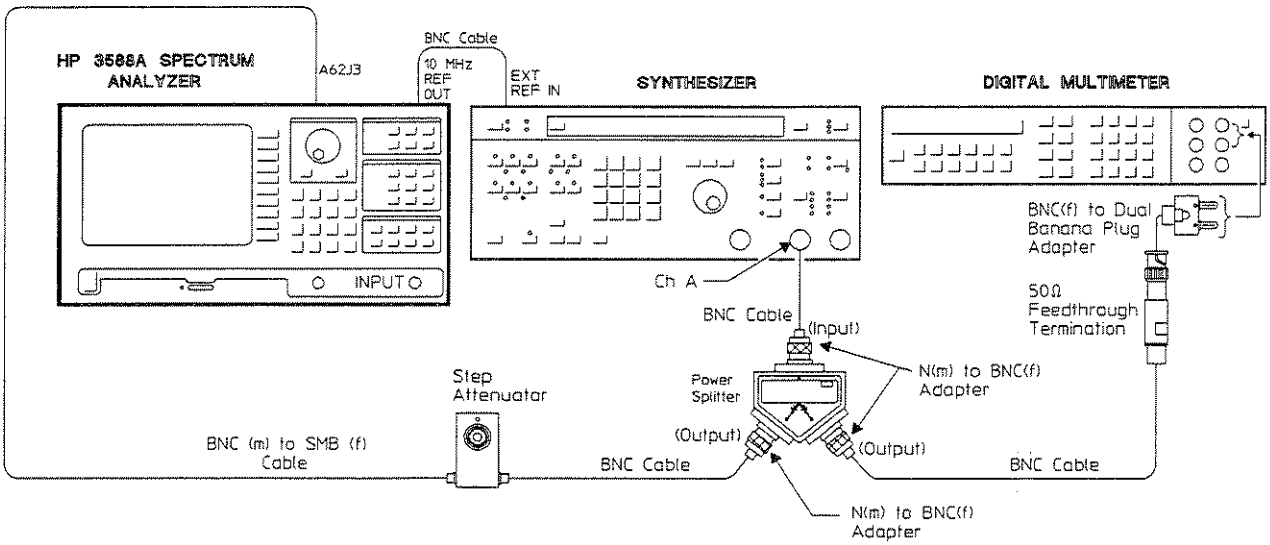

Figure 5-24. Troubleshooting Log Scale Accuracy

4. Press the following keys:

   [**Preset**]
   [**Spcl Fctn**]
      [SINGLE CAL]
      [AUTO CAL ON **OFF**]
   [**Freq**]
      [CENTER]
      100
      [kHz]
      [SPAN]
      1
      [kHz]
   [**Sweep**]
      [SWEEP AUTO **MAN**]
   [**Range/Input**]
      [RANGE]
      10
      [dBm]

5. Set the step attenuator to 0 dB.

6. Set the synthesizer as follows:

Frequency	187.5 kHz
Amplitude	(adjust for **Man** readout of 10 dBm ± 0.01 dB)

7. Press the following keys:

   [**Marker**]
   [ZERO OFFSET]
   [**Avg/Pk Hld**]
   [VIDEO AVERAGE]

8. Set the multimeter's math mode to dBm and null. For an HP 3458A Digital Multimeter, press the following keys:

blue shift key	L
Menu Scroll ⇓	(until MATH is shown)
5, 9 (dBm, NULL)	ENTER

Note

If your digital multimeter does not have math null capability, record the multimeter readout in dBm for later calculations.

If your digital multimeter does not have dBm math capability, use the following formula to convert your measurement results to dBm.

$10 \times \log_{10} (\text{readout}^2/\text{RES}/1\ \text{mW}) = \text{dBm}$

readout = multimeter's readout in volts
RES = measured resistance of the feedthrough termination

---

9. Adjust the synthesizer's amplitude down from the reference amplitude (set in step 6) by the level that failed the performance test.

Note

If your digital multimeter does not have math null capability, subtract the multimeter readout in step 8 from the current multimeter readout.

---

10. Press [**Meas Restart**].

11. If the Δ **Man** readout is still out of specification, the A62 ADC/Digital Filter assembly is probably faulty.

Troubleshooting Miscellaneous Failures

The following tests provide troubleshooting information for miscellaneous failures that are not detected by the self tests.

Test 33. Memory Battery

Use this test when battery-backed-up memory is suspected of failing. This test separates Memory assembly failures from memory battery failures.

1. Press the following keys:

   [**Preset**]
   [**Spcl Fctn**]
   [DATE MMDDYY]
   010101
   [ENTER]

2. Set the power switch to STANDBY (⏻), then to ON (|).

3. Press the following keys:

   [**Spcl Fctn**]
   [DATE MMDDYY]

4. If the date is 01/01/01, the battery-backed-up memory is functioning correctly, go to Test 9. Self Test to continue troubleshooting.

5. If the date is incorrect, remove the Memory assembly (see figures 2-3, 2-4, and 5-0 in section II, "Replaceable Parts").

6. Check the voltage at B402. If the voltage is 3.7 ± 1V, the Memory assembly is probably faulty. If the battery voltage is incorrect, replace the battery.

Note

Set the analyzer's HP-IB address after replacing the battery or the Memory assembly (see "Replacing the Memory Assembly" in section II, "Replaceable Parts").

Test 34. Fan Power

Use this test when the analyzer is operating correctly, but the fan on the BNC connector side of the analyzer is not working. This test determines which of the following is faulty:

- Motherboard
- A90 Fan Power assembly or optional A91 Fan Power/Oven assembly
- Fan

1. Set the power switch to STANDBY (⏻), and disconnect the power cord from the rear panel. Remove the top cover, rear panel, and fan/oven housing (see figures 2-3, 2-4, and 2-11 in section II, "Replaceable Parts").

2. Disconnect the connector with the yellow, red, and black wires from the A90 Fan Power assembly or the optional A91 Fan Power/Oven assembly (see figure 2-12).

3. Set the power switch to ON (I). Check that the voltage at the yellow wire is -18 ± 2V and the voltage at the red wire is $+18 \pm 2$V. If either voltage is incorrect, the motherboard or the wire is probably faulty.

4. Set the power switch to STANDBY (⏻). Reconnect the connector with yellow, red, and black wires, and disconnect the connector with the red and black wires.

5. Set the power switch to ON (I) and check that J3 pin 2 is -18 ± 2V. If the voltage is correct, the fan is probably faulty. If this voltage is incorrect, the A90 Fan Power assembly or the optional A91 Fan Power/Oven assembly is probably faulty.

Test 35. Trigger

Use this test when the analyzer is operating correctly, but the HP-IB trigger or external trigger is not functioning. This test determines if the A33 Trigger assembly or A81 CPU assembly is faulty.

Note If the analyzer triggers using external trigger and does not trigger using HP-IB trigger, the A81 CPU assembly is probably faulty.

---

1. Set a synthesizer for a 2 Hz, 5 Vp-p square wave.
2. Using a BNC cable, connect the synthesizer's output to EXT TRIG on the rear panel.
3. Press the following keys:

   [**Preset**]
   [**Trigger**]
   [EXTERNAL TRIGGER]
4. The analyzer should briefly display WAITING FOR TRIGGER between each sweep. If this did not occur, the A33 Trigger assembly is probably faulty. Before replacing the assembly, go to step 6 to check the voltages at the connector.
5. Using a logic probe, check that TRIG OUT on the rear panel toggles between a TTL high and TTL low level. If this did not occur, the A33 Trigger assembly is probably faulty. Do the next step before replacing the assembly.
6. Before replacing the probable faulty assembly, do the following to check that the voltages from the power supply assembly are present at the assembly's motherboard connector:

   a. Set the power switch to STANDBY (⏻). Remove the screw at each end of the suspected assembly. Remove the assembly and place an extender board in the card nest.

   b. Set the power switch to ON (I), then measure the pins of the extender board for correct voltages (see table 4-13 on page 4-59).

Power-on Test Descriptions

A portion of the self tests listed in table 5-31 are run when the analyzer is powered up. These self tests are the power-on tests and are divided into low-level and high-level tests (as indicated in the table).

Note

The calibration routine is run immediately following the power-on tests. If an error occurs during the calibration routine, a failure message is recorded in the fault log.

Low-level Tests

The low-level power-on tests exercise the core of the CPU assembly and, depending on the position of A81 SW100(6), run the short or long RAM test. If an error occurs during the low-level tests, the tests pause for 10 seconds and display an error code on the CPU assembly's power-on test LEDs (see Test 2. Power-on for details on decoding the power-on test LEDs).

The short RAM test does one read and write test of RAM plus a RAM refresh test. If the short RAM test fails, the only error code displayed on the CPU's power-on test LEDs is the RAM refresh error code (81 hexadecimal). The long RAM test does eight passes of RAM plus the RAM refresh test. The long RAM test displays the RAM specific bit errors on the CPU's power-on test LEDs. Set SW100(6) to zero (factory setting) to run the short RAM test and to one to run the long RAM test.

Note

If A81 SW100 switch 4 is set to 0, the CPU determines the installed RAM size and bypasses the high-level tests. The factory setting for A81 SW100(4) is 1.

High-level Test

The high-level power-on test exercises the fast bus. If an error occurs during the fast bus test, the analyzer locks up and the power-on LEDs display the fast bus error code (A1 hexadecimal).

Power-on Test Messages

Table 5-30 provides additional information for interpreting the power-on test LEDs. Using table 5-29, translate the power-on test LEDs to their equivalent hexadecimal code. Table 5-30 describes the power-on subtests in the order they are run. Table 5-30 also shows the relationship between a failing power-on subtest and the assemblies or sub-blocks.

Note

False error codes can be caused by shorts on the buses, reset line, or interrupt line. If an error code is caused by the last bus connected, it is probably the source of the failure.

Table 5-29. Binary to Hexadecimal

Binary 1 = LED on 0 = LED off	Hexadecimal
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Table 5-30. Power-on Test Messages

Hexadecimal Code	Message	Assembly/Sub-block (Chart Below)						
		1	2	3	4	5	6	7
Undefined	Initial power-on	x	x	x				
FF*	CPU flashes LEDs	0	x	x	x			
05	Start CPU test	0	x	x	x			
06	CPU test failure	0	x	x	x			
90	Start monitor ROM test	0	0	0	x			
91	Monitor ROM failure, low byte	0	0	0	x			
92	Monitor ROM failure, high byte	0	0	0	x			
93	Monitor ROM failure, both bytes	0	0	0	x			
08	Start display controller test	0	0	0	0	x		
09	Display controller test fails	0	0	0	0	x		
0A	Display control didn't return DTACK	0	0	0	0	x		
F0	Start program ROM test	0	0	0	0	0	x	
F1, D0 to DF	Program ROM failure, low byte	0	0	0	0	0	x	
F2, E0 to EF	Program ROM failure, high byte	0	0	0	0	0	x	
F3, C0 to CF	Program ROM failure, both bytes	0	0	0	0	0	x	
F4	Number of ROMs out of range	0	0	0	0	0	x	
0B	RAM size test	0	0	0	0	0	x	
0F	Start RAM test	0	0	0	0	0	x	
0F flash	Memory did not return MEM_DTACK	0	0	0	0	0	x	
10, 11	RAM test failure, low byte	0	0	0	0	0	x	
20, 21	RAM test failure, high byte	0	0	0	0	0	x	
30, 31	RAM test failure, both bytes	0	0	0	0	0	x	
40 to 7F	RAM test, chip failure	0	0	0	0	0	x	
80	Start RAM refresh test	0	0	0	0	0	x	
81	RAM refresh failure	0	0	0	0	0	x	
A1	Fast bus test	0	0	0	0	0	0	x
00	Clear (passed power-on sequence)	0	0	0	0	0	0	0

Assembly/Sub-block Chart
- 1 = Power Supply
- 2 = A81 MPU (6800) & Address Decoder
- 3 = A81 MPU Buses
- 4 = A81 Monitor EPROM
- 5 = A81 Display Controller
- 6 = A87 Memory
- 7 = A81 Fast Bus

0 Assembly or sub-block is used but is probably not the cause of the failure message.
X Assembly or sub-block is probably the cause of the failure message.
(blank) Assembly or sub-block is not used in the test.
FF* If the area of failure is unclear, all LEDs flash continuously.

Self-Test Descriptions

Thirty-six self tests are available that can be run in groups or individually. Table 5-31 lists the assemblies used by the self tests and shows the assembly that would be the most likely cause of a self-test failure. To run these self tests in the order shown, press the following keys:

[**Spcl Fctn**]
[ ] (second softkey from bottom)
– 99
[ ] (second softkey from bottom)
[SERVICE FUNCTIONS]
[SELF TEST]
[FUNCTIONL TESTS]
[ALL]

To run a single self test, press the softkey shown in the table instead of [ALL]. To determine the key path for the self-test softkeys, see table 5-32, "Self-Test Menu Map and HP-IB Commands."

Note

Certain instrument malfunctions cause multiple self-test failures. Therefore, to determine the most likely cause when more than one self test fails, look in table 5-31 for assemblies common to all failing self tests.

Table 5-31. Assemblies Used in Self Tests

Self Test Softkey	Assembly																		
	A81	A87	FP	DD	A62	A61	A13	A12	A11	A42	A41	A33	A32	A31	A52	A51	A24	A23	A22	A21
[PROCESSOR]†	X	0			0									0						
[RAM]†	0	X			0									0						
[ROM]†	0	X			0									0						
[INTERRUPT]	X	0			0									0						
[MULTI FCTN PERIPHERL]	X	0			0									0						
[FRONT PANEL]	0	0	X		0									0						
[DISPLAY DGTL HW]	X	0			0									0						
[HP-IB FUNC TEST]	X	0			0									0						
[DISK CONTROLLR]	X	0			0									0						
[MOTOR]	0	0		X	0									0						
[RESTORE]	0	0		X	0									0						
[RANDOM SEEK]	0	0		X	0									0						
[SEEK SECTOR]	0	0		X	0									0						
[READ]	0	0		X	0									0						
[READ/WRITE]	0	0		X	0									0						
[READ/WRITE ALL]	0	0		X	0									0						
[IIC BUS]	X	0	X		X				X	X	X	X		X	X	X		X		
[FAST BUS]‡	X	0			X									0						
[DMA]	X	0			0									0						
[MATH COPROCSSR]	X	0			0									0						
[SNGL LOOP TUN RANGE]	0	0			0							0	0	0	X	X		0		X
[MULT-LOOP TUN RANGE]	0	0			0							0	0	0	X	X		0		
[POST DIVIDER]	0	0			0	0	0	0	0			0	0	0	0	X	0	0	0	0
[AUTO RNG TRIP PTS]	0	0			0	0	0	0	X	0	X	0	0	0	0	0	0	0	0	0
[10 MHz LOCAL OSC]	0	0			0	0	0	0	0			X	X	X	X	X	X	X	X	X
[2ND IF LEVEL]	0	0			0	X	X	X	X	0	0	0	0	0	0	0	0	0	0	0
[ADC]	0	0			X	0	0	0	0			0	0	0	0	0	0	0	0	0
[DIGITAL FILTER]	0	0			X							0	0	0						
[DETECTOR]	0	0			X							0	0	0						
[187.5 kHz REFERENCE]	0	0			0					X	0	0	0	0						
[GILBERT CELL]	0	0			0					X	0	0	0	0						
[OUTPUT CKTS]	0	0			0					X	X	0	0	0	0	0	0	0	0	0
[FLATNESS]	0	0			0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	0
[QUICK CONF TEST]	0	0			X	X	X	X	X	X	X	0	0	X	0	0	0	0	0	0

X This assembly could be the cause of the failure message.

0 This assembly is probably not the cause of the failure message but could be.

No symbol means that the assembly is not used by the self test.

† Low-level power-on tests

‡ High-level power-on tests

The motherboard, power supply, and display are used in every test.

Self Tests that Perform a Measurement

The following self tests perform measurements:

- ADC
- POST DIVIDER
- AUTO RNG TRIP PTS
- 10 MHz LOCAL OSC
- FLATNESS
- QUICK CONF TEST

The measurements bypass any standard corrections and do not perform calibration data corrections. Therefore, all self-test measurements using analog data have limits larger than the standard calibration tolerances.

Some hardware setup modes used in these self tests are not used by normal measurements and cannot be accessed from the front panel. Once the hardware is set up, data is taken and time records are processed according to the needs of the specific test. Some tests monitor overloads, others require spectrum data, and others require time record data. After the data is collected, it is compared to an internal reference specification to determine if the self test passed or failed. The pass or fail information along with any additional information is placed in the Test Log.

Individual Self-Test Descriptions

[187.5 kHz REFERENCE]
(Source 187.5 kHz)

This test verifies that the reference signal is present at the input of the 187.5 kHz limiter on the Source Conversion assembly. In this test, a detector forces 187.5_SIG\ low if the 187.5_KHZ_SRCE signal is present. The Source Amplifier assembly provides control logic for 187.5_SIG\ and sends this information to the CPU assembly over the IIC bus.

[10 MHz LOCAL OSC]
(Receiver 10 MHz)

This test verifies that the swept LO signal, 300 MHz, 10 MHz, and 250 kHz reference signals are at the proper frequency. In this test, the 10 MHz calibration signal from the Reference/Calibrator assembly is connected to the receiver (the Input, First Conversion, Second Conversion, IF, and ADC/Digital Filter assemblies). This test then checks the output frequency of the ADC on the ADC/Digital Filter assembly.

[2ND IF LEVEL]
(Receiver 2nd IF)

This test verifies the integrity of the signal path through the Input, First Conversion, and Second Conversion assemblies up to the IF assembly. In this test the receiver's range is set to − 20 dBm and a 0 dBm signal (NORMALIZE) from the Source Amplifier assembly is connected to the Input assembly. The detector on the IF assembly forces SIG_DET high. The receiver's range is changed to 0 dBm, and SIG_DET returns to a logic low. The ADC/Digital Filter assembly provides the control logic for the SIG_DET signal and sends this information to the CPU assembly over the IIC bus.

[ADC]
(Receiver ADC)

This test verifies that the ADC on the ADC/Digital Filter assembly is functioning correctly. This test consists of 7 tests − positive overflow, negative overflow, positive limit, negative limit, 1st pass, 2nd pass, and zero. The positive and negative overflow tests set up the ADC test mode to cause positive and negative overflows, then checks the digital filter for interrupt flags. The positive and negative limit tests check the ADC's positive and negative limits. The 1st and 2nd pass tests connect the 10 MHz calibration signal from the Reference/Calibrator assembly to the Input assembly. The 1st pass test sets the 2nd pass result to zero and checks the signal into the ADC for the proper value and the gate array for interrupts or overloads. The 2nd pass test sets the 1st pass result to zero and checks the signal into the ADC for the proper value and the gate array for interrupts or overloads. The zero test checks for minimal output when the signal is removed.

[AUTO RNG TRIP PTS]
(Receiver autorange)

This test verifies that the receiver's auto range trip points are set correctly. This test calibrates the source at − 20 dBm, then connects the NORMALIZE signal from the Source Amplifier assembly to the Input assembly. The NORMALIZE signal is increased until the range up trip point is found, then decreased until the range down trip point is found. This test compares the trip points to acceptable levels.

[DETECTOR]
(Detector gate array)

This test verifies that the detector on the ADC/Digital Filter assembly is operating correctly. The microprocessor on the CPU assembly writes data to the detector over the fast bus. The microprocessor then reads the data and compares it to the data sent.

[DIGITAL FILTER]
(Digital filter gate array)

This test verifies that the digital filter's gate array on the ADC/Digital Filter assembly is operating correctly. The CPU assembly's microprocessor configures the digital filter's gate array over the fast bus. The microprocessor then reads the control lines to check circuits internal to the gate array and verify correct configuration. This test also writes to and reads from the gate array's RAM, checking for stuck bits.

[DISK CONTROLLR]
(Disk controller)

This test verifies that the disk controller on the CPU assembly is operating correctly. In this test, the microprocessor sends an invalid command to the disk controller, and the disk controller reports the command as invalid.

[DISPLAY DGTL HW]
(Display digital)

This test checks that the display controller on the CPU assembly is operating correctly. In this test, the microprocessor writes a pattern to the display controller, then reads the pattern checking for errors.

[DMA]
(DMA)

This test checks the DMA controller on the CPU assembly. In this test, the microprocessor writes to the DMA controller, then reads the registers checking for errors.

[FAST BUS]
(Fast bus)

This test verifies that the fast bus is operating correctly. In this test, the microprocessor on the CPU assembly writes data to the detector gate array on the ADC/Digital Filter assembly over the fast bus. The microprocessor then reads data.

[FLATNESS]
(Source flatness)

This test verifies the flatness of the source (Source Conversion and Source Amplifier assemblies) for all attenuator settings (10 dBm to − 50 dBm in 10 dB steps) from 200 kHz to 150 MHz. This test connects the NORMALIZE signal from the Source Amplifier assembly to the Input assembly. The receiver (the Input, First Conversion, Second Conversion, IF, and ADC/Digital Filter assemblies) measures the signal, and the microprocessor on the CPU assembly compares the results to acceptable levels.

[FRONT PANEL]
(Front panel)

This test verifies that the IIC controller on the Front Panel assembly is operating correctly. In this test, the microprocessor on the CPU assembly reads the IIC controller on the Front Panel assembly and verifies that no front-panel keys are held down.

[GILBERT CELL]
(Source gilbert cell)

This test verifies that the gilbert cell multiplier on the Source Conversion assembly is operating correctly. In this test, the gilbert cell generates a full scale signal and a detector forces 187.5_SIG\ low. The gilbert cell reduces its amplitude and 187.5_SIG\ returns to a logic high. The Source Amplifier assembly provides control logic for 187.5_SIG\ and sends this information to the CPU assembly over the IIC bus.

[HP-IB CONNECTOR]

This is a user-interactive test of the HP-IB connector on the CPU assembly. In this test, a diagram of the HP-IB connector is displayed on the screen. The user then connects an HP-IB pin to ground, and the pin is highlighted on the screen. See Test 12. HP-IB/RS-232 for the procedure to use with this softkey.

[HP-IB FUNC TEST]
(HP-IB)

This test verifies that the HP-IB interface on the CPU assembly is operating correctly. In this test, the microprocessor sets the HP-IB interface to a listen only state, then tests for a listen only state.

[IIC BUS]
(IIC bus)

This test verifies that the CPU assembly can write to and read from all assemblies with IIC interfaces. This test also checks the CPU assembly's EEROM. The following assemblies have IIC interfaces:

Front Panel
A11 Input
A23 Step Phase Detector
A31 Reference/Calibrator
A33 Trigger
A41 Source Conversion
A42 Source Amplifier (write only)
A51 Interpolation VCO
A52 Fractional-N
A62 ADC/Digital Filter

[INTERRUPT]
(Interrupt)

This test verifies that the interrupt circuits on the CPU assembly are operating correctly. In this test, the microprocessor writes to the interrupt registers and reads the registers for verification.

[LONG CONF TEST]

This test performs most of the self tests. The tests are performed in the following order:

[PROCESSOR]
[RAM]
[ROM]
[INTERRUPT]
[MULTI FCTN PERIPHERL]
[DISPLAY DGTL HW]
[FRONT PANEL]
[HP-IB FUNC TEST]
[IIC BUS]
[FAST BUS]
[DMA]
[MATH COPROCSSR]
[SNGL LOOP TUN RANGE]
[MULT-LOOP TUN RANGE]
[POST DIVIDER]
[AUTO RNG TRIP PTS]
[10 MHz LOCAL OSC]
[2ND IF LEVEL]
[ADC]
[DIGITAL FILTER]
[DETECTOR]
[187.5 kHz REFERENCE]
[GILBERT CELL]
[OUTPUT CKTS]
[FLATNESS]
[QUICK CONF TEST]

[MATH COPROCSSR]
(Math coprocessor)

This test verifies the processing capability of the TMS320 signal processor on the CPU assembly. In this test, the microprocessor reads from and writes to the TMS320's SRAM. This test also does two cyclic redundancy checks on the TMS320's SRAM contents.

[MOTOR]
(Disk motor)

This test verifies that the Disk Drive assembly's motor is operating correctly. In this test, the CPU assembly's disk controller instructs the Disk Drive assembly to turn its motor on and off. While the motor is turning on and off, the disk controller monitors the DISK_READY\ signal. This test requires a flexible disk.

[MULT FCTN PERIPHERL]
(Mult fctn peripheral)

This test verifies that the MFP (multi-function peripheral) on the CPU assembly is operating correctly. In this test, the microprocessor writes to the MFP, then reads the registers checking for errors.

[MULT-LOOP TUN RANGE]
(Mult loop tuning range)

This test checks the tuning range of the local oscillator's interpolation loop (Interpolation VCO and Fractional-N assemblies). In this test, the local oscillator is in multiple loop mode and the Interpolation VCO's frequency is set to a minimum locking value. Then while monitoring the interpolation loop for an unlock condition, the Interpolation VCO's frequency is decreased until the loop unlocks. This test then sets the Interpolation VCO's frequency to a valid locking value and checks that the loop locked. Next this test sets the Interpolation VCO's frequency to a maximum locking value. Then while monitoring the interpolation loop for an unlock condition, the Interpolation VCO's frequency is increased until the loop unlocks. This test then sets the Interpolation VCO's frequency to a valid locking value and checks that the loop locked.

[OUTPUT CKTS]
(Source output level)

This test checks the output of the Source Amplifier assembly and verifies that the source can reduce its amplitude. In this test, the overload threshold is lowered and the overload detection circuit detects an overload. Then the source amplitude is reduced, and the overload detection circuit verifies that the overload is gone.

[POST DIVIDER]
(Post divider)

This test checks for proper operation of the divide-by-10/divide-by-5 circuit on the Interpolation VCO assembly. In this test, the local oscillator is in multiple loop mode, and the 10 MHz calibration signal is connected to the receiver. While the receiver is measuring the signal, the divide by number is changed from 10 to 5. This causes the frequency the receiver is measuring to change, indicated by the receiver unable to measure the calibration signal.

[PROCESSOR]
(Processor)

This test verifies that the microprocessor on the CPU assembly is operating correctly. In this test, the following microprocessor operations are tested:

Immediate move and compare instructions
Data and address registers
Data direct and address direct addressing modes
AND, EOR, OR, multiply, divide, shift, and rotate

[QUICK CONF TEST]
(Quick confidence)

This test calibrates the analyzer and checks the calibration limits. See "Calibration Routine Description" in section IV, "Circuit Descriptions," for a description of the calibration routine. This test lists the following calibration correction information in the test log:

LO null real: n, imag: n
1 MOhm nominal crtn: n
50 Ohm nominal crtn: n
src crtn: gain: n, offset: n

The **LO null real** and **imag** numbers are the calibration correction numbers to null the receiver's LO feedthrough. These numbers can range from 1 to 100, but typically range from 40 to 90. The nominal number is 50. This test fails if either the real or the imaginary number is 1 or 100.

The **1 MOhm** and **50 Ohm nominal crtn** numbers are the calibration correction numbers for the receiver's 1 MΩ input path and 50Ω input path (− 20 dBm range, no attenuators engaged). The nominal number is 1.0 with typical numbers ranging from 0.4 to 2.5. When either the 1 MΩ or the 50Ω input path can not be calibrated, this test fails and the correction number is set to 1.000 (no correction applied).

The **src crtn gain** and **offset** numbers are the calibration gain and offset correction numbers for the source. The nominal number for gain is 1.00 with typical numbers ranging from 0.7 to 1.4. The nominal number for offset is 0 with typical numbers ranging from − 5 to 7.

[RAM]
(RAM)

This test checks the RAM on the Memory assembly. Before writing to a memory location, this test stores the memory contents in a register. The memory location is restored after the memory is tested. This test disables the keyboard and all interrupts.

[RANDOM SEEK]
(Disk random seek)

This test verifies that the Disk Drive assembly's head can move to a random sector on the flexible disk. In this test, the disk controller on the CPU assembly instructs the disk-drive head to move to a random sector. This test requires a flexible disk that is not write protected.

[READ]
(Disk read)

This test verifies that the Disk Drive assembly can read a flexible disk. In this test, the CPU assembly's disk controller instructs the Disk Drive assembly to read the current sector on the flexible disk. While the current sector is being read, the disk controller monitors the READ_DATA\ signal to verify the read operation. The current sector is set by the [SEEK SECTOR] test. This test requires a flexible disk that is not write protected.

[READ/WRITE]
(Disk read/write)

This test verifies that the Disk Drive assembly can read and write to a flexible disk. In this test, the CPU assembly's disk controller instructs the Disk Drive assembly to read the current sector on the flexible disk. While the current sector is being read, the disk controller monitors the READ_DATA\ signal to verify the read operation. The disk controller then instructs the Disk Drive assembly to write to the current sector. While the current sector is being written to, the disk controller monitors the WRITE_DATA\ signal to verify the write operation. The current sector is set by the [SEEK SECTOR] test. This test requires a flexible disk that is not write protected.

[READ/WRITE ALL]
(Disk read/write all)

This test verifies that the Disk Drive assembly can read and write to all sectors of a flexible disk. In this test, the CPU assembly's disk controller instructs the Disk Drive assembly to read every available sector on the flexible disk (excluding privileged tracks). While the flexible disk is being read, the disk controller monitors the READ_DATA\ signal to verify the read operation. The disk controller then instructs the Disk Drive assembly to write to every available sector on the flexible disk (excluding privileged tracks). While the flexible disk is being written to, the disk controller monitors the WRITE_DATA\ signal to verify the write operation. This test stops on the first error. If there are no errors, this test takes approximately 20 minutes to complete. This test requires a flexible disk that is not write protected.

[RESTORE]
(Disk restore)

This test verifies that the Disk Drive assembly's head can move away from track 0, then back to track 0. In this test, the CPU assembly's disk controller instructs the disk-drive head to move away from track 0, then back to track 0. The disk controller monitors the T00\ signal to verify the move operation. This test requires a flexible disk that is not write protected.

[ROM]
(ROM)

This test calculates and verifies checksums for all ROMs on the Memory assembly.

[SEEK SECTOR]
(Disk sector seek)

This test verifies that the Disk Drive assembly's head can move to a user specified sector on the flexible disk. In this test, the disk controller on the CPU assembly instructs the disk-drive head to move to a user specified sector. The user specified sector number must be in the range of valid sector numbers. The default sector number is 1. This test requires a flexible disk that is not write protected.

[SNGL LOOP TUN RANGE]
(Single loop tuning range)

This test checks the tuning range of the local oscillator's single loop (Sum VCO, Interpolation VCO, and Fractional-N assemblies). In this test, the local oscillator is in single loop mode and the Sum VCO's frequency is set to a minimum locking value. Then while monitoring the single loop for an unlock condition, the Sum VCO's frequency is decreased until the loop unlocks. This test then sets the Sum VCO's frequency to a valid locking value and checks that the single loop locked. Next this test sets the Sum VCO's frequency to a maximum locking value. Then while monitoring the single loop for an unlock condition, the Sum VCO's frequency is increased until the loop unlocks. This test then sets the Sum VCO's frequency to a valid locking value and checks that the single loop locked.

[TEST PATTERN]

This is a user-interactive test of the Display assembly and the CPU assembly's display controller. In this test, a test pattern is displayed on the screen. See adjustment "18. Display," in section I, "Adjustments," for more information.

Table 5-32. Self Test Menu Map and HP-IB Commands

Self Test	HP-IB Command
[SELF TEST]	
[QUICK CONF TEST]	TEST:SHOR
[LONG CONF TEST]	TEST:LONG
[FUNCTIONL TESTS]	
[CPU]	
[PROCESSOR]	TEST:PROC:CPU
[RAM]	TEST:PROC:RAM
[ROM]	TEST:PROC:ROM
[INTERRUPT]	TEST:PROC:INT
[MULT FCTN PERIPHERL]	TEST:PROC:MFP
[DISPLAY DGTL HW]	TEST:PROC:DISP
[ALL]	TEST:PROC:ALL
[DISPLAY]	
[TEST PATTERN]	TEST:DISP:PATT
[DMA]	TEST:PROC:DMA
[I/O]	
[FRONT PANEL]	TEST:IO:FPAN
[HP-IB]	
[HP-IB FUNC TEST]	TEST:IO:GPIB
[HP-IB CONNECTOR]	
[INTERNAL DISK]	
[DISK CONTROLLR]	TEST:IO:DISK:CONT
[MOTOR]	TEST:IO:DISK:MOT
[RESTORE]	TEST:IO:DISK:REST
[RANDOM SEEK]	TEST:IO:DISK:RAND
[SEEK SECTOR]	TEST:IO:DISK:SEEK
[READ]	TEST:IO:DISK:READ
[READ/WRITE]	TEST:IO:DISK:WRIT
[READ/WRITE ALL]	TEST:IO:DISK:RWR
[ALL]	TEST:IO:DISK:ALL
[IIC BUS]	TEST:IO:IIC
[FAST BUS]	TEST:IO:FBUS
[ALL]	TEST:IO:ALL
[MATH COPROCSSR]	TEST:MATH
[LOCAL OSC]	
[SNGL LOOP TUN RANGE]	TEST:LOSC:SLO:TRAN
[MULT-LOOP TUN RANGE]	TEST:LOSC:MLO:TRAN
[POST DIVIDER]	TEST:LOSC:PDIV
[ALL]	TEST:LOSC:ALL

Table 5-32. Self Test Menu Map and HP-IB Commands (continued)

Self Test	HP-IB Command
[RECEIVER]	
[AUTO RNG TRIP PTS]	TEST:REC:AUT
[10 MHz LOCAL OSC]	TEST:LOCS:TENM
[2ND IF LEVEL]	TEST:IF:LEV
[ADC]	TEST:REC:GARR
[DIGITAL FILTER]	TEST:DFIL:GARR
[DETECTOR]	TEST:DET:GARR
[ALL]	TEST:REC:ALL
[SOURCE]	
[FLATNESS]	TEST:SOUR:FLAT
[187.5 kHz REFERENCE]	TEST:SOUR:REF
[GILBERT CELL]	TEST:SOUR:GILB
[OUTPUT CKTS]	TEST:SOUR:DAC:ATT †
[ALL]	TEST:SOUR:ALL
[ALL]	TEST:ALL
[LOOP MODE ON OFF]	TEST:LOOP ON TEST:LOOP OFF
[TEST LOG]	TEST:LOG:DATA?
[CLEAR TEST LOG]	TEST:LOG:CLE
[NEXT PAGE]	
[PREVIOUS PAGE]	

† This test will fail if the Source Amplifier assembly detects a voltage at its front-panel connector. Therefore, before running this test, disconnect any cable connected to the SOURCE connector.

Note

To view the analyzer's fault log via HP-IB, send SYST:FLOG:DATA?. To clear the fault log send SYST:FLOG:CLE.

Index

E

F

H

I

R

S

T

V