Errata

Title & Document Type: 3562A Dynamic Signal Analyzer Service Manual

Manual Part Number: 03562-90010

Revision Date: October 1985

HP References in this Manual

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

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Agilent Technologies

HEWLETT PACKARD

SERVICE MANUAL

MODEL 3562A
DYNAMIC SIGNAL ANALYZER

Serial Number: 2435A00101

IMPORTANT NOTICE

This manual applies to instruments with the above serial number and greater. As changes are made in the instrument to improve performance and reliability, the appropriate pages will be revised to include this information.

WARNING

To prevent potential fire or shock hazard, do not expose instrument to rain or moisture.

Manual Part No. 03562-90010
Microfiche No. 03562-90210

8600 Soper Hill Road, Everett, Washington 98205-1298 U.S.A.

Printed: September 1985

HEWLETT PACKARD

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 that 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

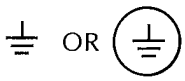
Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

SAFETY SYMBOLS

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

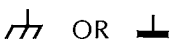
Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

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.

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

SECTION I
GENERAL INFORMATION

Contents

Tables

Figures

SECTION I
GENERAL INFORMATION

1-1 HOW THIS MANUAL IS ORGANIZED

This service manual provides all the information required by service personnel to test, adjust, and service the HP 3562A Dynamic Signal Analyzer. Figure 1-1 shows the front and rear views of the HP 3562A and figure 1-2 shows the accessories supplied with the HP 3562A.

The service manual is divided into nine sections, each covering a particular topic for servicing the HP 3562A. A brief description of these sections and when each section should be used is given in table 1-1.

This service manual is designed for troubleshooting the HP 3562A in a two step process. In step one, the information given in Section VII is used to isolate the failure to a circuit board. The information in Section VIII is used to isolate the failure to the component level. To start the troubleshooting process go to section VII.

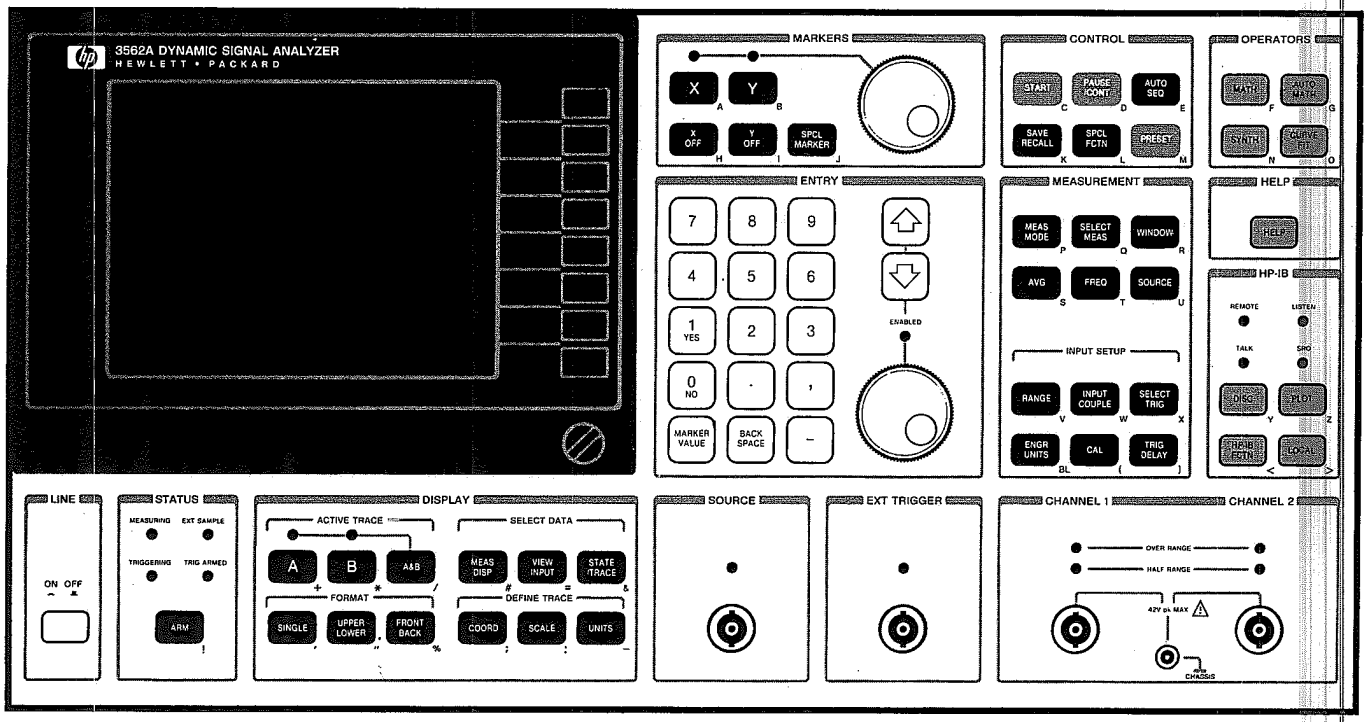
1-2 MANUAL AND INSTRUMENT IDENTIFICATION

The instrument identification serial number is located on the rear panel of the instrument. Hewlett-Packard uses a two section serial number consisting of a four-digit prefix and a five-digit suffix separated by a letter designating the country in which the instrument was manufactured (A = U.S.A., G = West Germany, J = Japan, and U = United Kingdom). The prefix is the same for all identical instruments and changes only when a major instrument change is made. The suffix is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix as listed on the title page of this manual.

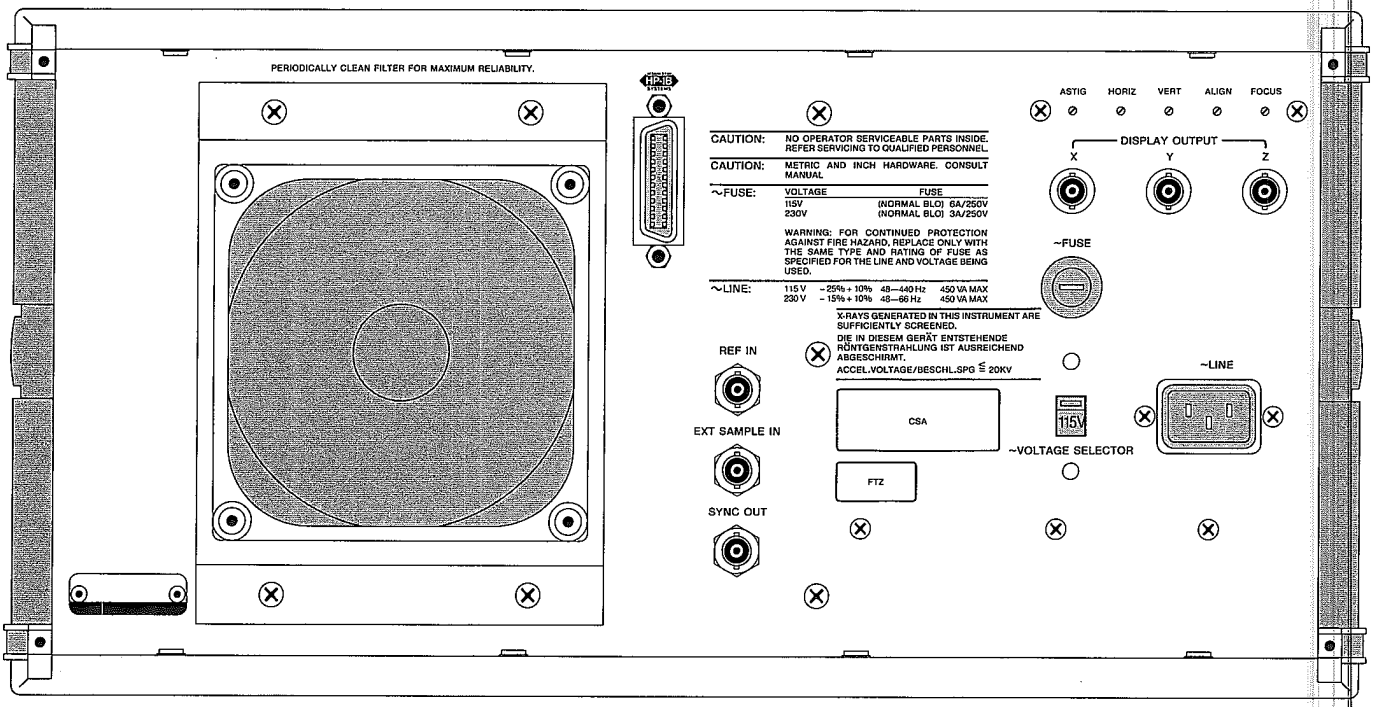
Instruments manufactured after the printing of this manual may have a serial number prefix which is not listed on the title page. This unlisted prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument may be supplied with a yellow "Manual Changes" supplement which contains information documenting the differences.

In addition to instrument change information, the supplement may contain information for correcting the manual. To keep this manual as accurate as possible, Hewlett-Packard recommends that you periodically request the latest "Manual Changes" supplement.

Listed on the title page of this manual is a manual part number and a microfiche part number. The manual part number can be used to order extra copies of this service manual. The microfiche part number can be used to order 4 by 6 inch microfilm transparencies of this service manual.



HP 3562A Front View

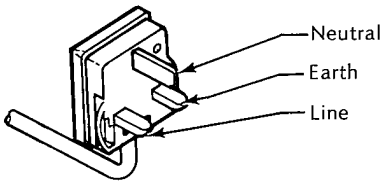


HP 3562A Rear View

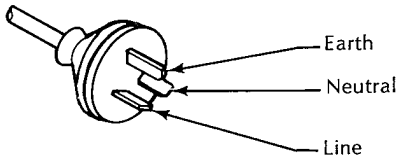
Figure 1-1 HP 3562A Front and Rear Views

WARNING

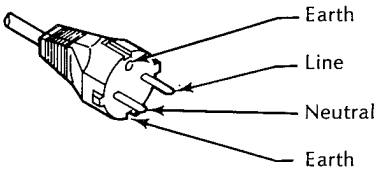
The power cable plug must be inserted into a socket outlet provided with a protective earth terminal. Defeating the protection of the grounded instrument cabinet can subject the operator to lethal voltages.



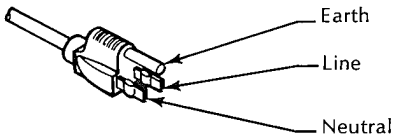
PLUG*: BS 1363A
CABLE*: HP 8120-1703
240 V OPERATION



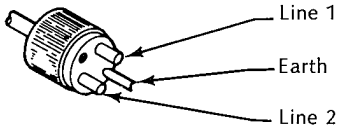
PLUG*: NZSS 198/AS C112
CABLE*: HP 8120-0696
240 V OPERATION



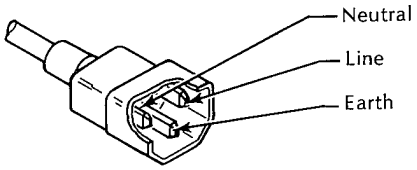
PLUG*: CEE7-V11
CABLE*: HP 8120-1692
240 V OPERATION



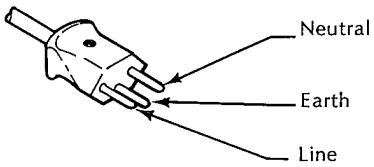
PLUG*: NEMA 5-15P
CABLE*: HP 8120-1521
120 V-6A**



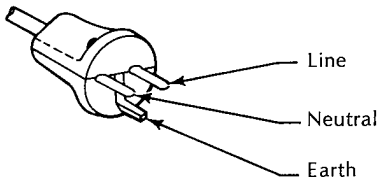
PLUG*: NEMA 5-15P
CABLE*: HP 8120-0698
240 V - 6A**



PLUG*: CEE7-V11
CABLE*: HP 8120-1692
240 V OPERATION



PLUG*: SEV 1011.1959-24507
TYPE 12
CABLE*: HP 8120-2104
240 V OPERATION



PLUG*: DHCR 107
CABLE*: HP 8120-2956
240 V OPERATION

*The number shown for the plug is the industry identifier for the plug only.
The number shown for the cable is an HP part number for a complete cable including the plug.
**UL listed for use in the United States of America.

Figure 1-2 Accessories Supplied with the HP 3562A

Table 1-1 Manual Section Descriptions

SECTION	TITLE	DESCRIPTION
I	GENERAL INFORMATION	This section contains information on how to use this manual. Also included are Safety Considerations, Recommended Test Equipment and the HP 3562A Performance Specifications.
II	PERFORMANCE TESTS	This section contains the Operational Verification and the Performance Tests. Use the operational verification for incoming and after-repair inspections. Use the performance tests to verify that the HP 3562A conforms to its published specifications.
III	ADJUSTMENTS	This section describes the adjustment procedures which will return the instrument to peak operating condition. Use this section when adjustment is recommended in Sections II and VIII.
IV	REPLACEABLE PARTS	This section lists the replaceable parts in order of their reference designators. Ordering information is also included.
V	BACKDATING	This section lists the information required to adapt this service manual to instruments manufactured prior to the printing of this manual.
VI	CIRCUIT DESCRIPTIONS	This section contains the HP 3562A theory of operation, the signal name descriptions, and circuit board block diagrams. Use this section to understand how the HP 3562A's circuits function.
VII	FAULT ISOLATION	This section contains the information required to isolate failures to the circuit board level. Diagnostic pass and fail messages are found in this section. Use this section to start troubleshooting the HP 3562A.
VIII	SERVICE	This section contains all the information required to isolate failures to the component level. The information is listed in order of the circuit board assembly number, A1 through A35. Use this section after the faulty assembly has been identified.
IX	SCHEMATICS	This section contains circuit board schematics, component locators, and the instrument block diagram. Use this section with Sections VII and VIII.

1-3 ACCESSORIES

The following accessories are supplied with the HP 3562A:

Line Power Cord ..... See figure 1-2
Operating Manual ..... HP 03562-90000
Programming Manual ..... HP 03562-90030
Service Manual ..... HP 03562-90010
Display Service Manual ..... HP 01345-90916

The following accessories are available:

Transit Case ..... HP 9211-2663

1-4 INSTRUMENT DESCRIPTION

The HP 3562A is a dual-channel, FFT-based network, spectrum and waveform analyzer which provides analysis capabilities in both the time and frequency domains. The 0-to-100 kHz frequency range, 150 dB measurement range and 80 dB dynamic range of the HP 3562A make it a powerful tool for testing and analysis in electronic, mechanical and servo control system applications.

This analyzer has a pair of differential input channels and a built-in signal source. Besides linear and logarithmic resolution measurement modes, the HP 3562A also provides swept sine measurements.

The digital section of this instrument provides the flexibility to manipulate the gathered data into almost any format required through waveform math, frequency response synthesis, and curve fitting routines. The HP 3562A also directly drives HP-GL plotters without a controller. External disc drives can be directly driven for data and instrument state storage.

1-5 OPTIONS

There are five options available for the HP 3562A. They are available either when the instrument is ordered, or they may be installed later. These options are listed in table 1-2.

Table 1-2 HP 3562A Options

Option	Description
907	Front Handle Kit
908	Rack Mount Kit
909	Rack Mount and Front Handle Kit
910	Extra Operating Manuals (1 set)
914	Delete Service Manual

1-6 SAFETY CONSIDERATIONS

The HP 3562A 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 which must be followed to ensure safe operation and retain the HP 3562A in safe operating condition. Service and adjustments should be performed only by qualified personnel who are aware of the hazards involved.

1-7 GROUNDING

On the HP-IB connector pin 12 and pins 18 through 24 are tied to protective earth ground and the HP-IB cable shield. The instrument frame, chassis, covers and all exposed metal surfaces are connected to protective earth ground. The input terminal outer BNC conductor is NOT connected to protective earth ground, and can be raised to a maximum of 42 Vpk with respect to instrument chassis.

WARNING

DO NOT interrupt the protective earth ground or "float" the HP 3562A. This action could expose the operator to potentially hazardous voltages.

1-8 OPERATOR MAINTENANCE

Operator maintenance is limited to replacing the line fuse (MP205) and cleaning the fan filter. There are no operator controls or user serviceable parts inside the HP 3562A. Only trained service personnel should perform instrument repairs.

WARNING

To avoid serious injury, disconnect the ac line power cord before removing or installing the ac line fuse.

Voltage settings

There are two voltage settings on the rear panel of the HP 3562A. Before connecting the line power cord or turning on the instrument, verify the voltage selector switch is in the correct position for the input line voltage.

WARNING

Only a fuse (MP205) with the required rated current and specified type should be used for replacement. The use of repaired fuses and short circuiting of fuse holders is not permitted. Whenever it is likely that the protection offered by the fuse has been impaired, the HP 3562A must be made inoperative and secured against unintended operation.

WARNING

Under no circumstances should an operator remove any covers, screws, or in any other way enter the HP 3562A. There are no operator controls inside the HP 3562A.

How to clean air filter

The cooling fan's air filter is located on the rear panel. To service the filter, remove the power cable and remove the four knurled nuts that hold the filter to the rear panel. Clean the filter using a solution of warm water and a mild soap or replace the filter. The air filter should be cleaned every 30 days.

Cleaning Solvents

Unplug the instrument power cord before cleaning any portion of the instrument. Use only non-abrasive, non-corrosive cleansers. A solution of warm water and mild soap is recommended.

1-9 SPECIFICATIONS

The 3562A specifications are listed in table 1-3. These specifications describe the instrument's warranted performance. Supplemental characteristics are intended to provide information useful in applying the instrument by giving typical, but non-warranted, performance specifications. Supplemental characteristics are denoted as "typical, "nominal", or "approximately".

Table 1-3 **Specifications**

FREQUENCY

Measurement Range: 64 μHz to 100 kHz, both channels single or dual channel operation.

Accuracy: $\pm$0.004% of frequency reading

Resolution: Span/800, both channels, single or dual channel operation.

Spans:	Baseband	Zoom
# of spans	66	65
Minimum span	10.24 mHz	20.48 mHz
Maximum span	100 kHz	100 kHz
Time record (Sec)	800/Span	800/Span

Window Functions: Hanning, flat top, uniform, force, exponential, and user-defined.

Window Parameters:	Flat Top	Hanning	Uniform
Noise Equiv BW (% of span)	0.478	0.188	0.125
3 dB BW (% of span)	0.45	0.185	0.125
Shape Factor (60 dB BW/ 3 dB BW)	2.6	9.1	716

Typical Real Time Bandwidth:	
Single channel, single display	2.5 kHz
Single channel, fast averaging	10 kHz
Dual channel, single display	2 kHz
Dual channel, fast averaging	5 kHz
Throughput to CS/80 disc	
Single channel	10 kHz
Dual channel	5 kHz

Table 1-3 **Specifications cont.**

AMPLITUDE

Accuracy: Defined as full-scale accuracy at any of the 801 calculated frequency points. Overall accuracy is the sum of absolute accuracy, window flatness and noise level.

Absolute Accuracy:
Single channel (Channel 1 or Channel 2)
±0.15 dB ±0.015% of input range (+27 dBV to −40 dBV, input connections as specified in Cases 1 and 2 in figure 1-3)
±0.25 dB ±0.025% of input range (−41 dBV to −51 dBV, input connections as specified in Cases 1 and 2 in figure 1-3)

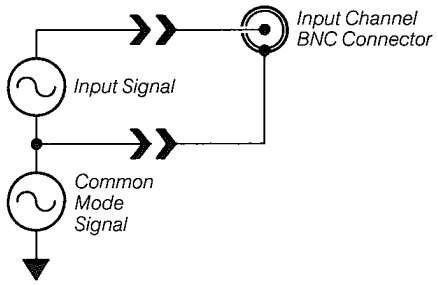
DC Response: Auto-Cal on

Input Range (dBVrms)	DC Level
+27 to −35	>30 dB below full scale
−36 to −51	>20 dB below full scale

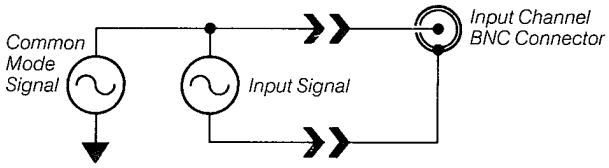
Frequency Response Channel Match:
±0.1 dB, ±0.5° (input connections as specified in Cases 1 and 2 in figure 1-3)

Input Connections:
Cases 1 and 2 are the recommended input connections.

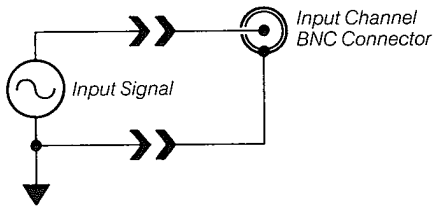
Case 1



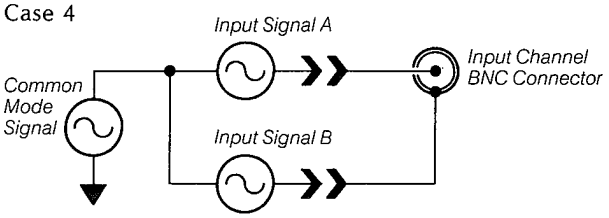
Case 3



Case 2



Case 4



Cases 3 and 4 are input connections which degrade amplitude accuracy. For these cases, the amplitude accuracy previously specified must be modified with the accuracy adders. (See next paragraph)

Figure 1-3 Input Connections

Table 1-3 **Specifications cont.**

Accuracy Adder: Single channel, inputs connected as shown in Cases 3 and 4 in figure 1-3. Add ±0.35 dB and ±4.0° to the absolute accuracy.

Accuracy Adder: Dual channel measurements Add ±0.35 dB and ±4.0° once for each input connected as shown in Cases 3 and 4 in figure 1-3.

Window Flatness:

Flat Top:	+0, −0.01 dB
Hanning:	+0, −1.5 dB
Uniform:	+0, −4.0 dB

Noise Floor: Flat top window, 50Ω source impedance. −51 dBV range
20 Hz to 1 kHz (1 kHz span) < −126 dBV (< −134 dBV/$\sqrt{Hz}$)
1 kHz to 100 kHz (100 kHz span) < −116 dBV (< −144 dBV/$\sqrt{Hz}$)
Dynamic Range: All distortion (intermodulation and harmonic), spurious and alias products ≥ 80 dB below full scale input range (16 averages <10 kΩ termination).

PHASE

Accuracy: Single Channel, input connections as specified in Cases 1 and 2 in figure 1-3.

< 10 kHz	±- 2. 5°
10 kHz to 100 kHz	±- 12 .0°

INPUTS

Input impedance: 1 MΩ ±5% shunted by <100 pF.

Input Coupling: The inputs may be ac or dc coupled; ac rolloff is <3 dB at 1 Hz.

Crosstalk: < −140 dB (50Ω source, 50Ω input termination, input connectors shielded)

Common Mode Rejection:

0 Hz to 66 Hz	80 dB
66 Hz to 500 Hz	65 dB

Common Mode Voltage: dc to 500 Hz

Input Range (dBV rms)	Maximum (ac + dc)
+27 to −12	±42.0 Vpk
−13 to −51	±18.0 Vpk*

*For the −43 to −51 dBV input ranges, common mode signal levels cannot exceed ±18 Vpk or (Input Range) + (Common Mode Rejection), whichever is the lesser level.

Common Mode Voltage: 500 Hz to 100 kHz. The ac part of the signal is limited to 42 Vpk or (Input Range) + (10 dB), whichever is the lesser level.

Table 1-3 **Specifications cont.**

Common Mode Distortion: For the levels specified, distortion of common mode signals will be less than the level of the rejected common mode signal.

External Trigger Input Impedance: typically 50 kΩ ±5%

External Sampling Input: TTL compatible input for signals ≤256 kHz (maximum sample rate).

External Reference Input:
Input Frequencies: 1,2,5 or 10 MHz ±0.01%
Amplitude Range: 0 dBm to +20 dBm (50Ω)

TRIGGER

Trigger Modes: Free run, input channel 1, input channel 2, and external trigger. Free run applies to all measurement modes. Input channel 1, input channel 2 and external trigger apply to the linear resolution mode, time capture mode, and time throughput measurements.

Trigger Conditions:
Free Run: A new measurement is initiated by the completion the previous measurement.

Input: A new measurement is initiated when the input signal to either Channel 1 or Channel 2 meets the specified trigger conditions, trigger level range is ±100% of full scale input range; trigger level is user selectable in steps of (Input Range in volts)/128.

Source: Measurements are synchronized with the periodic signal types (burst random, sine chirp, and burst chirp).

External: A new measurement is initiated by a signal applied to the front panel Ext Trigger input. Trigger level range is ±10 Vpk; trigger level is user selectable in 80 mV steps.

Trigger Delay:
Pre-Trigger: The measurement can be based on data from 1 to 4095 samples in baseband and from 1 to 4094 samples in zoom prior to trigger conditions being met. Resolution is 1 sample (1/2048 of a time record).

Post-Trigger: The measurement is initiated from 1 to 65,536 samples (1/2048 to 32 time records) after the trigger conditions are met. Resolution is 1 sample (1/2048 of a time record).

SOURCE

Band limited, band translated random noise, burst random, sine chirp, burst chirp, as well as fixed sine and swept sine signals are available from the front panel source output. DC Offset is also user-selectable.

Output Impedance: 50Ω Nominal

Output Level: Between -10Vpk and +10 Vpk (ac + dc) into a load ≥10 kΩ, <1000 pF. Maximum current = 20 mA.

AC Level: ±5 Vpk (≥10 kΩ, <1000 pF load)

DC Offset: ±10 Vpk in 100 mV steps. Residual offset at 0V offset ≤10 mV.
%In-Band Energy: (1 kHz span, 5 kHz center frequency)
Random Noise: 70%
Sine Chirp: 85%

Accuracy and Purity: Fixed or Swept Sine
Flatness: ±1 dB from 0 to 65 kHz
+1 dB, −1.5 dB from 65 kHz to 100 kHz
Distortion: (including subharmonics)

dc to 10 kHz	−60 dB
10 kHz to 100 kHz	−40 dB

Table 1-3 **Specifications cont.**

GENERAL

Specifications apply when AUTO CAL is enabled, or within 5° C and 2 hours of last internal calibration.

Ambient Temperature: 0 to 55 °C.
Relative Humidity: ≤95% at 40 °C.
Altitude: ≤4,572m (15,000 ft).

Storage:
Temperature: −40 to +75 °C.
Altitude: ≤15,240m (50,000 ft).

Weight:
26 kg (56 lbs) net
35 kg (77 lbs) shipping

Power:
115 Vac +10%, −25%, 48 to 440 Hz
230 Vac +10%, −15%, 48 to 66 Hz
450 VA maximum

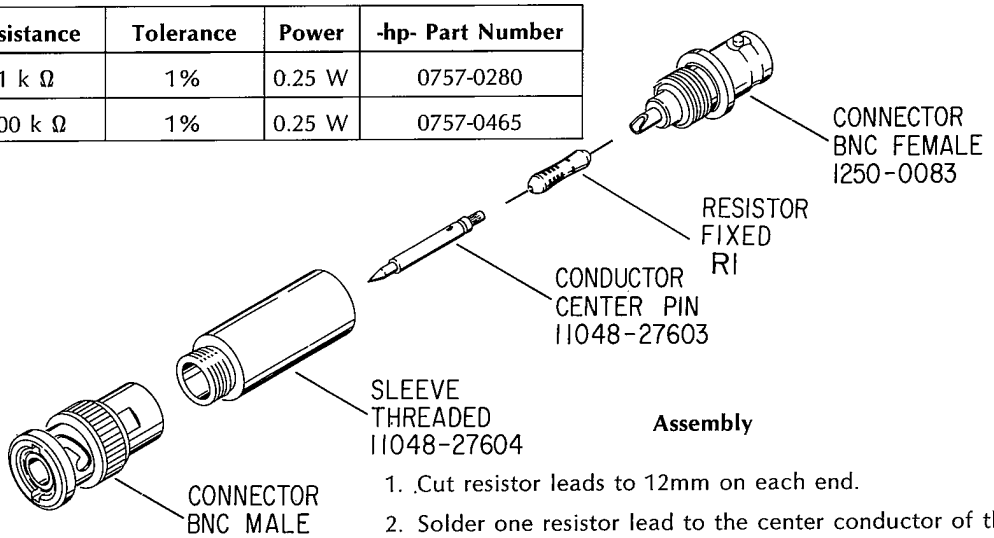
Dimensions:
222 mm (8.75 in) high
426 mm (16.25 in) wide
578 mm (22.75 in) deep

HP-IB:
Implementation of IEEE Std 488-1978
SH1 AH1 T5 TE0 L4 LE0 SR1 RL1 PP0 DC1 DT1 C0
Supports the 91XX and 794X families of HP disc drives as well as Hewlett-Packard Graphics Language (HP-GL) digital plotters.

1-10 RECOMMENDED TEST EQUIPMENT

The equipment required to maintain the HP 3562A is listed in table 1-4. Other equipment may be substituted for the recommended model if it meets or exceeds the listed critical specifications. When substitutions are made, the user may have to modify the performance and adjustment procedures to accommodate the different operating characteristics.

Resistance	Tolerance	Power	-hp- Part Number
1 k Ω	1%	0.25 W	0757-0280
100 k Ω	1%	0.25 W	0757-0465



Assembly

1. .Cut resistor leads to 12mm on each end.
2. Solder one resistor lead to the center conductor of the BNC FEMALE connector.
3. Solder the CONDUCTOR CENTER PIN to the other lead of the resistor.
4. Screw the SLEEVE and the BNC MALE connector into place. Tighten securely.

Figure 1-4 Constructing a Feedthrough

Table 1-4 Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use*
AC Calibrator	10 Hz to 100 kHz; 1 mV to 10V Amplitude Accuracy: ±.1%	Fluke 5200A Alternative HP 745A Datron 4200	P,O
Frequency Synthesizer (2)	Frequency Range: 1 Hz to 100 kHz Frequency Accuracy: 10 ppm Amplitude Range: 40 Vp-p Amplitude Accuracy: 0.2 dB from 1 Hz to 100 kHz 1 dB from 100 kHz to 1 MHz	HP 3325A Opt 001 Opt 002 Alternative (1) HP 3326A Opt 002	P,O
Digital Voltmeter	5½ digit AC Voltage: 30 Hz to 100 kHz; 0.1 to 500V; ±0.1%; 1 MΩ input impedance dc Voltage: 1V to 1000V; ±0.1%	HP 3456A	P,T,F
Low Distortion Oscillator	Frequency Range: 1 Hz to 100 kHz Amplitude Range: 0.1 V to 1 Vrms Distortion: ≤ −80 dB (0.01%)	HP 339A Alternative HP 3326A	P
Oscilloscope	Bandwidth: >50 MHz Two Channel; External Trigger	HP 1980B Alternative HP 1740	A,T,F
Signature Analyzer	Maximum Clock: >25 MHz Clock Set up Time: <20 ns	HP 5006A Alternative HP 5005A HP 5005B	T
Variable AC Power Supply	Voltage Range: 80 to 120 Vac Frequency Range: 60 Hz Voltage Accuracy: ±2%	**	T
Triple Output DC Power Supply	Voltage Range: +15 to −15 Vdc, 0 to +6 Vdc Power: 13 watts	HP 6235A Alternative: HP 6236A	T
Counter	Frequency Range: 0 Hz to 100 MHz External Frequency Standard Input: 10 MHz 10 MHz	HP 5335A Alternative: HP 5238B Opt 010	A

* P = Performance Tests, A = Adjustments, O = Operational Vertification, F = Fault Isolation, T = Troubleshooting

** No specific model number is recommended,any variable AC power supply which meets the listed critical specifications may be used.

Table 1-4 Recommended Test Equipment cont.

Instrument	Critical Specifications	Recommended Model	Use*
Probe, Oscilloscope	Impedance: 10 MΩ Division Ratio: 10:1 Maximum Voltage: 500 Vdc	HP 10014A Alternatives: HP 10016B HP 10004A HP 10005D	A,F, T
HP 3562A Service Kit	Digital Extender Brd (HP 03562-66540) Analog Extender Brd (HP 03562-66541) Input/Analog Ext Brd (HP 03562-66542) Common Mode Cable (HP 03562-61620) Input Extender Cable (HP 03562-61621) SMB to BNC adapter cable (HP 03585-61616)	HP 03562-84401	P,A,O F,T
Feedthrough Terminations (2) (1)	 50Ω: ±1% at dc 600Ω: ±1% at dc	 HP 11048C Alternative: HP 10100C HP 11095A	P,O
Cables (2)	BNC to BNC: length ≤30 cm	HP 8120-1838 Alternative: HP 11170A	P,O
Adapters	BNC female to Banana male BNC (f) to dual banana male BNC Tee (m)(f)(f)	Pomona Elect. Model 1296 HP 1251-2277 HP 1250-0781	P,O
Resistors (2) (1)	Value 1 kΩ Accuracy: 1% Power: 0.25W Value: 100 kΩ Accuracy: 1% Power: 0.25W	HP 0757-0280 HP 0757-0465	P

* P = Performance Tests, A = Adjustments, O = Operational Verification, F = Fault Isolation, T = Troubleshooting

SECTION II
PERFORMANCE TESTS

Contents

Tables

Figures

SECTION II
PERFORMANCE TESTS

2-1 INTRODUCTION

This section contains the operational verification and the performance tests. The operational verification provides a high level of confidence regarding instrument operation and should be used for incoming and after-repair inspections. The completion of all the performance tests verifies that the HP 3562A conforms to its published specifications. One or more of the performance tests should be done after some repairs. Refer to "Service," Section VIII, for this information.

Note: Tables and figures beginning with "(OV)" are used in the operational verification tests.

2-2 CALIBRATION CYCLE

To verify that the HP 3562A is meeting its published specifications, the performance tests must be done every twelve months.

PART A
OPERATIONAL VERIFICATION

2-3 INTRODUCTION

These tests check selected specifications in their worst case conditions to provide a high level of confidence regarding instrument operation. This brief verification procedure should be used for incoming and after-repair inspections. The operational verification takes approximately two hours to complete.

2-4 HOW TO USE PART A

1. Start each operational verification test by setting the test equipment to the preset conditions listed in the "Initial Equipment Setup," paragraph 2-6.

2. There are two types of keys on the HP 3562A, hard keys and soft keys. In this section the hard keys are in bold text, and the soft keys are in regular text.

   For example:

   FREQ . . . . FREQ SPAN . . . . **10** kHz

   This example instructs you to press the hard key **FREQ** and the soft key FREQ SPAN. After pressing the soft key FREQ SPAN enter 10 kHz.

3. Refer to figure 2-1 for the position of the X and Y marker readings.

4. Record the results of each of the operational verification tests on the "Operation Verification Test Record," paragraph 2-16. This test record may be reproduced without written permission of Hewlett-Packard.

5. If the HP 3562A fails a test, use the "If Test Fails Check:" paragraph at the end of each test.

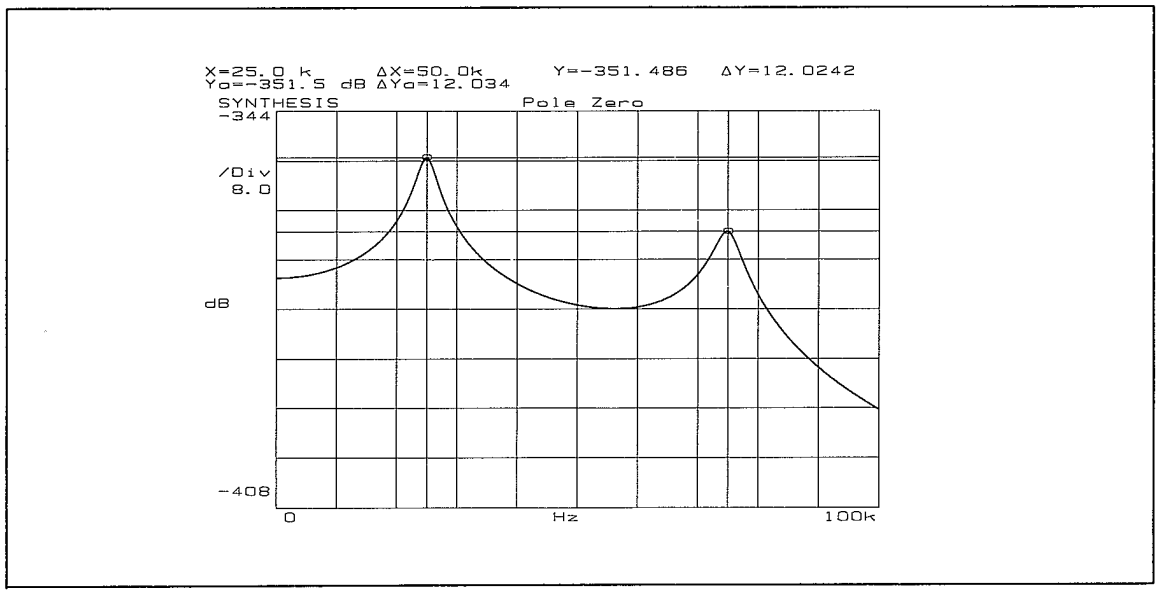


Figure 2-1 (OV) Marker Positions

2-5 REQUIRED TEST EQUIPMENT

The recommended test equipment is listed in table 1-4. If the recommended equipment is not available, a substitute may be used which meets or exceeds the required characteristics given in table 1-4.

2-6 INITIAL EQUIPMENT SETUP

When the recommended test equipment of table 1-4 is used to complete the operational verification, the instruments listed below must be set to the preset conditions listed before beginning the test. In each test, any unspecified parameters should be set to the following conditions:

HP 3325A frequency synthesizer

Function	. . . .	SINE WAVE (~)
Frequency	. . . .	1 kHz
Amplitude	. . . .	1 mVrms
Phase	. . . .	0 Degrees
dc Offset	. . . .	0V
Modulation	. . . .	OFF
Sweep	. . . .	OFF

Fluke 5200 ac calibrator

Frequency	. . . .	1 kHz
Amplitude	. . . .	.01 Vrms
Voltage Error %	. . . .	OFF
Vernier	. . . .	0
Mode	. . . .	OPER
Control	. . . .	LOCAL
Phase Lock	. . . .	OFF
Sense	. . . .	INTERNAL

2-7 SELF TEST

This test determines if the HP 3562A is operating correctly. No tests should be attempted until the instrument passes this test.

Required Test Equipment

None

Procedure

1. Press the HP 3562A keys as follows:

   SPCL FCTN . . . . SELF TEST

2. This test takes about 0.5 minutes to complete.

3. When "SELF TEST PASSES" is displayed in the lower right corner of the display, check PASS on the Operational Verification Test Record.

If Test Fails:

Go to "Fault Isolation Section", Section VII.

2-8 DC OFFSET

This test measures the level of the dc offset generated with auto cal on.

Required Test Equipment

(2) 50Ω feedthrough terminations . . . . HP 11048C

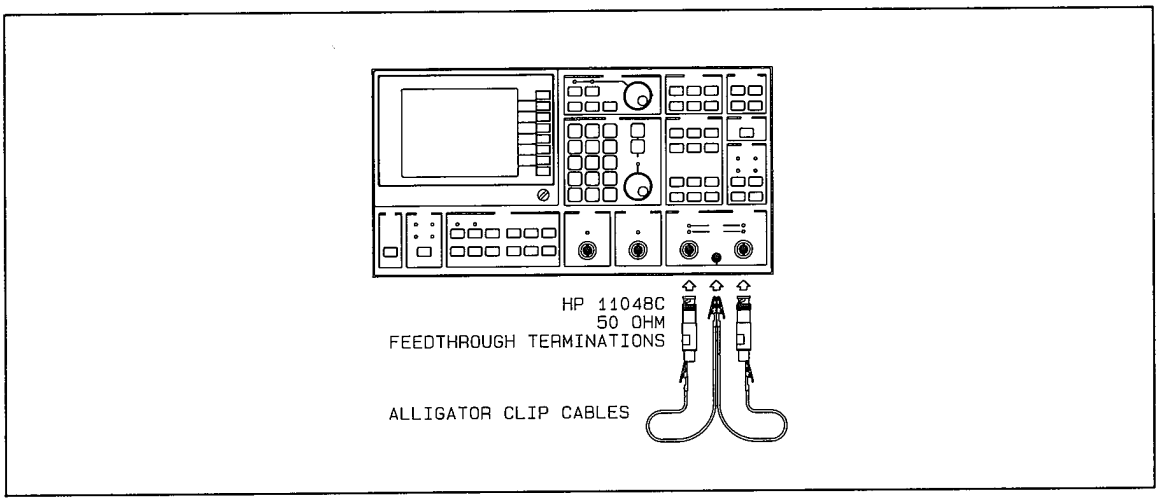


Figure 2-2 (OV) DC Offset Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-2. Keep the leads to chassis ground as short as possible.

B. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	AUTO ON		
	. . . .	SINGLE CAL		
WINDOW	. . . .	UNIFRM		
AVG	. . . .	**2**	. . . .	ENTER
	. . . .	STABLE		
FREQ	. . . .	**1** kHz		
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS
A & B				
X	. . . .	X VALUE	. . . .	**0** Hz
RANGE	. . . .	**−51** dBVrms		
START				

C. Record the Ya marker reading on the Operational Verification Test Record for the CHAN 1 measured value.

D. Record the Yb marker reading on the Operational Verification Test Record for CHAN 2 measured value.

If Test Fails Check:

Adjustments Section III	Track and Hold Offset Adjustment Input DC Offset Adjustment
Troubleshooting Section VIII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards

2-9 AMPLITUDE ACCURACY and FLATNESS

This test measures the amplitude accuracy and flatness of the HP 3562A using the amplitude reference of the ac calibrator.

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
AC Calibrator	. . . .	Fluke 5200A

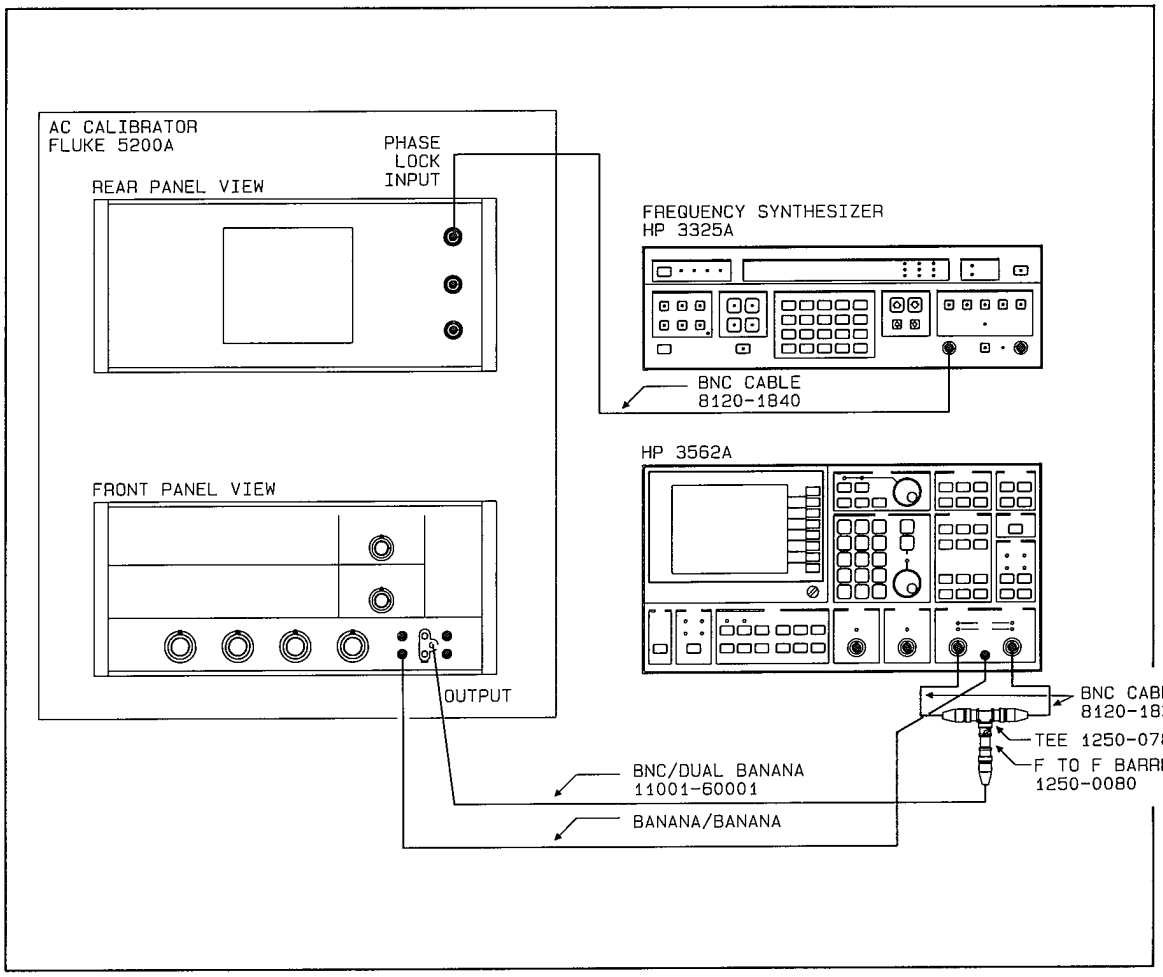


Figure 2-3(OV) Amplitude Accuracy and Flatness Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-3 . Refer to "Initial Equipment Setup," section 2-6, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer

Amplitude	. . . .	1 Vrms
Frequency	. . . .	1 kHz
Function	. . . .	Sine Wave

AC Calibrator

Phase Lock	. . . .	ON
Sense	. . . .	INTERNAL
Mode	. . . .	OPER
Frequency	. . . .	1 kHz
Amplitude	. . . .	2.7698 Vrms

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
WINDOW	. . . .	FLAT TOP		
AVG	. . . .	**4**	. . . .	ENTER
	. . . .	STABLE		
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS

A & B

Table 2-1 (OV) Amplitude Accuracy and Flatness

HP 3562A Range Setting	Signal Frequency	ac Calibrator Amplitude	Specification Lower Limit	Specification Upper Limit
9 dBVrms	1 kHz	2.8184 Vrms	8.849 dBV	9.151 dBV
9 dBVrms	99 kHz	2.8184 Vrms	8.849 dBV	9.151 dBV
0 dBVrms	1 kHz	1.0000 Vrms	−.1513 dBV	.1513 dBV
0 dBVrms	99 kHz	1.0000 Vrms	−.1513 dBV	.1513 dBV
−13 dBVrms	1 kHz	.22387 Vrms	−13.15 dBV	−12.85 dBV
−13 dBVrms	99 kHz	.22387 Vrms	−13.15 dBV	−12.85 dBV

D. For each of the frequencies listed in table 2-1 perform steps 1 through 7:

1. Press the HP 3562A keys as follows:

RANGE	. . . .	To range setting in table	
FREQ	. . . .	CENTER FREQ . . .	To signal frequency in table

2. Set the ac calibrator to the signal frequency.

3. Set the frequency synthesizer to the signal frequency.

4. Set the ac calibrator's amplitude.

5. Press the HP 3562A keys as follows:

START		
SPCL		
MARKER	. . . .	MRKR → PEAK

6. Record the Ya marker reading on the Operational Verification Test Record for CHAN 1.

7. Record the Yb marker reading on the Operational Verification Test Record for CHAN 2.

If Test Fails Check:

Adjustments Section III	2nd Pass Gain Adjustment ADC Offset and Reference Adjustment Input Flatness Adjustment Input Attenuator Adjustments Calibrator Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards A30 Analog Source Board

2-10 AMPLITUDE AND PHASE MATCH

This test determines if the HP 3562A's amplitude and phase match between channel 1 and channel 2 are within the specified limits.

Required Test Equipment

BNC Tee HP 1250-0781

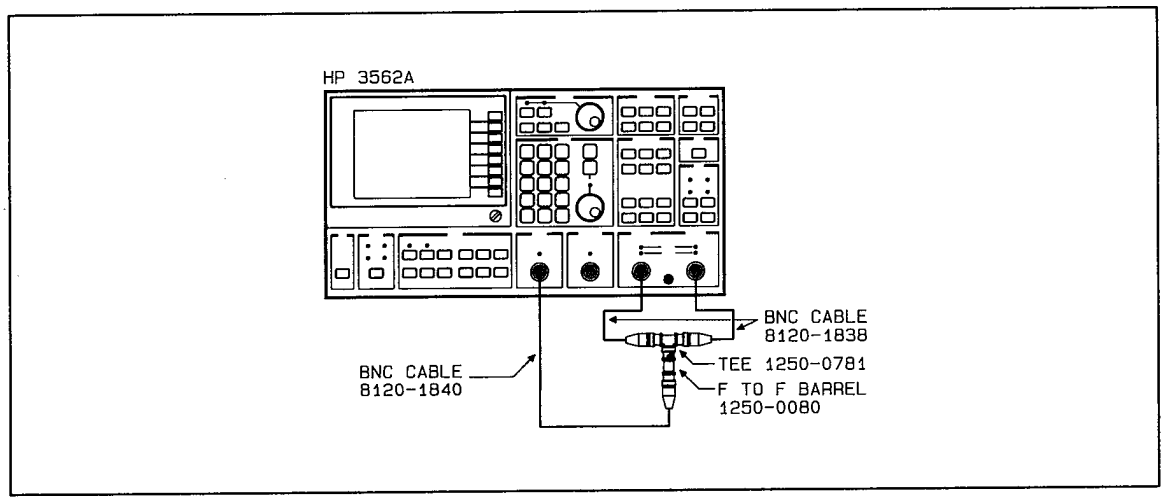


Figure 2-4 (OV) Amplitude and Phase Match Test Setup

Procedure

A. Connect the HP 3562A as shown in figure 2-4. The cables to channel 1 and channel 2 must be the same length.

B. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET
CAL	. . . .	SINGLE CAL
INPUT **COUPLE**	. . . .	CHAN1 AC
	. . . .	CHAN2 AC
	. . . .	GROUND CHAN1
	. . . .	GROUND CHAN2

SELECT TRIG	. . . .	**0** V		
	. . . .	SOURCE TRIG		
WINDOW	. . . .	UNIFRM		
AVG	. . . .	**16**	. . . .	ENTER
	. . . .	STABLE		
SOURCE	. . . .	PRIODC CHIRP		
MEAS DISP	. . . .	FREQ RESP		
SCALE	. . . .	X FIXD SCALE	. . . .	**.375, 100** kHz

C. Perform steps 1 through 6:

1. Press the HP 3562A keys as follows:

RANGE	. . . .	**−47** dBVrms		
SOURCE	. . . .	SOURCE LEVEL	. . . .	**−49** dBVrms
SCALE	. . . .	Y FIXD SCALE	. . . .	**−.2, .2** dB
START				
Y	. . . .	**−.1, .1** dB		

2. If the measurement is within the marker band, check PASS on the Operation Verification Test Record for part 1.

3. Press the HP 3562A keys as follows:

RANGE	. . . .	**0** dBVrms		
SOURCE	. . . .	SOURCE LEVEL	. . .	**0** dBVrms
START				
Y	. . . .	**−.1,.1** dB		

4. If the measurement is within the marker band, check PASS on the Operation Verification Test Record for part 2.

5. Press the HP 3562A keys as follows:

RANGE	. . . .	**10** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**10** dBVrms
START			
Y	. . . .	**−.1,.1** dB	

6. If the measurement is within the marker band, check PASS on the Operation Verification Test Record for part 3.

D. Perform steps 1 through 6:

1. Press the HP 3562A keys as follows:

RANGE	. . . .	**−47** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**−49** dBVrms
COORD	. . . .	PHASE	
START			
SCALE	. . . .	Y FIXD SCALE	**−1, 1** Degree
Y	. . . .	Y VALUE	**−.5, .5** Degree

2. If the measurement is within the marker band, check PASS on the Operation Verification Test Record for part 4.

3. Press the HP 3562A keys as follows:

RANGE	. . .	**0** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**0** dBVrms
START			
Y	. . . .	Y VALUE	**−.5,.5** Degree

4. If the measurement is within the marker band, check PASS on the Operation Verification Test Record for part 5.

5. Press the HP 3562A keys as follows:

RANGE	. . . .	**10** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**10** dBVrms
START			
Y	. . . .	Y VALUE	**−.5, .5** Degree

6. If the measurement is within the marker band, check PASS on the Operation Verification Test Record for part 6.

If Test Fails Check:

Adjustments Section III	2nd Pass Gain Adjustment ADC Offset and Reference Adjustment Input Flatness Adjustment Input Attenuator Adjustments Calibrator Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards A30 Analog Source Board

2-11 FREQUENCY ACCURACY

This test measures the frequency accuracy of the HP 3562A.

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
50Ω feedthrough termination	. . . .	HP 11048C

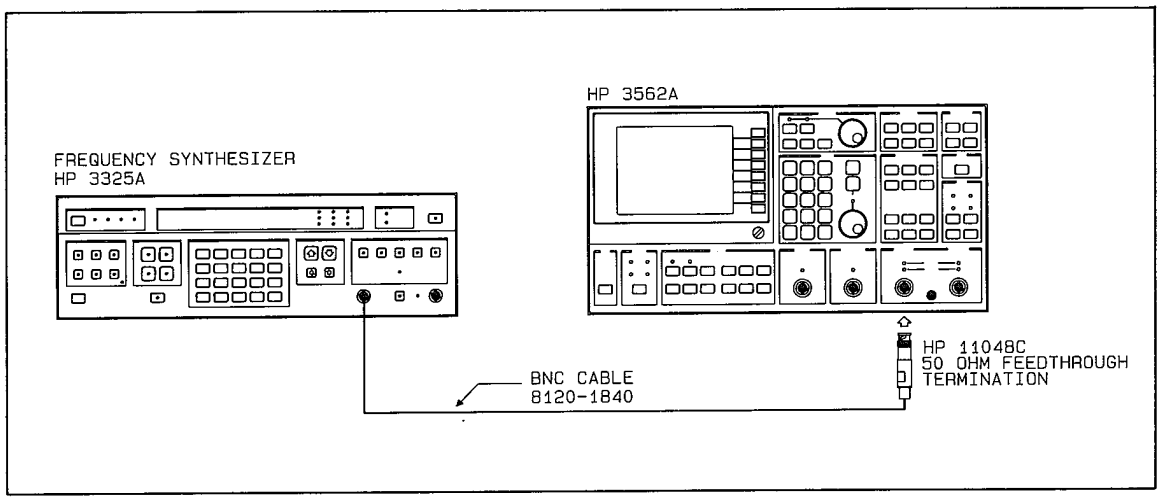


Figure 2-5 (OV) Frequency Accuracy Test Setup

Procedure

A. Connect the test equipment as shown in figure 2-5. Refer to "Initial Equipment Setup," section 2-6, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer

Frequency	. . . .	99 kHz
Amplitude	. . . .	1 Vrms
Function	. . . .	Sine Wave

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
RANGE	. . . .	**0** dBVrms		
FREQ	. . . .	CENTER FREQ	. . . .	**99** kHz
AVG	. . . .	**2**	. . . .	ENTER
	. . . .	STABLE		
START				
X				

D. Record the X marker reading as the measured value on the Operational Verification Test Record.

If Test Fails Check:

Adjustments Section III	20.48 MHz Reference Adjustment
Troubleshooting Section VII	A31 Trigger Board

2-12 COMMON MODE REJECTION

This test measures the capability of the 3562A to ignore a signal which appears simultaneously and in phase at the high and low input of a single channel.

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
Common Mode Cable	. . . .	HP 03562-61620

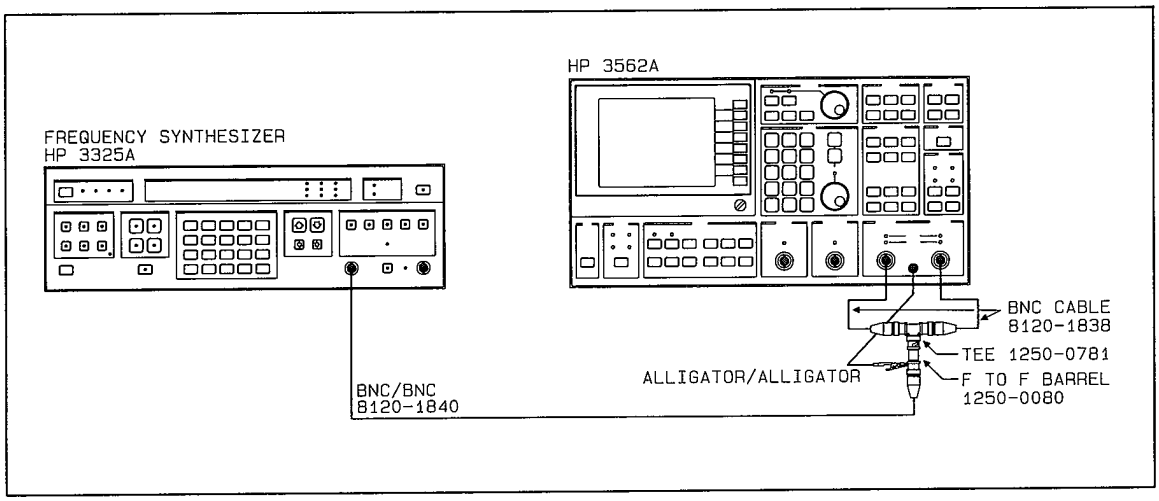


Figure 2-6 (OV) Common Mode Rejection Test Setup #1

Procedure

A. Connect the test instruments as shown in figure 2-6. Refer to "Initial Equipment Setup", paragraph 2-6, for unspecified parameters.

B. Set the frequency synthesizer as follows:

Function	. . . .	Sine Wave
High Voltage Output	. . . .	ON

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
AVG	. . . .	**16**	. . . .	ENTER
	. . . .	STABLE		
WINDOW	. . . .	FLAT TOP		
A & B				
UNITS	. . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS

Table 2-2 (OV) Common Mode Rejection

Signal Amplitude	Signal Frequency	Range Setting #1	Range Setting #2	Specification
5.680 Vrms	66 Hz	16 dBVrms	−8 dBVrms	≤80 dB
3.413 Vrms	500 Hz	11 dBVrms	−12 dBVrms	≤65 dB

D. For each of the frequencies listed in table 2-2 perform steps 1 through 9:

1. Set the Frequency Synthesizer as follows:

Amplitude	. . . .	To signal amplitude in table
Frequency	. . . .	To signal frequency in table

2. Press the HP 3562A keys as follows:

FREQ	. . . .	CENTER FREQ	. . . . To signal frequency in table
RANGE	. . . .	To range setting #1 in table	
START			
SPCL **MARKER**	. . . .	MRKR → PEAK	

3. Record the Ya marker amplitude reading on the Operation Verification Test Record as the first measurement for CHAN 1.

4. Record the Yb marker amplitude reading on the Operation Verification Test Record as the first measurement for CHAN 2.

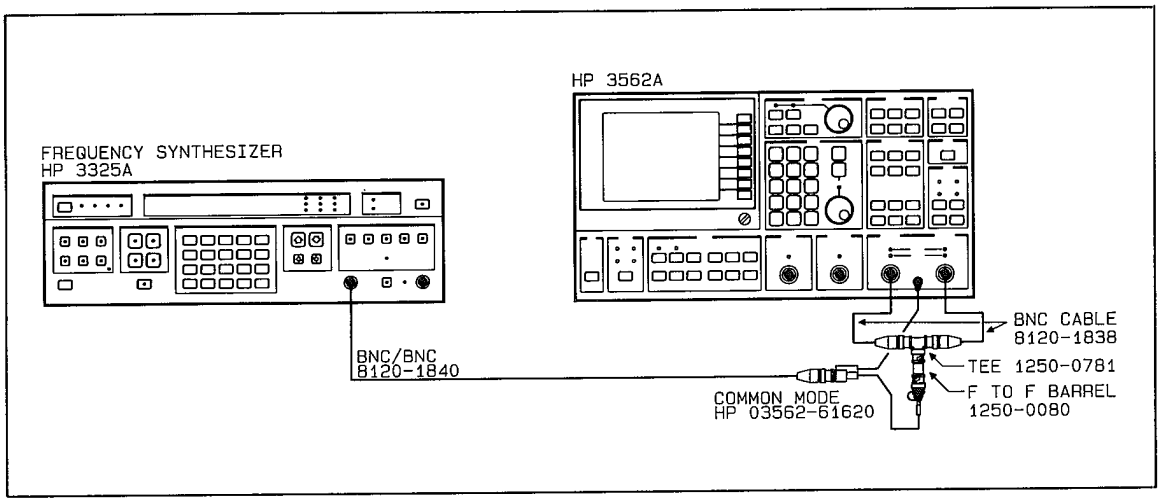


Figure 2-7 (OV) Common Mode Rejection Test Setup #2

5. Connect the test instruments as shown in figure 2-7.

6. Press the HP 3562A keys as follows:

RANGE	. . . .	To range setting #2 in table
START		
SCALE	. . . .	Y AUTO SCALE
X	. . . .	To signal frequency in table

7. When the average is complete, record the Ya amplitude reading on the Operation Verification Test Record as the second measurement for CHAN 1.

8. Record the Yb amplitude reading on the Operation Verification Test Record as the second measurement for CHAN 2.

9. Calculate the relative value for both channels:

First Measurement	—	Second Measurement	=	Relative Value

If Test Fails Check:

Adjustments Section III	Input dc Offset Adjustment Calibrator Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A30 Analog Source

2-13 SINGLE CHANNEL PHASE ACCURACY

This test measures the phase accuracy of the HP 3562A relative to the phase of the trigger signal. The frequency synthesizer is used to input a square wave to one channel and the external trigger input.

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
50Ω feedthrough termination	. . . .	HP 11048C
2 BNC Tees	. . . .	HP 1250-0781

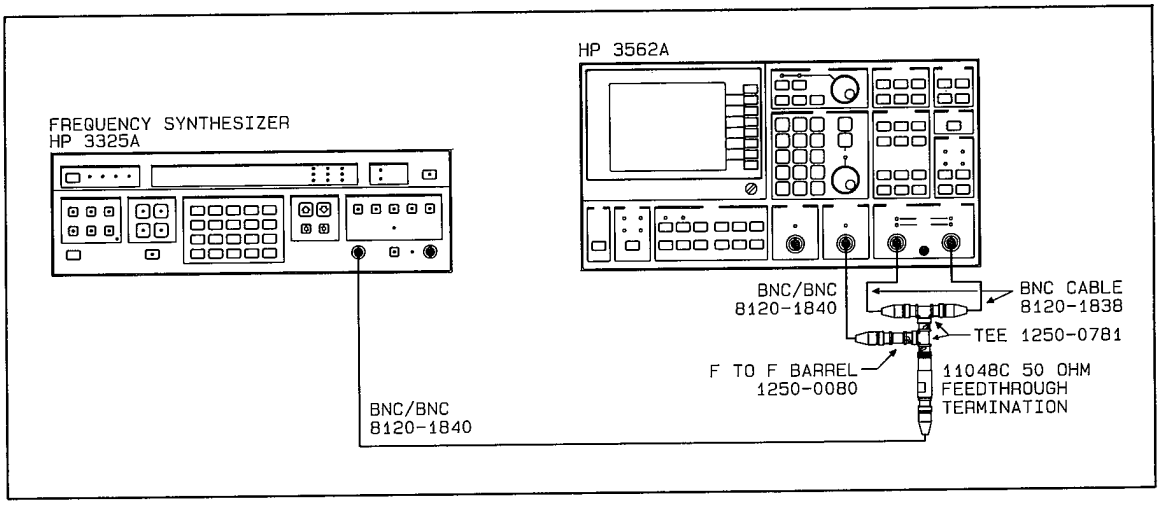


Figure 2-8 (OV) Single Channel Phase Accuracy Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-8. Refer to "Initial Equipment Setup," section 2-6, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer

Frequency	. . . .	9 kHz
Amplitude	. . . .	1 Vrms
DC Offset	. . . .	0 Vdc
Function	. . . .	Square Wave

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
SELECT MEAS	. . . .	POWER SPEC		
AVG	. . . .	**5**	. . . .	ENTER
	. . . .	STABLE		
	. . . .	TIM AV ON		
WINDOW	. . . .	UNIFRM		
SELECT TRIG	. . . .	**0** V		
	. . . .	EXT		
MEAS DISP	. . . .	FILTRD INPUT	. . . .	AVRG
			. . . .	LINEAR SPEC 1
B			. . . .	LINEAR SPEC 2
A & B				
COORD	. . . .	PHASE		
START				
X	. . . .	**9** kHz		

D. Record the Ya marker reading on the Operational Verification Test Record for CHAN 1.

E. Record the Yb marker reading on the Operational Verification Test Record for CHAN 2.

F. Set the frequency Synthesizer as follows:

Frequency	. . . .	99 kHz

G. Press the HP 3562A keys as follows:

SELECT		
TRIG	. . . .	CHAN1 INPUT
START		
X	. . . .	**99** kHz

H. Record the Ya marker reading on the Operational Verification Test Record for CHAN 1.

I. Record the Yb marker reading on the Operational Verification Test Record for CHAN 2.

If Test Fails Check:

Adjustments	None
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards A31 Trigger Board A6 Digital Filter Controller A1 Digital Source

2-14 NOISE AND SPURIOUS SIGNAL LEVEL

This test measures the level of the noise floor and any spurious signals generated within the HP 3562A.

Required Test Equipment

(2) 50Ω feedthrough terminations . . . . HP 11048C

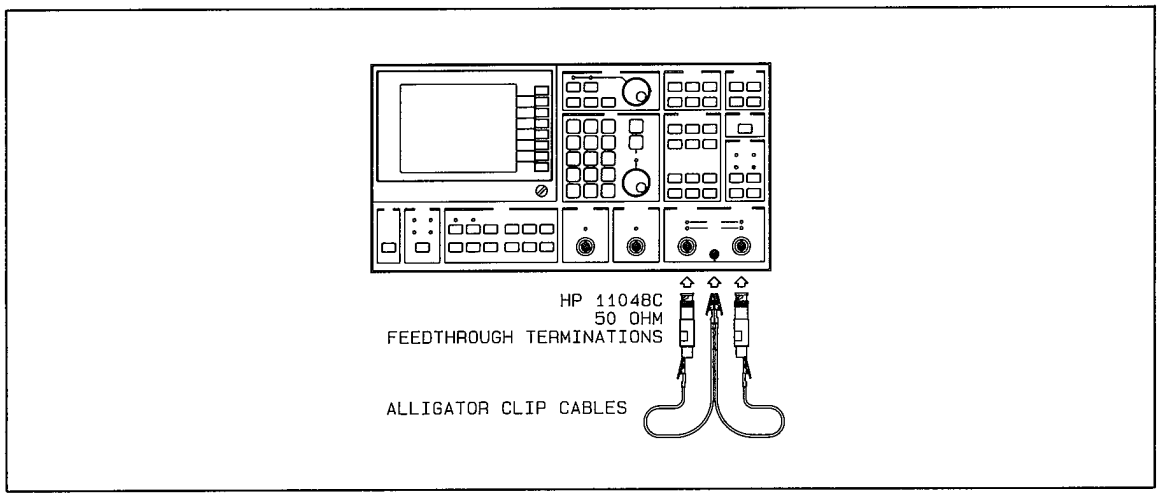


Figure 2-9 (OV) Noise and Spurious Signal Level Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-9. Keep the leads from the feed-through terminations to chassis ground as short as possible.

B. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
RANGE	. . . .	**−51** dBVrms		
INPUT COUPLE	. . . .	CHAN 1 AC		
	. . . .	CHAN 2 AC		
FREQ	. . . .	FREQ SPAN	. . . .	**1** kHz
	. . . .	START FREQ	. . . .	**20** Hz
AVG	. . . .	**20**	. . . .	ENTER
	. . . .	STABLE		
WINDOW	. . . .	UNIFRM		
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS

C. Perform steps 1 through 4:

1. Press the HP 3562A keys as follows:

START		
SCALE	. . . .	Y AUTO SCALE
SPCL MARKER	. . . .	MRKR → PEAK

2. If the Ya marker reading is less than or equal to −131 dBVrms check PASS on the Operation Verification Test Record for CHAN 1.

3. Press the HP 3562A keys as follows:

B		
SCALE	. . . .	Y AUTO SCALE
SPCL		
MARKER	. . . .	MRKR → PEAK

4. If the Yb marker reading is less than or equal to −131 dBVrms check PASS on the Operation Verification Test Record for CHAN 2.

Table 2-3 (OV) Spurious Signals

Start Frequency	Frequency Span	Specification
20 Hz	1 kHz	≤ −131 dBV
1 kHz	10 kHz	≤ −131 dBV
90 kHz	10 kHz	≤ −131 dBV

D. For the rest of the start frequencies in table 2-3 perform steps 1 through 4:

1. Press the HP 3562A keys as follows:

FREQ	. . . .	START FREQ	. . . .	To start frequency in table
A	. . . .	FREQ SPAN	. . . .	To frequency span in table
START				
SPCL				
MARKER	. . . .	MRKR → PEAK		

2. If the Ya marker reading is less than or equal to −131 dBVrms check PASS on the Operation Verification Test Record for CHAN 1.

3. Press the HP 3562A keys as follows:

B

SPCL
MARKER . . . . MRKR →
PEAK

4. If the Yb marker reading is less than or equal to −131 dBVrms check PASS on the Operation Verification Test Record for CHAN 2.

Table 2-4 (OV) Noise Level

Start Frequency	Frequency Span	Specification
20 Hz	1 kHz	≤ -134 dBV/$\sqrt{\text{Hz}}$
1 kHz	50 kHz	≤ -144 dBV/$\sqrt{\text{Hz}}$
50 kHz	50 kHz	≤ -144 dBV/$\sqrt{\text{Hz}}$

E. Press the HP 3562A keys as follows:

WINDOW . . . . FLAT TOP

UNITS . . . . P SPEC UNITS . . . . V/$\sqrt{\text{Hz}}$

F. For each of the start frequencies listed in table 2-4 perform steps 1 through 5:

1. Press the HP 3562A keys as follows:

FREQ . . . . START FREQ . . . . To start frequency in table

. . . . FREQ SPAN . . . . To frequency span in table

START

2. When the average is complete, press the HP 3562A keys as follows:

A

SPCL
MARKER . . . . MRKR →
PEAK

3. If the Ya marker reading is less than or equal to the specification, check PASS on the Operation Verification Test Record for CHAN 1.

4. Press the HP 3562A keys as follows:

   B

   SPCL
   MARKER . . . . MRKR →
   PEAK

5. If the Yb marker reading is less than or equal to the specification, check PASS on the Operation Verification Test Record for CHAN 2.

If Test Fails Check:

Adjustments Section III	2nd Pass Gain Adjustment ADC Offset and Reference Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter A5 Digital Filter A4 Local Oscillator

2-15 SOURCE AMPLITUDE ACCURACY AND FLATNESS

This test measures the amplitude accuracy and flatness of the HP 3562A source.

Required Test Equipment

None

Procedure

A. Connect the HP 3562A source to channel 1.

B. Press the HP 3562A keys as follows:

PRESET . . . . RESET

CAL . . . . SINGLE
CAL

INPUT
COUPLE . . . . GROUND
CHAN 1

RANGE . . . . 5 V

MEAS
MODE . . . . SWEPT
SINE . . . . LINEAR
SWEEP

SOURCE

. . . . SOURCE LEVEL . . . . **4.47** V

UNITS . . . . P SPEC . . . . VOLTS
UNITS RMS

. . . . VOLTS

FREQ . . . . STOP
FREQ . . . . **65** kHz

START

C. When the sweep is complete perform steps 1 and 2:

1. Press the HP 3562A keys as follows:

SCALE . . . . Y FIXD
SCALE . . . . **9,11** dB

2. If the trace is between the 9 dB and the 11 dB limits, check PASS on the Operation Verification Test Record for the 0 to 65 kHz span.

D. Press the HP 3562A keys as follows:

FREQ . . . . START
FREQ . . . . **65** kHz

START

E. When the sweep is complete perform stage 1 and 2:

1. Press the HP 3562A keys as follows:

SCALE . . . . Y FIXD
SCALE . . . . **8.5, 11** dB

2. If the trace is between the 8.5 dB and the 11 dB limits, check PASS on the Operation Verification Test Record for the 65 kHz to 100 kHz span.

If Test Fails Check:

Adjustments	None
Troubleshooting Section VIII	A30 Analog Source Board

2-16 OPERATIONAL VERIFICATION TEST RECORD

2-7 Self Test	PASS	

2-8 DC Offset			
Range Setting	Measured Value		Specification
	CHAN 1	CHAN 2	
−51 dBV			< −71 dBV

2-9 Amplitude Accuracy and Flatness					
CHAN 1 and CHAN 2 Floating					
Range Setting	Signal Frequency	Specification		Measured Value	
		Lower Limit	Upper Limit	CHAN 1	CHAN 2
9 dBV	1 kHz	8.849 dBV	9.151 dBV		
9 dBV	99 kHz	8.849 dBV	9.151 dBV		
0 dBV	1 kHz	−0.1513 dBV	0.1513 dBV		
0 dBV	99 kHz	−0.1513 dBV	0.1513 dBV		
−13 dBV	1 kHz	−13.15 dBV	−12.85 dBV		
−13 dBV	99 kHz	−13.15 dBV	−12.85 dBV		

2-10 Amplitude and Phase Match						
Range Setting	Part	PASS	Amplitude Specification	Part	PASS	Phase Specification
−49 dBV	1		±0.1 dB	4		±0.5°
0 dBV	2		±0.1 dB	5		±0.5°
10 dBV	3		±0.1 dB	6		±0.8°

2-11 Frequency Accuracy			
Signal Frequency	Specification Lower Limit	Upper Limit	Measured Value
99,000 Hz	98.996 kHz	99.004 kHz	

2-12 Common Mode Rejection				
	First Measurement −	Second Measurement =	Relative Value	
Signal Frequency	First Measurement CHAN 1	Second Measurement CHAN 1	**Measured Value** CHAN 1	Specification
66 Hz				≥80 dB
500 Hz				≥65 dB
Signal Frequency	First Measurement CHAN 2	Second Measurement CHAN 2	**Measured Value** CHAN 2	Specification
66 Hz				≥80 dB
500 Hz				≥65 dB

2-13 Single Channel Phase Accuracy						
Signal Frequency	Trigger		Specification		**Measured Value**	
	Slope	Type	Lower Limit	Upper Limit	CHAN 1	CHAN 2
9 kHz	POS	EXT	−92.5°	−87.5°		
99 kHz	POS	CHAN 1	−102°	−78.0°		

2-14 Noise and Spurious Signal Level				
Spurious Signals				
Start Frequency	Frequency Span	**PASS** CHAN 1	**PASS** CHAN 2	Specification
20 Hz	1 kHz			≤ −131 dBV
1 kHz	10 kHz			≤ −131 dBV
90 kHz	10 kHz			≤ −131 dBV
Noise Level				
Start Frequency	Frequency Span	**PASS** CHAN 1	**PASS** CHAN 2	Specification
20 Hz	1 kHz			≤ −134 dBV/$\sqrt{\text{Hz}}$
1 kHz	50 kHz			≤ −144 dBV/$\sqrt{\text{Hz}}$
50 kHz	50 kHz			≤ −144 dBV/$\sqrt{\text{Hz}}$

2-15 Source Amplitude Accuracy and Flatness	
0 Hz to 65 kHz	**PASS**
65 kHz to 100 kHz	**PASS**

PART B
PERFORMANCE TESTS

2-17 INTRODUCTION

To verify the the HP 3562A is meeting its published specifications, the performance tests must be done in the order listed every twelve months. Use the "Operational Verification," part A, for incoming and after-repair inspections. The performance tests take approximately eight hours to complete.

2-18 HOW TO USE PART B

1. Start each performance test by setting the test equipment to the preset conditions listed in the "Initial Equipment Setup," paragraph 2-20.

2. There are two types of keys on the HP 3562A, hard keys and soft keys. In this section the hard keys are in bold text, and the soft keys are in regular test.

   For example:

   FREQ .... FREQ SPAN .... **10** kHz

   This example instructs you to press the hard key FREQ and the soft key FREQ SPAN. After pressing the soft key FREQ SPAN enter 10 kHz.

3. Refer to figure 2-10 for the position of the X and Y marker readings.

4. Record the results of each of the performance tests on the "Performance Test Record," paragraph 2-42. This test record may be reproduced without written permission of Hewlett-Packard.

5. If the HP 3562A fails a test, use the "If Test Fails Check:" paragraph at the end of each test.

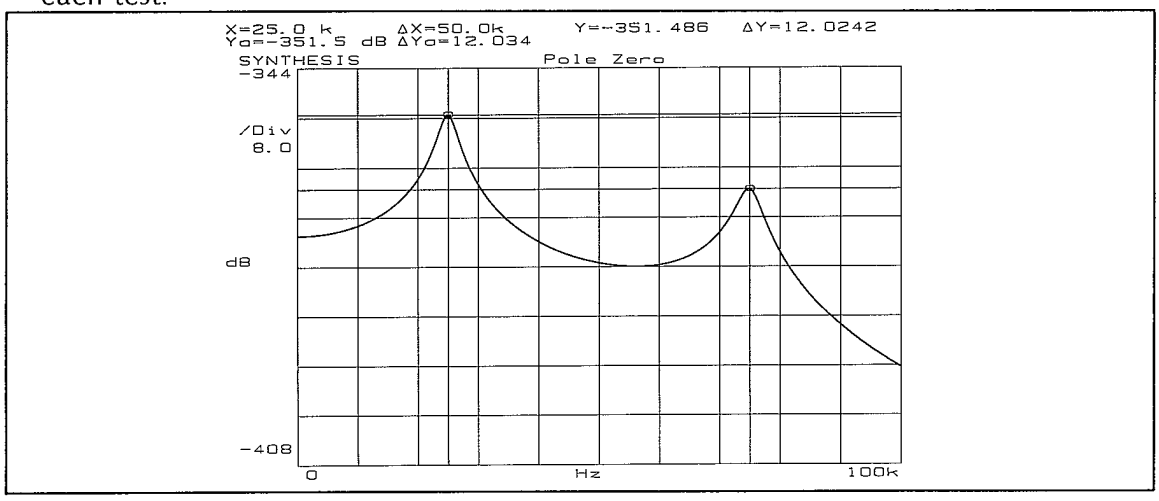


Figure 2-10 Marker Positions

2-19 REQUIRED TEST EQUIPMENT

The recommended test equipment is listed in table 1-4. If the recommended equipment is not available, a substitute may be used which meets or exceeds the required characteristics given in table 1-4.

2-20 INITIAL EQUIPMENT SETUP

When the recommended test equipment of table 1-4 is used to complete the performance tests, the instruments listed below must be set to the preset conditions listed before beginning the test. In each test, any unspecified parameters should be set to the following conditions:

HP 3325A Frequency Synthesizer

Function	. . . .	SINE WAVE (~)
Frequency	. . . .	1 kHz
Amplitude	. . . .	1 mVrms
Phase	. . . .	0 Degrees
dc Offset	. . . .	0V
Modulation	. . . .	OFF
Sweep	. . . .	OFF

Fluke 5200 AC Calibrator

Frequency	. . . .	1 kHz
Amplitude	. . . .	.01 Vrms
Voltage Error %	. . . .	OFF
Vernier	. . . .	0
Mode	. . . .	OPER
Control	. . . .	LOCAL
Phase Lock	. . . .	OFF
Sense	. . . .	INTERNAL

HP 3456A Digital Voltmeter

Function	. . . .	ac V (~V)
Range	. . . .	AUTO
Trigger	. . . .	INTERNAL
Sample Rate	. . . .	MAXIMUM
High Resolution	. . .	ON
Auto Cal	. . . .	ON

2-21 SELF TEST

This test determines if the HP 3562A is operating correctly. No tests should be attempted until the instrument passes this test.

Required Test Equipment

None

Procedure

1. Press the HP 3562A keys as follows:

   SPCL FCTN . . . . SELF TEST

2. This test takes about 0.5 minutes to complete.

3. When "SELF TEST PASSES" is displayed in the lower right corner of the display, check PASS on the Performance Test Record.

If Test Fails:

Go to "Fault Isolation," Section VII.

2-22 DC OFFSET

This test measures the level of the dc offset generated within the HP 3562A with auto on.

Specification

For range settings between +27 dBV and −35 dBV the DC offset will be greater than 30 dB below the range setting. For range settings between −36 dBV and −51 dBV the offset will be greater than 20 dB below the range setting.

Required Test Equipment

(2) 50Ω feedthrough terminations . . . . HP 11048C

Table 2-5 DC Offset

Range Setting	Specification
7 dBVrms	< −23 dBV
−35 dBVrms	< −65 dBV
−51 dBVrms	< −71 dBV

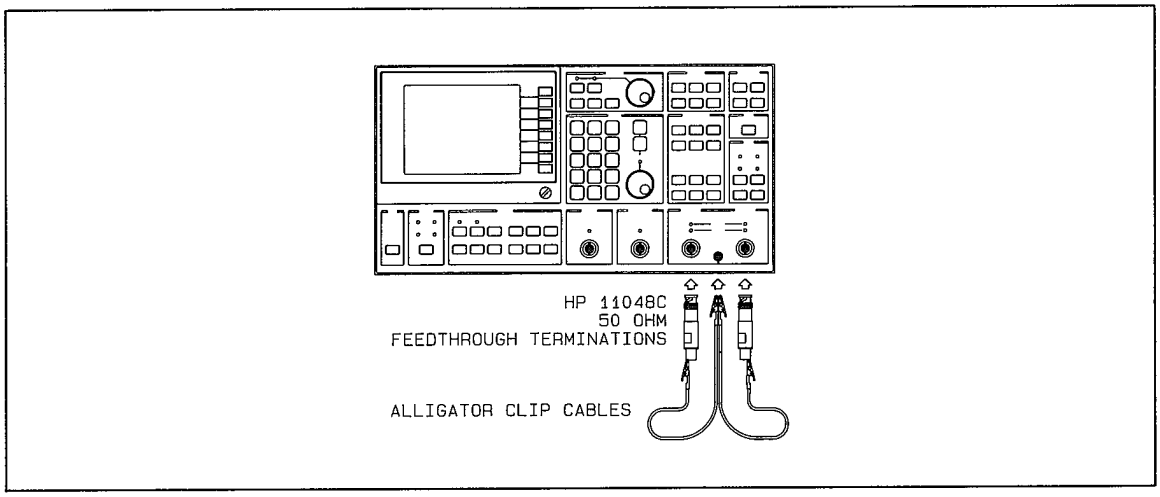


Figure 2-11 DC Offset Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-11. Keep the leads to chassis ground as short as possible.

B. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	AUTO ON		
	. . . .	SINGLE CAL		
WINDOW	. . . .	UNIFRM (NONE)		
AVG	. . . .	**2**	. . . .	ENTER
	. . . .	STABLE		
FREQ	. . . .	**1** kHz		
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
A & B			. . . .	VOLTS
X	. . . .	**0** Hz		

C. For each of the range settings listed in table 2-5, perform steps 1 through 3:

1. Press the HP 3562A keys as follows:

RANGE	. . . .	To range setting in table
START		

2. Record the Ya marker reading on the performance test record for the CHAN 1 measured value.

3. Record the Yb marker reading on the performance test record for the CHAN 2 measured value.

If Test Fails Check:

Adjustments Section III	Track and Hold Offset Adjustment Input DC Offset Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards

2-23 AMPLITUDE ACCURACY and FLATNESS

This test measures the amplitude accuracy and flatness of the HP 3562A using the amplitude reference of the ac calibrator.

Specification

If the measurement of a signal is between the BNC center conductor and BNC shell and the amplitude is equal to the range setting, the marker amplitude reading will not deviate from the actual signal amplitude by more than:

Range Setting	Accuracy
+27 dBV to −40 dBV	±0.15 dB ±0.015% Range Setting
−41 dBV to −51 dBV	±0.25 dB ±0.025% Range Setting

If the measurement of a signal includes a signal between the BNC shell and the chassis, the marker amplitude reading will not deviate from the actual signal amplitude by more than:

Range Setting	Accuracy
+27 dBV to −40 dBV	±0.50 dB ±.015% Range Setting
−41 dBV to −51 dBV	±0.60 dB ±.025% Range Setting

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
AC Calibrator	. . . .	Fluke 5200A
BNC Tee	. . . .	HP 1250-0781

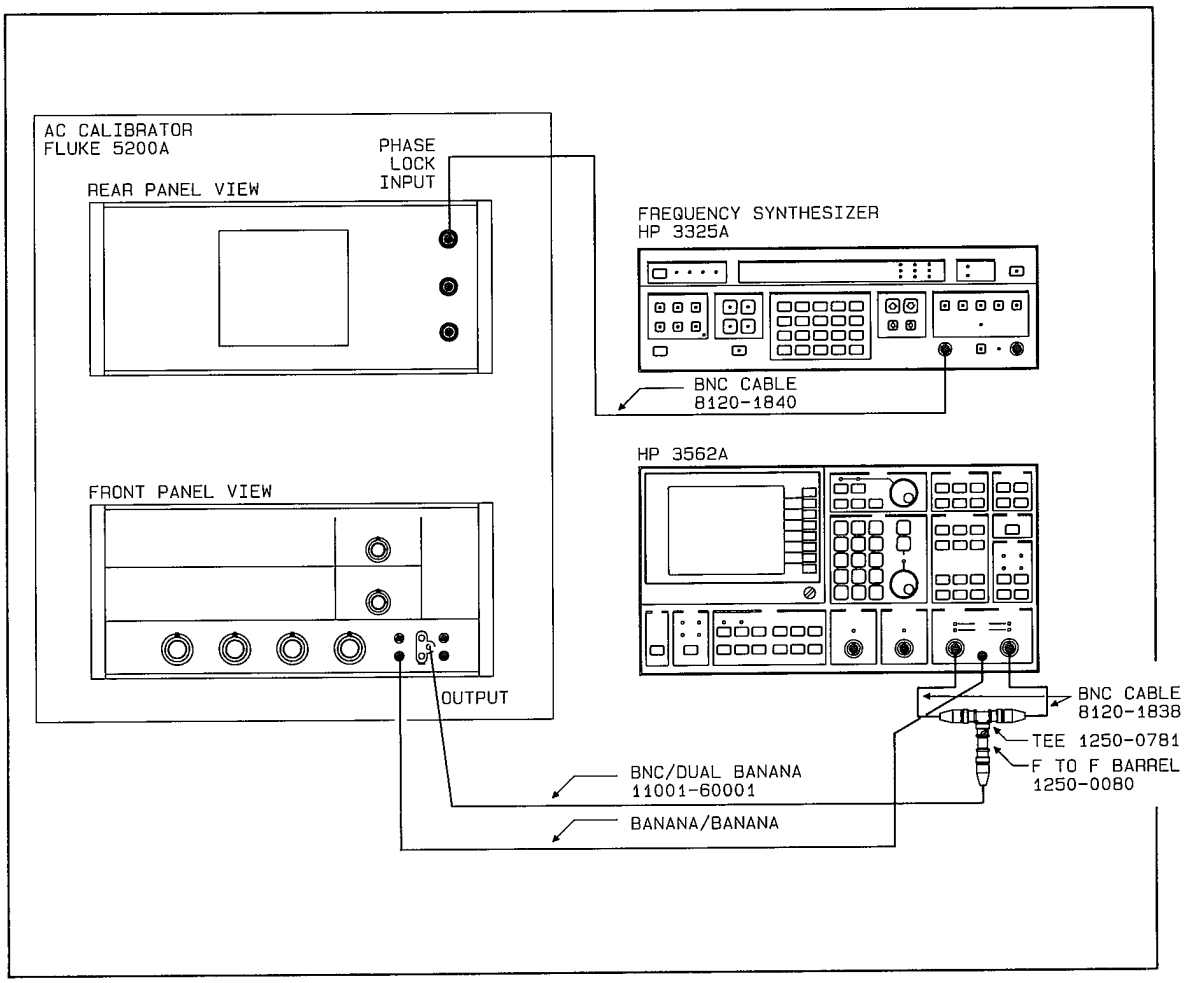


Figure 2-12 Amplitude Accuracy and Flatness Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-12. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer

Amplitude	. . . .	0.5 Vrms
Frequency	. . . .	1 kHz
Function	. . . .	Sine Wave

AC Calibrator

Phase Lock	. . . .	ON
Sense	. . . .	INTERNAL
Mode	. . . .	OPER
Frequency	. . . .	1 kHz
Amplitude	. . . .	2.8184 Vrms

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
INPUT COUPLE	. . . .	GROUND CHAN 1		
	. . . .	GROUND CHAN 2		
WINDOW	. . . .	FLAT TOP		
AVG	. . . .	**4**	. . . .	ENTER
	. . . .	STABLE		
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS

A & B

Table 2-6 Amplitude Accuracy and Flatness Measurement One

BNC shell grounded				
HP 3562A Range Setting	Signal Frequency	AC Calibrator Amplitude	Specification Lower Limit	Upper Limit
9 dBVrms	1 kHz	2.8184 Vrms	8.849 dBV	9.151 dBV
9 dBVrms	99 kHz	2.8184 Vrms	8.849 dBV	9.151 dBV
−13 dBVrms	1 kHz	.22387 Vrms	−13.15 dBV	−12.85 dBV
−13 dBVrms	50 kHz	.22387 Vrms	−13.15 dBV	−12.85 dBV
−13 dBVrms	90 kHz	.22387 Vrms	−13.15 dBV	−12.85 dBV
−13 dBVrms	99 kHz	.22387 Vrms	−13.15 dBV	−12.85 dBV
−23 dBVrms	1 kHz	70.795 mVrms	−23.15 dBV	−22.85 dBV
−23 dBVrms	99 kHz	70.795 mVrms	−23.15 dBV	−22.85 dBV
−26 dBVrms	1 kHz	50.119 mVrms	−26.15 dBV	−25.85 dBV
−21 dBVrms	1 kHz	89.125 mVrms	−21.15 dBV	−20.85 dBV
−17 dBVrms	1 kHz	.14125 Vrms	−17.15 dBV	−16.85 dBV
−14 dBVrms	1 kHz	.19953 Vrms	−14.15 dBV	−13.85 dBV
−11 dBVrms	1 kHz	.28184 Vrms	−11.15 dBV	−10.85 dBV

D. For each of the frequencies listed in table 2-6 perform steps 1 through 7.

1. Press the HP 3562A keys as follows:

RANGE . . . . To range setting in table

FREQ . . . . CENTER FREQ . . . . To signal frequency in table

2. Set the ac calibrator to the signal frequency.

3. Set the frequency synthesizer to the signal frequency.

4. Set the ac calibrator's amplitude.

5. Press the HP 3562A keys as follows:

START

SPCL
MARKER . . . . MRKR → PEAK

6. Record the Ya marker reading on the Performance Test Record for the measured value CHAN 1.

7. Record the Yb marker reading on the Performance Test Record for the measured value CHAN 2.

Table 2-7 Amplitude Accuracy and Flatness Measurement Two

BNC shell grounded				
HP 3562A Range Setting	Signal Frequency	AC Calibrator Amplitude	Specification Lower Limit	Upper Limit
−51 dBVrms	1 kHz	2.8184 mVrms	−51.25 dBV	−50.75 dBV
−49 dBVrms	1 kHz	3.5481 mVrms	−49.25 dBV	−48.75 dBV
−47 dBVrms	1 kHz	4.4668 mVrms	−47.25 dBV	−46.75 dBV
−45 dBVrms	1 kHz	5.6234 mVrms	−45.25 dBV	−44.75 dBV
−43 dBVrms	1 kHz	7.0795 mVrms	−43.25 dBV	−42.75 dBV
−41 dBVrms	1 kHz	8.9125 mVrms	−41.25 dBV	−40.75 dBV
−39 dBVrms	1 kHz	11.220 mVrms	−39.25 dBV	−38.75 dBV

E. Repeat part D using table 2-7 for measurement two.

F. Press the HP 3562A keys as follows:

INPUT
COUPLE . . . . FLOAT
CHAN 1

. . . . FLOAT
CHAN 2

G. Reverse the banana plug connector at the ac calibrator so the high input signal goes to the BNC shell of HP 3562A's input channels. The BNC center conductor should be grounded for each channel.

Table 2-8 Amplitude Accuracy and Flatness Measurement Three

BNC center conductor grounded				
HP 3562A Range Setting	Signal Frequency	AC Calibrator Amplitude	Specification Lower Limit	Specification Upper Limit
8 dBVrms	1 kHz	2.4570 Vrms	7.499 dBV	8.501 dBV
8 dBVrms	99 kHz	2.4570 Vrms	7.499 dBV	8.501 dBV
−11 dBVrms	1 kHz	.27701 Vrms	−11.50 dBV	−10.50 dBV
−13 dBVrms	1 kHz	.21404 Vrms	−13.50 dBV	−12.50 dBV
−13 dBVrms	50 kHz	.21404 Vrms	−13.50 dBV	−12.50 dBV
−13 dBVrms	90 kHz	.21404 Vrms	−13.50 dBV	−12.50 dBV
−13 dBVrms	99 kHz	.21404 Vrms	−13.50 dBV	−12.50 dBV
−27 dBVrms	1 kHz	43.702 mVrms	−27.50 dBV	−26.50 dBV
−27 dBVrms	99 kHz	43.702 mVrms	−27.50 dBV	−26.50 dBV

H. Repeat part D using table 2-8 for measurement three.

If Test Fails Check:

Adjustments Section III	2nd Pass Gain Adjustment AC Offset and Reference Adjustment Input Flatness Adjustment Input Attenuator Adjustments Calibrator Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards A30 Analog Source Board

2-24 AMPLITUDE LINEARITY

This test measures the amplitude linearity of the HP 3562A by using the amplitude reference of the ac calibrator.

Specification

If the measurement of a signal is between the BNC center conductor and BNC shell and the amplitude is equal to the range setting, the marker amplitude reading will not deviate from the actual signal amplitude by more than:

Range Setting	Accuracy
+27 dBV to −40 dBV	±0.15 dB ±0.015% Range Setting
−41 dBV to −51 dBV	±0.25 dB ±0.025% Range Setting

If the measurement of a signal includes a signal between the BNC shell and the chassis, the marker amplitude reading will not deviate from the actual signal amplitude by more than:

Range Setting	Accuracy
+27 dBV to −40 dBV	±0.50 dB ±.015% Range Setting
−41 dBV to −51 dBV	±0.60 dB ±.025% Range Setting

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
AC Calibrator	. . . .	Fluke 5200A
BNC	. . . .	HP 1250-0781

Procedure

A. Connect the test instruments as shown in figure 2-13. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer

Frequency	. . . .	10 kHz
Amplitude	. . . .	1 Vrms

AC Calibrator

Frequency	. . . .	10 kHz
Amplitude	. . . .	10 Vrms
Phase Lock	. . . .	ON
Sense	. . . .	INTERNAL
Mode	. . . .	OPER

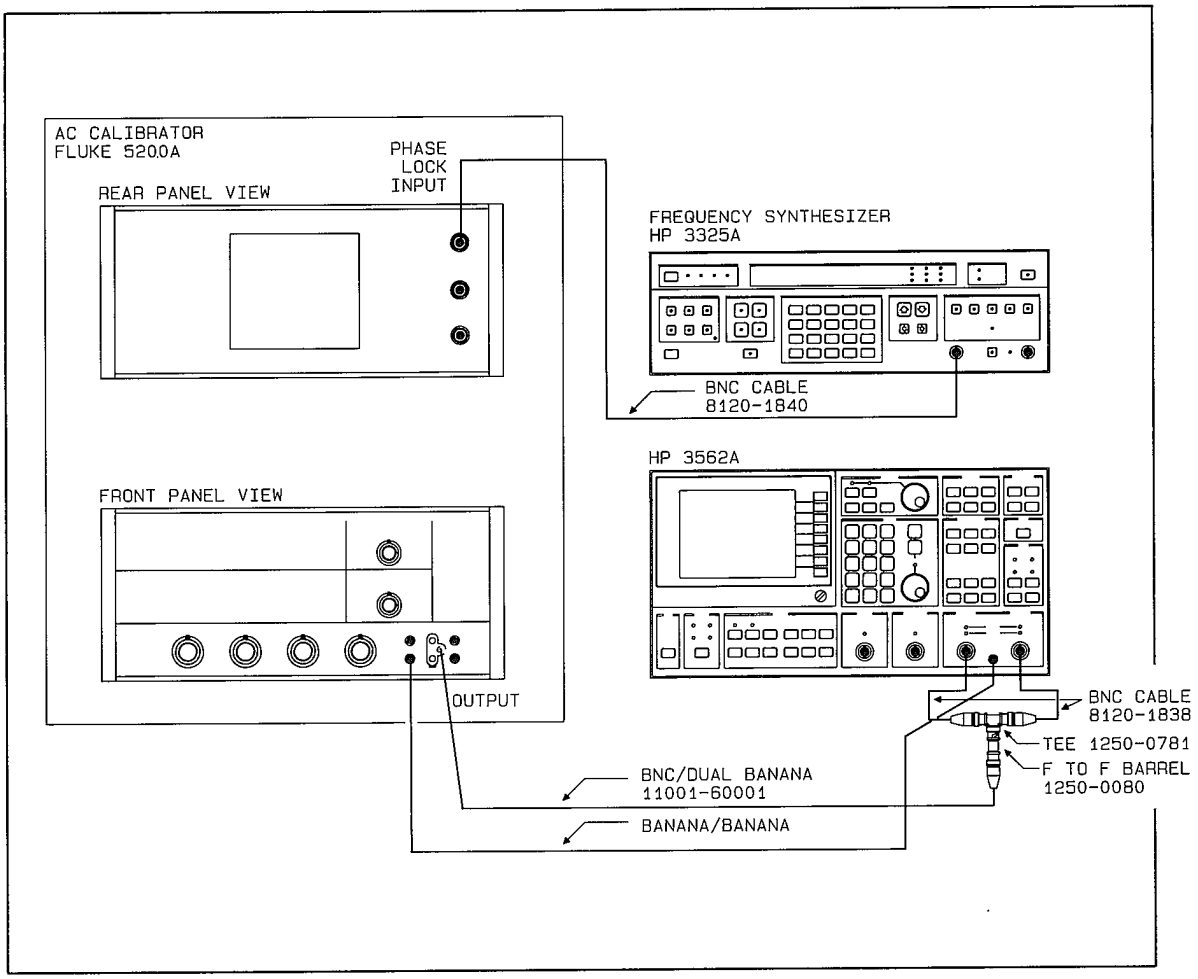


Figure 2-13 Amplitude Linearity Test Setup

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
WINDOW	. . . .	FLAT TOP		
AVG	. . . .	**4**	. . . .	ENTER
	. . . .	STABLE		
RANGE	. . . .	**21** dBVrms		
FREQ	. . . .	CENTER FREQ	. . . .	**10** kHz

INPUT
COUPLE . . . . GROUND
CHAN 1

. . . . GROUND
CHAN 2

UNITS . . . . P SPEC UNITS . . . . VOLTS
RMS

. . . . VOLTS

A & B

COORD . . . . MAG
(LIN)

SCALE . . . . Y AUTO SCALE

Table 2-9 Amplitude Linearity

AC Calibrator Amplitude	Specification BNC shell grounded		Specification BNC center conductor grounded	
	Upper Limit	Lower Limit	Upper Limit	Lower Limit
10.00 Vrms	10.18 Vrms	9.827 Vrms	10.59 Vrms	9.439 Vrms
1.000 Vrms	1.019 Vrms	981.4 mVrms	1.061 Vrms	942.6 mVrms
100.0 mVrms	103.2 mVrms	96.79 mVrms	107.4 mVrms	92.91 mVrms
10.00 mVrms	11.67 mVrms	8.329 mVrms	12.09 mVrms	7.941 mVrms
3.1623 mVrms	4.717 mVrms	1.608 mVrms	4.850 mVrms	1.485 mVrms
1.000 mVrms	2.517 mVrms	−517.1 uVrms	2.559 mVrms	−555.9 uVrms

D. For each of the amplitudes listed in table 2-9 perform steps 1 through 4.

1. Set the ac calibrator's amplitude.

2. Press the HP 3562A keys as follows:

   START

   SPCL
   MARKER . . . . MRKR →
   PEAK

3. Record the Ya marker reading on the Performance Test Record for the measured value CHAN 1.

4. Record the Yb marker reading on the Performance Test Record for the measured value CHAN 2.

E. Press the HP 3562A keys as follows:

INPUT COUPLE	. . . .	FLOAT CHAN 1
	. . . .	FLOAT CHAN 2

F. Reverse the banana plug connector at the ac calibrator so the high input signal goes to the BNC shell of HP 3562A's input channels. The BNC center conductor should be grounded for each channel.

G. Repeat part D for BNC center conductor grounded.

If Test Fails Check:

Adjustments Section III	2nd Pass Gain Adjustment ADC Offset and Reference Adjustment Input Flatness Adjustment Input Attenuator Adjustments Calibrator Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards A30 Analog Source Board

2-25 AMPLITUDE AND PHASE MATCH

This test determines if the HP 3562A's amplitude and phase match between channel 1 and channel 2 are within the specified limits.

Specification

BNC shell of both channels grounded:

The amplitude deviation between channels will be no more than ±0.1dB, and the phase deviation no more than ±0.5 degrees.

BNC center conductor of both channels grounded:

The amplitude deviation between channels will be no more than ±0.8dB, and the phase deviation no more than ±8.5 degrees.

Required Test Equipment

BNC TEE	. . . .	HP 1250-0781

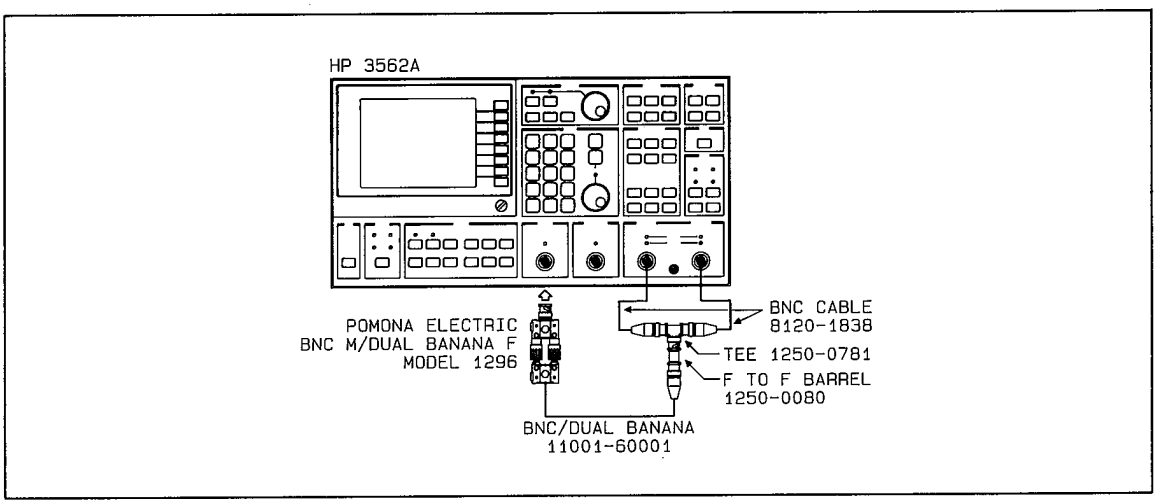


Figure 2-14 Amplitude and Phase Match Test Setup

Procedure

A. Connect the HP 3562A as shown in figure 2-14. The cables to channel 1 and channel 2 must be the same length.

B. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET
CAL	. . . .	SINGLE CAL
INPUT **COUPLE**	. . . .	CHAN1 AC
	. . . .	CHAN2 AC
	. . . .	GROUND CHAN1
	. . . .	GROUND CHAN2
SELECT **TRIG**	. . . .	**0** V
	. . . .	SOURCE TRIG

WINDOW	. . . .	UNIFRM		
AVG	. . . .	**16**	. . . .	ENTER
	. . . .	STABLE		
SOURCE	. . . .	PRIODC CHIRP		
MEAS **DISP**	. . . .	FREQ RESP		
SCALE	. . . .	X FIXD SCALE	. . . .	**.375, 100** kHz

C. Perform steps 1 through 6:

1. Press the HP 3562A keys as follows:

RANGE	. . . .	**−47** dBVrms		
SOURCE	. . . .	SOURCE LEVEL	. . . .	**−49** dBVrms
SCALE	. . . .	Y FIXD SCALE	. . . .	**−.2, .2** dB
START				
Y	. . . .	**−.1, .1** dB		

2. If the measurement is within the marker band, check PASS on the Performance Test Record for part 1.

3. Press the HP 3562A keys as follows:

RANGE	. . . .	**0** dBVrms		
SOURCE	. . . .	SOURCE LEVEL	. . . .	**0** dBVrms
START				
Y	. . . .	**−.1,.1** dB		

4. If the measurement is within the marker band, check PASS on the Performance Test Record for part 2.

5. Press the HP 3562A keys as follows:

RANGE	. . . .	**10** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**10** dBVrms
START			
Y	. . . .	**−.1,.1** dB	

6. If the measurement is within the marker band, check PASS on the Performance Test Record for part 3.

D. Perform steps 1 through 6:

1. Press the HP 3562A keys as follows:

RANGE	. . .	**−47** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**−49** dBVrms
COORD	. . . .	PHASE	
START			
SCALE	. . . .	Y FIXD SCALE	**−1, 1** Degree
Y	. . . .	Y VALUE	**−.5, .5** Degree

2. If the measurement is within the marker band, check PASS on the Performance Test Record for part 4.

3. Press the HP 3562A keys as follows:

RANGE	. . . .	**0** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**0** dBVrms
START			
Y	. . . .	Y VALUE	**−.5,.5** Degree

4. If the measurement is within the marker band, check PASS on the Performance Test Record for part 5.

5. Press the HP 3562A keys as follows:

RANGE	. . . .	**10** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**10** dBVrms
START			
Y	. . . .	Y VALUE	**−.5, .5** Degree

6. If the measurement is within the marker band, check PASS on the Performance Test Record for part 6.

E. Reverse one of the banana plug connectors so the center conductor of each channel's BNC is grounded.

F. Perform steps 1 through 4:

1. Press the HP 3562A keys as follows:

INPUT COUPLE	. . . .	FLOAT CHAN1	
	. . . .	FLOAT CHAN2	
COORD	. . . .	MAG(dB)	
SCALE	. . . .	Y FIXD	
		SCALE	**−1,1** dB
RANGE	. . . .	**−13** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**−13** dBVrms
START			
Y	. . . .	Y VALUE	**−.8, .8** dB

2. If the measurement is within the marker band, check PASS on the Performance Test Record for part 7.

3. Press the HP 3562A keys as follows:

RANGE	. . . .	**8** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**8** dBVrms
START			
Y	. . . .	Y VALUE	**−.8,.8** dB

4. If the measurement is within the marker band, check PASS on the Performance Test Record for part 8.

G. Perform steps 1 through 4:

1. Press the HP 3562A keys as follows:

RANGE	. . . .	**−13** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**−13** dBVrms
COORD	. . . .	PHASE	
START			
SCALE	. . . .	Y FIXD SCALE	**−10, 10** Degree
Y	. . . .	Y VALUE	**−8.5, 8.5** degree

2. If the measurement is within the marker band, check PASS on the Performance Test Record for part 9.

3. Press the HP 3562A keys as follows:

RANGE	. . . .	**8** dBVrms	
SOURCE	. . . .	SOURCE LEVEL	**8** dBVrms
START			
Y	. . . .	Y VALUE	**−8.5, 8.5** Degree

4. If the measurement is within the marker band, check PASS on the Performance Test Record for part 10.

If Test Fails Check:

Adjustments Section III	2nd Pass Gain Adjustment ADC Offset and Reference Adjustment Input Flatness Adjustment Input Attenuator Adjustments Calibrator Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards A30 Analog Source Board

2-26 ANTI-ALIAS FILTER RESPONSE

Signals with frequencies greater than 156 kHz may be shifted down into the 100 kHz frequency range as a result of the HP 3562A's 256 kHz sample rate. This test measures the ability of the 100 kHz low pass anti-alias filter to reject frequencies 156 kHz and greater.

NOTE

The HP 3325A may produce some spurious signals in the 0 to 100 kHz span. Ignore signals at frequencies other than those listed in the table when performing this test.

Specification

All signals aliasing into the 0 to 100 kHz frequency span will be attenuated at least 80 dB below the range setting.

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
50Ω feedthrough termination	. . . .	HP 11048C
BNC Tee	. . . .	HP 1250-0781

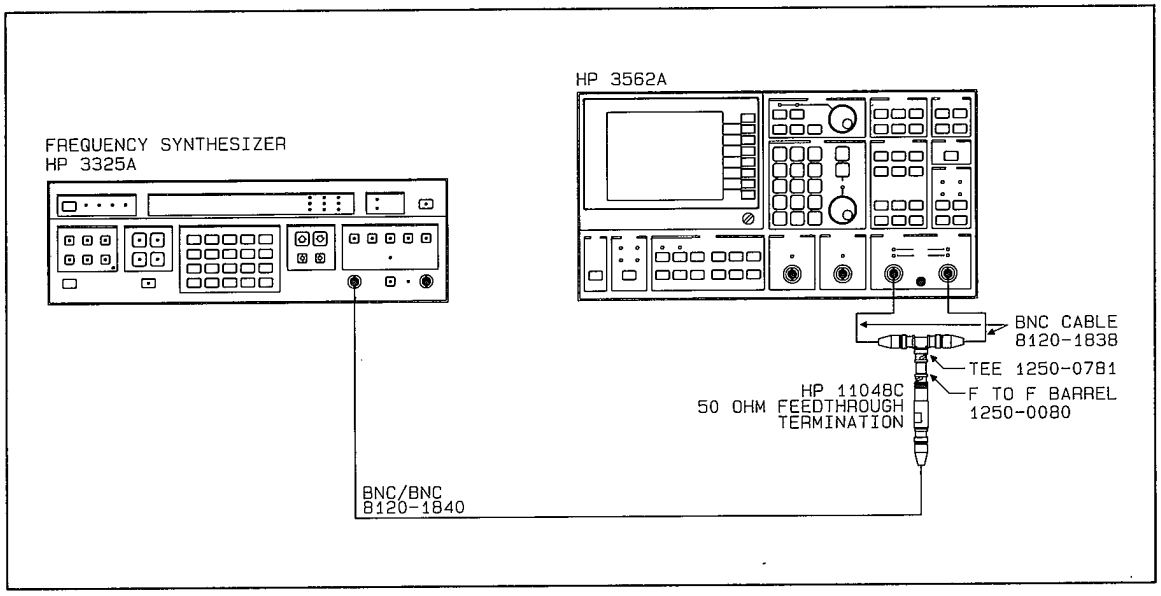


Figure 2-15 Anti-Alias Filter Response Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-15. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer

Amplitude	. . . .	1 Vrms
Frequency	. . . .	156 kHz
Function	. . . .	Sine Wave

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
RANGE	. . . .	**1** Vrms		
AVG	. . . .	**16**	. . . .	ENTER
	. . . .	STABLE		
WINDOW	. . . .	FLAT TOP		
INPUT COUPLE	. . . .	GROUND CHAN1		
	. . . .	GROUND CHAN2		
A & B				
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS

Table 2-10 Anti-Alias Filter

Signal Frequency	Alias Frequency
156 kHz	100 kHz
184 kHz	72 kHz
206 kHz	50 kHz
267 kHz	11 kHz

D. For each of the signal frequencies listed in table 2-10 perform steps 1 through 4:

1. Set the frequency synthesizer to the signal frequency in table.

2. Press the HP 3562A keys as follows:

   START

   X . . . . To alias frequency in table

3. If the Ya reading is less than or equal to −80 dBVrms check PASS on the Performance Test Record for CHAN 1.

4. If the Yb reading is less than or equal to −80 dBVrms check PASS on the Performance Test Record for CHAN 2.

If Test Fails Check:

Adjustments Section III	None
Troubleshooting Section VIII	A32, A34 Analog Digital Converter Boards

2-27 FREQUENCY ACCURACY

This test measures the frequency accuracy of the HP 3562A.

Specification

The frequency reading will not deviate from the actual signal frequency by more than 0.004%.

Required Test Equipment

Frequency Synthesizer	HP 3325A
50Ω feedthrough termination	HP 11048C

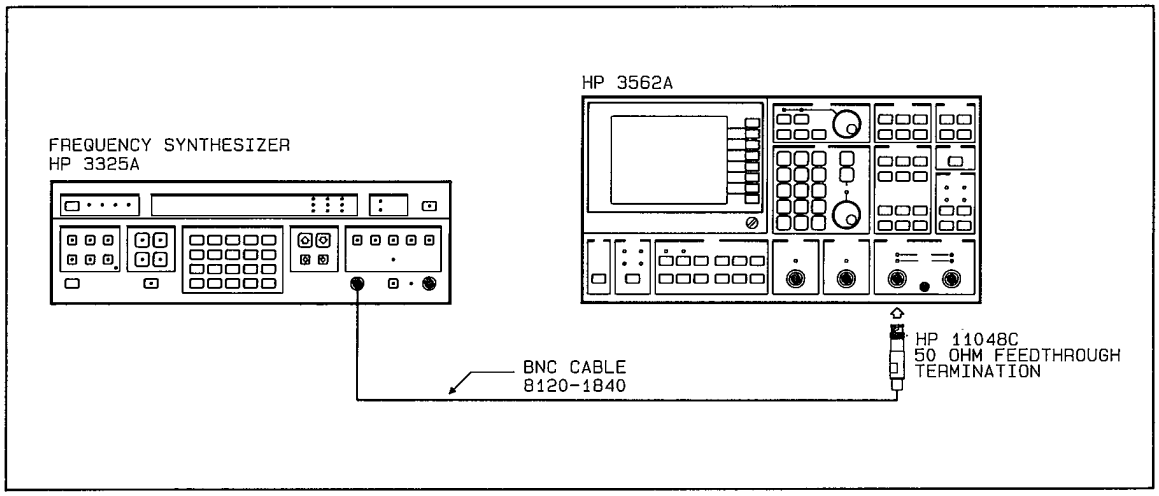


Figure 2-16 Frequency Accuracy Test Setup

Procedure

A. Connect the test equipment as shown in figure 2-16. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer

Frequency	. . . .	99 kHz
Amplitude	. . . .	1 Vrms
Function	. . . .	Sine Wave

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
RANGE	. . . .	**0** dBVrms		
FREQ	. . . .	CENTER FREQ	. . . .	**99** kHz
	. . . .	FREQ SPAN	. . . .	**.5** kHz
AVG	. . . .	**2**	. . . .	ENTER
	. . . .	STABLE		
START				
X				

D. Record the X marker reading as the measured value on the Performance Test Record.

If Test Fails Check:

Adjustments Section III	20.48 MHz Reference Adjustment
Troubleshooting Section VIII	A31 Trigger Board

2-28 INPUT COUPLING INSERTION LOSS

This test measures the insertion loss at 1 Hz due to the ac coupling capacitors. The amplitude of a 1 Hz signal is measured in both ac and dc coupled modes. The insertion loss is calculated as:

$$\frac{\text{dc Coupled Amplitude}}{\text{ac Coupled Amplitude}} = \text{Insertion Loss}$$

Specification

The insertion loss at 1 Hz due to the ac coupling capacitors will be less than 3 dB (41.3%).

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
50Ω feedthrough termination	. . . .	HP 11048C
BNC Tee	. . . .	HP 1250-0781

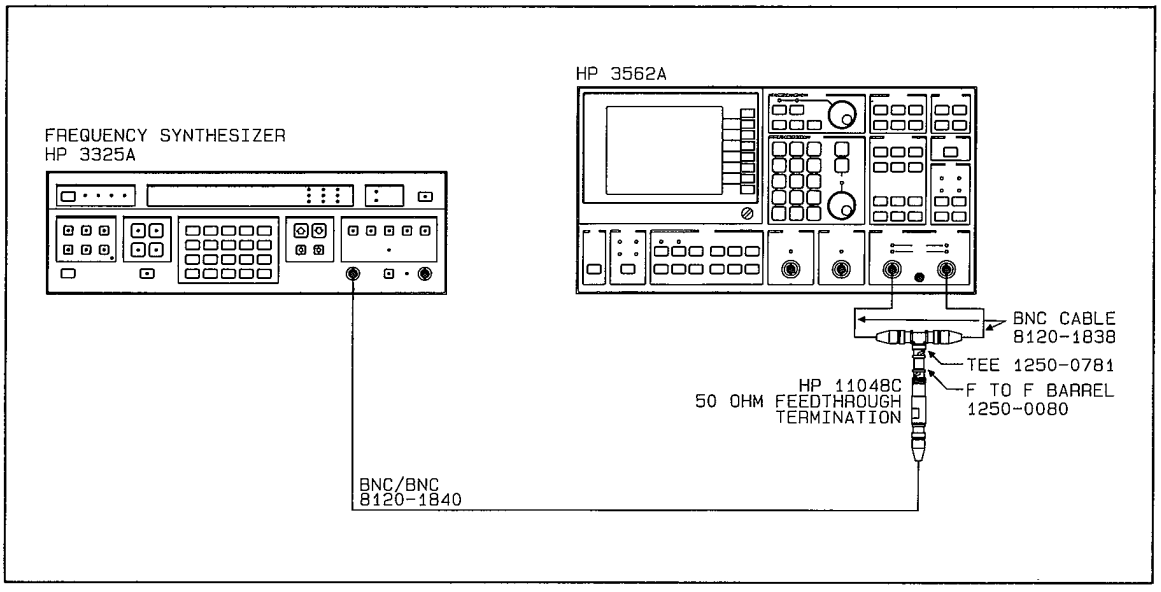


Figure 2-17 Input Coupling Insertion Loss Test Setup

Procedure

A. Connect the test equipment as shown in figure 2-17. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the frequency synthesizer initially as follows:

Frequency Synthesizer

Frequency	. . . .	1 Hz
Amplitude	. . . .	1 Vrms
Function	. . . .	Sine Wave

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET				
CAL	. . . .	SINGLE CAL				
RANGE	. . . .	**1** Vrms				
FREQ	. . . .	FREQ SPAN	. . . .	**100** Hz		
WINDOW	. . . .	UNIFRM				
AVG	. . . .	**4**	. . . .	ENTER		
	. . . .	STABLE				
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS		
			. . . .	VOLTS		
INPUT COUPLE	. . . .	CHAN1 AC				
START						
X	. . . .	**1** Hz	. . . .	X MRKR SCALE		
SAVE RECALL	. . . .	SAVE DATA #	. . . .	**1**	. . . .	ENTER
INPUT COUPLE	. . . .	CHAN1 DC				
START						
MATH	. . . .	DIV	. . . .	SAVED 1		

(NOTE: Ignore math overflow message.)

D. Record the Ya reading on the Performance Test Record for channel 1.

E. Press the HP 3562A keys as follows:

B

INPUT COUPLE . . . . CHAN2 AC

START

SAVE RECALL . . . . SAVE DATA # . . . . **2** . . . . ENTER

INPUT COUPLE . . . . CHAN2 DC

START

MATH . . . . DIV . . . . SAVED 2

F. Record the Yb reading on the Performance Test Record for channel 2.

If Test Fails Check:

Adjustments	None
Troubleshooting Section VIII	A33, A35 Input Boards

2-29 SINGLE CHANNEL PHASE ACCURACY

This test measures the phase accuracy of the HP 3562A relative to the phase of the trigger signal. The frequency synthesizer is used to input a square wave to one channel and the external trigger input.

Specification

When the BNC shell of a channel is grounded, the marker phase reading will not deviate from the actual phase of the signal relative to the trigger by more than:

Frequency Range	Phase Deviation
0 Hz to <10 kHz	±2.5 degrees
10 kHz to 100 kHz	±12.0 degrees

When the BNC center conductor of a channel is grounded, the marker phase reading will not deviate from the actual phase of the signal relative to the trigger by more than:

Frequency Range	Phase Deviation
0 to <10 kHz	±6.5 degrees
10 kHz to 100 kHz	±16.0 degrees

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
50Ω feedthrough termination	. . . .	HP 11048C
(2) BNC Tees	. . . .	HP 1250-0781

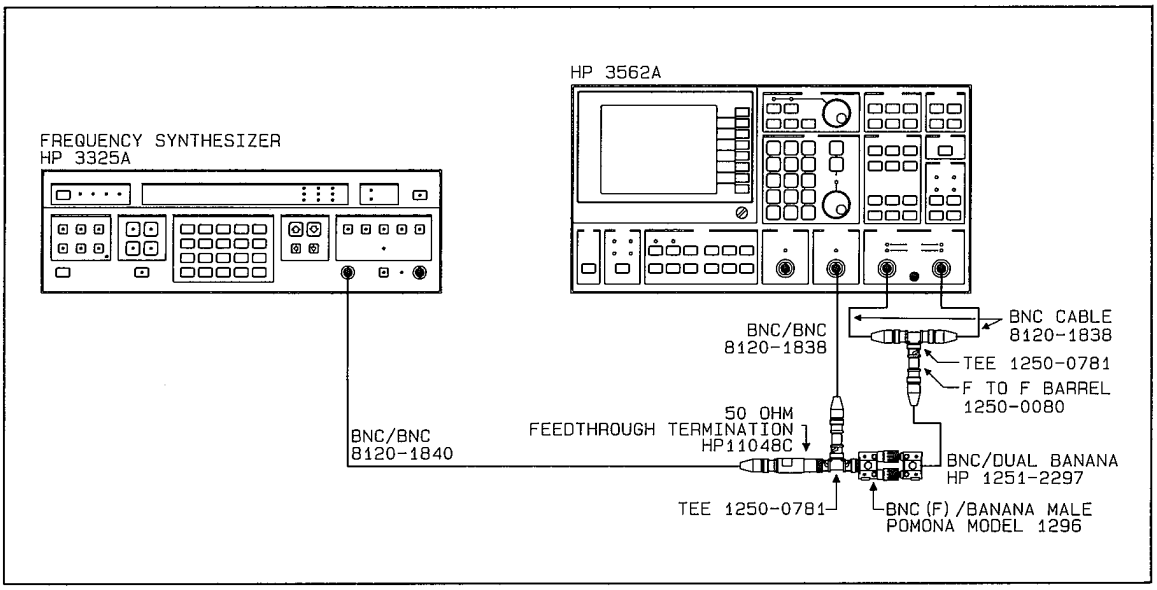


Figure 2-18 Single Channel Phase Accuracy Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-18. Refer to "Initial Equipment Setup", paragraph 2-20, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer

Frequency	. . . .	9 kHz
Amplitude	. . . .	1 Vrms
DC Offset	. . . .	0 Vdc
Function	. . . .	Square Wave

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
SELECT MEAS	. . . .	POWER SPEC		
INPUT COUPLE	. . . .	GROUND CHAN1		
	. . . .	GROUND CHAN2		
AVG	. . . .	**5**	. . . .	ENTER
	. . . .	STABLE		
	. . . .	TIM AV ON		
WINDOW	. . . .	UNIFRM		
SELECT TRIG	. . . .	**0** V		
MEAS DISP	. . . .	FILTRD INPUT	. . . .	AVRG
			. . . .	LINEAR SPEC 1
B				
			. . . .	LINEAR SPEC 2
A & B				
COORD	. . . .	PHASE		

Table 2-11 Single Channel Phase Accuracy

Signal Frequency	Trigger Slope	Trigger Type
9 kHz	POS	INPUT CHAN 1
9 kHz	POS	INPUT CHAN 2
9 kHz	POS	EXTERNAL
9 kHz	NEG	EXTERNAL
99 kHz	POS	INPUT CHAN 1
99 kHz	POS	INPUT CHAN 2
99 kHz	POS	EXTERNAL

D. For each of the frequencies listed in table 2-11 perform steps 1 through 4:

1. Set the frequency Synthesizer as follows:

   Frequency . . . . To signal frequency in table

2. Press the HP 3562A keys as follows:

   SELECT
   TRIG . . . . To trigger slope in table

   . . . . To trigger type in table

   START

   X . . . . To signal frequency in table

3. Record the Ya marker reading on the Performance Test Record for CHAN 1 measured value, BNC shell grounded.

4. Record the Yb marker reading on the Performance Test Record for CHAN 2 measured value, BNC shell grounded.

E. Reverse one of the banana plug connectors so the center conductor of each channel's BNC is grounded.

F. Press the HP 3562A keys as follows:

INPUT COUPLE	. . . .	FLOAT CHAN 1
	. . . .	FLOAT CHAN 2

G. Repeat part D for the BNC center conductors grounded.

If Test Fails Check:

Adjustments	None
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards A31 Trigger Board A6 Digital Filter Controller A1 Digital Source

2-30 INPUT IMPEDANCE

This test measures the input impedance of the HP 3562A as a series resistance and capacitance. The digital multimeter is used to measure the input resistance directly. The input capacitance is then measured by inputting a 100 kHz signal from the frequency synthesizer. This equation is used to calculate the capacitance:

$$C = \left[\left(\frac{Vin}{Vc} - 1\right)\right] 15.9\ pF - 1.59\ pF$$

Note

An LCR meter (HP 4261A, HP 4332A) can be used to measure the input capacitance directly.

Specification

Input Resistance (R) = 1 MΩ ±50 kΩ (5%)

Input Capacitance (C) = <100 pF

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
Digital Voltmeter	. . . .	HP 3456A
100 kΩ Resistor	. . . .	HP 0757-0465
50Ω feedthrough termination	. . . .	HP 11048C

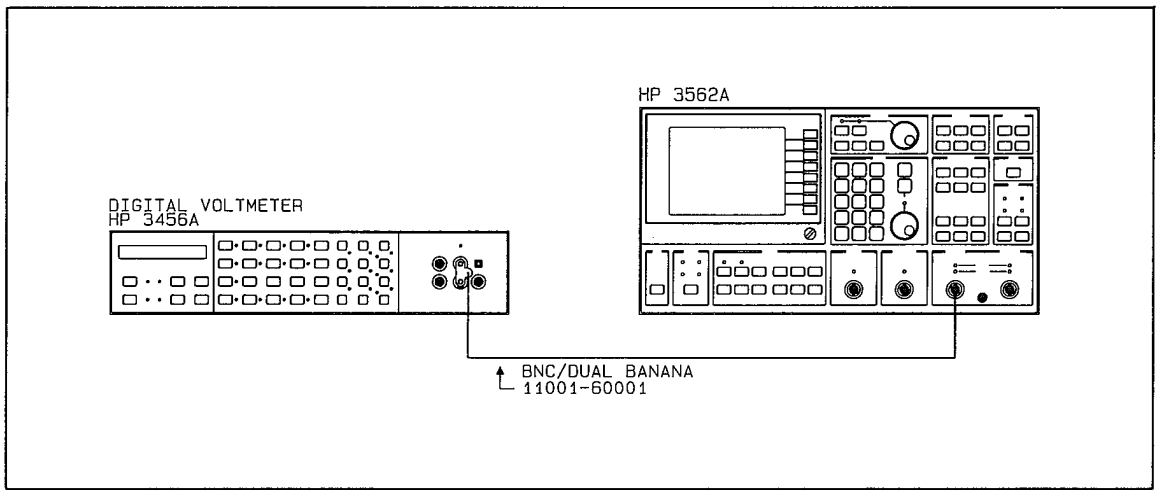


Figure 2-19 Input Resistance Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-19. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the digital voltmeter initially as follows:

Function	. . . .	2 WIRE OHM
Range	. . . .	AUTO
Trigger	. . . .	INTERNAL

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET
CAL	. . . .	SINGLE CAL
INPUT COUPLE	. . . .	GROUND CHAN 1
	. . . .	GROUND CHAN 2
RANGE	. . . .	**20** dBVrms

Table 2-12 Resistance Measurement

Range Setting	Specification	
	Lower Limit	Upper Limit
20 dBVrms	950 kΩ	1050 kΩ
0 dBVrms	950 kΩ	1050 kΩ
−13 dBVrms	950 kΩ	1050 kΩ

D. For each of the range settings listed in table 2-12 perform steps 1 and 2:

1. Press the HP 3562A keys as follows:

   RANGE . . . . To the range setting in table

2. Record the digital voltmeter reading on the Performance Test Record.

E. Change the BNC input connector to channel 2 and repeat part D.

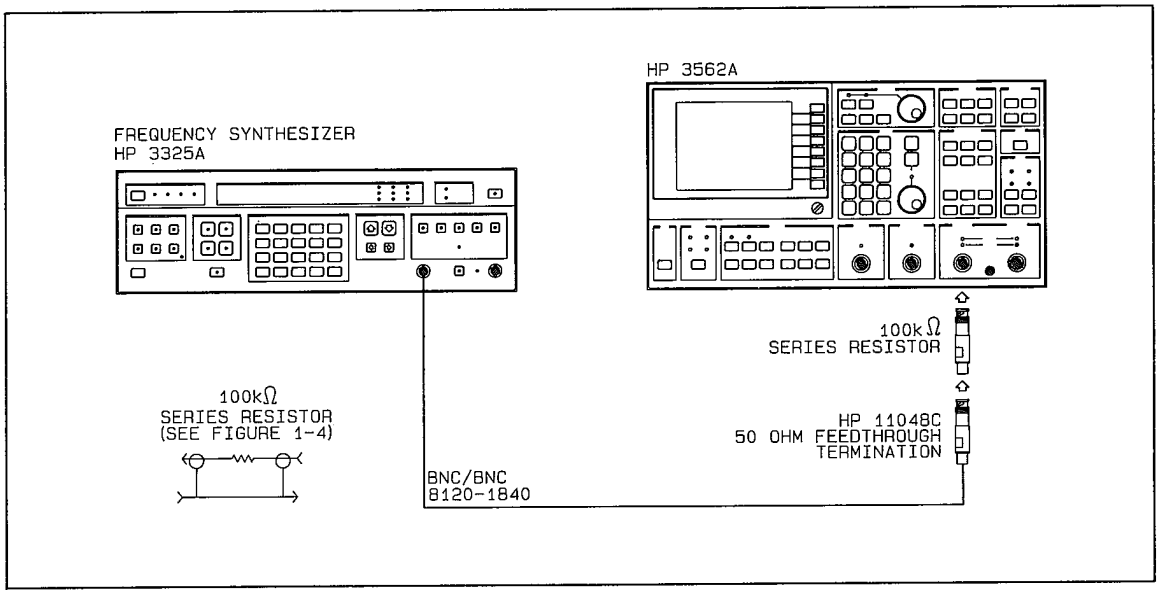


Figure 2-20 Input Capacitance Test Setup

F. Connect the test instruments as shown in figure 2-20.

G. Set the frequency synthesizer initially as follows:

Frequency . . . . 100 kHz

Amplitude . . . . 1 Vrms

H. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	AUTO OFF		
AVG	. . . .	**16**	. . . .	ENTER
	. . . .	STABLE		
INPUT COUPLE	. . . .	CHAN 1 AC		
	. . . .	CHAN 2 AC		
	. . . .	GROUND CHAN 1		
	. . . .	GROUND CHAN 2		
RANGE	. . . .	**0** dBVrms		
START				
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS
COORD	. . . .	MAG(LIN)		
X	. . . .	**100** kHz		

I. Record the Ya amplitude reading in the Vc position of the Performance Test Record for CHAN 1.

J. Perform steps 1 through 3:

1. Connect the 50Ω feedthrough to channel 2.

2. Press the HP 3562A keys as follows:

B		
START		
COORD	. . . .	MAG(LIN)

3. Record the Yb amplitude reading in the Vc position of the Performance Test Record for CHAN 2.

K. Remove the 100 kΩ resistor from the signal path and connect the BNC cable with the 50Ω termination directly to the HP 3562A's channel 1 input connector.

L. Perform steps 1 and 2:

1. Press the HP 3562A keys as follows:

A

START

2. Record the Ya amplitude reading in the Vin position of the Performance Test Record for CHAN 1.

M. Perform steps 1 through 3:

1. Connect the 50Ω feedthrough to channel 2.

2. Press the HP 3562A keys as follows:

B

START

3. Record the Yb amplitude reading in the Vin position of the Performance Test Record for CHAN 2.

N. Use the equation given on the Performance Test Record to calculate the input capacitance.

If Test Fails Check:

Adjustments	None
Troubleshooting Section VIII	A33, A35 Input Boards

2-31 HARMONIC DISTORTION

This test measures the harmonic distortion generated in the HP 3562A when a full scale input is present.

Specification

The relative amplitude of all harmonics will be at least 80 dB below the fundamental amplitude.

Required Test Equipment

Low Distortion Oscillator	. . . .	HP 339A
600Ω feedthrough termination	. . . .	HP 11095A

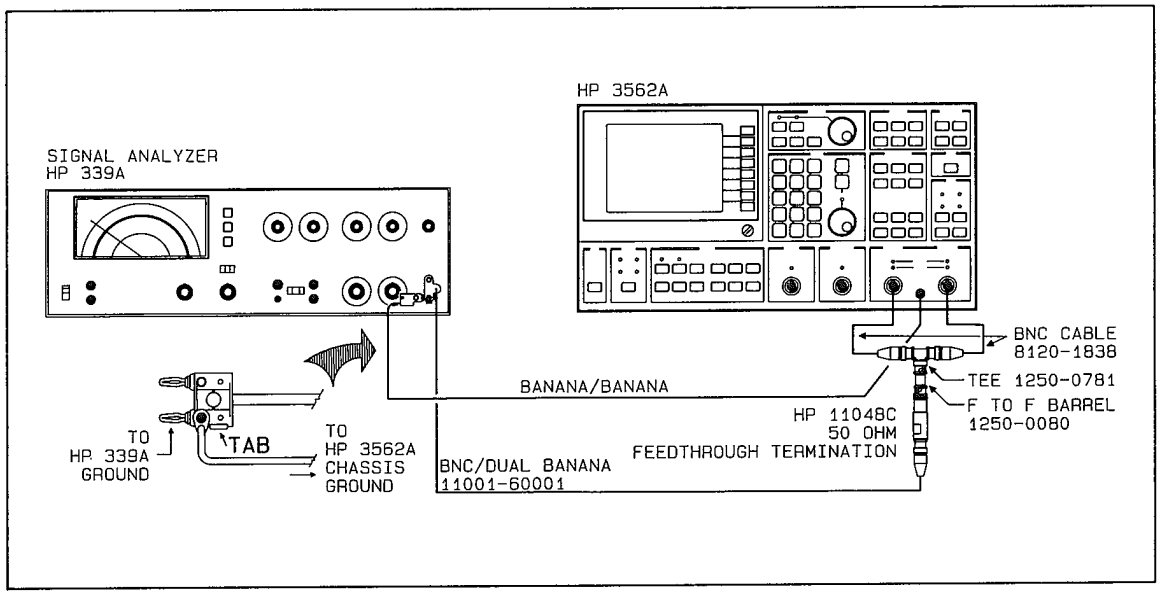


Figure 2-21 Harmonic Distortion Test Setup #1

Procedure

A. Connect the test instruments as shown in figure 2-21. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the low distortion oscillator initially as follows:

Frequency	. . . .	49 kHz
Amplitude	. . . .	1 Vrms

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
RANGE	. . . .	**0** dBVrms		
INPUT COUPLE	. . . .	CHAN 1 AC		
	. . . .	CHAN 2 AC		
	. . . .	GROUND CHAN 1		
	. . . .	GROUND CHAN 2		
WINDOW	. . . .	FLAT TOP		
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS

Table 2-13 Harmonic Frequencies

HP 339A Coarse Frequency	SIGNAL FREQUENCY	Harmonic Number	Harmonic Frequency
49 kHz	49500 Hz	2nd	99 kHz
32 kHz	33000 Hz	3rd	99 kHz
24 kHz	24750 Hz	4th	99 kHz
19 kHz	19800 Hz	5th	99 kHz

D. For each of the signal frequencies listed in table 2-13 perform steps 1 through 7:

1. Set the low distortion oscillator as follows:

Frequency	. . . .	To coarse frequency in table

2. Press the HP 3562A keys as follows:

FREQ	. . . .	CENTER FREQ	. . . .	To signal frequency in table
AVG	. . . .	AVG OFF		
START				
SINGLE				
X	. . . .	To signal frequency in table		

3. Adjust the low distortion oscillator's frequency vernier until it equals the signal frequency.

4. Adjust the low distortion oscillator's amplitude vernier until Ya=0 dBVrms ±0.1 dBVrms.

5. Press the HP 3562A keys as follows:

A & B

AVG	. . . .	**4**	. . . .	ENTER
	. . . .	STABLE		
FREQ	. . . .	MAX SPAN		
START				
X	. . . .	**99** kHz		

6. Record the Ya marker amplitude reading on the Performance Test Record as the harmonic frequency amplitude for channel 1.

7. Record the Yb marker amplitude reading on the Performance Test Record as the harmonic frequency amplitude for channel 2.

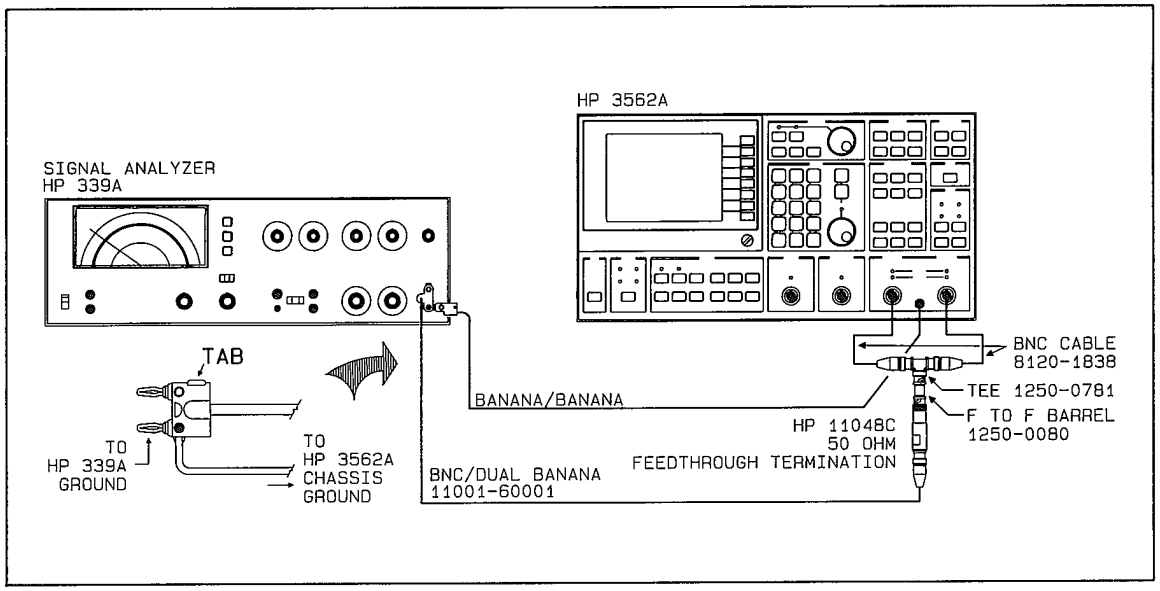


Figure 2-22 Harmonic Distortion Test setup #2

E. For measurement two, connect the test instruments as shown in figure 2-22. The chassis ground cable must go to the ground terminal of the low distortion oscillator.

F. Press the HP 3562A keys as follows:

INPUT		
COUPLE	. . . .	FLOAT
		CHAN 1
	. . . .	FLOAT
		CHAN 2

G. Repeat part D for measurement two.

If Test Fails Check:

Adjustments	2nd Pass Gain Adjustment
Section III	ADC Offset and Reference Adjustment
Troubleshooting	A33, A35 Input Boards
Section VII	A32, A34 Analog Digital Converter Boards

2-32 INTERMODULATION DISTORTION

This test measures the level of the intermodulation distortion products generated within the HP 3562A to the 4th order.

NOTE

The HP 3325A may produce some spurious signals in the 0 to 100 kHz span. Ignore signals at frequencies other than those listed in the tables when performing this test.

Specification

The amplitude of all intermodulation products will be at least 80 dB below the fundamental amplitude.

Required Test Equipment

(2) Frequency Synthesizers	. . . .	HP 3325A
(2) 50Ω feedthrough terminations	. . . .	HP 11048C
(2) 1 kΩ resistors	. . . .	HP 0757-0465
(2) BNC Tee	. . . .	HP 1250-0781

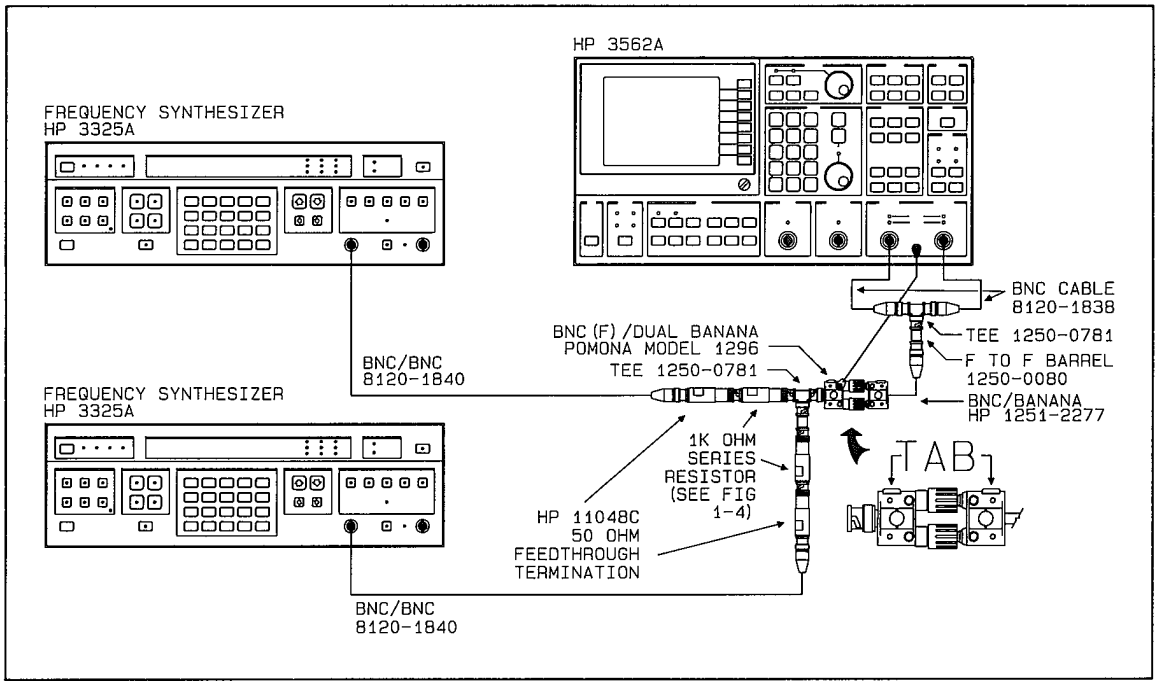


Figure 2-23 Intermodulation Distortion Test Setup #1

Procedure

A. Connect the test instruments as shown in figure 2-23. Keep the connecting cables as short as possible. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the test instruments initially as follows:

Frequency Synthesizer #1

Frequency	. . . .	20 kHz
Amplitude	. . . .	1 Vrms
Function	. . . .	Sine Wave

Frequency Synthesizer #2

Frequency	. . . .	26 kHz
Amplitude	. . . .	1 Vrms
Function	. . . .	Sine Wave

C. Perform steps 1 through 5:

1. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
RANGE	. . . .	**2** Vrms		
INPUT COUPLE	. . . .	GROUND CHAN 1		
	. . . .	GROUND CHAN 2		
WINDOW	. . . .	FLAT TOP		
FREQ	. . . .	CENTER FREQ	. . . .	**20** kHz
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS
A & B				
X	. . . .	**20** kHz		

2. Adjust the amplitude of frequency syntheziser #1 until Ya=0 dBVrms ±50 mdB.

3. Press the HP 3562A keys as follows:

   X . . . . **26** kHz

4. Adjust the amplitude of frequency syntheziser #2 until Ya=0 dBVrms ±50 mdB.

5. Press the HP 3562A keys as follows:

   AVG . . . . **16** . . . . ENTER

   . . . . STABLE

   SCALE . . . . Y FIXD SCALE . . . . **−100, .1** dB

Table 2-14 Intermodulation Distortion Measurement One

Fundamental Frequencies F1	Fundamental Frequencies F2	Harmonic Frequency
20 kHz	26 kHz	6 kHz
20 kHz	26 kHz	14 kHz
20 kHz	26 kHz	12 kHz
20 kHz	26 kHz	8 kHz

D. For each of the harmonic frequencies listed in table 2-14 perform steps 1 through 3:

1. Press the HP 3562A keys as follows:

   FREQ . . . . CENTER FREQ . . . . To harmonic frequency in table

   START

   X . . . . To harmonic frequency in table

2. If the Ya marker reading is less than or equal to −80 dBVrms, check PASS on the Performance Test Record for measurement one, channel 1 with the BNC shell grounded.

3. If the Yb marker reading is less than or equal to −80 dBVrms, check PASS on the Performance Test Record for measurement one, channel 2 with the BNC shell grounded.

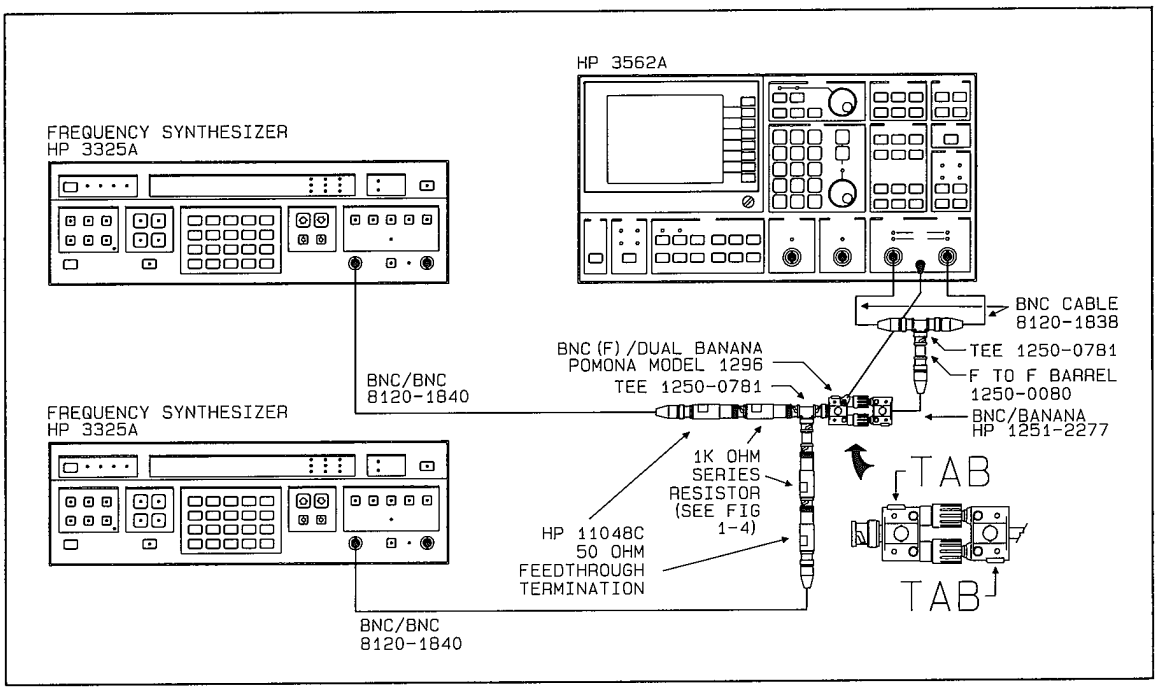


Figure 2-24 Intermodulation Distortion Test Setup #2

E. Perform steps 1 and 2:

1. Connect the test instruments as shown in figure 2-24 so the center conductor of each channel's BNC is grounded.

2. Press the HP 3562A keys as follows:

INPUT
COUPLE . . . . FLOAT
CHAN 1

. . . . FLOAT
CHAN 2

F. For each of the harmonic frequencies listed in table 2-14 perform steps 1 through 3:

1. Press the HP 3562A keys as follows:

FREQ	. . . .	CENTER FREQ	. . . . To harmonic frequency in table
START			
X	. . . .	To harmonic frequency in table	

2. If the Ya marker reading is less than or equal to −80 dBVrms, check PASS on the Performance Test Record for measurement one, channel 1 with the BNC center conductor grounded.

3. If the Yb marker reading is less than or equal to −80 dBVrms, check PASS on the Performance Test Record for measurement one, channel 2 with the BNC center conductor grounded.

G. Connect the test instruments as shown in figure 2-23.

H. Set the test instruments as follows:

Frequency Synthesizer #1

Frequency . . . . 89 kHz

Frequency Synthesizer #2

Frequency . . . . 99 kHz

I. Perform steps 1 through 5:

1. Press the HP 3562A keys as follows:

AVG	. . . .	AVG OFF	
FREQ	. . . .	CENTER FREQ	. . . . **89** kHz
START			
X	. . . .	**89** kHz	

2. Adjust the amplitude of frequency synthesizer #1 until Ya = 0 dB ±50 mdB.

3. Press the HP 3562A keys as follows:

FREQ	. . . .	CENTER FREQ	. . . . **99** kHz
X	. . . .	**99** kHz	

4. Adjust the amplitude of frequency synthesizer #2 until Ya = 0 dB ±50 mdB.

5. Press the HP 3562A keys as follows:

   AVG . . . . STABLE

Table 2-15 Intermodulation Distortion Measurement Two

Fundamental Frequencies F1	Fundamental Frequencies F2	Harmonic Frequency
89 kHz	99 kHz	10 kHz
89 kHz	99 kHz	79 kHz
89 kHz	99 kHz	20 kHz
89 kHz	99 kHz	69 kHz

J. For each of the harmonic frequencies listed in table 2-15 perform steps 1 through 3:

   1. Press the HP 3562A keys as follows:

      FREQ . . . . CENTER FREQ . . . . To harmonic frequency in table

      START

      X . . . . To harmonic frequency in table

   2. If the Ya marker reading is less than or equal to −80 dBVrms, check PASS on the Performance Test Record for measurement two, channel 1 with the BNC shell floating.

   3. If the Yb marker reading is less than or equal to −80 dBVrms, check PASS on the Performance Test Record for measurement two, channel 2 with the BNC shell floating.

K. Connect the test instruments as shown in figure 2-24 so the center conductor of each channel's BNC is grounded.

L. For each of the harmonic frequencies listed in table 2-15 perform steps 1 through 3:

   1. Press the HP 3562A keys as follows:

      FREQ . . . . CENTER FREQ . . . . To harmonic frequency in table

      START

      X . . . . To harmonic frequency in table

2. If the Ya marker reading is less than or equal to −80 dBVrms, check PASS on the Performance Test Record for measurement two, channel 1 with the BNC center conductor grounded.

3. If the Yb marker reading is less than or equal to −80 dBVrms, check PASS on the Performance Test Record for measurement two, channel 2 with the BNC center conductor grounded.

If Test Fails Check:

Adjustments Section III	2nd Pass Gain Adjustment ADC Offset and Reference Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A32, A34 Analog Digital Converter Boards

2-33 NOISE AND SPURIOUS SIGNAL LEVEL

This test measures the level of the noise floor and any spurious signals generated within the HP 3562A.

Specification

When the input is terminated with a 50Ω load, the amplitude of all spurious signals must be at least 80 dB below the range setting. When using a flat top window and a 50Ω load, the average noise level must be less than:

Frequency	Noise Level
20 Hz to 1 kHz	-134 dBV/$\sqrt{\text{Hz}}$
1 kHz to 100 kHz	-144 dBV/$\sqrt{\text{Hz}}$

Required Test Equipment

(2) 50Ω feedthrough terminations . . . . HP 11048C

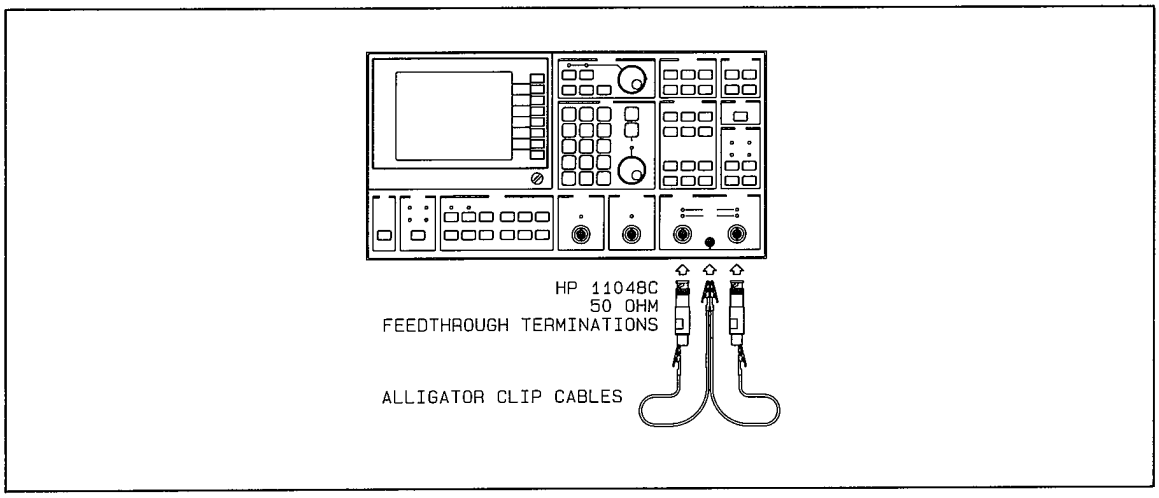


Figure 2-25 Noise and Spurious Signal Level Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-25. Keep the leads from the feedthrough terminations to chassis ground as short as possible.

B. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
RANGE	. . . .	**−51** dBVrms		
INPUT COUPLE	. . . .	CHAN 1 AC		
	. . . .	CHAN 2 AC		
FREQ	. . . .	FREQ SPAN	. . . .	**1** kHz
	. . . .	START FREQ	. . . .	**20** Hz
AVG	. . . .	**20**	. . . .	ENTER
	. . . .	STABLE		
WINDOW	. . . .	UNIFRM		
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS

C. Perform steps 1 through 4:

1. Press the HP 3562A keys as follows:

START		
SCALE	. . . .	Y AUTO SCALE
SPCL MARKER	. . . .	MRKR → PEAK

2. If the Ya marker reading is less than or equal to −131 dBVrms, check PASS on the Performance Test Record for CHAN 1.

3. Press the HP 3562A keys as follows:

B

SCALE . . . . Y AUTO SCALE

SPCL
MARKER . . . . MRKR → PEAK

4. If the Yb marker reading is less than or equal to −131 dBVrms, check PASS on the Performance Test Record for CHAN 2.

Table 2-16 Spurious Signals

Start Frequency	Frequency Span	Specification
20 Hz	1 kHz	≤ −131 dBV
1 kHz	10 kHz	≤ −131 dBV
10 kHz	10 kHz	≤ −131 dBV
20 kHz	10 kHz	≤ −131 dBV
30 kHz	10 kHz	≤ −131 dBV
40 kHz	10 kHz	≤ −131 dBV
50 kHz	10 kHz	≤ −131 dBV
60 kHz	10 kHz	≤ −131 dBV
70 kHz	10 kHz	≤ −131 dBV
80 kHz	10 kHz	≤ −131 dBV
90 kHz	10 kHz	≤ −131 dBV

D. For the rest of the start frequencies in table 2-16 perform steps 1 through 4:

1. Press the HP 3562A keys as follows:

FREQ . . . . START FREQ . . . . To start frequency in table

. . . . FREQ SPAN . . . . To frequency span in table

A

START

SPCL
MARKER . . . . MRKR →
PEAK

2. If the Ya marker reading is less than or equal to −131 dBVrms, check PASS on the Performance Test Record for CHAN 1.

3. Press the HP 3562A keys as follows:

B

SPCL
MARKER . . . . MRKR →
PEAK

4. If the Yb marker reading is less than or equal to −131 dBVrms, check PASS on the Performance Test Record for CHAN 2.

Table 2-17 Noise Level

Start Frequency	Frequency Span	Specification
20 Hz	1 kHz	≤ -134 dBV/$\sqrt{\text{Hz}}$
1 kHz	50 kHz	≤ -144 dBV/$\sqrt{\text{Hz}}$
50 kHz	50 kHz	≤ -144 dBV/$\sqrt{\text{Hz}}$

E. Press the HP 3562A keys as follows:

WINDOW . . . . FLAT TOP

UNITS . . . . P SPEC UNITS . . . . V/$\sqrt{\text{Hz}}$

F. For each of the start frequencies listed in table 2-17 perform steps 1 through 5:

1. Press the HP 3562A keys as follows:

FREQ . . . . START FREQ . . . . To start frequency in table

. . . . FREQ SPAN . . . . To frequency span in table

START

2. When the average is complete, press the HP 3562A keys as follows:

   A

   SPCL
   MARKER . . . . MRKR →
   PEAK

3. If the Ya marker reading is less than or equal to the specification, check PASS on the Performance Test Record for CHAN 1.

4. Press the HP 3562A keys as follows:

   B

   SPCL
   MARKER . . . . MRKR →
   PEAK

5. If the Yb marker reading is less than or equal to the specification, check PASS on the Performance Test Record for CHAN 2.

If Test Fails Check:

Adjustments	2nd Pass Gain Adjustment
Section III	ADC Offset and Reference Adjustment
Troubleshooting	A33, A35 Input Boards
Section VII	A32, A34 Analog Digital Converter
	A5 Digital Filter
	A4 Local Oscillator

2-34 CROSS TALK

The cross talk test measures the amount of energy in one channel that has been coupled across from the other channel. This is accomplished by placing a high signal level on one channel and then measuring the relative signal amplitude on the other channel.

Specification

When a 50Ω termination is used, the cross talk between channels will be at least 140 dB below the input signal level.

Required Test Equipment

Frequency Synthesizer	HP 3325A
50Ω feedthrough termination	HP 11048C

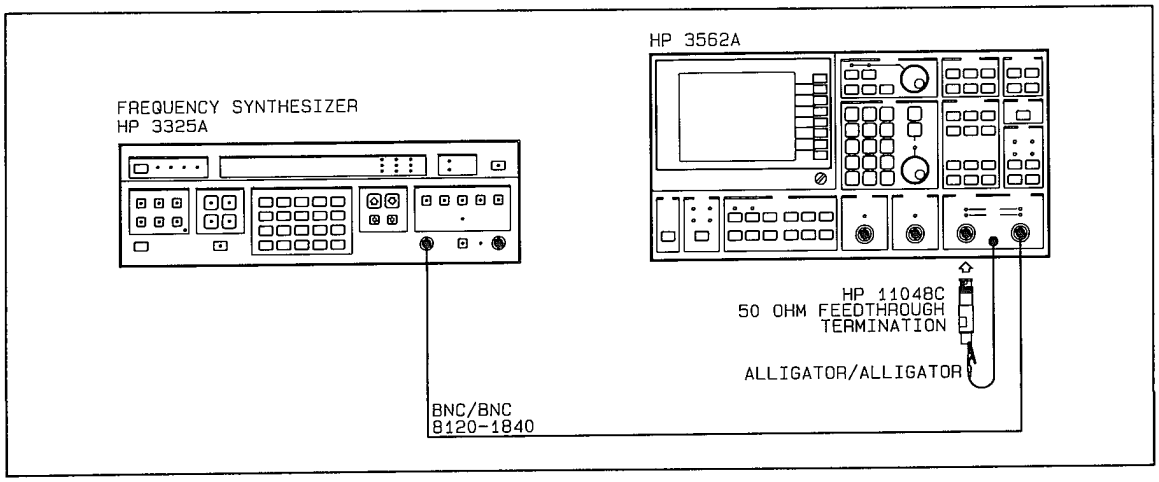


Figure 2-26 Cross Talk Channel 1 Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-26. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the frequency synthesizer as follows:

Amplitude	. . . .	14 Vrms
High Voltage Output	. . . .	ON
Frequency	. . . .	100 kHz
Function	. . . .	Sine Wave

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
FREQ	. . . .	CENTER FREQ	. . . .	**99** kHz
WINDOW	. . . .	FLAT TOP		
AVG	. . . .	**16** ENTER		
	. . . .	STABLE		
RANGE	. . . .	AUTO 1 UP & DWN	. . . .	AUTO 2 UP & DWN
START				
A & B				
X	. . . .	100 kHz		

SCALE . . . . Y FIXD
SCALE . . . . **−140,23** dB

B
Y

D. Using the marker knob, move the Y marker to the center of the X marker dot and press the HP 3562A keys as follows:

HOLD Y
UPPER

A

E. Using the marker knob, move the Y marker to the center of the X marker dot.

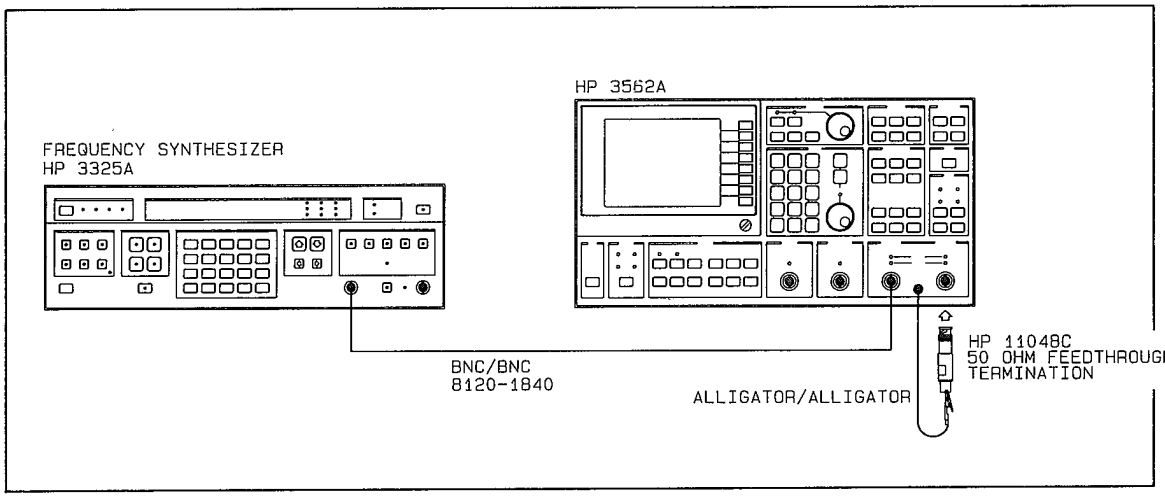


Figure 2-27 Cross Talk Channel 2 Test Setup

F. If the delta Y is greater than or equal to 140 dB, check PASS on the Performance Test Record for channel 1.

G. Connect the test instruments as shown in figure 2-27.

H. Press the HP 3562A keys as follows:

Y OFF

START

A & B

X . . . . 100 kHz

A

Y

I. Using the marker knob, move the Y marker to the center of the X marker dot and press the HP 3562A keys as follows:

HOLD Y
UPPER

B

J. Using the marker knob, move the Y marker the center of the X marker dot.

K. If the delta Y is greater than or equal to 140 dB, check PASS on the Performance Test Record for channel 2.

If Test Fails Check:

Adjustments	None
Troubleshooting Section VIII	A33, A35 Input Boards

2-35 COMMON MODE REJECTION

This test measures the capability of the 3562A to ignore a signal which appears simultaneously and in phase at the high and low input of a single channel.

Specification

When a common mode signal is input to a single channel, the relative value compared to the amplitude of the input single will be:

Frequency	Specification
0 Hz to 66 Hz	≤80 dB
66 Hz to 500 Hz	≤65 dB

Required Test Equipment

Frequency Synthesizer	. . . .	HP 3325A
Common Mode Cable	. . . .	HP 03562-61620

Procedure

A. Connect the test instruments as shown in figure 2-28. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the frequency synthesizer as follows:

Function	. . . .	Sine Wave
High Voltage Output	. . . .	ON

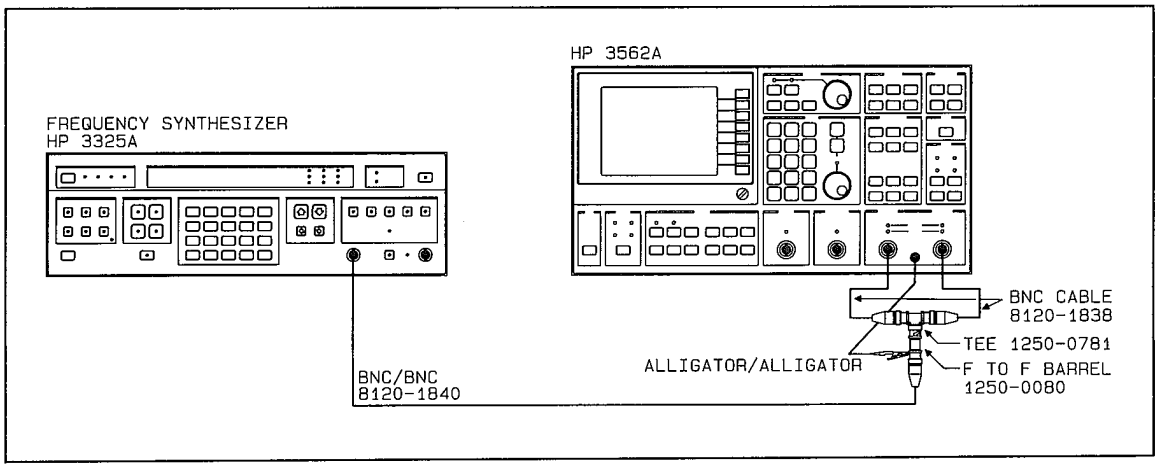


Figure 2-28 Common Mode Rejection Test Setup #1

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
AVG	. . . .	**16**	. . . .	ENTER
	. . . .	STABLE		
WINDOW	. . . .	FLAT TOP		
A & B				
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS

Table 2-18 Common Mode Rejection

Signal Amplitude	Signal Frequency	Range Setting #1	Range Setting #2	Specification
5.680 Vrms	66 Hz	16 dBVrms	−8 dBVrms	≤80 dB
3.413 Vrms	500 Hz	11 dBVrms	−12 dBVrms	≤65 dB

D. For each of the frequencies listed in table 2-18 perform steps 1 through 9:

1. Set the Frequency Synthesizer as follows:

Amplitude	. . . .	To signal amplitude in table
Frequency	. . . .	To signal frequency in table

2. Press the HP 3562A keys as follows:

FREQ	CENTER FREQ	To signal frequency in table
RANGE	To range setting #1 in table	
START		
SPCL **MARKER**	MRKR → PEAK	

3. Record the Ya marker amplitude reading on the Performance Test Record as the first measurement for CHAN 1.

4. Record the Yb marker amplitude reading on the Performance Test Record as the first measurement for CHAN 2.

5. Connect the test instruments as shown in figure 2-29.

6. Press the HP 3562A keys as follows:

RANGE	To range setting #2 in table	
START		
SCALE	Y AUTO SCALE	
X	To signal frequency in table	

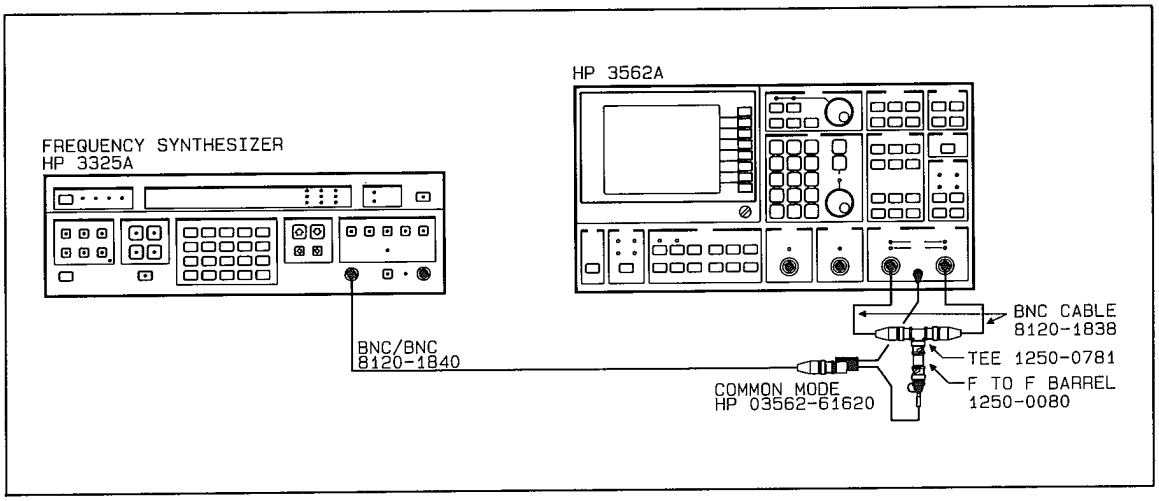


Figure 2-29 Common Mode Rejection Test Setup #2

7. When the average is complete, record the Ya amplitude reading on the Performance Test Record as the second measurement for CHAN 1.

8. Record the Yb amplitude reading on the Performance Test Record as the second measurement for CHAN 2.

9. Calculate the relative value for both channels:

$$\text{First Measurement} - \text{Second Measurement} = \text{Relative Value}$$

If Test Fails Check:

Adjustments Section III	Input dc Offset Adjustment Calibrator Adjustment
Troubleshooting Section VII	A33, A35 Input Boards A30 Analog Source

2-36 EXTERNAL REFERENCE TEST

This test determines if the external reference input will lock on to an external signal that is within the specified range.

Specification

The HP 3562A will lock to external signals of 1, 2, 5, and 10 MHz ±0.01%. The amplitude of the signal must be between 0 dBm and +20 dBm.

Required Test Equipment

Frequency Synthesizer . . . . HP 3325A

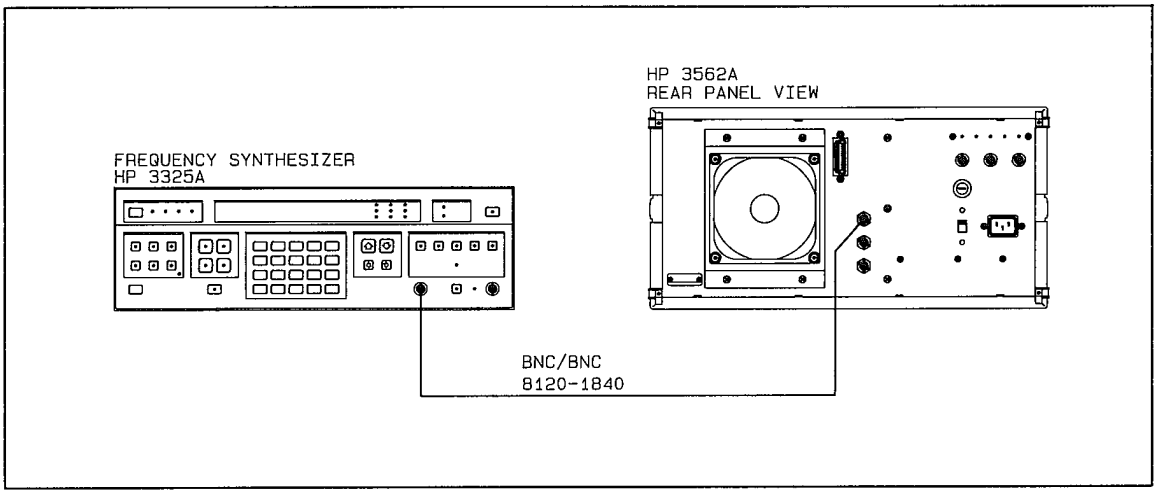


Figure 2-30 External Reference Test Setup

Procedure

A. Connect the HP 3562A as shown in figure 2-30. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set frequency synthesizer as follows:

Frequency	1.000 MHz
Amplitude	0 dBm
Function	Sine Wave

C. Press the HP 3562A keys as follows:

PRESET	RESET
CAL	SINGLE CAL

D. Perform steps 1 through 3:

1. Press "FREQ" on the 3325A.
2. Using the modify arrows on the 3325A, slowly decrease the frequency in 100 Hz steps until the 'Source Not Locked' message is displayed.
3. Record the frequency value on the Performance Test Record.

E. Set the Frequency Synthesizer as follows:

Frequency	10.000 MHz

F. Perform steps 1 through 4:

1. Press **"PRESET"** on the HP 3562A.
2. Press "FREQ" on the 3325A.
3. Using the modify arros on the 3325A, slowly increase the frequency in 1 kHz steps until the 'Source Not Locked' message is displayed.
4. Record the frequency value on the Performance Test Record.

If Test Fails Check:

Adjustments Section III	20.48 MHz Reference Adjustment
Troubleshooting Section VIII	A31 Trigger Board

2-37 SOURCE RESIDUAL OFFSET

This test measures the level of residual offset generated by the source at the 0V offset setting.

Specification

The source residual offset will be no more than 10 mV at the 0V offset setting.

Required Test Equipment

Digital Voltmeter . . . . HP 3456A

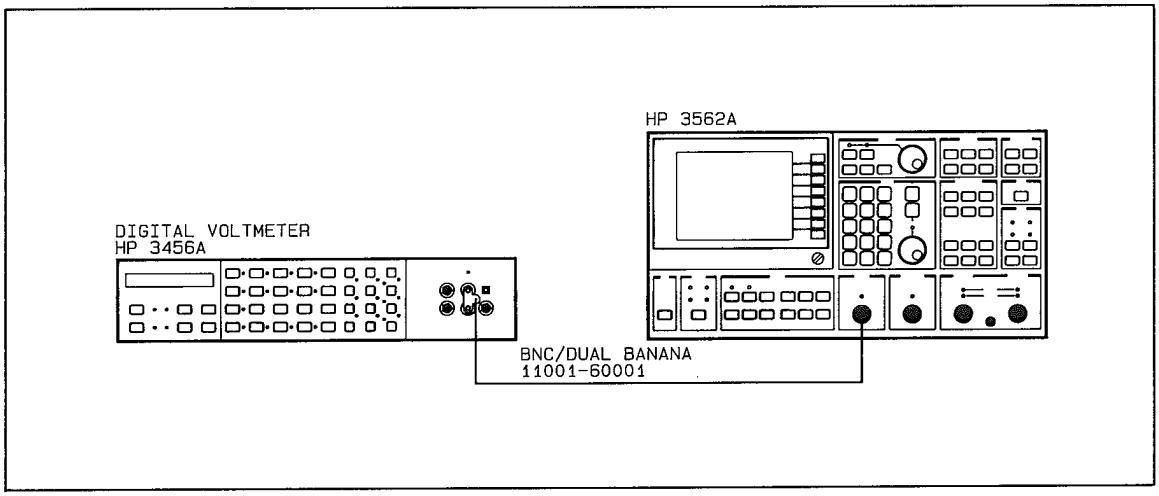


Figure 2-31 Source Residual Offset Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-31. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the digital voltmeter as follows:

Function	. . . .	dc (⎓V)
Trigger	. . . .	Internal
Range	. . . .	Auto

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET	
CAL	. . . .	SINGLE CAL	
SOURCE	. . . .	SOURCE LEVEL	**1** V
	. . . .	FIXED SINE	**100** kHz

D. Record the digital voltmeter reading on the Performance Test Record for the 1V setting.

E. Press the HP 3562A keys as follows:

SOURCE . . . . SOURCE LEVEL . . . . **5** V

F. Record the digital voltmeter reading on the Performance Test Record for the 5V setting.

If Test Fails Check:

Adjustments	None
Troubleshooting Section VIII	A30 Analog Source Board

2-38 SOURCE AMPLITUDE ACCURACY AND FLATNESS

This test measures the amplitude accuracy and flatness of the HP 3562A source.

Specification

The amplitude reading will not deviate from the source amplitude setting by more than 1 dB (12.2%) when terminated into 1 MΩ for frequencies between 0 Hz and 65 kHz, and +1 dB, —1.5 dB for frequencies between 65 kHz and 100 kHz.

Procedure

A. Connect the HP 3562A source to channel 1.

B. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
INPUT COUPLE	. . . .	GROUND CHAN 1		
RANGE	. . . .	**5** Vpk		
MEAS MODE	. . . .	SWEPT SINE	. . . .	LINEAR SWEEP
SOURCE	. . . .	ON		
	. . . .	SOURCE LEVEL		**4.47** V

UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS
FREQ	. . . .	STOP FREQ	. . . .	**65** kHz
START				

C. When the sweep is complete perform steps 1 and 2:

1. Press the HP 3562A keys as follows:

SCALE	. . . .	Y FIXD SCALE	. . . .	**9,11 dB**

2. If the trace is between the 9 dB and the 11 dB limits, check PASS on the Performance Test Record for the 0 to 65 kHz span.

D. Press the HP 3562A keys as follows:

FREQ	. . . .	START FREQ	. . . .	**65** kHz
START				

E. When the sweep is complete perform steps 1 and 2:

1. Press the HP 3562A keys as follows:

SCALE	. . . .	Y FIXD SCALE	. . . .	**8.5, 11** dB

2. If the trace is between the 8.5 dB and the 11 dB limits, check PASS on the Performance Test Record for the 65 kHz to 100 kHz span.

If Test Fails Check:

Troubleshooting Section VIII	A30 Analog Source Board

2-39 SOURCE OUTPUT RESISTANCE CHARACTERIZATION (Optional)

This test measures the output impedance of the analog source as a series resistance.

Specification

The output impedance of the source is 50 Ω Nominal

Required Test Equipment

50Ω feedthrough termination	. . . .	HP 11048C
BNC cable	. . . .	HP 11170A

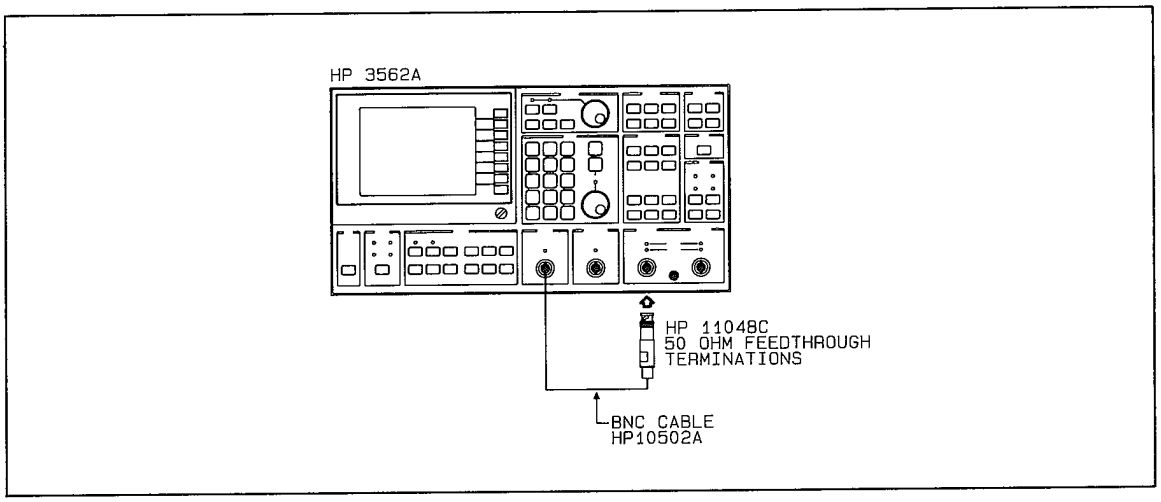


Figure 2-32 Source Output Resistance Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-32.

B. Press the HP 3562A keys as follows:

PRESET	. . . . .	RESET		
CAL	. . . . .	SINGLE CAL		
INPUT COUPLE	. . . . .	GROUND CHAN 1	. . . . .	CHAN 1 AC
MEAS MODE	. . . . .	SWEPT SINE	. . . . .	LINEAR SWEEP
SOURCE	. . . . .	SOURCE LEVEL	. . . . .	**1** Vrms
START				
COORD	. . . . .	MAG (LIN)		
UNITS	. . . . .	SWEPT UNITS	. . . . .	VOLTS
SCALE	. . . . .	Y AUTO SCALE		

C. When the sweep is complete press the HP 3562A keys as follows:

SAVE
RECALL . . . . SAVE DATA # . . . . **1** . . . .ENTER

D. Remove the 50Ω termination from the signal path and connect the output of the source directly to channel 1.

E. Press the HP 3562A keys as follows:

START

F. When the sweep is complete press the HP 3562A keys as follows:

MATH	. . . . .	SUB	. . . . .	SAVED 1
	. . . . .	DIV	. . . . .	SAVED 1
	. . . . .	MPY	. . . . .	50, 0

2-40 SOURCE DISTORTION

This test measures the level of any spurious signals generated by the HP 3562A source.

Specification

When the source is set between dc and 10 kHz, the distortion will be at least 60 dB below the signal level. When the source is set between 10 kHz and 100 kHz, the distortion will be at least 40 dB below the signal level.

Required Test Equipment

None

Procedure

A. Connect the HP 3562A source to channel 1.

B. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET
CAL	. . . .	SINGLE CAL
INPUT **COUPLE**	. . . .	CHAN 1 AC
	. . . .	GROUND CHAN 1

WINDOW . . . . FLAT TOP

AVG . . . . **4** . . . . ENTER

. . . . STABLE

SCALE . . . . X FIXD

SCALE . . . . **.375, 100** kHz

Table 2-19 Source Distortion

Range Setting	Source Amplitude	Source Frequency	Delta Y Value
25 mVpk	25 mVpk	10 kHz	60 dB
5 Vpk	5 Vpk	10 kHz	60 dB
25 mVpk	25 mVpk	99 kHz	40 dB
5 Vpk	5 Vpk	99 kHz	40 dB

C. For each of the range settings listed in table 2-19 perform steps 1 through 5:

1. Press the HP 3562A keys as follows:

Y OFF

RANGE . . . . To range setting in table

SOURCE . . . . SOURCE LEVEL . . . . To source amplitude in table

. . . . FIXED SINE . . . . To source frequency in table

START

SCALE . . . . Y AUTO SCALE

SPCL MARKER . . . . MRKR → PEAK

Y

2. Using the marker knob, move the Y marker to the center of the X marker dot.

3. Press the HP 3562A keys as follows:

Y . . . . HOLD Y UPPER

4. Using the marker knob, move the Y marker until the delta Y reading equals the delta Y value in the table.

5. If there is no distortion above the lower Y marker line, check PASS on the Performance Test Record.

If Test Fails Check:

Adjustments Section III	Source dc Offset Adjustment
Troubleshooting Section VII	A30 Analog Source Board A4 Local Oscillator Board

2-41 SOURCE ENERGY MEASUREMENT

This test measures the in-band energy of the HP 3562A noise source using the power marker function of the HP 3562A and a true rms voltmeter.

Specification

The percentage in-band energy of the random noise will be at least 70%. The percentage in-band energy of the chirp will be at least 85%.

Required Test Equipment

Digital Voltmeter	. . . .	HP 3456A
BNC Tee	. . . .	HP 1250-0781

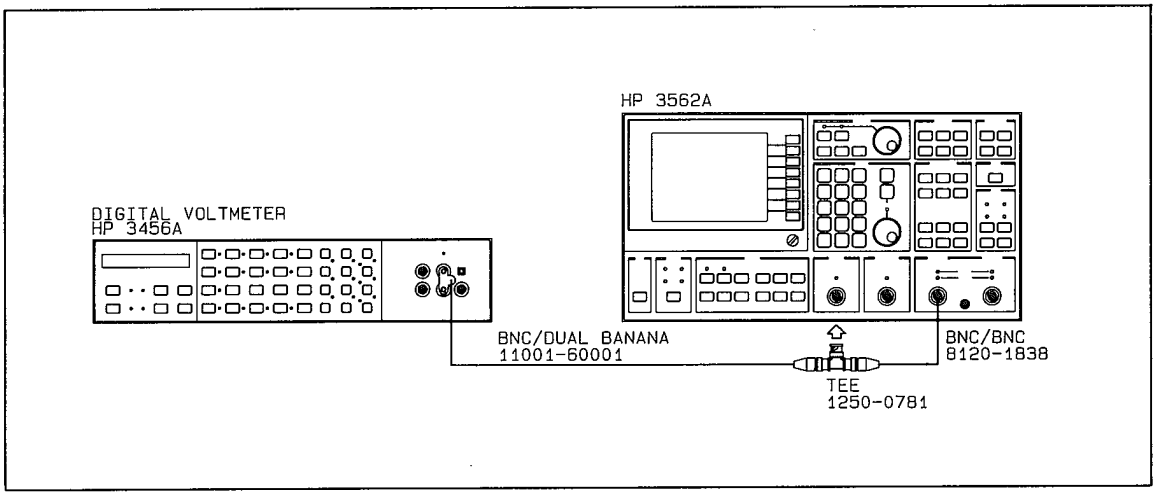


Figure 2-33 Source Energy Measurement Test Setup

Procedure

A. Connect the test instruments as shown in figure 2-33. Refer to "Initial Equipment Setup," paragraph 2-20, for unspecified parameters.

B. Set the test instruments initially as follows:

Digital Voltmeter

Function	. . . .	ac V (~V)
Trigger	. . . .	Internal

C. Press the HP 3562A keys as follows:

PRESET	. . . .	RESET		
CAL	. . . .	SINGLE CAL		
INPUT COUPLE	. . . .	GROUND CHAN 1		
WINDOW	. . . .	UNIFRM (NONE)		
RANGE	. . . .	1 Vrms		
SOURCE	. . . .	SOURCE LEVEL	. . . .	**1** Vrms
FREQ	. . . .	FREQ SPAN	. . . .	**1** kHz
	. . . .	CENTER FREQ	. . . .	**5** kHz
AVG	. . . .	**160**	. . . .	ENTER
	. . . .	STABLE		
START				
UNITS	. . . .	P SPEC UNITS	. . . .	VOLTS RMS
			. . . .	VOLTS
COORD	. . . .	MAG(LIN)		
SPCL MARKER	. . . .	POWER		

D. Perform steps 1 through 3:

1. Take at least 160 averages by pressing the HP 3456A keys as follows:

   MATH

   2

   RDGS
   STORE

2. After the "RDGS STORE" annunicator turns off, press the HP 3456A keys as follows:

   HOLD

   RDGS
   STORE

   RECALL

   0

3. Record the voltmeter average on the Performance Test Record.

E. Record the HP 3562A power measurement on the Performance Test Record.

F. Press the HP 3562A keys as follows:

SOURCE	. . . .	PRIODC CHIRP
SELECT		
TRIG	. . . .	SOURCE TRIG
START		
SPCL		
MARKER	. . . .	POWER

G. Repeat parts D and E.

H. The percentage in-band energy for random noise and chirp are calculated using the following formula:

$$\frac{\sqrt{\text{HP 3562A Reading}}}{\text{Voltmeter Reading}} \times 100 = \text{percentage in-band energy}$$

If Test Fails Check:

Adjustments	None
Troubleshooting Section VII	A30 Analog Source Board A1 Digital Source Board A4 Local Oscillator Board

2-42 PERFORMANCE TEST RECORD

2-21 Self Test	PASS	

2-22 DC Offset			
Range Setting	Measured Value		Specification
	CHAN 1	CHAN 2	
7 dBV			< −23 dBV
−35 dBV			< −65 dBV
−51 dBV			< −71 dBV

2-23 Amplitude Accuracy and Flatness Measurement One					
BNC shell grounded					
Range Setting	Signal Frequency	Specification		**Measured Value**	
		Lower Limit	Upper Limit	CHAN 1	CHAN 2
9 dBV	1 kHz	8.849 dBV	9.151 dBV		
9 dBV	99 kHz	8.849 dBV	9.151 dBV		
−13 dBV	1 kHz	−13.15 dBV	−12.85 dBV		
−13 dBV	50 kHz	−13.15 dBV	−12.85 dBV		
−13 dBV	90 kHz	−13.15 dBV	−12.85 dBV		
−13 dBV	99 kHz	−13.15 dBV	−12.85 dBV		
−23 dBV	1 kHz	−23.15 dBV	−22.85 dBV		
−23 dBV	99 kHz	−23.15 dBV	−22.85 dBV		
−26 dBV	1 kHz	−26.15 dBV	−25.85 dBV		
−21 dBV	1 kHz	−21.15 dBV	−20.85 dBV		
−17 dBV	1 kHz	−17.15 dBV	−16.85 dBV		
−14 dBV	1 kHz	−14.15 dBV	−13.85 dBV		
−11 dBV	1 kHz	−11.15 dBV	−10.85 dBV		

2-23 Amplitude Accuracy and Flatness Measurement Two					
BNC shell grounded					
Range Setting	Signal Frequency	Specification		**Measured Value**	
		Lower Limit	Upper Limit	CHAN 1	CHAN 2
−51 dBV	1 kHz	−51.25 dBV	−50.75 dBV		
−49 dBV	1 kHz	−49.25 dBV	−48.75 dBV		
−47 dBV	1 kHz	−47.25 dBV	−46.75 dBV		
−45 dBV	1 kHz	−45.25 dBV	−44.75 dBV		
−43 dBV	1 kHz	−43.25 dBV	−42.75 dBV		
−41 dBV	1 kHz	−41.25 dBV	−40.75 dBV		
−39 dBV	1 kHz	−39.25 dBV	−38.75 dBV		

2-23 Amplitude Accuracy and Flatness Measurement Three

BNC center conductor grounded

Range Setting	Signal Frequency	Specification		Measured Value	
		Lower Limit	Upper Limit	CHAN 1	CHAN 2
8 dBV	1 kHz	7.499 dBV	8.501 dBV		
8 dBV	99 kHz	7.499 dBV	8.501 dBV		
−11 dBV	1 kHz	−11.50 dBV	−10.50 dBV		
−13 dBV	1 kHz	−13.50 dBV	−12.50 dBV		
−13 dBV	50 kHz	−13.50 dBV	−12.50 dBV		
−13 dBV	90 kHz	−13.50 dBV	−12.50 dBV		
−13 dBV	99 kHz	−13.50 dBV	−12.50 dBV		
−27 dBV	1 kHz	−27.50 dBV	−26.50 dBV		
−27 dBV	99 kHz	−27.50 dBV	−26.50 dBV		

2-24 Amplitude Linearity

Signal Frequency = 10 kHz Range Setting = 10 Vrms

BNC shell grounded

Amplitude	Specification		Measured Value	
	Upper Limit	Lower Limit	CHAN 1	CHAN 2
10.00 Vrms	10.18 Vrms	9.827 Vrms		
1.000 Vrms	1.019 Vrms	981.4 mVrms		
100.0 mVrms	103.2 mVrms	96.79 mVrms		
10.00 mVrms	11.67 mVrms	8.329 mVrms		
3.1623 mVrms	4.717 mVrms	1.608 mVrms		
1.000 mVrms	2.517 mVrms	−517.1 μVrms		
BNC center conductor grounded				
10.00 Vrms	10.59 Vrms	9.439 Vrms		
1.000 Vrms	1.061 Vrms	942.6 mVrms		
100.0 mVrms	107.4 mVrms	92.91 mVrms		
10.00 mVrms	12.09 mVrms	7.941 mVrms		
3.1623 mVrms	4.850 mVrms	1.485 mVrms		
1.000 mVrms	2.559 mVrms	−555.9 μVrms		

2-25 Amplitude and Phase Match						
BNC shell grounded						
Range Setting	Part	**PASS**	Amplitude Specification	Part	**PASS**	Phase Specification
−49 dBV	1		±0.1 dB	4		±0.5°
0 dBV	2		±0.1 dB	5		±0.5°
10 dBV	3		±0.1 dB	6		±0.5°
BNC center conductor grounded						
−13 dBV	7		±0.8 dB	9		±8.5°
8 dBV	8		±0.8 dB	10		±8.8°

2-26 Anti-Alias Filter Response				
Signal Frequency	Alias Frequency	**PASS** CHAN 1	**PASS** CHAN 2	Specification
156 kHz	100 kHz			≤ −80 dB
184 kHz	72 kHz			≤ −80 dB
206 kHz	50 kHz			≤ −80 dB
267 kHz	11 kHz			≤ −80 dB

2-27 Frequency Accuracy			
Signal Frequency	Specification Lower Limit	Upper Limit	**Measured Value**
99,000 Hz	98.996 kHz	99.004 kHz	

2-28 Input Coupling Insertion Loss			
Channel 1		Channel 2	
Insertion Loss	Specification	**Insertion Loss**	Specification
	<3 dB		<3 dB

2-29 Single Channel Phase Accuracy						
BNC shell grounded						
Signal Frequency	Trigger		Specification		Measured Value	
	Slope	Type	Lower Limit	Upper Limit	CHAN 1	CHAN 2
9 kHz	POS	CHAN 1	−92.5°	−87.5°		
9 kHz	POS	CHAN 2	−92.5°	−87.5°		
9 kHz	POS	EXT	−92.5°	−87.5°		
9 kHz	NEG	EXT	87.5°	92.5°		
99 kHz	POS	CHAN 1	−102°	−78.0°		
99 kHz	POS	CHAN 2	−102°	−78.0°		
99 kHz	POS	EXT	−102°	−78.0°		

BNC center conductor grounded						
Signal Frequency	Trigger		Specification		Measured Value	
9 kHz	POS	CHAN 1	−96.5°	−83.5°		
9 kHz	POS	CHAN 2	−96.5°	−83.5°		
9 kHz	POS	EXT	−96.5°	−83.5°		
9 kHz	NEG	EXT	83.5°	96.5°		
99 kHz	POS	CHAN 1	−106°	−74.0°		
99 kHz	POS	CHAN 2	−106°	−74.0°		
99 kHz	POS	EXT	−106°	−74.0°		

2-30 Input Impedance

Resistance Measurement

Range Setting	Specification Lower Limit	Specification Upper Limit	**Measured Value** CHAN 1	**Measured Value** CHAN 2
20 dBV	950 kΩ	1050 kΩ		
0 dBV	950 kΩ	1050 kΩ		
−13 dBV	950 kΩ	1050 kΩ		

Capacitance Measurement

Channel 1	Channel 2
Vin = Vrms	Vin = Vrms
Vc = Vrms	Vc = Vrms

$$C = \left[\left(\frac{Vin}{Vc} - 1\right)\right] 15.9\ pF - 1.59\ pF$$

Measured Value CHAN 1	**Measured Value** CHAN 2	Specification
pF	pF	<100 pF

2-31 Harmonic Distortion

Measurement One

Signal Frequency	**Measured** Channel 1 Harmonic Frequency Amplitude	**Measured** Channel 2 Harmonic Frequency Amplitude	Specification
49500 Hz			≤ −80 dB
33000 Hz			≤ −80 dB
245750 Hz			≤ −80 dB
19800 Hz			≤ −80 dB

Measurement Two

Signal Frequency	**Measured** Channel 1 Harmonic Frequency Amplitude	**Measured** Channel 2 Harmonic Frequency Amplitude	Specification
49500 Hz			≤ −80 dB
33000 Hz			≤ −80 dB
24750 Hz			≤ −80 dB
19800 Hz			≤ −80 dB

2-32 Intermodulation Distortion Measurement One				
BNC shell grounded	Channel 1		Channel 2	
Harmonic Frequency	**PASS**	Specification	**PASS**	Specification
6 kHz		≤ −80 dB		≤ −80 dB
14 kHz		≤ −80 dB		≤ −80 dB
12 kHz		≤ −80 dB		≤ −80 dB
8 kHz		≤ −80 dB		≤ −80 dB
BNC center conductor grounded	Channel 1		Channel 2	
Harmonic Frequency	**PASS**	Specification	**PASS**	Specification
6 kHz		≤ −80 dB		≤ −80 dB
14 kHz		≤ −80 dB		≤ −80 dB
12 kHz		≤ −80 dB		≤ −80 dB
8 kHz		≤ −80 dB		≤ −80 dB

2-32 Intermodulation Distortion Measurement Two				
BNC shell floating	Channel 1		Channel 2	
Harmonic Frequency	**PASS**	Specification	**PASS**	Specification
10 kHz		≤ −80 dB		≤ −80 dB
79 kHz		≤ −80 dB		≤ −80 dB
20 kHz		≤ −80 dB		≤ −80 dB
69 kHz		≤ − 80 dB		≤ −80 dB
BNC center conductor grounded	Channel 1		Channel 2	
Harmonic Frequency	**PASS**	Specification	**PASS**	Specification
10 kHz		≤ −80 dB		**≤ −80 dB**
79 kHz		≤ −80 dB		**≤ −80 dB**
20 kHz		≤ −80 dB		**≤ −80 dB**
69 kHz		≤ −80 dB		**≤ −80 dB**

2-33 Noise and Spurious Signal Level				
Spurious Signals				
Start Frequency	Frequency Span	**PASS** CHAN 1	**PASS** CHAN 2	Specification
20 Hz	1 kHz			≤ −131 dBV
1 kHz	10 kHz			≤ −131 dBV
10 kHz	10 kHz			≤ −131 dBV
20 kHz	10 kHz			≤ −131 dBV
30 kHz	10 kHz			≤ −131 dBV
40 kHz	10 kHz			≤ −131 dBV
50 kHz	10 kHz			≤ −131 dBV
60 kHz	10 kHz			≤ −131 dBV
70 kHz	10 kHz			≤ −131 dBV
80 kHz	10 kHz			≤ −131 dBV
90 kHz	10 kHz			≤ −131 dBV
Noise Level				
Start Frequency	Frequency Span	**PASS** CHAN 1	**PASS** CHAN 2	Specification
20 Hz	1 kHz			≤ −134 dBV/$\sqrt{\text{Hz}}$
1 kHz	50 kHz			≤ −144 dBV/$\sqrt{\text{Hz}}$
50 kHz	50 kHz			≤ −144 dBV/$\sqrt{\text{Hz}}$

2-34 Cross Talk		
PASS Channel 1	**PASS** Channel 2	Specification
		≥140 dB

2-35 Common Mode Rejection				
	First Measurement − Second Measurement = Relative Value			
Signal Frequency	First Measurement CHAN 1	Second Measurement CHAN 1	**Measured Value** CHAN 1	Specification
66 Hz				≥80 dB
500 Hz				≥65 dB
Signal Frequency	First Measurement CHAN 2	Second Measurement CHAN 2	**Measured Value** CHAN 2	Specification
66 Hz				≥80 dB
500 Hz				≥65 dB

2-36 External Reference Test		
Frequency	**Measured Value**	Specification
1 MHz		<999.90 kHz
10 MHz		>10.001 MHz

2-37 Source Residual Offset			
Voltage Range Setting	Specification Lower Limit	Upper Limit	**Measured Value**
1 Vpk	−10 mVpk	10 mVpk	
5 Vpk	−10 mVpk	10 mVpk	

2-38 Source Amplitude Accuracy and Flatness	
0 Hz to 65 kHz	**PASS**
65 kHz to 100 kHz	**PASS**

2-40 Source Distortion			
Source Amplitude	Source Frequency	**PASS**	Specification
25 mVpk	10 kHz		≥60 dB
5 Vpk	10 kHz		≥60 dB
25 mVpk	99 kHz		≥40 dB
5 Vpk	99 kHz		≥40 dB

2-41 Source Energy Measurement

Random Noise:

HP 3562A Reading $\frac{(\sqrt{\quad})}{\quad}$ X 100 = _____ ≥70%

Voltmeter Average ( ) % in-band energy

Periodic Chirp:

HP 3562A Reading $\frac{(\sqrt{\quad})}{\quad}$ X 100 = _____ ≥85%

Voltmeter Average ( ) % in-band energy

SECTION III
ADJUSTMENTS

Contents

Tables

Figures

SECTION III
ADJUSTMENTS

3-1 INTRODUCTION

This section describes adjustments and checks required to bring the HP 3562A within the specifications listed in Table 1-1. If adjustments are made to a particular board, all adjustments specified for that board should made in the order shown in Table 3-1. These procedures should be performed if the specifications of Table 1-1 are not met, if instructed to do so in the troubleshooting section, or after component replacement. These procedures should not be performed as routine maintenance.

NOTE

Allow the HP 3562A to warm up for an hour before performing any adjustments. This is not critical for most of the adjustments due to the automatic calibration feature. It is important when setting the reference and calibrator.

The adjustments described for the ADC and input boards apply to both channel one and channel two of the analyzer front end.

Table 3-1 Adjustment Components

Adjustment Name	Board	Component
Power supply shut-down level	Pwr supply	A18R1
20.48 MHz reference	Trigger	A31R208
2nd pass offset	ADC	A32R408
2nd pass gain	ADC	A32R422
ADC offset	ADC	A32R400
ADC reference	ADC	A32R401
Track-&-hold offset	ADC	A32R408
Input dc offset side A	Input	A33R212
Input dc offset side B	Input	A33R112
Input attenuators:		
side A 40 dB	Input	A33C206
side A 20 dB	Input	A33C202
side B 40 dB	Input	A33C106
side B 20 dB	Input	A33C102
Source dc offset	Source	A30R9
Calibrator gain	Source	A30R10

3-2 EQUIPMENT REQUIRED

Table 1-2 lists the equipment required for the adjustment procedures. Any equipment which meets the critical specifications given in the table may be substituted for the recommended model.

3-3 SAFETY CONSIDERATIONS

Although the HP 3562A is designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to keep the unit in a safe operating condition. Service and adjustments should be performed only by qualified personnel who are aware of the hazards involved.

WARNING

Any interruption of the protective (ground) conductor inside or outside the unit, or disconnection of the protective earth terminal can expose operators to potentially dangerous voltages.

Only fuses of the rated current and specified type should be used for replacement. The use of repaired fuses and short circuiting of fuse holders is not permitted. Whenever fuse protection has been impaired, the HP 3562A must be made inoperative.

Adjustments performed in this section are performed with power applied and the protective covers removed. These adjustments should be performed only by trained service personnel who are aware of the hazards involved (such as fire and electrical shock).

***Under no circumstances** should an operator remove any covers, screws, shields or in any other way access the interior of the HP 3562A. There are no operator controls inside the instrument.*

3-4 POWER SUPPLY ADJUSTMENTS

Description:

The only power supply (A18) adjustment is the line level voltage at which the power supply becomes active. This adjustment should be made only when there has been a failure of the low-line power shut down circuit or the power shut down occurs for line voltages above 81 Vrms when operated on 115 Vac mains power or above 162 Vrms when operated on 230 Vac mains power.

None of the HP 3562A dc power supply voltages are adjustable.

Equipment Required:

Variable ac power supply	
Oscilloscope	HP 1980B
10:1 Oscilloscope probe	HP 10014A

Procedure:

1. Turn the HP 3562A off, remove the line power cord from the rear panel and place the instrument on its top or side with the bottom panel fully accessible.

2. Remove the HP 3562A bottom cover. None of the internal covers need to be removed.

3. If the mains power voltage selector (on the rear panel) is not in the 115V setting, switch it to 115V.

WARNING

Even with the power switch in the OFF position and the line power cord removed, dangerous voltages may be present on the power supply capacitors.

4. Set the variable ac power supply to output 81 Vrms ±2 Vrms and connect the main power cord of the HP 3562A to the variable ac power supply.

5. Configure the scope for dc coupling and connect the scope input to A18**TP12** using a 10:1 probe. See figure 3-1.

6. Turn the HP3562A on.

7. Turn A18**R1** fully CCW and then CW until the signal at TP12 goes low; then turn it CCW until it just goes high. The setting may be tested by lowering the output voltage of the variable ac power supply to 78 Vrms at which point the signal on TP12 should be low.

This completes adjustment of the power supply. If the instrument is normally operated on 230 Vac mains supply, set the rear panel voltage selector to 230V.

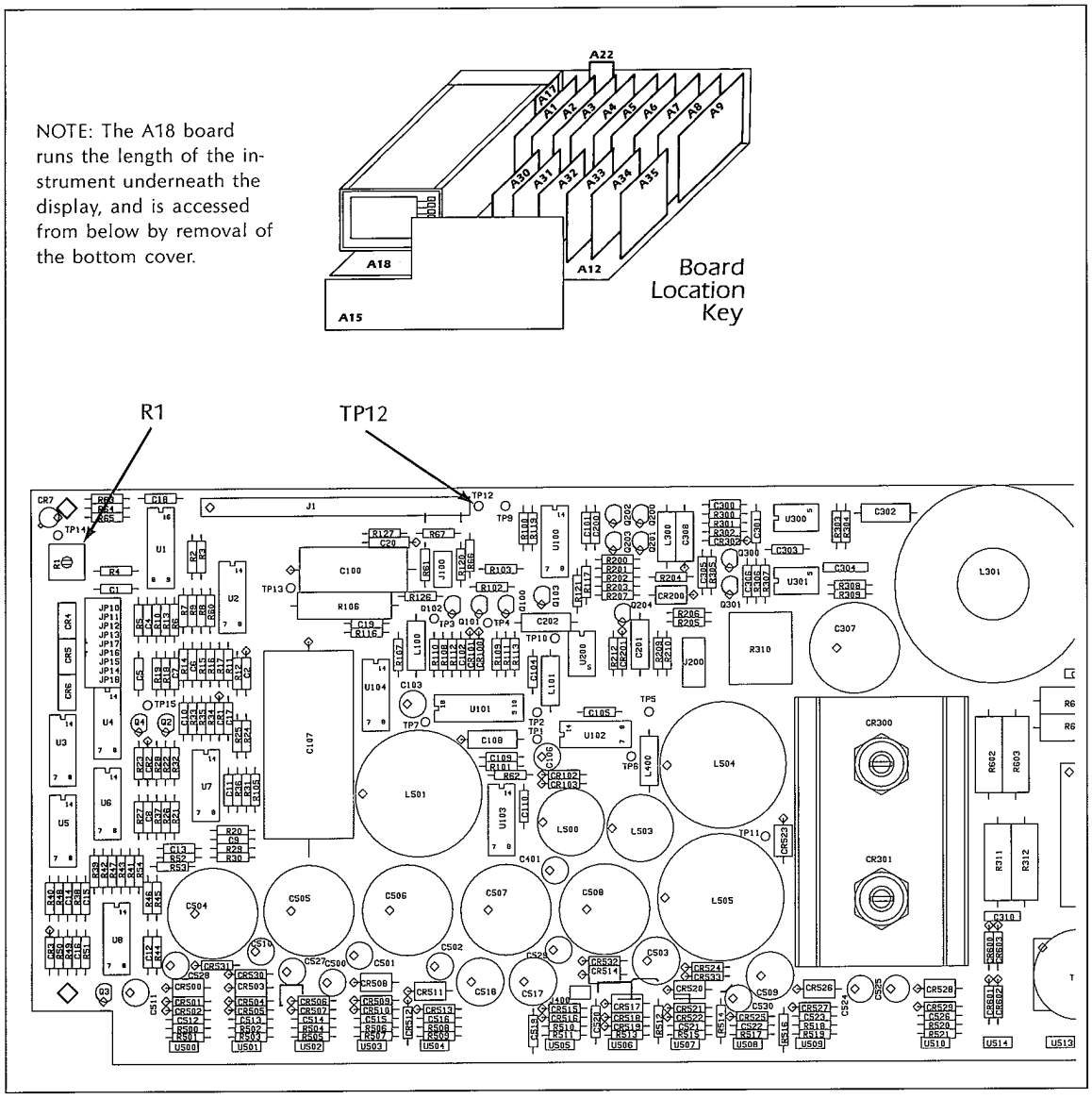


Figure 3-1 Power supply component locator (A18)

3-5 20.48 MHz REFERENCE ADJUSTMENT

Description:

This procedure adjusts the 20.48 MHz frequency reference circuit on the trigger board (A31). This circuit is the source of the timing reference for the ADC boards (A33), the local oscillator (A4) and the main power supply (A18).

Equipment Required:

Frequency Standard ..... 10 MHz Freq Standard
Frequency counter ..... HP 5351B
1:1 scope probe ..... HP 10083A

CAUTION

Instrument power should always be turned off before any boards are removed or installed. Failing to do so causes circuit failure in most cases.

Procedure

1. Disconnect the line power cord from the rear panel of the HP 3562A.
2. Remove the instrument top cover. This adjustment can be performed without putting the board on an extender board.
3. Move jumper A31**J201** to the test position (connects the lower two pins together).
4. Reconnect the line power cord and turn the power switch ON.

NOTE

Before making this adjustment the HP 3562A must be left on for approximately two hours to allow the reference to come to a stable operating temperature.

5. Connect the frequency standard output to the counter reference input and connect the counter's main counting input to A31**TP10** (VCO output) using the 1:1 probe.
6. Adjust A31**R208** for a counter reading of 20.48 MHz ±200 Hz.
7. Remove the power and return A31**J201** to the normal position on the upper two pins.

This completes the adjustment.

3-6 SECOND PASS GAIN ADJUSTMENT

Description:

This procedure adjusts the dc offset of the second pass circuit on the ADC board (A32). This procedure adjusts the dc offsets to prevent nonlinear ADC operation near DAC transition levels. If this adjustment is performed, 3-8 (track and hold offset) must also be done.

Equipment Required:

Synthesized function generator	HP 3325A
Oscilloscope	HP 1980B
1:1 Oscilloscope probe	HP 10083A
Extender board (part of kit 03562-84401)	HP 03562-66542
Adapter cable (part of kit 03562-84401)	HP 03585-61616
Capacitive load	(see note)
Shorting clip	

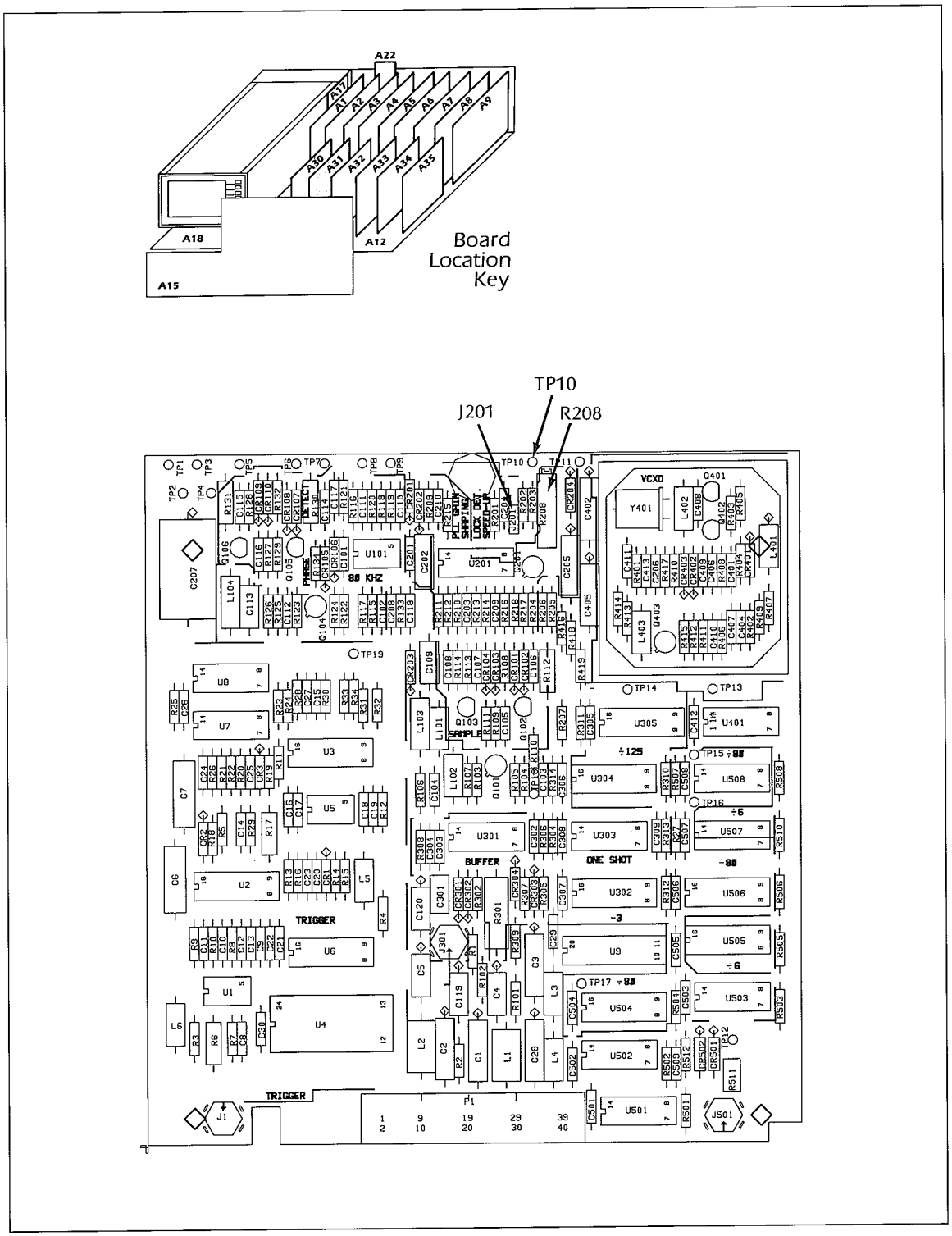
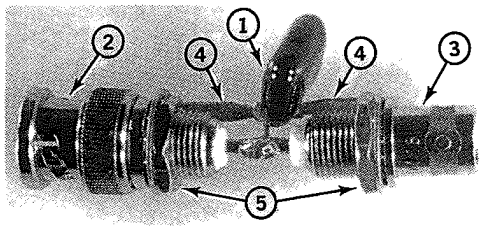


Figure 3-2 Trigger board component locator (A31)

Special note: A capacitive load may be used to reduce noise on the scope display in the following adjustment. This part is not required to perform this adjustment, but it does make it easier to evaluate the results the first few times through the procedure. It consists of a capacitor between the scope input and ground. It is made using a 3300 pf silver mica capacitor and two panel-mount BNC connectors; one female and one male. The HP part numbers for these parts and a drawing showing construction appear in figure 3-3.



Item	Qty.	Description	HP P/N
1	1	3300 pf cap	0160-2230
2	1	male BNC	1250-0045
3	1	female BNC	1250-0018
4	2	solder lugs	0360-1632
5	2	hex nuts	2950-0043

Figure 3-3 Capacitive load

CAUTION

Instrument power should always be turned off before any boards are removed or installed. Failing to do so causes circuit failure in most cases.

Procedure:

1. Disconnect the line power cord from the rear panel of the HP 3562A.

2. Remove the ADC board to be adjusted and place it on the extender board.

3. Reconnect the line power cord and turn the power switch ON.

4. Connect A32**TP400** to a ground test point with a shorting clip. This disables the offset DAC.

5. Remove the coaxial cable connected to A32**J200** and connect the synthesizer output to A32**J200** with the BNC-to-SMB adapter cable. Set the synthesizer for a 30 mVp-p triangle wave at 200 Hz.

6. Connect the scope to A32**TP401** with a 1:1 probe and a capacitive load. Connect the SYNC output of the synthesizer to the MAIN TRIG input of the scope. The scope should be set for 2 mV/div, 2 ms/div, ac coupling, BW limit on, and externally triggered.

7. Press the following keys in the order given:

PRESET .... RESET

RANGE .... 7 ..... dBVrms

SPCL FCTN .... BEEPER ON/OFF .. **−66** .. ENTER (Dither off)
.... BEEPER ON/OFF .. **−69** .. ENTER (2nd pass only)

NOTE

Pressing the beeper key toggles the beeper between on and off. It does not matter whether the beeper is turned on or off as long as the keys are pressed in the order specified. If beeper commands have been activated, the instrument must be reset before it can make measurements. This is required because the beeper commands configure internal circuits for special tests which do not allow accurate measurements to be made.

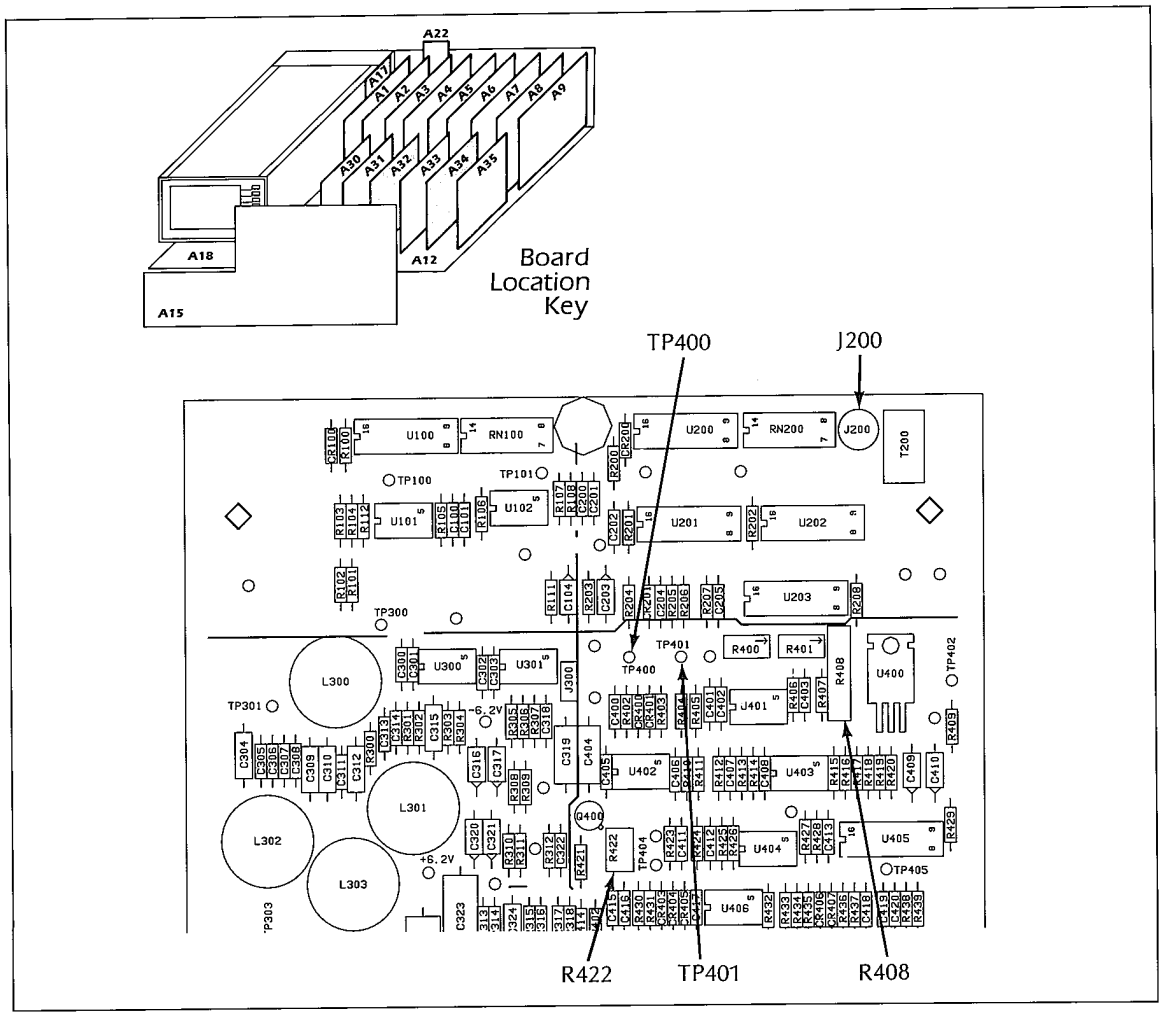


Figure 3-4 ADC board component locator (A32)

If the circuit is badly out of adjustment the signal may appear as a triangle waveform with either the upper or lower corners extending outward as spikes as shown in figure 3-5. The following adjustments should reduce the spikes to form a regular triangle waveshape and then flatten the triangle waveform into a "straight" line as shown in figure 3-8. The noise remaining after adjustment appears in varying amounts on most boards.

8. Adjust A32**R408** to remove sharp spikes in the scope waveform as shown in figure 3-6. These spikes may protrude up or down, depending on which way the adjustment is off.
9. Adjust A32**R422** to flatten the triangle signal at A32**TP401** (shown out of adjustment in figure 3-7).

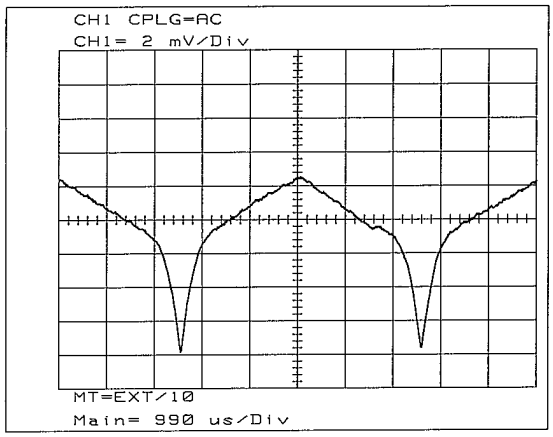


Figure 3-5 Both R408 & R422 out of adjustment

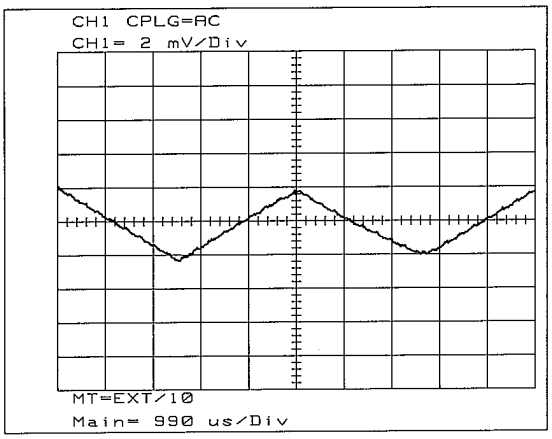


Figure 3-6 R408 needs adjustment

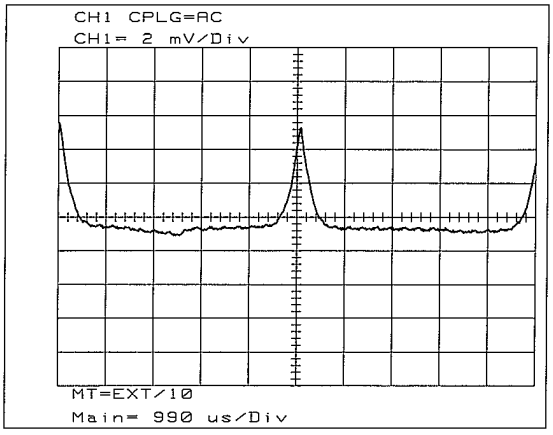


Figure 3-7 R422 needs adjustment (spikes may extend down)

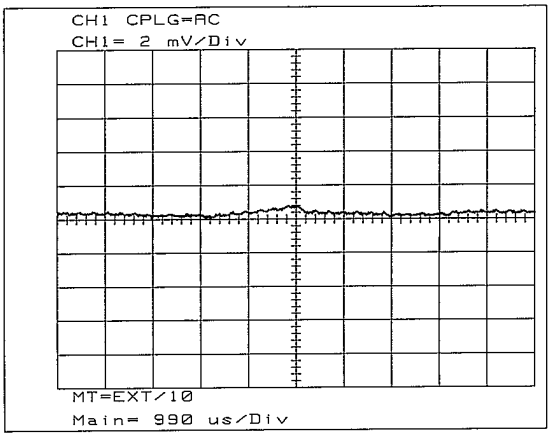


Figure 3-8 Second pass gain adjustments complete

This completes the adjustment. If no more adjustments are to be made to this board, remove the line power cord from the HP 3562A rear panel, remove the extender board and reinstall the ADC board in the card cage.

3-7 ADC OFFSET AND REFERENCE ADJUSTMENT

Description:

This procedure nulls the ADC's dc offset and optimizes its reference voltage.

NOTE

The second pass gain adjustment described in section 3-6 must be completed before making this adjustment.

Equipment Required:

Frequency Synthesizer	HP 3325A
Oscilloscope	HP 1980B
10:1 Oscilloscope Probe	HP 10014A
Extender board (part of kit 03562-84401)	HP 03562-66542
Adapter cable (part of kit 03562-84401)	HP 03585-61616

CAUTION

Instrument power should always be turned off before any boards are removed or installed. Failing to do so causes circuit failure in most cases.

Procedure:

1. Disconnect the line power cord from the rear panel of the HP 3562A.
2. Remove the ADC board to be adjusted and place it on the extender board.
3. Reconnect the line power cord and turn the power switch ON.
4. Connect A32**TP400** to a ground test point.
5. Set the frequency synthesizer for a 800 mVp-p triangle signal at 200 Hz. Connect the frequency synthesizer to A32**J200** through the adapter cable.
6. Connect the scope to A32**TP405** using the 10:1 probe. **Do not** use the capacitive load. Configure the scope for 15 mV/div, 1.5 ms/div, dc coupling, BW limiting on, and triggering HF rejection.
7. Press the following keys in the order given:

   PRESET .... RESET

   RANGE .... 7 ..... dBVrms

   SPCL FCTN .... BEEPER ON/OFF .. **−66** .. ENTER (Dither off)

   (if still in "second pass only" from previous adjustment, beeper **−68** enter will return to normal two pass operation)

   NOTE

   Pressing the beeper key toggles the beeper between on and off. It does not matter whether the beeper is turned on or off as long as the keys are pressed in the order specified. If beeper commands have been activated, the instrument must be reset before it can make measurements. This is required because the beeper commands configure internal circuits for special tests which do not allow accurate measurements to be made.

8. Three traces should now appear on the scope display as shown in figure 3-10; 1) a straight, horizontal line in the upper half of the display, 2) a clean triangle wave in the lower half of the display, and 3) a "noisy" signal in the lower half of the display that may appear as either a straight or triangular line. The following adjustments flatten this last signal and center it in the clean triangular signal.

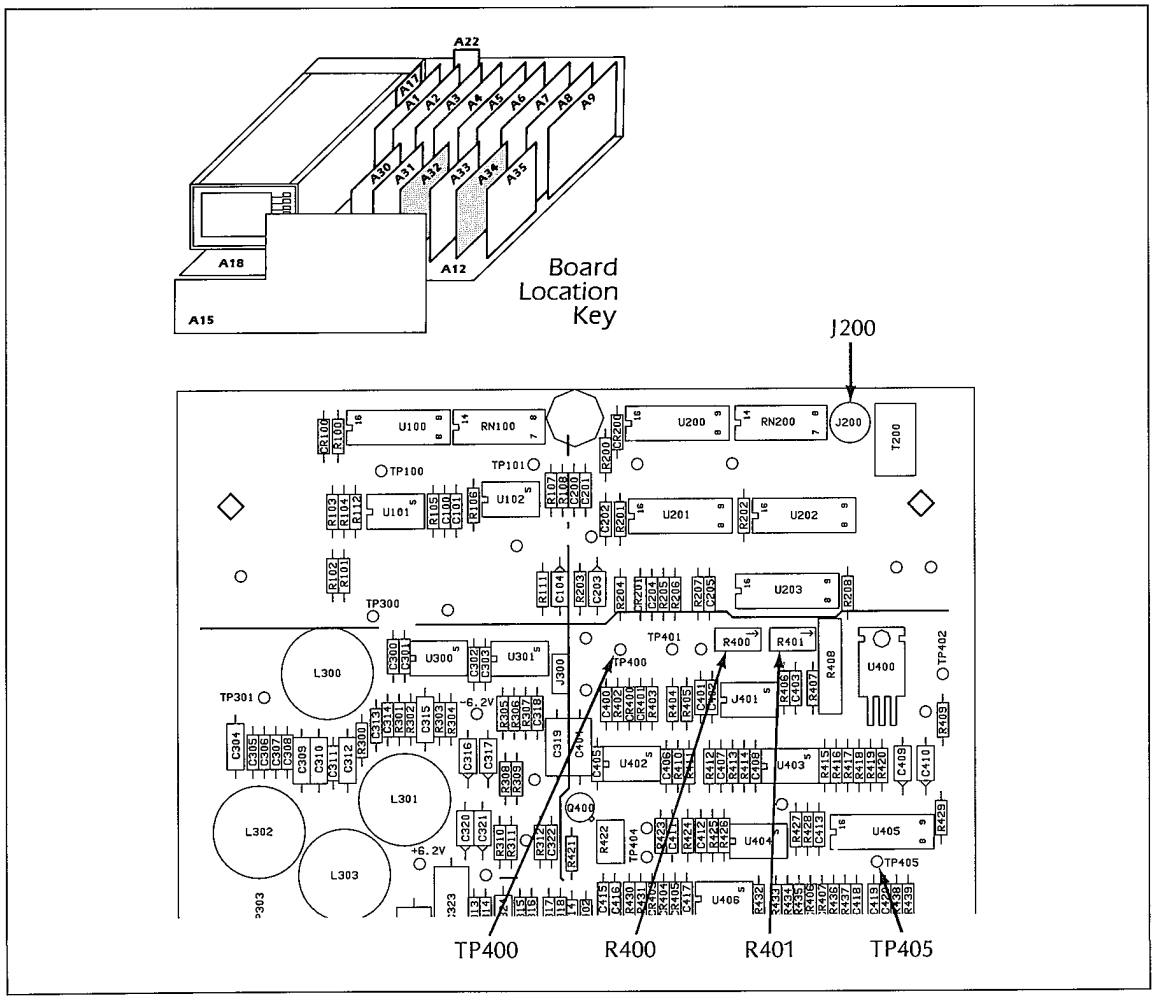


Figure 3-9 ADC board component locator (A32)

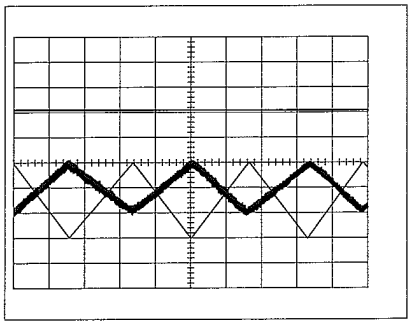


Figure 3-10 Both R401 & R400 out of adjustment

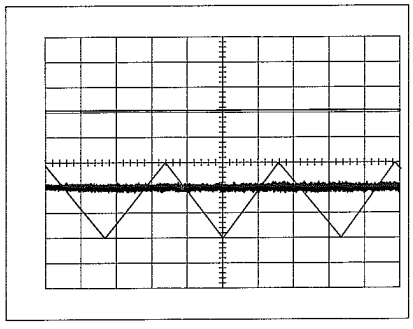


Figure 3-11 R401 adjusted to flatten "noisy" triangle signal

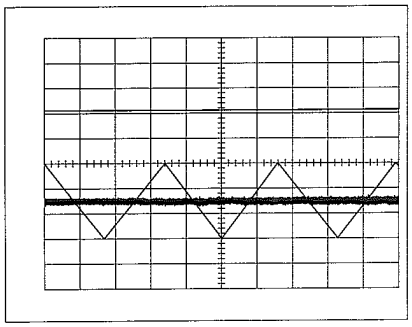


Figure 3-12 R400 adjusted to place "noisy" line in the center of the triangle signal

9. Adjust A32**R401** for a flat "noisy" trace as shown in figure 3-11.

10. Adjust A32**R400** to center the flat trace in the clean triangle trace as shown in figure 3-12.

This completes the adjustment. If no more adjustments are to be made to this board, remove the line power cord from the HP 3562A rear panel, remove the extender board and reinstall the ADC board in the card cage.

3-8 TRACK AND HOLD OFFSET ADJUSTMENT

Description:

This procedure minimizes the track and hold dc offset. This adjustment is required if the second pass gain adjustment (3-6) is performed, for optimal dc response.

Equipment Required:

Extender board (part of kit 03562-84401) . . . . . HP 03562-66542

CAUTION

Instrument power should always be turned off before any boards are removed or installed. Failing to do so causes circuit failure in most cases.

Procedure:

1. Disconnect the line power cord from the rear panel of the HP 3562A.

2. Remove the ADC board to be adjusted and place it on the extender board.

3. Reconnect the line power cord and turn the power switch ON.

4. Connect A32**TP400** to a test point ground.

5. Move A32**J300** to the lower two pins.

6. Press the following keys in the order given:

PRESET	. . . . RESET	
RANGE	. . . . 7 . . . . . dBVrms	
SPCL FCTN	. . . . BEEPER ON/OFF	. . **–66** . . ENTER (Dither off)
	. . . . BEEPER ON/OFF	. . **–67** . . ENTER (Autozero off)
	. . . . SERVIC TEST	
	. . . . LOOP ON	
	. . . . TEST INPUT	
	. . . . ADC	
	. . . . PASS THRU	

NOTE

Pressing the beeper key toggles the beeper between on and off. It does not matter whether the beeper is turned on or off as long as the keys are pressed in the order specified. If beeper commands have been activated, the instrument must be reset before it can make measurements. This is required because the beeper commands configure internal circuits for special tests which do not allow accurate measurements to be made.

8. Numbers appear on the screen under the headings "Channel 1" and Channel 2." Adjust A32**R408** until the number corresponding to the channel under test is 0 ±16.

This completes the adjustment of the ADC board. Remove the line power cord from the HP 3562A rear panel, return jumper J300 to the upper two pins (normal position), remove the shorting clip between TP400 and ground, remove the extender board and reinstall the ADC board in the card cage.

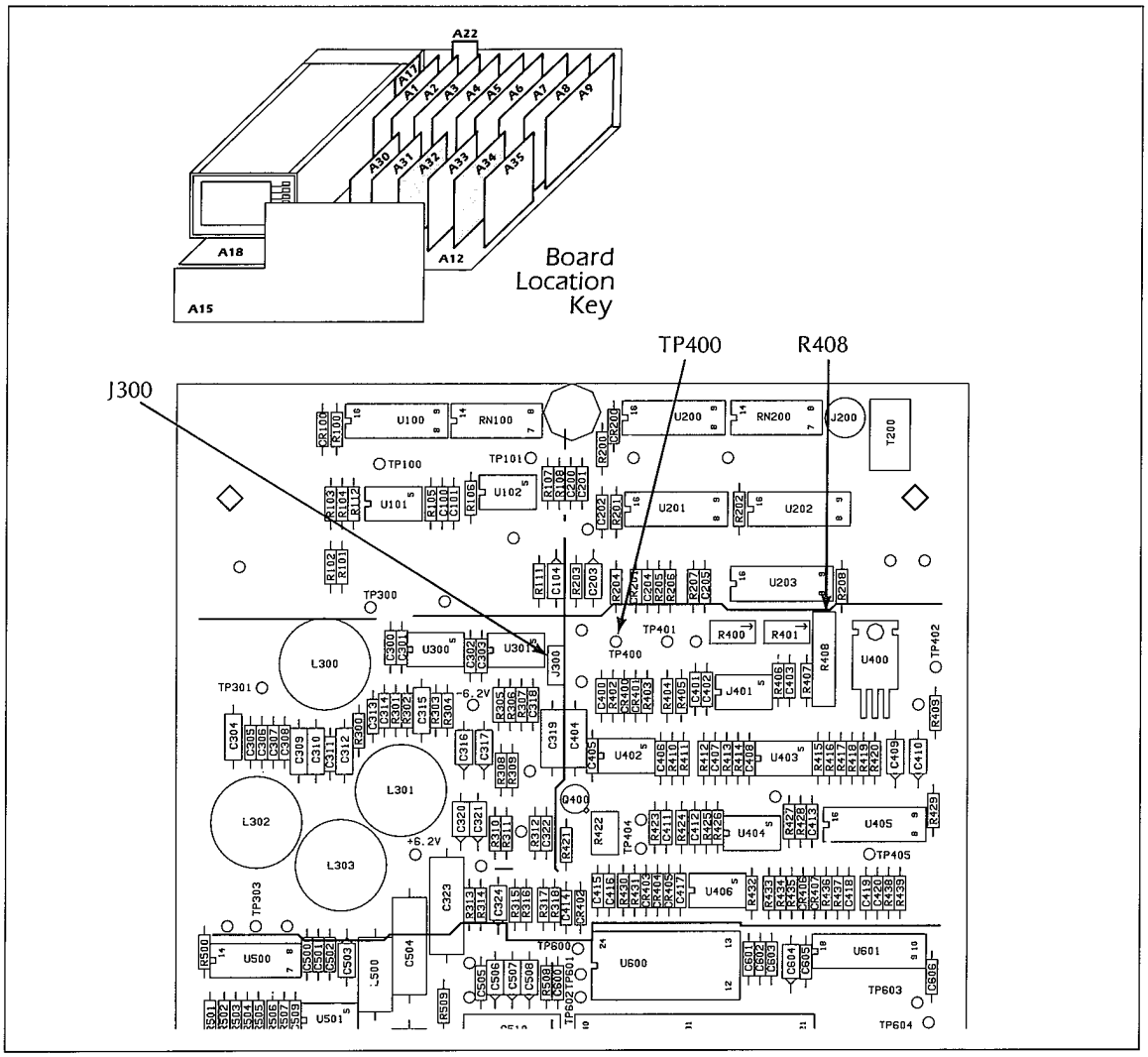


Figure 3-13 *ADC board component locator (A32)*

3-9 INPUT DC OFFSET ADJUSTMENT

Description:

This procedure centers the offset DAC on the ADC board to allow it maximum correction range in either the positive or negative direction.

Equipment Required:

Extender board (part of kit 03562-84401) . . . . . HP 03562-66542

CAUTION

Instrument power should always be turned off before any boards are removed or installed. Failing to do so causes circuit failure in most cases.

Procedure:

1. Disconnect the line power cord from the rear panel of the HP 3562A.
2. Remove the Input board (A33) to be adjusted and place it on the extender board. Be sure to reconnect the coax between the input board and its accompanying ADC board.
3. Remove the ADC board of the same channel as the input board under adjustment and ground TP400. Replace the board in the instrument.
4. Short all three pins of the input connector A33**J300** and A33**TP501** together. Since the center pin of the input connector is ground, this grounds the input signals and TP501.
5. Reconnect the line power cord and turn the power switch ON.
6. Press the following keys in the order given:

   RANGE . . . . **−51** . . . . dBVrms

   INPUT COUPLE . . . . Select dc coupling

   X . . . . (Turn on the X marker at frequency having the largest magnitude; in this case it should be 0 Hz)

   To adjust channel two, also press:

   MEAS DISP . . . . POWER SPEC2

7. Adjust A33**R212** for a marker amplitude reading of less than −85 dB on the HP 3562A display.
8. Remove the ground connection from A33**TP501**.

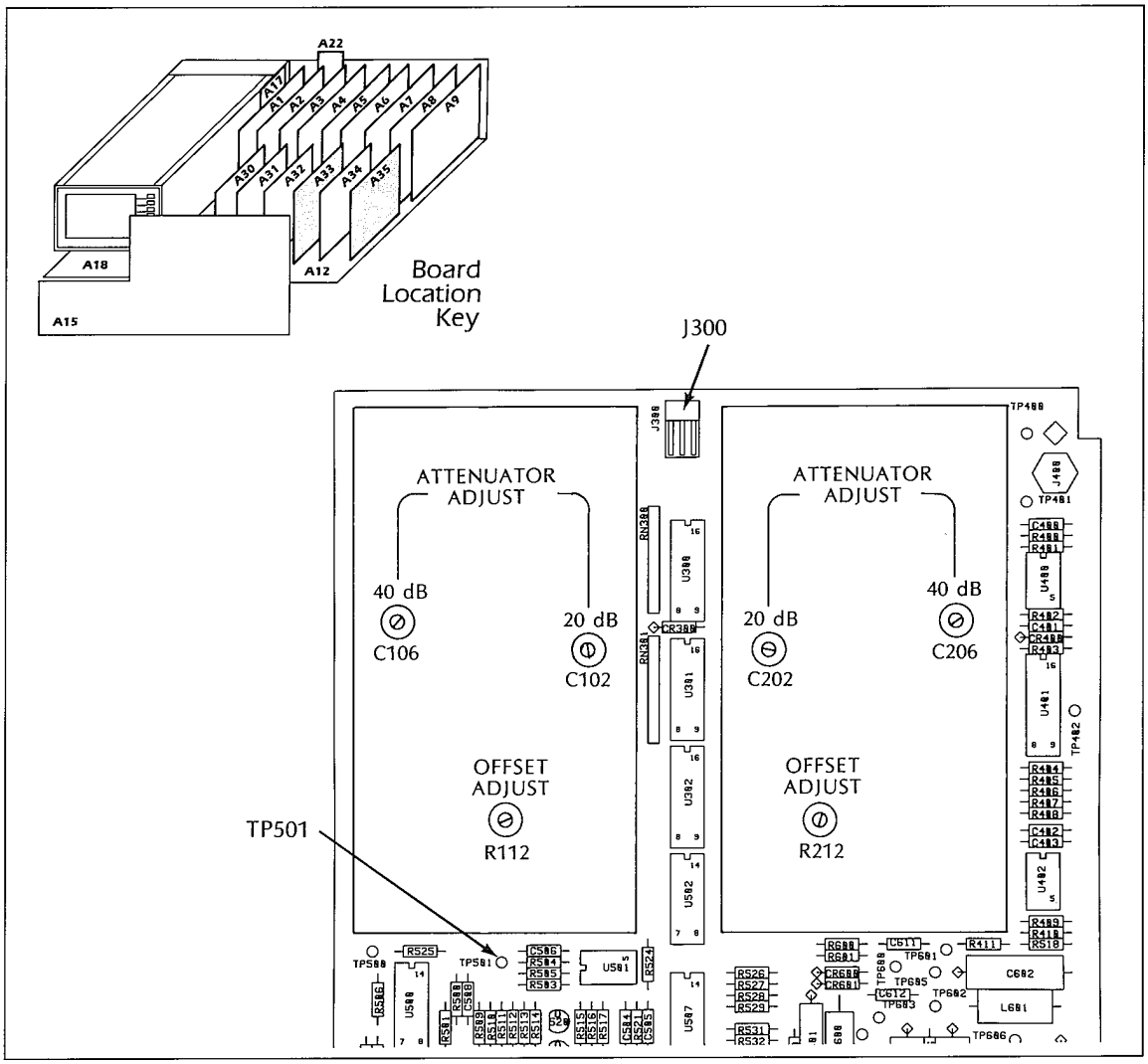


Figure 3-14 Input board component locator (A33)

9. Adjust A33**R112** as described in step 7.

This completes the adjustment. If no more adjustments are to be made to this board, remove the line power cord from the HP 3562A rear panel, remove the ground wire from the ADC board, remove the extender board and reinstall the input board in the card cage.

3-10 INPUT ATTENUATORS

Description:

These adjustments set the input attenuation levels on either of the two input boards (A33 or A35). There are two pair of attenuators on each channel. In measurements made with reference to ground, two attenuators (one 20 dB and one 40 dB) are used for range setting on the input boards. When the inputs are floated there are 20 dB and 40 dB attenuators for each side of the input signal for each board (2 ranges on 2 signal lines on 2 boards = 8 total).

NOTE

The input board assemblies for the two channels are identical but it is recommended that they not be interchanged after adjustment.

Equipment Required:

Extender board (part of kit 03562-84401) . . . . . HP 03562-66542

CAUTION

Instrument power should always be turned off before any boards are removed or installed. Failing to do so causes circuit failure in most cases.

Procedure:

1. Disconnect the line power cord from the rear panel of the HP 3562A.
2. Remove the Input board to be adjusted and place it on the extender board.
3. Reconnect the line power cord and turn the power switch ON.
4. Connect the front two pins of the input connector together. This grounds the low side of the differential input signal.
5. Press the following keys in the order given:

PRESET . . . . RESET

RANGE . . . . **1** dBVrms (disables autoranging)

PAUSE/CONT

SPCL FCTN . . . . SERVIC TEST
. . . . LOOP ON
. . . . TEST INPUT
. . . . FR END ADJUST
. . . . SIDE A 40 dB

Numbers should appear on the screen under the headings "Channel 1" and "Channel 2".

6. Adjust A33**C206** for a zero reading on the HP 3562A display.
7. Press the **SIDE A 20 dB** softkey.
8. Adjust A33**C202** for a zero reading on the HP 3562A display.
9. Move the shorting clip on the input connector to the rear two pins, shorting the high side of the differential input signal to ground.

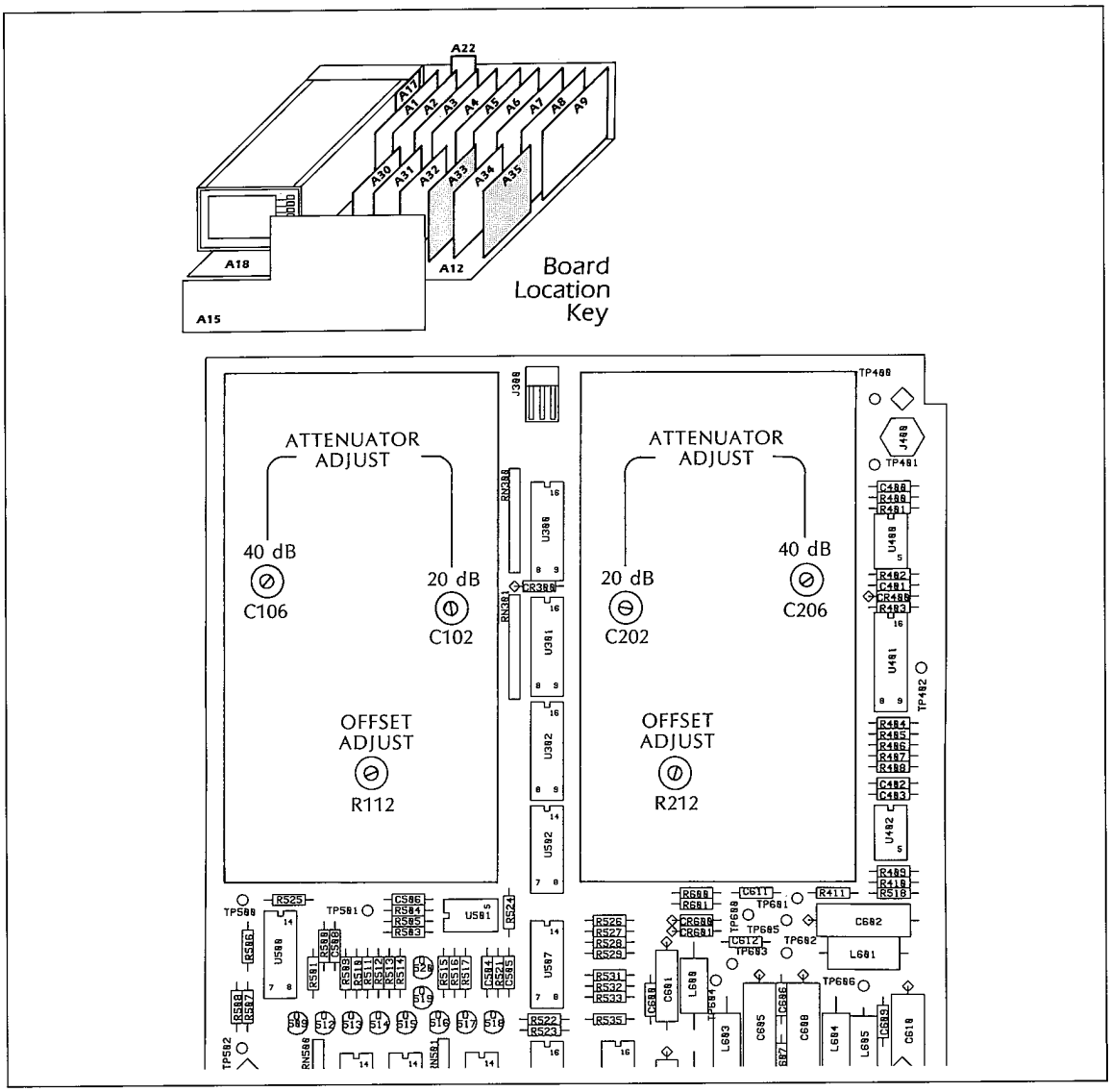


Figure 3-15 Input board component locator (A33)

10. Press the **SIDE B 40 dB** softkey.

11. Adjust A33**C106** for a zero reading on the HP 3562A display.

12. Press the **SIDE B 20 dB** softkey.

13. Adjust A33**C102** for a zero reading on the HP 3562A display.

This completes the adjustment. Disconnect the line power cord from the HP 3562A rear panel, remove the extender board and reinstall the input board in the card cage.

3-11 SOURCE DC OFFSET ADJUSTMENT

Description:

This procedure adjusts the dc offset control circuitry for proper amplitude. This adjustment sets the gain for the dc offset D/A converter.

Equipment Required:

Digital Voltmeter ..... HP 3455A

Procedure:

1. Preset the HP 3562A by pressing the PRESET hardkey and the RESET softkey.

2. Press the following keys in the order given:

SOURCE	.... SOURCE LEVEL	.... **0**	Vpk
	.... DC OFFSET	... **10** ...	Vpk

3. Connect the digital voltmeter to the HP 3562A source front panel output using a BNC cable and a BNC-to-banana adapter.

4. Adjust A30**R9** for a 10 V ±75 mV reading on the voltmeter.

5. Press the DC OFFSET softkey and enter a −10 Vpk offset.

6. Check for a −10 V voltmeter reading. Adjust A30**R9** so both the the +10 V setting and the −10 V setting are within 75 mV of the programmed value.

This completes the adjustment. Remove the line power cord from the rear panel and disconnect all equipment.

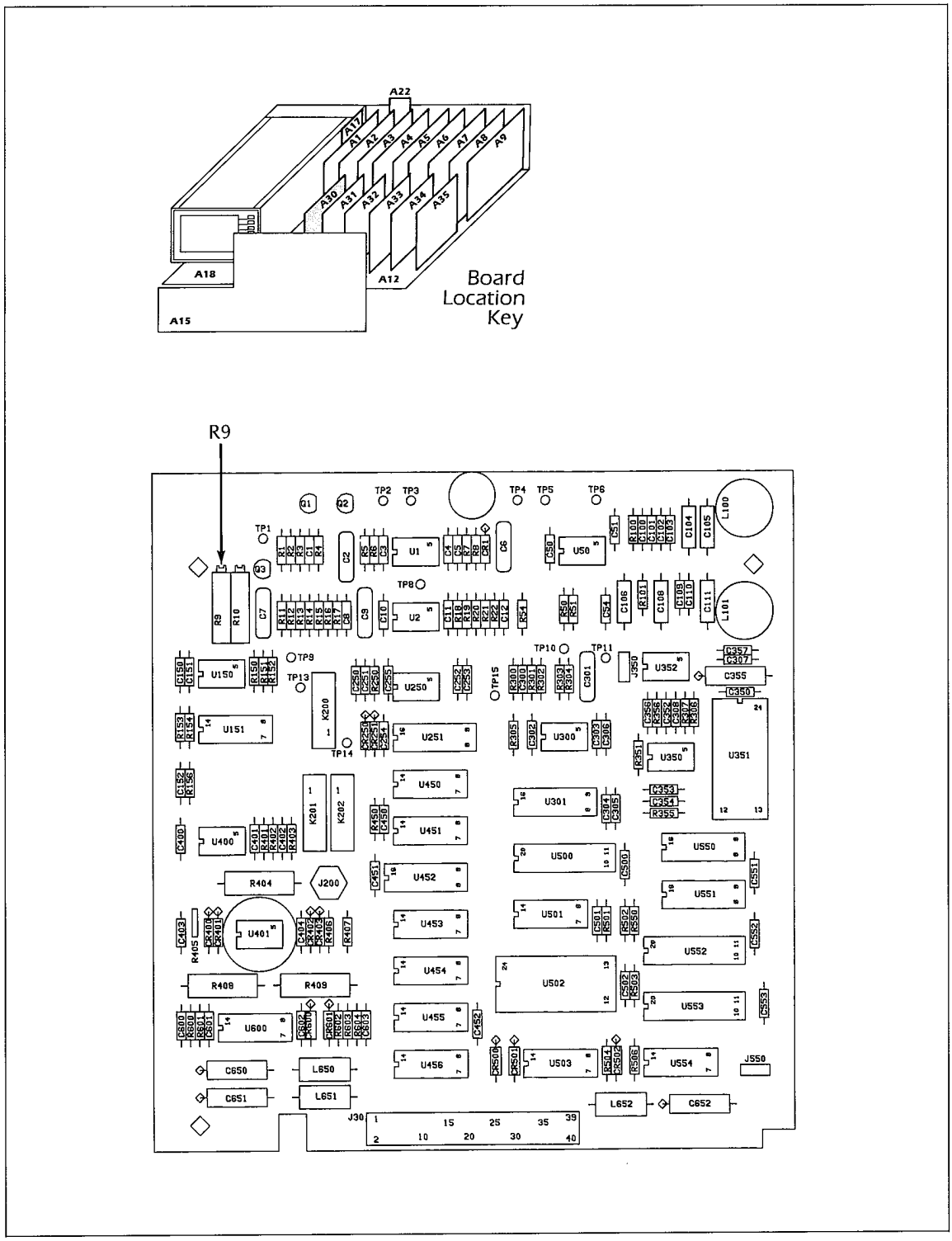


Figure 3-16 Analog source component locator; A30R9

3-12 CALIBRATOR GAIN ADJUSTMENT

Description:

This procedure adjusts the HP 3562A's internal calibrator on the analog source board for the optimum amplitude setting.

Equipment Required:

AC Calibrator ..... Fluke 5200A
Synthesized function generator ..... HP 3325A

Procedure:

1. Phase lock the calibrator to the function generator and turn calibrator phase lock ON.

2. Preset the HP 3562A by pressing the PRESET hardkey and the RESET softkey.

3. Set the calibrator for 0.2 Vrms and 4 kHz.

4. Connect the calibrator output to the HP 3562A Input 1.

5. Press the following keys in the order given:

   PAUSE/CONT ....

   SPCL FCTN .... SERVIC TEST
   .... LOOP ON
   .... TEST INPUT
   .... FR END ADJUST
   .... CALIBR ADJUST

6. The HP 3562A display should now show a number that is constantly changing. Adjust A30**R10** until this number is positive as often as it is negative.

This completes the adjustment. Remove the line power cord and reinstall the instrument top cover.

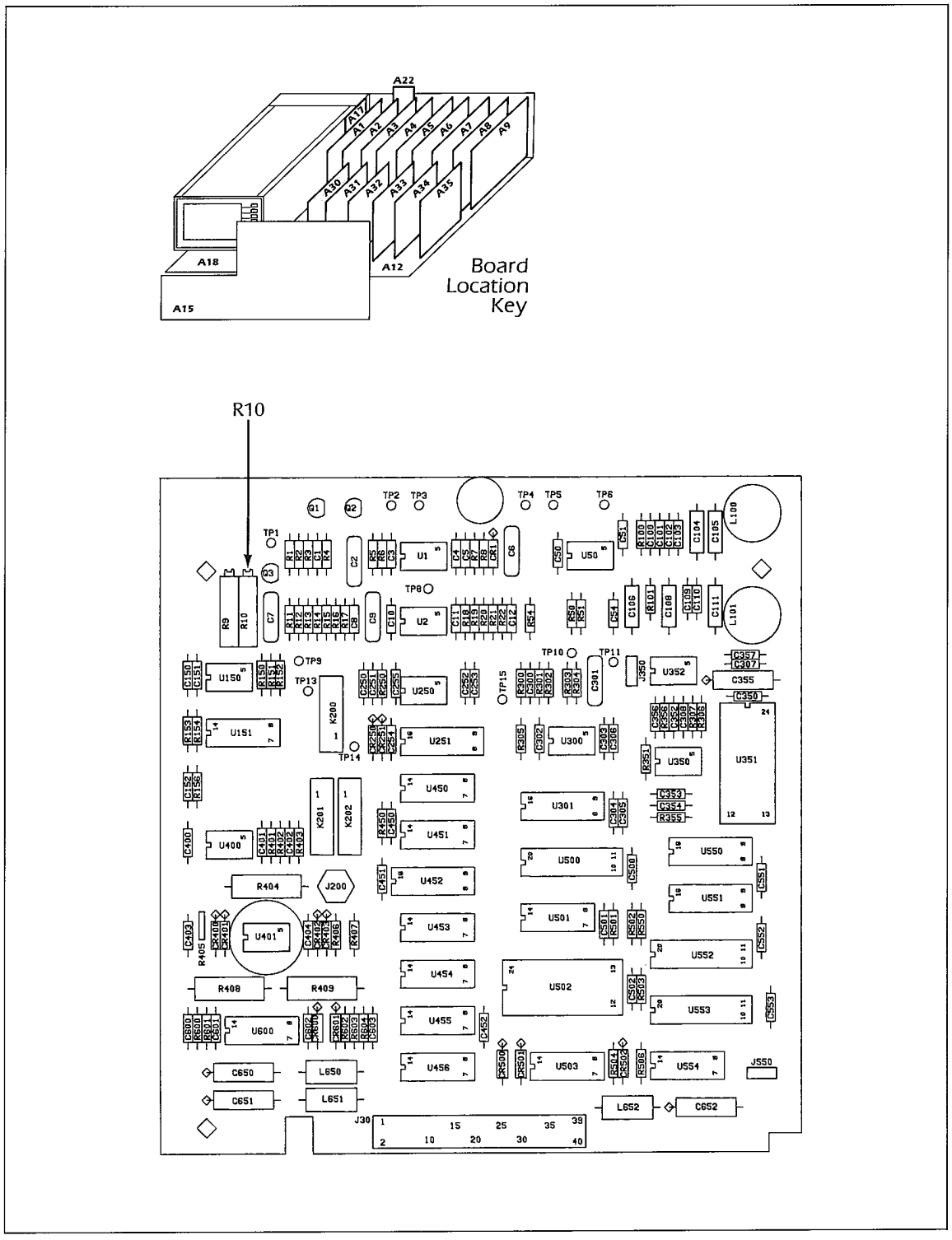


Figure 3-17 ***Analog source component locator; A30R10***

SECTION IV
REPLACEABLE PARTS

Contents

Tables

Figures

SECTION IV
REPLACEABLE PARTS

4-1 INTRODUCTION

This section contains information for ordering replacement parts. Table 4-1 lists the abbreviations used in Table 4-3, Replaceable Parts List, and throughout this manual. Table 4-2 lists the names and addresses that correspond to the manufacturers' code numbers.

NOTE

An instrument may contain mixed English/metric fasteners. Instruments with serial numbers less than 2502A00566 use English fasteners for the cabinet. Instruments with serial numbers 2502A00566 and above use metric fasteners for the cabinet (an M-designation is under the front bezel plastic trim strip).

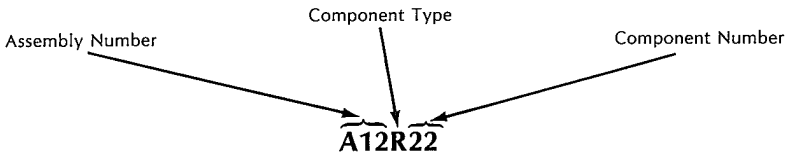
4-2 REPLACEABLE PARTS LIST

Table 4-3 is organized as follows:

1. PC boards and their components is alphanumeric order by reference designators.
2. Chassis-mounted components and hardware grouped by top, bottom, front, back and side assemblies. Cables are included in a separate group.

The information for each part consists of the following:

1. REFERENCE DESIGNATOR



2. HP PART NUMBER
3. CD - The Check Digit used by HP to verify that an order has been transmitted correctly.
4. QTY - The total quantity in the PC board.
5. DESCRIPTION - The HP description of the part.
6. MFR CODE - The manufacturer's code.
7. MFR PART NUMBER - The manufacturer's part number.

NOTE

The total quantity of each part is given once for each board — at the first appearance of the part number on the board component listing.

4-3 ORDERING INFORMATION

Ordering Listed Parts

To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number (with the check (CD)), indicate the quantity required, and address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

Ordering Non-listed Parts

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

Direct Mail Order System

Within the U.S.A., Hewlett-Packard can supply parts through a direct mail order system. Advantages of using this system are:

- Direct ordering and shipment from the HP Parts Center in Mountain View, California.
- 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 you local Hewlett-Packard sales and service office.

Special Handling

The HP 3562A contains many static sensitive components. Use the appropriate precautions when removing, handling and installing all parts to avoid unnecessary damage.

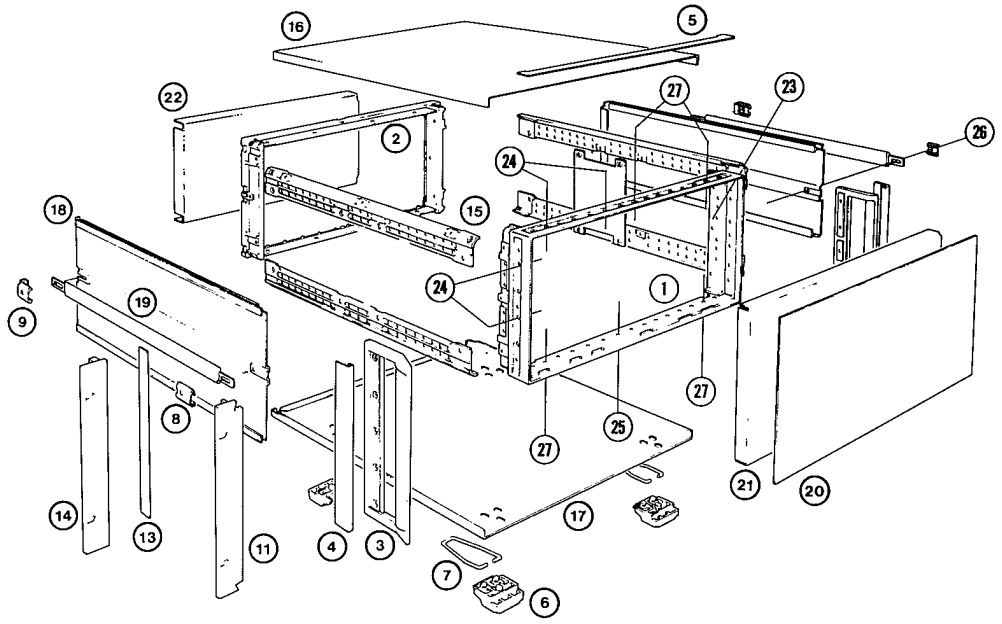


Figure 4-2 Cabinet Parts, Exploded View

	MP#*	Description	Qty	Current Part Number (Metric)**	Previous Part Number (English)**
1.	—	Front frame	1	5021-5807	5020-8807
2.	—	Rear frame	1	5021-5808	5020-8808
3.	—	Front handle kit (optional)	2	5061-9691	5061-0091
4.	—	Trim, front handle	2	5020-8898	
5.	507	Top trim, front frame	1	5040-7202	
6.	506	Foot	4	5040-7201	
7.	—	Tilt stand	2	1460-1345	
8.	508	Front strap handle cap	2	5041-6819	5040-7219
9.	509	Rear strap handle cap	2	5041-6820	5040-7220
11.	—	Rack mount flange kit with front handle (optional)	2	5061-9685	5061-0085
12.	—	Side gusset	2	5001-8234	
13.	505	Side trim, front frame w/o front handle	2	5001-0441	
14.	—	Rack mount flange kit w/o front handle (optional)	2	5061-9679	5061-0079
15.	—	Corner strut with tapped holes	4	5021-5838	5020-8838
16.	510	Top cover	1	5061-9436	5060-9836
17.	511	Bottom cover	1	5061-9448	5060-9848
18.	—	Side cover, perforated with handle recess	2	5060-9948	
19.	509	Strap handle	2	5060-9805	
20.	100	Front dress panel	1	03562-00201	
21.	101	Front sub panel	1	03562-00202	
22.	200	Rear panel	1	03562-00203	
23.	—	Screw	16	0515-1331	2510-0192
24.	—	Screw (attaches to CRT bezel)	4	0515-0889	0515-0218
25.	—	Screw	1	0515-0081	
		Lock washer	1	2190-0047	
26.	—	Screw	4	0515-1132	2680-0172
27.	—	Screw	5	0515-0657	0515-0218

* From replaceable parts list, table 4-3

** The current part numbers apply to instruments with serial numbers 2502A00566 and greater. The previous part numbers apply to serial numbers 2435A00565 and lower. If there is no previous part number listed, all serial numbers use the current part number.

Table 4-1 Reference Designations and Abbreviations

Abbreviations

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

Designators

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

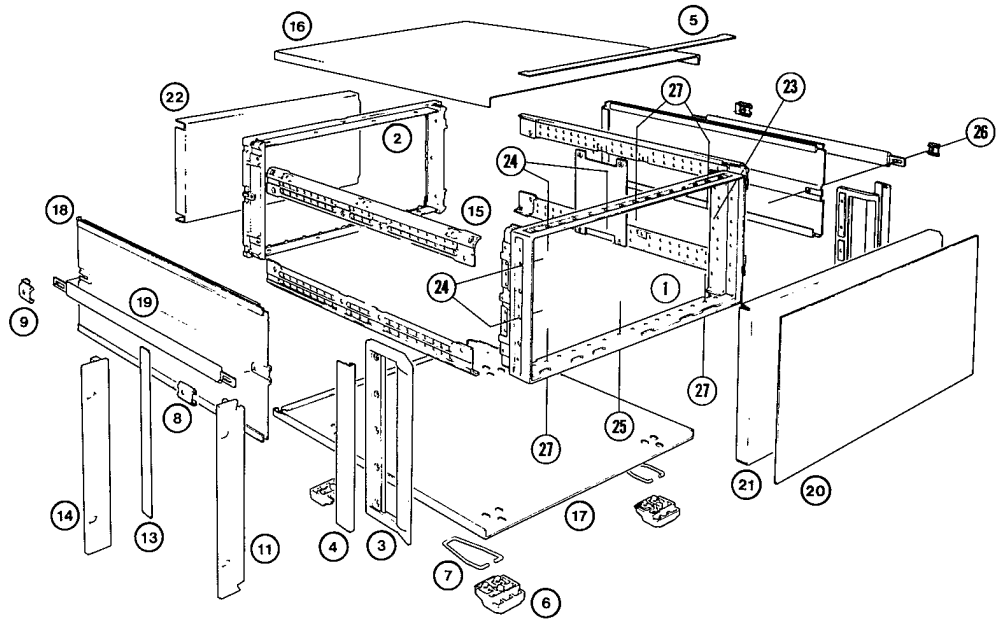


Figure 4-2 Cabinet Parts, Exploded View

	MP#*	Description	Qty	Current Part Number (Metric)**	Previous Part Number (English)**
1.	—	Front frame	1	5021-5807	5020-8807
2.	—	Rear frame	1	5021-5808	5020-8808
3.	—	Front handle kit (optional)	2	5061-9691	5061-0091
4.	—	Trim, front handle	2	5020-8898	
5.	507	Top trim, front frame	1	5040-7202	
6.	506	Foot	4	5040-7201	
7.	—	Tilt stand	2	1460-1345	
8.	508	Front strap handle cap	2	5041-6819	5040-7219
9.	509	Rear strap handle cap	2	5041-6820	5040-7220
11.	—	Rack mount flange kit with front handle (optional)	2	5061-9685	5061-0085
12.	—	Side gusset	2	5001-8234	
13.	505	Side trim, front frame w/o front handle	2	5001-0441	
14.	—	Rack mount flange kit w/o front handle (optional)	2	5061-9679	5061-0079
15.	—	Corner strut with tapped holes	4	5021-5838	5020-8838
16.	510	Top cover	1	5061-9436	5060-9836
17.	511	Bottom cover	1	5061-9448	5060-9848
18.	—	Side cover, perforated with handle recess	2	5060-9948	
19.	509	Strap handle	2	5060-9805	
20.	100	Front dress panel	1	03562-00201	
21.	101	Front sub panel	1	03562-00202	
22.	200	Rear panel	1	03562-00203	
23.	—	Screw	16	0515-1331	2510-0192
24.	—	Screw (attaches to CRT bezel)	4	0515-0889	0515-0218
25.	—	Screw	1	0515-0081	
		Lock washer	1	2190-0047	
26.	—	Screw	4	0515-1132	2680-0172
27.	—	Screw	5	0515-0657	0515-0218

* From replaceable parts list, table 4-3

** The current part numbers apply to instruments with serial numbers 2502A00566 and greater. The previous part numbers apply to serial numbers 2435A00565 and lower. If there is no previous part number listed, all serial numbers use the current part number.

Table 4-1 Reference Designations and Abbreviations

Abbreviations

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

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

Table 4-2 Manufacturers Code List

MFR NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
H9027	Schurter A G H	Luzern	SW	
00779	Amp Inc	Harrisburg	PA	17105
00853	Sangamo Weston Inc	Pickens	SC	29671
01121	Allen-Bradley Co	Milwaukee	WI	53204
01295	Texas Instr Inc Semicon Cmpnt Div	Dallas	TX	75222
01536	Textron Inc, Camcar Div	Rockford	IL	61108
02114	Emperex Electronic Corp	Saugerties	NY	12477
03580	French Creek Granite Co Inc	St Peters	PA	
04213	Caddell-Burns Mfg Co Inc	Mimeola	NY	11501
04222	AVX Ceramics Div	Myrtle Beach	SC	29577
04713	Motorola Semiconductor Products	Phoenix	AZ	85008
05245	Corcom Inc	Libertyville	IL	60048
06090	Raychem Corp	Menlo Park	CA	94025
06560	Airco Electronics Inc	Mogales	AZ	
06665	Precision Monolithics Inc	Santa Clara	CA	95050
07263	Fairchild Semiconductor Div	Mountain View	CA	94042
09023	Cornell-Dubilier Electronics	Fuquay-Varina	NC	27526
09161	The Brucon Co	San Francisco	CA	
09353	C & K Components Inc	Newton	MA	02158
09922	Burndy Corp	Norwalk	CT	06856
11236	CTS of Berne Inc	Berne	IN	46711
11502	TRW Resistive Products Div	Boone	NC	28607
13103	Thermalloy Co	Dallas	TX	75234
13606	Sprague Elect Co Semiconductor Div	Concord	NH	03301
15454	Ametek/Rodan Div	Anaheim	CA	92806
16941	Long-Loc Fasteners Corp	Cincinnati	OH	45215
17856	Siliconix Inc	Santa Clara	CA	95054
18324	Signetics Corp	Sunnyvale	CA	94086
18546	Bean Rubber Mfg Co	San Jose	CA	95112
19378	Diganostic/Retrieval Systems Inc	Oakland	NJ	07436
19701	Mepco/Electra Corp	Mineral Wells	TX	76067
22526	Du Pont E I de Remours & Co	New Cumberland	PA	17070
22670	G M Nameplate Inc	Seattle	WA	98119
24226	Gowanda Electronics Corp	Gowanda	NY	14070
24355	Analog Devices Inc	Norwood	MA	02062
24444	General Semiconductor Industries	Tempe	AZ	85281
24931	Specialty Connector Co	Greenwood	IN	46142
25088	Siemens Corp	Iselin	NJ	08830
25403	N.V. Philips-Elcoma Department	Eindhoven	HL	02867
27014	National Semiconductor Corp	Santa Clara	CA	95051
27167	Corning Glass Works (Wilmington)	Wilmington	NC	28401
27264	Molex Inc	Lisle	IL	60532
27463	Tharco Precision Inc	San Lorenzo	CA	94580
28480	Hewlett-Packard Co Corporate HQ	Palo Alto	CA	94304
31785	Isotemp Research Inc	Charlottesville	VA	22901
32997	Bourns Inc Trimpot Prod Div	Riverside	CA	92507
33096	Colorado Crystal Corp	Loveland	CO	80537
34114	OAD Industries Inc	Rancho Bernardo	CA	92127
34333	Silicon General Inc	Garden Grove	CA	92641
34335	Advanced Micro Devices Inc	Sunnyvale	CA	94086
34371	Harris Semicon Div Harris-Intertype	Melbourne	FL	32901
34649	Intel Corp	Santa Clara	CA	95051
35860	Canadian Standards Assn	Rexdale	ONT	
46384	Penn Engineering and Mfg Corp	Danboro	PA	
51633	Fluorocarbon Co	Sunnyvale	CA	94088
54013	Randolph and Baldwin Inc	Waltham	MA	02154
55285	Bergquist Co	Minneapolis	MN	55099
55680	Michicon/America Corp	Schaumburg	IL	60195
70318	Allmetal Screw Products Inc	Garden City	NY	11530
71482	Clare Div of General Instrument	Chicago	IL	60645
71707	Coto Corp	Providence	RI	02905
71279	Midland-Ross Corp	Cambridge	MA	02140
73138	Beckman Instruments Inc Helipot Div	Fullerton	CA	92634
73734	Federal Screw Products Inc	Chicago	IL	60618
75042	TRW Electronic Components	Philadelphia	PA	19108
75263	Keystone Carbon Co	St Marys	PA	15857
75915	Littelfuse Inc	Des Plaines	IL	60016
76381	Minnesota Mining and Manufacturing	St Paul	MN	55101
76854	Oak Switch Systems Inc	Crystal Lake	IL	60014
77250	Allied Products Corp	Chicago	IL	60650
77902	Rohm and Maas Co	Philadelphia	PA	19105
82877	Rotron Inc Custom Div	Woodstock	NY	12498
83486	Elco Industries	Rockford	IL	61101
84411	TRW Capacitor Div	Ogallala	NE	69153
84830	Lee Spring Co	Brooklyn	NY	11219
86928	Seastrom Mfg Co	Glendale	CA	91201
90949	United States Steel Corp	San Francisco	CA	94101
91345	Miller Dial Corp	El Monte	CA	91734
91637	Dale Electronics Div	Columbus	NE	68601
98291	Sealectro Corp	Trumbull	CT	06611
98978	Intl Electronic Research Corp	Burbank	CA	91510
99484	Flexsteel Industries Inc	Dubuque	IA	52001

Table 4-3 Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	03562-66501	5	1	PC BOARD ASSY	28480	03562-66501
A1C1	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A1C200-C240	0160-4571	8	49	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A1C405	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A1C414	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	13606	150D685X9035B2-DYS
A1C416-C417	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M025A
A1C418-C419	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A1C420	0160-4811	9	1	CAPACITOR-FXD 270PF +-5% 100VDC CER	27167	CAC02C0G271J100A
A1C421-C424	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A1C425	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	13606	150D685X9035B2-DYS
A1C502	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A1CR501-CR502	1901-1080	1	2	DIODE-SCHOTTKY 1N5817 20V 1A	04713	SBR5120KBRL
A1CR503	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	04713	SZ30016-1182
A1J2	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	22526	65580-105
A1J3	1251-4670	2	6	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A1J10	1250-1255	1	1	CONNECTOR-RF SMB M PC 50-OHM	98291	51-051-0000
A1J701-J705	1251-4670	2		CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A1P1	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A1Q1	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A1R1	0683-1025	9	18	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R4-R6	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R103	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R302-R305	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R403	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R501	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R502	0837-0275	6	1	THERMISTOR DISC 50-OHM TC=+2.35%/C-DEG	75263	RL3006-50-110-25-PTO
A1R505-R506	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R507	0683-1055	5	1	RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A1R508-R511	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R600	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R601	0683-1035	1	1	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A1R602-R603	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A1R604	0683-4705	8	1	RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A1RP401	1810-0204	6	1	NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81-R1K
A1TP1-TP15	1251-0600	0	15	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A1U1-U2	1820-2779	5	2	IC CNTR TTL ALS BIN SYNCHRO	01295	SN71537N
A1U3	03562-60324	8	1	SW ASSY-BW	28480	03562-60324
A1U4	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A1U5	03562-60325	9	1	PROGRAMMED PAL	28480	03562-60325
A1U6	1820-2635	2	1	IC GATE TTL ALS AND QUAD 2-INP	01295	SN71172N
A1U7	1820-3144	0	3	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN71560N
A1U8-U9	1820-2488	3	4	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A1U10	1820-1433	6	2	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN57194
A1U11-U12	1820-2757	9	6	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A1U13	1820-1922	8	1	IC SHF-RGTR TTL LS PRL-IN SERIAL-OUT	01295	SN58781N
A1U14	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A1U101	1820-1244	7	2	IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE DUAL	01295	SN53619
A1U102	03562-60326	0	1	PROGRAMMED PAL	28480	03562-60326
A1U103	1820-1195	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53526
A1U104	1820-2096	9	1	IC CNTR TTL LS BIN DUAL 4-BIT	01295	SN59197N
A1U105	1820-1244	7		IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE DUAL	01295	SN53619
A1U106	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A1U107-U108	1820-3144	0		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN71560N
A1U109	1820-2657	8	1	IC GATE TTL ALS OR QUAD 2-INP	01295	SN71173N
A1U110	1820-1433	6		IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN57194
A1U111-U112	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A1U113	1820-2201	8	1	IC SHF-RGTR TTL LS COM CLEAR SERIAL-OUT	01295	SN59874N
A1U201	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN53243
A1U202	1820-2634	1	2	IC INV TTL ALS HEX	01295	SN71332N
A1U203-U204	1820-1730	6	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN58039
A1U205	1820-1278	7	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN53646
A1U206-U207	1820-1975	1	2	IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN58817N
A1U208	1820-1281	2	1	IC DCDR TTL LS 2-TO-4-LINE DUAL	01295	SN53657
A1U209	1820-2120	0	1	IC MULTR TTL LS 8-BIT	34335	AM25LS14ADC
A1U210	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN58039
A1U212	1820-1441	6	2	IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN57202

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1U301	1820-1074	1	1	IC DRVR TTL NOR QUAD 2-INP	01295	SN43266
A1U302	1820-2634	1		IC INV TTL ALS HEX	01295	SN71332N
A1U303	03562-60328	2	1	SW ASSY-BW	28480	03562-60328
A1U304	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN58039
A1U305	1820-3093	8	1	IC-8000-SERIES PROGRAMMABLE TIMER	34649	P8254
A1U306-U307	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A1U308	1820-1470	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN53524
A1U310	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN58039
A1U311	1820-1297	0	1	IC GATE TTL LS EXCL-NOR QUAD 2-INP	01295	SN53659
A1U312	1820-1441	6		IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN57202
A1U313	03562-60327	1	1	PROGRAMMED PROM	28480	03562-60327
A1U401	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53526
A1U402	1820-2775	1	1	IC GATE TTL ALS NAND TPL 3-INP	01295	SN71546N
A1U403	1820-2710	4	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN71708N
A1U404	1820-2740	0	1	IC COMPTR TTL LS MAGTD 2-INP 8-BIT	34335	AM25LS2521PC
A1U405-U406	1820-3362	4	2	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71879N
A1U407	1820-1077	4	1	IC MUXR/DATA-SEL TTL S 2-TO-1-LINE QUAD	01295	SN43268
A1U409	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A1U410-U413	1820-3423	8	4	IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74LS595N
A1U414	1820-0493	6	1	IC OP AMP GP 8-DIP-P PKG	27014	SL10084
A1U415	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P PKG	27014	SL14334
A1U601	1820-3349	7	1	IC BFR TTL ALS NAND QUAD 2-INP	01295	SN71692N
	1258-0141	8	6	JMPR-REM .025P	22526	65474-004
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
A2	03562-66502	6	1	PC BOARD ASSY CPU/HPIB	28480	03562-66502
A2B1	1420-0301	7	1	BATTERY 3.4V 1.8A-HR LITHIUM THIONYL	T01139	15-51-03-410-000
A2C1	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A2C4	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A2C100-C101	0160-4571	8	55	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C103-C105	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C107	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C109-C110	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C112-C113	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C204-C205	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C207	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C209-C212	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C303-C306	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C404	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C406-C410	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C412-C413	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C500	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C503-C512	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C600-C602	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C604-C611	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2C700-C703	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A2CR1	1902-0947	9	1	DIODE-ZNR 3.6V 5% DO-35 PD=.4W TC=-.036%	04713	SZ30035-005
A2CR2	1901-0539	3		DIODE-SCHOTTKY SM SIG	28480	1901-0539
A2CR4	1901-0539	3	2	DIODE-SCHOTTKY SM SIG	28480	1901-0539
A2DS1	1990-0486	6	1	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	1990-0486
A2DS2	1990-0622	2	1	LED-LAMP ARRAY LUM-INT=200UCD	28480	1990-0622
A2DS3-DS4	1990-0652	8	1	LED-LAMP ARRAY LUM-INT=200UCD IF=5MA-MAX	28480	1990-0652
A2J1	1251-6515	8	2	CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A2J2	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	22526	65580-105
A2J4-J7	1252-0169	8		3X8 CONN JUMPER POST	22526	1252-0169
A2J8-J10	1251-4670	2		CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A2J11	1251-6515	8		CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A2J12-J13	1251-4670	2		CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A2J14	1251-6515	8		CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A2J15-J18	1251-4670	2	10	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A2J20	1251-7229	3	1	CONN-POST TYPE .100-PIN-SPCG 26-CONT	28480	1251-7229
A2J21	1251-4670	2		CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A2P1	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A2Q1	1854-0215	1	1	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A2Q2	1853-0393	4	1	TRANSISTOR PNP SI TO-18 PD=500MW	04713	SPS 7011
A2Q3-Q9	1854-0094	4		TRANSISTOR NPN SI PD=200MW FT=350MHZ	04713	SPS 234

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R1-R2	0757-0280	3	15	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A2R3	0757-0398	4	1	RESISTOR 75 1% .125W F TC=0+-100	19701	5033R
A2R4	0757-0417	8	1	RESISTOR 562 1% .125W F TC=0+-100	19701	5033R
A2R5	0757-0411	2	1	RESISTOR 332 1% .125W F TC=0+-100	19701	5033R
A2R6	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A2R7-R8	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A2R9-R10	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A2R11	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A2R12-R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A2R17	0757-0451	0	1	RESISTOR 24.3K 1% .125W F TC=0+-100	19701	5033R
A2R18-R19	0698-4470	5	2	RESISTOR 6.98K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A2R20	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	19701	5033R
A2R21	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A2R22	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	19701	5033R
A2R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A2R24	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	5033R
A2R25	0698-3558	8	2	RESISTOR 4.02K 1% .125W F TC=0+-100	19701	5033R
A2R26-R27	0698-3450	9	4	RESISTOR 42.2K 1% .125W F TC=0+-100	19701	5033R
A2R28	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+-100	19701	5033R
A2R29-R30	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	19701	5033R
A2R31	0698-3158	4	1	RESISTOR 23.7K 1% .125W F TC=0+-100	19701	5033R
A2R32	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	19701	5033R
A2R33-R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A2R35	0698-3558	8		RESISTOR 4.02K 1% .125W F TC=0+-100	19701	5033R
A2R36	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A2R37	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A2R38	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A2R50	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A2RP1-RP2	1810-0277	3		NETWORK-RES 10-SIP 2.2K OHM X 9	91637	CSC10A01-222G/MSP10A01-222G
A2RP3	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-472G
A2RP4-RP5	1810-0277	3		NETWORK-RES 10-SIP 2.2K OHM X 9	91637	CSC10A01-222G/MSP10A01-222G
A2S1	3101-2170	8	1	SWITCH-PB SPDT MOM	09353	8125-D8AE
A2TP1-TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A2U100	1820-2505	5	1	IC-MPU; CLK FREQ=8MHZ, INSTRUCTION	04713	SC88072L
A2U103	1820-2882	1		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
A2U104	1820-2861	6	1	IC DCDR TTL F 3-TO-8-LINE	07263	74F138PC
A2U105	03562-60333	9	1	PROGRAMMED EPROM	28480	03562-60333
A2U105	1200-0567	1	2	SOCKET-IC 28-CONT DIP DIP-SLDR	09922	DILB28P-308T
A2U107	1818-3183	2	8	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	54013	HM6264LP-15
A2U109-U110	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	54013	HM6264LP-15
A2U112	1820-3431	8	1	IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	27014	DS75160AN
A2U113	1820-3513	7	1	IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	27014	DS75161AN
A2U204	1820-2656	7	3	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A2U205	03562-60334	0	1	PROGRAMMED EPROM	28480	03562-60334
A2U205	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	09922	DILB28P-308T
A2U207	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	54013	HM6264LP-15
A2U209-U212	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	54013	HM6264LP-15
A2U303	1820-2656	7		IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A2U304	1820-2657	8	2	IC GATE TTL ALS OR QUAD 2-INP	01295	SN71173N
A2U305	03562-60332	8	1	PROGRAMMED PAL	28480	03562-60332
A2U306	1820-2739	7	1	IC GATE TTL ALS NOR QUAD 2-INP	01295	SN71336N
A2U404	1820-2947	9	1	IC DIVR TTL LS BIN	01295	SN71558N
A2U406	1820-2656	7		IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A2U407	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A2U408	1820-2923	1	1	IC GATE CMOS/74HC NAND TPL 3-INP	04713	MC74HC10N
A2U409	1820-2657	8		IC GATE TTL ALS OR QUAD 2-INP	01295	SN71173N
A2U410	1820-1433	6	1	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN57194
A2U412	1820-2548	6	1	IC-GENERAL PURPOSE INTERFACE BUS ADAPTER	01295	MP9203NL
A2U413	1820-2469	0	1	IC-PROGRAMMABLE TIMER, 3 TIME INTERVALS	04713	SC67515P
A2U500	1820-1851	2	1	IC ENCDR TTL LS	01295	SN70488N
A2U503	1820-0684	7	1	IC INV TTL S HEX 1-INP	01295	SN24652
A2U504	03562-60329	3	1	PROGRAMMED PAL	28480	03562-60329
A2U505	1820-3649	0	1	IC-D 74F164 TTL F SHFRGT P14	07263	74F164PC
A2U506-U507	1820-3362	4		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71879N
A2U508	1820-2795	5	2	IC DRVR TTL F LINE DRVR OCTL	07263	SM83462
A2U509	1820-2882	1	3	IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
A2U510	1820-2710	4		IC DRVR TTL LS LINE DRVR OCTL	01295	SN71708N
A2U511	1820-2882	1		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2U512	1820-2710	4		IC DRVR TTL LS LINE DRVR OCTL	01295	SN71708N
A2U600	1820-2684	1	1	IC GATE TTL F NAND QUAD 2-INP	07263	SL82676
A2U601	1820-2779	5	1	IC CNTR TTL ALS BIN SYNCHRO	01295	SN71537N
A2U602	1820-3185	9	1	IC SCHMITT-TRIG CMOS/74HC INV HEX	27014	MM74HC14N
A2U604	1820-2795	5		IC DRVR TTL F LINE DRVR OCTL	07263	SM83462
A2U605	03562-60331	7	1	PROGRAMMED PAL	28480	03562-60331
A2U606	03562-60330	6	1	PROGRAMMED PAL	28480	03562-60330
A2U607-U609	1820-2698	7	3	IC DRVR TTL F LINE DRVR OCTL	07263	SL82820
A2U610-U611	1820-2710	4	4	IC DRVR TTL LS LINE DRVR OCTL	01295	SN71708N
A2U700	1813-0130	3	1	CRYSTAL CLKOSC 16MHZ MCAN	04713	RASCO-2-16MHZ
A2U701	1820-1450	7	1	IC BFR TTL S NAND QUAD 2-INP	01295	SN85496
A2U702-U703	1820-0697	2	2	IC DRVR TTL S NAND LINE DUAL 4-INP	01295	SN24665
A2W1	1258-0141	8	13	JMPR-REM .025P	22526	65474-004
A2W3	1258-0141	8		JMPR-REM .025P	22526	65474-004
A2W4-W7	1258-0218	0	4	JUMPER,16 CKT,CONN	22526	76266-108
A2W8-W18	1258-0141	8		JMPR-REM .025P	22526	65474-004
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
A3	03562-66503	7	1	ASSY, ROM	28480	03562-66503
A3C1-C3	0160-4571	8	54	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A3C5	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A3C10-C15	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A3C21-C23	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A3C100-C120	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A3C200-C220	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A3J1	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	22526	65580-105
A3J2	1251-4670	2	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A3MP684	1200-0567	1	40	SOCKET-IC 28-CONT DIP DIP-SLDR	09922	DILB28P-308T
A3P3	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A3R1-R21	0757-0384	8	41	RESISTOR 20 1% .125W F TC=0+-100	19701	5033R
A3R29-R37	8150-3375	5	12	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A3R40-R41	8150-3375	5		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A3R42	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A3R50	8150-3375	5		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A3R51-R53	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A3R101-R120	0757-0384	8		RESISTOR 20 1% .125W F TC=0+-100	19701	5033R
A3TP1-TP3	1251-0600	0	3	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A3U1-U3	1820-2698	7		IC DRVR TTL F LINE DRVR OCTL	07263	SL82820
A3U10	1820-2685	2	1	IC GATE TTL F NOR QUAD 2-INP	07263	SL82677
A3U11	1820-2692	1	1	IC GATE TTL F EXCL-OR QUAD 2-INP	07263	SL82686
A3U12	1820-2689	6	1	IC GATE TTL F NAND DUAL 4-INP	07263	SL82682
A3U13-U14	1820-2691	0	2	IC FF TTL F D-TYPE POS-EDGE-TRIG	07263	SL82685
A3U15	1820-0687	0	1	IC GATE TTL S AND TPL 3-INP	01295	SN24655
A3U21-U23	1820-2861	6	3	IC DCDR TTL F 3-TO-8-LINE	07263	74F138PC
A3U100	1820-2698	7		IC DRVR TTL F LINE DRVR OCTL	07263	SL82820
A3U101	03562-60343	1	1	PROGRAMMED EPROM	28480	03562-60343
A3U102	03562-60344	2	1	PROGRAMMED EPROM	28480	03562-60344
A3U103	03562-60345	3	1	PROGRAMMED EPROM	28480	03562-60345
A3U104	03562-60346	4	1	PROGRAMMED EPROM	28480	03562-60346
A3U105	03562-60347	5	1	PROGRAMMED EPROM	28480	03562-60347
A3U106	03562-60348	6	1	PROGRAMMED EPROM	28480	03562-60348
A3U107	03562-60349	7	1	PROGRAMMED EPROM	28480	03562-60349
A3U108	03562-60350	0	1	PROGRAMMED EPROM	28480	03562-60350
A3U109	03562-60351	1	1	PROGRAMMED EPROM	28480	03562-60351
A3U110	03562-60352	2	1	PROGRAMMED EPROM	28480	03562-60352
A3U111	03562-60353	3	1	PROGRAMMED EPROM	28480	03562-60353
A3U112	03562-60354	4	1	PROGRAMMED EPROM	28480	03562-60354
A3U113	03562-60355	5	1	PROGRAMMED EPROM	28480	03562-60355
A3U114	03562-60356	6	1	PROGRAMMED EPROM	28480	03562-60356
A3U115	03562-60357	7	1	PROGRAMMED EPROM	28480	03562-60357
A3U116	03562-60358	8	1	PROGRAMMED EPROM	28480	03562-60358
A3U117	03562-60359	9	1	PROGRAMMED EPROM	28480	03562-60359
A3U118	03562-60360	2	1	PROGRAMMED EPROM	28480	03562-60360
A3U119	03562-60361	3	1	PROGRAMMED EPROM	28480	03562-60361
A3U120	03562-60362	4	1	PROGRAMMED EPROM	28480	03562-60362
A3U200	1820-2698	7		IC DRVR TTL F LINE DRVR OCTL	07263	SL82820

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A3U201	03562-60363	5	1	PROGRAMMED EPROM	28480	03562-60363
A3U202	03562-60364	6	1	PROGRAMMED EPROM	28480	03562-60364
A3U203	03562-60365	7	1	PROGRAMMED EPROM	28480	03562-60365
A3U204	03562-60366	8	1	PROGRAMMED EPROM	28480	03562-60366
A3U205	03562-60367	9	1	PROGRAMMED EPROM	28480	03562-60367
A3U206	03562-60368	0	1	PROGRAMMED EPROM	28480	03562-60368
A3U207	03562-60369	1	1	PROGRAMMED EPROM	28480	03562-60369
A3U208	03562-60370	4	1	PROGRAMMED EPROM	28480	03562-60370
A3U209	03562-60371	5	1	PROGRAMMED EPROM	28480	03562-60371
A3U210	03562-60372	6	1	PROGRAMMED EPROM	28480	03562-60372
A3U211	03562-60373	7	1	PROGRAMMED EPROM	28480	03562-60373
A3U212	03562-60374	8	1	PROGRAMMED EPROM	28480	03562-60374
A3U213	03562-60388	4	1	PROGRAMMED EPROM	28480	03562-60388
A3U214	03562-60389	5	1	PROGRAMMED EPROM	28480	03562-60389
A3U215	03562-60390	8	1	PROGRAMMED EPROM	28480	03562-60390
A3U216	03562-60391	9	1	PROGRAMMED EPROM	28480	03562-60391
A3U217	03562-60392	0	1	PROGRAMMED EPROM	28480	03562-60392
A3U218	03562-60393	1	1	PROGRAMMED EPROM	28480	03562-60393
A3U219	03562-60394	2	1	PROGRAMMED EPROM	28480	03562-60394
A3U220	03562-60395	3	1	PROGRAMMED EPROM	28480	03562-60395
	1258-0141	8	4	JMPR-REM .025P	22526	65474-004
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
A4	03562-66504	8	1	ASSY, L O	28480	03562-66504
A4C2	0160-4571	8	46	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C4-C5	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C7	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C9-C10	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C12	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C14-C15	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C17	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C19-C20	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C22	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C24	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C26	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C28-C29	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C31	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C33-C34	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C36-C38	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C40	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C42-C43	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C45	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C47-C48	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C50	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C52-C55	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C57	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C59	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C61-C62	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C64	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C66	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C68	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C70-C73	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C75	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A4C100	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A4J1	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	22526	65580-105
A4P1	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A4R14	0757-0280	3	35	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R21	8150-3375	5	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A4R23	8150-3375	5		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A4R25	8150-3375	5		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A4R31	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R37	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R39	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R41	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R46-R55	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R59	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R62	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R64-R67	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R69	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4R70-R77	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A4TP1-TP24	1251-0600	0	29	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A4TP30-TP34	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A4U1	1820-3318	0	3	IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71690N
A4U2-U3	1816-0724	7		IC TTL S 64-BIT STAT RAM 35-NS 3-S	01295	SN86666N
A4U4	1820-1470	1		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN53524
A4U5-U6	1820-3318	0		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71690N
A4U7-U8	1816-0724	7		IC TTL S 64-BIT STAT RAM 35-NS 3-S	01295	SN86666N
A4U9	1820-1470	1		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN53524
A4U10	1816-0724	7		IC TTL S 64-BIT STAT RAM 35-NS 3-S	01295	SN86666N
A4U11	1820-1871	6	2	IC ADDR TTL S BIN FULL ADDR 4-BIT	01295	SN44449N
A4U12	1820-1444	9	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN57205
A4U13	03562-60340	8	1	PROGRAMMED PROM	28480	03562-60340
A4U14	1820-2691	0	4	IC FF TTL F D-TYPE POS-EDGE-TRIG	07263	SL82685
A4U15	1816-0724	7		IC TTL S 64-BIT STAT RAM 35-NS 3-S	01295	SN86666N
A4U16	1820-1871	6		IC ADDR TTL S BIN FULL ADDR 4-BIT	01295	SN44449N
A4U17	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53526
A4U18-U19	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
Δ A4U20	03562-60342	0		PROGRAMMED EPROM	28480	03562-60342
A4U21-U23	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A4U24	1820-3362	4	1	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71879N
A4U25-U27	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A4U28	1820-2710	4	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN71708N
Δ A4U29	03562-60341	9		PROGARMMED PROM	28480	03562-60341
A4U30	1820-1300	6		IC SHF-RGTR TTL LS R-S PRL-IN PRL-OUT	01295	SN53662
A4U31	1820-1195	7	4	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53526
A4U32	03562-60339	5	1	PROGRAMMED PAL	28480	03562-60339
A4U33	1820-2711	5	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN71504N
A4U34-U35	1820-1300	6	4	IC SHF-RGTR TTL LS R-S PRL-IN PRL-OUT	01295	SN53662
A4U36	1820-2180	2	1	IC-PERIPHERAL INTERFACE ADAPTER (PIA)	04713	SC67312L
A4U37	1820-2311	1	1	IC COMPTR TTL LS MAGTD 8-BIT	34335	AM25LS2521PC
A4U38	1820-1300	6		IC SHF-RGTR TTL LS R-S PRL-IN PRL-OUT	01295	SN53662
A4U39	1820-1458	5	1	IC ARITH-LGC-UN TTL S 4-BIT	01295	SN85504
A4U40	1820-2656	7	2	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A4U41-U42	1820-3423	8		IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74HS595N
A4U43-U44	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A4U45	1820-2506	6	2	IC INV TTL F HEX	07263	SL82678
A4U46	1820-2691	0		IC FF TTL F D-TYPE POS-EDGE-TRIG	07263	SL82685
A4U47	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A4U48-U49	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A4U50	1820-2691	0		IC FF TTL F D-TYPE POS-EDGE-TRIG	07263	SL82685
A4U51	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53526
A4U52	1820-0688	1	1	IC GATE TTL S NAND DUAL 4-INP	01295	SN24656
A4U53-U54	1820-3669	4		IC-D 74LS674 TTL LS SHFRGT P24	01295	SN74LS674N
A4U55	03562-60338	4	1	PROGRAMMED PAL	28480	03562-60338
A4U56	03562-60337	3	1	PROGRAMMED PAL	28480	03562-60337
A4U57	1820-1470	1	3	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN53524
A4U58	03562-60336	2	1	PROGRAMMED PAL	28480	03562-60336
A4U59	1820-2692	1	1	IC GATE TTL F EXCL-OR QUAD 2-INP	07263	SL82686
A4U60	1820-2656	7		IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A4U61	1820-2684	1	1	IC GATE TTL F NAND QUAD 2-INP	07263	SL82676
A4U62	1820-3669	4		IC-D 74LS674 TTL LS SHFRGT P24	01295	SN74LS674N
A4U63	1820-1322	2	1	IC GATE TTL S NOR QUAD 2-INP	01295	SN84050
A4U64	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53526
A4U65	1820-2777	3	1	IC CNTR TTL ALS BIN SYNCHRO	01295	SN71349N
A4U66	1820-2488	3	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A4U67	1820-2506	6		IC INV TTL F HEX	07263	SL82678
A4U68	03562-60335	1	1	PROGRAMMED PAL	28480	03562-60335
A4U69	1820-2739	7	1	IC GATE TTL ALS NOR QUAD 2-INP	01295	SN71336N
A4U70	1820-1210	7	1	IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN53517
A4U71	1820-2691	0		IC FF TTL F D-TYPE POS-EDGE-TRIG	07263	SL82685
A4U72	1820-2690	9	1	IC GATE TTL F OR QUAD 2-INP	07263	SL82683

Δ See backdating.

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4U73	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A4U74	1820-2698	7	1	IC DRVR TTL F LINE DRVR OCTL	07263	SL82820
A4U75	1820-2795	5	1	IC DRVR TTL F LINE DRVR OCTL	07263	SM83462
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
	1200-0638	7	1	SOCKET-IC 14-CONT DIP DIP-SLDR	09922	DILB14P-308T
A5	03562-66505	9	1	PC BOARD ASSY DGTL FLTR	28480	03562-66505
A5C1-C4	0160-4810	8	4	CAPACITOR-FXD 330PF +-5% 100VDC CER	27167	CAC02C0G331J100A
A5C5-C7	0180-0374	3	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A5C8	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A5C9-C10	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A5C101-C104	0160-4571	8	54	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C105	0180-0309	4	6	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A5C106-C108	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C109	0180-0309	4		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A5C110-C141	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C142	0180-0309	4		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A5C143-C148	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C150	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C152	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C154	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C156-C157	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C159-C160	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C161	0180-0309	4		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A5C162	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C163	0180-0309	4		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A5C164	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A5C165	0180-0309	4		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A5CR1	1902-3114	8	1	DIODE-ZNR 6.19V 2% DO-35 PD=.4W	04713	SZ30016-123
A5CR2	1901-0734	0	1	DIODE-PWR RECT 1N5818 30V 1A	04713	SBR5303
A5J2-J6	1251-4670	2	5	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A5J7	1251-6515	8	1	CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A5MP600	03561-41101	8	6	HEAT SINK	28480	03561-41101
A5MP601	1460-1087	2	24	SPRING-CPRSN .24-IN-OD .375-IN-OA-LG MUW	84830	LC-029C-1-MW
A5MP685	1200-1011	2	6	SOCKET-ADAPTER 65-CONT SQUARE DIP-SLDR	A01102	C5065-01TG
A5P1	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A5R100	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R101-R102	0683-3325	6	2	RESISTOR 3.3K 5% .25W CF TC=0-400	77902	R-25J
A5R103-R104	0683-1005	5	8	RESISTOR 10 5% .25W CF TC=0-400	77902	R-25J
A5R105	0698-0082	7	4	RESISTOR 464 1% .125W F TC=0+-100	19701	5033R
A5R106	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A5R107-R108	0683-1005	5		RESISTOR 10 5% .25W CF TC=0-400	77902	R-25J
A5R109	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	19701	5033R
A5R110	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A5R111-R112	0683-1005	5		RESISTOR 10 5% .25W CF TC=0-400	77902	R-25J
A5R113	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	19701	5033R
A5R114	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A5R115-R116	0683-1005	5		RESISTOR 10 5% .25W CF TC=0-400	77902	R-25J
A5R117	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	19701	5033R
A5R118	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A5R119-R120	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R121	0683-6815	5	2	RESISTOR 680 5% .25W CF TC=0-400	77902	R-25J
A5R122-R124	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R125	0683-2415	3		RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A5R126	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R127	0683-2415	3	4	RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A5R128-R129	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R130	0683-2415	3		RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A5R131-R133	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R134	0683-2415	3		RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A5R135-R136	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R137	0683-6815	5		RESISTOR 680 5% .25W CF TC=0-400	77902	R-25J
A5R138-R142	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R143	0698-4125	7	1	RESISTOR 953 1% .125W F TC=0+-100	19701	5033R
A5R144	0683-5115	6	1	RESISTOR 510 5% .25W CF TC=0-400	77902	R-25J
A5R145	0757-0283	6	1	RESISTOR 2K 1% .125W F TC=0+-100	19701	5033R
A5R146-R152	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J

See introduction to this section for ordering information
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Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5RP1-RP7	1810-0279	5	7	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-472G
A5TP1-TP24	1251-0600	0	24	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5U101	1820-2103	9	4	IC DRVR TTL CLK DUAL	27014	DS0056CJ-8
A5U102	1820-0681	4	2	IC GATE TTL S NAND QUAD 2-INP	01295	SN24649
A5U103	1820-2103	9		IC DRVR TTL CLK DUAL	27014	DS00056CJ-8
A5U106	1820-2635	2	2	IC GATE TTL ALS AND QUAD 2-INP	01295	SN71172N
A5U107	1820-3466	9	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71746N
A5U108	1820-2488	3	3	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A5U109	1820-2635	2		IC GATE TTL ALS AND QUAD 2-INP	01295	SN71172N
A5U110	1820-3466	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71746N
A5U111	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A5U114	1820-2103	9		IC DRVR TTL CLK DUAL	27014	DS00056CJ-8
A5U115	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN24649
A5U116	1820-2103	9		IC DRVR TTL CLK DUAL	27014	DS00056CJ-8
A5U201	1SC3-0033	5	4	DECIMATION FLTR	28480	1SC3-0033
A5U204	03562-60381	7	1	PROGRAMMED PAL	28480	03562-60381
A5U205	03562-60378	2	1	PROGRAMMED PAL	28480	03562-60378
A5U206	1820-2757	9	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A5U207	03562-60380	6	2	PROGRAMMED PROM	28480	03562-60380
A5U208	03562-60379	3	1	PROGRAMMED PAL	28480	03562-60379
A5U209	03562-60380	6		PROGRAMMED PROM	28480	03562-60380
A5U210	1820-2889	8	1	IC GATE TTL ALS AND TPL 3-INP	01295	SN71536N
A5U211	03562-60377	1	1	PROGRAMMED PROM	28480	03562-60377
A5U212	03562-60376	0	1	PROGRAMMED PROM	28480	03562-60376
A5U213	1820-0629	0	1	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN23357
A5U215	1SC3-0033	5		DECIMATION FLTR	28480	1SC3-0033
A5U304	1820-3351	1	4	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN71932NT
A5U305	1820-3238	3	6	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71492N
A5U306	1820-3239	4	1	IC DRVR TTL ALS BUS OCTL	01295	SN71491N
A5U307	1820-4019	0	2	IC-D AM9517A-5PC	28480	1820-4019
A5U309	1820-4019	0		IC-D AM9517A-5PC	28480	1820-4019
A5U311	1820-3237	2	1	IC LCH TTL ALS TRANSPARENT NEG-EDGE-TRIG	01295	SN71490NT
A5U312	1820-3238	3		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71492N
A5U313	1820-3351	1		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN71932NT
A5U401	1SC4-0034	8	2	FLTR CONTROLLER	28480	1SC4-0034
A5U404	1820-3351	1		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN71932NT
A5U404-U406	1820-3238	3		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71492N
A5U411-U412	1820-3238	3		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71492N
A5U413	1820-3351	1		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN71932NT
A5U415	1SC4-0034	8		FLTR CONTROLLER	28480	1SC4-0034
A5U501	1SC3-0033	5		DECIMATION FLTR	28480	1SC3-0033
A5U505	03562-60375	9	1	PROGRAMMED PAL	28480	03562-60375
A5U506	1820-2657	8	1	IC GATE TTL ALS OR QUAD 2-INP	01295	SN71173N
A5U507-U510	1820-3003	0	4	IC LCH TTL ALS D-TYPE OCTL	01295	SN71330N
A5U511	1820-1568	8	1	IC BFR TTL LS BUS QUAD	01295	SN57451N
A5U512	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A5U513	1820-3402	3	1	IC BFR TTL ALS NAND QUAD 2-INP	01295	SN71743N
A5U515	1SC3-0033	5		DECIMATION FLTR	28480	1SC3-0033
	0590-0526	6	24	THREADED INSERT-NUT 4-40 .065-IN-LG SST	46384	KFS2-440
	0380-0411	3	24	SPACER-RND .5-IN-LG .114-IN-ID	34114	3-5162-111
	2200-0149	6	24	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	77250	4367
	1258-0141	8	7	JMPR-REM .025P	22526	65474-004
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
A6	03562-66506	0	1	ASSY,DGTL FLTR	28480	03562-66506
A6C1	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A6C2-C3	0180-0197	8	2	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	13606	150D225X9020A2-DYS
A6C100-C130	0160-4571	8	31	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A6C131-C132	0160-4788	9		CAPACITOR-FXD 18PF +-5% 100VDC CER 0+-30	04222	MA101A180JAA
A6J2	1251-4670	2	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A6P1	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A6R1	0683-2025	1	1	RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A6R2-R3	0683-6835	9		RESISTOR 68K 5% .25W CF TC=0-400	77902	R-25J
A6RP1RP2	1810-0279	5	2	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-472G
A6TP1-TP7	1251-0600	0	7	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A6U104	1820-2657	8	2	IC GATE TTL ALS OR QUAD 2-INP	01295	SN71173N
A6U106	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A6U107	1820-3466	9	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71746N
A6U108	1820-2775	1	1	IC GATE TTL ALS NAND TPL 3-INP	01295	SN71546N
A6U109	1820-2604	5	1	IC-8-BIT/16-BIT SYSTEM TIMING CONTROLLER	34335	AM9513ADC
A6U201-U203	1820-2488	3	4	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A6U204	1820-2657	8		IC GATE TTL ALS OR QUAD 2-INP	01295	SN71173N
A6U206	1820-2635	2	1	IC GATE TTL ALS AND QUAD 2-INP	01295	SN71172N
A6U207	1820-2758	0	1	IC FF TTL ALS J-K BAR POS-EDGE-TRIG	01295	SN71174N
A6U208	1820-2951	5	1	IC DRVR TTL ALS BUS OCTL	01295	SN71341N
A6U301	1820-3318	0	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71690N
A6U302	1820-2724	0	2	IC LCH TTL ALS D-TYPE OCTL	01295	SN71340N
A6U303	1820-2772	8	1	IC FF TTL ALS J-K NEG-EDGE-TRIG	01295	SN71543N
A6U304	03562-60383	9	1	PROGRAMMED PAL	28480	03562-60383
A6U305	1820-2691	0	1	IC FF TTL F D-TYPE POS-EDGE-TRIG	07263	SL82685
A6U306	03562-60382	8	1	PROGRAMMED PAL	28480	03562-60382
A6U307	1820-3318	0		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71690N
A6U308	1820-2724	0		IC LCH TTL ALS D-TYPE OCTL	01295	SN71340N
A6U309	03562-60396	4	1	PROGRAMMED PAL	28480	03562-60396
A6U310	1820-1437	0	1	IC MV TTL LS MONOSTBL DUAL	01295	SN57198
A6U401-U402	1820-3349	7	2	IC BFR TTL ALS NAND QUAD 2-INP	01295	SN71692N
A6U403	1820-3239	4	1	IC DRVR TTL ALS BUS OCTL	01295	SN71491N
A6U404	1820-3106	4	1	IC COMPTR TTL ALS MAGTD 8-BIT	01295	SN71693N
A6U405-U406	1820-3362	4	2	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71879N
A6U409	03562-60397	5	1	PROGRAMMED PAL	28480	03562-60397
A6U410	1820-3391	9	1	IC MUXR/DATA-SEL TTL ALS 8-TO-1-LINE	01295	SN71873N
A6U500	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A6W2	1258-0141	8	1	JMPR-REM .025P	22526	65474-004
A6X1	0410-1410	9	1	CRYSTAL-QUARTZ 4.91520 MHZ HC-18/U-HLDR	S01163	0410-1410
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
A7	03562-66507	1	1	ASSY, FPP	28480	03562-66507
A7C1-C50	0160-4571	8	50	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A7C51-C52	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A7J1	1251-4822	6	4	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A7J2	1251-6515	8	5	CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A7J3A	1251-6515	8		CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A7J3C	1251-6515	8		CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A7J4	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A7J5	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	22526	65580-105
A7J6	1251-6515	8		CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A7J7-J8	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A7J9	1251-6515	8		CONN-POST TYPE .100-PIN-SPCG 6-CONT	22526	65610-106
A7JP1	1258-0141	8	14	JMPR-REM .025P	22526	65474-004
A7JP2A	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP2B	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP3A	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP3B	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP3C	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP3D	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP4	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP6A	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP6B	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP7	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP8	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP9A	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7JP9B	1258-0141	8		JMPR-REM .025P	22526	65474-004
A7LED1-LED2	1990-0652	8	1	LED-LAMP ARRAY LUM-INT=200UCD IF=5MA-MAX	28480	1990-0652
A7P1	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A7R1-R8	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A7R9-R10	0683-1025	9	3	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R11	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A7R12	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R13	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A7R14-R15	0699-0065	8	1	RESISTOR 51.01 .25% .5W F TC=0+-50	19701	5053R

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7R16-R17	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A7TP1-TP11	1251-0600	0	11	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A7U103	1820-3657	0	1	IC-12 BIT WIDE MICROPROGRAMMER	34335	AM2910ADC
A7U104	03562-60314	6	1	PROGRAMMED PROM	28480	03562-60314
A7U105	03562-60315	7	1	PROGRAMMED PROM	28480	03562-60315
A7U106	03562-60317	9	1	PROGRAMMED PROM	28480	03562-60317
A7U110	03562-60316	8	1	PROGRAMMED PROM	28480	03562-60316
A7U111	03562-60318	0	1	PROGRAMMED PROM	28480	03562-60318
A7U112	03562-60319	1	1	PROGRAMMED PROM	28480	03562-60319
A7U113	1820-1281	2	1	IC DCDR TTL LS 2-TO-4-LINE DUAL	01295	SN53657
A7U114	1820-2757	9	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A7U115	1820-2795	5	1	IC DRVR TTL F LINE DRVR OCTL	07263	SM83462
A7U201	1820-2613	6	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN70689N
A7U202	03562-60313	5	1	PROGRAMMED PROM	28480	03562-60313
A7U204-U205	1820-2711	5	2	IC DRVR TTL LS LINE DRVR OCTL	01295	SN71504N
A7U206-U207	1820-1858	9	2	IC FF TTL LS D-TYPE OCTL	01295	SN58490N
A7U209	03562-60323	7	1	PROGRAMMED PROM	28480	03562-60323
A7U211	1820-2389	3	2	IC-LOOK-AHEAD CARRY GEN, 4 INPUT PAIRS	34335	AM2902APC
A7U212	03562-60320	4	1	PROGRAMMED PAL	28480	03562-60320
A7U213	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53526
A7U215	1820-2488	3	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A7U301	1820-1298	1	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN53660
A7U302	1820-2389	3		IC-LOOK-AHEAD CARRY GEN, 4 INPUT PAIRS	34335	AM2902APC
A7U303-U308	1820-2377	9	6	IC-BIT SLICE, 16 FUNCT ALU, EXPANDED	34335	AM2903DC
A7U310	1820-2377	9		IC-BIT SLICE, 16 FUNCT ALU, EXPANDED	34335	AM2903DC
A7U312	1820-2690	9	2	IC GATE TTL F OR QUAD 2-INP	07263	SL82683
A7U313	03562-60321	5	1	PROGARMMED PAL	28480	03562-60321
A7U314	03562-60322	6	1	PROGRAMMED PAL	28480	03562-60322
A7U315	1820-2690	9		IC GATE TTL F OR QUAD 2-INP	07263	SL82683
A7U401	03562-60312	4	1	PROGRAMMED PAL	28480	03562-60312
A7U412-U415	1820-2882	1		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
A7U501	1820-2635	2	1	IC GATE TTL ALS AND QUAD 2-INP	01295	SN71172N
A7U502	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A7U503	1820-3349	7	1	IC BFR TTL ALS NAND QUAD 2-INP	01295	SN71692N
A7U504	1820-2951	5	1	IC DRVR TTL ALS BUS OCTL	01295	SN71341N
A7U505-U506	1820-2882	1		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
A7U507	1820-2740	0	1	IC COMPTR TTL LS MAGTD 2-INP 8-BIT	34335	AM25LS2521PC
A7U510-U515	1820-2882	1		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
A8	03562-66508	2	1	PC BD ASSY RAM/DSPL	28480	03562-66508
A8C1	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A8C2	0180-0097	7	1	CAPACITOR-FXD 47UF+-10% 35VDC TA	13606	150D476X9035S2-DYS
A8C101	0160-4571	8	67	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C103-C111	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C201-C211	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C301-C312	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C400-C401	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C404-C409	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C411	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C500-C509	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C511-C512	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8C600-C612	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A8CR1	1990-0486	6	1	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	1990-0486
A8J1-J2	1251-5202	8		CONN-POST TYPE .125-PIN-SPCG 5-CONT	22526	65580-105
A8J3-J4	1251-4670	2	7	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A8J5	1252-0169	8	1	3X8 CONN JUMPER POST	22526	1252-0169
A8J6-J9	1251-4670	2		CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A8R1	0757-0411	2	3	RESISTOR 332 1% .125W F TC=0+-100	19701	5033R
A8R2-R14	0757-0180	2	13	RESISTOR 31.6 1% .125W F TC=0+-100	19701	5033R
A8R15-R16	0757-0411	2		RESISTOR 332 1% .125W F TC=0+-100	19701	5033R
A8R17	0698-4123	5	1	RESISTOR 499 1% .125W F TC=0+-100	19701	5033R
A8RP1-RP3	1810-0277	3	3	NETWORK-RES 10-SIP 2.2K OHM X 9	91637	CSC10A01-222G/MSP10A01-222G
A8RP4-RP5	1810-0280	8	2	NETWORK-RES 10-SIP 10.0K OHM X 9	91637	CSC10A01-103G/MSP10A01-103G
A8TP1-TP7	1251-0600	0	7	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A8U101	1820-2947	9	1	IC DIVR TTL LS BIN	01295	SN71558N

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8U103-U110	1818-3006	8		IC NMOS 65536 (64K) DYN RAM 200-NS 3-S	54013	HM4864P-3
A8U111	1820-1450	7	3	IC BFR TTL S NAND QUAD 2-INP	01295	SN85496
A8U201	1820-2488	3	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A8U202	1820-2657	8	1	IC GATE TTL ALS OR QUAD 2-INP	01295	SN71173N
A8U203-U210	1818-3006	8		IC NMOS 65536 (64K) DYN RAM 200-NS 3-S	54013	HM4864P-3
A8U211	1820-1450	7		IC BFR TTL S NAND QUAD 2-INP	01295	SN85496
A8U301	1820-0697	2	6	IC DRVR TTL S NAND LINE DUAL 4-INP	01295	SN24665
A8U302	1820-2701	3	2	IC FF TTL F D-TYPE POS-EDGE-TRIG COM	07263	SL82694
A8U303	03562-60384	0	1	PROGRAMMED PROM	28480	03562-60384
A8U304	1820-2684	1	4	IC GATE TTL F NAND QUAD 2-INP	07263	SL82676
A8U305	1820-1450	7		IC BFR TTL S NAND QUAD 2-INP	01295	SN85496
A8U306-U308	1820-0697	2		IC DRVR TTL S NAND LINE DUAL 4-INP	01295	SN24665
A8U309	1820-2692	1	1	IC GATE TTL F EXCL-OR QUAD 2-INP	07263	SL82686
A8U310	1820-2684	1		IC GATE TTL F NAND QUAD 2-INP	07263	SL82676
A8U311-U312	1813-0424	8	3	ACTIVE DELAY LINE 14	E01049	SXTTLDM-104
A8U400-U401	1820-1435	8	7	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN57196N
A8U404	1820-1278	7	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN53646
A8U405	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A8U406	1820-0697	2		IC DRVR TTL S NAND LINE DUAL 4-INP	01295	SN24665
A8U407-U408	1820-2656	7	2	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A8U409	1820-0697	2		IC DRVR TTL S NAND LINE DUAL 4-INP	01295	SN24665
A8U411	1813-0424	8		ACTIVE DELAY LINE 14	E01049	SXTTLDM-104
A8U500	1820-3349	7	1	IC BFR TTL ALS NAND QUAD 2-INP	01295	SN71692N
A8U501	1820-1435	8		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN57196N
A8U502-U505	1820-3362	4	8	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71879N
A8U506	03562-60385	1	1	PROGRAMMED PAL	28480	03562-60385
A8U507	1820-2701	3		IC FF TTL F D-TYPE POS-EDGE-TRIG COM	07263	SL82694
A8U508	1820-3362	4		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71879N
A8U509	1820-2795	5	1	IC DRVR TTL F LINE DRVR OCTL	07263	SM83462
A8U511-U512	1820-2270	1	2	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	34335	AM25LS2569DC
A8U600-U603	1820-1435	8		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN57196N
A8U604-U605	1820-3362	4		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71879N
A8U606-U607	1820-2684	1		IC GATE TTL F NAND QUAD 2-INP	07263	SL82676
A8U608	1820-3362	4		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71879N
A8U609-U610	1820-3654	7		IC-BIDIRECTIONAL BUS TRANSCEIVER(8-WIDE)	34335	AM2946PC
A8U611-U612	1820-2763	7	2	IC MUXR/DATA-SEL TTL F 2-TO-1-LINE QUAD	07263	SL83215
	1258-0141	8	7	JMPR-REM .025P	22526	65474-004
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
	1258-0218	0	1	JUMPER,16 CKT,CONN	22526	76266-108
	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A9	03562-66509	3	1	PC BD ASSY FFT	28480	03562-66509
A9C101-C102	0160-4791	4	2	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	27167	CAC02C0G100J100A
A9C103	0160-4571	8	42	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C105-C107	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C109	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C117	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C206	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C208-C218	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C301	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C303	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C305	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C307	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C310-C311	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C313-C315	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C317	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C403	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C405-C406	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C408-C409	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C411-C412	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C501	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C502	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	13606	30D107G025DD2-DSM
A9C503	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C505-C506	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C507	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C515-C516	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A9C518	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9CR101-CR102	1990-0652	8	1	LED-LAMP ARRAY LUM-INT=200UCD IF=5MA-MAX	28480	1990-0652
A9J1-J2	1251-4670	2	2	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A9J3-J4	1252-0169	8	2	3X8 CONN JUMPER POST	22526	1252-0169
A9J5	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	22526	65580-105
A9JP1-JP2	1258-0141	8	2	JMPR-REM .025P	22526	65474-004
A9JP3-JP4	1258-0218	0	2	JUMPER,16 CKT,CONN	22526	76266-108
A9P1	1251-7506	9	1	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	1-532956-8
A9R206	0683-1025	9	10	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9R209	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9R211	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9R213	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9R216	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9R303	8150-3375	5	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A9R305	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9R414	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9R501-R502	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9R511	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A9TP1-TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A9U103	1820-3974	4	1	IC-M TMS320 NMOS 16BMPU P40	01295	TMS32010NL
A9U105-U108	1820-1987	5		IC SHF-RGTR TTL LS COM CLEAR STOR 8-BIT	34335	AM74LS299N
A9U109	1820-2634	1	2	IC INV TTL ALS HEX	01295	SN71332N
A9U111-U112	1820-1440	5	2	IC LCH TTL LS QUAD	01295	SN57201
A9U115	03562-60311	3	1	PROGRAMMED PAL	28480	03562-60311
A9U117	03562-60310	2	1	PROGRAMMED PROM	28480	03562-60310
A9U202	1820-1729	3	1	IC LCH TTL LS COM CLEAR 8-BIT	07263	74LS259PC
A9U206	1820-1217	4	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN53523
A9U207	03562-60307	7	1	PROGRAMMED PAL	28480	03562-60307
A9U208	1820-1282	3	1	IC FF TTL LS J-K BAR POS-EDGE-TRIG	01295	SN53656
A9U209-U210	1820-3144	0	2	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN71560N
A9U211	1820-3349	7	1	IC BFR TTL ALS NAND QUAD 2-INP	01295	SN71692N
A9U212	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A9U213	1820-2488	3	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A9U214	1820-2657	8	1	IC GATE TTL ALS OR QUAD 2-INP	01295	SN71173N
A9U215	1820-2634	1		IC INV TTL ALS HEX	01295	SN71332N
A9U216-U217	1820-2861	6	2	IC DCDR TTL F 3-TO-8-LINE	07263	74F138PC
A9U218	1820-2635	2	2	IC GATE TTL ALS AND QUAD 2-INP	01295	SN71172N
A9U301	03562-60309	9	1	PROGRAMMED PROM	28480	03562-60309
A9U303	03562-60308	8	1	PROGRAMMED PROM	28480	03562-60308
A9U305	03562-60387	3	1	PROGRAMMED PROM	28480	03562-60387
A9U307	1820-2635	2		IC GATE TTL ALS AND QUAD 2-INP	01295	SN71172N
A9U309-U311	1820-1438	1		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN57199N
A9U312	1820-1447	2	1	IC TTL LS 16-BIT STAT RAM 45-NS 3-S	01295	SN57208
A9U313	03562-60306	6	2	PROGRAMMED PAL	28480	03562-60306
A9U314	03562-60306	6		PROGRAMMED PAL	28480	03562-60306
A9U315	03562-60304	4	1	PROGRAMMED PROM	28480	03562-60304
A9U317	03562-60303	3	1	PROGRAMMED PROM	28480	03562-60303
A9U403	1820-3238	3	2	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71492N
A9U405-U406	1820-2757	9	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A9U408	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN53518N
A9U409-U411	1820-1194	6	3	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN53527
A9U412-U413	1820-2724	0	2	IC LCH TTL ALS D-TYPE OCTL	01295	SN71340N
A9U501	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A9U502	03562-60305	5	1	PROGRAMMED PROM	28480	03562-60305
A9U503	1820-3238	3		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN71492N
A9U505	1820-1640	7	1	IC DRVR TTL LS BUS HEX 1-INP	01295	SN57699N
A9U506-U509	1820-2882	1		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
A9U510	1820-3106	4	1	IC COMPTR TTL ALS MAGTD 8-BIT	01295	SN71693N
A9U511-U516	1820-2882	1		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
A9U517-U518	1820-2711	5	2	IC DRVR TTL LS LINE DRVR OCTL	01295	SN71504N
A9Y1	0410-1501	9	1	CRYSTAL-QUARTZ 20 MHZ HC-18/U-HLDR	33096	CCAT 101842
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	G01016	GP24-063 X 250-17
	4040-0753	0	2	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	V01022	4040-0753
A12	03562-66512	8	1	PC BD ASSY MOTHERB'D	28480	03562-66512
A12C1	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A12C2	0180-2249	5	1	CAPACITOR-FXD 47UF+-10% 20VDC TA	13606	150D476X9020R2-DYS
A12J1-J10	1251-8097	5	10	CONN-POST TYPE .100-PIN-SPCG 120-CONT	00779	102692-9

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12J15	1252-1187	2	1	CONN-POST-TP-HDR 40 PIN .155"	28480	1252-1187
A12J16	1251-6173	4	1	CONN-POST TYPE .156-PIN-SPCG 2-CONT	27264	09-72-1021
A12J17	1251-7627	5	4	CONN-POST TYPE .100-PIN-SPCG 40-CONT	00779	1-102567-2
A12J30-J32	1251-7627	5		CONN-POST TYPE .100-PIN-SPCG 40-CONT	00779	1-102567-2
A12J33	1251-7754	9	2	CONN-POST TYPE .100-PIN-SPCG 30-CONT	00779	1-102567-3
A12J34	1251-7627	5		CONN-POST TYPE .100-PIN-SPCG 40-CONT	00779	1-102567-2
A12J35	1251-7754	9		CONN-POST TYPE .100-PIN-SPCG 30-CONT	00779	1-102567-3
A12MP686	03562-48305	9	2	KEY,C.BD,FOOLPRF	28480	03562-48305
A12R1	0757-0795	5	1	RESISTOR 75 1% .5W F TC=0+-100	19701	5053R
A12R2	0757-0178	8	1	RESISTOR 100 1% .25W F TC=0+-100	19701	5043R
A12R4	0757-1040	5	1	RESISTOR 50 1% .25W F TC=0+-100	19701	5043R
A12RP1-RP10	1810-0372	9	10	NETWORK-RES 10-SIP 220.0 OHM X 9	11236	750-101-R220
A12W13	03562-61613	0	1	CBL PWR/MBD	28480	03562-61613
	2190-0007	2	4	WASHER-LK INTL T NO. 6 .141-IN-ID	T12345	1906-00-00-2580
	0380-0005	1	4	SPCR-RD .31LG.18ID.25D BRSNI	L01005	0380-0005
	0515-0211	8	4	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	16941	0515-0211
	0515-0900	2	4	SCREW-MACH M3.5 X 0.6 14MM-LG PAN-HD	M01088	0515-0900
	0535-0007	2	4	NUT-HEX DBL-CHAM M3.5 X 0.6 2.8MM-THK	H01043	0535-0007
	1251-7627	5	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	00779	1-102567-2
A15	03562-66515	1	1	PC BD ASSY KYBD	28480	03562-66515
A15C1	0180-2249	5	1	CAPACITOR-FXD 47UF+-10% 20VDC TA	13606	150D476X9020R2-DYS
A15C2-C3	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C4-C5	0160-4788	9	2	CAPACITOR-FXD 18PF +-5% 100VDC CER 0+-30	04222	MA101A180JAA
A15C105-C106	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C108	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C205-C206	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C208	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C210	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C300-C308	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C402	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C404	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15C406	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A15CR1-CR3	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	1990-0487
A15CR4	1990-0485	5	4	LED-LAMP LUM-INT=2MCD IF=30MA-MAX BVR=5V	28480	1990-0485
A15CR5-CR6	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	1990-0487
A15CR7	1990-0486	6	3	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	1990-0486
A15CR8-CR11	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	1990-0487
A15CR12	1990-0485	5		LED-LAMP LUM-INT=2MCD IF=30MA-MAX BVR=5V	28480	1990-0485
A15CR13-CR15	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	1990-0487
A15CR16	1990-0486	6		LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	1990-0486
A15CR17	1990-0485	5		LED-LAMP LUM-INT=2MCD IF=30MA-MAX BVR=5V	28480	1990-0485
A15CR18	1990-0486	6		LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	1990-0486
A15CR19	1990-0485	5		LED-LAMP LUM-INT=2MCD IF=30MA-MAX BVR=5V	28480	1990-0485
A15CR20	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A15J1	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	22526	65580-105
A15J2	1251-4670	2	5	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A15J3	1251-5041	3	2	CONN-POST TYPE .100-PIN-SPCG 5-CONT	22526	65500-105
A15J4	1252-0169	8	1	3X8 CONN JUMPER POST	22526	1252-0169
A15J5	1251-4670	2		CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A15J6	1251-5041	3		CONN-POST TYPE .100-PIN-SPCG 5-CONT	22526	65500-105
A15J7-J9	1251-4670	2		CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A15J10	1251-3782	5	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	76381	3432-1002
A15Q1	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A15R1	0683-2215	1	1	RESISTOR 220 5% .25W CF TC=0-400	77902	R-25J
A15R2	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A15R3	0757-0273	4	1	RESISTOR 3.01K 1% .125W F TC=0+-100	19701	5033R
A15R8	0757-0482	7	1	RESISTOR 511K 1% .125W F TC=0+-100	19701	5033R
A15RP1	1810-0280	8	3	NETWORK-RES 10-SIP 10.0K OHM X 9	91637	CSC10A01-103G/MSP10A01-103G
A15RP2	1810-0277	3	5	NETWORK-RES 10-SIP 2.2K OHM X 9	91637	CSC10A01-222G/MSP10A01-222G
A15RP3	1810-0280	8		NETWORK-RES 10-SIP 10.0K OHM X 9	91637	CSC10A01-103G/MSP10A01-103G
A15RP4-RP7	1810-0277	3		NETWORK-RES 10-SIP 2.2K OHM X 9	91637	CSC10A01-222G/MSP10A01-222G
A15RP8-RP9	1810-0372	9	2	NETWORK-RES 10-SIP 220.0 OHM X 9	11236	750-101-R220
A15RP10	1810-0280	8		NETWORK-RES 10-SIP 10.0K OHM X 9	91637	CSC10A01-103G/MSP10A01-103G
A15SPK1	0960-0483	9	1	ALARM-AUDIBLE	P01152	0960-0483
A15SW1-SW70	5060-9436	7	70	PB-SWITCH	28480	5060-9436

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15TP1-TP6	1251-0600	0	6	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A15U105	1820-2488	3	3	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A15U106	1820-3665	0	1	IC-D 74HCT245 CMOS TRNCVR P20	27014	MM74HCT245N
A15U108	1820-2724	0	1	IC LCH TTL ALS D-TYPE OCTL	01295	SN71340N
A15U205	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A15U206	1820-2762	6	1	IC-8-BIT MICROPROCESSOR	04713	MC146805E2P
A15U208	03562-60386	2	1	PROGRAMMED PROM	28480	03562-60386
A15U210	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN57177
A15U300	1820-2951	5	2	IC DRVR TTL ALS BUS OCTL	01295	SN71341N
A15U301	1820-3668	3	1	IC-D 74ALS642 TRNCVR P20	01295	SN74ALS642AN
A15U302	1820-2882	1	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
A15U303	1820-2951	5		IC DRVR TTL ALS BUS OCTL	01295	SN71341N
A15U304-U305	1820-2757	9	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN71342N
A15U306	1820-3176	8	1	IC MUXR/DATA-SEL CMOS/74HC 8-TO-1-LINE	27014	MM74HC151N
A15U307	1820-3650	3	1	IC-D 74LS445 TTL LS DECDRV P16	01295	SN74LS445N
A15U308	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN71418N
A15U402	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A15U404	1820-3270	3	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71534N
A15U406	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A15W17	03562-61617	4	1	CABLE ASSY DISP.ADJ.	28480	03562-61617
A15Y1	0410-1388	0	1	CRYSTAL-QUARTZ 4.0000 MHZ HC-18/U-HLDR	N01090	NDK-040
	05328-40003	8	19	STAND-L.E.D	28480	05328-40003
	1258-0141	8	5	JMPR-REM .025P	22526	65474-004
	1258-0218	0	1	JUMPER,16 CKT,CONN	22526	76266-108
A17	03562-66517	3	1	DISPLAY ASSY	28480	03562-66517
A17C1-C3	0160-4571	8	6	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A17C4	0180-1794	3	1	CAPACITOR-FXD 22UF+-10% 35VDC TA	13606	150D226X9035R2-DYS
A17C10-C12	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A17CR1-CR6	1901-0704	4	6	DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
A17CR7	1902-0940	2	1	DIODE-ZNR 1N5339B 5.6V 5% PD=5W IR=1UA	04713	SZP40149
A17J10-J12	1251-4836	2		CONN-POST TYPE 2.5-PIN-SPCG 2-CONT	27264	22-12-1022
A17P17	1251-7629	7	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	00779	532955-7
A17R1-R3	0837-0298	3	1	PTC THERMISTER	28480	0837-0298
A17R4	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A17R5	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A17R7	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A17R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A17R10	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A17TP1-TP2	1251-0600	0	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A17U1-U2	1820-2882	1		IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71333N
A17U3	1820-3145	1	1	IC DRVR TTL ALS BUS OCTL	01295	SN71649N
A17W1	1251-4670	2	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A17W14	03562-61614	1	1	CBLE ASSY DISP I/O	28480	03562-61614
A17W190-W192	03562-61619	6		CABLE-DISPLAY XYZ	28480	03562-61619
	1258-0141	8	1	JMPR-REM .025P	22526	65474-004
A18	03562-66518	4	1	PC BD-PWR SPLY	28480	03562-66518
A18C2	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A18C4-C17	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A18C18-C19	0160-4571	8	26	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A18C20	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	13606	150D225X9020A2-DYS
A18C100	0180-3115	6	1	CAPACITOR-FXD 330UF+50-10% 63VDC AL	U01027	SM63T330
A18C101-C102	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A18C103	0180-2825	3	14	CAPACITOR-FXD 22UF+50-10% 50VDC AL	13606	510D057
A18C104	0160-4822	2	1	CAPACITOR-FXD 1000PF +-5% 100VDC CER	27167	CAC03C0G102J100A
A18C105	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A18C106	0180-2825	3		CAPACITOR-FXD 22UF+50-10% 50VDC AL	13606	510D057
A18C107	0180-2351	0	1	CAPACITOR-FXD 2000UF+75-10% 50VDC AL	13606	39D243-DSB
Δ A18C108	0180-0374	3	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
Δ A18C109-C110	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
Δ A18C200	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A18C201-C202	0160-0302	5	1	CAPACITOR-FXD .018UF +-10% 200VDC POLYE	13606	192P18392
A18C300	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA

Δ See backdating.

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

	Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	A18C301	0160-4809	5	1	CAPACITOR-FXD 390PF +-5% 100VDC CER	27167	CAC02C0G391J100A
	A18C302	0160-0159	0	1	CAPACITOR-FXD 6800PF +-10% 200VDC POLYE	13606	192P68292
	A18C303	0160-4835	7	1	CAPACITOR-FXD .1UF +-10% 50VDC CER	27167	CAC04X7R104K050A
	A18C304	0160-0128	3	1	CAPACITOR-FXD 2.2UF +-20% 50VDC CER	13606	3C37Z5U225M050A
	A18C305-C306	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
	A18C307	0180-3525	2	1	C-F 3300UF --% 12V ALUMEr	13606	674D338H012HJ5A
	A18C308	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
	A18C310	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	T01067	805-504 Y5V 103Z
	A18C400	0140-0200	0	2	CAPACITOR-FXD 390PF +-5% 300VDC MICA	09023	0140-0200
	A18C401	0180-2825	3		CAPACITOR-FXD 22UF+50-10% 50VDC AL	13606	510D057
	A18C402	0160-6087	5	1	C-F 2UF 10% 400V POLYPa	84411	TRW-35 2UF 400V
	A18C403-C404	0180-3500	3	2	C-F 1400UF --% 250V ALSTMr	13606	623D214
	A18C405	0160-4281	7	1	CAPACITOR-FXD 2200PF +-20% 250VAC(RMS)	W01110	PME271Y422
	A18C406	0160-6087	5		C-F 2UF 10% 400V POLYPa	84411	TRW-35 2UF 400V
	A18C407	0140-0200	0		CAPACITOR-FXD 390PF +-5% 300VDC MICA	09023	0140-0200
	A18C408	0150-0012	3	1	CAPACITOR-FXD .01UF +-20% 1KVDC CER	T01067	818-584 Z5U 103M
	A18C500-C502	0180-2825	3		CAPACITOR-FXD 22UF+50-10% 50VDC AL	13606	510D057
	A18C503	0180-0550	7	4	CAPACITOR-FXD 330UF+100-10% 25VDC AL	55680	R1-A25U-330
	A18C504-C505	0180-3524	1	2	C-F 227UF --% 100V ALUMEr	13606	674D227H100HJ5A
	A18C506-C508	0180-3499	9		C-F 470UF --% 50V ALUMEr	13606	674D477H050JE5A
	A18C509	0180-0550	7		CAPACITOR-FXD 330UF+100-10% 25VDC AL	55680	R1-A25U-330
	A18C510-C511	0180-2825	3		CAPACITOR-FXD 22UF+50-10% 50VDC AL	13606	510D057
	A18C512-C516	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
	A18C517-C518	0180-0550	7		CAPACITOR-FXD 330UF+100-10% 25VDC AL	55680	R1-A25U-330
	A18C519-C523	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
	A18C524-C525	0180-2825	3		CAPACITOR-FXD 22UF+50-10% 50VDC AL	13606	510D057
	A18C526	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
Δ	A18C527-C530	0180-2825	3		CAPACITOR-FXD 22UF+50-10% 50VDC AL	13606	510D057
	A18C600	0160-3455	5	1	CAPACITOR-FXD 470PF +-10% 1KVDC CER	T01067	838-546 X5E 471K
	A18C700-C701	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
	A18C800-C801	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
	A18C802-C803	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
	A18CR1-CR3	1901-0050	3	18	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
	A18CR4-CR6	1990-0652	8	3	LED-LAMP ARRAY LUM-INT=200UCD IF=5MA-MAX	28480	1990-0652
	A18CR7	1826-1138	0	1	IC MISC 3-TO-46 PKG	27014	LM135AH
	A18CR100-CR103	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
	A18CR200	0837-0299	4	1	VOLTAGE SUPPRESSOR VR= 5.0V, BV= 5.3V	24444	GMP-5B
	A18CR201	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
	A18CR300-CR302	1901-0960	4	2	DIODE-PWR RECT 50V 75A DO-5	18546	VSK71
	A18CR400	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
	A18CR401-CR402	1901-0704	4	1	DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR403	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
	A18CR500	0837-0303	1	1	VOLTAGE SUPPRESSOR VR=33.3V, BV=37.1 TO	24444	P6KE39A
	A18CR501-CR502	1901-0704	4	24	DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR503	0837-0303	1		VOLTAGE SUPPRESSOR VR=33.3V, BV=37.1 TO	24444	P6KE39A
	A18CR401-CR402	1901-0704	4	1	DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR403	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
	A18CR500	0837-0303	1	1	VOLTAGE SUPPRESSOR VR=33.3V, BV=37.1 TO	24444	P6KE39A
	A18CR501-CR502	1901-0704	4	20	DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR503	0837-0303	1		VOLTAGE SUPPRESSOR VR=33.3V, BV=37.1 TO	24444	P6KE39A
	A18CR504-CR507	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR508	0837-0300	8	1	VOLTAGE SUPPRESSOR VR=8.55V, BV= 9.5 TO	24444	P6KE10A
	A18CR509-CR510	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR511	0837-0300	8		VOLTAGE SUPPRESSOR VR=8.55V, BV= 9.5 TO	24444	P6KE10A
	A18CR512-CR513	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR514	0837-0302	0	1	VOLTAGE SUPPRESSOR VR=16.2V, BV=18.0 TO	24444	P6KE20
	A18CR515-CR516	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR517	0837-0302	0		VOLTAGE SUPPRESSOR VR=16.2V, BV=18.0 TO	24444	P6KE20
	A18CR518-CR519	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR520	0837-0302	0		VOLTAGE SUPPRESSOR VR=16.2V, BV=18.0 TO	24444	P6KE20
	A18CR521-CR522	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR523	0837-0302	0		VOLTAGE SUPPRESSOR VR=16.2V, BV=18.0 TO	24444	P6KE20
	A18CR524-CR525	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR526	0837-0301	9	1	VOLTAGE SUPPRESSOR VR=12.8V, BV=14.3 TO	24444	P6KE15A
	A18CR527	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR528	0837-0301	9		VOLTAGE SUPPRESSOR VR=12.8V, BV=14.3 TO	24444	P6KE15A
Δ	A18CR529-CR533	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR600-CR603	1901-1106	2	1	DIODE-PWR RECT 400V 1A 50NS	9N171	UES-1106

Δ See backdating.

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Table 4-3 Replaceable Parts cont.

	Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	A18CR700-CR707	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
	A18J3	1251-6310	1	1	CONN-UTIL METMAT 6-CKT 6-CONT	00779	207583-5
	A18CR528	0837-0301	9		VOLTAGE SUPPRESSOR VR=12.8V, BV=14.3 TO	24444	P6KE15A
	A18CR529-CR533	1901-0704	4		DIODE-GEN PRP 1N4002 100V 1A DO-41	03580	1N4002
	A18CR600-CR603	1901-1106	2	1	DIODE-PWR RECT 400V 1A 50NS	9N171	UES-1106
	A18CR700	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
	A18J10-J18	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
	A18J100	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
	A18J103	03562-61611	8	1	CBL ASSY PWR/DISP	28480	03562-61611
	A18J201	03562-61622	1	1	CABLE ASSY +5V	28480	03562-61612
	A18J202	03562-61623	2	1	CABLE-GROUND	28480	03562-61623
	A18J402-J407	1251-1636	4		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	71279	450-3388-01-03-00
	A18L100-L101	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
	A18L300	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
	A18L301	03562-60302	2	1	IND 44UH 30A	28480	03562-60302
	A18L400	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
	A18L500	9140-0893	6	2	INDUCTOR 2MH	09161	PE 50502
	A18L503	9140-0893	6		INDUCTOR 2MH	09161	PE 50502
	A18MP4	1205-0586	4	1	HEATSINK TO 220	98978	7-370-BA
	A18MP5	1205-0587	5	1	HEATSINK TWIN DO5	13103	1676B-2XDO-5
	A18MP6-MP7	1205-0495	4	2	HEAT SINK SGL TO-3-CS	13103	16301B-4-SM4
	A18MP665	03562-01101	5	1	HEATSINK POWER SUPPLY	28480	03562-01101
	A18MP666	03562-01205	0	1	BRKT-PWR SUPPLY	28480	03562-01205
	A18Q2-Q4	1854-0215	1	6	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
	A18Q100-Q101	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
	A18Q102	1853-0036	2	7	TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
Δ	A18Q200-Q202	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
	A18Q203	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
	A18Q204	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
Δ	A18Q300-Q301	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
	A18Q400-Q401	1855-0473	5	2	TRANSISTOR MOSFET N-CHAN TO-3	I01060	IR 94-0116
	A18R1	2100-3211	7	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	72PR1K-105B
	A18R2-R3	0757-0280	3	14	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
	A18R4	0757-0473	6	1	RESISTOR 221K 1% .125W F TC=0+-100	19701	5033R
	A18R5	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	19701	5033R
	A18R6	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	19701	5033R
	A18R7	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R8	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	19701	5033R
	A18R9	0757-0465	6	7	RESISTOR 100K 1% .125W F TC=0+-100	19701	5033R
	A18R10	0757-0442	9	23	RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R11	0757-0449	6	3	RESISTOR 20K 1% .125W F TC=0+-100	19701	5033R
	A18R12	0698-3558	8	1	RESISTOR 4.02K 1% .125W F TC=0+-100	19701	5033R
	A18R13	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	19701	5033R
	A18R14	0698-3484	9	1	RESISTOR 6.65K 1% .125W F TC=0+-100	19701	5033R
	A18R15	0698-3279	0	5	RESISTOR 4.99K 1% .125W F TC=0+-100	19701	5033R
	A18R16	0757-0472	5	1	RESISTOR 200K 1% .125W F TC=0+-100	19701	5033R
	A18R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
	A18R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R19	0698-3499	6	1	RESISTOR 40.2K 1% .125W F TC=0+-100	19701	5033R
	A18R20-R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R22-R25	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
	A18R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R27	0757-0349	5	2	RESISTOR 22.6K 1% .125W F TC=0+-100	19701	5033R
	A18R28	0757-0446	3	4	RESISTOR 15K 1% .125W F TC=0+-100	19701	5033R
	A18R29	0698-3154	0	2	RESISTOR 4.22K 1% .125W F TC=0+-100	19701	5033R
	A18R30	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R31	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	19701	5033R
	A18R32	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R33	0757-0349	5		RESISTOR 22.6K 1% .125W F TC=0+-100	19701	5033R
	A18R34	0757-0446	3		RESISTOR 15K 1% .125W F TC=0+-100	19701	5033R
	A18R35	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	19701	5033R
	A18R36	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R37	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	19701	5033R
	A18R38	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R39-R42	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
	A18R43-R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R45	0698-3519	1	2	RESISTOR 12.4K 1% .125W F TC=0+-100	19701	5033R
	A18R46-R47	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R

Δ See backdating.

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Table 4-3 Replaceable Parts cont.

	Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	A18R48	0698-3202	9	1	RESISTOR 1.74K 1% .125W F TC=0+-100	19701	5033R
	A18R49	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	19701	5033R
	A18R50	0757-0446	3	1	RESISTOR 15K 1% .125W F TC=0+-100	19701	5033R
	A18R51	0698-3268	7	1	RESISTOR 11.5K 1% .125W F TC=0+-100	19701	5033R
	A18R52	0698-3519	1		RESISTOR 12.4K 1% .125W F TC=0+-100	19701	5033R
	A18R53-R54	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R60	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R61	0698-4486	3	1	RESISTOR 24.9K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R62	0683-2055	7	1	RESISTOR 2M 5% .25W CF TC=0-900	77902	R-25J
	A18R63	0757-0435	0	1	RESISTOR 3.92K 1% .125W F TC=0+-100	19701	5033R
	A18R64	0757-0427	0	1	RESISTOR 1.5K 1% .125W F TC=0+-100	19701	5033R
	A18R65	0757-0283	6	1	RESISTOR 2K 1% .125W F TC=0+-100	19701	5033R
	A18R66-R67	0698-3228	9	5	RESISTOR 49.9K 1% .125W F TC=0+-100	19701	5033R
	A18R100	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R101	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
	A18R102	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R103	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
Δ	A18R105	0698-3279	0		RESISTOR 4.99K 1% .125W F TC=0+-100	19701	5033R
	A18R106	0812-0047	8	1	RESISTOR 5 5% 5W PW TC=0+-50	91637	CW-5
	A18R107	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	19701	5033R
	A18R108-R109	0757-0384	8	2	RESISTOR 20 1% .125W F TC=0+-100	19701	5033R
	A18R110	0698-3225	6	1	RESISTOR 1.43K 1% .125W F TC=0+-100	19701	5033R
	A18R111	0757-0283	6	3	RESISTOR 2K 1% .125W F TC=0+-100	19701	5033R
	A18R112	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
	A18R113	0698-3279	0		RESISTOR 4.99K 1% .125W F TC=0+-100	19701	5033R
Δ	A18R116	0698-8827	4	3	RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
	A18R117	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
Δ	A18R119-R120	0698-3228	9		RESISTOR 49.9K 1% .125W F TC=0+-100	19701	5033R
	A18R121	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
Δ	A18R126	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
	A18R127	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
	A18R200	0698-3228	9		RESISTOR 49.9K 1% .125W F TC=0+-100	19701	5033R
	A18R201	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	19701	5033R
	A18R202	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R203	0698-3279	0		RESISTOR 4.99K 1% .125W F TC=0+-100	19701	5033R
	A18R204	0698-3162	0	2	RESISTOR 46.4K 1% .125W F TC=0+-100	19701	5033R
	A18R205-R206	0698-0082	7	2	RESISTOR 464 1% .125W F TC=0+-100	19701	5033R
	A18R207	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	19701	5033R
	A18R209	0698-8827	4	1	RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
	A18R210	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	19701	5033R
	A18R212	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
	A18R300-R301	0698-3136	8	2	RESISTOR 17.8K 1% .125W F TC=0+-100	19701	5033R
	A18R302	0698-3279	0		RESISTOR 4.99K 1% .125W F TC=0+-100	19701	5033R
	A18R303	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	19701	5033R
Δ	A18R304	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	19701	5033R
	A18R305	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	19701	5033R
	A18R306	0698-3581	7	1	RESISTOR 13.7K 1% .125W F TC=0+-100	19701	5033R
	A18R307	0698-4445	4	1	RESISTOR 5.76K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R308	0757-0446	3		RESISTOR 15K 1% .125W F TC=0+-100	19701	5033R
	A18R309	0698-4461	4	1	RESISTOR 698 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R310	63312-88002	1	1	RES-SEN 1 OHM	28480	63312-88002
	A18R311-R312	0698-3607	8	1	RESISTOR 18 5% 2W MO TC=0+-200	11502	GS-3
	A18R400	0698-3609	0	1	RESISTOR 22 5% 2W MO TC=0+-200	11502	GS-3
	A18R401	0686-4725	8	2	RESISTOR 4.7K 5% .5W CC TC=0+647	01121	EB4725
	A18R402	0764-0007	7	1	RESISTOR 27K 5% 2W MO TC=0+-200	11502	GS-3
	A18R403	0699-1167	3	1	RESISTOR-FUSE 18 OHM +-1%; .5W AT 70 DEG	91637	CMF60-64
	A18R404	0699-1168	4	1	RESISTOR-FUSE 3.9K OHM +-2%; T.C. 0+-100	91637	CMF60-64
	A18R405	0764-0007	7		RESISTOR 27K 5% 2W MO TC=0+-200	11502	GS-3
	A18R406	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R407	0686-4725	8		RESISTOR 4.7K 5% .5W CC TC=0+647	01121	EB4725
	A18R408	0698-3609	0		RESISTOR 22 5% 2W MO TC=0+-200	11502	GS-3
	A18R409	0699-1167	3		RESISTOR-FUSE 18 OHM +-1%; .5W AT 70 DEG	91637	CMF60-64
	A18R410	0699-1168	4		RESISTOR-FUSE 3.9K OHM +-2%; T.C. 0+-100	91637	CMF60-64
	A18R411	0837-0308	6	1	THERMISTER 8 ADC	15454	SG-170
	A18R412-R413	0698-3609	0		RESISTOR 22 5% 2W MO TC=0+-200	11502	GS-3
	A18R500	0698-3151	7	2	RESISTOR 2.87K 1% .125W F TC=0+-100	19701	5033R
	A18R501	0698-4408	9	10	RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R502	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	19701	5033R

Δ See backdating.

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

	Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	A18R503	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R504	0698-3437	2	1	RESISTOR 133 1% .125W F TC=0+-100	19701	5033R
	A18R505	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R506	0757-0419	0	2	RESISTOR 681 1% .125W F TC=0+-100	19701	5033R
	A18R507	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R508	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	19701	5033R
	A18R509	0698-4408	9	1	RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R510	0698-4423	8	4	RESISTOR 1.37K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R511	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R512	0698-4423	8		RESISTOR 1.37K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R513	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R514	0698-4423	8		RESISTOR 1.37K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R515	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R516	0698-4423	8		RESISTOR 1.37K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R517	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R518	0698-4196	2	2	RESISTOR 1.07K 1% .125W F TC=0+-100	19701	5033R
	A18R519	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R520	0698-4196	2		RESISTOR 1.07K 1% .125W F TC=0+-100	19701	5033R
	A18R521	0698-4408	9		RESISTOR 124 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R600-R603	0698-3634	1	1	RESISTOR 470 5% 2W MO TC=0+-200	11502	GS-3
	A18R800	0698-4376	0	1	RESISTOR 32.4 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
	A18R801	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
	A18R802	0757-0446	3		RESISTOR 15K 1% .125W F TC=0+-100	19701	5033R
	A18R803	0698-4123	5	1	RESISTOR 499 1% .125W F TC=0+-100	19701	5033R
	A18R804	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	19701	5033R
	A18R805	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	19701	5033R
	A18SUP1-SUP2	1970-0094	0		TUBE-ELECTRON SURGE V PTCTR	71482	CG2-250AL+-10%
	A18T1	9100-4402	7	1	PWR XFMER 128KHZ	28480	9100-4402
	A18T2	9100-4348	0	1	INDUCTOR-FIXED CURRENT SENSE INDUCTOR;L	09161	51719
	A18T3	9100-4369	5	1	BIAS XFMR	28480	9100-4369
	A18T4	9140-0828	7	1	GATE DRIVE TFMR	28480	9140-0828
	A18TP1-TP15	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
	A18U1	1820-3670	7	1	IC-D 74HC133 CMOS NANDGT P16	27014	MM74HC133N
	A18U2	1826-0138	8	4	IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
	A18U3-U6	1820-2922	0	5	IC GATE CMOS/74HC NAND QUAD 2-INP	04713	SC40291PK
	A18U7-U8	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
Δ	A18U100	1820-2922	0		IC GATE CMOS/74HC NAND QUAD 2-INP	04713	SC40291PK
	A18U101	1826-1040	3	1	IC V RGLTR-SWG 4.85/5.15V 18-DIP-C PKG	34333	SG3526J
	A18U102	1820-1288	9	1	IC DRVR TTL CLK TTL-TO-MOS 1-INP	27014	SD31013
	A18U103	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
	A18U104	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
	A18U200	1826-1097	0	1	IC OP AMP WB 8-DIP-C PKG	06665	OP-17 073Z
	A18U300-U301	1826-0357	3		IC OP AMP WB TO-99 PKG	27014	SL32498
	A18U400	1906-0069	4	1	DIODE-FW BRDG 400V 1A	18546	VM48
	A18U401	1906-0080	9	1	DIODE-FW BRDG 600V 10A	18546	VJ647
	A18U500	1826-0393	7	7	IC V RGLTR-ADJ-POS 1.2/37V TO-220 PKG	27014	SL33706
	A18U501	1826-0527	9	4	IC V RGLTR-ADJ-NEG 1.2/37V TO-220 PKG	27014	SL35761
	A18U502-U506	1826-0393	7		IC V RGLTR-ADJ-POS 1.2/37V TO-220 PKG	27014	SL33706
	A18U507-U509	1826-0527	9		IC V RGLTR-ADJ-NEG 1.2/37V TO-220 PKG	27014	SL35761
	A18U510	1826-0393	7		IC V RGLTR-ADJ-POS 1.2/37V TO-220 PKG	27014	SL33706
	A18U511-U512	1906-0301	7	2	DUAL RECT 200V 20A	18546	VHE2404
	A18U513-U514	1901-1157	3	2	DIODE-GENERAL PURPOSE	18546	VHE1404
	A18U800	1826-0175	3	1	IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	SL26763
	A18W1-W10	1258-0141	8		JMPR-REM .025P	22526	65474-004
	A18W400-W401	1258-0224	8		JUMPER,PROGRAMMING	M01051	461-2872-02-03-10
		2190-0004	9	15	WASHER-LK INTL T NO. 4 .115-IN-ID	T12345	SF 1904-00
		3050-0440	2	15	WASHER-SHLDR NO. 4 .115-IN-ID .2-IN-OD	86928	5607-45
		2200-0139	4	15	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	83486	2200-0139
		2260-0001	5	15	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	T1234	2260-0001
		0340-0564	3	15	INSULATOR-XSTR THRM-CNDCT	55285	7403-09FR-51
		0515-0212	9	4	SCREW-MACH M3.5 X 0.6 6MM-LG PAN-HD	16941	0515-0212
		0535-0031	2	4	NUT-HEX W/LKWR M3 X 0.5 2.4MM-THK	H01043	0535-0031
		0515-0413	2	3	SCREW-MACH M4 X 0.7 6MM-LG PAN-HD	16941	0515-0413
		1400-0249	0	3	CABLE TIE .062-.625-DIA .091-WD NYL	59730	TY-23M-8
		1400-0507	3	3	CABLE TIE .062-2-DIA .095-WD NYL	59730	TY-232M
		2190-0027	6	2	WASHER-LK INTL T 1/4 IN .256-IN-ID	T12345	1914-00
		2190-0060	7	2	WASHER-LK INTL T 1/4 IN .256-IN-ID	T12345	1214-10
		2950-0134	8	2	NUT-HEX-DBL-CHAM 1/4-28-THD .125-IN-THK	70318	2950-0134

Δ See backdating.

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	2360-0121	2	1	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	01536	2360-0121
	2420-0001	5	1	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	T12345	511-061800-00-0280-2580
	1252-0139	2	1	HEADER,RND-W,PLZ,15 CONT	27264	10-19-1151
	1251-5383	6	1	CONN-POST TYPE .100-PIN-SPCG 2-CONT	27264	22-29-2021
A22	03562-66522	0	1	HPIB INTERFACE	28480	03562-66522
A22J1	1251-8517	4	1	CONN-RECT MICRORBN 24-CKT 24-CONT	00779	554194-2
A22MP687	03577-24701	6	2	SPACER	76854	03577-24701
A22W14	03562-61614	1	1	CBLE ASSY DISP I/O	28480	03562-61614
	2190-0918	4	2	WASHER-LK HLCL NO. 6 .141-IN-ID	73734	2190-0918
	0380-1214	6	2	STANDOFF-HEX 4.7-MM-LG M3.5 X 0.6-THD	L01005	0380-1214
	0535-0007	2	2	NUT-HEX DBL-CHAM M3.5 X 0.6 2.8MM-THK	H01043	0535-0007
A30	03562-66530	0	1	ASSY,SCE/ANLG	28480	03562-66530
A30C1	0160-4571	8	45	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C2	0160-0128	3	1	CAPACITOR-FXD 2.2UF +-20% 50VDC CER	13606	3C37Z5U225M050A
A30C3-C5	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C6-C7	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M025A
A30C8	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C9	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M025A
A30C10-C12	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C50-C51	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C54	0160-5439	9	1	CAPACITOR-FXD 510PF +-5% 100VDC CER	27167	CAC03C0G511J100A
A30C100	0160-4790	3	2	CAPACITOR-FXD 12PF +-5% 100VDC CER 0+-30	27167	CAC02C0G120J100A
A30C101	0160-5404	8	1	CAPACITOR-FXD 360PF +-5% 100VDC CER	27167	CAC02C0G361J100A
A30C102	0160-4792	5	1	CAPACITOR-FXD 8.2PF +-.5PF 100VDC CER	27167	CAC02C0G8R2D100A
A30C103	0160-4811	9	1	CAPACITOR-FXD 270PF +-5% 100VDC CER	27167	CAC02C0G271J100A
A30C104	0160-5889	3	1	CAPACITOR-FXD 5600PF +-1% 50VDC CER	27167	CAC05C0G562F050A
A30C105	0160-5877	9	1	CAPACITOR-FXD 2400PF +-1% 50VDC CER	27167	CAC04C0G242F050A
A30C106	0160-5890	6	1	CAPACITOR-FXD 9100PF +-1% 50VDC CER	27167	CAC05C0G912F050A
A30C108	0160-5878	0	1	CAPACITOR-FXD 3600PF +-1% 50VDC CER	27167	CAC04C0G362F050A
A30C109	0160-4794	7	1	CAPACITOR-FXD 5.6PF +-.5PF 100VDC CER	27167	CAC02C0G5R6D100A
A30C110	0160-5405	9	1	CAPACITOR-FXD 130PF +-5% 100VDC CER	27167	CAC02C0G131J100A
A30C111	0160-5876	8	1	CAPACITOR-FXD 1300PF +-1% 50VDC CER	27167	CAC03C0G132F050A
A30C150-C151	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C152	0160-3046	0	1	CAPACITOR-FXD 250PF +-1% 100VDC MICA	09023	0160-3046
A30C250-C254	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C255	0160-4790	3		CAPACITOR-FXD 12PF +-5% 100VDC CER 0+-30	27167	CAC02C0G120J100A
A30C300	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C301	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M025A
A30C302-C308	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C350	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C352	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C353	0160-4803	9	1	CAPACITOR-FXD 68PF +-5% 100VDC CER 0+-30	27167	CAC02C0G680J100A
A30C354	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C355	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	13606	150D475X9035B2-DYS
A30C356-C357	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C400-C401	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C402	0160-2530	5	1	CAPACITOR-FXD 180PF +-2% 300VDC MICA	00853	0160-2530
A30C403-C404	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C450-C452	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C500-C502	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C551-C553	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C600-C603	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A30C650-C651	0180-3113	4		CAPACITOR-FXD 330UF+50-10% 25VDC AL	P01016	ECEB1EV331S
A30C652	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A30CR1	1902-0686	3	1	DIODE-ZNR 6.2V 2% DO-7 PD=.4W TC=+.002%	04713	SZ 12170
A30CR250-CR251	1901-0050	3	6	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A30CR402-CR403	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A30CR500-CR502	1901-1080	1	3	DIODE-SCHOTTKY 1N5817 20V 1A	04713	SBR5120KBRL
A30CR600-CR601	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A30J200	1250-1255	1	1	CONNECTOR-RF SMB M PC 50-OHM	98291	51-051-0000
A30J350	1251-4670	2	2	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A30J550	1251-4670	2		CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A30K200-K202	0490-1403	8	3	RELAY-REED 1A 500MA 200VDC 5VDC-COIL	71707	2900-0022
A30L100	03562-60301	1	1	IND 393.8	28480	03562-60301
A30L101	03562-60300	0	1	IND 335	28480	03562-60300
A30L151	9100-1665	8	1	INDUCTOR RF-CH-MLD 3.3MH 5% .23DX.57LG	24226	22M334J
A30L650-L651	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
A30L652	9100-1788	6	1	CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	02114	VK200 20/4B
A30P30	1251-7629	7	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	00779	532955-7
A30Q1-Q3	1854-0215	1	1	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30R1	0683-4705	8	2	RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A30R2	0683-5125	8	2	RESISTOR 5.1K 5% .25W CF TC=0-400	77902	R-25J
A30R3	0757-0449	6	1	RESISTOR 20K 1% .125W F TC=0+-100	19701	5033R
A30R4	0698-4438	5	1	RESISTOR 3.09K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A30R5	0698-6625	6	2	RESISTOR 6K .1% .125W F TC=0+-25	19701	5033R
A30R6	0698-6377	5	2	RESISTOR 200 .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A30R7	0757-0401	0	6	RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A30R8	0698-6625	6		RESISTOR 6K .1% .125W F TC=0+-25	19701	5033R
A30R9	2100-3095	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	73138	89PR200
A30R10	2100-3164	9	1	RESISTOR-TRMR 10 20% C SIDE-ADJ 17-TRN	73138	89PR10
A30R11	0757-0462	3	3	RESISTOR 75K 1% .125W F TC=0+-100	19701	5033R
A30R12	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	19701	5033R
A30R13	0683-5125	8		RESISTOR 5.1K 5% .25W CF TC=0-400	77902	R-25J
A30R14	0698-3484	9	1	RESISTOR 6.65K 1% .125W F TC=0+-100	19701	5033R
A30R15	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A30R16	0698-6806	5	1	RESISTOR 119.3 .25% .125W F TC=0+-25	19701	5033R
A30R17	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A30R18	0698-6624	5	2	RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A30R19	0698-6362	8	3	RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A30R20	0698-4376	0	1	RESISTOR 32.4 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A30R21	0698-4492	1	1	RESISTOR 32.4K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A30R22	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A30R50	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A30R51	0698-3518	0	1	RESISTOR 7.32K 1% .125W R TC=0+-100	19701	5033R
A30R54	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A30R100	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A30R101	0698-6377	5		RESISTOR 200 .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A30R150-R151	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A30R152	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A30R153	0698-4123	5	4	RESISTOR 499 1% .125W F TC=0+-100	19701	5033R
A30R154	0698-8827	4	1	RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
A30R156	0698-6322	0	1	RESISTOR 4K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A30R250	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A30R300-R301	0698-8607	8	2	RESISTOR 4.5K .1% .125W F TC=0+-25	19701	5033R
A30R302	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A30R303	0683-1855	3	1	RESISTOR 1.8M 5% .25W CF TC=0-900	77902	R-25J
A30R304-R305	0699-0533	5	2	RESISTOR 4.64K .1% .125W F TC=0+-25	19701	5033R
A30R306-R307	0757-0277	8	2	RESISTOR 49.9 1% .125W F TC=0+-100	19701	5033R
A30R351	0757-0283	6	1	RESISTOR 2K 1% .125W F TC=0+-100	19701	5033R
A30R355	0698-4123	5		RESISTOR 499 1% .125W F TC=0+-100	19701	5033R
A30R356	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A30R401	0698-3279	0	1	RESISTOR 4.99K 1% .125W F TC=0+-100	19701	5033R
A30R402	0698-6320	8	2	RESISTOR 5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A30R403	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A30R404	0757-0072	1	1	RESISTOR 49.9 1% .5W F TC=0+-100	19701	5053R
A30R405	0837-0275	6	1	THERMISTOR DISC 50-OHM TC=+2.35%/C-DEG	75263	RL3006-50-110-25-PTO
A30R406	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	19701	5033R
A30R407	0683-2225	3	8	RESISTOR 2.2K 5% .25W CF TC=0-400	77902	R-25J
A30R408-R409	0757-0991	3	1	RESISTOR 20 1% .5W F TC=0+-100	19701	5053R
A30R450	0683-2225	3		RESISTOR 2.2K 5% .25W CF TC=0-400	77902	R-25J
A30R501-R504	0683-2225	3		RESISTOR 2.2K 5% .25W CF TC=0-400	77902	R-25J
A30R506	0683-2225	3		RESISTOR 2.2K 5% .25W CF TC=0-400	77902	R-25J
A30R550	0683-2225	3		RESISTOR 2.2K 5% .25W CF TC=0-400	77902	R-25J
A30R600	0698-4123	5		RESISTOR 499 1% .125W F TC=0+-100	19701	5033R
A30R601	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A30R602	0698-4123	5		RESISTOR 499 1% .125W F TC=0+-100	19701	5033R
A30R603	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	19701	5033R
A30R604	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A30TP1-TP11	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A30TP13-TP15	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034

See introduction to this section for ordering information
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Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A30U1	1820-0493	6	2	IC OP AMP GP 8-DIP-P PKG	27014	SL10084
A30U2	1826-0715	7	1	IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A30U50	1826-0601	0	1	IC OP AMP PRCN TO-99 PKG	06665	OP-16 008J
A30U150	1826-0601	0		IC OP AMP PRCN TO-99 PKG	06665	OP-16 008J
A30U151	1826-0778	2	1	ANALOG SWITCH 2 SPST 14 -DIP-P	17856	DG300CJ
A30U250	1826-0601	0		IC OP AMP PRCN TO-99 PKG	06665	OP-16 008J
A30U251	1826-0838	5	1	D/A 10-BIT 16-PLASTIC CMOS	24355	AD11/435
A30U300	1820-0493	6		IC OP AMP GP 8-DIP-P PKG	27014	SL10084
A30U301	1820-1934	2	1	D/A 8-BIT 16-CERDIP BPLR	06665	DAC-08 096Q
A30U350	1826-1097	0	1	IC OP AMP WB 8-DIP-C PKG	06665	OP-17 073Z
A30U351	1826-0726	0	1	D/A 12-BIT 24-DIP-C BPLR	24355	AD40997
A30U352	1820-0224	1	1	IC OP AMP SPCL TO-99 PKG	27014	SH08495
A30U400	1826-0601	0		IC OP AMP PRCN TO-99 PKG	06665	OP-16 008J
A30U401	1820-0224	1	1	IC OP AMP SPCL TO-99 PKG	27014	SH08495
A30U401	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	98978	TXBF-032-025B
A30U450	1820-2096	9	1	IC CNTR TTL LS BIN DUAL 4-BIT	01295	SN59197N
A30U451	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A30U452	1820-1244	7	1	IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE DUAL	01295	SN53619
A30U453	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN53518N
A30U454	1820-2773	9	1	IC GATE TTL ALS NAND 8-INP	01295	SN71544N
A30U455	1820-1433	6	2	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN57194
A30U456	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A30U500	1820-3318	0	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG COM	01295	SN71690N
A30U501	1820-1433	6		IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN57194
A30U502	1820-2313	3	1	IC SHF-RGTR TTL LS SERIAL-IN SERIAL-OUT	01295	SN70509N
A30U503	1820-1209	4	1	IC BFR TTL LS NAND QUAD 2-INP	01295	SN53516
A30U550-U551	1820-1196	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53525
A30U552-U553	1820-1987	5	2	IC SHF-RGTR TTL LS COM CLEAR STOR 8-BIT	34335	AM74LS299N
A30U554	1820-2634	1	1	IC INV TTL ALS HEX	01295	SN71332N
A30U600	1826-0175	3	1	IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	SL26763
A30W350	1258-0141	8	2	JMPR-REM .025P	22526	65474-004
A30W550	1258-0141	8		JMPR-REM .025P	22526	65474-004
	0360-1917	4	1	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	98291	011-6812-00-0-206
	5000-9043	6	1	PIN EXTR	28480	5000-9043
A31	03562-66531	1	1	PC BD-TRIGGER	28480	03562-66531
A31C1-C2	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	13606	150D685X9035B2-DYS
A31C3	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A31C4-C5	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A31C6-C7	0160-2414	4	2	CAPACITOR-FXD .022UF +-5% 200VDC POLYE	13606	192P22352
A31C8-C10	0160-4571	8	45	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C11-C12	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	27167	CAC02C0G100J100A
A31C13-C15	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C16	0160-4801	7	3	CAPACITOR-FXD 100PF +-5% 100VDC CER	27167	CAC02C0G101J100A
A31C17-C18	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C19	0160-4791	4	5	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	27167	CAC02C0G100J100A
A31C20-C21	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C22	0160-4832	4	8	CAPACITOR-FXD .01UF +-10% 100VDC CER	27167	CAC02X7R103K100A
A31C23-C27	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C28	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A31C29-30	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C45	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	13606	150D685X9035B2-DYS
A31C101C103	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C104	0160-5880	4	1	CAPACITOR-FXD 2200PF +-1% 50VDC CER	27167	CAC03C0G222F050A
A31C105	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C106-C107	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	27167	CAC02C0G101J100A
A31C108	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C109	0160-5099	7	2	CAPACITOR-FXD 3300PF +-5% 100VDC CER	27167	CAC05C0G332J100A
A31C110-C111	0160-4812	0	2	CAPACITOR-FXD 220PF +-5% 100VDC CER	27167	CAC02C0G221J100A
A31C112	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C113	0160-5099	7		CAPACITOR-FXD 3300PF +-5% 100VDC CER	27167	CAC05C0G332J100A
A31C108	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C109	0160-5099	7	2	CAPACITOR-FXD 3300PF +-5% 100VDC CER	27167	CAC05C0G332J100A
A31C110-C111	0160-4812	0	2	CAPACITOR-FXD 220PF +-5% 100VDC CER	27167	CAC02C0G221J100A
A31C112	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C113	0160-5099	7		CAPACITOR-FXD 3300PF +-5% 100VDC CER	27167	CAC05C0G332J100A

See introduction to this section for ordering information
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Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31C114-C115	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	27167	CAC02X7R103K100A
A31C116-C117	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C118	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	27167	CAC02X7R103K100A
A31C119-C120	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A31C201	0160-4835	7	1	CAPACITOR-FXD .1UF +-10% 50VDC CER	27167	CAC04X7R104K050A
A31C202	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2€37Z5U105M025A
A31C203-C203	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C205	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A31C206	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C208	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	27167	CAC02X7R103K100A
A31C209-C210	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	27167	CAC02C0G100J100A
A31C301	0160-4005	3	1	CAPACITOR-FXD 1UF +-20% 100VDC CER	04222	SR401E105MAA
A31C302-C308	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C309	0160-4787	8	1	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A31C402	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A31C404	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	27167	CAC02X7R103K100A
A31C406	0160-4811	9	1	CAPACITOR-FXD 270PF +-5% 100VDC CER	27167	CAC02C0G271J100A
A31C407	0160-4823	3	1	CAPACITOR-FXD 820PF +-5% 100VDC CER	27167	CAC03C0G821J100A
A31C408-C409	0160-4822	2	2	CAPACITOR-FXD 1000PF +-5% 100VDC CER	27167	CAC03C0G102J100A
A31C410	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C411	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	27167	CAC02X7R103K100A
A31C412	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31C413	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	27167	CAC02X7R103K100A
A31C501-C509	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A31CR1	1902-3097	6	1	DIODE-ZNR 5.23V 2% DO-35 PD=.4W	04713	SZ30016-102
A31CR2-CR3	1902-0958	2		DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.075%	04713	SZ30035-016
A31CR101-CR104	1901-0040	1	8	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A31CR105-CR106	1901-0050	3	6	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A31CR107-CR110	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A31CR201-CR202	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A31CR203	1902-0950	4	1	DIODE-ZNR 4.7V 5% DO-35 PD=.4W TC=+.025%	04713	SZ30035-008
A31CR204	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	19701	5033R
A31CR301-CR302	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A31CR303-CR304	1902-0958	2		DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.075%	04713	SZ30035-016
A31CR401	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A31CR402-CR403	0122-0162	5	2	DIODE-VVC 29PF 10% BVR=30V	25403	BB809
A31CR501-CR502	1901-1080	1	2	DIODE-SCHOTTKY 1N5817 20V 1A	04713	SBR5120KBRL
A31J1	1250-1255	1	3	CONNECTOR-RF SMB M PC 50-OHM	98291	51-051-0000
A31J201	1251-4670	2	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	22526	65500-103
A31J301	1250-1255	1		CONNECTOR-RF SMB M PC 50-OHM	98291	51-051-0000
A31J501	1250-1255	1		CONNECTOR-RF SMB M PC 50-OHM	98291	51-051-0000
A31L1-L2	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
A31L3-L4	9100-1788	6	1	CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	02114	VK200 20/4B
A31L5-L6	9100-1622	7	1	INDUCTOR RF-CH-MLD 24UH 5% .166DX.385LG	06560	15-4455-1J
A31L101	9100-3912	2	1	INDUCTOR RF-CH-MLD 15UH 5% .166DX.385LG	24226	15M152J
A31L102	9100-3341	1	1	INDUCTOR RF-CH-MLD 1UH 2% .166DX.385LG	06560	4425-6G
A31L103-L104	9100-2574	0	2	INDUCTOR RF-CH-MLD 1.2MH 10%	24226	9100-2574
A31L401	9140-0253	2	1	INDUCTOR RF-CH-MLD 300NH 1% .166DX.385LG	24226	15M300F-1
A31L402	9140-0454	5	1	INDUCTOR RF-CH-MLD 18UH 5% .166DX.385LG	24226	15M-182J
A31L403	9140-0399	7	1	INDUCTOR RF-CH-MLD 2.2UH 5% .166DX.385LG	24226	15M221J
A31P1	1251-7629	7	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	00779	532955-7
A31Q101	1853-0010	2	1	TRANSISTOR PNP SI TO-18 PD=360MW	04713	SM4713
A31Q102-Q103	1853-0089	5	1	TRANSISTOR PNP 2N4917 SI PD=200MW	07263	S33022
A31Q104	1853-0010	2		TRANSISTOR PNP SI TO-18 PD=360MW	04713	SM4713
A31Q105-Q106	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	S33022
A31Q201	1855-0410	0	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	27014	SF51006
A31Q401-Q402	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A31Q403	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	07263	S-6516
A31R1-R2	0757-0346	2	5	RESISTOR 10 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A31R3-R5	0757-0394	0	12	RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R6	0698-4740	2	1	RESISTOR 42.2K 1% .25W F TC=0+-100	91637	CMF-60-1, T-1
A31R7	0698-7579	1	1	RESISTOR 7.853K .1% .125W F TC=0+-25	19701	5033R
A31R8	0698-3259	6	3	RESISTOR 7.87K 1% .125W F TC=0+-100	19701	5033R
A31R9	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	19701	5033R
A31R10	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R11	0757-0280	3	28	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R12-R13	0698-6366	2	2	RESISTOR 800 .1% .125W F TC=0+-25	19701	5033R
A31R14	0698-3157	3	7	RESISTOR 19.6K 1% .125W F TC=0+-100	19701	5033R

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31R15	0698-6348	0	1	RESISTOR 3K .1% .125W F TC=0+-25	19701	5033R
A31R16	0698-0085	0	3	RESISTOR 2.61K 1% .125W F TC=0+-100	19701	5033R
A31R17	0757-0726	2	1	RESISTOR 511 1% .25W F TC=0+-100	19701	5043R
A31R18	0757-0416	7	3	RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A31R19	0698-3132	4	4	RESISTOR 261 1% .125W F TC=0+-100	19701	5033R
A31R20	0757-0411	2	2	RESISTOR 332 1% .125W F TC=0+-100	19701	5033R
A31R21	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R22	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	19701	5033R
A31R23	0698-4496	5	2	RESISTOR 45.3K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A31R24	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	19701	5033R
A31R25	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R26	0698-4496	5		RESISTOR 45.3K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A31R27-R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R29	8150-3375	5	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A31R30-R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R101-R102	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A31R103	0698-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0+-100	19701	5033R
A31R104	0757-0273	4	3	RESISTOR 3.01K 1% .125W F TC=0+-100	19701	5033R
A31R105	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R106	0698-3488	3	1	RESISTOR 442 1% .125W F TC=0+-100	19701	5033R
A31R107	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	19701	5033R
A31R108	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	19701	5033R
A31R109	0757-0410	1	2	RESISTOR 301 1% .125W F TC=0+-100	19701	5033R
A31R110-R111	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R112	0757-0338	2	2	RESISTOR 1K 1% .25W F TC=0+-100	19701	5043R
A31R113	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R114	0757-0273	4		RESISTOR 3.01K 1% .125W F TC=0+-100	19701	5033R
A31R115	0757-0442	9	4	RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A31R116	0698-3259	6		RESISTOR 7.87K 1% .125W F TC=0+-100	19701	5033R
A31R117	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A31R118	0698-3160	8	4	RESISTOR 31.6K 1% .125W F TC=0+-100	19701	5033R
A31R119	0698-3259	6		RESISTOR 7.87K 1% .125W F TC=0+-100	19701	5033R
A31R120	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	19701	5033R
A31R121	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R122	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	19701	5033R
A31R123	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	19701	5033R
A31R124	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R125	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	19701	5033R
A31R126	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	19701	5033R
A31R127	0757-0410	1		RESISTOR 301 1% .125W F TC=0+-100	19701	5033R
A31R128	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R129	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R130-R131	0757-0338	2		RESISTOR 1K 1% .25W F TC=0+-100	19701	5043R
A31R132-R133	0698-8958	2	3	RESISTOR 511K 1% .125W F TC=0+-100	19701	5033R
A31R134	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	19701	5033R
A31R201	0698-8827	4	2	RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
A31R202	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A31R203-R204	0698-3451	0	2	RESISTOR 133K 1% .125W F TC=0+-100	19701	5033R
A31R205	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	19701	5033R
A31R206	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
A31R207	1902-0777	3	1	DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	SZ14376RL
A31R208	2100-3103	6	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	73138	89PR10K
A31R209	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A31R210	0757-0463	4	1	RESISTOR 82.5K 1% .125W F TC=0+-100	19701	5033R
A31R211	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	19701	5033R
A31R212	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	19701	5033R
A31R213	0699-0121	7	1	RESISTOR 2.05M 1% .125W F TC=0+-100	D8439	MK2
A31R214	0698-3515	7	2	RESISTOR 5.9K 1% .125W F TC=0+-100	19701	5033R
A31R215	0698-8958	2		RESISTOR 511K 1% .125W F TC=0+-100	19701	5033R
A31R216	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0+-100	19701	5033R
A31R217	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R218	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A31R301	0757-0072	1	1	RESISTOR 49.9 1% .5W F TC=0+-100	19701	5053R
A31R302	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	19701	5033R
A31R304	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A31R305	0757-0411	2		RESISTOR 332 1% .125W F TC=0+-100	19701	5033R
A31R306	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	19701	5033R

See introduction to this section for ordering information
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Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31R307	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R308	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	19701	5033R
A31R309	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A31R310-R313	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R314	0698-3515	7		RESISTOR 5.9K 1% .125W F TC=0+-100	19701	5033R
A31R401	0757-0273	4		RESISTOR 3.01K 1% .125W F TC=0+-100	19701	5033R
A31R402	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	19701	5033R
A31R403	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R404	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A31R405	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	19701	5033R
A31R406	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R407	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	19701	5033R
A31R408	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R409	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	19701	5033R
A31R410-R412	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R413-R414	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	19701	5033R
A31R415	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	19701	5033R
A31R416	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A31R417-R419	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R501-R508	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R510	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A31R511	0837-0275	6	1	THERMISTOR DISC 50-OHM TC=+2.35%/C-DEG	75263	RL3006-50-110-25-PTO
A31R512	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	19701	5033R
A31TP1-TP19	1251-0600	0	19	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A31U1	1826-0488	1	1	IC OP AMP WB TO-99 PKG	27014	SL34907
A31U2	1826-0846	5	1	ANALOG SWITCH 4 SPST 16 -CBRZ/SDR	27014	LF13332D
A31U3	1820-1281	2	1	IC DCDR TTL LS 2-TO-4-LINE DUAL	01295	SN53657
A31U4	1820-2313	3	1	IC SHF-RGTR TTL LS SERIAL-IN SERIAL-OUT	01295	SN70509N
A31U5	1826-0035	4	1	IC OP AMP LOW-DRIFT TO-99 PKG	27014	SL12451
A31U6	1820-1934	2	1	D/A 8-BIT 16-CERDIP BPLR	06665	DAC-08 096Q
A31U7	1826-0210	7	2	IC COMPARATOR HS 14-DIP-P PKG	27014	SL27610
A31U8	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN53518N
A31U9	1820-3145	1	1	IC DRVR TTL ALS BUS OCTL	01295	SN71649N
A31U101	1826-0521	3	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	01295	SN99855P
A31U201	1826-0522	4	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	SN99856N
A31U301	1826-0210	7		IC COMPARATOR HS 14-DIP-P PKG	27014	SL27610
A31U302	1820-2772	8	2	IC FF TTL ALS J-K NEG-EDGE-TRIG	01295	SN71543N
A31U303	1820-1422	3	1	IC MV TTL LS MONOSTBL RETRIG	01295	SN57183
A31U304-U305	1820-2779	5		IC CNTR TTL ALS BIN SYNCHRO	01295	SN71537N
A31U401	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A31U501	1820-1415	4	1	IC SCHMITT-TRIG TTL LS NAND DUAL 4-INP	01295	SN57176
A31U502-U503	1820-0697	2	2	IC DRVR TTL S NAND LINE DUAL 4-INP	01295	SN24665
A31U504	1820-2776	2	2	IC CNTR TTL ALS DECD SYNCHRO	01295	SN71744N
A31U505	1820-2772	8		IC FF TTL ALS J-K NEG-EDGE-TRIG	01295	SN71543N
A31U506	1820-2776	2		IC CNTR TTL ALS DECD SYNCHRO	01295	SN71744N
A31U507-U508	1820-2691	0	2	IC FF TTL F D-TYPE POS-EDGE-TRIG	07263	SL82685
A31W201	1258-0141	8	1	JMPR-REM .025P	22526	65474-004
A31Y401	0410-1503	1	1	CRYSTAL-QUARTZ 20.48 MHZ HC-18/U-HLDR	33096	0410-1503
	5000-9043	6	1	PIN EXTR	28480	5000-9043
A32, A34	03562-66532	2	2	PC BOARD ASSY ADC	28480	03562-66532
A32C100-C101	0160-4571	8	36	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C104	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A32C200-C201	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C202	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A32C203	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A32C204-C205	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C300	0160-5865	5	1	CAPACITOR-FXD 36PF +-5% 200VDC CER 0+-30	U01025	C114G360J2G5CA
A32C301	0160-5862	2	1	CAPACITOR-FXD 240PF +-1% 100VDC CER	U01025	C114G241F1G5CA
A32C302-C303	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C304	0160-5872	4	1	CAPACITOR-FXD 750PF +-1% 100VDC CER	27167	CAC03C0G751F100A
A32C305-C306	0160-5861	1		CAPACITOR-FXD 100PF +-1% 100VDC CER	27167	CAC02C0G101F100A
A32C307	0160-5870	2	1	CAPACITOR-FXD 430PF +-1% 100VDC CER	27167	CAC03C0G431F100A
A32C308	0160-4788	9	1	CAPACITOR-FXD 18PF +-5% 100VDC CER 0+-30	04222	MA101A180JAA
A32C309-C310	0160-5874	6	2	CAPACITOR-FXD 2000PF +-1% 50VDC CER	27167	CAC03C0G202F050A
A32C311	0160-5861	1		CAPACITOR-FXD 100PF +-1% 100VDC CER	27167	CAC02C0G101F100A

See introduction to this section for ordering information
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Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A32C312	0160-5880	4	1	CAPACITOR-FXD 2200PF +-1% 50VDC CER	27167	CAC03C0G222F050A
A32C313	0160-5871	3	1	CAPACITOR-FXD 510PF +-1% 100VDC CER	27167	CAC03C0G511F100A
A32C314	0160-4807	3	1	CAPACITOR-FXD 33PF +-5% 100VDC CER 0+-30	27167	CAC02C0G330J100A
A32C315	0160-5873	5	1	CAPACITOR-FXD 1500PF +-1% 50VDC CER	27167	CAC03C0G152F050A
A32C316-C317	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A32C318	0160-5863	3	1	CAPACITOR-FXD 330PF +-1% 100VDC CER	U01025	C124G331F1G5CA
A32C319	0160-4812	0	1	CAPACITOR-FXD 220PF +-5% 100VDC CER	27167	CAC02C0G221J100A
A32C320-C321	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A32C322	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C323	0180-1794	3		CAPACITOR-FXD 22UF+-10% 35VDC TA	13606	150D226X9035R2-DYS
A32C324	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A32C400	0160-4793	6	3	CAPACITOR-FXD 6.8PF +-.5PF 100VDC CER	27167	CAC02C0G6R8D100A
A32C401	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C402	0160-4789	0	2	CAPACITOR-FXD 15PF +-5% 100VDC CER 0+-30	27167	CAC02C0G150J100A
A32C403	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C404	0160-4447	7	1	CAPACITOR-FXD 220PF +-10% 50VDC POLYP	25088	B33063-A1221-K
A32C405-C406	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C407	0160-4787	8	1	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A32C408	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C409	0180-0309	4	1	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A32C410	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A32C411	0160-4793	6		CAPACITOR-FXD 6.8PF +-.5PF 100VDC CER	27167	CAC02C0G6R8D100A
A32C412-C416	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C417	0160-4793	6		CAPACITOR-FXD 6.8PF +-.5PF 100VDC CER	27167	CAC02C0G6R8D100A
A32C418	0160-4825	5	1	CAPACITOR-FXD 560PF +-5% 100VDC CER	27167	CAC03C0G561J100A
A32C419-C420	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C500-C502	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C503	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A32C504	0180-1794	3	1	CAPACITOR-FXD 22UF+-10% 35VDC TA	13606	150D226X9035R2-DYS
A32C505	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C506-C507	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A32C508	0180-0309	4		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A32C509	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C510	0180-1794	3		CAPACITOR-FXD 22UF+-10% 35VDC TA	13606	150D226X9035R2-DYS
A32C511	0160-4789	0		CAPACITOR-FXD 15PF +-5% 100VDC CER 0+-30	27167	CAC02C0G150J100A
A32C512-C514	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C600-C602	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C603	0160-4808	4	1	CAPACITOR-FXD 470PF +-5% 100VDC CER	27167	CAC02C0G471J100A
A32C604	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	13606	150D225X9020A2-DYS
A32C605-C608	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A32C609	0160-4822	2	1	CAPACITOR-FXD 1000PF +-5% 100VDC CER	27167	CAC03C0G102J100A
A32CR100	1901-0050	3	4	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A32CR200	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A32CR201	1902-0686	3	1	DIODE-ZNR 6.2V 2% DO-7 PD=.4W TC=+.002%	04713	SZ 12170
A32CR400-CR401	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A32CR402	1902-0952	6	1	DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A32CR403-CR404	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	28480	1901-0518
A32CR405-CR407	1901-0040	1	5	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A32CR500-CR501	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A32J300	1251-4822	6	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A32J400	1251-7629	7	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	00779	532955-7
A32L300	03561-60302	1	1	L-2304UH 1%	28480	03561-60302
A32L301	03561-60301	0		L-2035UH 1%	28480	03561-60301
A32L302	03561-60303	2	1	L-1834UH 1%	28480	03561-60303
A32L303	03561-60301	0	2	L-2035UH 1%	28480	03561-60301
A32L500-L501	9140-0029	0		INDUCTOR RF-CH-MLD 100UH 10% .25DX.313LG	99484	3100-12-101
A32L502	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
A32MP688	0340-0564	3	1	INSULATOR-XSTR THRM-CNDCT	55285	7403-09FR-51
A32Q400	1855-0269	7	1	TRANSISTOR MOSFET N-CHAN E-MODE TO-72 SI	S01041	SD214
A32R100	0757-0280	3	17	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R101	0698-6360	6	1	RESISTOR 10K .1% .125W F TC=0+-25	19701	5033R
A32R102	0698-7847	6	1	RESISTOR 1.111K .1% .125W F TC=0+-25	19701	5033R
A32R103	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A32R104	0698-6624	5	7	RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A32R105	0698-6362	8	5	RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A32R106	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A32R107	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A32R108	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A32R111	0757-0346	2	10	RESISTOR 10 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R112	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+-100	19701	5033R
A32R200	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R201	0698-3279	0	2	RESISTOR 4.99K 1% .125W F TC=0+-100	19701	5033R
A32R202	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R203	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R204	0698-4205	4	1	RESISTOR 21K 1% .125W F TC=0+-100	19701	5033R
A32R205	0757-0274	5	3	RESISTOR 1.21K 1% .125W F TC=0+-100	19701	5033R
A32R206	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A32R207	0698-3279	0		RESISTOR 4.99K 1% .125W F TC=0+-100	19701	5033R
A32R208	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R300	8150-3375	5	2	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A32R301	0698-4500	2	1	RESISTOR 57.6K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R302	0698-8629	4	1	RESISTOR 1.69K .1% .125W F TC=0+-25	19701	5033R
A32R303	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A32R304	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A32R305	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A32R306	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A32R307	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A32R308-R311	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R312	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	19701	5033R
A32R313-R316	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R317	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	19701	5033R
A32R318	0698-3161	9	2	RESISTOR 38.3K 1% .125W F TC=0+-100	19701	5033R
A32R400	2100-3354	9	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	73138	72XR50K-149B
A32R401	2100-3207	1	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-502
A32R402	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	19701	5033R
A32R403	8150-3375	5		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	75042	ZEROHM
A32R404	0698-6320	8	1	RESISTOR 5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A32R405	0698-6627	8	1	RESISTOR 25K .1% .125W F TC=0+-25	19701	5033R
A32R406	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A32R407	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	19701	5033R
A32R408	2100-3054	6	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	73138	89PR50K
A32R409	0698-6377	5	1	RESISTOR 200 .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A32R410	0698-4412	5	1	RESISTOR 143 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R411	0698-3161	9		RESISTOR 38.3K 1% .125W F TC=0+-100	19701	5033R
A32R412	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	19701	5033R
A32R413	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A32R414	0757-0467	8	1	RESISTOR 121K 1% .125W F TC=0+-100	19701	5033R
A32R415	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	5033R
A32R416	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	19701	5033R
A32R417-R418	0698-6361	7	3	RESISTOR 8K .1% .125W F TC=0+-25	19701	5033R
A32R419	0698-4503	5	1	RESISTOR 66.5K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R420	0699-0690	5	1	RESISTOR 302 .1% .125W F TC=0+-25	19701	5033R
A32R421	0757-0459	8	1	RESISTOR 56.2K 1% .125W F TC=0+-100	19701	5033R
A32R422	2100-3502	9	1	RESISTOR-TRMR 200 10% C TOP-ADJ 17-TRN	73138	67WR200
A32R423	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0+-100	19701	5033R
A32R424	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	19701	5033R
A32R425	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	5033R
A32R426	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	19701	5033R
A32R427	0698-8959	3	1	RESISTOR 619K 1% .125W F TC=0+-100	19701	5033R
A32R428	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	19701	5033R
A32R429	0698-6366	2	1	RESISTOR 800 .1% .125W F TC=0+-25	19701	5033R
A32R430	0757-0472	5	1	RESISTOR 200K 1% .125W F TC=0+-100	19701	5033R
A32R431	03562-62501	7		COMPONENT KIT	28480	03562-62501
A32R432	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	19701	5033R
A32R433	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	19701	5033R
A32R434	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A32R435	0699-0842	9	1	RESISTOR 6.19K .1% .125W F TC=0+-25	19701	5033R
A32R436	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A32R437	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R438	0698-7394	8	1	RESISTOR 698 .1% .125W F TC=0+-25	19701	5033R
A32R439	0698-6361	7		RESISTOR 8K .1% .125W F TC=0+-25	19701	5033R
A32R500-R501	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R502-R503	0698-3454	3	2	RESISTOR 215K 1% .125W F TC=0+-100	19701	5033R
A32R504	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R505	0757-0482	7	1	RESISTOR 511K 1% .125W F TC=0+-100	19701	5033R

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A32R506	0698-4429	4	1	RESISTOR 1.87K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R507	0698-4471	6	1	RESISTOR 7.15K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R508	0683-0475	1	1	RESISTOR 4.7 5% .25W CF TC=0-400	77902	R-25J
A32R509	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R510	0757-0273	4	1	RESISTOR 3.01K 1% .125W F TC=0+-100	19701	5033R
A32R511	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R512	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A32R513	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	19701	5033R
A32R514	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R516	0698-3202	9	1	RESISTOR 1.74K 1% .125W F TC=0+-100	19701	5033R
A32R511	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R512	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A32R513	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	19701	5033R
A32R514	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R516	0698-3202	9	1	RESISTOR 1.74K 1% .125W F TC=0+-100	19701	5033R
A32R517-R520	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R600-R602	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R604	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32RN100	1810-0523	2	2	NETWORK-RES 14-DIP MULTI-VALUE	7M605	1172
A32RN200	1810-0523	2		NETWORK-RES 14-DIP MULTI-VALUE	7M605	1172
A32T200	9100-2616	1	1	TRANSFORMER-PULSE BIFILAR WOUND; 18.0 MM	13606	9100-2616
A32U100	1826-0581	5	2	ANALOG MULTIPLEXER 8 CHNL 16 -CBRZ/SDR	27014	SL37506
A32U101-U102	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A32U200	1826-0581	5		ANALOG MULTIPLEXER 8 CHNL 16 -CBRZ/SDR	27014	SL37506
A32U201	1820-1934	2	1	D/A 8-BIT 16-CERDIP BPLR	06665	DAC-08 096Q
A32U202-U203	1820-3423	8	2	IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74LS595N
A32U300-U301	1826-0715	7	5	IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A32U400	1826-0445	0	1	IC V RGLTR-FXD-NEG 4.8/5.2V TO-220 PKG	07263	SL26583
A32U401-U402	1826-0109	3	1	IC OP AMP WB TO-99 PKG	34371	HA2-2625 B3053-032
A32U403	1826-1127	7	1	IC PRCN DUAL 8-TO-99 PKG	27014	LF412CH
A32U404	1826-0528	0	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	SL35806
A32U405	1826-0501	9	1	ANALOG MULTIPLEXER 6 CHNL 16 -DIP-P	04713	SC45297PK
A32U406	1826-0109	3		IC OP AMP WB TO-99 PKG	34371	HA2-2625 B3053-032
A32U500	1826-0175	3	2	IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	SL26763
A32U501	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A32U502	1826-0175	3		IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	SL26763
A32U503	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A32U504	1820-0471	0	1	IC INV TTL HEX 1-INP	01295	SN19235
A32U505	1820-1645	2	1	IC BFR TTL LS BUS QUAD	01295	SN57686N
A32U600	03562-62501	7	1	COMPONENT KIT	28480	03562-62501
A32U600	1826-1110	8	1	D/A 16-BIT 24-DIP-C BPLR	8E175	DAC702KH/2D330
A32U601	1826-1112	0	1	A/D 8-1/2-BIT 18-DIP-C BPLR	T01085	TDC1001J8C
A32U602	1820-3441	0	1	IC GATE-ARY CMOS	S0167	MB63H301P
A32U603	1820-3423	8		IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74LS595N
A32U604	1820-2711	5	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN71504N
A32U605	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A32U606	1820-2696	5	1	IC FF TTL F D-TYPE POS-EDGE-TRIG COM CLK	07263	SL82690
A32U607	1820-1074	1	1	IC DRVR TTL NOR QUAD 2-INP	01295	SN43266
A32U608	1820-0697	2	1	IC DRVR TTL S NAND LINE DUAL 4-INP	01295	SN24665
	1251-0600	0	49	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
	2190-0004	9	1	WASHER-LK INTL T NO. 4 .115-IN-ID	T12345	SF 1904-00
	2200-0103	2	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	83486	2200-0103
	5000-9043	6	1	PIN EXTR	28480	5000-9043
	2260-0001	5	1	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	T1234	2260-0001
	1258-0141	8	1	JMPR-REM .025P	22526	65474-004
	1250-1339	2	1	CONNECTOR-RF SM-SLD M PC 50-OHM	98291	52-051-0000
A33, A35	03562-66533	3	2	PC BOARD-INPUT	28480	03562-66533
A33C100	0160-3440	8	1	CAPACITOR-FXD .39UF +-5% 200VDC	84411	HEW-249
A33C101	0160-4796	9	4	CAPACITOR-FXD 3.9PF +-.25PF 100VDC CER	27167	CAC02C0G3R9C100A
A33C102	0121-0556	9	4	C-V .6-6PF 50V AIR	18736	V5027
A33C103	0160-4796	9		CAPACITOR-FXD 3.9PF +-.25PF 100VDC CER	27167	CAC02C0G3R9C100A
A33C104	0160-2207	3	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	00853	0160-2207
A33C105	0160-4798	1	2	CAPACITOR-FXD 2.7PF +-.25PF 100VDC CER	27167	CAC02C0G2R7C100A
A33C106	0121-0556	9		C-V .6-6PF 50V AIR	18736	V5027
A33C107	0160-4787	8	4	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A33C108	0160-4571	8	16	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C109	0180-0210	6	4	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A33C110	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS
A33C111-C112	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C113	0160-4786	7	2	CAPACITOR-FXD 27PF +-5% 100VDC CER 0+-30	27167	CAC02C0G270J100A
A33C200	0160-3440	8		CAPACITOR-FXD .39UF +-5% 200VDC	84411	HEW-249
A33C201	0160-4796	9		CAPACITOR-FXD 3.9PF +-.25PF 100VDC CER	27167	CAC02C0G3R9C100A
A33C202	0121-0556	9		C-V .6-6PF 50V AIR	18736	V5027
A33C203	0160-4796	9		CAPACITOR-FXD 3.9PF +-.25PF 100VDC CER	27167	CAC02C0G3R9C100A
A33C204	0160-2207	3		CAPACITOR-FXD 300PF +-5% 300VDC MICA	00853	0160-2207
A33C205	0160-4798	1		CAPACITOR-FXD 2.7PF +-.25PF 100VDC CER	27167	CAC02C0G2R7C100A
A33C206	0121-0556	9		C-V .6-6PF 50V AIR	18736	V5027
A33C207	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A33C208	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C209-C210	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS
A33C211-C212	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C213	0160-4786	7		CAPACITOR-FXD 27PF +-5% 100VDC CER 0+-30	27167	CAC02C0G270J100A
A33C400-C403	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C504	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A33C505	0160-4792	5	1	CAPACITOR-FXD 8.2PF +-.5PF 100VDC CER	27167	CAC02C0G8R2D100A
A33C506	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	27167	CAC02C0G100J100A
A33C508	0160-4806	2	1	CAPACITOR-FXD 39PF +-5% 100VDC CER 0+-30	27167	CAC02C0G390J100A
A33C509-C510	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A33C600	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C601	0180-1731	8	1	CAPACITOR-FXD 4.7UF+-10% 50VDC TA	13606	150D475X9050B2-DYS
A33C602	0180-2207	5	1	CAPACITOR-FXD 100UF+-10% 10VDC TA	13606	150D107X9010R2-DYS
A33C603	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C604	0180-1731	8		CAPACITOR-FXD 4.7UF+-10% 50VDC TA	13606	150D475X9050B2-DYS
A33C605	0180-0097	7	1	CAPACITOR-FXD 47UF+-10% 35VDC TA	13606	150D476X9035S2-DYS
A33C606-C607	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C608	0180-0097	7		CAPACITOR-FXD 47UF+-10% 35VDC TA	13606	150D476X9035S2-DYS
A33C609	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C610	0180-1794	3	1	CAPACITOR-FXD 22UF+-10% 35VDC TA	13606	150D226X9035R2-DYS
A33C611-C612	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33CR100	1902-0654	5	4	DIODE-ZNR 33V 5% PD=1W IR=5UA	04713	SZ40145-025
A33CR101	1901-0050	3	8	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR102-CR103	1901-0579	1	4	DIODE-SWITCHING 40V 20MA 300NS DO-7	07263	FJT1100
A33CR104	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR105	1902-0654	5		DIODE-ZNR 33V 5% PD=1W IR=5UA	04713	SZ40145-025
A33CR106	1902-0952	6	1	DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A33CR107	1901-0527	9	3	DIODE-CUR RGLTR 75V DO-7	04713	SCL-040
A33CR108	1902-0952	6		DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A33CR109	1901-0527	9	1	DIODE-CUR RGLTR 75V DO-7	04713	SCL-040
A33CR200	1902-0654	5		DIODE-ZNR 33V 5% PD=1W IR=5UA	04713	SZ40145-025
A33CR201	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR202-CR203	1901-0579	1		DIODE-SWITCHING 40V 20MA 300NS DO-7	07263	FJT1100
A33CR204	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR205	1902-0654	5		DIODE-ZNR 33V 5% PD=1W IR=5UA	04713	SZ40145-025
A33CR206	1902-0952	6		DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A33CR207	1901-0527	9		DIODE-CUR RGLTR 75V DO-7	04713	SCL-040
A33CR208	1902-0952	6		DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A33CR209	1901-0527	9		DIODE-CUR RGLTR 75V DO-7	04713	SCL-040
A33CR300	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR400	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR600-CR601	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33J300	1251-5971	8	1	CONN-POST TYPE 2.5-PIN-SPCG 3-CONT	27264	22-12-1032
A33J400	1250-1339	2	1	CONNECTOR-RF SM-SLD M PC 50-OHM	98291	52-051-0000
A33J701	1251-7755	0	1	CONN-POST TYPE .100-PIN-SPCG 30-CONT	00779	532955-5
A33K100-K109	0490-1403	8		RELAY-REED 1A 500MA 200VDC 5VDC-COIL	71707	2900-0022
A33K200-K209	0490-1403	8		RELAY-REED 1A 500MA 200VDC 5VDC-COIL	71707	2900-0022
A33L600-L602	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
A33L603-L604	9140-0029	0	1	INDUCTOR RF-CH-MLD 100UH 10% .25DX.313LG	99484	3100-12-101
A33L605	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
A33MP678	03562-04109	9	1	COVER-SHIELD	28480	03562-04109
A33MP679	03562-04110	2	1	COVER-SHIELD	28480	03562-04110
A33MP680-MP681	03577-20601	7	2	SHLD-CIRC SIDE	28480	03562-20601
A33MP682-MP683	03577-20602	8		SHLD-COMP SIDE	28480	03562-20602
A33Q100-Q101	1855-0460	0	1	TRANSISTOR J-FET N-CHAN	27014	1855-0460
A33Q102	1853-0037	3	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	04713	SS 2109
A33Q103-Q104	1854-0022	8	1	TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A32R506	0698-4429	4	1	RESISTOR 1.87K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R507	0698-4471	6	1	RESISTOR 7.15K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A32R508	0683-0475	1	1	RESISTOR 4.7 5% .25W CF TC=0-400	77902	R-25J
A32R509	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R510	0757-0273	4	1	RESISTOR 3.01K 1% .125W F TC=0+-100	19701	5033R
A32R511	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R512	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A32R513	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	19701	5033R
A32R514	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R516	0698-3202	9	1	RESISTOR 1.74K 1% .125W F TC=0+-100	19701	5033R
A32R511	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R512	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A32R513	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	19701	5033R
A32R514	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R516	0698-3202	9	1	RESISTOR 1.74K 1% .125W F TC=0+-100	19701	5033R
A32R517-R520	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R600-R602	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32R604	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A32RN100	1810-0523	2	2	NETWORK-RES 14-DIP MULTI-VALUE	7M605	1172
A32RN200	1810-0523	2		NETWORK-RES 14-DIP MULTI-VALUE	7M605	1172
A32T200	9100-2616	1	1	TRANSFORMER-PULSE BIFILAR WOUND; 18.0 MM	13606	9100-2616
A32U100	1826-0581	5	2	ANALOG MULTIPLEXER 8 CHNL 16 -CBRZ/SDR	27014	SL37506
A32U101-U102	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A32U200	1826-0581	5		ANALOG MULTIPLEXER 8 CHNL 16 -CBRZ/SDR	27014	SL37506
A32U201	1820-1934	2	1	D/A 8-BIT 16-CERDIP BPLR	06665	DAC-08 096Q
A32U202-U203	1820-3423	8	2	IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74LS595N
A32U300-U301	1826-0715	7	5	IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A32U400	1826-0445	0	1	IC V RGLTR-FXD-NEG 4.8/5.2V TO-220 PKG	07263	SL26583
A32U401-U402	1826-0109	3	1	IC OP AMP WB TO-99 PKG	34371	HA2-2625 B3053-032
A32U403	1826-1127	7	1	IC PRCN DUAL 8-TO-99 PKG	27014	LF412CH
A32U404	1826-0528	0	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	SL35806
A32U405	1826-0501	9	1	ANALOG MULTIPLEXER 6 CHNL 16 -DIP-P	04713	SC45297PK
A32U406	1826-0109	3		IC OP AMP WB TO-99 PKG	34371	HA2-2625 B3053-032
A32U500	1826-0175	3	2	IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	SL26763
A32U501	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A32U502	1826-0175	3		IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	SL26763
A32U503	1820-2656	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A32U504	1820-0471	0	1	IC INV TTL HEX 1-INP	01295	SN19235
A32U505	1820-1645	2	1	IC BFR TTL LS BUS QUAD	01295	SN57686N
A32U600	03562-62501	7	1	COMPONENT KIT	28480	03562-62501
A32U600	1826-1110	8	1	D/A 16-BIT 24-DIP-C BPLR	8E175	DAC702KH/2D330
A32U601	1826-1112	0	1	A/D 8-1/2-BIT 18-DIP-C BPLR	T01085	TDC1001J8C
A32U602	1820-3441	0	1	IC GATE-ARY CMOS	S0167	MB63H301P
A32U603	1820-3423	8		IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74LS595N
A32U604	1820-2711	5	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN71504N
A32U605	1820-2488	3	1	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN71171N
A32U606	1820-2696	5	1	IC FF TTL F D-TYPE POS-EDGE-TRIG COM CLK	07263	SL82690
A32U607	1820-1074	1	1	IC DRVR TTL NOR QUAD 2-INP	01295	SN43266
A32U608	1820-0697	2	1	IC DRVR TTL S NAND LINE DUAL 4-INP	01295	SN24665
	1251-0600	0	49	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
	2190-0004	9	1	WASHER-LK INTL T NO. 4 .115-IN-ID	T12345	SF 1904-00
	2200-0103	2	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	83486	2200-0103
	5000-9043	6	1	PIN EXTR	28480	5000-9043
	2260-0001	5	1	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	T1234	2260-0001
	1258-0141	8	1	JMPR-REM .025P	22526	65474-004
	1250-1339	2	1	CONNECTOR-RF SM-SLD M PC 50-OHM	98291	52-051-0000
A33, A35	03562-66533	3	2	PC BOARD-INPUT	28480	03562-66533
A33C100	0160-3440	8	1	CAPACITOR-FXD .39UF +-5% 200VDC	84411	HEW-249
A33C101	0160-4796	9	4	CAPACITOR-FXD 3.9PF +-.25PF 100VDC CER	27167	CAC02C0G3R9C100A
A33C102	0121-0556	9	4	C-V .6-6PF 50V AIR	18736	V5027
A33C103	0160-4796	9		CAPACITOR-FXD 3.9PF +-.25PF 100VDC CER	27167	CAC02C0G3R9C100A
A33C104	0160-2207	3	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	00853	0160-2207
A33C105	0160-4798	1	2	CAPACITOR-FXD 2.7PF +-.25PF 100VDC CER	27167	CAC02C0G2R7C100A
A33C106	0121-0556	9		C-V .6-6PF 50V AIR	18736	V5027
A33C107	0160-4787	8	4	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A33C108	0160-4571	8	16	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C109	0180-0210	6	4	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A33C110	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS
A33C111-C112	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C113	0160-4786	7	2	CAPACITOR-FXD 27PF +-5% 100VDC CER 0+-30	27167	CAC02C0G270J100A
A33C200	0160-3440	8		CAPACITOR-FXD .39UF +-5% 200VDC	84411	HEW-249
A33C201	0160-4796	9		CAPACITOR-FXD 3.9PF +-.25PF 100VDC CER	27167	CAC02C0G3R9C100A
A33C202	0121-0556	9		C-V .6-6PF 50V AIR	18736	V5027
A33C203	0160-4796	9		CAPACITOR-FXD 3.9PF +-.25PF 100VDC CER	27167	CAC02C0G3R9C100A
A33C204	0160-2207	3		CAPACITOR-FXD 300PF +-5% 300VDC MICA	00853	0160-2207
A33C205	0160-4798	1		CAPACITOR-FXD 2.7PF +-.25PF 100VDC CER	27167	CAC02C0G2R7C100A
A33C206	0121-0556	9		C-V .6-6PF 50V AIR	18736	V5027
A33C207	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A33C208	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C209-C210	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS
A33C211-C212	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C213	0160-4786	7		CAPACITOR-FXD 27PF +-5% 100VDC CER 0+-30	27167	CAC02C0G270J100A
A33C400-C403	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C504	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A33C505	0160-4792	5	1	CAPACITOR-FXD 8.2PF +-.5PF 100VDC CER	27167	CAC02C0G8R2D100A
A33C506	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	27167	CAC02C0G100J100A
A33C508	0160-4806	2	1	CAPACITOR-FXD 39PF +-5% 100VDC CER 0+-30	27167	CAC02C0G390J100A
A33C509-C510	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	27167	CAC02C0G220J100A
A33C600	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C601	0180-1731	8	1	CAPACITOR-FXD 4.7UF+-10% 50VDC TA	13606	150D475X9050B2-DYS
A33C602	0180-2207	5	1	CAPACITOR-FXD 100UF+-10% 10VDC TA	13606	150D107X9010R2-DYS
A33C603	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C604	0180-1731	8		CAPACITOR-FXD 4.7UF+-10% 50VDC TA	13606	150D475X9050B2-DYS
A33C605	0180-0097	7	1	CAPACITOR-FXD 47UF+-10% 35VDC TA	13606	150D476X9035S2-DYS
A33C606-C607	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C608	0180-0097	7		CAPACITOR-FXD 47UF+-10% 35VDC TA	13606	150D476X9035S2-DYS
A33C609	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33C610	0180-1794	3	1	CAPACITOR-FXD 22UF+-10% 35VDC TA	13606	150D226X9035R2-DYS
A33C611-C612	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA205E104ZAA
A33CR100	1902-0654	5	4	DIODE-ZNR 33V 5% PD=1W IR=5UA	04713	SZ40145-025
A33CR101	1901-0050	3	8	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR102-CR103	1901-0579	1	4	DIODE-SWITCHING 40V 20MA 300NS DO-7	07263	FJT1100
A33CR104	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR105	1902-0654	5		DIODE-ZNR 33V 5% PD=1W IR=5UA	04713	SZ40145-025
A33CR106	1902-0952	6	1	DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A33CR107	1901-0527	9	3	DIODE-CUR RGLTR 75V DO-7	04713	SCL-040
A33CR108	1902-0952	6		DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A33CR109	1901-0527	9	1	DIODE-CUR RGLTR 75V DO-7	04713	SCL-040
A33CR200	1902-0654	5		DIODE-ZNR 33V 5% PD=1W IR=5UA	04713	SZ40145-025
A33CR201	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR202-CR203	1901-0579	1		DIODE-SWITCHING 40V 20MA 300NS DO-7	07263	FJT1100
A33CR204	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR205	1902-0654	5		DIODE-ZNR 33V 5% PD=1W IR=5UA	04713	SZ40145-025
A33CR206	1902-0952	6		DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A33CR207	1901-0527	9		DIODE-CUR RGLTR 75V DO-7	04713	SCL-040
A33CR208	1902-0952	6		DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	04713	SZ30035-010
A33CR209	1901-0527	9		DIODE-CUR RGLTR 75V DO-7	04713	SCL-040
A33CR300	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR400	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33CR600-CR601	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A33J300	1251-5971	8	1	CONN-POST TYPE 2.5-PIN-SPCG 3-CONT	27264	22-12-1032
A33J400	1250-1339	2	1	CONNECTOR-RF SM-SLD M PC 50-OHM	98291	52-051-0000
A33J701	1251-7755	0	1	CONN-POST TYPE .100-PIN-SPCG 30-CONT	00779	532955-5
A33K100-K109	0490-1403	8		RELAY-REED 1A 500MA 200VDC 5VDC-COIL	71707	2900-0022
A33K200-K209	0490-1403	8		RELAY-REED 1A 500MA 200VDC 5VDC-COIL	71707	2900-0022
A33L600-L602	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
A33L603-L604	9140-0029	0	1	INDUCTOR RF-CH-MLD 100UH 10% .25DX.313LG	99484	3100-12-101
A33L605	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	04213	1670-1
A33MP678	03562-04109	9	1	COVER-SHIELD	28480	03562-04109
A33MP679	03562-04110	2	1	COVER-SHIELD	28480	03562-04110
A33MP680-MP681	03577-20601	7	2	SHLD-CIRC SIDE	28480	03562-20601
A33MP682-MP683	03577-20602	8		SHLD-COMP SIDE	28480	03562-20602
A33Q100-Q101	1855-0460	0	1	TRANSISTOR J-FET N-CHAN	27014	1855-0460
A33Q102	1853-0037	3	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	04713	SS 2109
A33Q103-Q104	1854-0022	8	1	TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A33Q105	1853-0037	3		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	04713	SS 2109
A33Q200-Q201	1855-0460	0		TRANSISTOR J-FET N-CHAN	27014	1855-0460
A33Q202	1853-0037	3		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	04713	SS 2109
A33Q203-Q204	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A33Q205	1853-0037	3		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	04713	SS 2109
A33Q509	1855-0091	3	1	TRANSISTOR J-FET N-CHAN D-MODE SI	27014	NS5141
A33Q512-Q520	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	27014	NS5141
A33R100	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R101	0698-6305	9	2	RESISTOR 900K .1% .25W F TC=0+-25	19701	5043R
A33R102	0698-6979	3	2	RESISTOR 111.1K .1% .125W F TC=0+-25	19701	5033R
A33R103	0698-6975	9	2	RESISTOR 10.1K .1% .125W F TC=0+-25	19701	5033R
A33R104	0698-6306	0	2	RESISTOR 990K .1% .25W F TC=0+-25	19701	5043R
A33R106	0698-7332	4	1	RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
A33R107	0757-0123	3	4	RESISTOR 34.8K 1% .125W F TC=0+-100	19701	5033R
A33R108-R109	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R110	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+-100	19701	5033R
A33R111	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R112	2100-3874	8	2	RESISTOR-TRMR 5K 10% C TOP-ADJ 17-TRN	32997	3299W-DM3-502
A33R113	0757-0280	3	8	RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A33R114	0757-0393	9	8	RESISTOR 47.5 1% .125W F TC=0+-100	19701	5033R
A33R115	0698-3558	8	2	RESISTOR 4.02K 1% .125W F TC=0+-100	19701	5033R
A33R116	0757-0393	9		RESISTOR 47.5 1% .125W F TC=0+-100	19701	5033R
A33R117	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A33R118-R119	0757-0393	9		RESISTOR 47.5 1% .125W F TC=0+-100	19701	5033R
A33R120	0837-0315	5	1	PTC RESISTOR	75263	RL3312-200-120-50-PTO
A33R200	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R201	0698-6305	9		RESISTOR 900K .1% .25W F TC=0+-25	19701	5043R
A33R202	0698-6979	3		RESISTOR 111.1K .1% .125W F TC=0+-25	19701	5033R
A33R203	0698-6975	9		RESISTOR 10.1K .1% .125W F TC=0+-25	19701	5033R
A33R204	0698-6306	0		RESISTOR 990K .1% .25W F TC=0+-25	19701	5043R
A33R206	0698-7332	4		RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
A33R207	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+-100	19701	5033R
A33R208-R209	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R210	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+-100	19701	5033R
A33R211	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R212	2100-3874	8		RESISTOR-TRMR 5K 10% C TOP-ADJ 17-TRN	32997	3299W-DM3-502
A33R213	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A33R214	0757-0393	9		RESISTOR 47.5 1% .125W F TC=0+-100	19701	5033R
A33R215	0698-3558	8		RESISTOR 4.02K 1% .125W F TC=0+-100	19701	5033R
A33R216	0757-0393	9		RESISTOR 47.5 1% .125W F TC=0+-100	19701	5033R
A33R217	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A33R218	0757-0393	9		RESISTOR 47.5 1% .125W F TC=0+-100	19701	5033R
A33R219	0757-0393	9		RESISTOR 47.5 1% .125W F TC=0+-100	19701	5033R
A33R400	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R401	0698-6624	5	2	RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A33R402	0698-6362	8	3	RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A33R403	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A33R404	0698-6348	0	1	RESISTOR 3K .1% .125W F TC=0+-25	19701	5033R
A33R405	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	19701	5033R
A33R406	0698-3178	8	1	RESISTOR 487 1% .125W F TC=0+-100	19701	5033R
A33R407	0698-6699	4	1	RESISTOR 127 .25% .125W F TC=0+-50	19701	5033R
A33R408	0698-8634	1	1	RESISTOR 1.05K .1% .125W F TC=0+-25	19701	5033R
A33R409	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	19701	5033R
A33R410	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A33R411	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R500	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A33R501	0698-4463	6	1	RESISTOR 845 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A33R503	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R504	0698-6320	8	4	RESISTOR 5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A33R505	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A33R506	0698-6630	3	1	RESISTOR 20K .1% .125W F TC=0+-25	19701	5033R
A33R507	0698-3557	7	1	RESISTOR 806 1% .125W F TC=0+-100	19701	5033R
A33R508	0698-6329	7	1	RESISTOR 845 1% .125W F TC=0+-25	19701	5033R
A33R509	0698-6322	0	1	RESISTOR 4K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A33R510	0698-6361	7	1	RESISTOR 8K .1% .125W F TC=0+-25	19701	5033R
A33R511	0698-8046	9	1	RESISTOR 16K .1% .125W F TC=0+-25	19701	5033R
A33R512	0698-8047	0	1	RESISTOR 32K .1% .125W F TC=0+-25	19701	5033R

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A33R513	0698-8049	2	1	RESISTOR 64K .1% .125W F TC=0+-25	19701	5033R
A33R514	0698-8053	8	1	RESISTOR 128K .1% .125W F TC=0+-25	19701	5033R
A33R515	0698-8050	5	1	RESISTOR 256K .1% .125W F TC=0+-25	19701	5033R
A33R516	0699-0676	7	1	RESISTOR 511K .1% .125W F TC=0+-50	19701	5033R
A33R517	0699-0730	4	1	RESISTOR 1M .1% .125W F TC=0+-25	19701	5033R
A33R518	0698-3511	3	1	RESISTOR 665 1% .125W F TC=0+-100	19701	5033R
A33R521	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A33R522	0757-0283	6	1	RESISTOR 2K 1% .125W F TC=0+-100	19701	5033R
A33R523	0757-0273	4	1	RESISTOR 3.01K 1% .125W F TC=0+-100	19701	5033R
A33R524	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A33R525	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33R526	0698-4528	4	3	RESISTOR 210K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A33R527-R528	0757-0446	3	2	RESISTOR 15K 1% .125W F TC=0+-100	19701	5033R
A33R529	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A33R531-R532	0698-4528	4		RESISTOR 210K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A33R533	0698-4487	4	1	RESISTOR 25.5K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A33R535	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A33R600	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	5033R
A33R601	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	5033R
A33RN300-RN301	1810-0231	9	2	NETWORK-RES 8-SIP 2.2K OHM X 7	11236	750-81-R2.2K
A33RN500-RN501	1810-0371	8	2	NETWORK-RES 8-SIP 100.0K OHM X 7	11236	750-81-R100K
A33U100	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A33U200	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A33U300-U301	1858-0047	5	2	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A33U302-U303	1820-3423	8	3	IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74LS595N
A33U400	1826-0715	7	4	IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A33U401	1826-0581	5	1	ANALOG MULTIPLEXER 8 CHNL 16 -CBRZ/SDR	27014	SL37506
A33U402	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A33U500-U501	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A33U502	1820-1273	2	1	IC BFR TTL LS NOR QUAD 2-INP	01295	SN53649
A33U503-U505	1826-0138	8	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
A33U506	1820-3423	8		IC SHF-RGTR TTL LS ASYNCHRO SERIAL-IN	01295	SN74LS595N
A33U507	1826-0175	3	1	IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	SL26763
A33U508	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
	0515-0411	0	8	SCREW-MACH M3 X 0.5 22MM-LG PAN-HD	16941	0515-0411
	5000-9043	6	1	PIN EXTR	28480	5000-9043
	9100-1788	6	1	CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	02114	VK200 20/4B
A34	SEE A32					
A35	SEE A33					
DSPL	1345A/C13/500	9	1	DISPLAY/CABLE ASSEMBLY	28480	1345A/C13/500
MP100	03562-00201	4	1	PANEL-FRONT	22670	03562-00201
MP101	03562-00202	5	1	PANEL-FRONT SUB	28480	03562-00202
MP102	03562-20602	1	2	NUT-BNC	76854	03562-20602
MP103	1250-0102	5	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JS109-1
MP104	1250-0698	4	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR	90949	31-10
MP105	1250-0083	1	3	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	90949	31-221-1020
MP106	1510-0038	8	1	BINDING POST ASSY SGL THD-STUD	L01005	1510-0038
MP107	5041-0202	7	1	HALF-CHWHT	28480	5041-0202
MP108	5061-8008	9	2	CABLE ASSY,RPG	28480	5061-8008
	1251-4182	1	4	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ SQ	22526	47565
	0960-0684	2	1	RPG QDES-8831	28480	0960-0684
	1251-5043	5	1	CONN-POST TYPE .100-PIN-SPCG CRP	22526	65039-032
MP109	0370-3069	2	2	KNOB RPG 1 1/8"	28480	0370-3069
MP200	03562-00203	6	1	PANEL-REAR	28480	03562-00203
MP201	3101-2299	2	5	SWITCH-SL DPDT STD 5A 250VAC SLDR-LUG	D8351	4021.0512
MP202	03562-01201	6	1	BRACKET-FAN	28480	03562-01201
MP203	03562-34301	6	1	SERIAL PLATE 3562A	28480	03562-34301
MP204	03562-04104	4		SHIELD-NUT PLATE	28480	03562-04104
MP206	2110-0543	3	1	FUSEHOLDER BODY EXTR PST; BAYONET; TND	H9027	FEC031.1603
MP207	2110-0545	5	1	FUSEHOLDER CAP BAYONET; 6.3A, 250V MAX	H9027	FEK031.1613
MP208	3150-0218	4	1	FILTER-AIR 32 STD MESH MET SCREEN	28480	3150-0218
MP209	3160-0408	5	1	FAN-TBAX 90-CFM 19-28VDC	82877	MD24B2
MP210	7120-4835	0	1	LABEL-INFORMATION .75-IN-WD 2-IN-LG PPR	35860	7120-4835
MP211	7121-0270	1	1	LABEL-INFORMATION .5-IN-WD 1-IN-LG MYLAR	22670	7121-0270

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
MP212	9135-0261	1	1	LINE FILTER	05245	F3186
MP213	03562-29301	5	1	FILTER-DISPLAY	22670	03562-29301
MP214	03582-04104	8	1	GUARD-FAN SW	28480	03582-04104
MP300	03562-00101	3	1	GUSSET-CENTER	28480	03562-00101
MP301	03562-00102	4	1	DECK-PWR SUPPLY	28480	03562-00102
MP303	03562-00103	5	1	CARD CAGE-FRONT	28480	03562-00103
	03562-00104	6	1	CARD CAGE-CENTER	28480	03562-00104
	0403-0510	3	6	GUIDE-PC BOARD	28480	0403-0510
	0403-0511	4	6	GUIDE-PC BOARD	28480	0403-0511
	0590-1380	2	5	THD-INSR-STDF 6MM L	46384	SOS-M4-6
MP304	03562-00105	7	1	CARD CAGE-REAR	28480	03562-00105
MP305	03562-00106	8	1	PLENUM-PWR SPLY	28480	03562-00106
MP306	03562-00603	0	2	SHIELD-ANALOG, FRONT END	28480	03562-00603
MP307	03562-01204	9	1	BRACKET-DISPLAY	28480	03562-01204
MP308	03562-04101	1	1	PLATE-SIDE	28480	03562-04101
MP309	03562-04108	8	1	COVER-SIDE DIG	28480	03562-04108
MP310	03562-48301	5	2	CARD GUIDE	28480	03562-48301
MP311	03562-04111	3	1	SHIELD-SIDE	28480	03562-04111
MP400	03562-00601	8	2	SHIELD-INPUT	28480	03562-00601
	0403-0510	3	1	GUIDE-PC BOARD	28480	0403-0510
	0403-0511	4	1	GUIDE-PC BOARD	28480	0403-0511
MP401	03562-00602	9	2	COVER SHIELD	28480	03562-00602
MP402	03562-01211	8	1	BRACKET-FRONT	28480	03562-01211
MP404	03562-01207	2	1	BRKT-CAP	28480	03562-01207
MP405	03562-01208	3	1	BRKT-SWITCH, ON/OFF	28480	03562-01208
MP406	03562-04102	2	1	COVER-TOP PLENUM	28480	03562-04102
MP407	03562-04103	3	1	COVER-BOTTOM PLENUM	28480	03562-04103
MP408	03562-04104	4	2	SHIELD-NUT PLATE	28480	03562-04104
MP409	03562-01209	4	1	BRKT-LINE FILTER	28480	03562-01209
MP500	03562-04105	5	1	MOTHER BOARD SHIELD	28480	03562-04105
MP501	03562-04106	6	1	COVER-POWER SUPPLY	28480	03562-04106
MP502	03562-04107	7	1	COVER-1345A DISPLAY	28480	03562-04107
MP503	03562-48306	0	1	RETAINER, DIGITAL BOARD	28480	03562-48306
MP504	03562-01212	9	1	RETAINER, ANALOG BOARD	28480	03562-01212
MP505	5001-0441	2	2	TRIM-SIDE	28480	5001-0441
MP506	5040-7201	8	4	FOOT	28480	5040-7201
MP507	5040-7202	9	1	TRIM TOP	28480	5040-7202
MP509	5060-9805	4	2	STRAP HANDLE	28480	5060-9805
MP510	5061-9436	9	1	COVER, TOP	28480	5061-9436
MP511	5061-9448	3	1	COVER, BOTTOM	28480	5061-9448
MP512	5060-9948	6	2	SIDE COVER, PERFORATED	28480	5060-9948
MP513	8160-0360	3	4	RFI ROUND STRIP STL MSH/SIL RBR SN-PL	C01185	02-0101-0053-05
MP514	0890-0100	8	2	TUBING-HS .093-D/.046-RCVD .02-WALL	06090	RNF-100-3/32-WHT
MP603	5040-7278	9	8	KEY-CAP EXT	28480	5040-7278
MP603	5041-0376	6	8	KEYCAP-BLANK	28480	5041-0376
MP604	5041-2099	4	1	KEY-CAP PRESET	28480	5041-2099
MP605	5041-2738	8	1	KEY-CAP LOCAL	28480	5041-2738
MP606	5041-2839	0	1	KEY-CAP A	28480	5041-2839
MP607	5041-2840	3	1	KEY-CAP B	28480	5041-2840
MP608	5041-2900	6	1	KEY-CAP AVG	28480	5041-2900
MP609	5041-2909	5	1	KEY-CAP BACK SPACE	28480	5041-2909
MP610	5041-2910	8	1	KEY-CAP -	28480	5041-2910
MP611	5041-2911	9	1	KEY-CAP .	28480	5041-2911
MP612	5041-2912	0	2	KEY-CAP ARO UP/DN	28480	5041-2912
MP613	5041-2914	2	1	KEY-CAP 2	28480	5041-2914
MP614	5041-2915	3	1	KEY-CAP 3	28480	5041-2915
MP615	5041-2916	4	1	KEY-CAP 4	28480	5041-2916
MP616	5041-2917	5	1	KEY-CAP 5	28480	5041-2917
MP617	5041-2918	6	1	KEY-CAP 6	28480	5041-2918
MP618	5041-2919	7	1	KEY-CAP 7	28480	5041-2919
MP619	5041-2920	0	1	KEY-CAP 8	28480	5041-2920
MP620	5041-2921	1	1	KEY-CAP 9	28480	5041-2921
MP621	5041-2924	4	1	KEY-CAP SCALE	28480	5041-2924
MP622	5041-2927	7	1	KEY-CAP FREQ	28480	5041-2927
MP623	5041-2974	4	1	KEY-CAP SINGLE	28480	5041-2974
MP624	5041-2988	0	1	KEY-CAP MARKER VALVE	28480	5041-2988
MP625	5041-2989	1	1	KEY-CAP 0 NO	28480	5041-2989

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
MP626	5041-2990	4	1	KEY-CAP 1 YES	28480	5041-2990
MP627	5041-2991	5	1	KEY-CAP ARM	28480	5041-2991
MP628	5041-2992	6	1	KEY-CAP TRIG DELAY	28480	5041-2992
MP629	5041-2993	7	1	KEY-CAP ENGR UNITS	28480	5041-2993
MP630	5041-2994	8	1	KEY-CAP SELECT TRIG	28480	5041-2994
MP631	5041-2995	9	1	KEY-CAP INPUT COUPLE	28480	5041-2995
MP632	5041-2996	0	1	KEY-CAP STATE/TRACE	28480	5041-2996
MP633	5041-2997	1	1	KEY-CAP MEAS DISP	28480	5041-2997
MP633	5041-2998	2	1	KEY-CAP FRONT BACK	28480	5041-2998
MP634	5041-2999	3	1	KEY-CAP UPPER LOWER	28480	5041-2999
MP635	5041-3000	9	1	KEY-CAP A & B	28480	5041-3000
MP636	5041-4501	7	1	KEY-CAP SPCL MARKER	28480	5041-4501
MP637	5041-4502	8	1	KEY-CAP Y OFF	28480	5041-4502
MP638	5041-4503	9	1	KEY-CAP X OFF	28480	5041-4503
MP639	5041-4504	0	1	KEY-CAP UNITS	28480	5041-4504
MP640	5041-4505	1	1	KEY-CAP CO-ORD	28480	5041-4505
MP641	5041-4506	2	1	KEY-CAP SOURCE	28480	5041-4506
MP642	5041-4507	3	1	KEY-CAP SELECT MEAS	28480	5041-4507
MP643	5041-4508	4	1	KEY-CAP MEAS MODE	28480	5041-4508
MP644	5041-4509	5	1	KEY-CAP SPCL FCTN	28480	5041-4509
MP645	5041-4510	8	1	KEY-CAP SAVE RECALL	28480	5041-4510
MP646	5041-4511	9	1	KEY-CAP HP-1B FCTN	28480	5041-4511
MP647	5041-4512	0	1	KEY-CAP DISC	28480	5041-4512
MP648	5041-4513	1	1	KEY-CAP CURVE FIT	28480	5041-4513
MP649	5041-4514	2	1	KEY-CAP AUTO MATH	28480	5041-4514
MP650	5041-4515	3	1	KEY-CAP PAUSE CONT	28480	5041-4515
MP651	5041-4516	4	1	KEY-CAP WINDOW	28480	5041-4516
MP652	5041-4517	5	1	KEY-CAP ,	28480	5041-4517
MP653	5041-4518	6	1	KEY-CAP START	28480	5041-4518
MP654	5041-4519	7	1	KEY-CAP MATH	28480	5041-4519
MP655	5041-4520	0	1	KEY-CAP SYNTH	28480	5041-4520
MP656	5041-4521	1	1	KEY-CAP HELP	28480	5041-4521
MP656	5041-4522	2	1	KEY-CAP RANGE	28480	5041-4522
MP657	5041-4523	3	1	KEY-CAP AUTO SEQ	28480	5041-4523
MP658	5041-4524	4	1	KEY-CAP X	28480	5041-4524
MP659	5041-4525	5	1	KEY-CAP Y	28480	5041-4525
MP660	5041-4526	6	1	KEY-CAP CAL	28480	5041-4526
MP661	5041-4527	7	1	KEY-CAP VIEW INPUT	28480	5041-4527
MP662	5041-4565	3	1	KEY-HALF	28480	5041-4565
W1	03562-61601	6	2	CABLE-INPUT	28480	03562-61601
	03562-20601	0	1	SHIELD, INPUT CABLE	28480	03562-20601
W2	03562-61602	7	1	CABLE-POWER, ON/OFF	28480	03562-61602
W4	03562-61604	9	1	CABLE-SOURCE	28480	03562-61604
W5	03562-61605	0	1	CABLE-TRIGGER	28480	03562-61605
W6	03562-61606	1	1	CABLE-EXT REF.	28480	03562-61606
W7	03562-61607	2	1	CABLE-SAMPLE	28480	03562-61607
W8	03562-61608	3	1	CABLE-SYNC OUT	28480	03562-61608
W9	03562-61609	4	2	CABLE (RF)-INPUT/ADC	28480	03562-61609
W10	03562-61610	7	1	CABLE-KEYBOARD	28480	03562-61610
W13	03562-61613	0	1	CABLE-POWER/MOTHERBOARD	28480	03562-61613
W14	03562-61614	1	1	CABLE-DISPLAY I/O	28480	03562-61614
W16	03562-61616	3	1	CABLE-FAN/PWR	28480	03562-61616
W17	03562-61617	4	1	CABLE-DISP.ADJ.	28480	03562-61617
W18	03562-61618	5	3	CABLE-POWER PRIM	28480	03562-61618
W24	03562-61624	3	2	CABLE-GRD	28480	03562-61624
W190-W192	03562-61619	6	3	CABLE-DISPLAY XYZ	28480	03562-61619
	8120-1378	1	1	POWERCORD, US/CAN STRGHT--GRAY	16428	KH-7081
	2110-0056	3	1	FUSE 6A 250V NTD 1.25X.25 UL	75915	312006
	03562-90000	0	1	MANUAL, OPER.	K01001	03562-90000
	03562-90009	9	1	MANUAL-PERFORMANCE TEST	28480	03562-90009
	03562-90030	6	1	MANUAL-PROGM	K01001	03562-90030
	03562-90890	6	1	MANUAL ASSEMBLY	28480	03562-90890
	0515-0413	2	39	SCREW-MACH M4 X 0.7 6MM-LG PAN-HD	16941	0515-0413
	0515-0210	7	38	SCREW-MACH M4 X 0.7 8MM-LG PAN-HD	16941	0515-0210
	0515-1331	5	16	SCR, M4X0.7X6 FH	77250	0515-1331
	0515-0407	4	12	SCREW-MACH M3 X 0.5 10MM-LG PAN-HD	16941	0515-0407
	0515-1232	5	11	SCREW-MACH M3.5 X 0.6 8MM-LG PAN-HD	77250	0515-1232

See introduction to this section for ordering information
*Indicates factory selected value

Table 4-3 Replaceable Parts cont.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	0515-0396	9	8	SCREW-MACH M4.0X10MM	16941	2510-0046
	0515-0211	8	7	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	16941	0515-0211
	2950-0043	8	7	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	H01042	2950-0043
	2190-0009	4	6	WASHER-LK INTL T NO. 8 .168-IN-ID	T12345	1908-00
	0535-0006	1	6	NUT-HEX DBL-CHAM M4 X 0.7 3.2MM-THK	H01043	0535-0006
	0403-0179	0	6	BUMPER FOOT-ADH MTG	76381	SJ 5012 BLK
	2190-0016	3	5	WASHER-LK INTL T 3/8 IN .377-IN-ID	T12345	1920-02
	2190-0054	9	5	WASHER-LK INTL T 1/2 IN .505-IN-ID	T12345	1924-12
	0515-0414	3	5	SCREW-MACH M4 X 0.7 10MM-LG PAN-HD	16941	0515-0414
	0515-0657	6	5	SCREW-MACH M3.5 X 0.6 8MM-LG	M01088	0515-0657
	2190-0007	2	4	WASHER-LK INTL T NO. 6 .141-IN-ID	T12345	1906-00-00-2580
	0515-0147	9	4	SCREW-MACH M3.5 X 0.6 20MM-LG PAN-HD	83486	0515-0147
	0515-1132	4	4	SCREW-MACH M5 X 0.8 10MM-LG	M01088	0515-1132
	2360-0195	0	4	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	01536	2360-0195
	0535-0007	2	4	NUT-HEX DBL-CHAM M3.5 X 0.6 2.8MM-THK	H01043	0535-0007
	0535-0013	0	4	NUT-THUMB M3.5 X 0.6 5MM-THK 8.6MM-WD	L01005	0535-0013
	0360-1632	0	3	TERMINAL-SLDR LUG LK-MTG FOR-#3/8-SCR	79963	761-3/8
	2950-0035	8	3	NUT-HEX-DBL-CHAM 15/32-32-THD	T123	2950-0035
	1400-1122	0	3	CLAMP-CABLE .187-DIA .735-WD NYL	34785	021-0188
	3050-0066	8	2	WASHER-FL MTLC NO. 6 .147-IN-ID	73734	1451
	3050-0067	9	2	WASHER-FL MTLC 5/16 IN .375-IN-ID	73734	31-550
	0515-0066	1	2	SCREW-MACH M3.5 X 0.6 6MM-LG PAN-HD	83486	0515-0066
	0515-0081	0	2	SCREW-MACH M3.5 X 0.6 10MM-LG	83486	0515-0081
	0515-0482	5	2	SCREW-SKT-HD-CAP M3 X 0.5 8MM-LG	A01148	0515-0482
	0361-1040	6	2	RVT-BLD DMHD .125D .06GRP AL	19738	1125-0404
	2950-0054	1	2	NUT-HEX-DBL-CHAM 1/2-28-THD .125-IN-THK	T123	2950-0054
	7120-3416	1	2	LABEL-WARNING 1.25-IN-WD 2.75-IN-LG	M01073	7120-3416
	0400-0011	3	2	GROMMET-RND .375-IN-ID .5-IN-GRV-OD	S02026	500
	0400-0062	4	1	GROMMET-RND .5-IN-ID .625-IN-GRV-OD	51633	8069
	2190-0047	0	1	WASHER-LK 82 CTSK EXT T NO. 6 .142-IN-ID	T12345	1506-00
	2190-0060	7	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	T12345	1214-10
	2190-0575	9	1	WASHER-LK INTL T 1/2 IN .64-IN-ID	73734	2190-0575
	2950-0006	3	1	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	73734	9000

See introduction to this section for ordering information
*Indicates factory selected value

SECTION V
MANUAL BACKDATING

Contents

Figures

SECTION V
MANUAL BACKDATING

5-1 INTRODUCTION

This revision of this manual applies directly to all instruments. Earlier versions of this instrument, however, differ in design and appearance from those currently being produced. The information in this section documents the earlier instrument configurations and associated servicing procedures.

5-2 MANUAL CHANGES SUPPLEMENT

As Hewlett-Packard continues to improve the performance of the HP 3562A, 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 office (see sales and support offices listing at the back of this manual).

5-3 FORMAT

Design and component changes within the instrument are noted by the "Δ" symbol. When this symbol appears, refer to the appropriate assembly heading in this section for the manual changes.

5-4 A1 DIGITAL SOURCE

Current revision: B

Previous revisions:

Revision A has U104 installed in a socket (part number 1200-0474). Revision A differs from Revision B in table A1-6. Change the signatures for U112 as follows:

Component	Pin	Signature
U112	12	OPHC
	16	OPHC

5-5 A2 CPU

Current revision: C

Previous revisions:

Revision B differs from revision C as follows:

1. There is no J021 on revision B.

2. Reference designator C101 is C1000 on revision B.

5-6 A3 PROGRAM ROM

Current revision: B

Previous revisions: None

5-7 A4 LOCAL OSCILLATOR

Current revision: C

Previous revisions:

Revision B is electrically identical to revision C. The following components are in sockets in revision B:

Component	Socket Part Number
U20	1200-0567
U36	1200-0654
U57	1200-0638
U47	1200-0638
U33	1200-0639

Revision A differs from revision B as follows:

1. Signature analysis connector J1 is mislabeled. It should be labeled as follows:

   J1-1 GND
   J1-3 CLK
   J1-4 STP
   J1-4 SRT

2. Change the following part numbers in the Replaceable Parts list:

   U20 to 03562-60342
   U29 to 03562-60341

3. In table A4-2, change the signatures for U20 and U29 as follows:

Component	Pin	Signature	Component	Pin	Signature
U20	9	P1A2	U29	9	UH9P
	10	9149		10	HF11
	11	P43P		11	11C0
	13	9C68		13	6582
	14	12C0		14	P104
	15	2H8P		15	4791
	16	6C7P		16	90AF
	17	6PA1			

4. Change the A4 schematic in section IX as shown in figure 5-A4a.

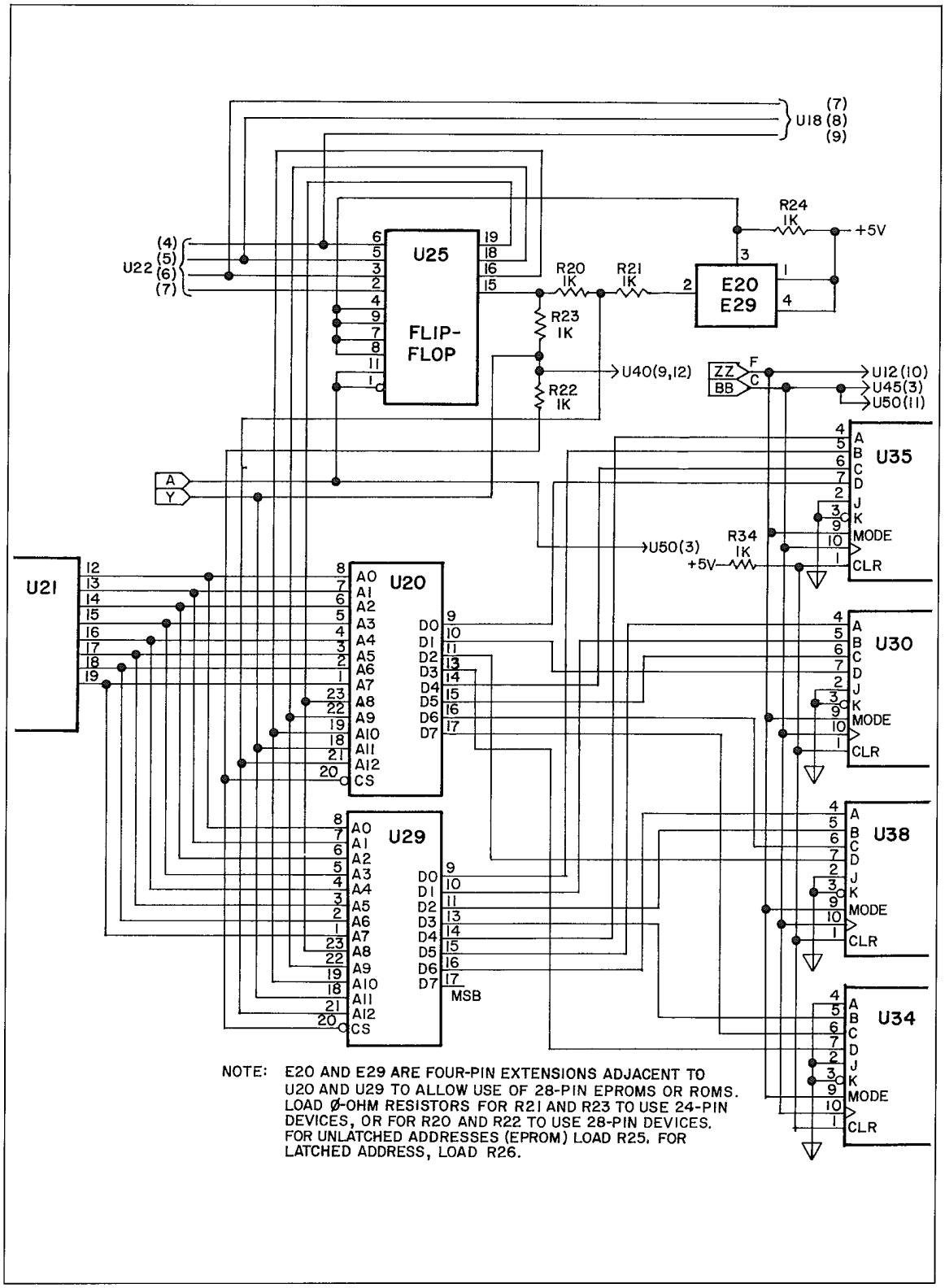


Figure 5-A4a Local Oscillator Schematic Revision A

5. Change the component locator as shown in figure 5-A4b.

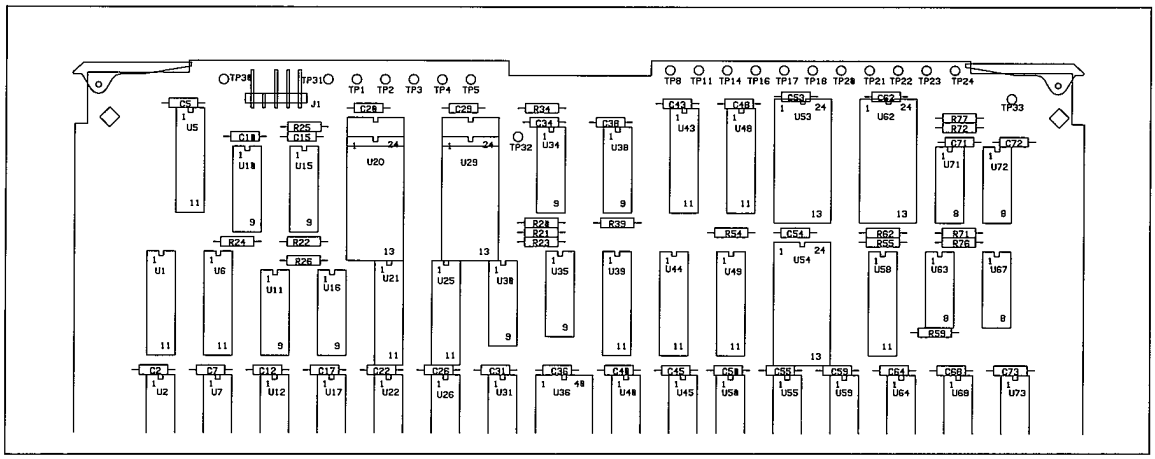


Figure 5-A4b Local Oscillator Component Locator Revision A

5-8 A5 DIGITAL FILTER

Current revision: E

Previous revisions: All revisions are electrically the same as revision E.

Revisions A through D: The following components are in sockets:

Component	Socket Part Number
U107	1200-0607
U109	1200-0638
U110	1200-0638
U512	1200-0638
U206	1200-0700
U306	1200-0700

Revisions A and B: All jumpers are identified with a "W" rather than a "J".

Revs. A and B	Later Revs.
W002	J002
W003	J003
W004	J004
W005	J005
W006	J006
W007	J007

Revision A: Make the following changes:

1. Polarity marks for CR1 and CR2 are at the wrong end of the component.

2. Change test point labels as follows:

Test Point	Rev A	Other Revs.
TP9	CHFB1	CH1FB1
TP10	CHFB2	CH1FB2
TP14	CH1SRT	CH1STRT
TP21	XCVRE1	XCVREN1
TP22	XCVRE2	XCVREN2

3. The test position for W7 is different on revision A. To put W7 in the normal (N) position, take the jumpers off. To put W7 in the test (T) position, set the jumpers as shown in figure 5-A5.

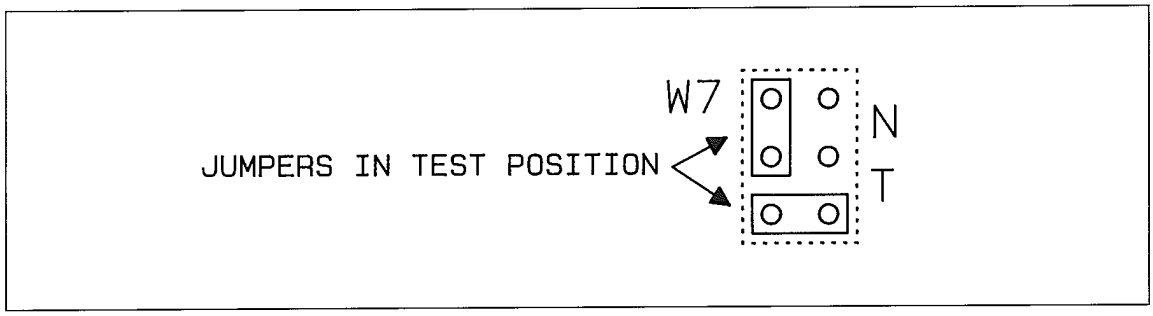


Figure 5-A5 Digital Filter W7 Position Revision A

5-9 A6 DIGITAL FILTER CONTROLLER

Current revision: C

Previous revisions are all electrically the same as revision C:

Revision B: Component U208 is in a socket (part number 1200-0700).

Revision A: Make the following changes:

1. The following components are in sockets:

Component	Socket Part Number
U206	1200-0638
U208	1200-0700
U309	1200-0700

2. Jumper J2 is identified as W2 on revision A.

5-10 A7 FLOATING POINT PROCESSOR

Current revision: B

Previous revisions:

Revision A is electrically identical to revision B. The following components are in different locations on the revision A component locator:

C43, U114, and U115 are closer to the top of the board.

R17 is located just above and parallel to C47.

5-11 A8 GLOBAL RAM

Current revision: B

Previous revisions:

Revision A is electrically identical to revision B. The test jumpers J3 through J9 are not labeled on revision A. Normal (N) position is to the left, test (T) position to the right.

5-12 A9 FAST FOURIER TRANSFORM PROCESSOR

Current revision: B

Previous revisions:

Revision A is electrically identical to revision B. On the revision A component locator, C117 is located directly above U117.

5-13 A12 MOTHER BOARD

Current revision: B

Previous revisions:

Revision A is electrically identical to revision B.

5-14 A15 KEYBOARD

Current revision: B

Previous revisions:

Revision A is electrically identical to revision B. On the revision A component locator, J9 is located just below U404.

5-15 A17 DISPLAY INTERFACE

Current revision: A

Previous revisions: None

5-16 A18 POWER SUPPLY

Current revision: C

Previous revisions:

Revisions A and B differ from revision C as follows:

1. Change the Replaceable Parts List, table 5-3, as follows:

   a. Change the following components:

      — C108 and C109 to 0160-4787, 22 pF.
      — C200 to 0160-0128, 2.2 μF.
      — C304 to 0180-0374, 10 μF.
      — R116 to 0757-0401, 100 OHM.
      — R126 and R304 to 0757-0442, 10K.

   b. Delete the following components:

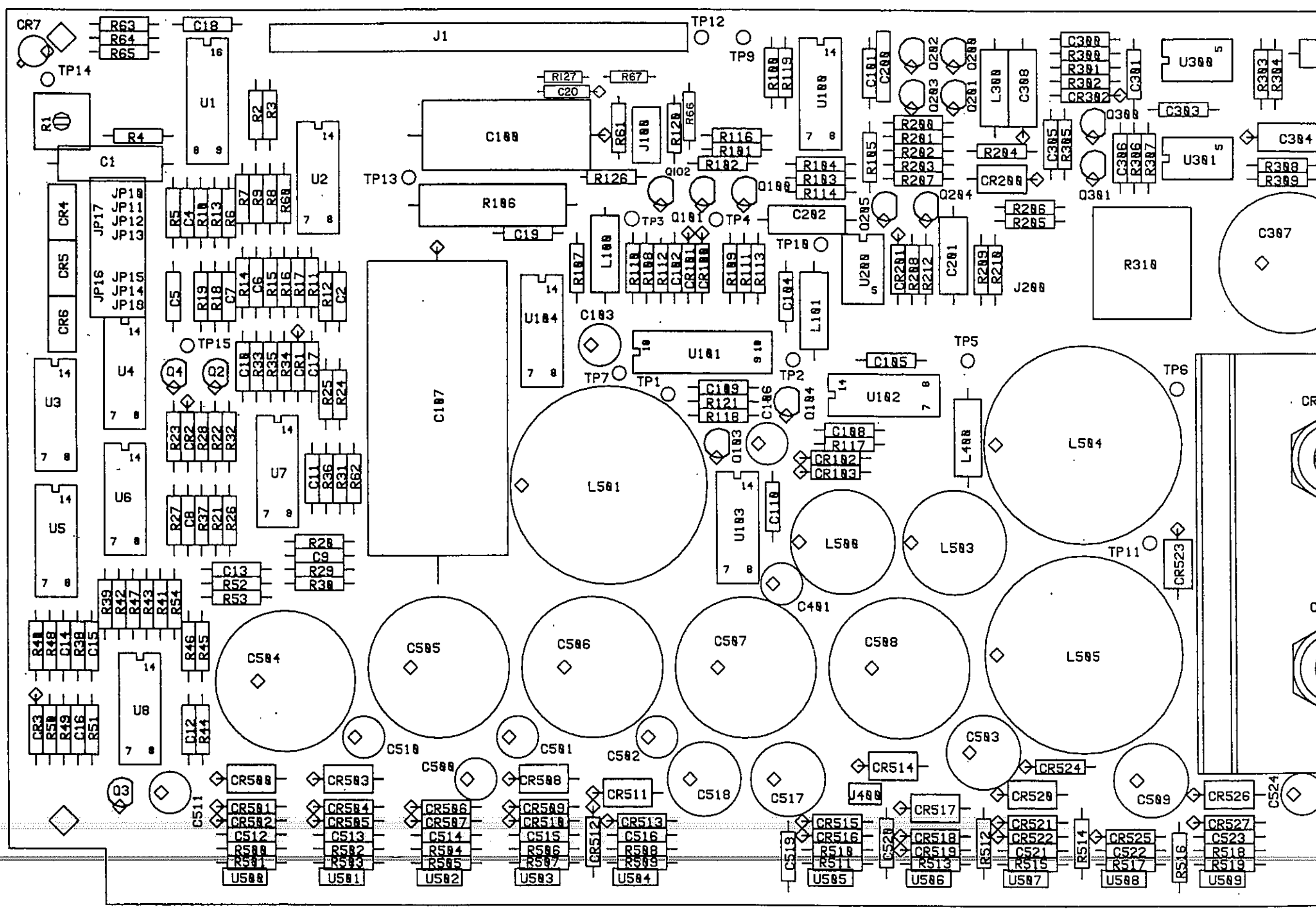
      — C527, C528, C529, and C530.
      — CR530, CR531, CR532, and CR533.

   c. Add the following components:

      — R104, 0757-0280, 1K.
      — R114, 0698-3228, 49.9K.
      — R118, 0698-3279, 4.99K.
      — R208, 0757-0465, 100K.
      — Q103 and Q104, 1854-0215, NPN 2N3904.
      — Q205, 1853-0036, PNP 2N3906.
      — U100, 1820-3183, 74HC03 CMOS.

2. Remove A18, component locator revision C, and schematic revision C, and replace them with figures 5-A18a and 5-A18c.

Revision A was modified to be electrically identical to revision B (see figure 5-A18b).


CR7
R63
R64
R65
C18
J1
TP12
TP9
TP14
R1
R4
C1
U1
R2
R3
U2
R127
R67
C20
C100
R61
J100
R120
R66
R116
R101
R102
R126
Q102
Q101
Q100
R100
R119
U100
C101
C200
Q202
Q200
Q203
Q201
L300
C300
R200
R201
R202
R203
R207
R204
CR200
R105
R104
R103
R114
C300
R300
R301
R302
CR302
C301
U300
C303
Q300
C305
R305
C306
R306
R307
U301
Q301
R303
R304
C304
R308
R309
TP13
R106
C19
JP10
JP11
JP12
JP13
JP17
JP16
JP15
JP14
JP18
CR4
CR5
CR6
R5
C4
R10
R13
R6
R7
R9
R8
R60
C5
R19
R18
C7
R14
C6
R15
R16
R17
R11
R12
C2
U3
U4
Q4
Q2
TP15
C10
R33
R35
R34
CR1
C17
R25
R24
C107
R107
L100
TP3
TP4
R110
R108
R112
C102
CR101
CR100
R109
R111
R113
C202
TP10
Q205
U200
Q204
CR201
R208
R212
C201
R209
R210
J200
R206
R205
R310
C307
U104
C103
U101
C104
L101
TP7
TP1
TP2
C109
R121
R118
C106
Q104
U102
C105
TP5
TP6
L400
L504
Q103
C108
R117
CR102
CR103
U103
C110
L501
L500
L503
TP11
CR523
C401
U6
U7
U5
R23
CR2
R28
R22
R32
R27
C8
R37
R21
R26
C11
R36
R31
R62
R20
C9
R29
R30
C13
R52
R53
R39
R42
R47
R43
R41
R54
R40
R48
C14
R38
C15
R46
R45
U8
CR3
R50
R49
C16
R51
C12
R44
C504
C505
C506
C507
C508
L505
C510
C501
C502
C500
C503
CR514
CR524
C509
Q3
C511
CR500
CR503
CR508
CR511
C518
C517
U400
CR517
CR520
CR526
C524
CR501
CR502
C512
R500
R501
U500
CR504
CR505
C513
R502
R503
U501
CR506
CR507
C514
R504
R505
U502
CR509
CR510
C515
R506
R507
U503
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U505
C520
CR518
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R513
U506
R512
CR521
CR522
C521
R515
U507
R514
CR525
C522
R517
U508
R516
CR527
C523
R518
R519
U509

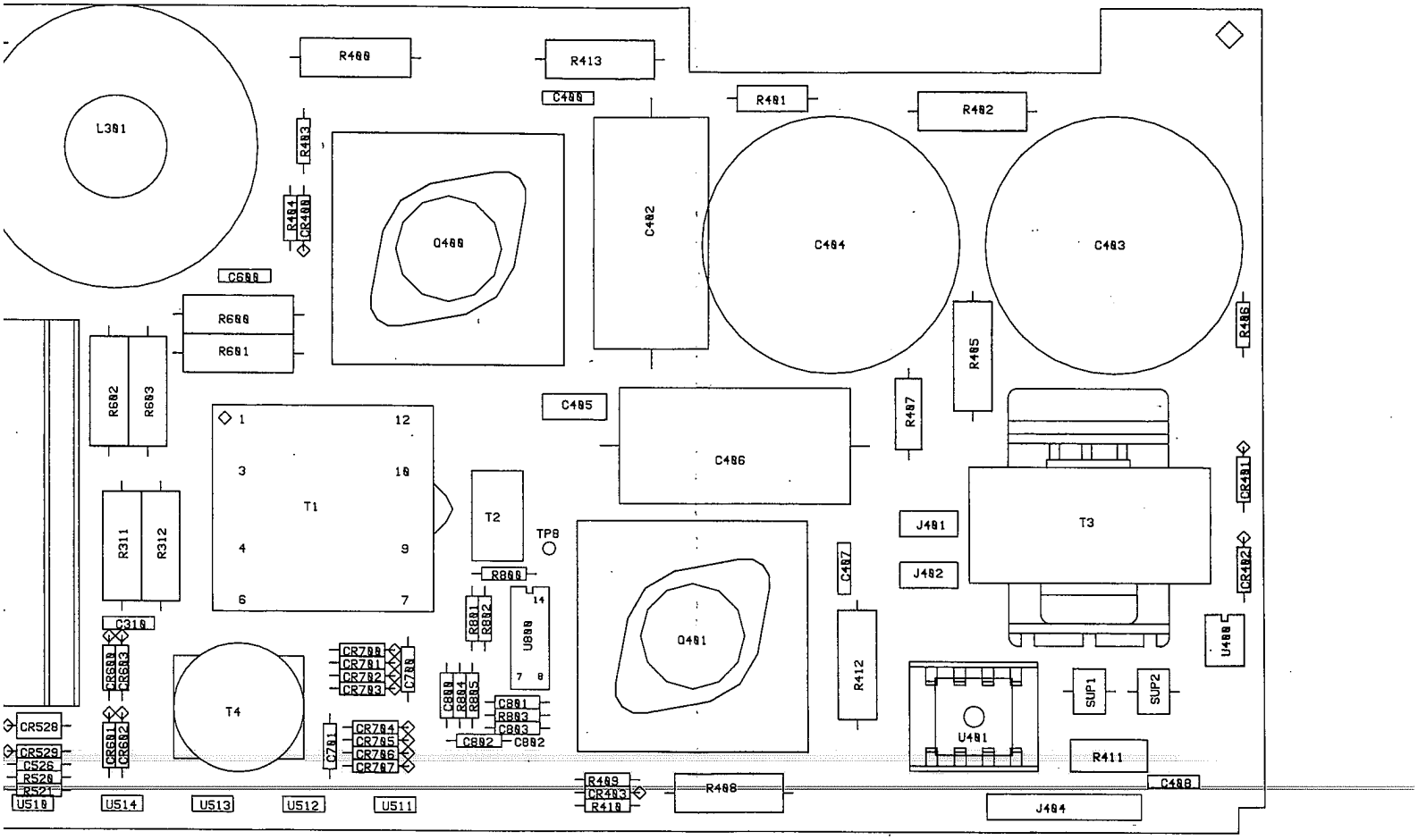
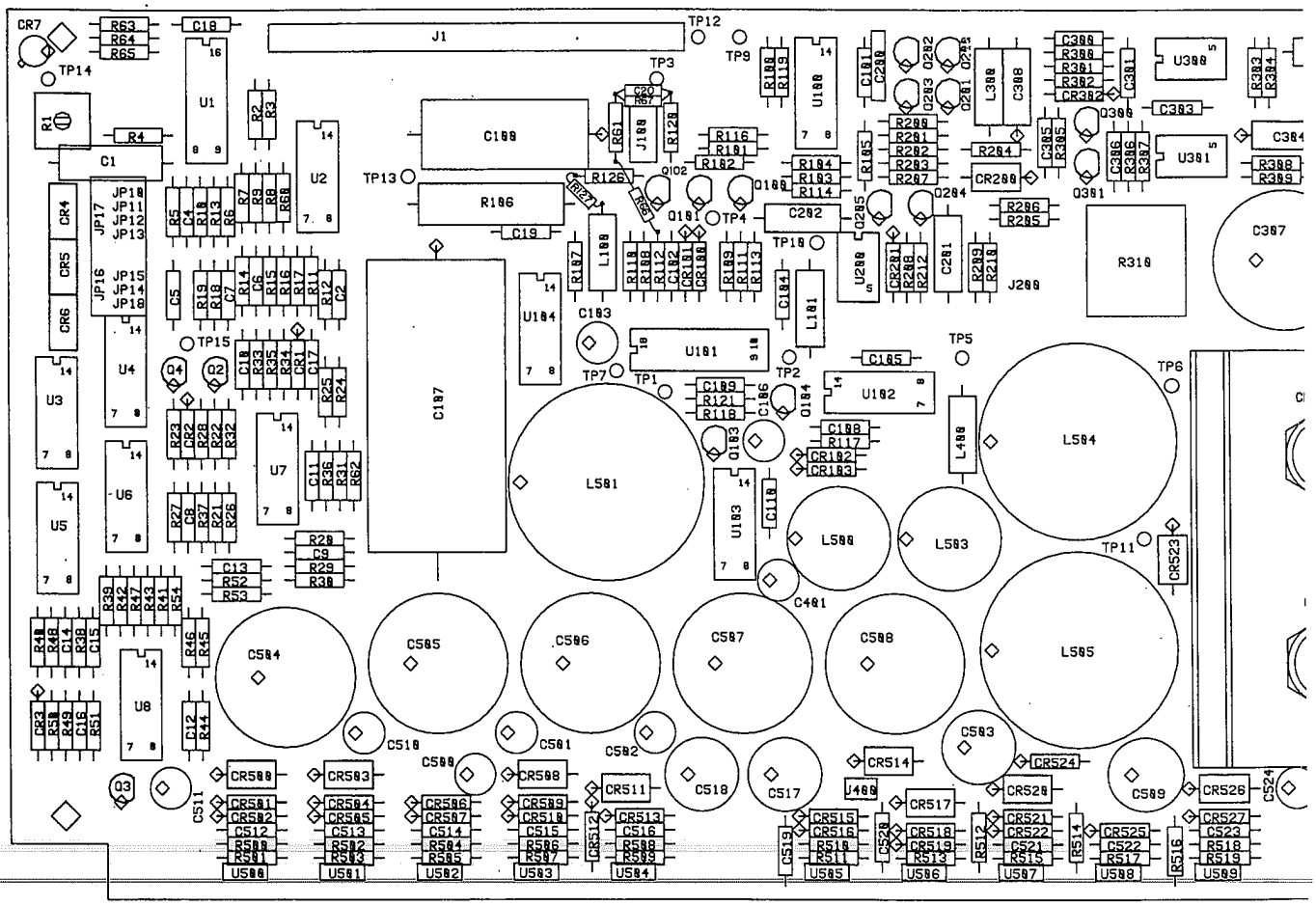


Figure 5-A18a Power Supply Component Locator Revision B


CR7
TP14
R63
R64
R65
C18
U1
J1
TP12
TP3
TP9
R1
R4
C1
R2
R3
U2
C188
R186
TP13
C19
R61
J188
R120
R126
Q102
Q101
TP4
R116
R181
R182
R184
R193
R114
Q100
C202
TP10
U200
Q205
Q204
C201
R209
R210
R206
R205
J200
R310
C307
C188
R187
L188
R188
R112
C182
CR181
CR180
R189
R111
R113
C184
L181
U184
C183
U181
TP7
TP1
TP2
C185
TP5
TP6
U182
C189
R121
R118
C186
Q184
Q183
C188
R117
CR182
CR183
L488
L484
L481
U183
C118
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L483
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C481
C187
C484
C485
C486
C487
C488
L485
C518
C501
C502
C503
C514
C518
C517
J400
CR517
CR524
CR526
C589
C524
C511
Q3
CR500
CR501
CR502
C512
R500
R501
U500
CR503
CR504
CR505
C513
R502
R503
U501
C500
CR506
CR507
C514
R504
R505
U502
CR508
CR509
C515
R506
R507
U503
CR511
CR512
CR513
C516
R508
R509
U504
CR515
CR516
R510
R511
U505
C519
C520
CR518
CR519
R513
U506
R512
CR521
CR522
C521
R515
U507
R514
CR525
C522
R517
U508
R516
CR527
C523
R518
R519
U509
U3
U4
U5
U6
U7
U8
JP18
JP11
JP12
JP13
JP17
JP16
JP15
JP14
JP10
CR4
CR5
CR6
TP15
Q4
Q2
C5
R19
R18
C7
R14
C6
R15
R16
R17
R11
R12
C2
C18
R33
R35
R34
CR1
C17
R25
R24
R23
CR2
R28
R22
R32
C11
R36
R31
R62
R27
C8
R37
R21
R26
R29
C9
R29
R30
C13
R52
R53
R39
R42
R47
R43
R41
R54
R48
R40
C14
R38
C15
R46
R45
C12
R44
CR3
R58
R49
C16
R51
C300
R300
R301
R302
CR302
C301
U300
R303
R304
Q300
C303
C304
C305
R305
C306
R306
R307
U301
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R309
Q301
CR200
R200
R201
R202
R203
R207
R204
R208
C308
L300

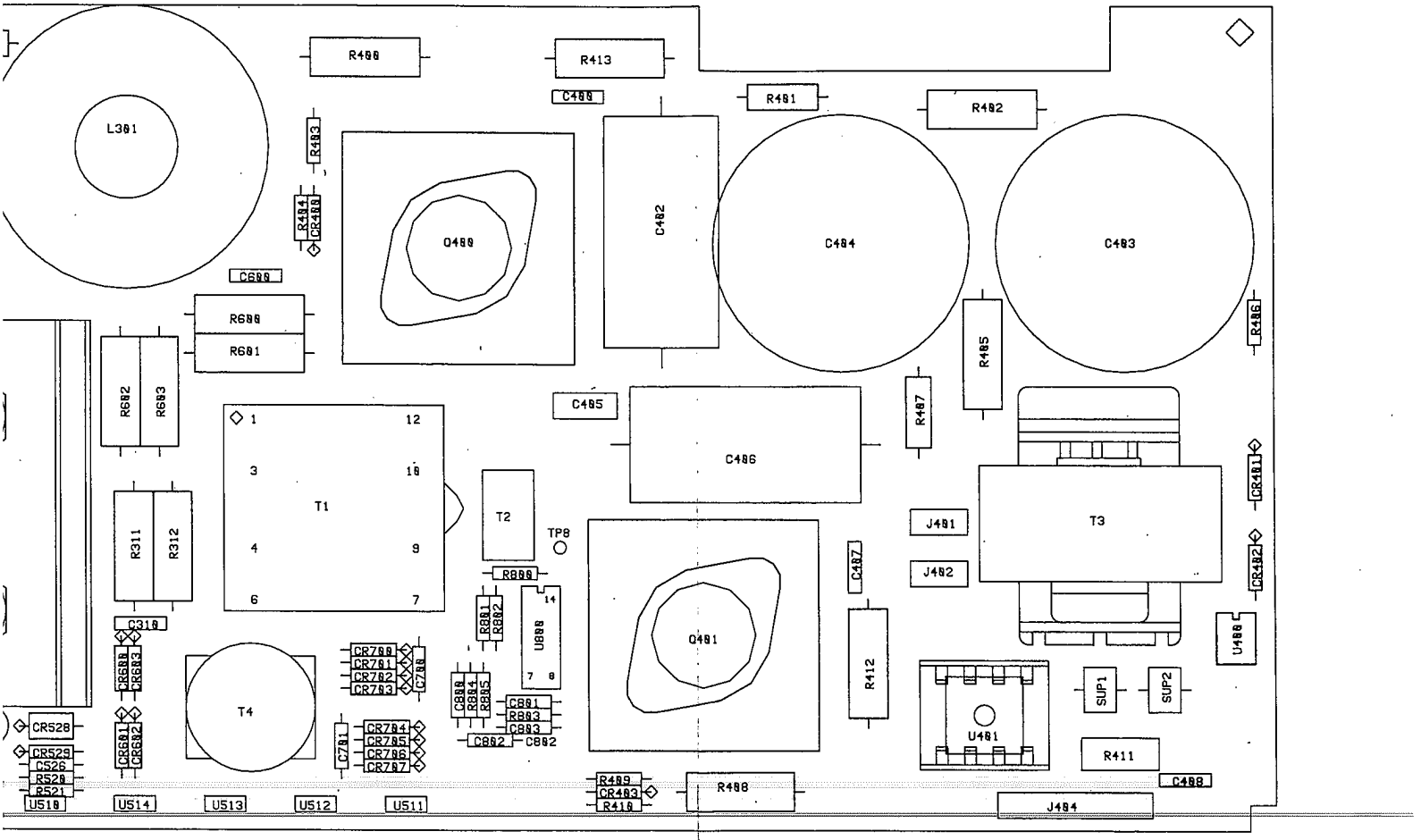
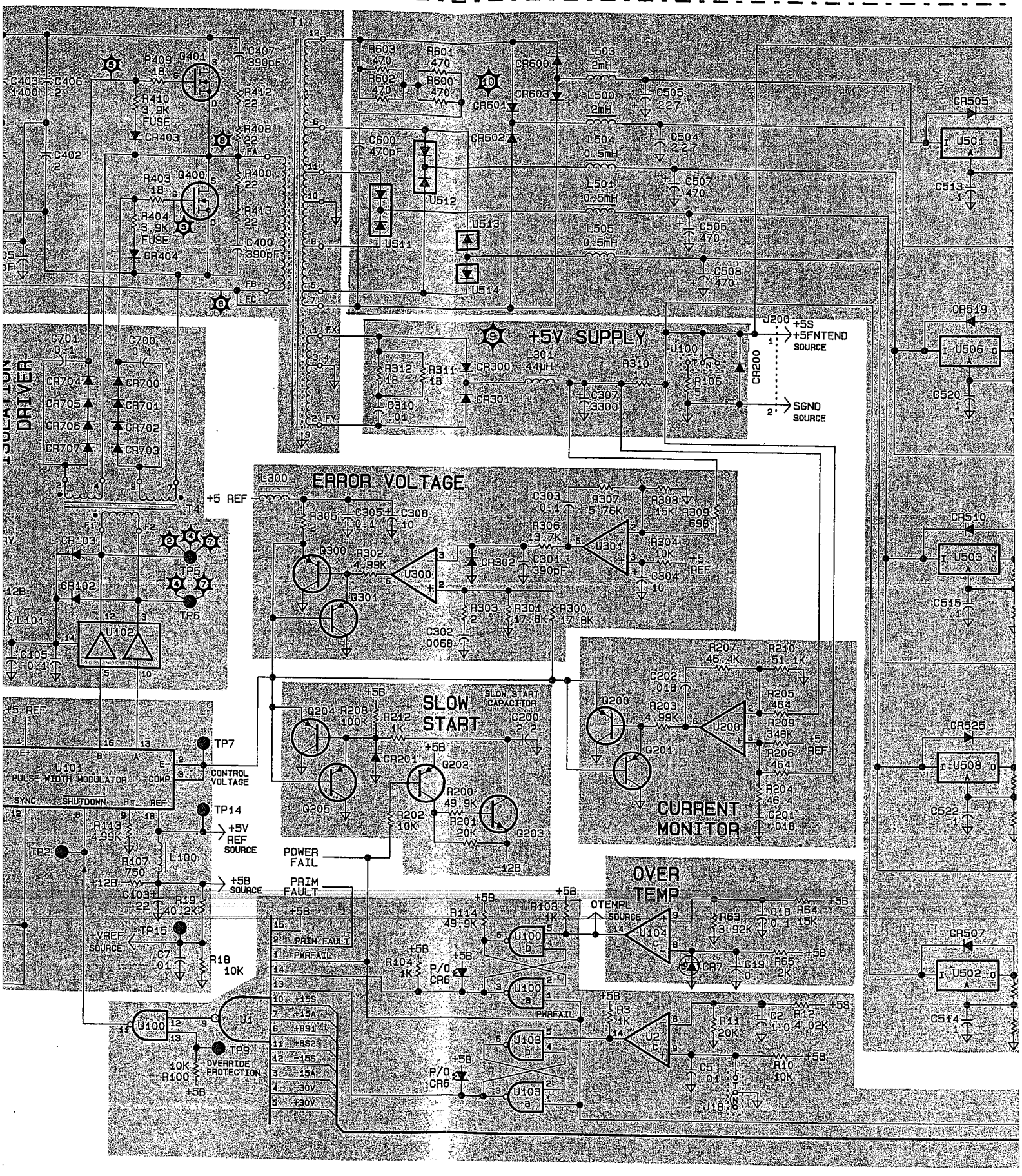


Figure 5-A18b Power Supply Component Locator Revision A


+5V SUPPLY
ERROR VOLTAGE
SLOW START
CURRENT MONITOR
OVER TEMP
ISOLATION DRIVER
+5 REF
CONTROL VOLTAGE
+5V REF SOURCE
+5B SOURCE
+VREF SOURCE
OVERRIDE PROTECTION
POWER FAIL
PRIM FAULT
SLOW START CAPACITOR
+5S SOURCE
+5FNTEND SOURCE
SGND SOURCE
PULSE WIDTH MODULATOR
SHUTDOWN
OTEMP SOURCE
FUSE
FUSE

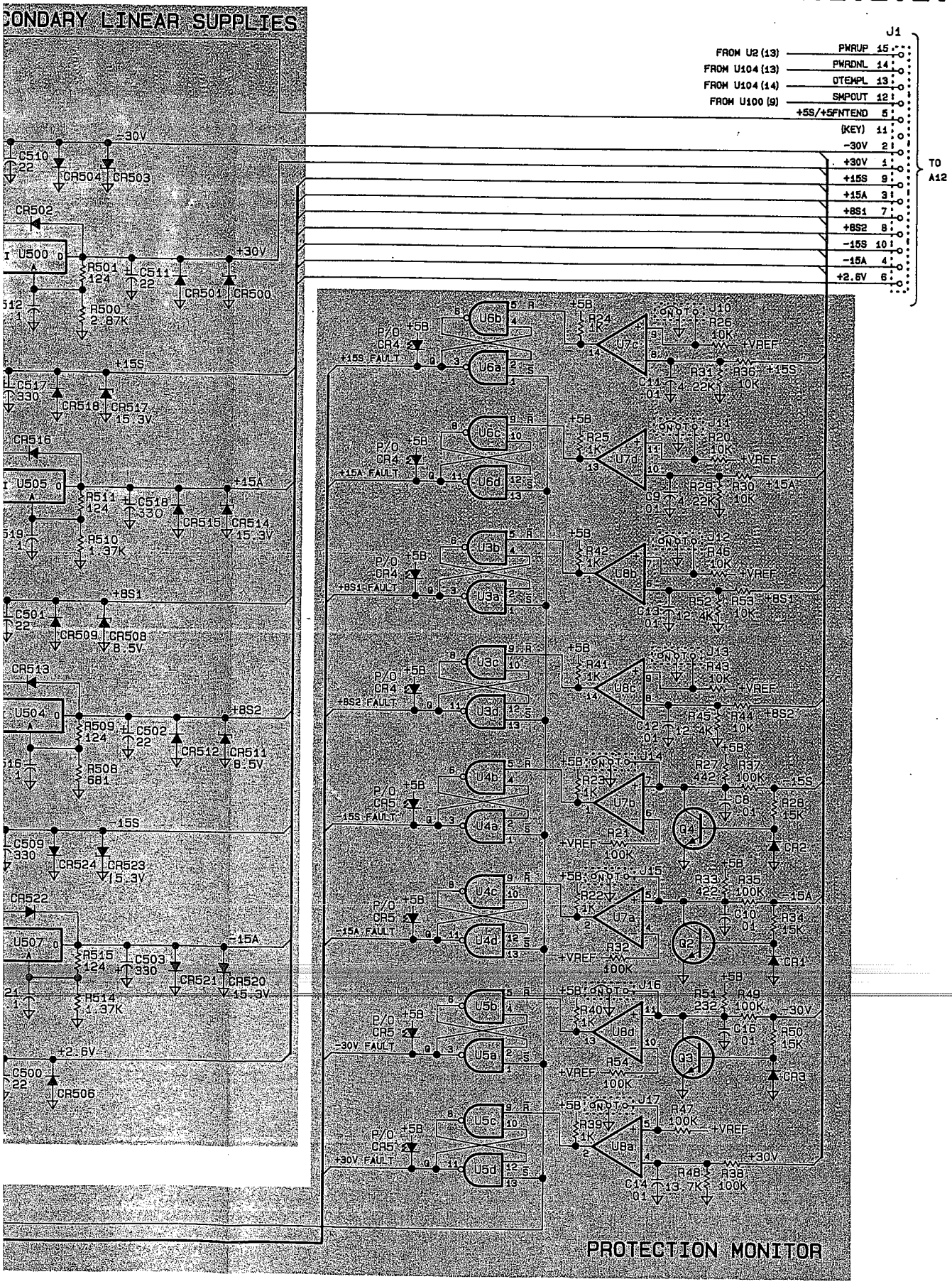
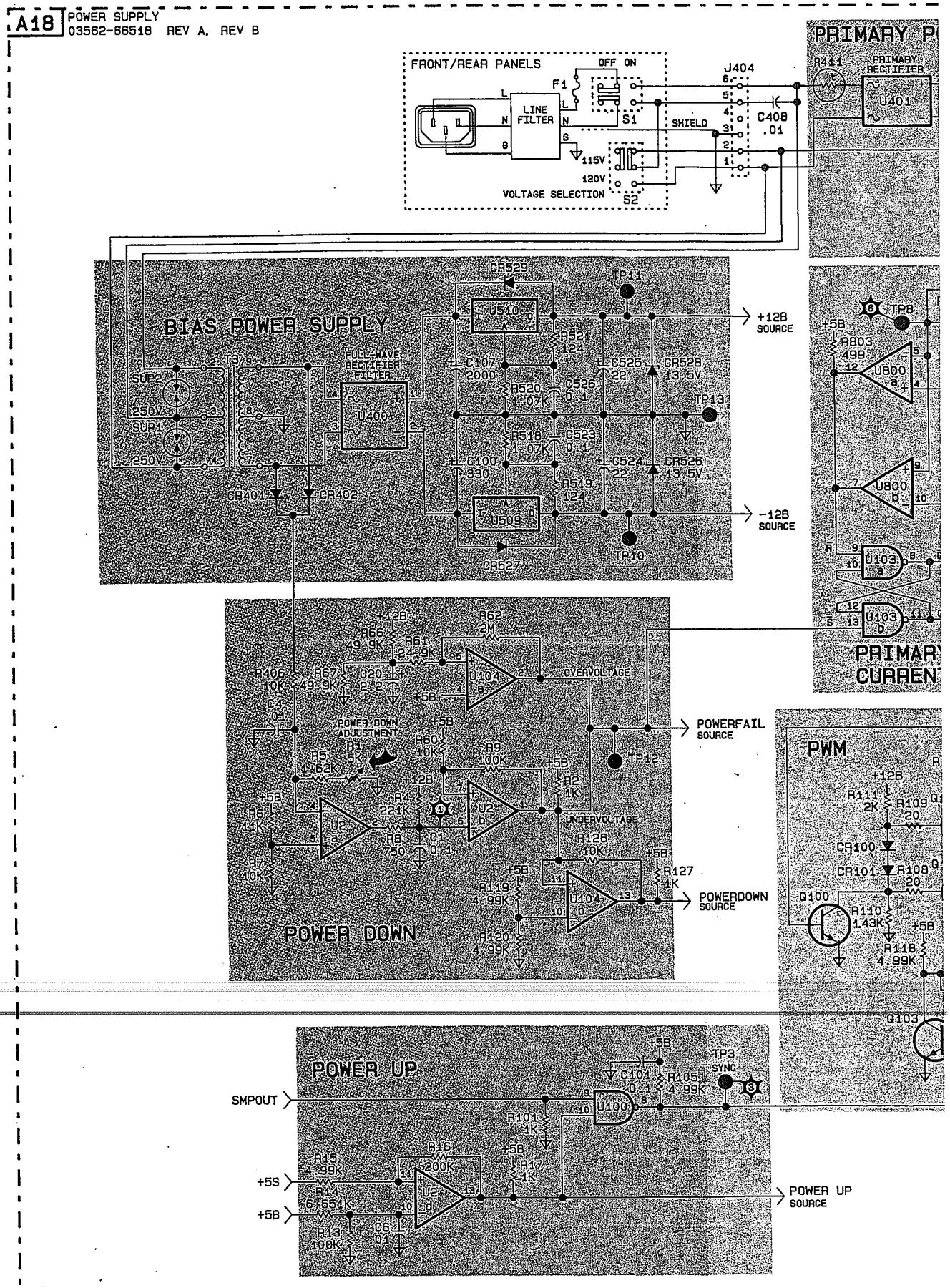
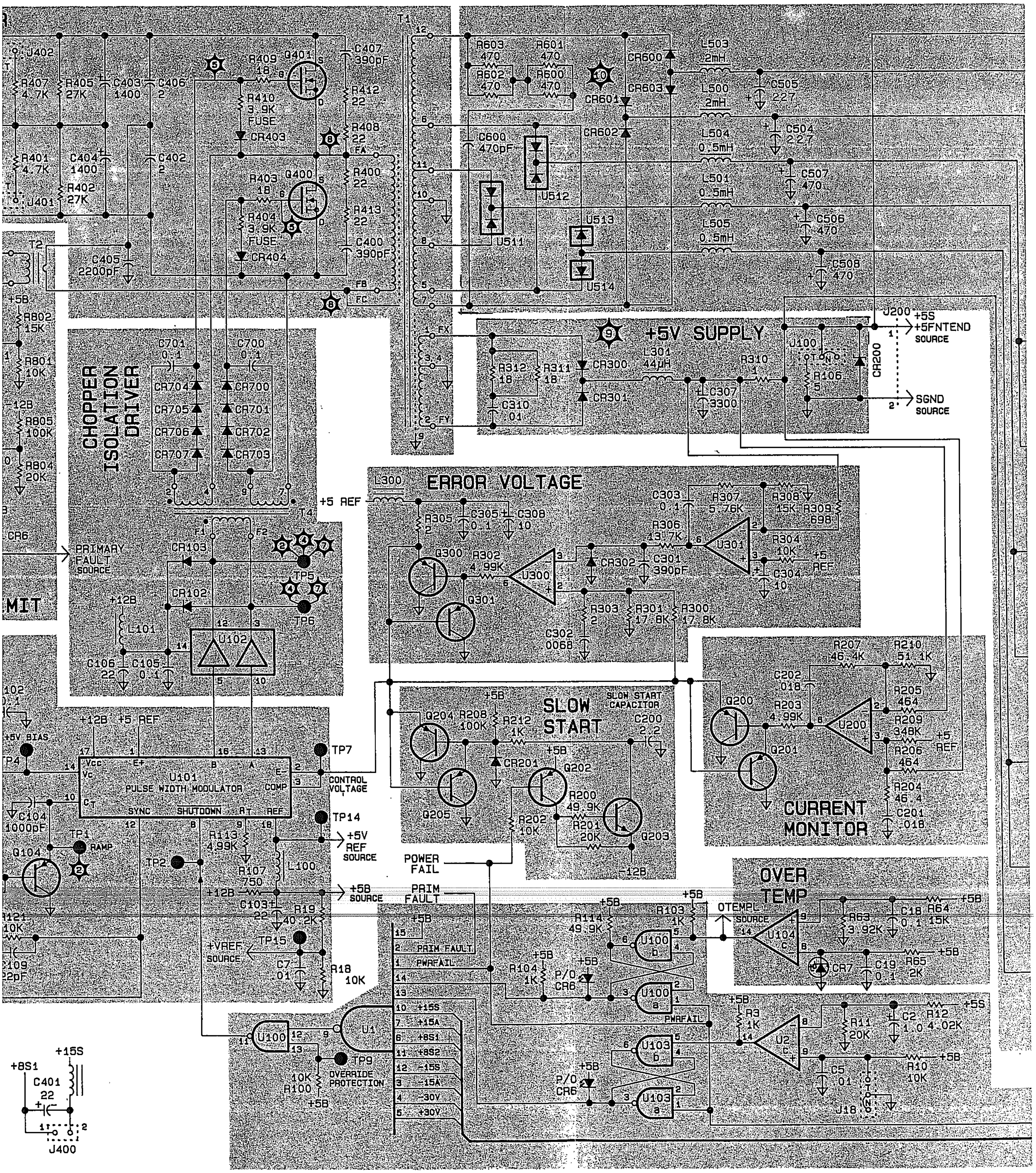


Figure 5-A18c Power Supply Schematic Revisions A and B

A18 POWER SUPPLY
03562-66518 REV A, REV B




CHOPPER ISOLATION DRIVER
+5V SUPPLY
ERROR VOLTAGE
SLOW START
SLOW START CAPACITOR
CURRENT MONITOR
OVER TEMP
PRIMARY FAULT SOURCE
+5S +5FNTEND SOURCE
SGND SOURCE
+5 REF
CONTROL VOLTAGE
+5V REF SOURCE
+5B SOURCE
+VREF SOURCE
POWER FAIL
PRIM FAULT
OTEMPL SOURCE
OVERRIDE PROTECTION
U101 PULSE WIDTH MODULATOR
Vcc Vc CT E+ B A E- COMP SYNC SHUTDOWN RT REF
U102
U300
U301
U200
U104
U100
U103
U1
U2
Q401 Q400 Q300 Q301 Q204 Q205 Q202 Q203 Q200 Q201 Q104
T1 T2 T4
J402 J401 J400 J100 J200 J18
TP1 RAMP TP2 TP4 TP5 TP6 TP7 TP9 TP14 TP15
R409 18 R410 3.9K FUSE R412 22 R408 22 R400 22 R413 22 R403 18 R404 3.9K FUSE
R407 4.7K R405 27K R401 4.7K R402 27K
C403 1400 C406 2 C404 1400 C402 2 C405 2200pF C407 390pF C400 390pF
CR403 CR404
R603 470 R601 470 R602 470 R600 470
CR600 CR603 CR601 CR602
L503 2mH L500 2mH L504 0.5mH L501 0.5mH L505 0.5mH
C505 227 C504 227 C507 470 C506 470 C508 470 C600 470pF
U511 U512 U513 U514
R312 18 R311 18 CR300 CR301 L301 44μH R310 1 C307 3300 C310 .01 R106 5 CR200
L300 R305 2 C305 0.1 C308 10 C303 0.1 R307 5.76K R308 15K R309 .698 R306 13.7K
R302 4.99K CR302 C301 390pF R304 10K C304 10 R303 2 R301 17.8K R300 17.8K C302 .0068
C701 0.1 C700 0.1 CR704 CR705 CR706 CR707 CR700 CR701 CR702 CR703
CR103 CR102 L101 C106 22 C105 0.1
+12B R208 100K R212 1K CR201 C200 2.2 R200 49.9K R201 20K R202 10K -12B
R207 46.4K R210 51.1K C202 .018 R203 4.99K R205 464 R209 348K R206 464 R204 46.4 C201 .018
+5B R802 15K R801 10K -12B R805 100K R804 20K
C104 1000pF R113 4.99K R107 750 L100 C103 22 R19 40.2K C7 .01 R18 10K R121 10K C109 22pF
R114 49.9K R103 1K R63 3.92K C18 0.1 R64 15K CR7 C19 0.1 R65 2K
R104 1K P/O CR6 PWRFAIL
R3 1K R11 20K C2 1.0 R12 4.02K C5 .01 R10 10K +5S
R100 10K
+15S +15A +8S1 +8S2 -15S -15A -30V +30V PRIM FAULT PWRFAIL
+8S1 +15S C401 22
LIMIT

5-17 A22 HP-IB

Current revision: A

Previous revisions: None

5-18 A30 ANALOG SOURCE

Current revision: C

Previous revisions:

Revision B is electrically identical to revision C.

The revision B component locator differs from revision C in the spacing of three groups of axial lead components. These components are located to the right of U600, U456, and U503.

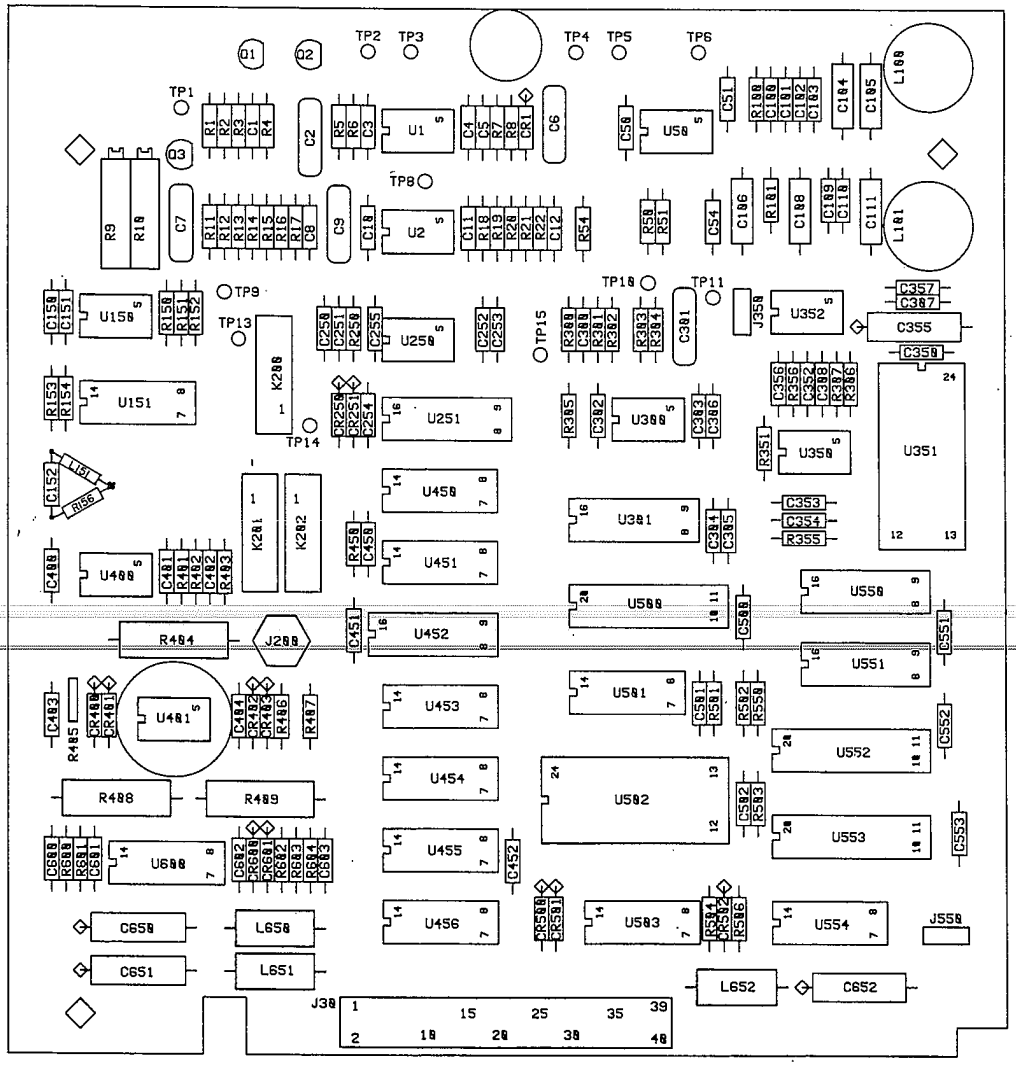


Figure A30 Analog Source Component Locator Revisions B & C

5-19 A31 TRIGGER

Current revision: B

Previous revisions:

Revision A differs from revision B as follows (see figures 5-A31a and 5-A31b):

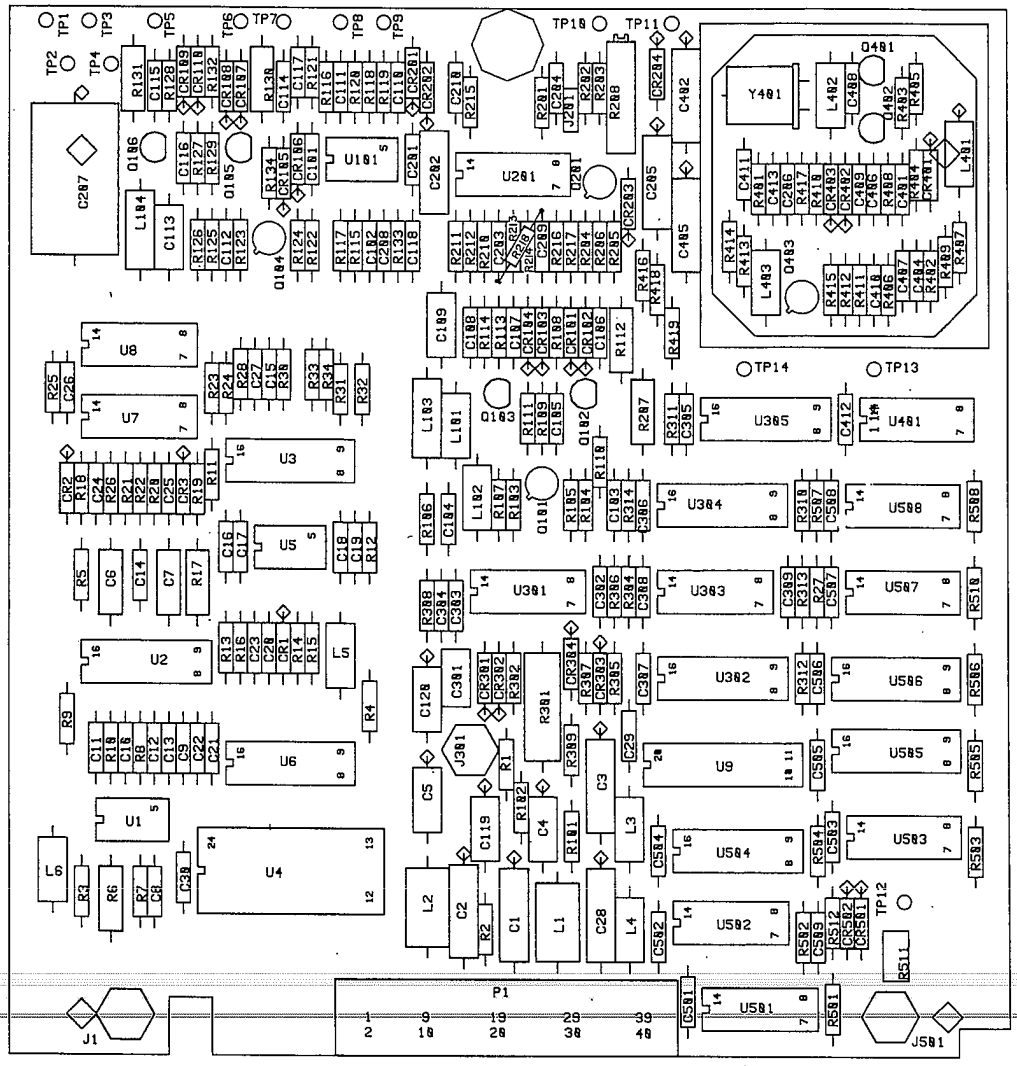
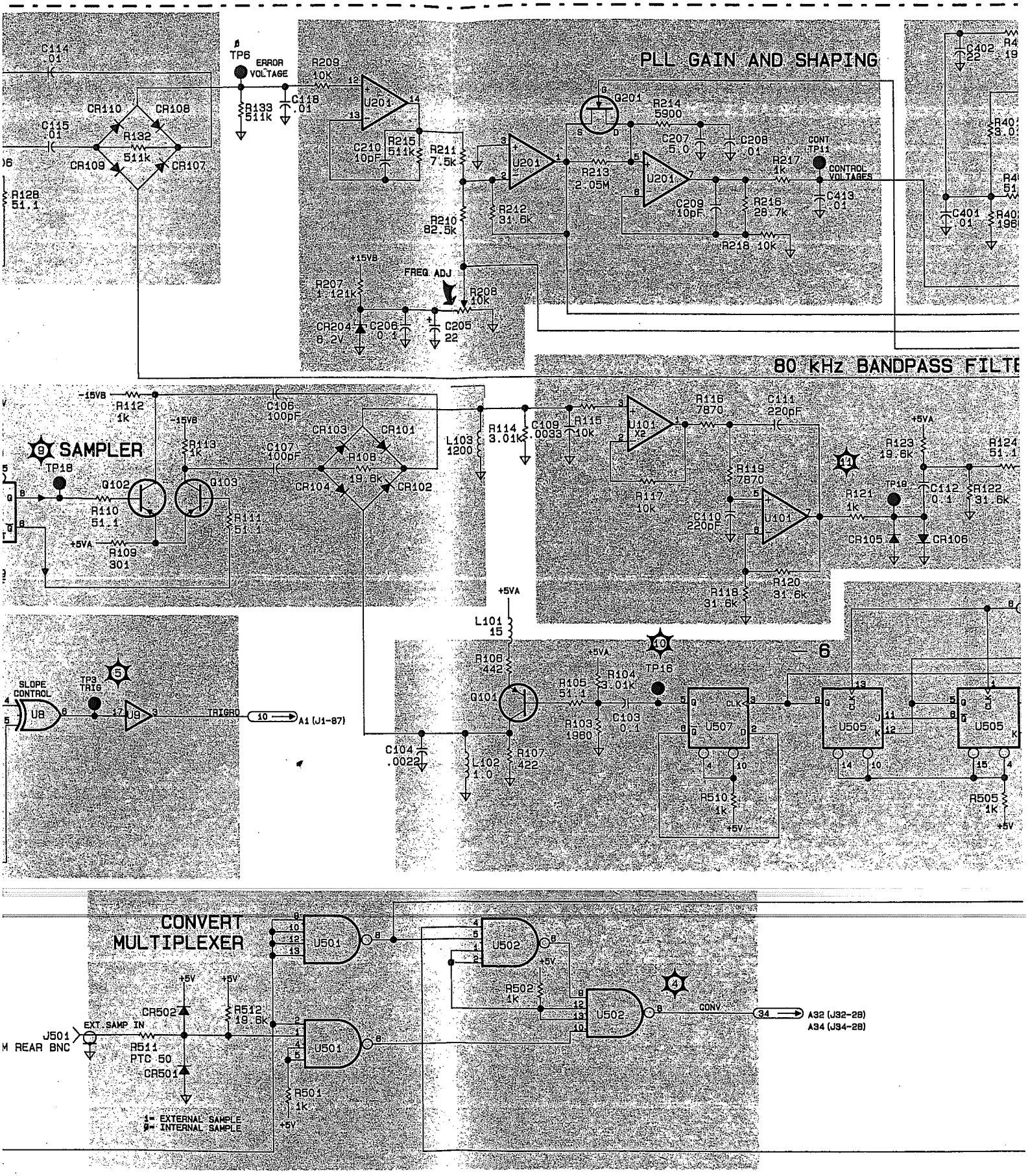


Figure 5-A31a Trigger Component Locator Revision A


PLL GAIN AND SHAPING
80 kHz BANDPASS FILTE
SAMPLER
CONVERT
MULTIPLEXER
TP6
ERROR VOLTAGE
FREQ ADJ
CONTROL VOLTAGES
TP18
TP19
TP16
TP3 TRIG
SLOPE CONTROL
TRIGRO
A1 (J1-87)
CONV
A32 (J32-28)
A34 (J34-28)
J501 M REAR BNC
EXT SAMP IN
1= EXTERNAL SAMPLE
0= INTERNAL SAMPLE
+15VB
-15VB
+5VA
+5V

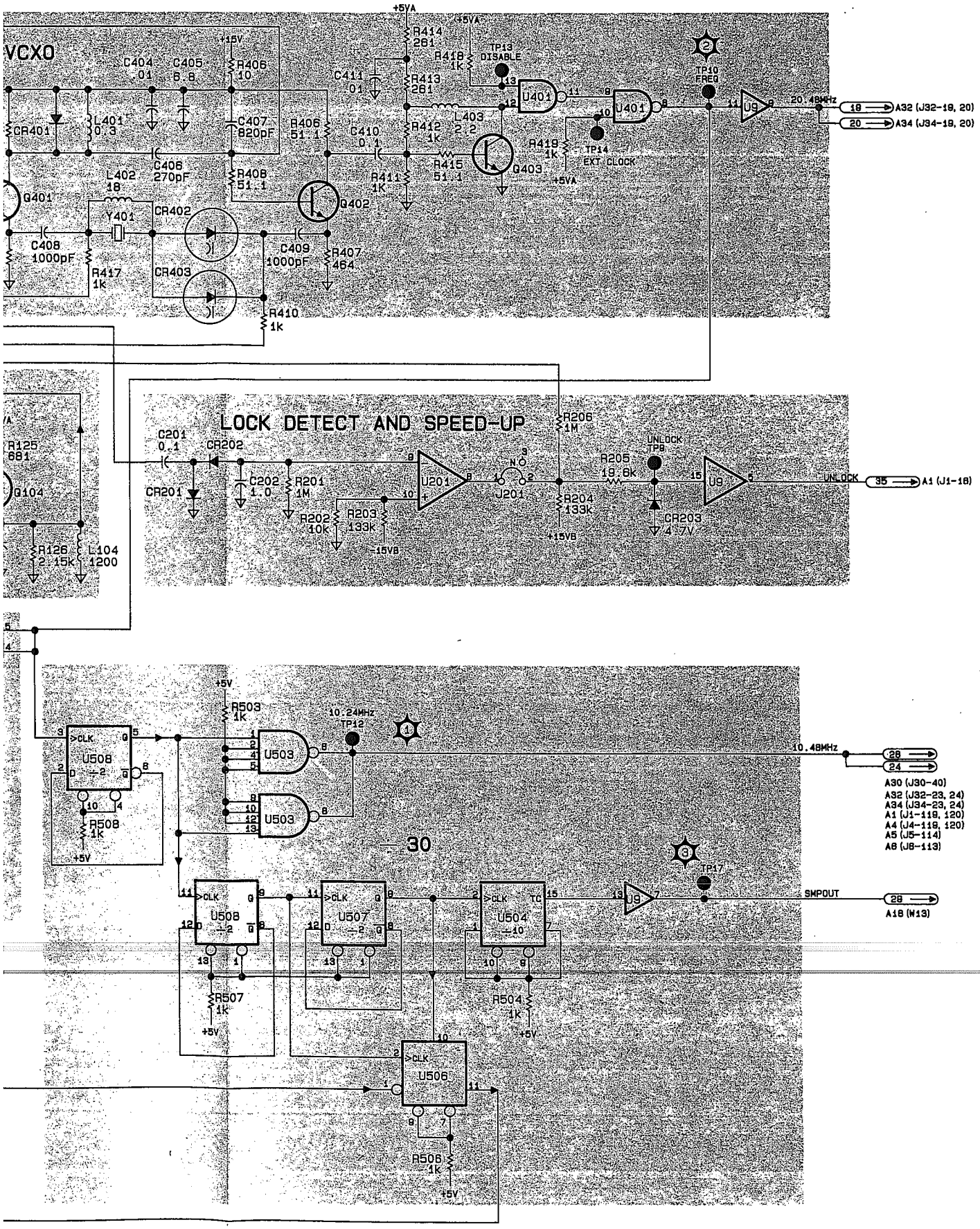


Figure 5-A31b Trigger Schematic Revision A

1. The following components are not on revision A:

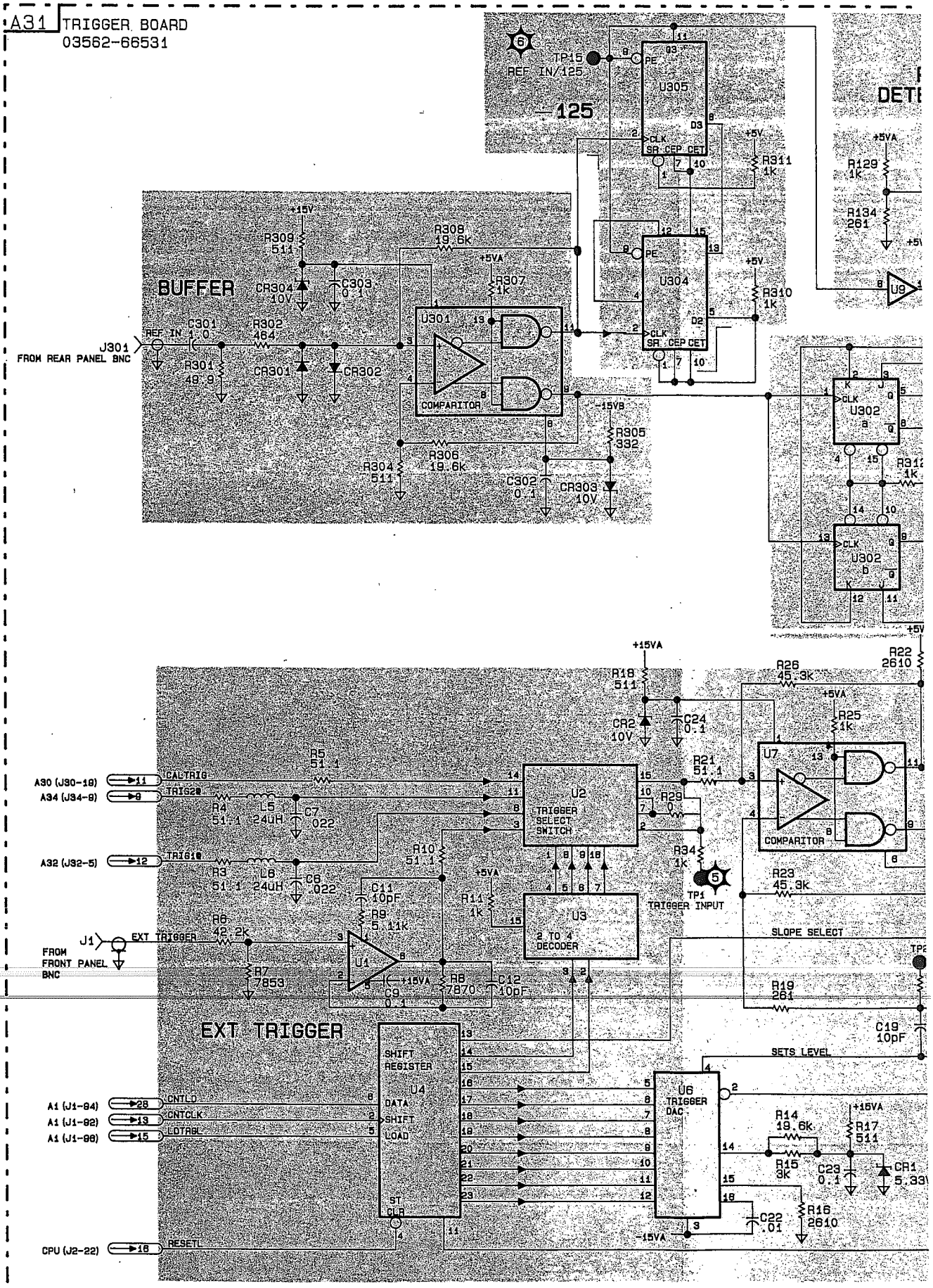
Reference	HP P/N
R209	0757-0442
R29	8150-3375
TP15-19	1251-0600

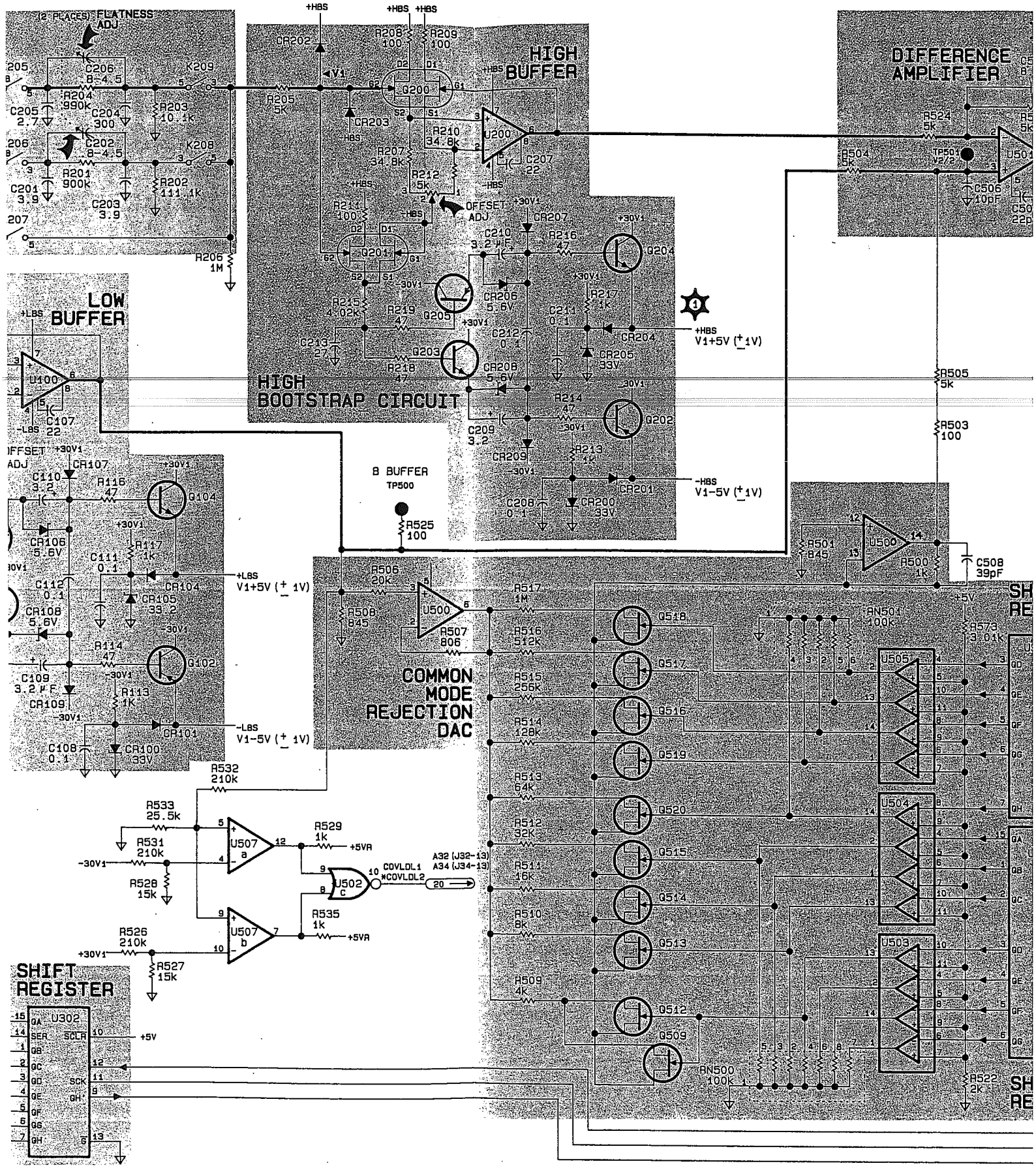
2. The following test locations on revision A correspond to the test points listed for revision B:

Revision A Test Location	Revision B Test Point
U305(11)	TP15
U507(5)	TP16
U9(7)	TP17
U303(8)	TP18
CR105 anode	TP19

3. The pulse width of REF IN/125 (A31 U305(11), TP15) is different.

A31 TRIGGER BOARD
03562-66531




(2 PLACES) FLATNESS ADJ
C206 8-45
K209
R204 990k
C205 2.7
C204 300
R203 10.1k
C202 8-45
K208
R201 900k
C201 3.9
C203 3.9
R202 111.1k
R206 1M
HIGH BUFFER
+HBS
-HBS
CR202
R208 100
R209 100
Q200
CR203
R205 5K
R210 34.8k
R207 34.8k
R212 5k
U200
C207 22
OFFSET ADJ
R211 100
Q201
+30V1
-30V1
C210 3.2µF
CR207
R216 47
Q204
R215 4.02k
R219 47
Q205
CR206 5.6V
R217 1k
C211 0.1
CR204
+HBS V1+5V (±1V)
C212 0.1
CR205 33V
C213 27
Q203
R218 47
CR208 5.6V
R214 47
Q202
C209 3.2
CR209
R213 1k
CR201
-HBS V1-5V (±1V)
C208 0.1
CR200 33V
HIGH BOOTSTRAP CIRCUIT
DIFFERENCE AMPLIFIER
R524 5k
R504 5k
TP501 V2/2
U501
C506 10pF
R505 5k
R503 100
LOW BUFFER
+LBS
-LBS
U100
C107 22
B BUFFER
TP500
R525 100
R506 20k
U500
R508 845
R507 806
COMMON MODE REJECTION DAC
R501 845
R500 1k
C508 39pF
CR107
C110 3.2
R116 47
Q104
CR106 5.6V
R117 1k
C111 0.1
CR104
+LBS V1+5V (± 1V)
C112 0.1
CR105 33.2
CR108 5.6V
R114 47
Q102
C109 3.2µF
CR109
R113 1k
CR101
-LBS V1-5V (± 1V)
C108 0.1
CR100 33V
R532 210k
R533 25.5k
R531 210k
R528 15k
U507 a
R529 1k
+5VR
U502 c
COVLDL1 *COVLDL2
A32 (J32-13) A34 (J34-13)
20
U507 b
R535 1k
R526 210k
R527 15k
R517 1M
R516 512k
R515 256k
R514 128k
R513 64k
R512 32k
R511 16k
R510 8k
R509 4k
Q518
Q517
Q516
Q519
Q520
Q515
Q514
Q513
Q512
Q509
RN501 100k
RN500 100k
R573 3.01k
U505
U504
U503
R522 2k
SHIFT REGISTER
U302
SCLR
SCK
SER
QA
QB
QC
QD
QE
QF
QG
QH
+5V

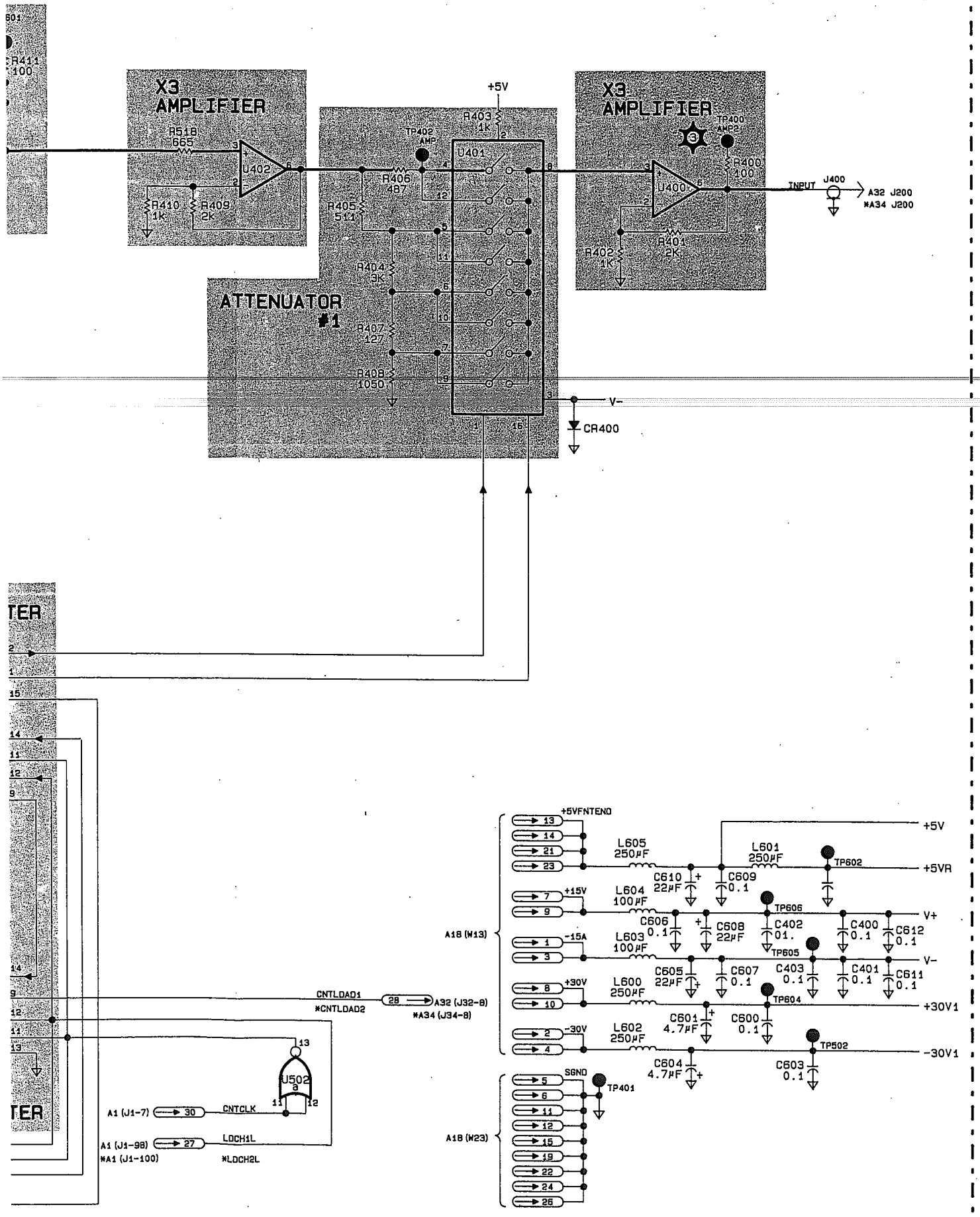
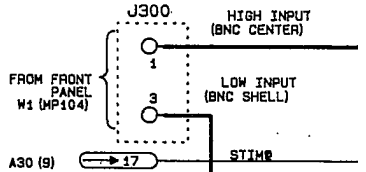
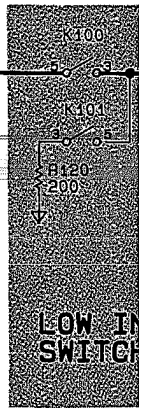
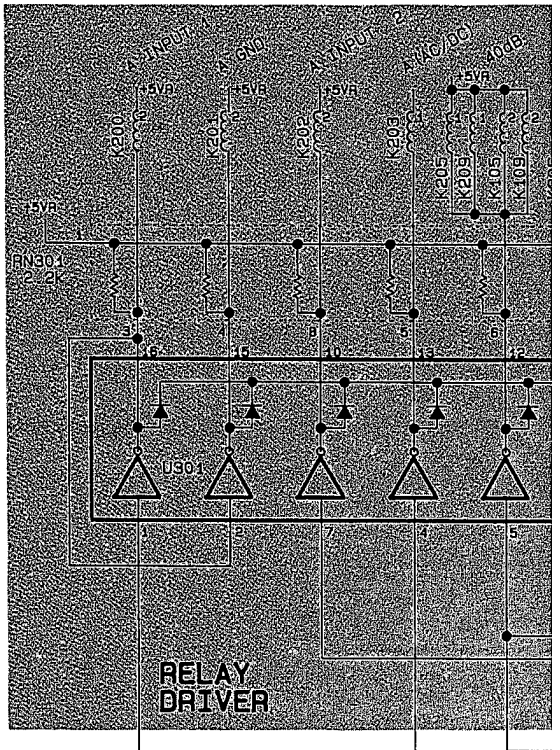


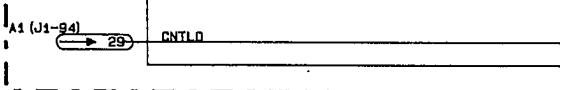
Figure 5-A33b Input Schematic Revision A

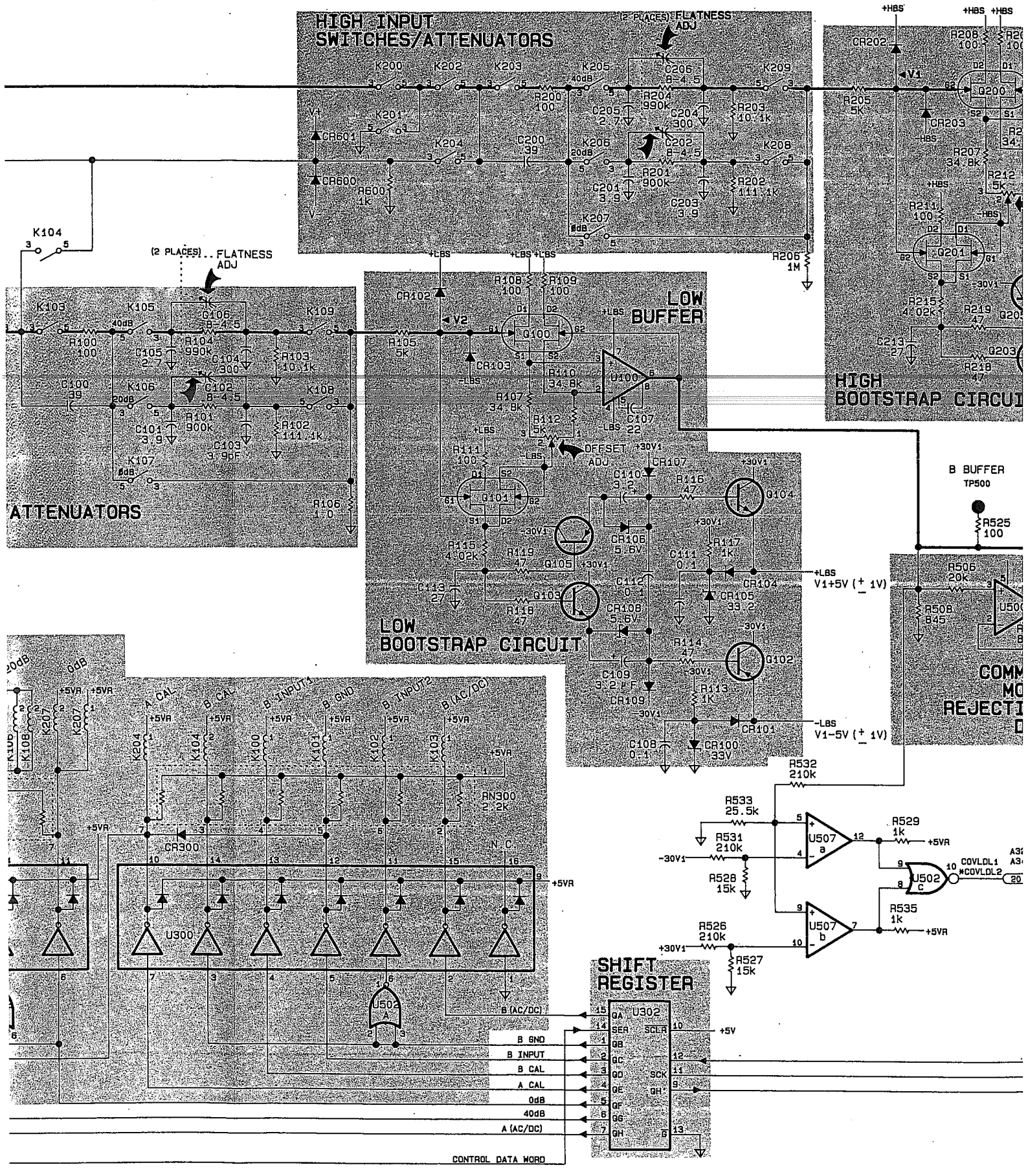
A33
A35 INPUT 1
03562-66533 REV A
INPUT 2
03562-66535
*WHERE NOTED










HIGH INPUT SWITCHES/ATTENUATORS
(2 PLACES) FLATNESS ADJ
K200
K202
K203
K205
K209
K201
K204
K206
K208
K207
K104
(2 PLACES) FLATNESS ADJ
K103
K105
K109
K106
K108
K107
ATTENUATORS
LOW BUFFER
OFFSET ADJ
LOW BOOTSTRAP CIRCUIT
HIGH BOOTSTRAP CIRCUI
B BUFFER
TP500
V1+5V (± 1V)
V1-5V (± 1V)
COMM MO REJECTI
SHIFT REGISTER
U300
U502
U507 a
U507 b
U502 c
U302
A CAL
B CAL
B INPUT1
B GND
B INPUT2
B (AC/DC)
0dB
40dB
A (AC/DC)
CONTROL DATA WORD
COVLDL1
COVLDL2

SECTION VI
CIRCUIT DESCRIPTIONS

Contents

Tables

Figures

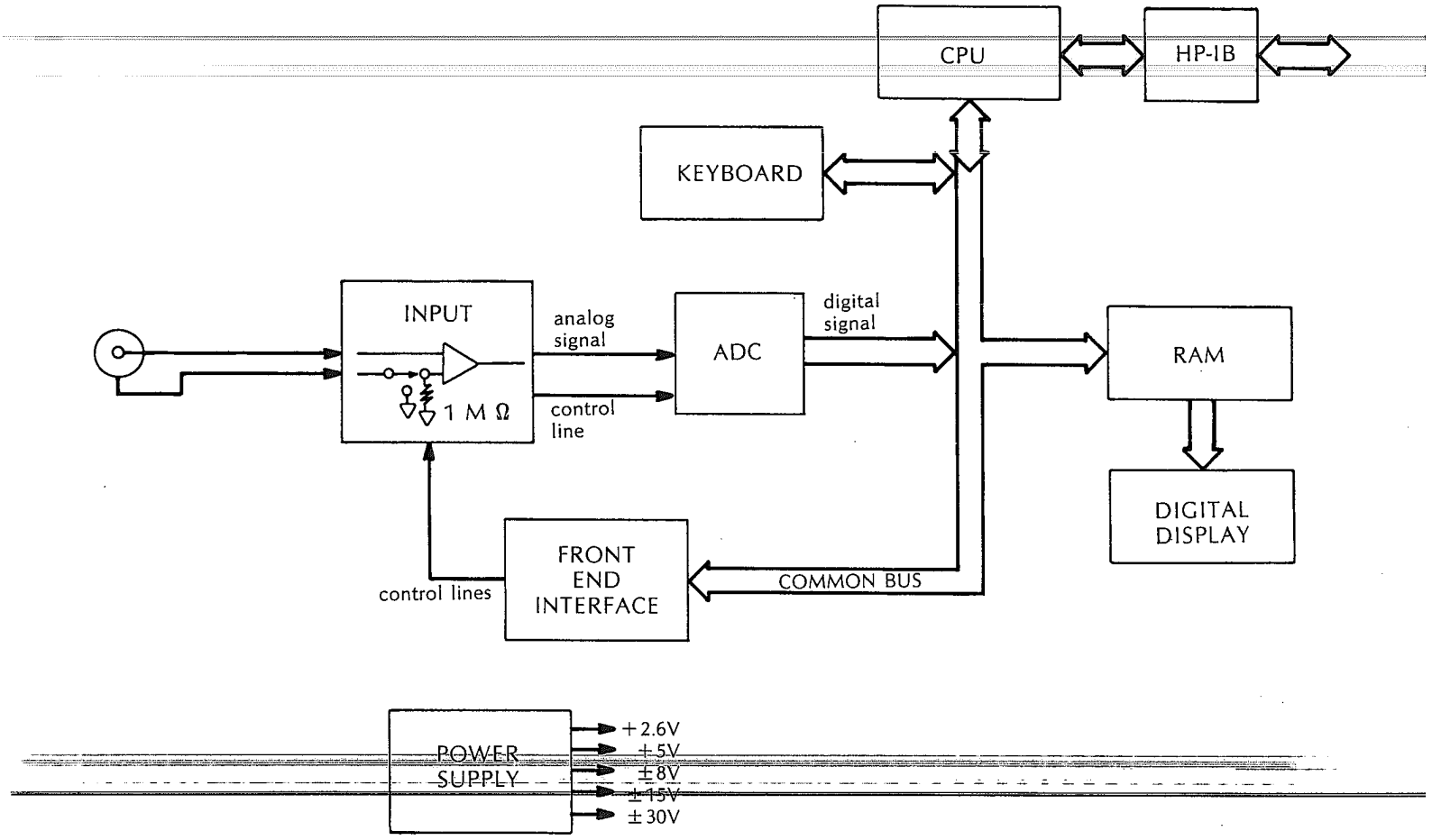


Figure 6-1 Waveform Recorder

SECTION VI
CIRCUIT DESCRIPTION

6-1 INTRODUCTION

This section provides the overall instrument description and the detailed description of each assembly to a functional block. The overall instrument description describes the interaction of the HP 3562A's individual assemblies. Use this section to gain an overall understanding of the HP 3562A's operation. Use the circuit descriptions along with the schematics in Section IX to understand the operation of an assembly. Refer to the end of this section for a description of the signals that operate between assemblies.

6-2 OVERALL INSTRUMENT DESCRIPTION

To understand the operation of the HP 3562A, the measurement it makes must be understood. The HP 3562A uses the Fast Fourier Transform (FFT) algorithm to make frequency domain measurements. The FFT algorithm takes time domain data and operates on it to produce a frequency spectrum. Recall that the Fourier transform, of which the FFT is a special case, states that all time domain waveforms can be represented as a summation of sine waves in the frequency domain.

Since the FFT is a special case of the more general Fourier transform, it requires special data collection requirements in order to operate. All the numerical values associated with the FFT such as sample rate, number of frequency data points, time required for a complete conversion, and others are all related to powers of two. For example, a time record is defined to be N consecutive, equally spaced samples of the input where N is a multiple of 2. This time record is transformed as a complete block into a complete block of frequency lines. With a Dynamic Signal Analyzer we do not get a valid result until a full time record has been gathered.

Taking a simple look at an FFT dynamic signal analyzer, the hardware can be characterized as a digital waveform recorder with a great amount of computation power. This view is illustrated by the waveform recorder diagram in figure 6-1.

In the waveform recorder, the signal is fed into the input assembly for proper amplitude scaling and then converted to digital data by the ADC (Analog to Digital Converter) assembly. The input and ADC assemblies receive the signals to control the amplitude scaling and conversion from the front end interface. The front end interface is programmed directly from the CPU (Central Processing Unit). The digital output of the ADC is then stored into RAM and displayed. HP-IB is included for remote control and a keyboard for local control.

In figure 6-2, the instrument is expanded to include two separate input sections and ADCs. A source is also included to make network measurements. All measurement assemblies are connected to the CPU through a common bus.

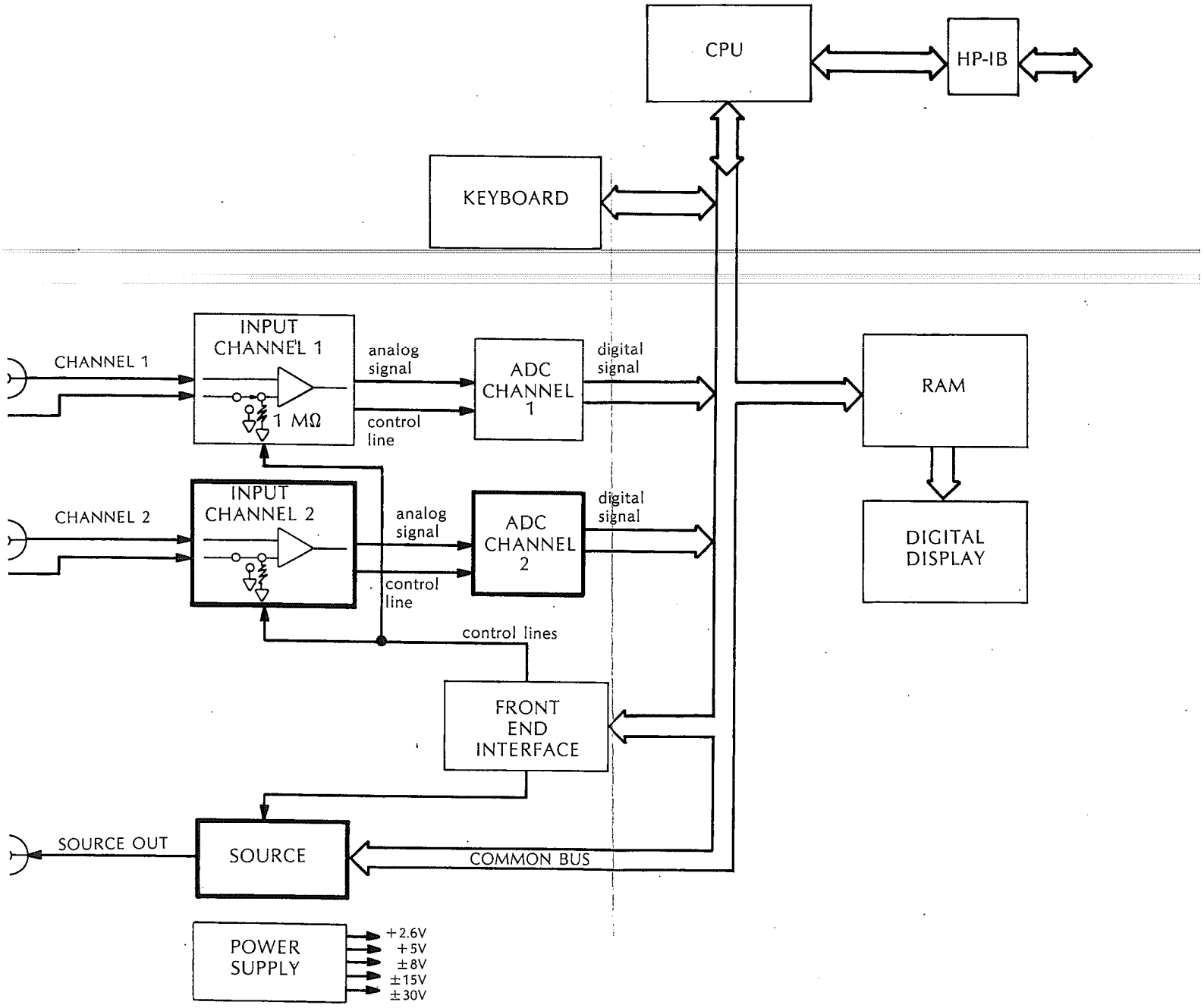


Figure 6-2 Two Channel Waveform Recorder with Source

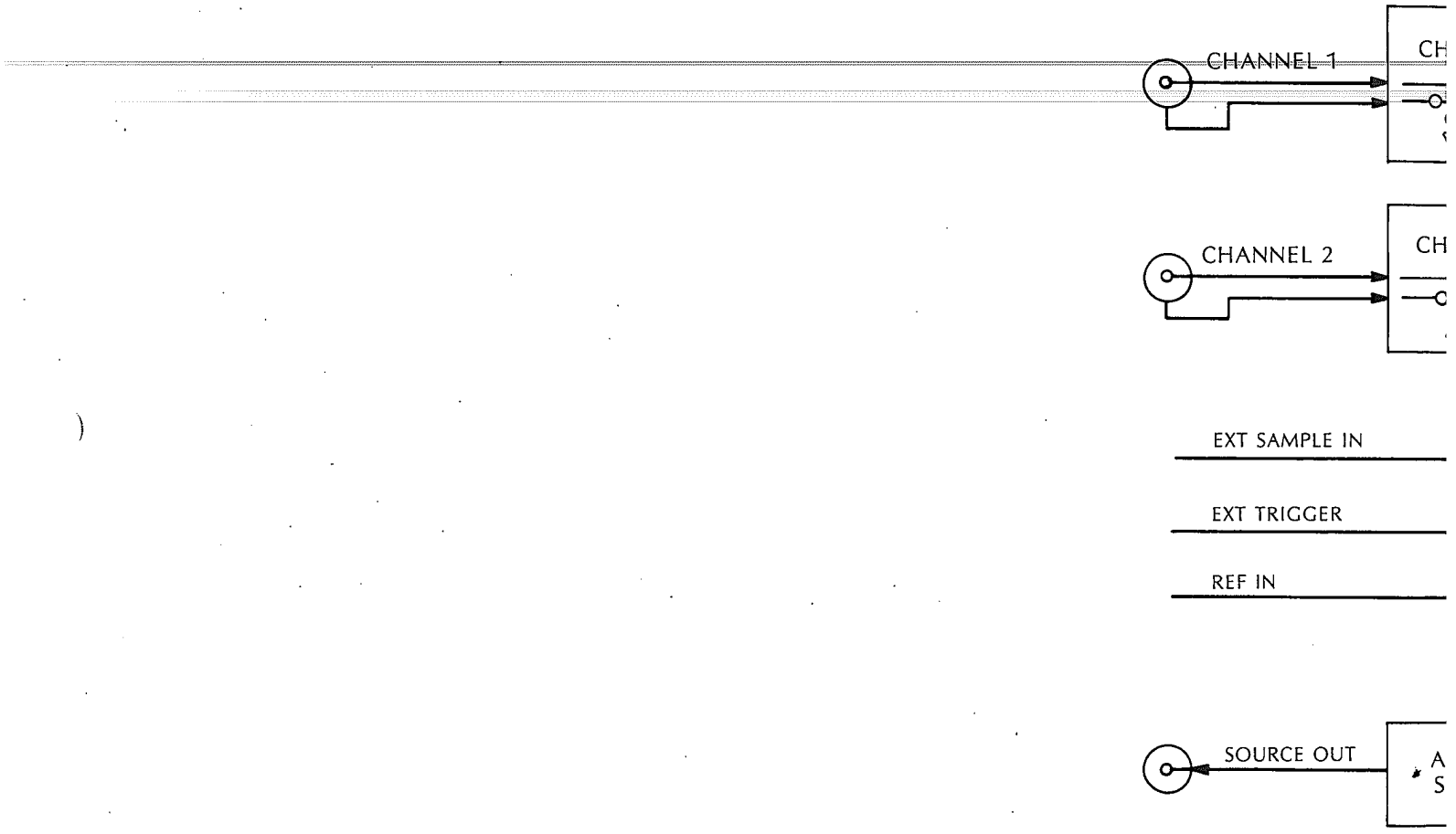
In figure 6-3, the two channel waveform recorder is converted into a two channel, fixed span, dynamic signal analyzer with source by adding the digital filter, FFT, and FPP (Floating Point Transform Processor) assemblies. The digital filter allows the user to look at the input spectrum with different resolution bandwidths and different shaped resolution bandwidth filters. The FFT assembly operates on the digital data out of the digital filter to provide a frequency domain representation of the input signal. The FFT data is stored in the RAM and displayed. The FPP is a bit slice processor which makes all the fast numerical calculations. A digital source assembly is added to simplify the CPU bus structure. This assembly controls all the digital settings for the input, ADC, and source assemblies. The CPU is now dedicated to supervising and controlling the operations of the instrument.

In figure 6-3, a trigger assembly was also added. The trigger assembly allows the instrument to operate in external trigger, external reference in, and external sample modes.

In figure 6-4, the analyzer becomes the HP 3562A by adding the local oscillator and program ROM assemblies. The local oscillator provides digital sine and cosine signals for the digital source and digital filter. The digital source distributes the digital sine to the analog source assembly for conversion to an analog signal. The digital filter uses the sine and cosine signals for zoom measurements. In a zoom measurement, a narrow frequency span is selected (<100 kHz) for a high resolution close-up shot of a frequency spectrum.

The program ROM assembly was added to give the instrument more program memory space. The common bus was split into two bus structures: the system data bus and the global data bus. The system bus is used to transfer commands from the system CPU to the other assemblies. The global bus is used to transfer measurement data between the assemblies.

In the HP 3562A process control is distributed away from the system CPU. Each assembly has its own processor or state machine which controls its local operations. The system CPU tells each assembly which process to execute and monitors the overall functioning and data processing of the instrument.


CHANNEL 1
CH
CHANNEL 2
CH
EXT SAMPLE IN
EXT TRIGGER
REF IN
SOURCE OUT
A
S

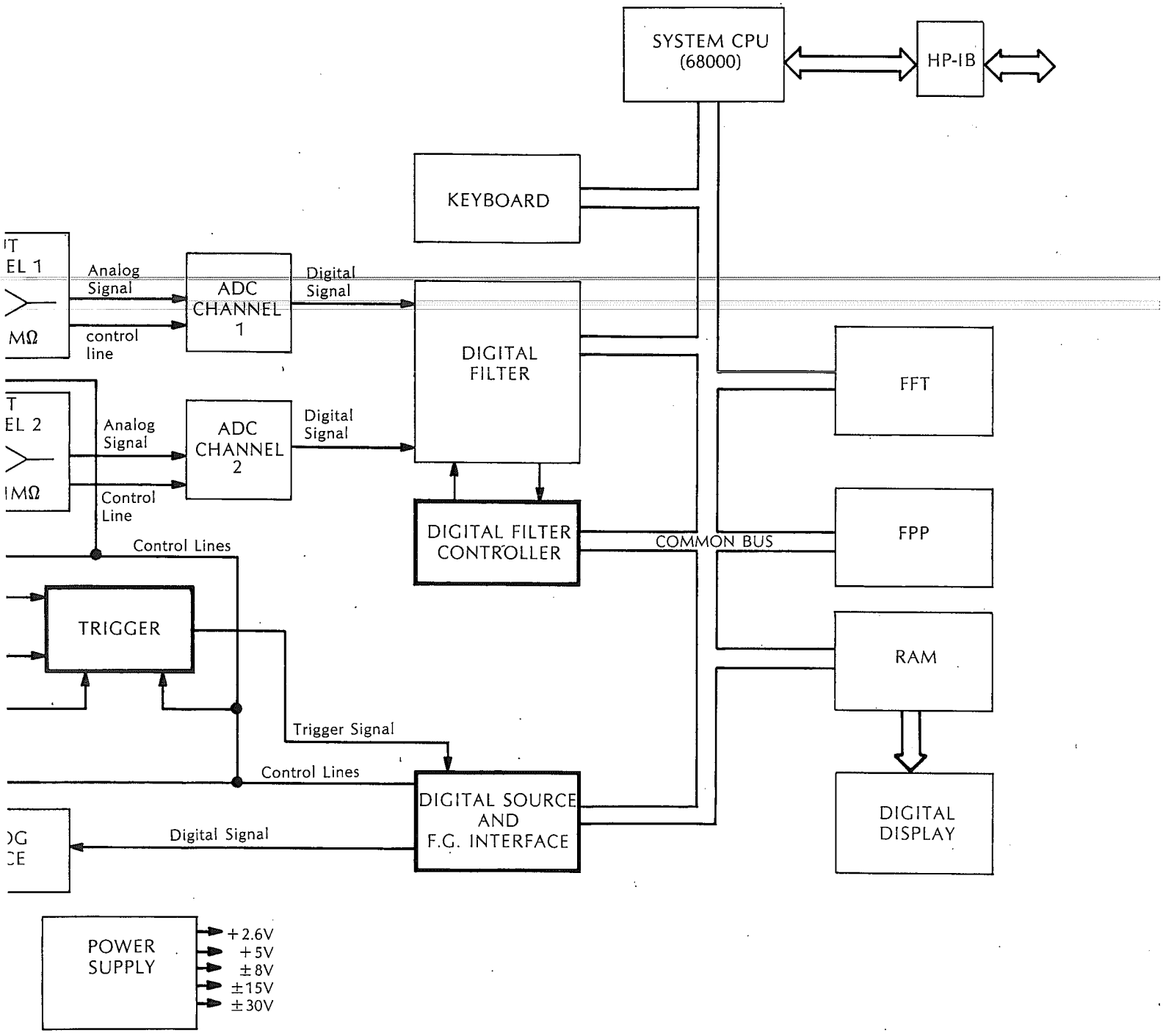
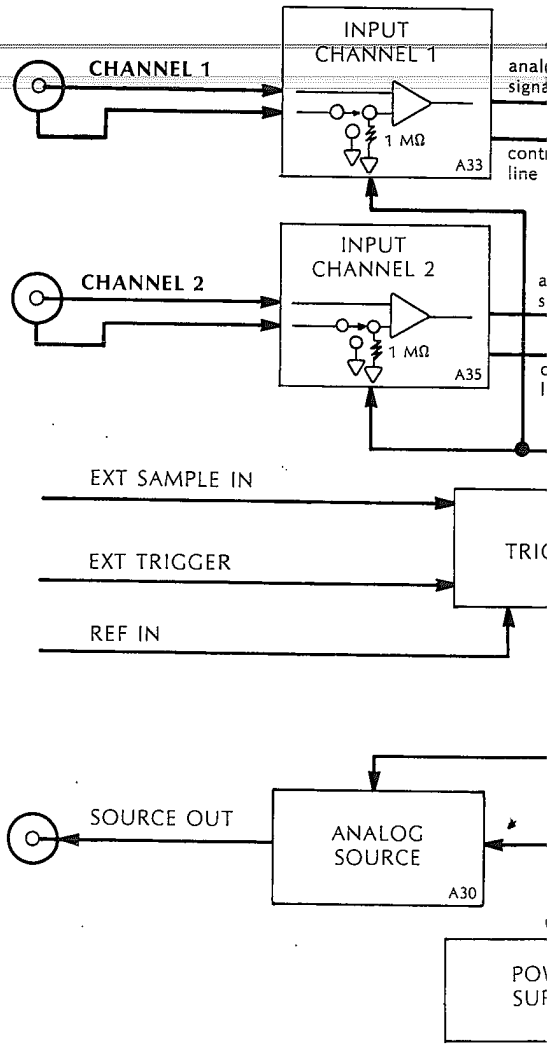


Figure 6-3 Two Channel Fixed Span Analyzer with Source


INPUT
CHANNEL 1
CHANNEL 1
1 MΩ
A33
INPUT
CHANNEL 2
CHANNEL 2
1 MΩ
A35
EXT SAMPLE IN
EXT TRIGGER
REF IN
SOURCE OUT
ANALOG
SOURCE
A30

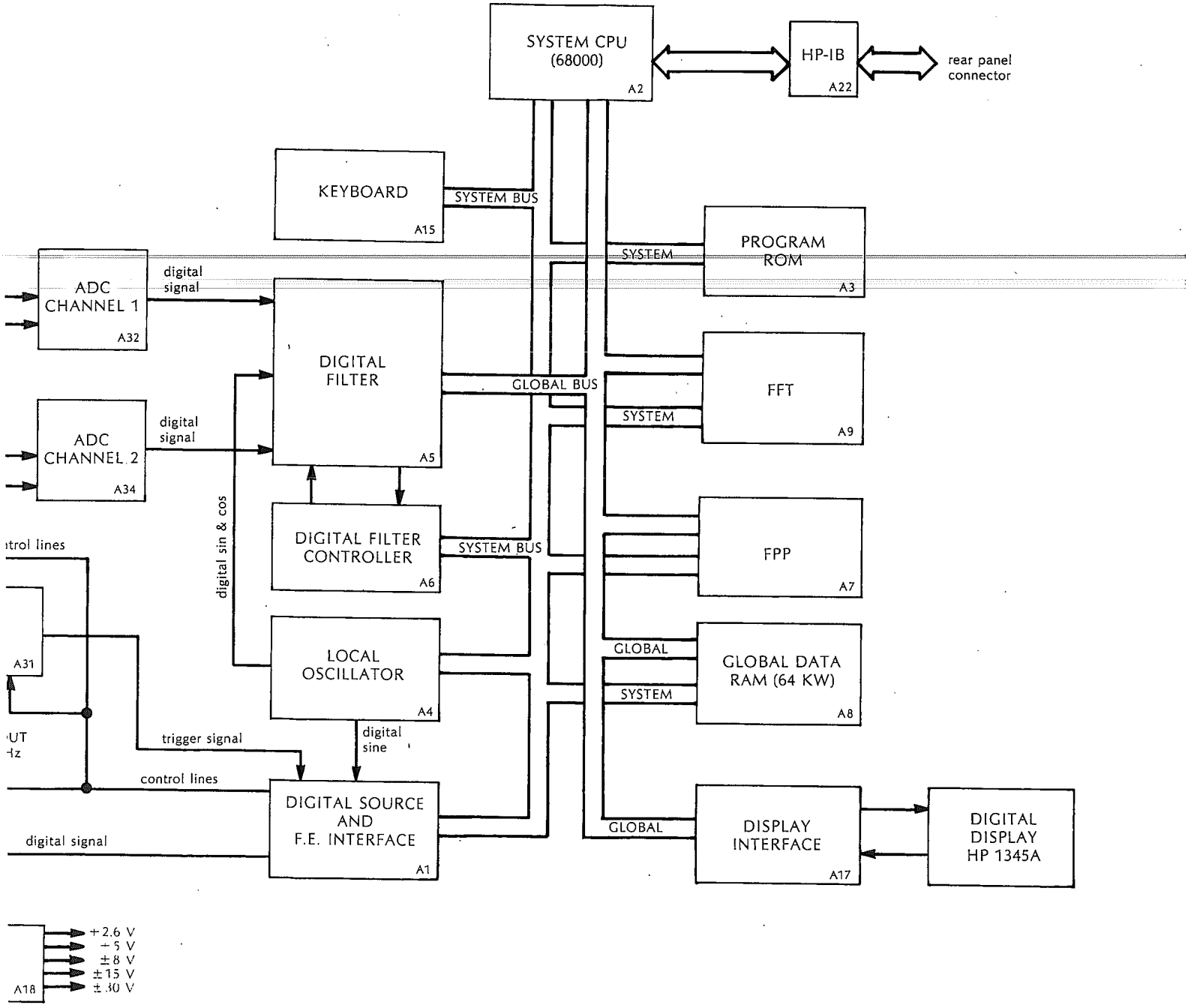
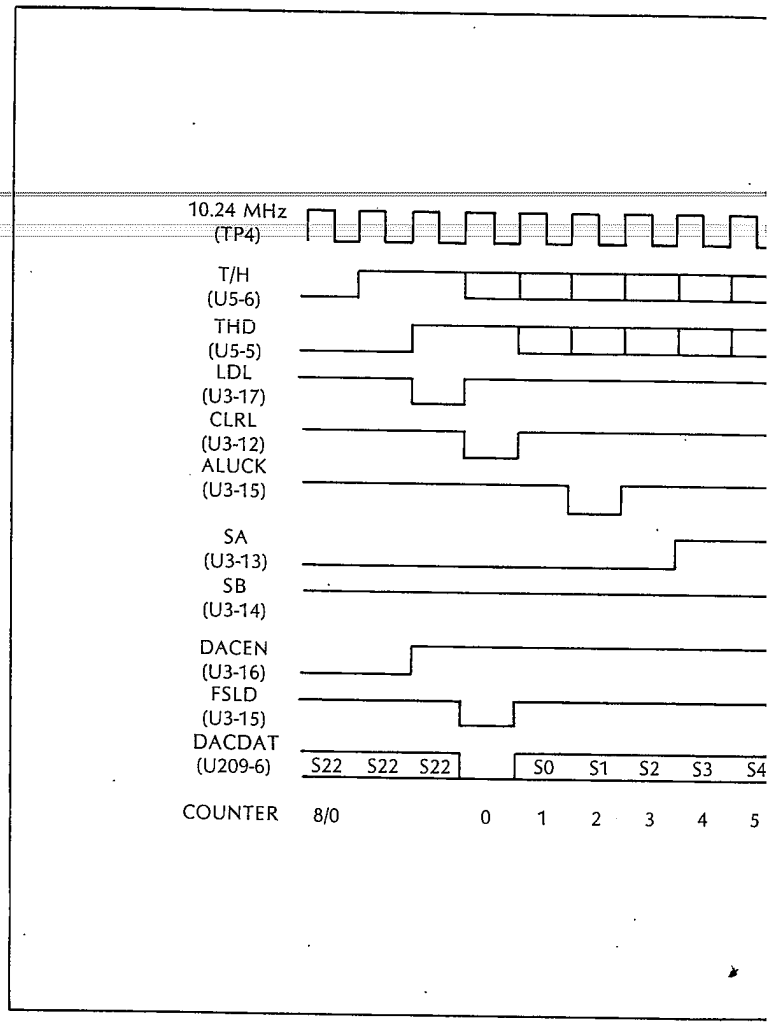


Figure 6-4 HP 3562A Block Diagram


10.24 MHz
(TP4)
T/H
(U5-6)
THD
(U5-5)
LDL
(U3-17)
CLRL
(U3-12)
ALUCK
(U3-15)
SA
(U3-13)
SB
(U3-14)
DACEN
(U3-16)
FSLD
(U3-15)
DACDAT
(U209-6)
S22 S22 S22 S0 S1 S2 S3 S4
COUNTER
8/0 0 1 2 3 4 5

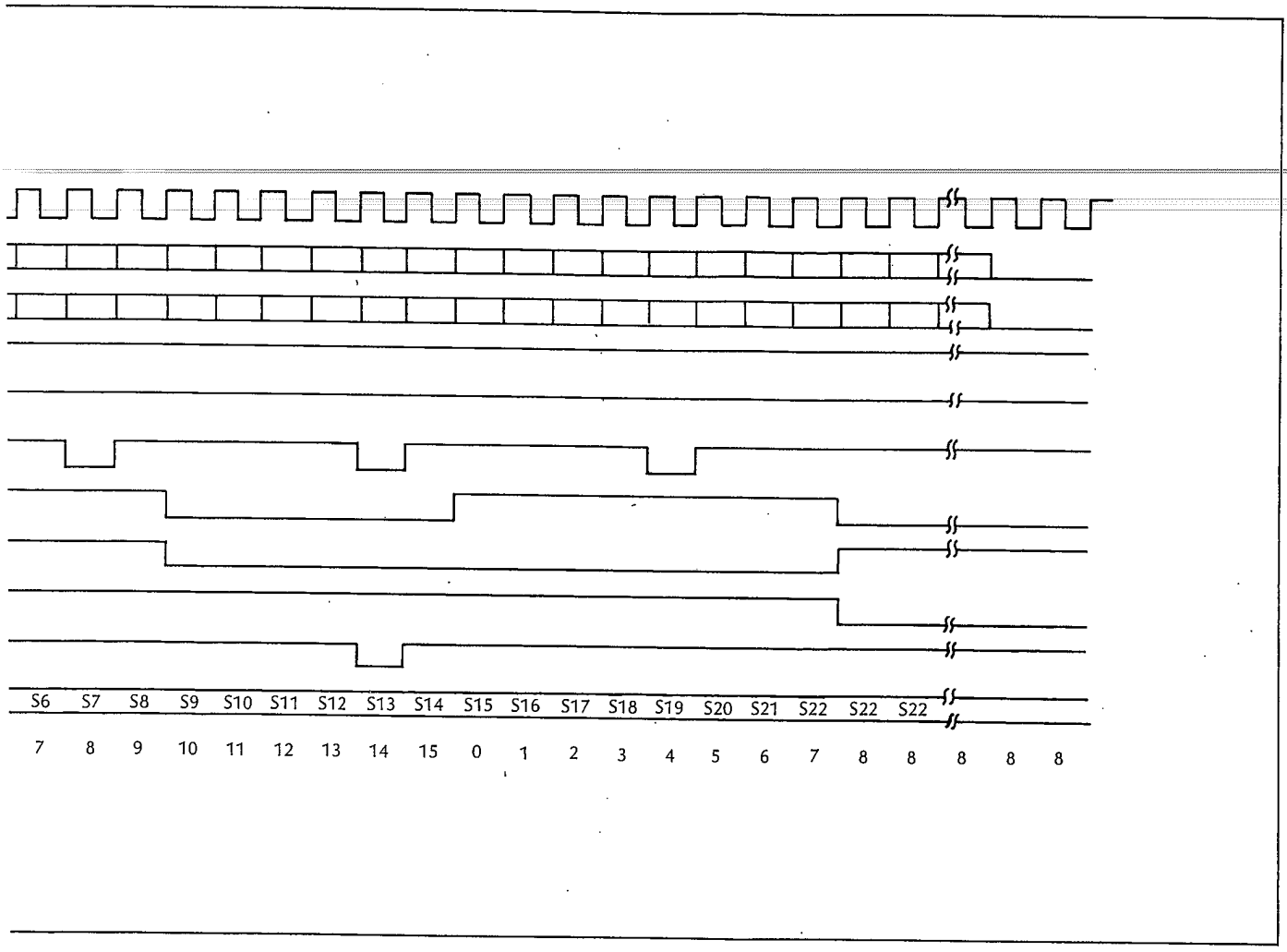
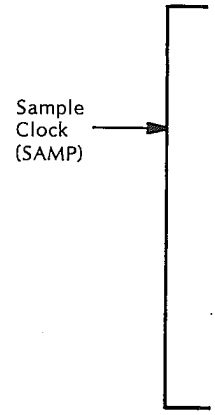
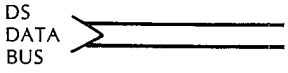


Figure 6-A1a Digital Source Timing





NOTE: FULL SPA
BASE BAI
MODE

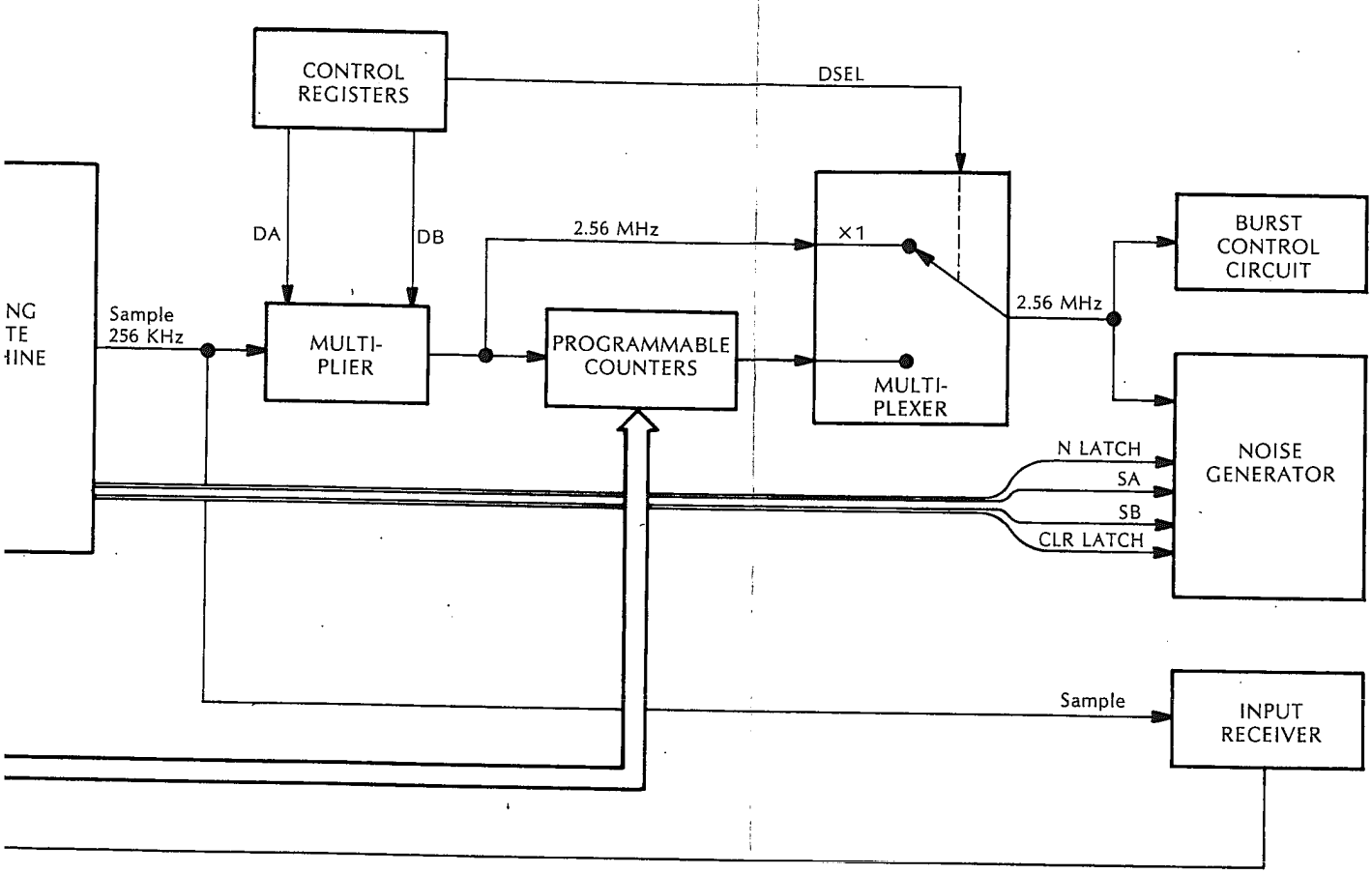


Figure 6-A1b Timing Control Circuit

Phase Resolution Circuit

(Refer to figure 6-A1c) The phase resolution circuit is used in external and internal triggered measurements. This circuit insures that the phase of a triggered measurement is accurate. Since the trigger moment does not always occur on a sample and hold edge (SAMP), there is a time delay and a phase error in the data. The phase resolution circuit counts the time between samples and the time between a sample and a trigger. It puts this information on the DS data bus which is read by the system CPU.

The ARML signal from the A6 Digital Filter Controller initializes the phase circuit and starts the trigger measurement process. This signal is only active when a triggered measurement is made. When the phase resolution circuit receives this signal, it sets BFST low and waits for the next sample clock (SAMP) from the ADC board. On the next sample clock the phase circuit starts counting and counts until a trigger signal (TRIGROL, REMTGL, SWTRIG, or BURSTRIG) is received. If another sample clock is received before the trigger signal, the phase state machine starts the count over and continues to wait for the trigger signal, clearing the counters each time a sample clock is received. When a trigger signal is received, the counters latch the first count into their output registers and continue counting until the next sample clock. On the next sample clock after the trigger signal, the second count is latched into the counters' output registers. BFST signal is then sent to the digital filter controller telling it to start taking data.

The phase resolution circuit now has a count between sample points and a count between the first sample point and the trigger point. When the RDPH1L or RDPH2L signal from the device decoder PAL becomes active, the phase resolution circuit puts the requested count on the DS data bus. The timing information is held until the next ARML signal is received or until it is read by the system CPU.

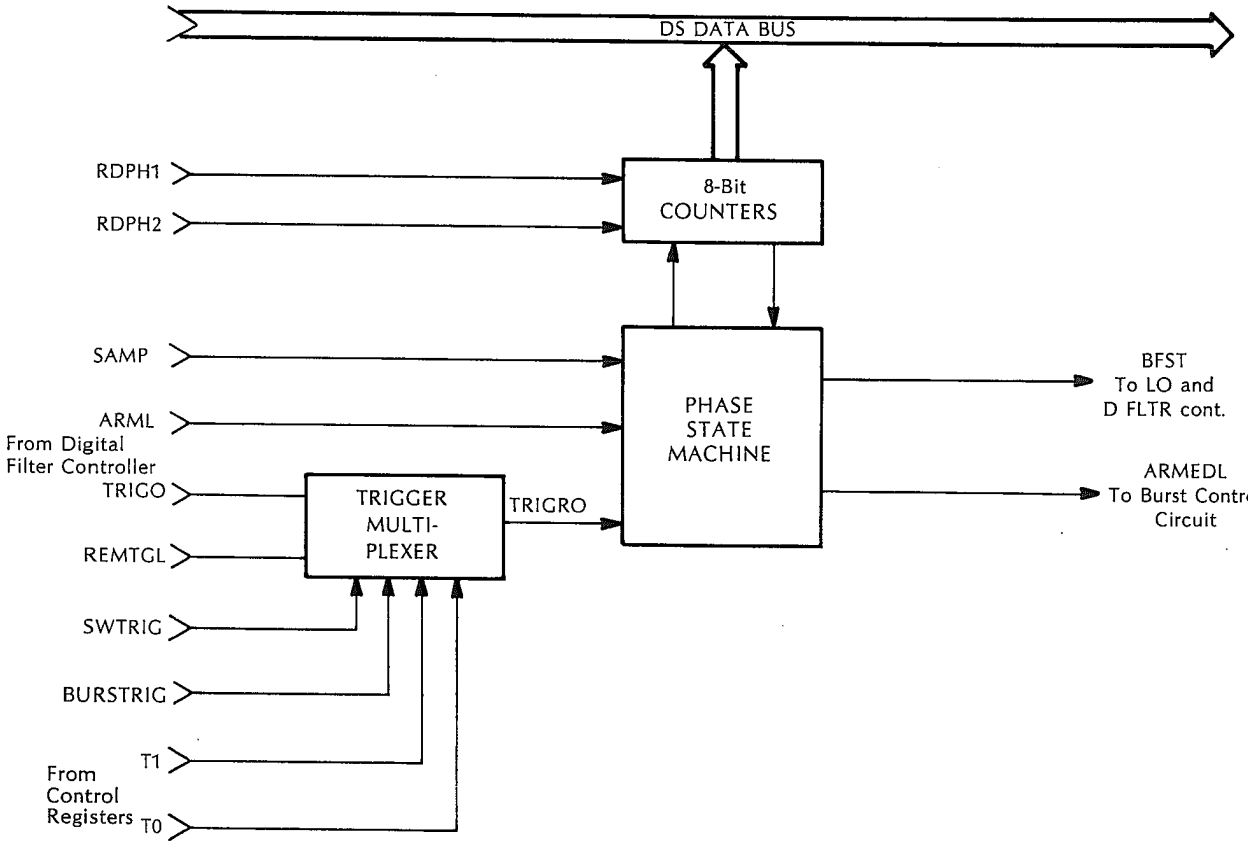


Figure 6-A1c Phase Resolution Circuit

Burst Control Circuit

(Refer to figure 6-A1d) The burst control circuit controls the burst length and generates the pulse signal (NCLK) to the local oscillator. It provides the gating signal (BURSTEN) that gates the analog source on and off during the burst and chirp modes. The burst control circuit also provides the SYNC OUT signal to the rear panel. This signal is high when the burst is on and is low when the burst is off.

When SELCNTERSL is active and WRITEL is low, a data word from the system CPU is latched into the programmable counters to set the time the burst is on and off. After the counters are programmed, the CONT signal from the control registers to the burst gate goes low. In freerun mode the freerun bit (U102-9) is set and the burst counters count blocks. The burst control circuit then gates the analog source on and off. In the triggered mode, the burst process starts when the ARMEDL signal from the phase resolution circuit goes low. The counters only count when ARMEDL is low. The ARMEDL signal also causes the burst control circuit to send the NCLK signal to the local oscillator. When NCLK is received by the local oscillator, the LO is set to the starting frequency of the burst. The local oscillator sends data (NDAT) to the digital source synchronized to NCLK. The data is processed by the LO input receiver and multiplier. DACDAT data is sent to the analog source at the same time the burst control circuit turns on the analog source.

After the burst is completed, the burst state machine checks to see if the ARMEDL signal is still active. If ARMEDL is active, the process repeats. All burst control operations are synchronized to the sample and trigger signals by the timing control circuit and the ARMEDL signal.

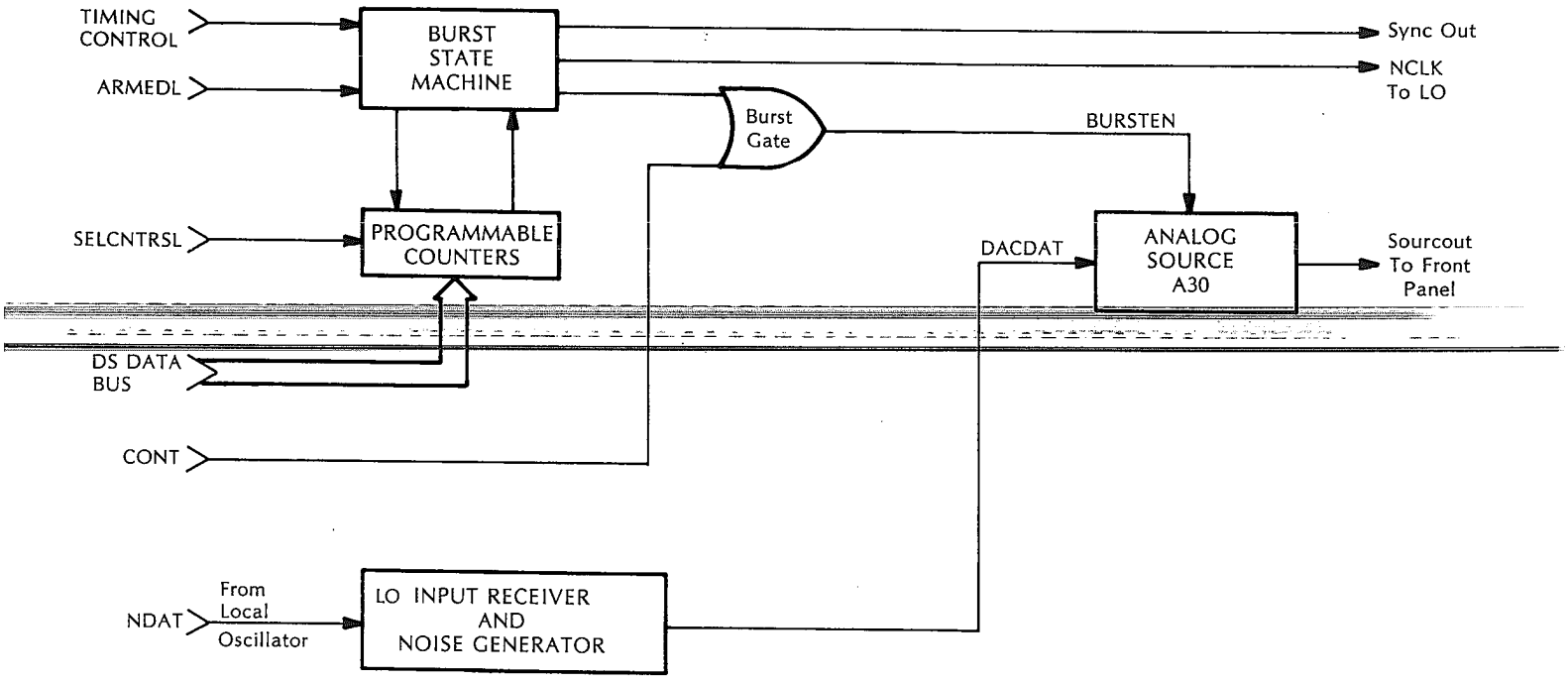


Figure 6-A1d Burst Control Circuit

LO Input Receiver

(Refer to figure 6-A1e) The purpose of the LO input receiver is to synchronize the local oscillator input data (NDAT) to the sample rate (SAMP). This is necessary because in external sample mode the LO data does not come at a regular rate. To synchronize the data to the sample rate, the LO input receiver shifts the serial data in and converts it to parallel data. The LO input receiver then clocks this data using the SAMPLE signal from the timing control circuit. After the data is synchronized, it is converted back to serial data and sent to the multiplier.

Multiplier

The multiplier is used to multiply the LO data by the noise and send it to the analog source. This is done with a parallel noise word and a serial LO word. This provides the means for frequency shifting the noise. When in zoom mode, the frequency shifting process shifts the center of the noise power frequency band to the frequency of the sine data from the local oscillator. When in chirp or sine mode, the output of the noise generator if forced to a constant so that LO data is passed through the multiplier with only an inversion.

Noise Generator

The noise generator produces a binary random sequence that is used for band-limited random noise and burst noise signals. The noise generator is a 32-bit shift register with feedback to generate a pseudorandom sequence. This sequence is multiplied by a squared analog random signal. This randomizes the feedback of the shift register. The analog random noise is a zener diode biased so that it is barely on and is thus noisy. The output of the zener diode is amplified until it is at a high enough level to square up. The noise filter is used to produce noise with necessary bandwidth. The bandwidth is determined by the rate that the noise is shifted into the noise filter. The rate the noise is shifted into the noise filter is determined by the effective sample rate.

The output of the noise generator is parallel loaded into the multiplier and mixed with the data from the local oscillator. This process is controlled by the timing state machine.

Internal Signal Descriptions

ARMEDL ARMED Active Low
Signal from the phase resolution circuit to the status register and the burst control circuit. ARMEDL goes low on the first sample point following the ARML signal It goes high after the trigger point.

BRST BURST RESET
Used to abort a burst in the burst control circuit. When low BRST causes the A30 Analog Source to output zero if the instrument is in the burst mode. This signal should be high for normal operation.

BUSYL PHASE COUNTERS BUSY
Active Low
This signal from the phase counters goes low after an ARML has occurred and goes high after the counters finish counting. BUSYL is sent to the status registers.

C10FSE 10x EFFECTIVE SAMPLE RATE CLOCK
In baseband mode this clock occurs at 10 times the effective sample rate.

CHIRPL CHIRP
Active Low
When this control signal is low, the sinusoidal signal from the A4 Local oscillator is passed through the digital source board without mixing with the random noise.

CNTRL BUSY CONTROL BUSY
This is the digital source handshake signal for sending the control data word (CNTLD). If it is "1', the digital source is sending the word. If it is "0', the digital source is ready to send another control data word. This signal is from the control register to the status registers.

CONT CONTINUOUS
When this control signal is high, the digital source keeps the A30 Analog Source enabled. When low, the analog source is gated by the burst control circuit.

CONTROL CONTROL
Signal from the device decoder PAL that latches the control word from the DS data bus.

COUNTENL COUNT ENABLE
Active Low
ARML starts the phase state machine which sets sets COUNTENL low and the counters start counting.

DA, DB DA, DB
These two signals from the control registers set the effective sample rate multipliers.

Example Frequency Spans	DA (U1-3)	DB (U4-12)	MULT (U1)	DSEL (U101-2)
1 kHz	0	0	x 1	1
3.125 kHz	0	1	x 2	1
10 kHz	1	0	x 5	1
100 kHz	1	1	x10	0
20 kHz	1	0	x 5	0
50 kHz	0	1	x 2	0

DESTA DESTINATION A, DESTINATION B
DESTB These control signals determine where the serial control word (CNTLD) is sent.

DESTA	DESTB	Assembly
0	0	A30 Analog Source (LDSRC)
0	1	A31 Trigger (LDTRG)
1	0	A33 Channel 1 & A32 ADC 1 (LDCH1)
1	1	A35 Channel 2 & A34 ADC 2 (LDCH2)

DMID MIDDLE DATA
DMID is the A4 Local Oscillator input signal before the multiplier. This signal goes to the status register.

DSA START DSA START, DSA STOP
DSA STOP These control signals are used for the signature analysis start and stop bits.

DSEL DIVIDER SELECT
Signal from the control registers that selects the multiplied sample rate or the divided sample rate for the burst control circuit and the noise generator. A high selects the divided sample rate. (Refer to DA, DB for chart)

ENLDL ENABLE LOAD
Active Low
Enable load from the control registers determines when the serial command word (CNTLD) is sent to the A30 Analog Source, the A31 Trigger, The A33, A35 Input boards, or the A32, A34 ADC boards.

FREERUN FREERUN
Signal from the control registers. When in the freerun mode, this signal is high.

LDCH1 LOAD
LDCH2 These signals are used to monitor the load pulses to the analog assemblies.
LDTRG
LDSRC

NSR NOISE SHIFT REGISTER DATA
This is the data that is shifted into the noise filter. In normal operation this includes the addition of the analog random noise. The analog random noise is disabled in the test mode.

SELCNTRSL SELECT COUNTERS
Active Low
This signal from the device decoder PAL along with DSA1 and DSA2 enables the counters for programming.

STATUSL STATUS
When STEST is active, the digital source is in the self-test mode. STEST is from the device decoder PAL to the test register. STEST latches the self-test data word into the test register.

SWARML SOFTWARE ARM
Active Low
Signal from the control registers that overrides the software arming of the phase counters and the buffer start. This signal is used for self-test and should be high in normal operation.

SWTRIG SOFTWARE TRIGGER
If SWTRIG is selected with T1 and T0, a trigger occurs on the low to high transition of the SWTRIG signal.

T0 TRIGGER SELECT
T1 T0 and T1 select where the trigger signal will come from.

T0	T1	Trigger Source
0	0	A31 Trigger Board (TRIGRO)
0	1	HP-IB Trigger (REMTGL)
1	0	Software Trigger (SWTRIG)
1	1	Source Trigger (BURSTRIG)

The system CPU may initiate a trigger by setting SWTRIG low, then high.

T10M TEST 10 MHz CLOCK
In the digital source self-test mode this signal becomes the 10 MHz clock, the LO serial data clock, and the serial data shift clock.

TDREQ DATA REQUEST
This signal is used when in the self-test mode as the data request line.

TEST TEST
This signal enables the self-test signals to be multiplexed into the data paths and clock lines. This signal must be low for the assembly to function in the normal mode.

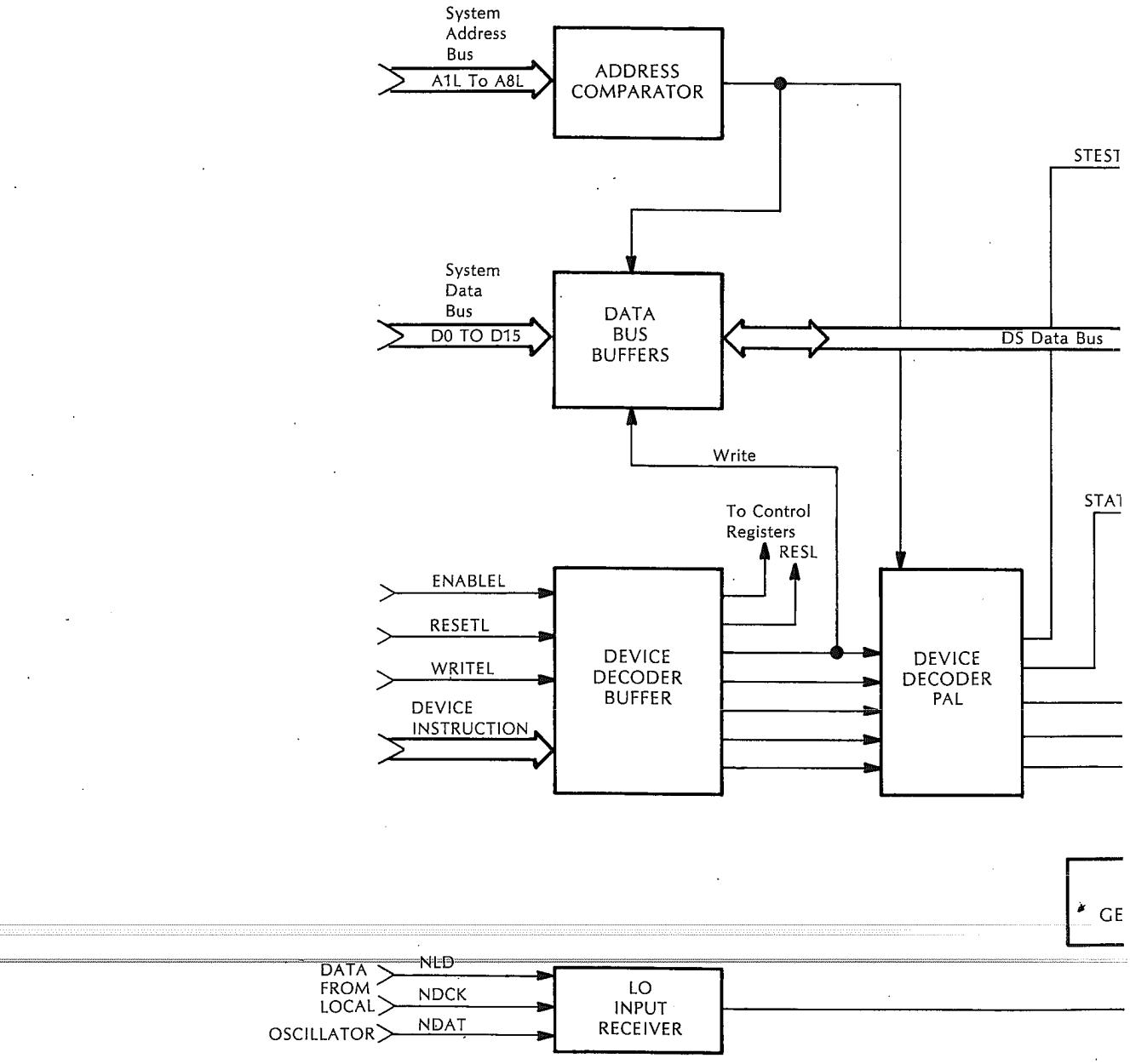
TLODAT TEST LOCAL OSCILLATOR DATA
This signal is used as the LO serial data for the self-test instead of using LO data.

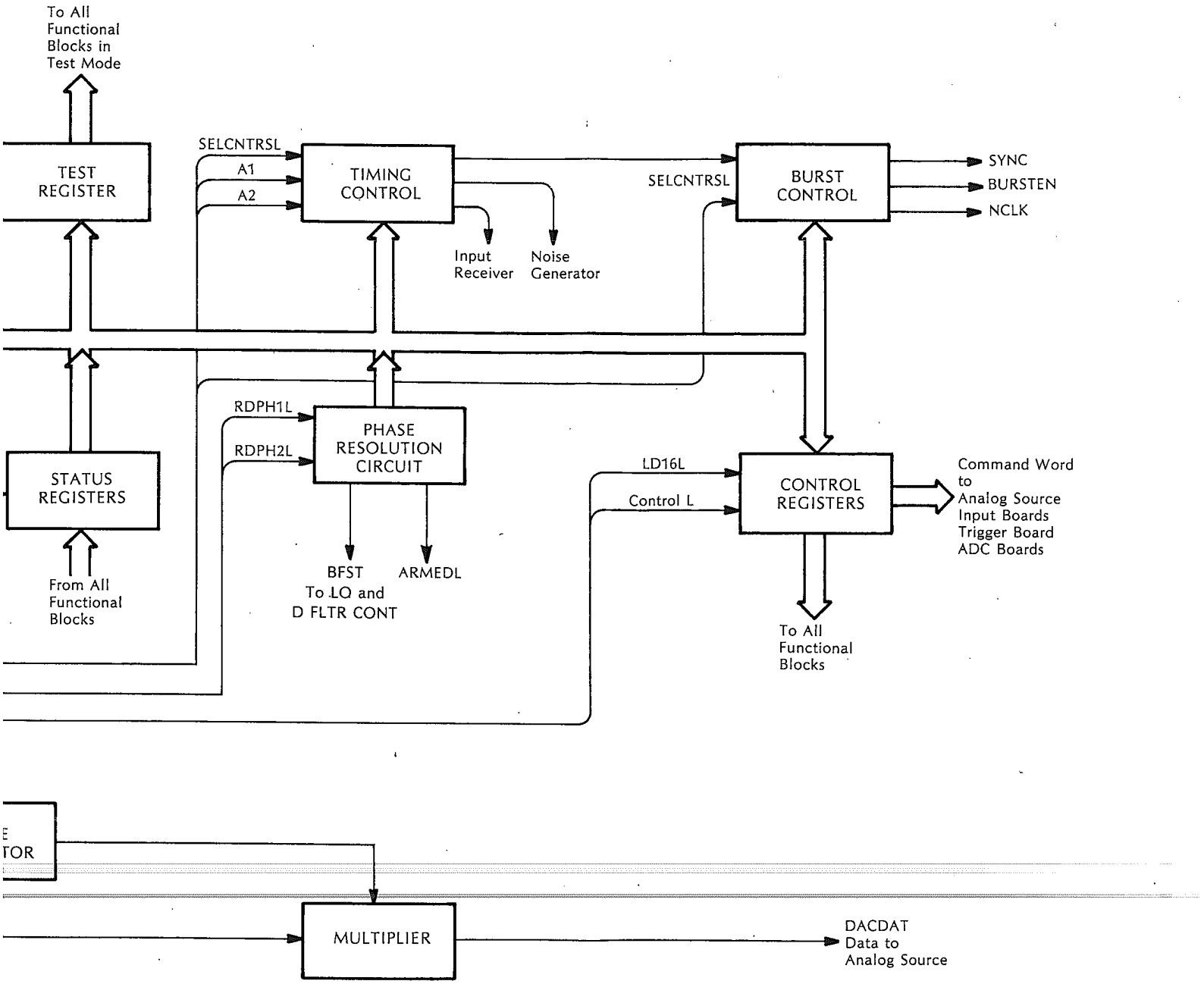
TLOLD TEST LOCAL OSCILLATOR LOAD
This signal is used in testing the LO input receiver.

TRIG TRIGGER
When TRIG goes high, the phase state machine strobes the current count of the phase counters into the counters' output registers.

TRIGGERED TRIGGERED
Signal from the phase resolution circuit to the status registers. When the ARML signal is received, TRIGGERED goes low. When a trigger is received, TRIGGERED go high. This indicates the trigger has occurred.

TTH TEST TRACK/HOLD
In the self-test mode this signal becomes the sample clock.


System
Address
Bus
A1L To A8L
ADDRESS
COMPARATOR
STEST
System
Data
Bus
D0 TO D15
DATA
BUS
BUFFERS
DS Data Bus
Write
To Control
Registers
RESL
STAT
ENABLEL
RESETL
WRITEL
DEVICE
INSTRUCTION
DEVICE
DECODER
BUFFER
DEVICE
DECODER
PAL
GE
DATA
FROM
LOCAL
OSCILLATOR
NLD
NDCK
NDAT
LO
INPUT
RECEIVER



: 6-A1e Digital Source Block Diagram

6-4 A2 SYSTEM CPU/HPIB

Refer to Figure 6-A2 for this discussion. The processing unit of the A2 System CPU (Central Processing Unit) is a MC68000 16-bit microprocessor. The function of the system CPU is to tell each assembly which process to execute and monitor the overall functioning and data processing of the instrument. The programs stored in memory (monitor memory) on the A2 System CPU and some of the programs on the A3 program ROM help the system CPU perform this function. The monitor memory is made up of ROM, RAM, and nonvolatile RAM (which is maintained by a battery backup).

The HP-IB interface is included on the A2 CPU assembly. This allows for direct memory access and a HP-IB device to talk directly with the system processor.

The system CPU is the system address and data bus master of all communications on the system bus. Interactions between the assemblies are maintained by using 16 bidirectional data lines (D0L to D15L), 23 address lines (A1L to A23L), and 17 system control lines. An assembly attracts the attention of the A2 System CPU by using interrupt lines IRQT2L to IRQT6L. The priority interrupt encoder determines when an assembly can interrupt the system processor. When interrupted, the system CPU processes the interrupt and sends the next command to the assembly. After receiving the information, the assembly handshakes with the system CPU. Most assemblies use the asynchronous signal Data Transfer Acknowledge (DTACKL) to handshake with the system CPU. The exception is the A4 Local Oscillator. It uses the synchronous signal Valid Peripheral Address (VPAL) to handshake with the system CPU.

Off-Board Operations

The system processor uses the system bus control, system address drivers, system data buffers, and handshake circuits to get programs stored in the A3 Program ROM and to command assemblies to perform operations. When the system CPU needs to load an instruction, it asserts the read/write line (WRITEL) low and puts the address for the A3 ROM assembly and the address of the needed instruction on the system address bus. The A3 ROM decodes the address lines, returns the DTACKL to the system CPU, and puts the requested instruction on the system data bus. The system CPU then loads the instruction from the system data bus.

The following happens when the system CPU commands an assembly to perform an operation:

1. The system processor puts the address for the assembly on the system address bus and the address decoder activates the proper control lines.

2. The address decoder selects the appropriate monitor memory location where the command is stored and the command is put on the system data bus.

   (To command the A7 Floating Point Processor, the system CPU loads a command stack into the A8 Global RAM before addressing the assembly. The data transferred on the system data bus is the starting address of the command stack in global RAM.)

3. The assembly recognizes it has been addressed and returns a handshake signal (DTACKL or VPAL).

4. The system processor asserts upper data strobe (UDSL) and/or lower data strobe (LDSL) signals to transfer byte data (8 bits) or word data (16 bits). The assembly being addressed determines whether UDSL or LDSL are used.

5. The assembly reads the system data bus and performs the operation.

6. When the assembly has finished the operation, it sends the system CPU an interrupt (IRQT).

On-Board Memory Operations

The system processor controls the monitor memory by asserting the address lines to the memory and the address decoder. The address decoder decodes these lines to select the ROM or RAM memory pair to be accessed. Next, the system processor asserts the upper data strobe (UDSL) or lower data strobe (LDSL). UDSL selects the upper memory and LDSL selects the lower memory. Both UDSL and LDSL are asserted at the same time if a 16 bit word is used. The read/write (R/WL) signal is also decoded and determines whether a read or write operation to memory is to occur. For the monitor memory to communicate with another assembly on the system data bus, the address decoder must activate SBUSENL, placing the system data bus in the input/output mode.

Interaction Between the A2 System CPU and the A8 Global RAM

The system CPU shares the global bus with all other devices to access the global RAM. For this operation, the system CPU has 16 address lines, 16 data lines, and 4 control lines connected to the global bus. The system CPU's global address bus connection (GA1L to GA16L) is an extension of the lower 16 bits of the CPU address bus. When the system CPU addresses a global RAM memory location, the system CPU's address decoder asserts the global request (GLRQTL) line to the handshake circuit. The handshake circuit sends the memory request (MR68L) to global RAM. The global RAM returns a memory grant (MG68L) when it gives bus control to the system CPU. This memory grant signal clears the memory request signal (MR68L) and enables the assertion of the global read/write signal (GR/GWL). When the system CPU has a write request, the assertion of GR/GWL causes memory data to be written onto the global data bus. For a read request, the global bus receivers latch the incoming data when the global data strobe (GDSL) signal is received.

Interrupt Circuit

An interrupt is sent when an assembly has information for the system CPU, finishes a process, or requests service. For example, the keyboard sends the system CPU the IRQT2L signal when a front panel key is pressed. When an assembly needs to communicate with the system CPU, the assembly asserts its interrupt request line (IRQT2L to IRQT6L). The priority interrupt encoder informs the system processor which assembly has interrupted it. For a description of the interrupt request lines, refer to paragraph 6-8, "Signal Descriptions".

Programmable Timer Module

The programmable timer module is an internal time base generator, clocked by the ENBL clock from the system processor. This timer is used for function time outs and to maintain relative time intervals. This module contains three clocks which get addressed by signals A1 to A3. The clocks are loaded and read by the system processor using the CPU data lines D0 to D7. A clock is enabled by the program timer module signal PTML. When the program timer module clock finishes counting, the interrupt request IRQT7L is generated.

Bus Time Out

When a system processor bus cycle is initiated, the bus time out ripple counter is started and runs until either the handshake is completed (DTACKL or VPAL is received) or the counter reaches its terminal count. If the timer reaches the terminal count of 32 μs before the handshake is completed, the bus error line (BERRL) to the system processor is asserted to abort the current bus cycle. The system processor then begins processing for the bus error. Bus errors are entered in the fault log along with the name of the assembly that failed to send the handshake signal.

Status Decoder

When the system processor is performing an operation, the status decoder lights one of the status LEDs (DS2). The status operations and corresponding LEDs are as follows:

LED	Label	Description
DS2-5	UD	User Data, CPU in user state and accessing data
DS2-4	UP	User Program, CPU in user state and accessing program
DS2-3	SD	Supervisor Data, CPU in supervisor state and accessing data
DS2-2	SP	Supervisor Program, CPU in supervisor state and accessing program
DS2-1	IACK	Interrupt Acknowledge, CPU is getting interrupt vector numbers

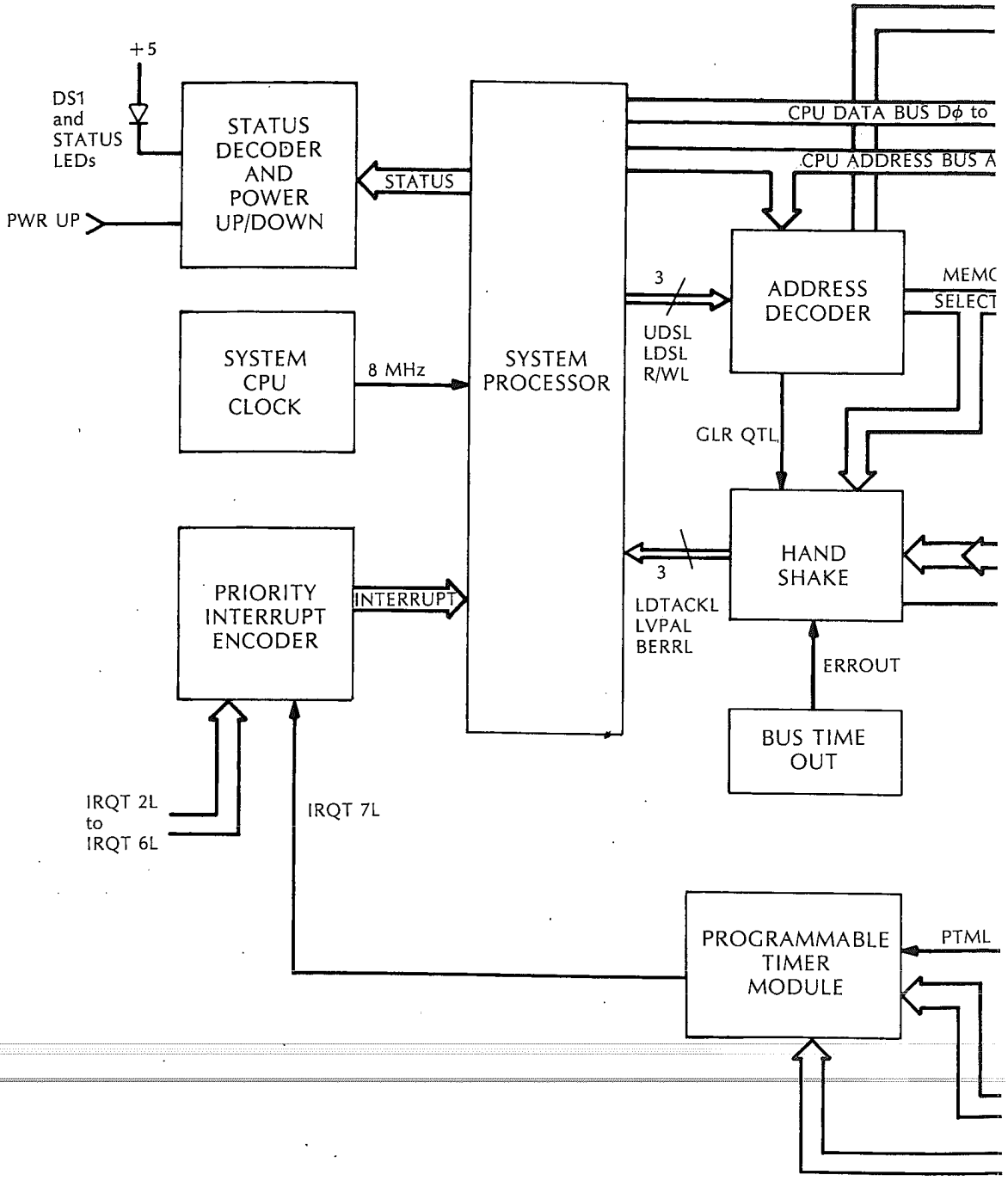
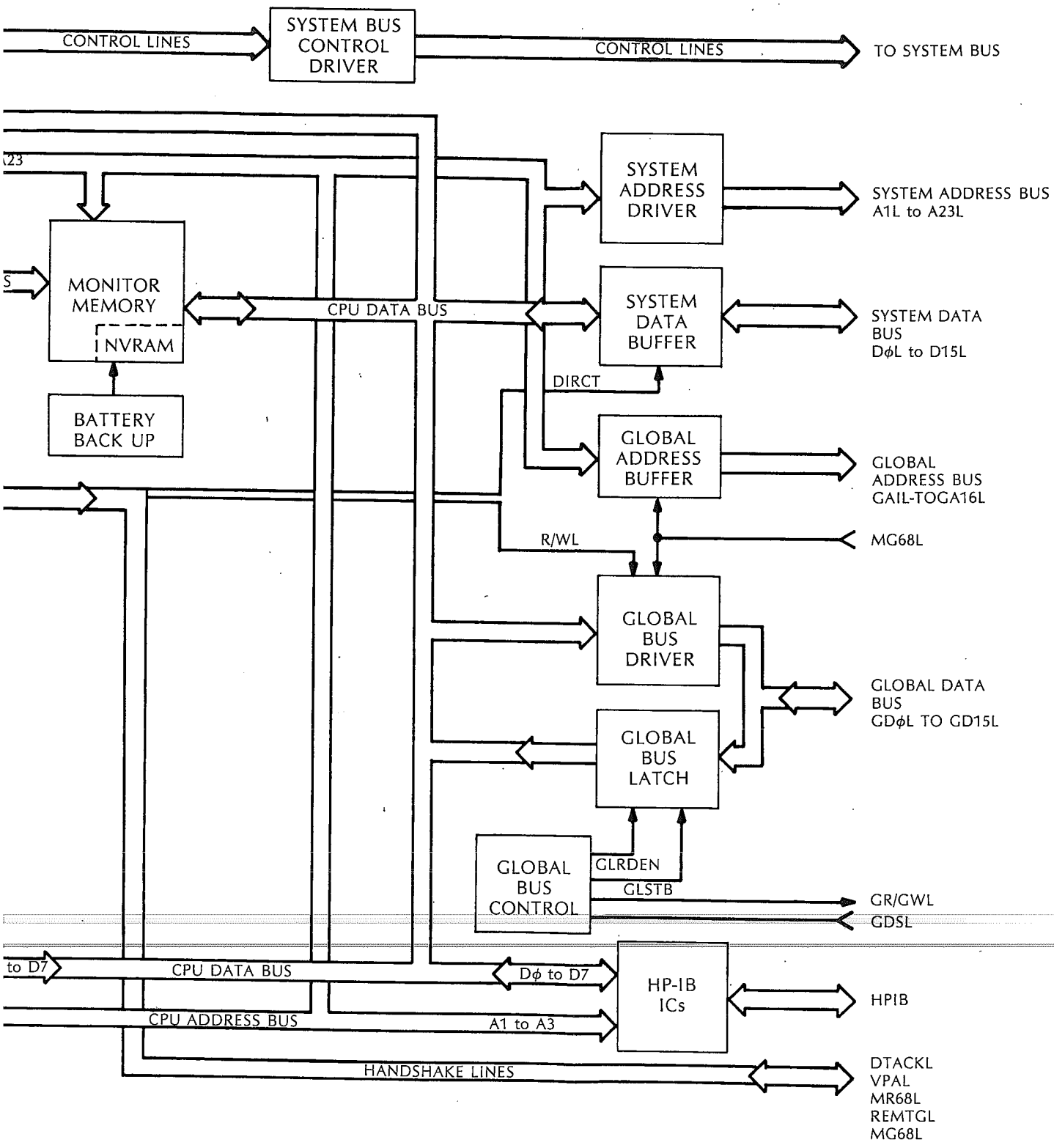

+5
DS1
and
STATUS
LEDs
PWR UP
STATUS
DECODER
AND
POWER
UP/DOWN
STATUS
SYSTEM
CPU
CLOCK
8 MHz
SYSTEM
PROCESSOR
CPU DATA BUS Dϕ to
CPU ADDRESS BUS A
3
UDSL
LDSL
R/WL
ADDRESS
DECODER
MEMC
SELECT
GLR QTL
HAND
SHAKE
3
LDTACKL
LVPAL
BERRL
ERROUT
BUS TIME
OUT
PRIORITY
INTERRUPT
ENCODER
INTERRUPT
IRQT 2L
to
IRQT 6L
IRQT 7L
PROGRAMMABLE
TIMER
MODULE
PTML

Figure 6-



System CPU/HPIB Block Diagram

6-5 A3, ROM

The A3 ROM board functions as an extension of read only memory for the system CPU board. The ROM board stores most programs for the HP 3562A except initial start-up routines. All communications between the system CPU board and the ROM board occur over the system bus. Refer to the timing diagram (figure 6-A3a), block diagram (figure 6-A3b), and the schematic (figure 9-A3) as referenced in the following circuit descriptions.

The following descriptions apply to the current ROM board. This board allows flexibility in the number and type of ROM chips used. ROM density (size) is selected by placement of jumpers in the OEL line to the ROM chips, the address comparator section, the delay section, and the ROM decoder section.

Address Comparator

The address comparator verifies that the ROM board is addressed and asserts the ROM select (ROMSELL) line low. The ROMSELL signal does the following:

1. Returns DTACKL to the system CPU to acknowledge that the ROM board was addressed.
2. Enables the ROM Decoder.
3. Enables the Data Bus Driver.

ROM Decoder

The ROM decoders (U21, U22, and U23) are 1-of-8 decoders. They generate the chip enable (CE1L through CE20L) signals by decoding system address lines A16 through A21. The chip enable signal causes the selected ROM pair to put data on the data bus.

Delay

U13 and U14 are used to delay the DTACKL signal based on the speed of the slowest component on the ROM board. The placement of R50 determines the length of the delay (from 0 to 4 clock cycles).

Memory

The memory section of the A3 ROM board consists of 32k by 8 bit read-only-memory chips. The chips are addressed by system address lines A1 through A16 and enabled by CE1L through CE20L. The inverting drivers pass the system address lines from the system bus to all ROMs. The memory is arranged as a lower byte (D0 through D7, stored in U101 through U120) and an upper byte (D8 through D15; stored in U201 through U220). Each CE line enables a lower byte chip and an upper byte chip to put all sixteen data bits on the bus simultaneously.

Data Bus Driver

When enabled by the ROMSELL signal, the data bus drivers transfer data from the ROM data bus to the system data bus.

Theory of Operation

Refer to figure 6-A3a for the following theory of operation. When the system CPU wants to load data from the ROM board, it unasserts the WRITEL line, puts a valid address on system bus lines A1 through A23, then asserts the address strobe (ASL). The address comparator verifies that the ROM board is addressed and asserts the ROM select (ROMSELL) line low. The ROM decoder samples A16 through A21. When gated by the ROMSELL signal, the ROM decoder issues a chip enable (CE) signal to the appropriate ROM pair. The CE signal enables the ROM pair to put data on the ROM data bus. The ROMSELL signal gates the data through the data bus drivers onto the system data bus and returns DTACKL (data acknowledge) to the system CPU.

Internal Signal Descriptions

CE1L through CE20L — Chip enable 1-20, active low. Enable the output from the selected ROM pair.

CLK — Inversion of the 8MHz system CPU clock, used in the delay circuit block.

ROMSELL — ROM select, active low. Indicates that the ROM board has been addressed, enables the ROM decoder, enables the data bus driver, and returns DTACKL to the system CPU.

6-5 A3, ROM

The A3 ROM board functions as an extension of read only memory for the system CPU board. The ROM board stores most programs for the HP 3562A except initial start-up routines. All communications between the system CPU board and the ROM board occur over the system bus. Refer to the timing diagram (figure 6-A3a), block diagram (figure 6-A3b), and the schematic (figure 9-A3) as referenced in the following circuit descriptions.

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The ROM decoders (U21, U22, and U23) are 1-of-8 decoders. They generate the chip enable (CE1L through CE20L) signals by decoding system address lines A16 through A21. The chip enable signal causes the selected ROM pair to put data on the data bus.

Delay

U13 and U14 are used to delay the DTACKL signal based on the speed of the slowest component on the ROM board. The placement of R50 determines the length of the delay (from 0 to 4 clock cycles).

Memory

The memory section of the A3 ROM board consists of 32k by 8 bit read-only-memory chips. The chips are addressed by system address lines A1 through A16 and enabled by CE1L through CE20L. The inverting drivers pass the system address lines from the system bus to all ROMs. The memory is arranged as a lower byte (D0 through D7, stored in U101 through U120) and an upper byte (D8 through D15; stored in U201 through U220). Each CE line enables a lower byte chip and an upper byte chip to put all sixteen data bits on the bus simultaneously.

Data Bus Driver

When enabled by the ROMSELL signal, the data bus drivers transfer data from the ROM data bus to the system data bus.

Theory of Operation

Refer to figure 6-A3a for the following theory of operation. When the system CPU wants to load data from the ROM board, it unasserts the WRITEL line, puts a valid address on system bus lines A1 through A23, then asserts the address strobe (ASL). The address comparator verifies that the ROM board is addressed and asserts the ROM select (ROMSELL) line low. The ROM decoder samples A16 through A21. When gated by the ROMSELL signal, the ROM decoder issues a chip enable (CE) signal to the appropriate ROM pair. The CE signal enables the ROM pair to put data on the ROM data bus. The ROMSELL signal gates the data through the data bus drivers onto the system data bus and returns DTACKL (data acknowledge) to the system CPU.

Internal Signal Descriptions

CE1L through CE20L — Chip enable 1-20, active low. Enable the output from the selected ROM pair.

CLK — Inversion of the 8MHz system CPU clock, used in the delay circuit block.

ROMSELL — ROM select, active low. Indicates that the ROM board has been addressed, enables the ROM decoder, enables the data bus driver, and returns DTACKL to the system CPU.

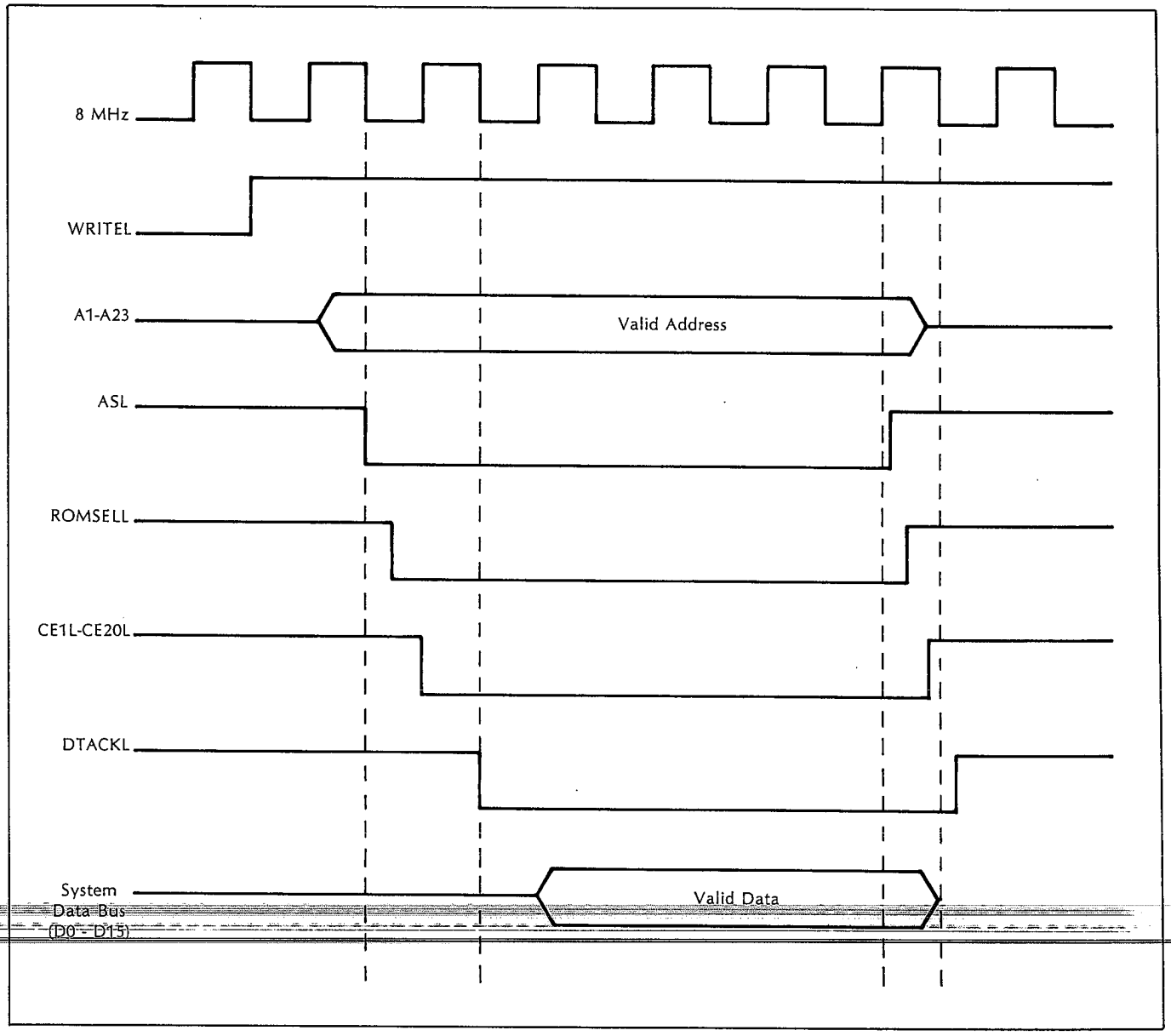
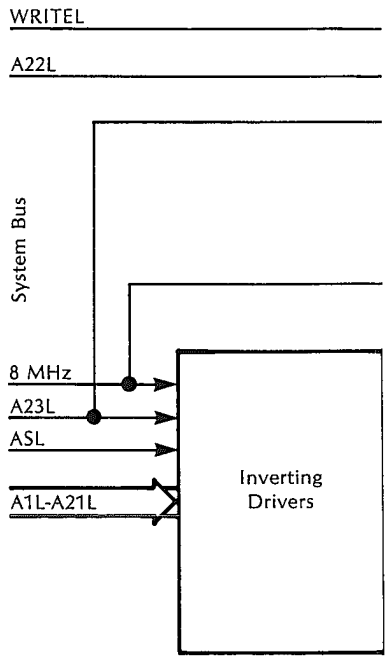


Figure 6-A3a ROM Timing Diagram


WRITEL
A22L
System Bus
8 MHz
A23L
ASL
A1L-A21L
Inverting
Drivers

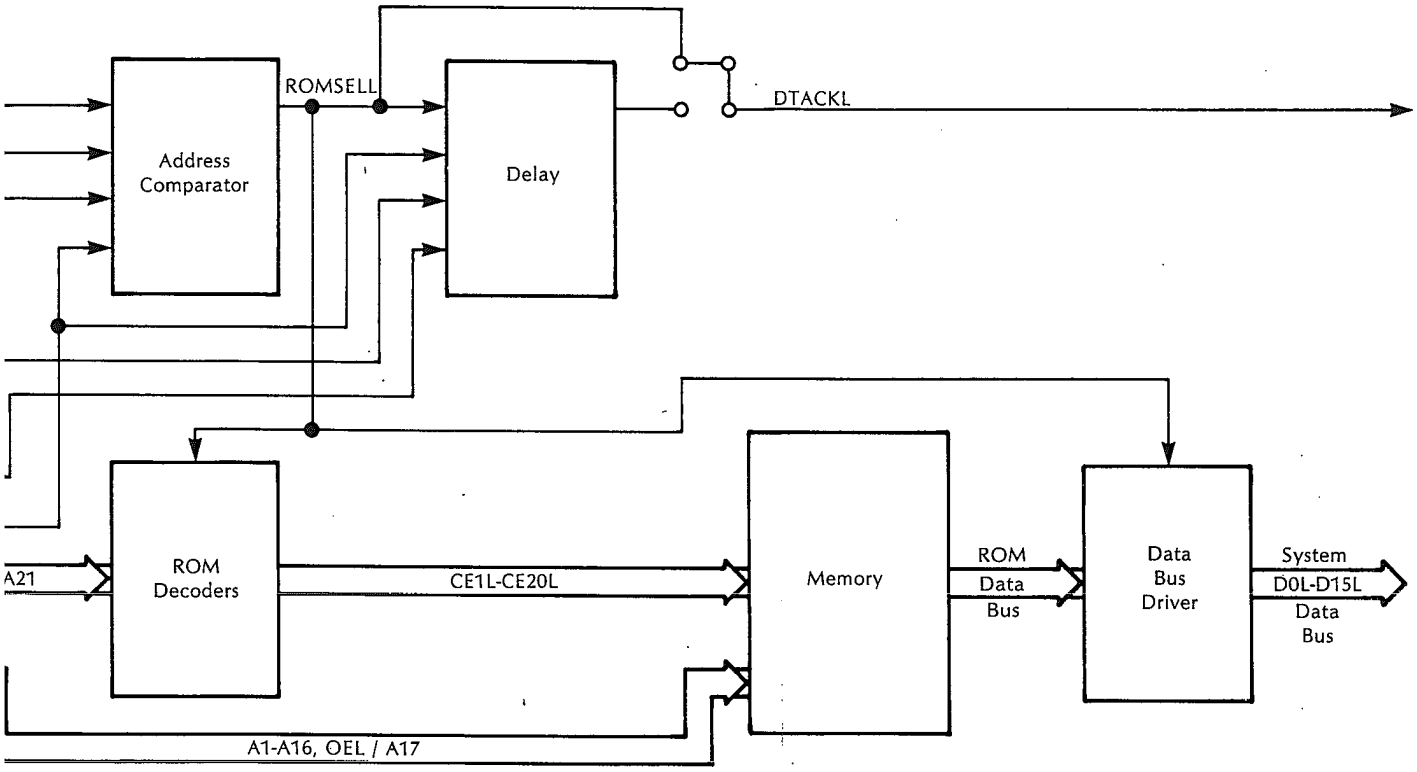


Figure 6-A3b ROM Block Diagram

6-6 A4 LOCAL OSCILLATOR

Introduction

(Refer to figure 6-A4) The A4 Local Oscillator (LO) produces digital sine and cosine signals which are synchronized with the sample rate. The LO outputs digital sine and cosine signals to the A5 Digital Filter. The digital filter uses these signals for the mixing operation when the instrument is in the 'zoom mode' (frequency span <100 kHz). The LO also outputs a cosine signal (NDAT) to the A1 Digital Source. The digital source uses the digital data from the LO to create band-limited noise and interfaces the LO output with the analog source. The analog source is basically a digital-to-analog converter for the LO digital sine wave. The LO output to the digital source is determined by the operation mode of the instrument as follows:

Mode	LO output to A1 (NDAT)
Baseband measurement	Constant output
Zoom	Cosine to digital filter
Swept sine	Cosine to digital filter
Periodic Chirp	Linear swept sine starting at trigger point
Burst chirp	Linear swept sine starting at trigger point and ending in accordance with the percent of span setting.
Fixed Sine	Sinusoidal wave of specified frequency.

Theory of Operation

The A2 System CPU starts the sine wave generation process by setting up the LO. When the LO recognizes it has been addressed, data from the system CPU is transferred into the LO's system bus interface. This data contains a command byte to put the LO in the desired mode of operation (the mode is determined by the instrument setup). Once the LO is initialized with the mode of operation and desired frequency values, the system CPU is no longer needed for the sine wave generation process.

After receiving the data from the system CPU, the parallel interface adapter (PIA) sets up the phase accumulator with the frequencies of the sine wave to be generated. The frequency is set by 32 bits of data from the CPU. The address determines which phase accumulator registers are loaded and thus what the frequency represents (source, chirp start, chirp increment, digital filter frequency, etc.) The phase accumulator sends an address that represents the phase value to the sine and interpolator ROMs. For example, an address of 00000000 corresponds to a phase value of 0 degrees, and an address of FFFFFFFF corresponds to a phase value of just under 360 degrees. The sine ROM is a look-up table containing the positive half of a sine wave. The interpolator ROM contains a set of data points used for linear interpolation between the sine ROM data points.

Outputs from the sine (16 bits) and interpolator ROMs (4 bits) are added four bits at a time to determine the sine, cosine, or NDAT data point. The 16-bit sum is sent to the LO output buffers in 4-bit nibbles which are converted to 16 bit words. The word is latched into the proper output buffer to be clocked out in series at the next SYNC2 pulse.

The A5 Digital Filter sends the SYNC2 signal to the LO when it is ready for the next sine and cosine wave data points. The data points are synchronized with SYNC2 and shifted out to the digital filter and digital source. Each serial data stream represents one point (amplitude value) on a sine or cosine wave.

Each sample period corresponds to an LO 'super-cycle'. Each super-cycle is composed of four cycles defined by the state variables S0 and S1. The phase accumulator generates a phase value for sine, cosine, or source during each cycle except for one which is used for general housekeeping. This is shown below:

S1 (U46-5)	S0 (U46-9)	Output of Phase Accumulator
0	0	Cosine data point
0	1	No output, set up for next super-cycle
1	1	Sine data point
SYNC2 occurs		
1	0	NDAT data point

While the present phase values are being generated in the phase accumulator, the previous set of data points are being processed in the interpolator and adder, and the set of data points before that are being sent to the digital filter and digital source. So, at any given time, there are a couple of sets of data points in process. The process repeats until the LO operation is changed by the system CPU.

When a trigger occurs, the phase value of the cosine is latched into the phase output latchs. The system CPU reads this value through the system bus interface and uses this information for an input correction factor. The self-test shift registers are used to test the assembly. During self-test, the system CPU reads and verifies the values from the self-test shift registers and the phase latchs.

System Bus Interface

All communications between the A2 System CPU and the LO is through the system bus interface. The main components of the interface are the system bus PAL (U32) and the parallel interface adapter (PIA, U36). The system bus PAL controls all the signals to and from the system CPU. To send a command or data to the LO, the system CPU puts the command or data on the system data bus (D0 to D7) and addresses the LO. A comparator (U37) checks A4L to A8L, LDSL, ASL, and VIOL for a valid address. When the address is valid, the comparator asserts the Valid Address line (VADDR) which enables the system bus PAL. The PAL sets the Valid Peripheral Address line (VPAL) low to enable the system data bus buffers (U24, U28) and to handshake with the system CPU. When the system CPU receives VPAL, it synchronizes the Valid Memory Address line (VMAL) with the Enable Clock (ENBLL). The data is transferred while VMAL is low. System bus lines are only valid as long as VMAL is low.

Phase Accumulator

The phase accumulator uses six internal registers with adders and latches to produce phase values (addresses). One or two registers (depending on mode) contain the phase values which are used to generate the desired sine and cosine values. The other registers contain phase increments, increments of phase increments (chirp mode), or are not being used. These phase increments determine the sine wave frequency (frequency = $\Delta\Theta/\Delta T$, where ΔT is the sample period). The only mode in which all registers are used is the chirp mode. The registers are 64 bits, but only the chirp sweep rate uses 64 bits. All other values use the 32 MSB. The data is handled in four, 8-bit chunks each cycle.

Sine ROM (U29, U20)

The sine ROM (U29, U20) takes the phase value from the phase accumulator and uses it to output a digital sinusoidal wave. The sine ROM contains the positive half of a sine wave in a lookup table. The sine ROM takes in 13 phase bits (an address) and outputs 16 amplitude bits (data).

Interpolator and Adder

The interpolator is used to increase the phase resolution of the sine ROM output and produce the data needed for a complete sine wave. The interpolator ROM (U13) uses the output from the phase accumulator to produce an interpolate value. This value is added to or subtracted from the sine ROM output to produce the high resolution output (parallel, 16-bit word) in four, 4-bit chunks.

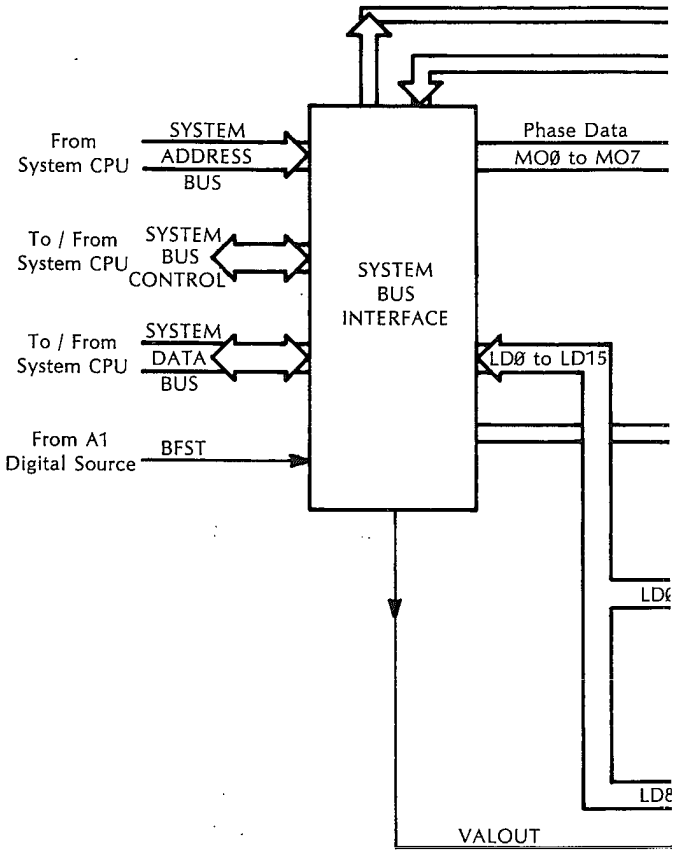
Output Buffers

The output buffers consist primarily of three, 16-bit parallel-in, serial-out shift registers and an output timing PAL (A4 U58). The timing PAL controls the shift registers and the self-test shift registers.

Control Circuits

The control circuits consist of two PALs, one PLA, and some related circuitry. The function of these circuits are as follows:

Phase Accumulator PAL (U56)	This PAL controls the input, output, and shifting of the data in the phase accumulator.
Interpolator PAL (U55)	This PLA controls the addition, subtraction, and slope functions for the interpolator output and other random logic functions.
Timing PAL (U68)	This PAL produces the basic timing signals of the LO.


From
System CPU
SYSTEM
ADDRESS
BUS
To / From
System CPU
SYSTEM
BUS
CONTROL
To / From
System CPU
SYSTEM
DATA
BUS
From A1
Digital Source
BFST
SYSTEM
BUS
INTERFACE
Phase Data
MOØ to MO7
LDØ to LD15
VALOUT

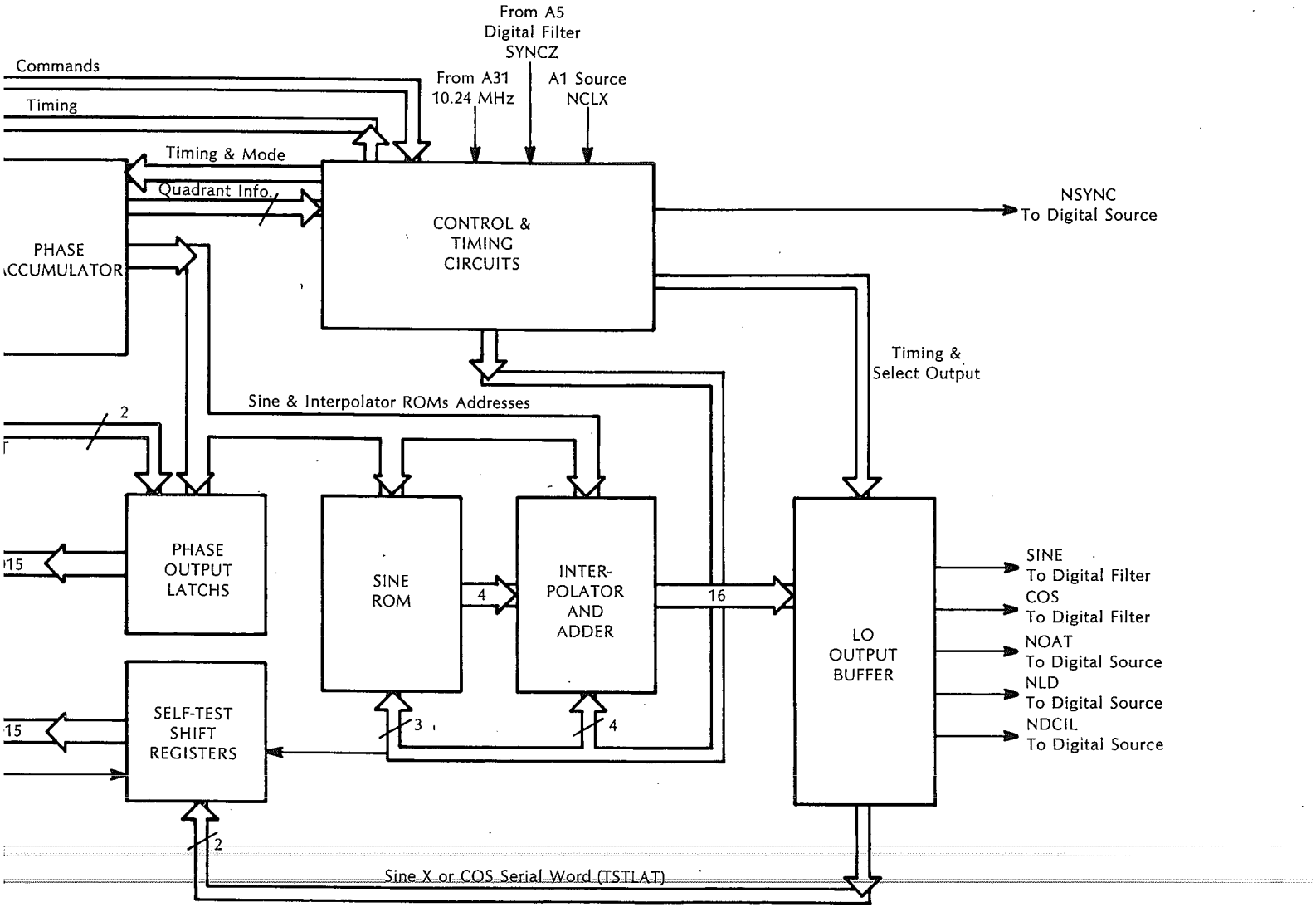


Figure 6-A4 Local Oscillator Block Diagram

6-7 A5, DIGITAL FILTER A6, DIGITAL FILTER CONTROLLER

The digital filter assembly (DFA) consists of the digital filter board (A5) and the digital filter controller board (A6). The digital filter processes two channels of serial data from the instrument front end (ADC boards) and stores the results in global RAM. Processing consists of conversion from a serial format to a parallel format and, if required, digital filtering or zoom (a combination of frequency shifting and filtering). The processed data is transferred on the global data bus to Global RAM (A8).

Data Flow

Refer to the block diagram in figure 6-A5a. Two data signals, one from each input, come onto the A5 board in a serial format from the A32 and A34 ADC boards. These signals enter the digital filter blocks where they are processed.

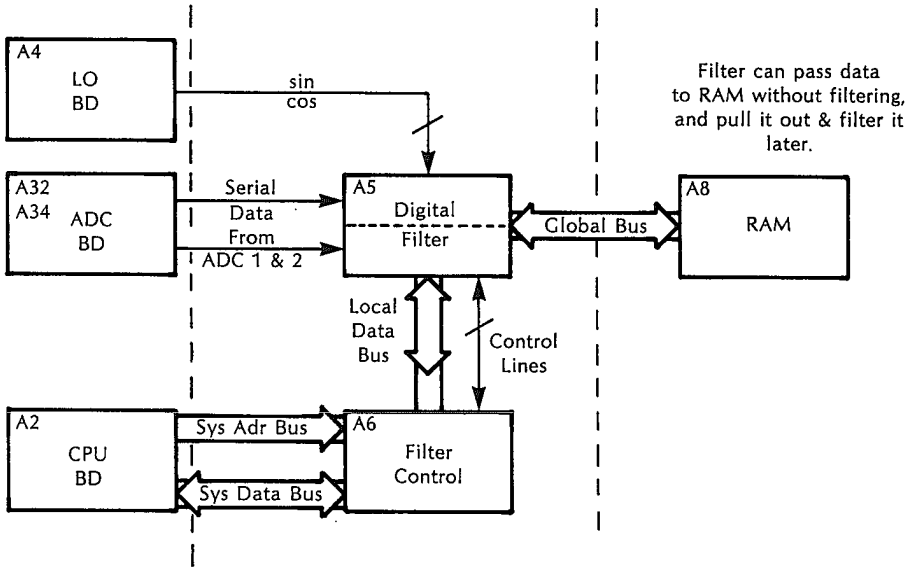


Figure 6-A5a System Block Diagram Referenced to the Digital Filter Boards

When the digital filter is ready for data, it sends DREQL (data request) to the ADC boards. In response, the ADC boards send data to the digital filter at a 10.24 MHz rate. The data is reclocked by A5 U512. The filter accepts one input data word and sends the SYNC2 pulse to the A4 Local Oscillator and A6 Digital Filter Control boards.

Measurement data is input serially to a filter controller. Incoming data is processed in one of three ways:

Streaming If VIEW TIME is selected with a span of 100 kHz or VIEW INPUT is active, processing consists only of conversion to a parallel format for storage in Global RAM.

Baseband If filtering is required and the frequency span is 100 kHz, the filter controller passes the incoming data to the filter ICs in serial format. The filter ICs multiply the incoming data by the LO data signal. This signal is a constant when not in zoom. The filter ICs filter the data and return it to the controller IC. Depending on the processing required, this may be a multipass operation. The controller IC converts the filtered data to a parallel format.

Zoom Zoom is used when the selected span is less than 100 kHz. The filter controller passes the data to the filter ICs in a serial format. The filters down-convert the input data by mixing it with a digital representation of the span center frequency from the LO board. The resultant sum and difference are filtered to remove the sum component and yield a reduced frequency span. See figure 6-A5b. The filters return the processed data to the controller IC, which converts the data to a parallel format.

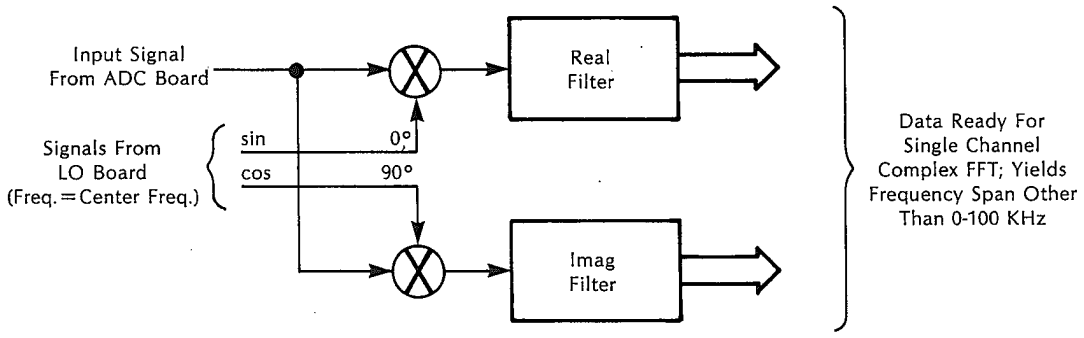


Figure 6-A5b Zoom Implementation

When he processed data is ready for storage, the controller ICs request the digital filter local data bus. When granted use of the bus, the controller ICs transfer the data to the global data bus interface. The global bus DMA controller sends a memory request to Global RAM. When Global RAM returns a memory grant, the data flows on the global data bus to Global RAM.

When data in global RAM requires filtering (as if the data were stored without filtering) the data comes into the filter controllers via the global data bus interface and the digital filter data busses. The remainder of the process is the same as described previously.

A5, Digital Filter Block Descriptions

Refer to figure 6-A5c, A5 Block Diagram, for the following circuit block descriptions.

DIGITAL FILTER

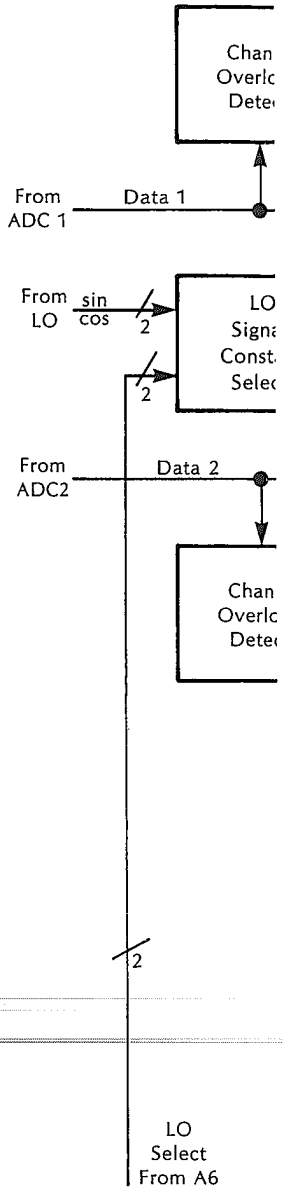
Each digital filter consists of a control IC and two filter ICs, one for real data and one for imaginary data. When in the zoom mode, the filters multiply the input data by a digital sine (real) and cosine (imaginary) function from the LO assembly.

The digital filters have three modes of operation, controlled by three DIS lines from the filter control block. The measurement data out of the filters corresponds to these lines as follows:

DIS1 In baseband (non-zoom) mode, the control IC outputs filtered data from the real filter. In zoom mode the control IC outputs the real data first, followed by the imaginary data.

DIS2 The control IC outputs the data from the imaginary filter (third octave).

DIS3 The control IC outputs unfiltered data.



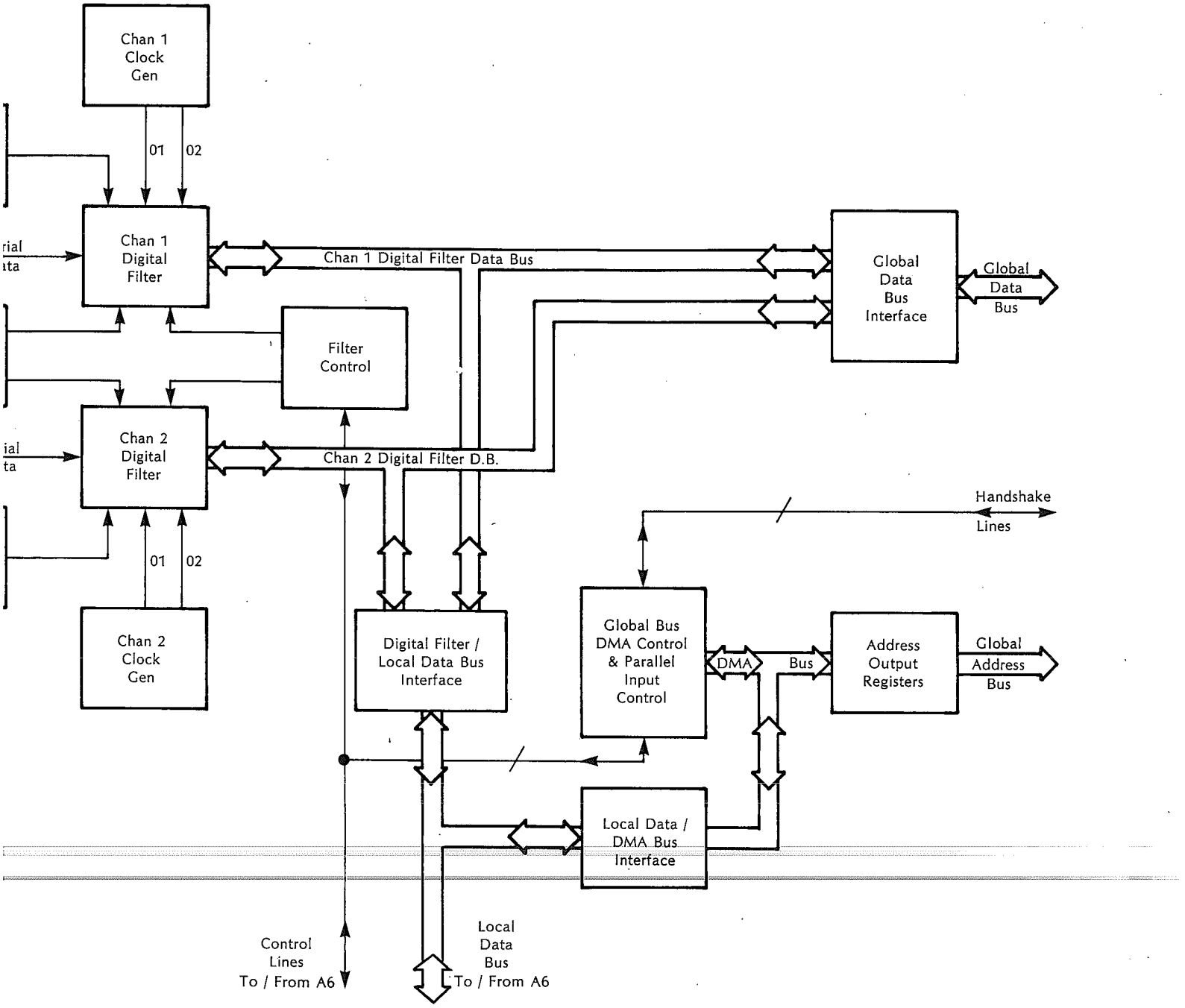


Figure 6-A5c A5 Block Diagram

CLOCK GENERATOR

The clock generator creates two complementary clock pulses from the 10.24 MHz system clock. This circuit produces an eight volt peak pulse signal for use in the digital filter ICs. This pulse must drive a high capacitance and still reach approximately eight volts.

OVERLOAD DETECT

The first three bits in the ADC serial data stream contain overrange information from the ADC converters. This information is stripped off the serial data stream by the digital filter control IC and processed by the ADC overload detect IC. The overload information is then sent to the digital filter control IC and included in the status information given to the system CPU.

LO SIGNAL/CONSTANT SELECT

The local oscillator/constant select circuit multiplexes the SINE and COSINE signals from the LO board to the CH1 and CH2 digital filter functional blocks. In baseband operation, a constant is output by activating CH1LOSEL and CH2LOSEL signals.

DIGITAL FILTER/LOCAL DATA BUS INTERFACE

The digital filter/local data bus interface isolates the digital filter bus from the local data bus. The information passing through these ICs consists of configuration commands from the system data bus to the digital filters and status information from the digital filters to the system data bus.

FILTER CONTROL

The filter control block controls data flow for the three digital filter modes. When a filter controller IC has data ready to store in global RAM, it requests the global bus by activating the CHxBRy signal, where x corresponds to input channel number (1 or 2) and y corresponds to the channel mode number (1, 2, or 3; see DIGITAL FILTER description). A5U205 and A6U206 enable only the channel and mode for which access to the global bus has been requested and granted.

GLOBAL BUS DMA CONTROL

The global bus DMA control and parallel input control block is composed of several smaller blocks. The function of these blocks is explained in the following discussion.

The **DMA address decoder** (A5U505) receives addresses from the system address decoder on the A6 Digital Filter Controller board. These addresses and the MYADDR control line are decoded to generate filter channel write control, channel output strobe, and read status signals.

The **DMA pointer register** (A5U311) latches into the DMA controller ICs (A5U307, A5U309) the address of an internal DMA Controller register that is to be loaded with information.

The **local data/DMA bus interface** (A5U406 and A5U411) latches start and stop addresses onto the DMA bus. This information is used by the DMA controller(s) to partition the global RAM on A8 for the different output modes of the DMA controller.

The **global data bus interface** (A5U304 and A5U404 for the channel one digital filter and A5U313, A5U413 for the channel two digital filter) latches data from the digital filter data busses to the global data bus.

The **global bus DMA control** circuit takes the decoded address information from the DMA address decoding functional block. The decoded information programs this block into the correct state machine mode for the output from the digital filters. The control line outputs from this functional block control the timing and synchronization of the output buffers and A8 global RAM addressing.

The **parallel input control** circuit controls the transfer of parallel data from the global RAM into the digital filters through the global data bus interface.

A6, Digital Filter Controller Block Descriptions

Refer to figure 6-A5d, A6 Block Diagram, for the following circuit block descriptions.

SYSTEM DATA BUS INTERFACE

The system data bus interface consists of tristate transceivers connecting the system data bus and the local data bus. The system CPU configures and reads status from various registers in the digital filter assembly through this interface and the local data bus.

SYSTEM ADDRESS DECODER

The system address decoder is divided between the A5 and A6 boards with some of the circuitry appearing on each. The system address bus is connected to the A6 control board. Part of the address (A5L-A8L and VIOL) is decoded by the system address decoder (A6U404). This IC is an eight-bit identity comparator configured to activate the signal MYADDRSL when the filter assembly is addressed by the system CPU.

The lower four bits of the system address and the signals UDSL, LDSL, WRITEL, and RESETL are buffered into the digital filter assembly by A6U403. These buffered signals go to address decoders on the control (A6) and filter boards A(5).

The address decoder on the control board (A6U304) decodes address information into measurement commands, counting instructions, and interrupt masks.

DATA POINT COUNTER

The data point counter monitors the information required to synchronize the actions of the various components of the filter assembly. A6U109 contains five 16-bit counters used to count the number of data points (samples) stored in Global RAM. Configuration information from the system CPU is written into this counter and status information read from it via the local data bus. Each of the five counters has an output (OUT1 through OUT5) to signal when the counter has reached its terminal count.

The **counter read/write control** (A6U107) controls timing for data transfer between the U109 counter and the local data bus. U107 is held in a clear state until the system CPU activates the counter select signal (COUNTERSELH). Operating as a shift register, U107 drives the chip select (CS) counter input and the NAND gates driving the read and write inputs to the counter. After four clock cycles of delay, the proper configuration signals cause the counter to write to or read from the local data bus.

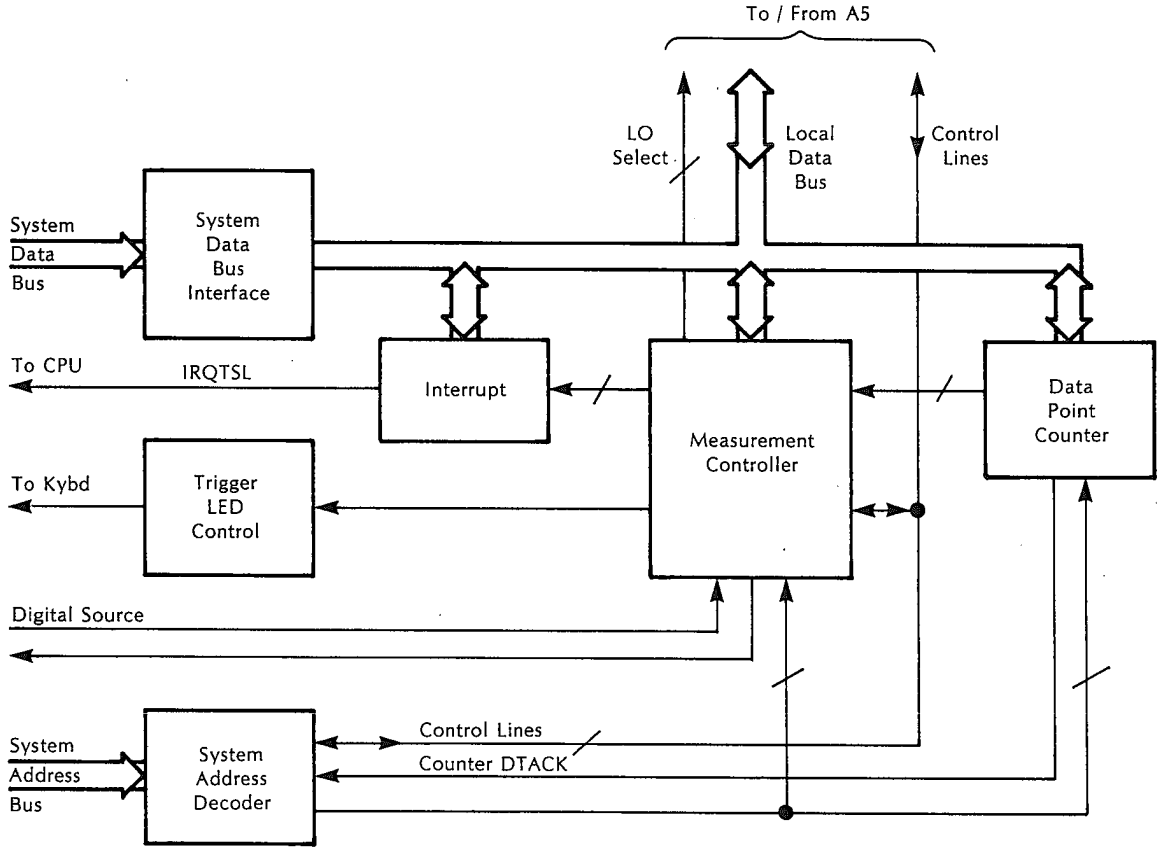


Figure 6-A5d A6 Block Diagram

MEASUREMENT STATE MACHINE

This block consists of five parts:

Command Register
Measurement Control Machine
Status Register
Start/Stop Control
Trigger Control

This block, configured by the system CPU, controls how the digital filter assembly works in the various modes.

The **command register** (flip-flops A6U307 and A6U109) is used to read data lines from the local data bus into the measurement state machine. The command is clocked into the register by the signal WRIBCCMDL (write IBC command) from the address decoder. (The digital filter assembly is sometimes called the input buffer control.) The commands configure the measurement state machine, control the LO selection on the digital filter board, and provide information to the trigger LED control block.

The **measurement control machine** senses configuration and status signals and controls the measurement. When it is configured for the type of measurement and receives a start signal, the measurement control machine enables the measurement to start. A measurement is complete when OUT4 is activated. OUT4 is reclocked, called BLKFULLH, and connected to an input of the measurement control machine. The measurement is terminated by activating the SETBLKREADYL signal, causing a CPU interrupt. The CPU decides when the transfer to RAM may be executed and grants the global bus appropriately.

The **status register** is an eight-line latch which allows the A1CPU to read the status of the digital filter assembly. The status word is latched onto the local data bus when the RDIBCSTATL signal is activated. Bit 0 is a signal called NOTREALTIMEFLG. This signal activates when data can not be moved through the DFA fast enough to prevent delay of further measurements. In this case, the data in global RAM is not updated fast enough to be real time. This flag is reset every time the status word is read. If the condition is still not real time, the reset does not change the status of the NOTREALTIMEFLG signal (CLR overrides a SET command).

The **start/stop control** (A6U309) and the **trigger control** (A6U409) are used to control triggered measurements. In a triggered measurement the digital filter begins processing data and storing it in RAM when the trigger board senses the trigger signal. There is also some interaction with the source. Here is an example sequence of events for a triggered measurement:

— If pretrigger delay is active, data is taken before a trigger signal is received. If pretrigger delay is 100 samples, the counter keeps track of the number of samples and the trigger signal is ignored until at least this many samples are taken. OUT1 is active when pretrigger delay is complete. The trigger control IC recognizes this and arms the trigger by activating the ARML signal. This signal goes to the digital source which is waiting for a trigger.

— When the digital source receives the trigger it activates the signal BFST (buffer start) going back to the trigger controller on A6.

— The trigger controller activates TRIGATEL, signaling the counters to continue counting input samples, and the measurement runs to completion.

— The start/stop controller controls the A5 Digital Filter outputs. CH1STOP1 controls DF1 main output and CH2STOP1 controls DF2 main output.

— When a triggered measurement is complete the output of the start/stop controller (BLKDONE) is sent to the measurement control state machine.

INTERRUPTS

There are six interrupt flags:

TRIGGERED	Set if a valid trigger event has occurred after ARML is activated
MARKER	Set if a marker count has finished during a freerun measurement
BLOCK3FULL	Set when the measurement mode data blocks are complete for both channels
BLOCK2FULL	Set when auxiliary data block 2 is filled
BLOCK1FULL	Set when the filtered auxiliary data block is filled
INBLOCKEMPTY	Set when the parallel input data blocks have been emptied

When one of these interrupt flags is set, the digital filter controller sends an interrupt (IRQT5L) to the A2 System CPU. After receiving the interrupt, the system CPU reads the Interrupt Register Latch (U302) to determine which signal caused the interrupt.

Any combination of flags may be cleared through the CLRINTL signal and the local data bus. These two signals are ANDed together into the CLR inputs of each of the interrupt flag flip-flop registers. Typically, the interrupt routine clears only the flag it deals with. The CPU uses addressing to activate CLRINTL.

The interrupt mask register (A6 U301) is a write only register that allows selective enabling of the interrupting events. The corresponding bit in the mask register must be set to enable an interrupting event to cause a system interrupt.

TRIGGER LED CONTROL

This circuit is composed of a dual monostable multivibrator (A6U310) and a one-of-eight multiplexer (A6U410). This circuitry causes the front panel TRIGGERING LED to flash once each time a trigger is received.

Internal Signal Descriptions, A6

ABORT	Used to stop Digital Filter Assembly activity
BLKDONE	Signal from start/stop controller to measurement control state machine to indicate that a triggered measurement is complete
BLKFULL	Block full. Input to measurement control machine which indicates that a measurement is complete
BLKREADYFLG	Set when the measurement mode data blocks are complete for both channels
BLK2FULLFLG	Set when the auxiliary data block 2 is filled
BLK3FULLFLG	Set when the unfiltered auxiliary data block is filled
CLRINTL	Clear interrupt. Clears the addressed interrupt flag flip-flop
COUNTERSEL	Counter select, enables U107
COUNTERDTACKL	Data point counter data transmit acknowledge
DMEANABLEL	Timing signal from measurement control machine to start/stop control and trigger control
FLASH	Signal activated in the trigger LED control block each time a trigger occurs
FREERUN	Used with TRIGGERED to select the measurement mode. If TRIGGERED is set and FREERUN is clear, triggered mode is selected. If FREERUN is set and TRIGGERED is clear, freerun mode is selected. If both bits are clear, stream mode is selected.
GATE2L	Signal to data point counter indicating that a trigger has occurred
INBLKEMPTYFLG	Set when the parallel input data blocks have been emptied
MARKER, MARKERFLG	Set if a marker count has finished
MASK0-2, 13-15	Outputs from the interrupt mask register
MEASURING	Set when the measurement is active. Used for control of the front panel TRIGGERING LED
NOTREALTIMEL	Signal to trigger LED control indicating that measurement is not real time
NOTREALTIMEFLG	Indicates that data cannot be moved through the DFA fast enough to prevent delaying further measurements.

RDIBCINTL	Read input buffer control interrupts
RDIBCSTATL	Read input buffer control status. Latches status word from status register onto the local data bus
SETBLKREADYL	Terminates a measurement by generating a CPU interrupt
SFLTRST	Set filter reset
STOPENL	Stop enable
TPULSE	Test pulse, replaces system clock signal when A6J2 is in test position
TRIGATEL	Signal from trigger controller to counters to continue counting input samples
TRIGGERED	See FREERUN
TRIGGERFLG	Set if a valid trigger event has occurred after being armed
WRIBCCMDL	Write input buffer control command. Clocks commands from the local data bus into the command register
WRINTMSKL	Write interrupt mask. Used to mask interrupt flags

Internal Signal Descriptions, A5

2XCLKL	The buffered on-board 10.24 MHz clock
CH1A/DDATA	Serial data inputs from the ADC assembly which have CH2A/DDATA been reclocked by U512
CH1AEN, CH2AEN	Channel 1 and channel 2 address enable
CH1BG1, CH2BG1 **CH1BG2, CH2BG2** **CH1BG3, CH2BG3**	Bus grants for DMA channels 1, 2, and 3
CH1BR1, CH2BR1 **CH1BR2, CH2BR2** **CH1BR3, CH2BR3**	Bus requests for DMA channels 1, 2, and 3
CH1DACK3L, **CH2DACK3L**	Data acknowledge, channel 1 and channel 2
CH1DIS1, CH2DIS1 **CH1DIS2, CH2DIS2** **CH1DIS3, CH2DIS2**	Disable DMA modes 1, 2, and 3
CH1DMACS, **CH2DMACS**	Enable channel 1 or channel 2 of the DMA Pointer Register and DMA Controller

CH1DMAL, CH2DMAL	Channel 1 and Channel 2 direct memory access
CH1DREQ3, CH2DREQ3	Data request, channel 1 and channel 2
CH1EOPL,CH2EOPL	Timing signal from DMA controller to filter control block
CH1HACK, CH2HACK **CH1HREQ, CH2HREQ**	Timing signals between DMA controllers and global bus DMA controller
CH1HLFSCALE, **CH2HLFSCALE**	Status signal from the ADC assembly asserted whenever the analog input exceeds half-range in amplitude
CH1IORL, CH2IORL **CH1IOWL, CH2IOWL**	Read/write signals in global bus DMA control block
CH1IS1L, CH2IS1L	Strobe from Global Bus DMA Control to Filter Controller for polling status word
CH1LO1 **CH1LO2**	Signals from the Digital Filter Controller assembly used to used to select the input to the digital filters. The input can be either the sine/cosine data from the local oscillator or a locally generated constant
CH1MEMRL, CH2MEMRL **CH1MEMWL, CH2MEMWL**	Clock data through global data bus interface
CH1OVLD, CH2OVLD **CH1 + OVLDL, CH2 + OVLDL** **CH1 – OVLD, CH2 – OVLD**	Status lines to Filter Controller to indicate overload condition on ADC assembly
CH1RDFLTSTATL, **CH2RDFLTSTATL**	Read filter status channel 1 and channel 2
CH1SHIFT1	Signal from the channel 1 filter control to request data from the ADC assemblies
CH1SYNC2	Serial data accepted. Signal to A6 board that the digital filter accepts an input data word
CH1XCVREN, **CH2XCVREN**	Channel 1 and Channel 2 transceiver enable
CH1*PHI*1 **CH1*PHI*2**	5.12 MHz non-overlapping clocks
CH1ϕ1FBL **CH1ϕ2FBL**	5.12 MHz clock signals
DIR1, DIR2	Control direction of data flow through global data bus interface
DMADTACKL	DMA data acknowledge

DMAPOINTER	Clock for DMA Pointer Register
DMARST	DMA reset
FCLK, FCLKL	5.12 MHz clock signals
MRST	Master reset signal
OS1L, OS2L, OS3L	Data valid strobes for mode words 1 and 2 and external parallel A/D data on the data bus
OS3ENL	Data valid strobe for external parallel A/D data on the data bus
PLGR1L, PLGR2L **PLGRANT** **PLRQL** **PXGO**	Signals from the parallel input control block which control the input of data from Global RAM to the digital filters.
TEST1L	A/D self test input to filter ICs
TEST2L	LO self test input to filter ICs
WRIBCCMDL	Write input buffer control command. Clocks data into the command register

6-8 A7 FLOATING POINT PROCESSOR

(Refer to figure 6-A7) The Floating Point Processor (FPP) is a fast arithmetic unit which carries out real and complex arithmetic operations on blocks of data stored in the A8 Global RAM. The processing units (ALUs) of the FPP are six AM2903 bit-slice microprocessor ICs. Instructions are provided to the ALUs by an address sequencer and seven microcode PROMs.

The FPP can perform 85 unique operations including addition, subtraction, multiplication, and division. Operations are performed on data blocks which have been normalized and stored in the A8 Global RAM. The data can have one of three formats:

- 2's complement integer (16 bit)
- Single precision floating point (32 bit)
- Double precision floating point (64 bit)

The operation the FPP performs on a data block is dictated by the A2 System CPU. The system CPU sets up a command stack in the global RAM to tell the FPP which operation to perform. A command stack consists of the following:

- 32 bit command word (add, sub, etc.)
- Number of entries in the data block which are to be operated on.
- Constants to indicate if the data block is real or complex.
- The beginning address of the data block in global RAM.
- The destination address of the results.

Commands may be executed individually or in groups. Commands in groups are executed in series and can include multiple looping.

To perform an operation, the FPP interfaces with the A2 System CPU and the A8 Global RAM. The programs stored in the microcode memory control the timing and interactions between the three assemblies. The following is an overview of an FPP operation:

1. The system CPU puts a command stack or series of command stacks in the global RAM.
2. The system CPU addresses the FPP using the system address bus and puts the starting address of the command stack on the system data bus.
3. The FPP recognizes that it has been addressed (ADDFLG) by the CPU.
4. The ALUs read the command stack's address that is now in the command pointer registers and on the B bus. The address of the command stack is stored in the internal registers of the ALUs.

5. The FPP fetches a 32 bit command using the Y bus and corresponding global bus registers.

6. The ALUs read and store the address of the data block to be operated on.

7. The instruction mapping PROM interprets the command data on the Y bus and tells the sequencer where to start its address sequence.

8. The sequencer addresses the microcode memory using the pipeline address bus.

9. The microcode memory sends the appropriate instruction to the ALUs using the A and B port address and ALUs instruction bus.

10. The designated instruction is performed.

11. When finished with a command (or an error is detected), the FPP sends an interrupt (IRQT3L) to the system CPU.

12. Steps 8 through 11 are repeated until the computation is completed. This process includes instructions for fetching data blocks from global RAM.

13. The result of the computation is stored in global RAM at an address previously specified in the command stack.

14. The FPP fetches the next command stack.

15. Steps 5 through 13 are repeated until all the command stacks are done (unless the FPP is reset or an error is detected by the condition code multiplexor).

16. The sequencer addresses the microcode memory for the 'wait' command.

17. The wait command is executed using the constant pipeline interface. The FPP remains in a wait loop until the next command address flag (ADDFLG) is sensed.

System Address Decoder and Handshake

After the command stacks have been set up in global RAM, the system CPU asserts the system address and control lines to start FPP operations. The address comparator asserts the My Address signal (MYADDRSL) to activate the address PAL. The address PAL activates the following signals:

1. Address Flag (ADDFLG)
   This signal latches the system data bus into the command pointer registers. (This data is the starting address of the command stack in global RAM.)

2. Data Acknowledge (DTACK)
   DTACK is returned to the system CPU to indicate the completion of the FPP handshake.

3. Condition Code (CCODE)
   CCODE is sent to the sequencer. When the sequencer receives CCODE, it branches out of wait loop and starts the FPP process.

Sequencer (U103)

The sequencer is an 'address sequencer' used to control the execution of microinstructions stored in the microcode memory. The sequencer has the capability of sequential access and conditional branching to any microinstruction in the microcode memory. During each microinstruction, the sequencer provides a 12-bit address to the microcode memory from one of four sources:

1. The incremented present address.

2. A jump address from the microcode memory or instruction mapping PROM.

3. A jump address from a previous microinstruction that stored an address in an internal register of the ALUs.

4. A subroutine return address from the sequencer's internal stack register.

The sequencer's next address is determined by the test and jump PROM, the conditional code multiplexor, and the instruction mapping PROM.

Global Bus Interface

The FPP has the ability to read and write 16 and 32 bit words to and from the global RAM. When doing a 32 bit operation, the FPP uses two consecutive 16 bit word operations. This is accomplished by addressing the first 16 bit word followed by inverting GA1L for the address of the second 16 bit word. For 32 bit floating point data, the first data word contains the most significant bits of a mantissa and the second data word contains the least significant bits of the mantissa and the exponent. This results in a 24 bit mantissa, 8 bit exponent, floating point data word.

To start the global bus transfer, the ALUs write the global RAM address for the data word on the B bus. The bus control PROM uses control lines PLSA, PLSB, and PLSC to command control PAL 1 and control PAL 2 to set up the FPP assembly for a data transfer. If the FPP is to read a 32 bit data word from global RAM, the following operations occur:

1. Control PAL 1 asserts the Memory Request Flag (MRFLG) signal which causes the following:
   a. The address on the B bus is latched into the global address registers.
   b. Bit 0 of the B bus is clocked through the test even flip-flop (U215) to determine if the address is an even or odd number.
   c. Control line PLSA is clocked through the read/write flip-flop (U215) to control PAL 2 to set up for a data read operation.

2. Control PAL 1 asserts the Memory Request FPP signal (MRFPPL) to the global RAM.

3. The global RAM responds by sending the Memory Grant FPP signal (MGFPPL) to the FPP. This causes the following to occur:
   a. The global address registers are enabled.
   b. Control PAL 2 asserts the Global Read/Write signal (GR/GWL) for a read operation.
   c. Control PAL 2 tests its Q1 input to determine if this is the first half or second half of the 32 bit word.

4. The global RAM assembly places the data on the global data bus and activates the Global Data Strobe signal (GDSL) which latches the data into the global bus registers.

5. The global RAM assembly sets the MGFPPL line low to inform control PAL 1 that the first half of the 32 bit data word has been loaded into the FPP assembly.

6. Control PAL 1 sets global address line 1 (GA1L) high which increments the address to global RAM by one for the second half of the data word.

7. The second half of the data word is now loaded into the global bus registers.

Arithmetic Logic Units (ALUs)

The Arithmetic Logic Units (ALUs) subblock consists of six 4-bit sliced arithmetic-oriented microprocessors (AM2903) cascaded for up to 24-bit mathematic operations. The ALUs can do complete arithmetic and logic instructions including multiplication, division, and normalization. Arithmetic and logic instructions are read from the ALUs instruction bus by the ALUs internal instruction decoder.

The ALUs have a 16 x 24 bit RAM for storing data. To load the ALUs RAM, the data in the global bus registers is placed on the Y bus when MANL is active and on the B bus when EXPL is active. The A Port Address from the microcode memory determines the storage location of the data block address (upper Y bus) and the B Port Address determines the location of the B bus data and the location of the data coming in and going out on the Y bus.

The ALUs perform operations using two operands. Multiplexors in the ALUs provide selection of various pairs for the operands which can be data from the ALUs RAM or data from the external buses.

After the ALUs have completed an operation, several status bits are sent to the condition code multiplexor for testing. The status bits are as follows:

ZERO
Indicates the ALUs Y bus output is zero (all 24 bits)

NEG
From the most significant ALU (U310) indicating a negative result.

OVR
From the most significant ALU (U310) indicating an operation has resulted in an overflow.

CN+4
From the most significant ALU (U310) indicating a carry-out of the ALU.

Internal Signal Descriptions

CCA
CCB
CCC
CONDITION CODING
Output lines of the test and jump PROM which controls the input selection of the condition code multiplexor.

CCEN
CONDITION CODE ENABLE
Enables the condition code multiplexor.

CCODE
CONDITION CODE
When the sequencer receives CCODE, it branches out of the wait loop and starts the FPP process.

CLKINHIY
CLOCK IN HIGH Y BUS
Signal from control PAL 2 which clocks the global data bus into the Y8 to Y23 global bus registers.

CLKINLOWY
CLOCK IN LOWER Y BUS
Signal from control PAL 2 which clocks the global data bus into the Y0 to Y7 and B17 to B23 global bus registers.

CLRIRQ
CLEAR INTERRUPT REQUEST
Clears the Interrupt Request (IRQT3L).

CPDL
CONSTANT PIPELINE DATA
Output signal of the B bus, Y bus control register which enables the pipeline data bus onto the Y bus.

EA
ENABLE A
This signal from the bus control PROM selects the input to the ALUs (ALUs internal RAM or Y bus).

ENHIYOUTL
ENABLE HIGH Y BUS OUT
Signal from control PAL 2 which enables the global bus registers output from Y8 to Y23 onto the global data bus.

ENLOWYOUTL
ENABLE LOW Y BUS OUT
Signal from control PAL 2 which enables the global bus registers output from Y0 to Y7 and B16 to B23 onto the global data bus.

EXPL
EXPONENT
This signal enables the global bus registers output onto the B17 to B23 bus lines.

I0 to I3
SEQUENCER INSTRUCTION
In test mode, these lines become the sequencer's instruction.

LDHIY
LOAD HIGH Y BUS
Signal from control PAL 2 which latches the Y8 to Y23 into the global bus registers.

LDLOWY LOAD LOW Y BUS
Signal from control PAL 2 which latches the upper B16 to B23 into a global bus register and Y0 to Y7 into a global bus register.

MANL MANTISSA
This signal enables the global bus registers output onto the Y bus.

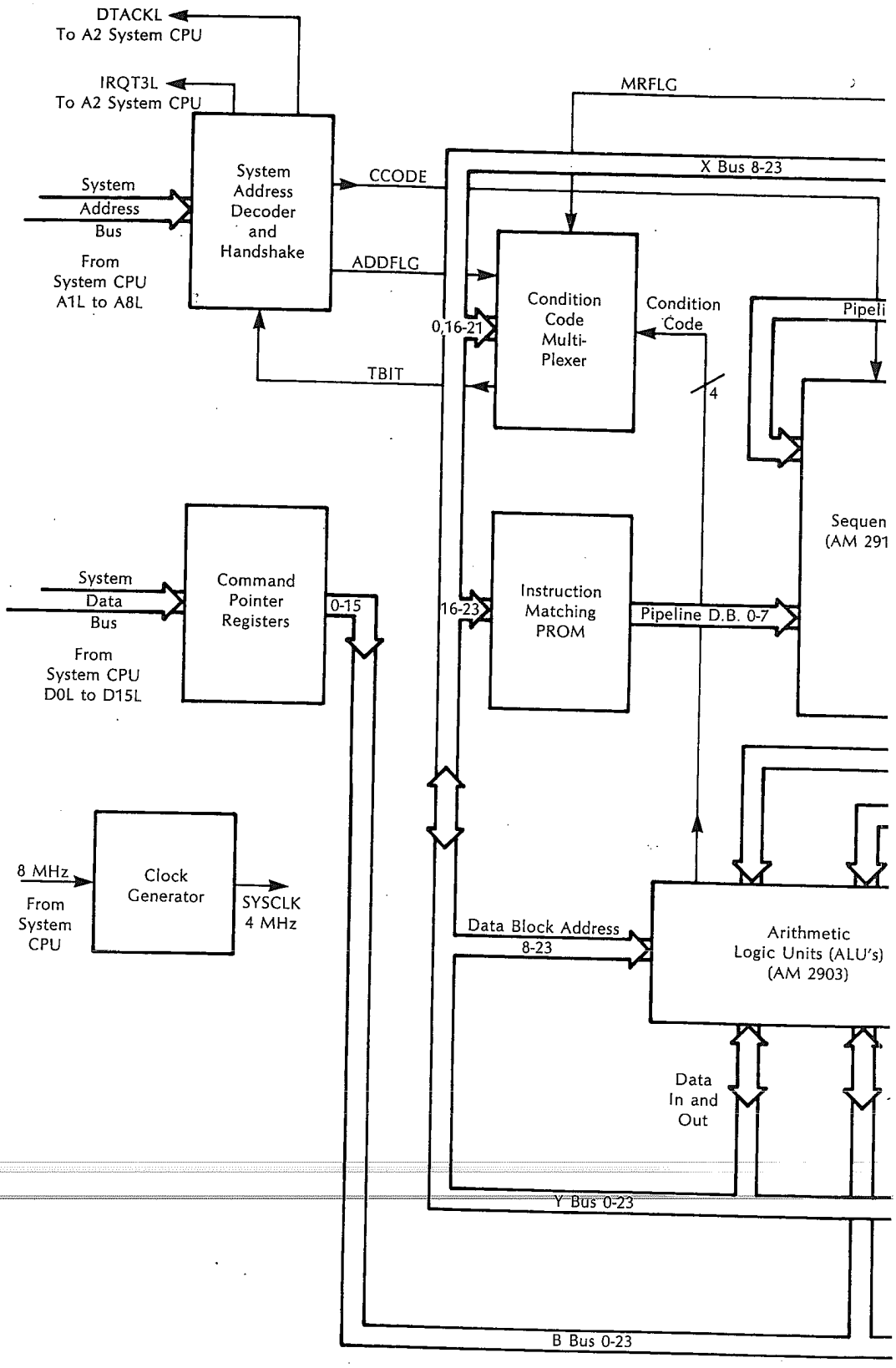
MYADDRL MY ADDRESS
Output signal of the address comparator to indicate the FPP assembly has been addressed by the A2 System CPU.

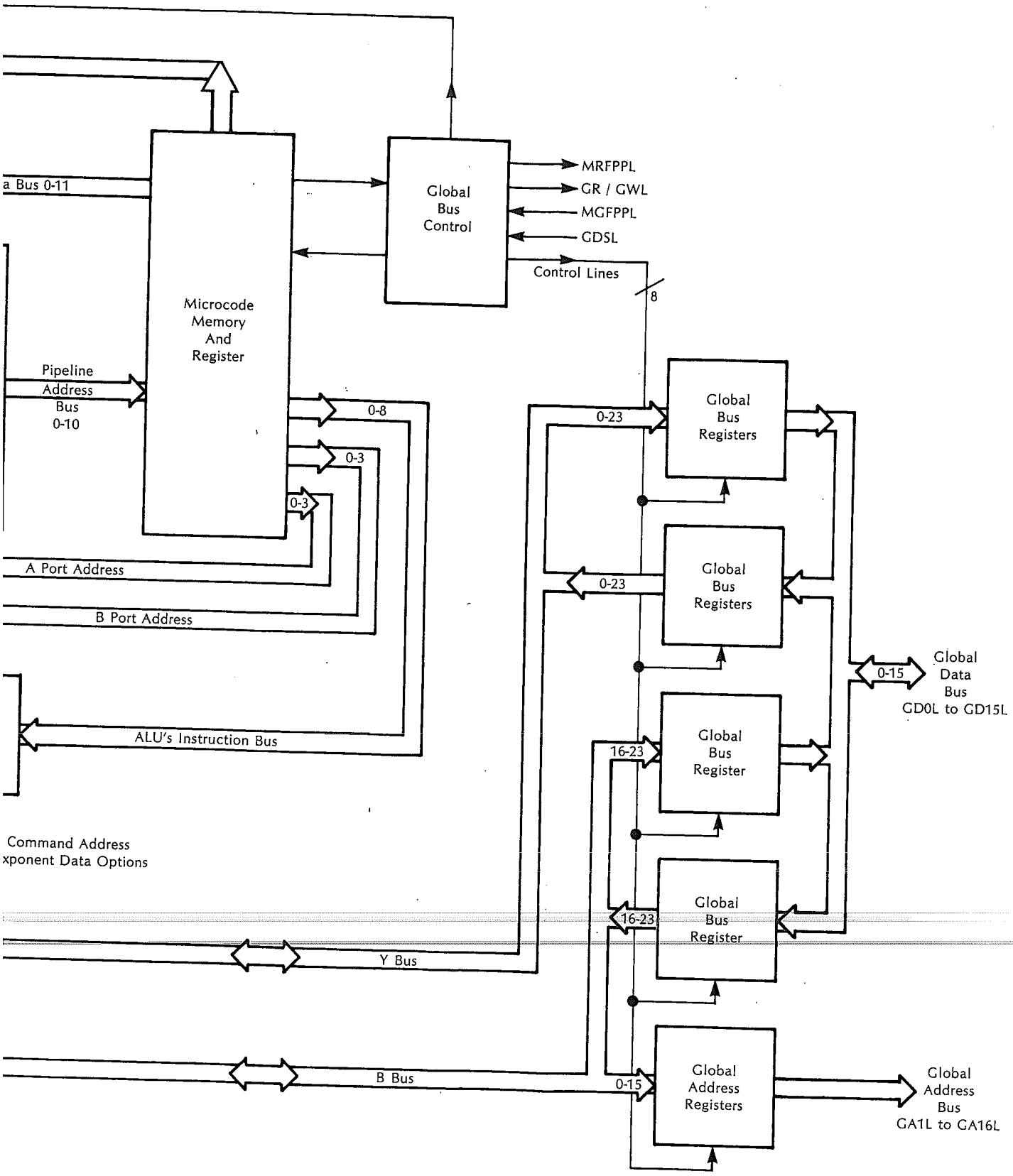
OPCLK OPTION CLOCK
This signal clocks the condition code of the FPP assembly into the condition code multiplexor.

QB0 Q BIT 0
This input to control PAL 1 determines whether GA1L is low or high.

Q1 OUTPUT 1
The output of control PAL 1 to control PAL 2 to indicate which half of a 32 bit global RAM transfer is to occur next.

SSADL SET ADD
Forces an add operation.


DTACKL
To A2 System CPU
IRQT3L
To A2 System CPU
MRFLG
X Bus 8-23
System
Address
Bus
From
System CPU
A1L to A8L
System Address Decoder and Handshake
CCODE
ADDFLG
TBIT
0,16-21
Condition Code Multi-Plexer
Condition Code
4
Pipeli
Sequen
(AM 291
System
Data
Bus
From
System CPU
D0L to D15L
Command Pointer Registers
0-15
16-23
Instruction Matching PROM
Pipeline D.B. 0-7
8 MHz
From
System
CPU
Clock Generator
SYSCLK
4 MHz
Data Block Address
8-23
Arithmetic Logic Units (ALU's) (AM 2903)
Data In and Out
Y Bus 0-23
B Bus 0-23



e 6-A7 **FPP Block Diagram**

6-9 A8, GLOBAL RAM/DISPLAY CONTROL A17, DISPLAY INTERFACE

The global RAM board stores data and arbitrates access to memory. It also works with the display interface board to control the transfer of data from memory to the display. Refer to the block diagrams in figures 6-A8a and 6-A8b and the schematic in figures 9-A8a and 9-A8b as referenced in the following circuit descriptions.

Arbiter

The arbiter section controls access to global RAM. Seven devices send memory request signals to the arbiter. The synchronizing register (U507) synchronizes the signals coming onto the board with respect to the global RAM. The priority decoder (U506) samples the memory requests periodically and allocates memory cycles based on the following priority list:

1. FFT, A9
2. DF1 (Digital Filter Channel 1), A5
3. DF2 (Digital Filter Channel 2), A5
4. RFSH (Memory Refresh), A8
5. B2D2 (Display Interface), A17
6. FPP, A7
7. 68 (System CPU), A2
8. Idle (If no device has asserted a memory request, the memory/global bus transceivers are disabled to prevent memory access.)

The feedback network (U405, U407, U408, and U508) prevents any device from receiving two consecutive memory cycles. The only exception is the FPP, which is allowed two consecutive memory cycles if no higher priority device is requesting memory.

A two-wire handshake coordinates memory requests and grants. When a device wants memory access, it first sets up valid global address and data at its output bus drivers. The device then initiates handshaking by asserting its memory request line low. When the device is allocated a memory cycle, its memory grant line goes low. This signal enables the device's address and data bus drivers. The address flows to the global RAM address multiplexer and is multiplexed into the memory. Data then flows into or out of memory through the bi-directional bus drivers. The global data strobe (GDSL) signal goes high to indicate valid data is on the bus. The memory grant unasserts and the handshake is ended.

Global Timing

The global timing section consists of a delay line oscillator and gating logic. Three delay lines (U311, U312, and U411) each have ten taps, each tap delayed 10 ns from the previous tap. The output from the third tap of the third delay line feeds back through an inverter to the input of the first delay line. The polarity of the signal changes every 235 nsec (230 nsec through the delay lines plus 5 nsec through the inverter). The result is a 2.13 MHz square wave. This signal is tapped at several intervals along the delay lines and passed through combinations of logic gates to generate timing signals.

Dynamic Memory Array

The RAM itself is a 64k by 16 bit dynamic memory array constructed from 16 64k by 1 bit dynamic RAM chips. The 16-pin RAM chips have 8 address input lines and require address multiplexing to receive 16 address bits.

Address Multiplexer and Address Drivers

The address multiplexer (U611 and U612) multiplexes the 16 global address lines and transfers the address 8 bits at a time to memory through the memory address drivers (U111 and U211).

Memory Control Drivers

The memory control circuit generates the row address strobe (RASLL and RASUL) and column address strobe (CASLL and CASUL) signals. These are clock signals which strobe the multiplexed address into the RAM.

Memory Refresh Timer and Refresh Address Counter

The dynamic global memory must be refreshed to prevent loss of data. Every 8.5 μs the memory refresh timer (U404) sends a memory refresh request (MRRFSHL) to the arbiter. When the arbiter issues a memory refresh grant (MGRFSHL), the output of the address multiplexer is disabled. The refresh address counter (U511 and U512) is enabled. The output is applied to the memory address drivers to set up the memory row to be refreshed. The row address strobe signals (RASUL and RASLL) are enabled and a read memory operation refreshes the RAM memory row.

Global Bus Transceivers

The global bus transceivers (U609 and U610) are bi-directional, inverting buffers which transfer data between the global data bus and memory locations. The RAMGR/GWL signal determines the direction of flow (if high, the transaction is a read cycle; if low, it is a write cycle).

Display Control/Interface

The display is presented to the viewer in the form of a frame. A frame consists of from 3 to 20 buffers (e.g. data, grid, scales). Each of these buffers has a predefined size and location in global memory. The display control/interface section monitors and directs the flow of this data to the 1345A display in response to control commands from the A2 System CPU.

DISPLAY CONTROLLER (A8)

The display controller (U303) is a field programmable logic sequencer or state machine. Among the inputs to the display controller are address and control lines from the system bus. The synchronizing register (U302) synchronizes the control inputs with the 8 MHz clock from the system CPU.

DISPLAY DMA WORD/ADDRESS COUNTERS (A8)

The system CPU puts the beginning address and the length of each buffer on the system data bus. They are clocked into the display DMA word (U400, U401, U500) and address (U600, U601, U602, U603) counters by the ALOADL and WLOADL signals from the display controller. Each time a display memory grant is asserted, the address from the address counters flows through the display address drivers (U604, U605) to the memory address multiplexer. After the display data has been transferred to the display interface board (A17), the count enable line (COUNT ENL) is asserted low. The address counters increment and the word counters decrement by one. This process continues until the entire buffer has been transmitted to the display interface. The word counters have gone to zero, asserting the TCL (terminate count) line low. This signal generates an interrupt to inform the system CPU that the buffer transmission is complete.

DISPLAY REFRESH TIMER (A8)

The display must be refreshed at a rate of 60 Hz or greater. U101 divides down the 8 MHz clock to 61 Hz. U201 is clocked by this 61 Hz signal and puts out a SYNC pulse every 16.4 msec. Each time the system CPU starts a new display frame it sets D15 on the system bus. This signal is used to reset the display refresh timer to coordinate the sync pulses with the new frame information.

DISPLAY INTERFACE (A17)

One section of the display interface board buffers information and control signals from the global bus to the 1345A display. This circuitry consists of two inverting registers (U1, U2) for the data lines and a non-inverting bus driver (U3) for the control lines.

The other section of the interface board is the output protection circuitry between the display X, Y, and Z outputs and their respective rear panel connectors.

Internal Signal Descriptions

ALOADL Address load, active low. Allows the contents of the system address bus to be loaded into the display address counter.

ARML Arm, active low. Clears the display refresh timer to synchronize the beginning of the frame with the negative to positive assertion of the SYNC signal.

BRSTL Board reset, active low. Software reset for the global RAM board, originates from the system CPU.

BUS EN1
BUS EN2 Timing signals which enable the global bus to perform a transaction.

C0 through C7 Counter address bus lines 0 through 7.

CASLL
CASUL — Column address strobes. Clock the multiplexed address into the dynamic RAMs.

CLK — 8 MHz clock. The 8 MHz system clock used to synchronize the global RAM board to the system CPU.

CD — Chip disable. Turns the global bus transceivers on (low) and off (high).

COUNT ENL — Count enable, active low. Increments the memory address counter and decrements the memory word counter for each word transfer to the display.

D15 — Set data bit 15. Set by the system CPU at the start of a new frame. Sets the ARML signal to clear the display refresh timer.

DAMUXL — Disable address multiplexer, active low. Opens the output of the address multiplexer so that the refresh address counter can be used for setting the global address lines. This is the inverse of the arbiter circuit signal YD, which indicates a memory refresh grant.

GD0 through GD15 — Global data lines between dynamic memory and global bus transceivers.

GSMP — Global sample. A 4.26 MHz clock produced by the delay line timer and used as the clock for the synchronizing register.

IDLEL — Idle, active low. Ensures that global RAM does not change when there is no memory grant asserted.

MA0 through MA7 — Memory address bus lines 0 through 7.

MCAS
MRAS — Master column (row) address strobe. Timing signals to the memory control drivers when the address is valid.

MGB2D2L — Memory grant, display, active low.

MGRFSHL — Memory grant, memory refresh, active low.

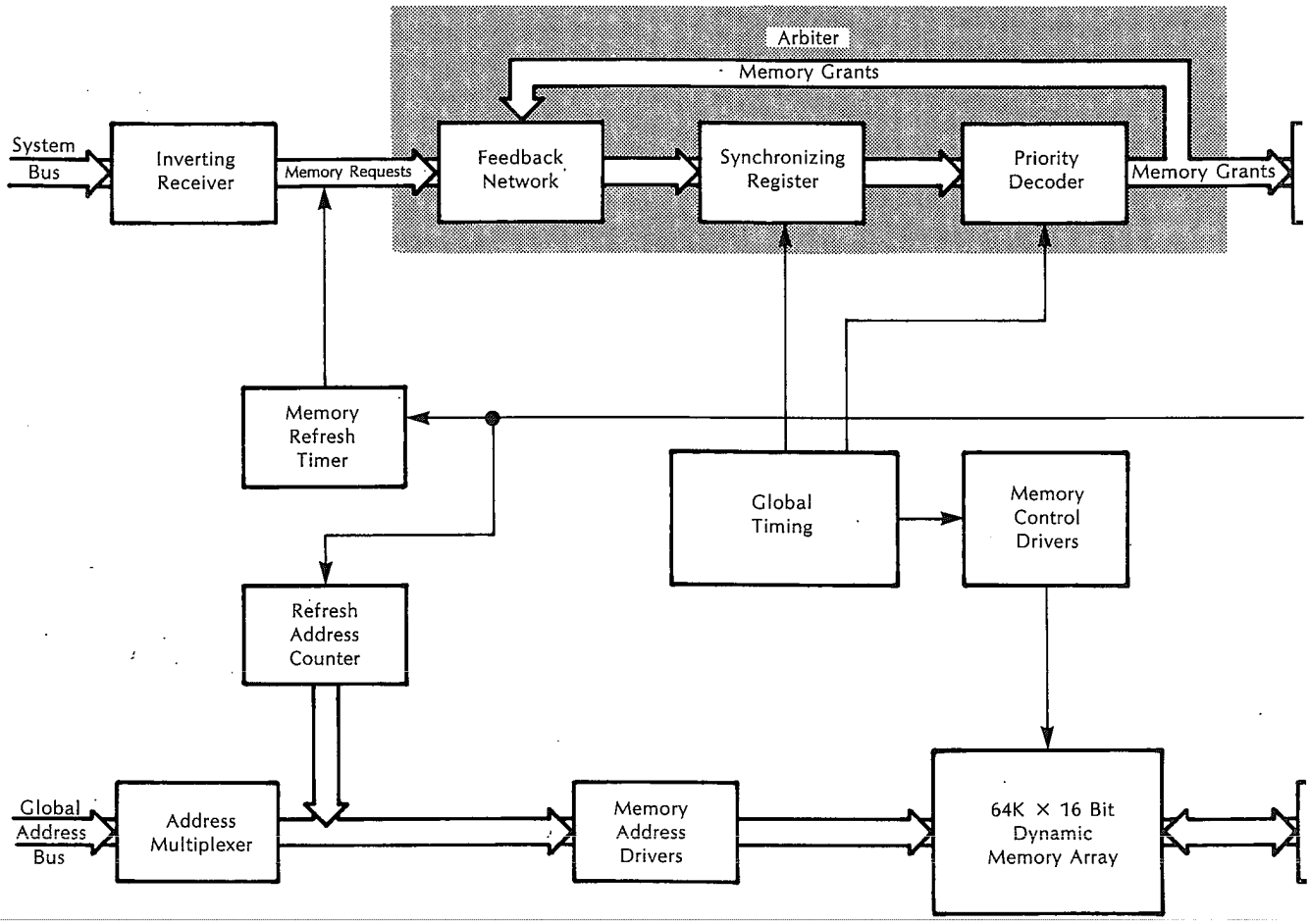
MRB2D2 — Memory request, display.

MRRFSH — Memory request, memory refresh.

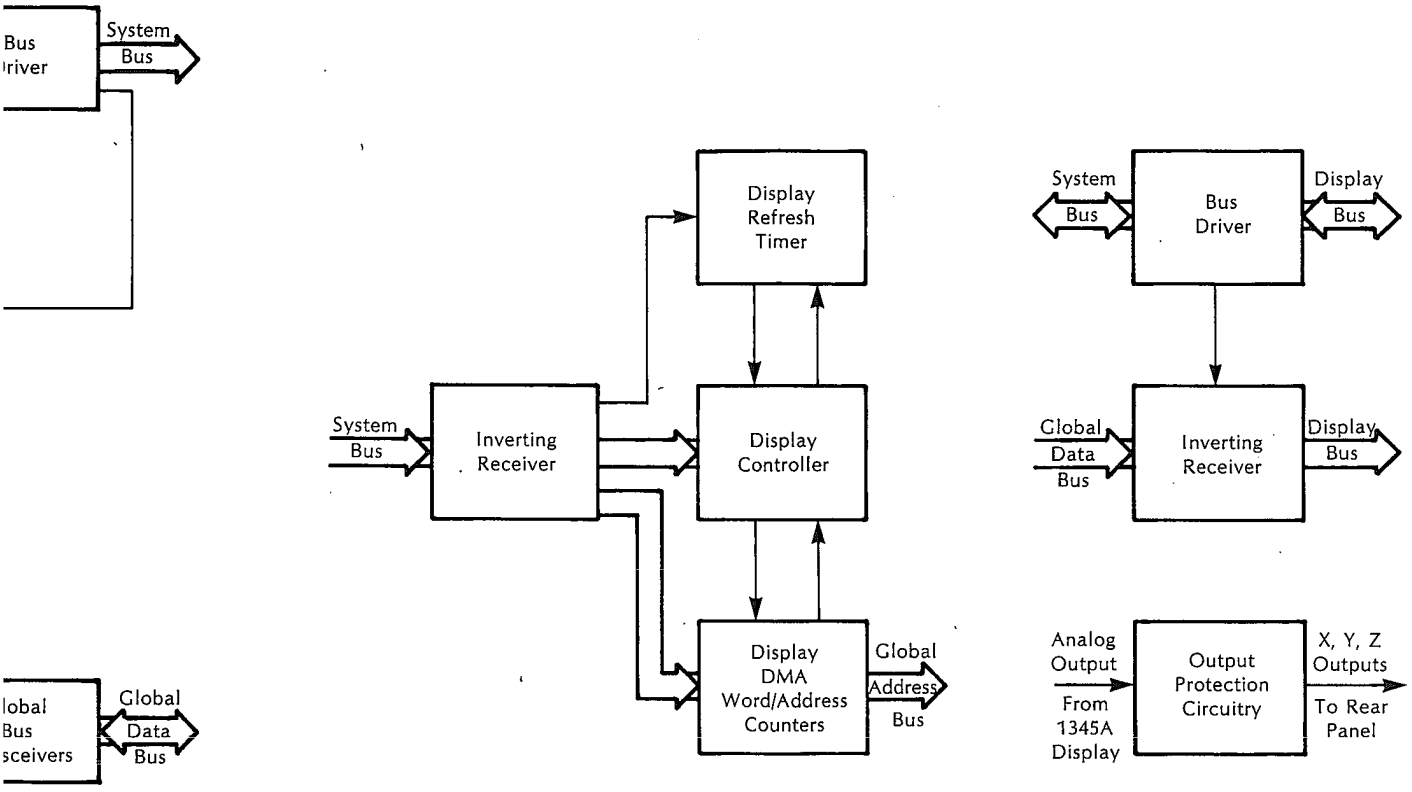
PWRON — Power on. Signal from system CPU to global timing circuit to ensure global timing is initialized at correct frequency.

RAM GR/GWL — RAM global read/global write, active low. Triggers the global bus tranceivers. When low, the transfer is a write cycle. When high, the transfer is a read cycle.

RAM GRL/GW	RAM global read (active low)/global write. Used to generate the WEL signal to allow a write transfer into memory.
RASLL **RASUL**	Row address strobes. Clock the multiplexed address into the dynamic RAMs.
RFDL	Ready for data, active low. Signal from display to inform controller that previous data point has been processed and a new data point is required.
ROW EN	Row enable. Switches the output of the address multiplexer.
RSTL	Rest. Software reset for the global RAM board, originates from the system CPU.
STROBE	Signal from global timing circuit used to generate global data strobe (GDSL).
SYNC	Output of the display refresh timer, used to synchronize frame refresh (approximately 61Hz).
TCL	Terminate count, active low. Indicates that the display word count has gone to zero.
WEL	Write enable, active low. Allows a write transfer into memory.
WLOADL	Word load, active low. Allows the word count from the system CPU to be loaded into the display word counters.
YA through YH	Memory grant lines from the priority decoder to the bus driver.



6-A8a Global RAM



A8 Display Controller

A17 Display Interface

6-A8b Display Controller / Interface

6-10 A9, FAST FOURIER TRANSFORM (FFT) PROCESSOR

The Fast Fourier Transform (FFT) processor board performs windowing, Fast Fourier Transform, and inverse Fast Fourier Transforms as specified by the System CPU (A2). Input and output data are stored in memory blocks in the global RAM. The FFT board performs the memory access (controls the global bus) to move these blocks to and from global memory (on the global bus). Input data may be real or complex, for one channel or two.

The description of how the FFT works covers operation at the system level (between the FFT board and the system CPU) and at the board level. Refer to the block diagrams in figures 6-A9a and 6-A9b and the schematic in figure 8-A9 for the following discussion of the theory of operation.

FFT Interaction with the CPU

The FFT board is controlled by the system CPU (A2) through the system bus. The FFT board appears to the main CPU board as a set of registers. These registers (sometimes called pseudo-registers) exist as RAM inside the FFT microprocessor chip.

FFT I/O is not synchronized with other activity on the global bus. The FFT requests control of the global bus for direct memory access (DMA) whenever it is necessary to get input data or store output data. The FFT has the highest priority interrupt status in the DMA chain. Memory access is provided within 500 ns of the FFT memory request.

FFT Microprocessor System

The FFT microprocessor (U103) is a TMS320 running at 5 MHz. The crystal oscillates at 20 MHz but the TMS320 divides that by four. The TMS320 and its ROM (U301 and U303) form a complete microprocessor system. The data bus between the TMS320 and its ROM is connected to the FFT internal data bus through a transceiver. The rest of the circuitry on the board appears to this system as individual I/O ports. The ports are activated by addressing combinations which activate the port decoder. The circuits that are not directly controlled by the TMS320 through the port decoder are indirectly controlled through the hardware control register.

Port Decoder

The port decoder (U216 and U217) is used by the TMS320 system to control the circuitry on the FFT board. This circuitry appears to the TMS320 as I/O ports on the internal data bus. The TMS320 enables ports through address and control lines which are input lines for the port decoder. When an address corresponding to a port appears on the address bus and the control lines are enabled, the port decoder selects one of thirteen lines to activate. These lines are described in the first part of the internal signal descriptions at the end of the FFT circuit description.

Hardware Control Register

The hardware control register (U405 and U406) is used to control circuits that are not directly connected to the internal data bus. It appears to the TMS320 as a write-only register on the internal data bus and is activated through the port decoder. It allows the TMS320 to control the global bus I/O sequencer, control the type of transform done, keep track of the level and scale factor during the transform, and monitor scale factors and execution status.

Address Generation

The FFT board must create addresses for the data input from and output to RAM when it has control of the global bus. This function is a major portion of the activity on the FFT board. The block entitled Address Generation on the main block diagram has its own block diagram made up of the blocks listed as follows. Refer to figure 6-A9b for the following discussion.

- I/O Sequencer
- Sequence Decoder
- Counters One and Two
- Address Translator
- Page Register
- Coefficient ROM

I/O SEQUENCER

The I/O sequencer (U117) controls the I/O process when the FFT board has control of the global bus. It manages the timing for global bus I/O and directs the generation of addresses used to transfer data to and from global RAM. The TMS320 system controls the I/O sequencer through the hardware control register. The sequencer is synchronized to the TMS320 operations through the port decoder to tell the sequencer when the TMS320 has accessed or provided data for the next I/O operation. The sequencer also initiates handshaking when the FFT needs memory access.

SEQUENCE DECODER

The sequence decoder (U115) decodes the outputs of the I/O sequencer. When the TMS320 begins a new level (the Fast Fourier Transform is performed in "levels", five of which are called "butterfly routines") it initializes the sequencer by activating LDHWCRL (load hardware control register). This signal from the port decoder also presets the sequencer (U117), starting the sequencer process. The memory access process is as follows:

- The sequencer asserts REQGBL (request global bus) to the global bus handshaking circuitry which produces a memory request (MRFFTL) to global RAM.
- When the memory grant (MGFFTL) comes back from global RAM the bus request is deactivated.
- If it's a read operation the read registers get loaded by GDSL (global data strobe). If it's a write operation, the write registers on the global data bus are enabled and the GR/GWL (global read/global write) signal is set low.
- When global RAM removes the memory grant signal (signaling that the cycle is complete) the address, data, and global write lines are all deactivated.

COUNTERS ONE AND TWO

Address generation begins with two counters. Counter One (U209 & U210) is an up-counter. Counter Two (U409-U411) is a loadable, count-up or count-down counter on the internal data bus. Counter Two appears as a write-only port to the TMS320 system. Typically, one counter is used to keep track of input addresses while the other is used to keep track of output addresses. The output of one of the two counters is selected by the counter multiplexer (U309-U311) to drive the address count bus.

ADDRESS TRANSLATOR

The address translator (U313 & U314) consists of 2 PAL ICs used to convert addresses on the address count bus to addresses on the FFT address bus depending on the FFT level and whether a read or a write operation is required. Several bits from the hardware control register are used to determine how the data on the address count bus is changed to FFT address bus data. PASSBIT0 is a control line (see schematic) used to mask off the least significant bit of the address during a complex transform requiring access to only even (real) window coefficient addresses.

PAGE REGISTER

The upper bits of the FFT address bus come from the Page Register (U312). This register on the internal data bus is a read-only register activated by the port decoder. It selects the RAM location for input and output blocks. The TMS320 sets the inputs which are written to (once) at the beginning of the transform. The page register specifies the four most significant bits of the FFT address bus dependent on whether the memory access is a read or a write (state of the FFTWR signal) and whether the information being accessed is window data or FFT data (state of the WINDPGL signal). (User defined windows are stored in RAM.)

COEFFICIENT ROM

The coefficient ROM (U315 and U317) appears on the internal data bus as a read-only register activated by the port decoder. The FFT address bus drives the ROM inputs. The purpose of this circuit is to convert FFT address information into coefficients used by the TMS320 system for the transform process.

Bus Interface

There are two busses connected to the FFT board; the system bus and the global bus. Each is composed of address lines and data lines. The system bus allows communication between the system CPU and the TMS320 system. The global bus allows the TMS320 system access to the global RAM which holds user defined window information and data for the Fourier transformation. The FFT board handles all memory access directly by requesting memory and controlling the global bus. The interface hardware consists of the following blocks:

System bus interface:

- System address bus buffer
- System data bus interface
- FFT interrupt circuit
- CPU interrupt circuit

Global bus interface:

- Global address bus interface
- Global data bus interface
- Global bus handshaking circuit

SYSTEM ADDRESS BUS BUFFER

The system address bus buffer (U505) appears as a read-only port to the TMS320 system. This register is used to tell the TMS320 processor which port the system CPU wants to access on the FFT board. These ports exists as RAM registers inside the TMS320.

SYSTEM DATA BUS INTERFACE

The system data interface (U506-U509) appears as one read-only register and one write-only register to the TMS320 system. Each is activated by the FF port decoder. These registers are used to transfer data between the FFT board and the system CPU (A2).

FFT INTERRUPT

The FFT board is controlled and monitored by the system CPU through the use of pseudo-registers inside the TMS320 integrated circuit. When the system CPU executes a write or read to one of these ports, the interrupt circuit on the FFT board generates an interrupt signal which is sent to the TMS320.

The FFT interrupt circuit consists of an identity comparator connected directly to the incoming system address bus. When the system CPU addresses the FFT board, the identity comparator (U510) in the interrupt block activates the BRDSELH (board select, active high) which generates an interrupt for the TMS320.

To determine which (pseudo) register the system CPU is requesting access to, the FFT interrupt service routine reads the address bus (through the address bus buffer, U505) onto the internal data bus. When the address is read, the interrupt is cleared and the data is transferred in the appropriate direction through the system data bus.

If the CPU is writing to the FFT board, the TMS320 reads the data registers by asserting the SDBUSINL (system data bus in) signal which activates DTACKL (data acknowledge). When the system CPU receives the DTACKL signal, it removes (or changes) the address, which deactivates BRDSELH, which deactivates DTACKL. If the FFT is writing to the CPU, the FFT puts the data on the output data registers (a write operation) and performs a (dummy) read to activate DTACKL, telling the CPU that the data on the bus is valid. When the CPU finishes reading the data it removes the FFT address, which deactivates BRDSELH, which deactivates DTACKL.

CPU INTERRUPT

The CPU interrupt circuit consists of an R-S flip-flop with two Reset inputs and one Set input. Inverters are used in pairs to ensure a single TTL load on the system bus. The RESETL signal from the system resets the CPU interrupt circuit to ensure that the FFT board does not have an impending interrupt request after a reset.

The FFT performs a CPU interrupt by activating the SIRQSYSL (set interrupt request, system) line which activates IRQT4L on the system bus. When the system CPU runs its interrupt service routine, it reads the status register on the FFT board and the TMS320 resets the interrupt.

GLOBAL ADDRESS BUS INTERFACE

The global address bus interface (U511 and U512) is a latch circuit which exists between the FFT address bus and the global address bus. These latches are clocked when the FFT board requests control of the global bus and are enabled when the FFT board is granted control of the bus.

GLOBAL DATA BUS INTERFACE

The global data bus interface appears as one read-only register and one write-only register to the TMS320. They are enabled by signals GDBINL and GDBOUTL from the port decoder.

GLOBAL BUS HANDSHAKING

This block is used to coordinate data transfers between the FFT board and global RAM. When the FFT board needs access to memory, it requests control of the global bus by activating REQGBL (request global bus) signal to the handshake block. This activates the MRFFTL (memory request from FFT) signal going off the FFT board. When the MGFFTL (memory grant to the FFT) signal becomes active, the memory request is removed and the read or write is performed through the global data bus interface. If the operation is a read, the GDSL (global data strobe) signal is used to indicate when the data on the bus is valid. If the operation is a write, the data is loaded into the write register at the same time the GR/GWL (global read/global write) signal is set low to indicate to the memory that the data on the bus is valid.

Pseudo-Scale ROM

All data operations are done in the TMS320 microprocessor. The only hardware doing math operations outside the TMS320 is the pseudo-scale ROM (U305). It looks at the internal data bus on each data write cycle and compares the upper eight bits to values stored in memory. The two output lines are reclocked by flip-flops in U208. The TMS320 clocks them when it puts something on the global data bus. The flip-flops store the largest value output for that particular pass of the FFT. Before beginning the next pass, the TMS320 examines (and clears) the DIVBY4 and DIVBY2 lines (from the flip-flops) to see how big the data was on the last pass; it then can select a scale for the next pass.

Butterfly Subroutine Address ROM

The TMS320 keeps track of the address process via the Butterfly Type PLA (U207) and the Butterfly Subroutine Address ROM (U502)-hereafter referred to as the Butterfly ROM. The Butterfly ROM is a read-only port on the internal data bus which is activated by the port decoder. The TMS320 uses information from this logic to keep track of execution status of the transform to guide its math operations (help select subroutines). Depending on where execution is in the pass, the TYPE2BF line from U207 tells the ROM which of two types of butterfly routines to execute.

Test Bit Mux

The test bit multiplexer (U206) selects the the TMS320 test bit (BIO320). This allows the TMS320 to examine the scale-compare flip-flops in U208 and examine the PASSDONE bit which comes from the sequencer telling the processor when execution has finished a level. It can also examine the PRN bit from U105.

Pseudorandom Number Generator

This circuit provides a bit that is randomly high or low. The FFT processor uses this information to do a math routine called dithered rounding.

LED Register

LED register (U202) is a write-only register on the FFT internal data bus. It drives the LED arrays CR101 and CR102. One line is used as the start/stop signal for digital signature analysis (DSA). Another line is used to clear the pseudorandom generator.

Internal Signal Descriptions

PORT DECODER OUTPUTS

SIRQSYSL Set interrupt request to system, active low.

RIRQSYSL Reset interrupt request to system, active low.

GDBINL Global data bus in, active low.

GDBOUTL Global data bus out, active low.

SDBUSINL System data bus in, active low.

SDBUSOUTL System data bus out, active low.

SABUSINL System address bus in, active low.

PROMINL Coefficient ROM read, active low.

LDPGSL Load page register, active low.

LDHWCRL Load hardware control register, active low.

LDCTR2L Load counter two, active low.

CLRSCALEL Clears the scale data in the pseudo-scale ROM output flip-flops, active low.

BFSUBADL Butterfly subroutine address, active low.

HARDWARE CONTROL REGISTER OUTPUTS

WINLOC Window location. The data for the standard windows is on the FFT board; the data for user defined windows are kept in global RAM.

BNKSELH Bank select, active high. Selects upper or lower 32k of memory.

SWAP Swap two halves of the time buffer.

CTR2DNL Set counter two to count down, active low.

TWOCH Measurement is two-channel as opposed to single channel.

REALDATA Data is real as opposed to complex.

SEQSEL0
SEQSEL1 These two lines select one of three sequences for the I/O sequencer; this tells it how to control the counters and page register depending on whether the execution is processing a window, an FFT, or a deinterlace (terms associated with FFT).

LEV2
LEV1
LEV0 These three lines select one of seven levels within the FFT process. The seven levels are: window, five butterfly passes, and (if necessary) deinterlace. Each level processes an entire block of data in memory. The LEV signals help keep track of addressing.

TBSEL2
TBSEL1
TBSEL0 These three lines are used to choose one of four signals used by the test bit mux.

SCALE1
SCALE0 These lines are used to select one of three signals to convey information about the math results on the previous level to the page register.

OTHER SIGNALS

IDB0 through **IDB15** Internal data bus lines 0 through 15.

SDOUTENL System data bus output enable, active low.

DIVBY4
DIVBY2 Two lines conveying information from the pseudo-scale ROM to the TMS320 test bit mux concerning data size.

PASSDONE Signals the end of a level (see LEV).

DIDONE Same as PASSDONE for the deinterlace pass.

IRQ320 Interrupt request to the TMS320 microprocessor.

LDCAL Load coefficient address, active low. Signal from the I/O sequencer which loads data on the internal data bus into the coefficient ROM address inputs.

CTR2B11 Counter two, bit 11. Bit 11 on the FFT address bus (FA11) originates in one of two places: counter two or the page register. The signal from the page register is W11. The sequence decoder picks one of these two, depending on some other addressing criteria, and puts out FA11.

W11 See CTR2B11.

FA11 See CTR2B11.

CTR1ENL Counter select, counter one is selected when low.

DEC2L Decrement counter two, active low.

INC2L Increment counter two, active low.

INC1L Increment counter one, active low.

FFTWR FFT write. Command from the I/O sequencer to the global bus handshake circuit to write. Also used in conjunction with the WINDPGL signal as input to the page register to determine address page to use depending on whether the operation is a read or a write and the data is window information or coefficient information. (It is not possible to write coefficient information).

WINDPGL Window page, active low. Used in conjunction with FFTWR as input to the page register. See FFTWR.

PASSBIT0 A signal ANDed with bit 0 on the FFT address bus so that it passes bit 0 when high and holds bit 0 low when low. See the discussion on the address translator.

GDINEMPTY Global data input register empty. Indicates that there is no data waiting to be read from the global data bus registers.

CLREMPTYL Clears the GDINEMPTY flip-flop.

GDOUTRDY Global data output register ready. Indicates that data in the global data output register is ready to be read (valid).

CLRRDYL Clears the GDOUTRDY flip-flop.

FFTMR FFT memory request. This signal is active high between the time that the FFT board requests the global bus and the time that it is granted control of the bus. It is an input to the I/O sequencer.

FFTMG FFT memory grant. This signal is a direct result of the FFT board being granted control of the global bus. It is an input to the I/O sequencer.

POSTINCL Post increment, active low. Controls whether counters are incremented after a read or write.

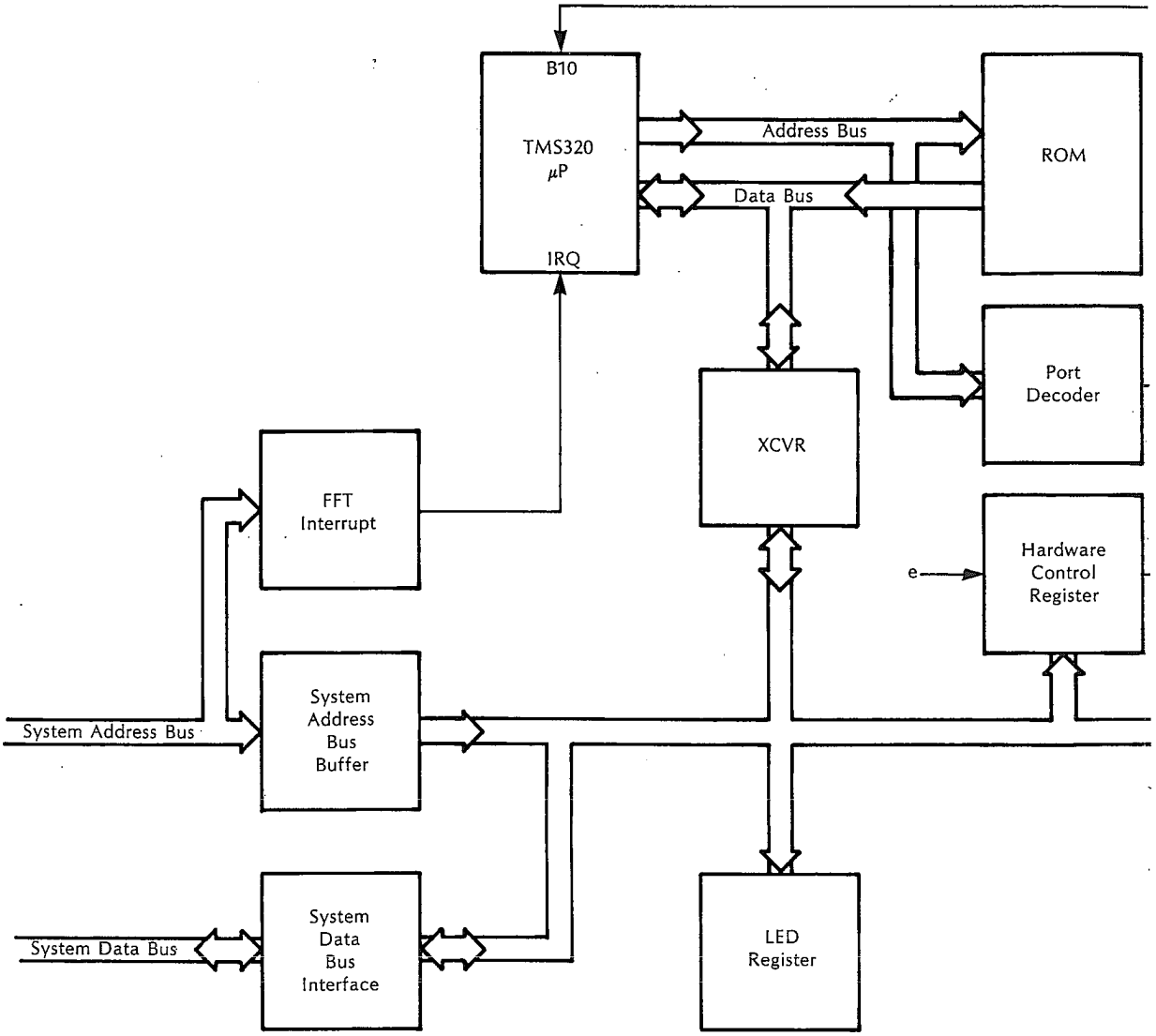
REQGBL Request global bus, active low. A signal from the I/O sequencer to the sequence decoder and the global bus handshake circuit requesting control of the global bus.

LDGDBRL Load global data bus register, active low. This signal loads data from the global data bus into the read registers. It is activated when the FFT is granted memory access and GDSL (global data strobe) becomes active (low).

BIO320L Branch on I/O, active low. A signal from the test bit mux to the TMS320 microprocessor.

IRQ320L Interrupt request to the TMS320 microprocessor, active low.

BRDSELH Board select, active high. Signal created by the identity comparator in the FFT interrupt circuit. This signal indicates that the system CPU is addressing the FFT board.


B10
TMS320
μP
IRQ
Address Bus
Data Bus
ROM
Port
Decoder
XCVR
FFT
Interrupt
Hardware
Control
Register
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System
Address
Bus
Buffer
System Address Bus
System
Data
Bus
Interface
System Data Bus
LED
Register

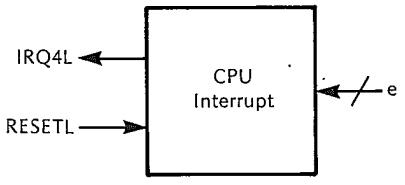
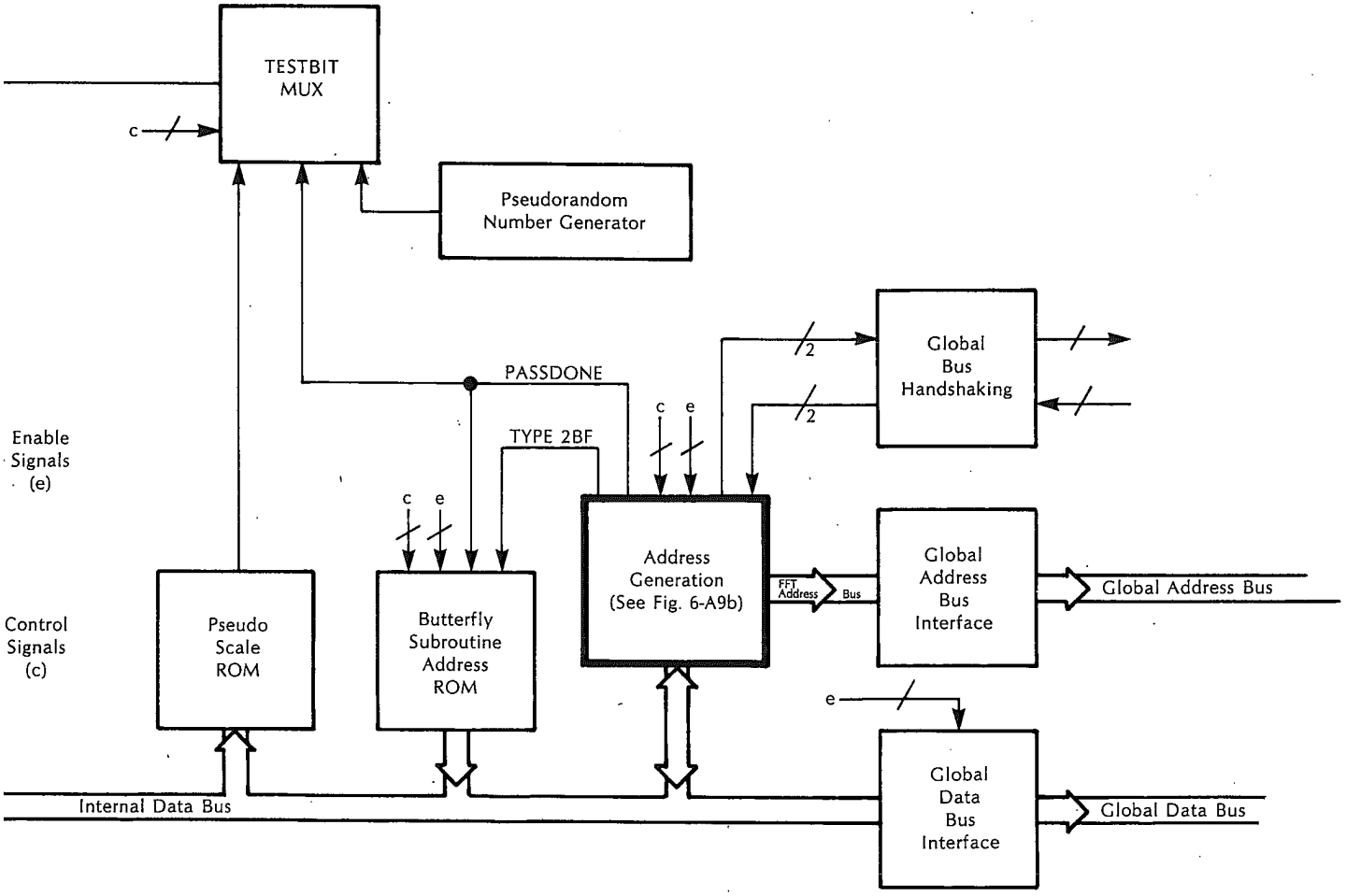
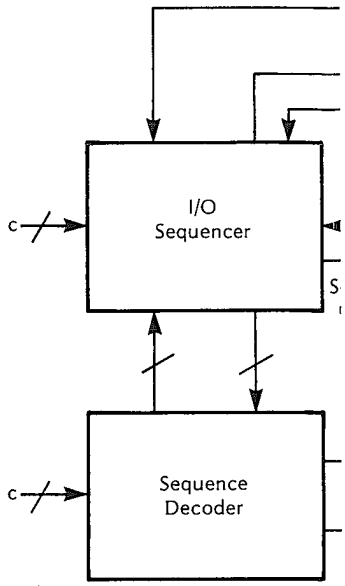
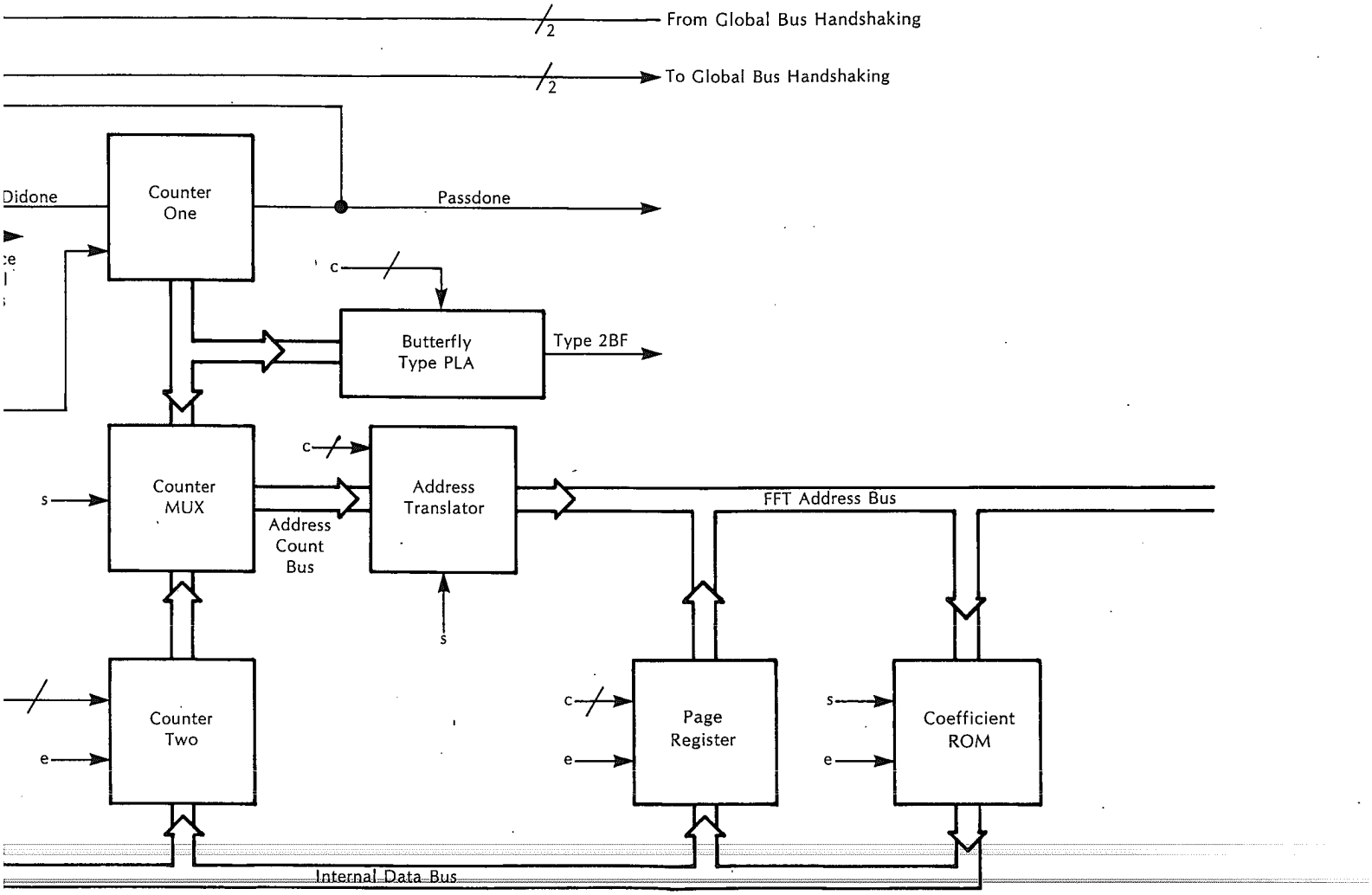

IRQ4L
RESETL
CPU
Interrupt
e

Figure 6-A



562A FFT Board Block Diagram


I/O
Sequencer
c
Sequence
Decoder
c



6-A9b Address Generation Block

6-11 A15 KEYBOARD

Refer to figure 6-A15 for this discussion. The keyboard provides operator inputs to the HP 3562A as well as operation feedback in the form of status LEDs. The three major functions of this assembly are:

1. To send the code of any key pressed to the A2 System CPU.
2. To indicate operational status with LEDs.
3. To inform the A2 System CPU when the rotational pulse generators (RPG1, RPG2) have been enabled.

LED Indicators

The A2 System CPU sets the appropriate system data line (D0L to D7L) for the LED which is to be turned on. Next, the system processor asserts the instruction lines for the keyboard (A1L, A2L, WRITEL, KYBRDL). After these lines are set up, the address strobe (ASL) line is asserted which causes the keyboard processor to be interrupted by the keyboard select (KYSEL) signal. When interrupted, the keyboard processor reads the instruction lines and causes LED1L or LED2L to latch the system data to the LEDs.

Front Panel Key Pressed

The keyboard processor continuously increments its output port except when it is interfacing with the system CPU. The output port controls a BCD-to-decimal decoder and multiplexer. When a key is pressed by the operator, an input line to the multiplexer is grounded and the KEY line is asserted. When the keyboard processor senses the asserted KEY line, it reads the matrix counter, and stores the value internally. At the same time, the keyboard processor asserts IRQ causing the interrupt request (IRQT2L) signal to be sent to the system processor.

The system processor always responds to a keyboard interrupt request by first sending a status request instruction to the keyboard. This instruction causes the following to happen:

1. The output register enabled (OREGENL) signal is asserted.
2. The keyboard status is put on the keyboard bus.
3. The status is stored in the data output register when OREGL is asserted.
4. The CLRPGL line is asserted to clear the IRQT2L line.
5. The DTACKL signal is sent to the A2 System CPU to indicate the data was transferred.
6. The A2 System CPU reads the status word to determine what has occurred on the keyboard.
7. The A2 System CPU sends an instruction to the keyboard processor to output the value stored in the keyboard matrix counter. This value is the key code.
8. The Key Code is read by the system processor to determine what key has been pressed.

In addition to reading the front panel keys the system processor can also sound the beeper when an error occurs. To sound the beeper, the A2 System CPU sends the beeper instruction to the keyboard. The keyboard processor sets the decoder output lines to activate the beeper.

Rotational Pulse Generators

The RPGs must be activated before they can be used. The signal lines XL and YL activate the marker RPG (RPG1) and the X and Y front panel LEDs. The ENABLED signal line activates the parameter RPG (RPG2). Since both RPGs operate in the same manner, only RPG1 is described.

After the A2 System Processor instructs the keyboard to turn on the X or Y LED, the input lines XL and YL activate the marker RPG; the output of the turn latch (RPG1) is set to a logic 1. When the RPG is turned, the clock of the turn latch toggles between TTL level high and TTL level low. The output of the turn latch (RPG1) toggles the clock of the direction latch. The output of the direction latch (DIR1) depends on the direction the RPG is turned. After the RPG1 and DIR1 signals are sent to the keyboard processor the following occurs:

1. The keyboard processor polls the RPG1 and DIR1 lines and IRQT2L is sent to the A2 System CPU.

2. The system processor instructs the keyboard to send its status. The status word tells the system processor which RPG was moved and in what direction.

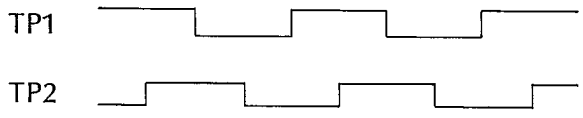
3. The keyboard processor asserts the Clear RPG (CLRPGL) line, clearing the turn and interrupt latches.

The system processor uses the information from the keyboard in the display routines. These routines increment the marker one location in the direction as indicated by DIR1 and DIR2.

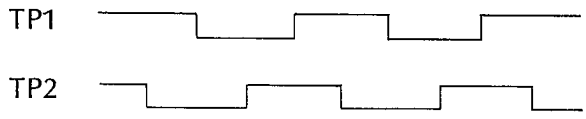
As the RPG moves, the above steps are repeated until no further movement of the RPG is detected.

The outputs of the RPG appears as follows:

Clockwise:



Counterclockwise:



When the RPG latches are enabled, turning of the RPG causes the RPG1 line to go high. This clocks the direction latch.

Internal Signal Descriptions

CLRPGL CLEAR ROTATION PULSE GENERATOR (RPG)
Active Low
Output of the keyboard device decoder. This signal clears the turn and interrupt latches.

DIR1 DIRECTION of ROTATION of RPG1
Direction latch 1 send DIR1 to the keyboard processor to indicate which direction the marker RPG has been rotated.

DIR2 DIRECTION of ROTATION of RPG2
Direction latch 2 sends DIR2 to the keyboard processor to indicate which direction the parameter RPG has been rotated.

ENABLEDL ENABLED PARAMETER
Active Low
The LEDs latch 1 sets ENABLEDL low to light the Enable LED and activate Turn Latch 2.

EP0 to EP7 EPROM0 to EPROM7
The keyboard EPROM sends instructions to the keyboard processor using these lines.

KACKL KEYBOARD ACKNOWLEDGE
Active Low
Signal from the keyboard device decoder to clock DTACKL out to the A2 System CPU.

KAS KEYBOARD ADDRESS STROBE
Signal from the keyboard processor indicating addresses KA8 to KA12 are valid.

KB0 to KB7 KEYBOARD BUS LINES 0 through 7
Keyboard data lines the keyboard processor uses for input and output.

KDS KEYBOARD DATA STROBE
The keyboard processor send KDS to the control circuit when there is valid data on KB0 to KB7.

KRD KEYBOARD READ/WRITE
This signal determines whether the keyboard processor is reading or writing on data lines KB0 to KB7. The keyboard control circuitry also uses KRD to set up input and output operations for the keyboard.

KROML KEYBOARD ROM
Active Low
This signal from the keyboard device decoder enables the instruction ROM lines EP0 to EP7.

KYSEL KEYBOARD SELECT
Active Low
The keyboard command register uses KYSEL to interrupt the keyboard processor when the keyboard has been addressed by the system processor.

LED1L LED 1 ENABLE
Active Low
This signal clocks the system data bus through the LED's Input Register into the keyboard LED's Latch 1.

LED2L LED 2 ENABLE
Active Low
This signal clocks the system data bus through the LED's Input Register into the keyboard LED's Latch 2.

OREGENL OUTPUT REGISTER ENABLE
Active Low
When this signal is low, keyboard data from the data output register is put on the system bus.

OREGL OUTPUT REGISTER
Active Low
This signal clocks keyboard data into the data output register.

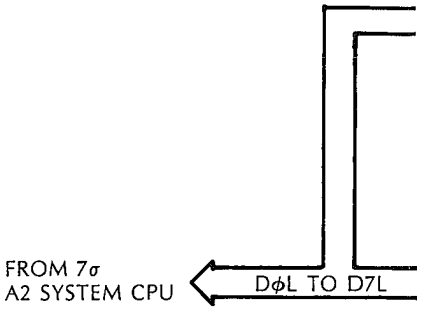
PA0 to PA7 PORT A0 to PORT A7
Port A lines are output lines of the keyboard processor. The keyboard processor uses PA0 to PA6 to set up the key matrix and uses PA7 to clock IRQT2L to the A2 System CPU.

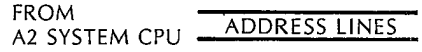
RPG1 ROTATION PULSE GENERATOR 1
When the marker RPG is moved, Turn Latch 1 sends RPG1 to the keyboard processor.

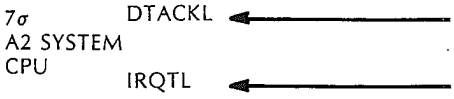
RPG2 ROTATION PULSE GENERATOR 2
When the parameter RPG is moved, Turn Latch 2 sends RPG2 to the keyboard processor.

XL X CURSOR
Active Low
Output signal of LED's Latch 1. It enables the X cursor LED and Turn Latch 1.

YL Y CURSOR
Active Low
Output signal of LEDs Latch 1. It enables the Y cursor LED and Turn Latch 1.


FROM 7σ
A2 SYSTEM CPU
DϕL TO D7L


FROM
A2 SYSTEM CPU
ADDRESS LINES


7σ
A2 SYSTEM
CPU
DTACKL
IRQTL

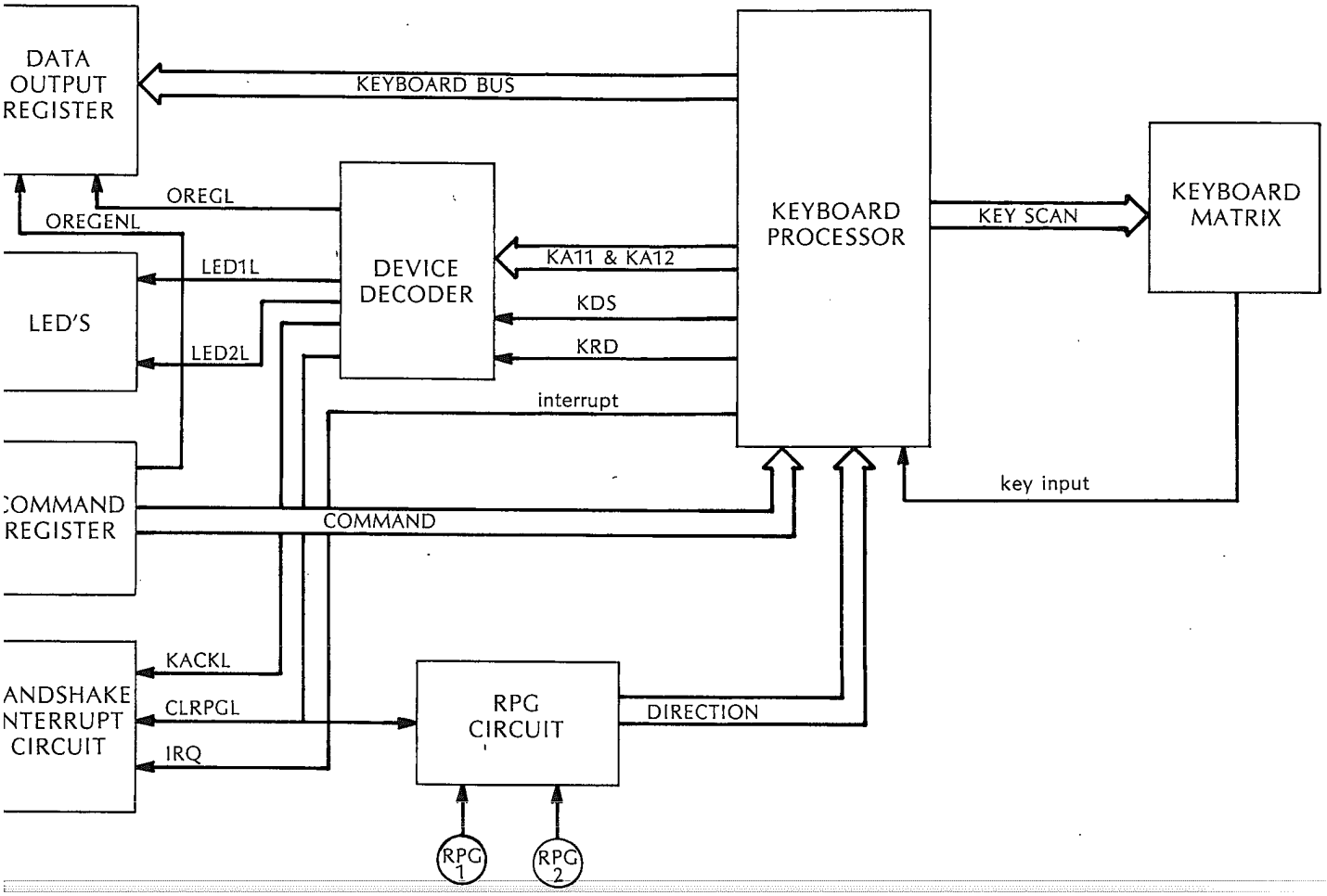


Figure 6-A15 Keyboard Block Diagram

6-12 A18 POWER SUPPLY

The HP 3562A power supply is a half-bridge switching power supply. It supplies 5 volts dc at 30 amps regulated power. It also supplies low power, linear regulated ±30 Vdc, ±15 Vdc, +8 Vdc, and +2.6 Vdc. The power supply operates with a line voltage from 84 Vac to 129 Vac and from 187 Vac to 255 Vac. The line frequency can vary from 47 Hz to 66 Hz.

Refer to figure 6-A18 for this discussion. The primary rectifier converts the ac line voltage to a high dc voltage with ripple. This dc voltage is fed into FET chopper switches to produce positive and negative pulses. The power output of the power supply increases and decreases with the pulse width. The pulse width is controlled by the pulse width modulator (PWM) compensating for line voltage and load variations. The control voltage used by the PWM to determine the pulse width is derived from the 5V supply. As the 5V supply deviates from the 5V reference voltage, the PWM reduces or increases the duty cycle of the FET chopper switches changing the output voltage. The output of the primary transformer is a square wave at 128 kHz which is rectified and filtered to make a dc output with ripple. The 5V supply and the secondary supplies then regulate the output to produce the dc voltages needed by the HP 3562A.

Turn On

At the moment the power supply is turned on, the primary capacitors and the bias power supply capacitors begin charging. The supply is not switching and the entire instrument is in the reset mode. The power down circuit monitors the bias supply's transformer to determine when the line voltage is at the correct level. When the voltage reaches the correct level, the power down circuit signals the PWM and the power supply starts switching. The slow start circuit is then triggered and the pulse width of the FET chopper switches increases slowly (0.1s) to its normal width. The slow start circuit is then triggered and the PWM slowly (0.1s) increases the pulse width to the correct level. As soon as the 5 volt output comes up to 4.75 volts, the PWRUP signal goes high and unlocks the A2 System CPU.

Primary Rectifier and RC Filter

This full-wave bridge rectifier and R-C filter network converts the ac power input to a high dc voltage between 236 Vdc and 364 Vdc with a 10V to 15V ripple. When switch S1 is set to the 115V position, the primary rectifier and filter functions as a voltage doubling circuit. When S1 is set to the 220V position, the primary rectifier and filter functions as a full-wave bridge circuit.

Bias Power Supply

The bias power supply is a linear, low power supply that provides power for the PWM, control circuits, and protection circuits. This supply takes its input directly from the ac line through its own transformer. The bias power supply provides ±12 Vdc which rises and falls with the line voltage.

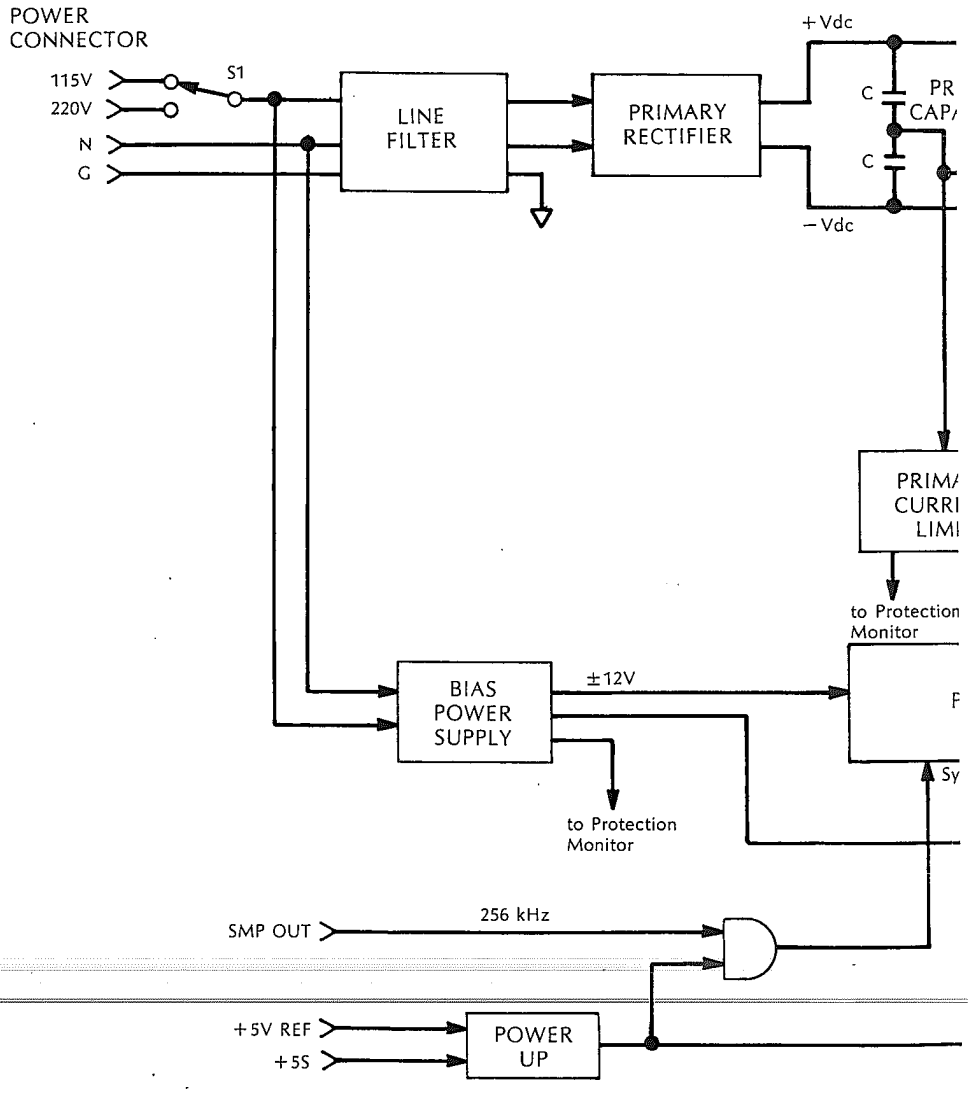
Pulse Width Modulator

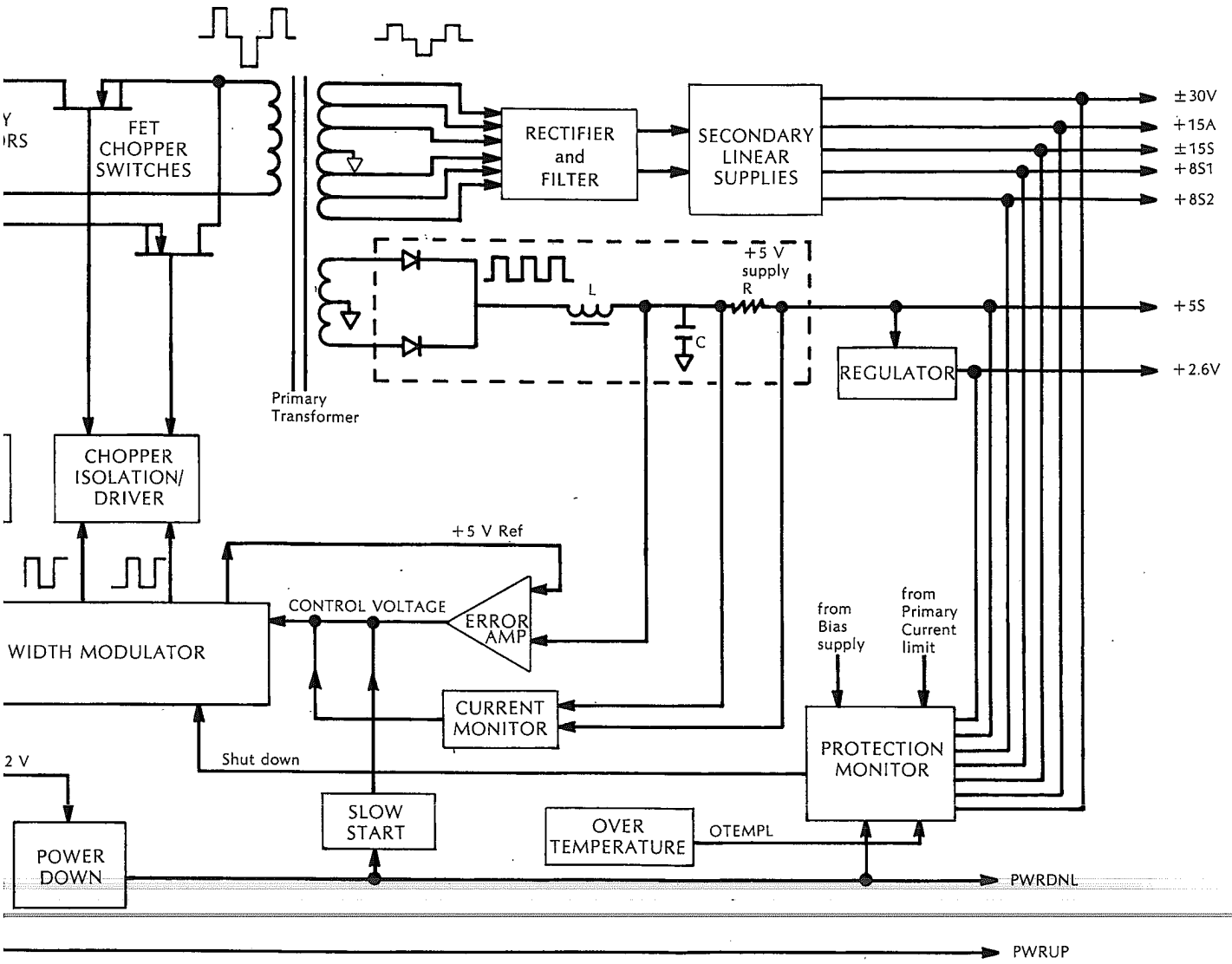
The voltage output of the power supply is controlled by the pulse width modulator (PWM). It drives the chopper switches in a manner which maintains a constant voltage output. The PWM compares the 5 Vdc voltage to its own internal reference using the error amplifier. This comparison determines the duty cycle of the FET chopper switches. The PWM contains its own internal oscillator and +5V reference. The PWM can be turned off by the protection monitor, power down, and current limit circuits.

Protection Circuits

There are five sections of protection circuits: the primary current limit, the power down, the current monitor, the over temperature circuit, and the protection monitor. The primary current limit circuit quickly shuts down the power supply when the current in the primary exceeds about 8A by shutting off the voltage supply of the PWM. If this fault occurs, the power must be cycled for the instrument to operate. When switch S1 is in the 115V position and the line voltage drops to less than 84 Vrms, the power fail sign (PWRDNL) becomes active. If the line voltage drops to less than 160 Vrms, PWRDNL becomes active (when switch S1 is in the 220V switch position). This signal goes to the protection and current monitors and the PWM is shut off. The power down signal also goes to the A30 Analog Source and the A2 System CPU to signal a power down is occurring.

The current monitor senses an over-current condition in the 5V supply. When this fault occurs, it reduces the control voltage to the PWM, which results in a reduction of the output power of the primary transformer. The protection monitor senses two things: over voltage in the positive supplies and if the voltages from the negative supplies rise above ground. When a voltage fault, current fault, power failure, or over temperature (OTEMP) occurs the protection monitor shuts off the PWM and lights the corresponding fault LED. The LED indicates which fault-detecting circuit was activated. All the LEDs are off during normal operation.


POWER
CONNECTOR
115V
220V
N
G
S1
LINE
FILTER
PRIMARY
RECTIFIER
+Vdc
−Vdc
C
C
PR
CAP
PRIM
CURR
LIM
to Protection
Monitor
BIAS
POWER
SUPPLY
±12V
to Protection
Monitor
SMP OUT
256 kHz
+5V REF
+5S
POWER
UP



re 6-A18 **Power Supply Block Diagram**

6-13 A30, ANALOG SOURCE

The descriptions in this chapter are written to help you understand the operation of the circuits of the analog source board. The circuit functions are discussed beyond the block level but not to the component level. Refer to the A30 schematic for part and pin numbers while reading this circuit description.

The analog source board performs two functions: 1) converts digital information from the digital source board (for sinusoidal signals) into an analog signal available at the front panel, and 2) generates pseudo random noise (PRN) and square wave signals which are used to calibrate the input and ADC boards. Refer to the block diagram and schematic drawings for the following discussion.

Sine Wave Interface

The digital source board provides the source signal in digital form to the analog source board which converts it into the selected analog signal. The digital information enters the analog source board in a serial format as a signal called DACDAT at pin 39 and is shifted into serial-to-parallel shift registers U553 and U552. The clock used to shift in the data is on pin 40 and the enable signal is on pin 27. The parallel output is latched by U551 and U550 into the D/A converter (DAC) U551.

Source Signal DAC

U551 changes the digital information originating on the digital source board into an analog signal. The output is a current signal which is converted to a voltage signal by U350 and buffered by U352.

100 kHz LPF

The filter consists of passive components followed by an amplifier stage (U50) which buffers the filter and has enough gain to make up for losses in the filter and losses in U251 (next stage).

Attenuator

U251 is a multiplying D/A converter used to control the amplitude of the source. The analog source signal from the 100 kHz LPF is connected to pin 15 which is the reference voltage input for the DAC. In this configuration the circuit performs as a step attenuator such that its output is 0 V when all control lines are low and it increases 5 mV for consecutively larger binary numbers. The digital information which sets the output level of the attenuator comes onto the board as a serial bit stream through the front end interface circuit as described for that block later in this section. The output of U251 is a current signal which is converted to a voltage signal by U250.

Summer/driver

U400 is an operational amplifier used to sum together the source signal and the user-selected dc offset coming from U301. U401 is the current driver for U400 and final amplifier for the analog source. K201 is used for protection of the source circuits from outside signals and for disconnecting the source from the front panel during the time that it is used for calibration. During calibration K201 opens and K202 or K200 is selected (closed) for calibration. The calibration signal is fed to the input boards via the mother board from pin 9 of the analog source board.

Front End Interface

Information for the dc offset, control data, and attenuator output level comes onto the board as serial data on pin 30 (CNTLD). The CNTCLK½ signal (pin 28) shifts the serial bit stream into the serial-to-parallel shift registers U501 and U502 and LDSRCL loads the data into latches U500 and U502. U500 holds dc offset information for the DAC U301. U502 holds information on the attenuation of the source signal and control information for: 1) selection of signal types (controls U452), 2) operation of the relays on the board, and 3) disconnecting the dc offset DAC output from U150 when a zero dc offset is selected.

dc Offset DAC

U301 receives offset information in digital format from U500 and converts it to an analog current signal. The current signal is changed to a voltage signal by U300. The output of U300 is connected to the switch U151. This signal is opposite in polarity and half the final amplitude of the dc offset. The switch is required because the DAC output signal is not exactly zero when zero offset is selected.

Offset Switch

The offset switch, U151, either connects the dc offset signal to amplifier U150 or terminates the line by connecting it to ground through R153. Control of the switching operation comes from the digital source board through U502 as described for the front end interface. One and only one of the switches in U152 is closed at any given time.

The amplifier circuit around U150 has a gain of two, adjustable with R9, which sets the dc offset level. The gain between the output of U150 and the front panel output is −1.

Overload Protection

U600 is two comparators configured to sense voltage on the source output line and signal an overload condition (source output fault) when the signal appearing on the output exceeds 12 Vpp.

Calibrator Introduction

The calibrator is driven by either square wave signals (64 kHz or 4 kHz) or pseudo random noise. These signals are generated on the analog source board, selected according to the needs of the current instrument process, and reclocked to assure synchronization.

Square Wave Source

The DAC load signal (DACLD) on pin 36 is used for a number of things in this part of the analog source. This 256 kHz square wave is divided by U450 (a dual 4-bit counter) which yields square waves whose frequencies are 64 kHz and a 4 kHz. Both signals are connected to the signal selection circuit.

Pseudo Random Source

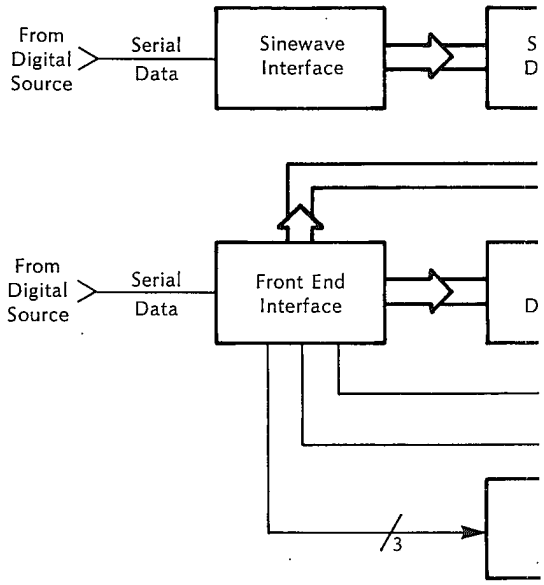
DACLD clocks U455 (serial shift register with 8-bit parallel output) which drives a group of gates, the end result of which is a pseudo random bit stream which repeats itself every 256 clock cycles. This signal and its inverse is connected to the signal selection circuit.

Signal Selection

Signal selection is done by U452 (a dual 1-of-4 selector/mux) and reclocking is done by U451. Inputs to this block consist of two square waves (64 kHz and 4 kHz) from U450 and the pseudo random noise (PRN) signal and its inverse. The control lines SELCAL and INVCAL from U502 select one of the four signals to pass to the calibrator circuit and to send to the trigger board as the signal CALTRIG. Pseudo random noise is not used for a CALTRIG signal, but a signal from the PRN source is connected to both C2 and C3 of the CALTRIG selector, U452A. See table A30-2 in section VIII for specific control information.

Calibrator

The 6.2 volt reference is divided by R5 and R6 such that 0.2 volts appears on the inverting input of U1. A feedback loop through Q1, Q2/Q3, and R7 forces the voltage across R8 to be the same as across R5. This makes Q1 a stable current source for Q2 and Q3. The bases of this transistor pair are driven by the TTL signal from the signal selection block such that one of the pair is on and the other is off at any given time. When Q3 is off there is no voltage drop across R16 and R10; when Q3 is on there is a voltage drop. Since the current through Q2 and Q3 is very well regulated, the voltage appearing on its collector is very stable.


From
Digital
Source
Serial
Data
Sinewave
Interface
From
Digital
Source
Serial
Data
Front End
Interface
3

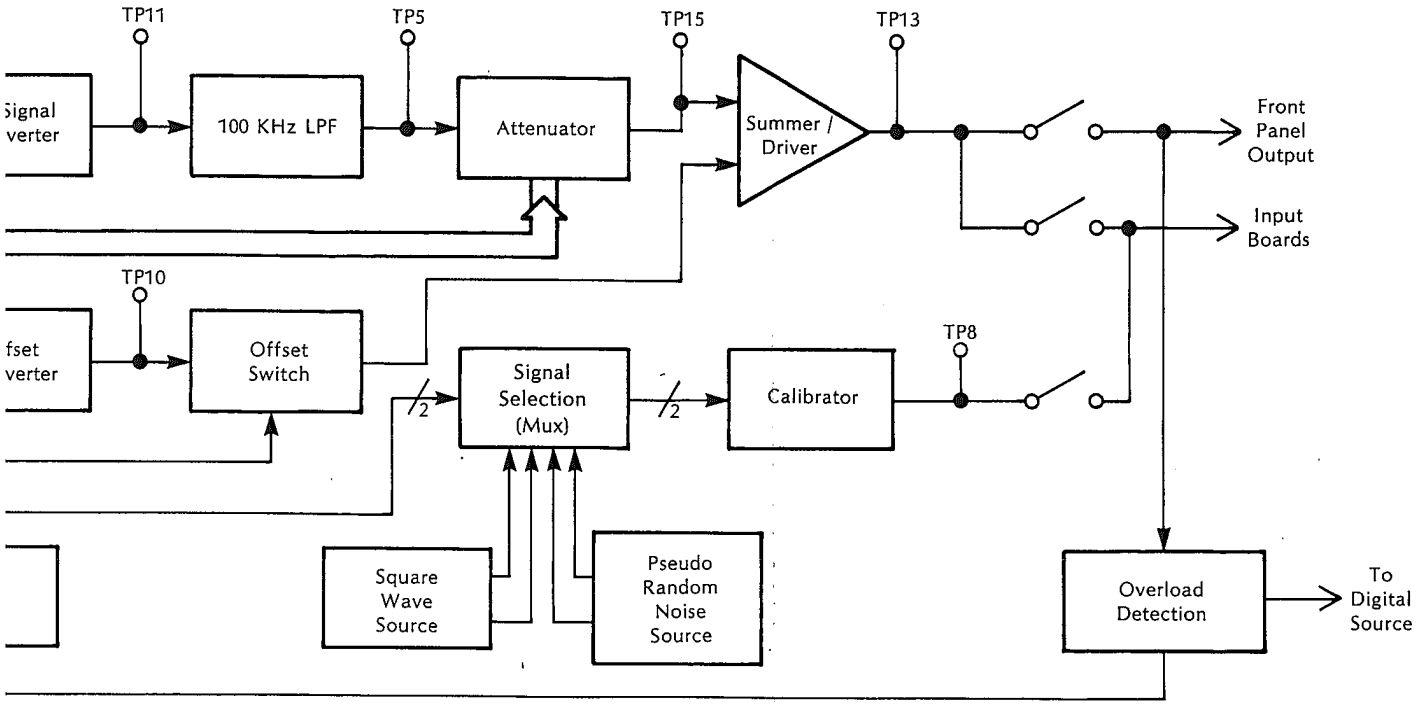


Figure 6-A30 Analog Source Block Diagram

6-14 A31 TRIGGER

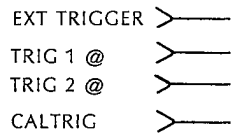
The trigger assembly produces the trigger signal (TRIGRO) for the A1 Digital Source and the A5 Digital Filter and the sample signal (CONV) that is sent to the A32, A34 ADCs. The trigger assembly also generates the 10.24 MHz clock used by the A1 Digital Source, the A4 Local oscillator, the A5 Digital Filter, the A6 Digital Filter Controller, the A30 Analog Source, and the A32, A34 ADCs assemblies. The 10.14 MHz clock can be locked to an external reference signal by using the rear panel REF IN input.

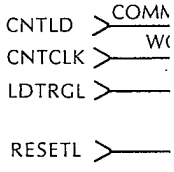
Trigger Level Circuit

(Refer to figure 6-A31a) To produce the trigger level, the trigger assembly uses one of four analog inputs; external trigger (EXT TRIGGER), channel 1 (TRIG1@), channel 2 (TRIG2@), or trigger calibration (CALTRIG). The trigger select switch selects one of the input signals and passes it to a comparator. The selected analog input is compared to a dc voltage from the trigger's DAC. The output of the comparator is low as long as the analog signal is below this dc value and is high if the analog signal is above the dc value. The output of the comparator is then sent through an exclusive OR gate which inverts the signal if the slope select line is high.

Trigger Control

The operations of the trigger assembly are controlled through the trigger's shift register. The shift register shifts in a command word from the A1 Digital Source assembly. The command word sets the input trigger selection, the trigger level, the trigger slope, and whether an internal or external sample is used (SELXS).


EXT TRIGGER
TRIG 1 @
TRIG 2 @
CALTRIG


CNTLD
CNTCLK
LDTRGL
RESETL

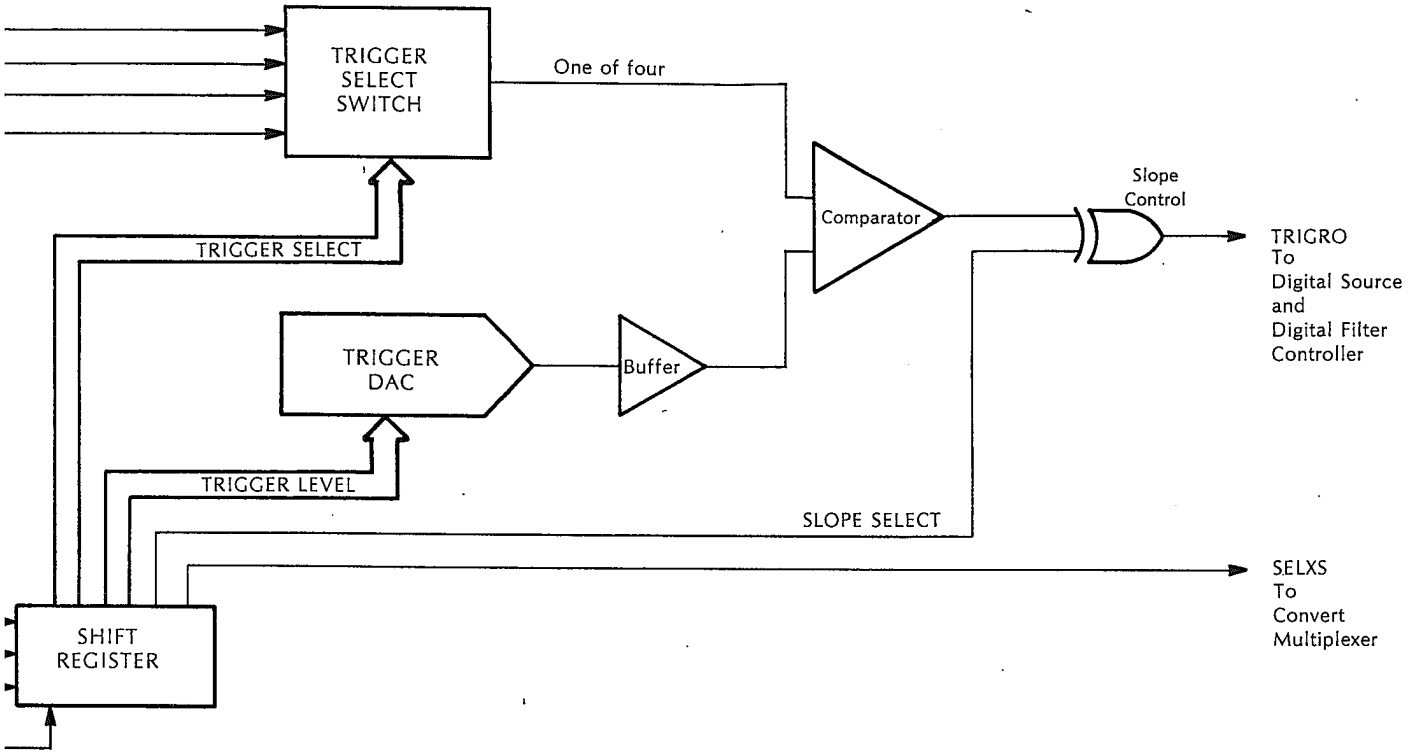


Figure 6-A31a Trigger Level Block Diagram

Trigger Clock Circuit

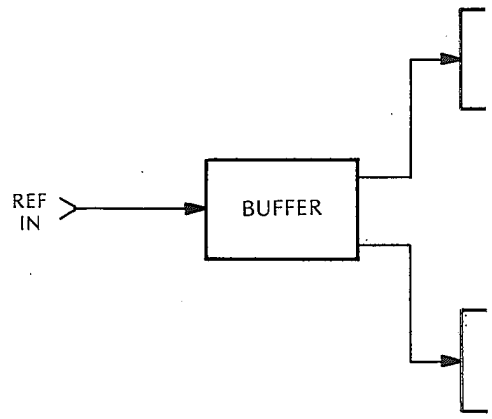
(Refer to figure 6-A31b) The trigger clock circuit produces the 10.24 MHz clock using a voltage controlled crystal oscillator (VCXO). When there is no external reference signal (REF IN) the phase lock loop is not used. The error voltage into the PLL gain and shaping subblock is zero. The frequency adjustment is used to adjust the frequency out of the VCXO to precisely 20.48 MHz. This signal is divided by two to form the 10.24 MHz clock. The 10.24 MHz signal is divided by forty to produce the internal sample signal (CONV, 256 kHz). The convert multiplexer selects the internal sample signal or an external sample signal. The signal SELXS from the shift register determines which is selected.

The phase lock loop is used when there is an external reference signal. The external reference signal can be 1,2,5, or 10 MHz. The difference in frequency between the 3.413 MHz harmonic of the external reference and the 3.413 MHz output of the VCXO are used for the phase comparison. The sampler subblock samples the 3.413 MHz clock from the VCXO with REF IN÷3 to produce the sum and difference frequencies of the clock and the reference signal's harmonics. These frequencies are then put through a bandpass filter to produce an 80 kHz signal.

At the same time the 80 kHz signal is being produced, the REF IN is divided by 125. The phase detector samples the 80 kHz signal with the REF IN÷125 signal to produce an error voltage. The error voltage is amplified and passed through a switchable low pass filter to generate the control signal for the VCXO. When the phase lock loop is in lock this control voltage is a dc value. If the phase lock loop is not locked, the control voltage deviates high and low until the phase lock loop locks.

Switchable Low Pass Filter (Q201, R214, C207, C208)

During normal operation the low pass filter has a very narrow bandwidth (≅16 Hz). This bandwidth can change to a wide bandwidth (≅4 kHz) to allow for a faster phase loop lock up. When the phase loop is in lock the output of the lock detect subblock is a negative dc voltage and a FET switch (Q201) in the PLL gain and shaping subblock is turned off. If the phase loop is not in lock the output of the lock detect subblock goes positive turning the FET switch on. This switches out the low pass filter and the UNLOCK signal is sent out to indicate the phase lock is unlocked. When the output of the lock detect returns to a steady positive dc voltage, the FET switch turns off and the low pass filter changes to a narrow bandwidth.


REF
IN
BUFFER


EXT
SAMPLE
IN

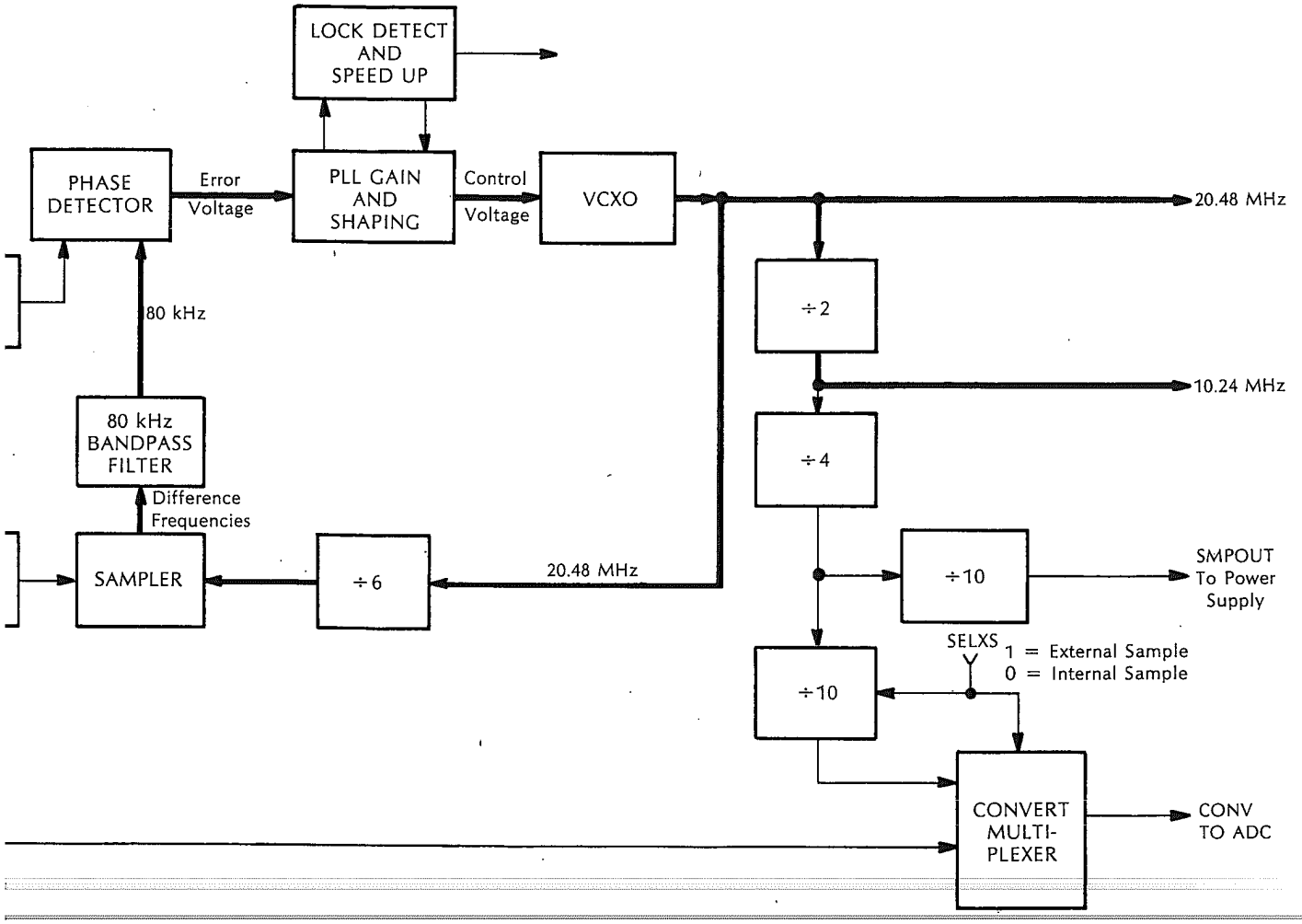


Figure 6-A31b Trigger Clock Block Diagram

6-15 A32, A34 ANALOG-to-DIGITAL CONVERTERS

(Refer to ADC Board Block Diagram on figure 6-A32) The ADC board converts analog data from the input board into 13-bit serial data words. The main parts of the ADC are two variable attenuators and their accompanying amplifiers, an anti-alias filter, a track and hold circuit, an 8-bit A/D converter (to avoid confusion, the board is referred to as "ADC" and the part is called "A/D converter"), a D/A converter (DAC), and a controller. Other circuits on the board include first and second pass circuits and the process switch, a dc offset D/A converter, an over range/half range circuit, a missed sample circuit, a diagnostic tester, and slave/master selection circuits.

The circuits in the data path may be divided into analog and digital. The signal is analog until it passes through the A/D converter. This discussion is divided into analog and digital sections.

Analog

The signal from the input board enters the ADC board through J200 and a balun and goes to attenuator #2 (#1 is on the input board). This attenuator is variable in 2 dB steps from 0 dB to 12 dB. It can also ground the input of the next amplifier (for calibration purposes). The configuration information for this attenuator and attenuator #3 come from serial-to-parallel (S/P) shift register U203. This information comes on the board from the input board and is shifted through U603, U203, and U202. The companion input board must be installed for the ADC board to receive configuration information.

The signal from attenuator #2 goes to amplifier #3. This amplifier is a non-inverting op amp circuit with a gain of 3. The signal from this amplifier goes to attenuator #3. This attenuator is identical to attenuator #2 except that instead of selecting a grounded input for the following amplifier it has another step of attenuation, giving it a range of 0 dB to 14 dB in 2 dB steps.

The purpose of all the amplifiers and variable attenuators up to this point is to assure that the strength of the signal to the anti-alias filter does not over drive it. Refer to table 6-A32a for information concerning attenuator configuration for a given range selection.

Table 6-A32a Attenuator configuration vs. range selection

Range (dBV)	Input Atten (dB)	Atten #1 (dB)	Atten #2 (dB)	Atten #3 (dB)	Total Atten (dB)
−51	0	0	0	0	0
−50	0	1	0	0	1
−49	0	0	0	2	2
−48	0	1	0	2	3
−47	0	0	0	4	4
−46	0	1	0	4	5
−45	0	0	0	6	6
−44	0	1	0	6	7
−43	0	0	0	8	8
−42	0	1	0	8	9
−41	0	0	0	10	10
−40	0	1	0	10	11
−39	0	0	0	12	12
−38	0	1	0	12	13
−37	0	0	0	14	14
−36	0	1	0	14	15
−35	0	0	2	14	16
−34	0	1	2	14	17
−33	0	0	4	14	18
−32	0	1	4	14	19
−31	0	0	6	14	20
−30	0	1	6	14	21
−29	0	0	8	14	22
−28	0	1	8	14	23
−27	0	0	10	14	24
−26	0	1	10	14	25
−25	0	0	12	14	26
−24	0	1	12	14	27
−23	0	12	2	14	28
−22	0	13	2	14	29
−21	0	12	4	14	30
−20	0	13	4	14	31
−19	0	12	6	14	32
−18	0	13	6	14	33
−17	0	12	8	14	34
−16	0	13	8	14	35
−15	0	12	10	14	36
−14	0	13	10	14	37
−13	0	12	12	14	38
−12	20	1	4	14	39

Table 6-A32a Attenuator configuration vs. range selection cont.

Range (dBV)	Input Atten (dB)	Atten #1 (dB)	Atten #2 (dB)	Atten #3 (dB)	Total Atten (dB)
−11	20	0	6	14	40
−10	20	1	6	14	41
−9	20	0	8	14	42
−8	20	1	8	14	43
−7	20	0	10	14	44
−6	20	1	10	14	45
−5	20	0	12	14	46
−4	20	1	12	14	47
−3	20	12	2	14	48
−2	20	13	2	14	49
−1	20	12	4	14	50
0	20	13	4	14	51
+1	20	12	6	14	52
+2	20	13	6	14	53
+3	20	12	8	14	54
+4	20	13	8	14	55
+5	20	12	10	14	56
+6	20	13	10	14	57
+7	20	12	12	14	58
+8	40	1	4	14	59
+9	40	0	6	14	60
+10	40	1	6	14	61
+11	40	0	8	14	62
+12	40	1	8	14	63
+13	40	0	10	14	64
+14	40	1	10	14	67
+15	40	0	12	14	68
+16	40	1	12	14	69
+17	40	12	2	14	68
+18	40	13	2	14	69
+19	40	12	4	14	70
+20	40	13	4	14	71
+21	40	12	6	14	72
+22	40	13	6	14	73
+23	40	12	8	14	74
+24	40	13	8	14	75
+25	40	12	10	14	76
+26	40	13	10	14	77
+27	40	12	12	14	78

The anti-alias filter is a passive low pass filter whose break frequency is 100 kHz. Following this filter are two non-inverting op amps, each with a gain of 3, which feed the track and hold circuit.

The track and hold circuit is controlled by the CONV signal from the trigger board and the TRH (track & hold) signal from the ADC controller. The CONV signal initiates the "hold" and the controller terminates it. The purpose of the track and hold circuit is to hold the voltage of the input signal for the period of time required for the value to be digitized. When tracking, the circuit acts like an inverting amplifier. See figure 6-A32a.

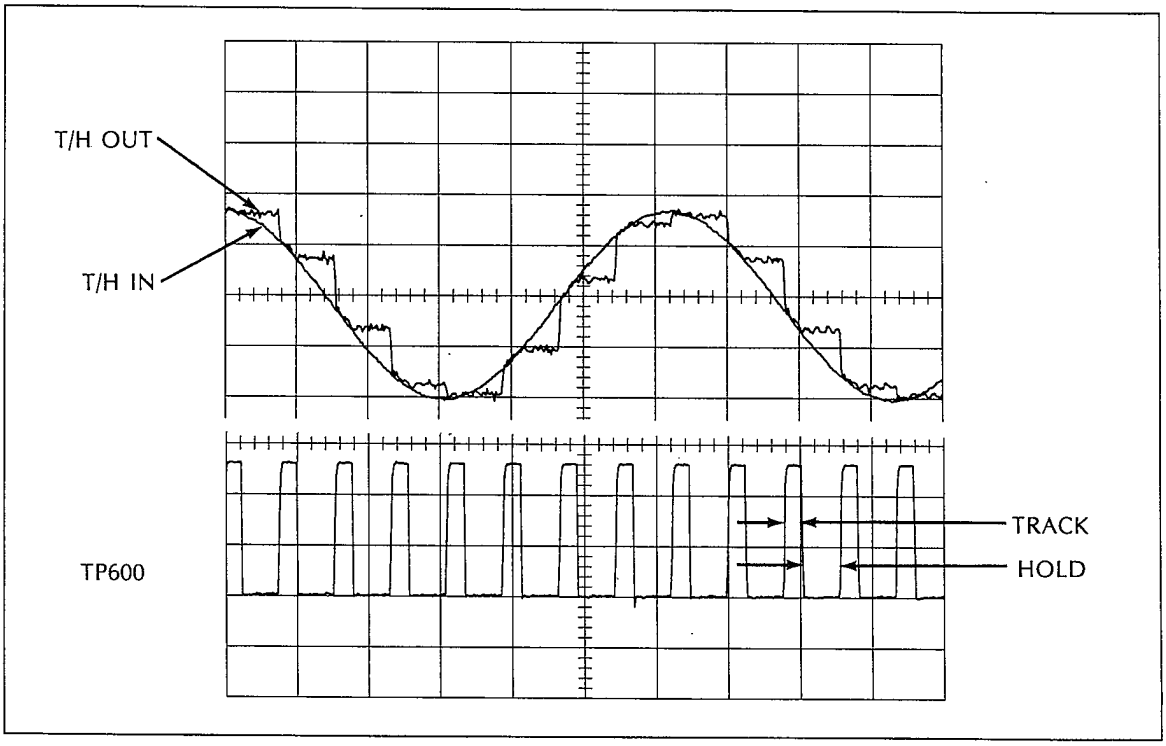


Figure 6-A32a Track & hold input vs. output

Digital

The conversion process starts when the controller receives a start conversion signal (CONV) from the trigger board. The ADC board in channel two generates the control signals which coordinates the two passes and controls the process switches on both boards. The T/H OUT signal is converted to a 13-bit digital word by passing the signal through an 8-bit A/D converter twice as described in the following discussion.

The first pass circuit takes the track and hold output, divides it by four, and level shifts it for the A/D converter. The controller then sets the process switch (U405) to send this signal to the A/D converter (see table 6-A32b for process switch configuration information). When the conversion is complete, the 8-bit word goes to the controller which combines the word with dither (a noise signal generated inside the controller chip) and outputs a 13-bit word to the DAC.

The DAC converts the first pass word back to a voltage which goes to the second pass circuit (U406). This circuit compares the converted signal to the original input signal and produces a difference voltage. The controller sets the the process switch to send this difference voltage to the A/D converter where it is converted. When the conversion is complete, the controller inputs the result, scales it down and adds it to the first pass word to obtain a 13-bit data word. The controller sends the converted data to the digital filter in a serial format after the digital filter sends a request for the data (DREQL).

Between each of the passes, the controller sets the process switch to send a .34 volt dc signal to the A/D converter to reset it. This "third pass" shows in figure 6-A32b as the high portion of the signal. The first pass appears as the signal following a roughly sinusoidal pattern and the second pass appears as a noisy signal centered within the first pass sine wave.

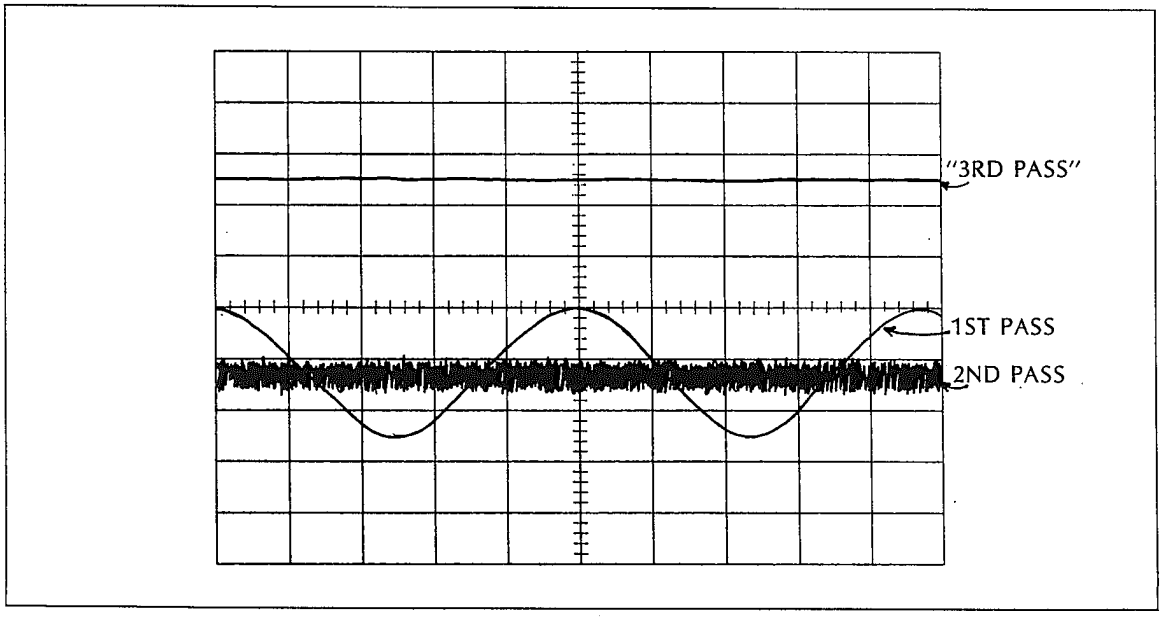


Figure 6-A32b Process switch output; TP405

Table 6-A32b Process switch configuration information

Input Selected	GSW	CLADC
First Pass Circuit	1	X
.34 Vdc Reference	0	1
Second Pass Circuit	0	0

6.2 V reference voltage

The ADC board uses the 6.2 voltage reference generated by the DAC. This reduces the error due to temperature variations. The voltage reference is used by the A/D converter, the track and hold circuit, and the over range/half range circuit. Since the A/D converter's gain is controlled by this reference, the adjustment for the voltage reference is also the A/D converter's gain adjustment.

Offset D/A Converter

U201 is a D/A converter connected to the data path at the output of amp 4 (U101) to correct the accumulated dc offset of the amplifiers. This process occurs during auto zeroing. The offset control information comes onto the board as serial data through U603, U203 and U202. U202 converts the offset DAC information to parallel format and latches it.

Over Range/Half Range Circuit

This circuit compares the signal at the output of U501 (which is the signal from the data path at TP100, amplified X4) to a fixed voltage reference to generate the overload (OVLD) and half range (HLFSCALE) signals. This is done with comparators U500 and U502. (Note that the signal from U501 also leaves the board as the trigger signal TRIG@). The comparators of U500 are configured to trigger on the positive portions of the signal as U502 triggers on the negative. The outputs of both are wire OR'd together. The COVLD signal from the input board is OR'd with the overload signal from the ADC board so that either could activate the OVLD signal.

Missed Sample Circuit

If an external sample signal is used which is too fast, the MSMP signal is sent to the digital filter controller. The missed sample circuit digitally determines if the track and hold is holding a signal at the time a CONV signal is received.

Diagnostic Tester

The ADC controller (U602) is a custom built state machine. Problems with this part may be diagnosed by using self tests which are activated by front panel key presses. Configuration commands and test signals are sent to the ADC board as serial data through the serial/parallel shift register U603, so the self tests also check the CNTLDAD (control data) path.

Master/Slave Selection

There is an ADC board in each analyzer input channel. These are identical boards. The digitizing process must occur simultaneously on both boards, so one controller must control both boards. When both boards are installed, the board in channel two acts as the controller of both boards. Each board contains a controller but only one controller is active. It sends the end of conversion (EOC) and the process switch (GSW) signals to the other controller so it can synchronize its operations with the controlling board. If no ADC board is installed in channel two, the controller on the board in channel 1 controls its own A/D conversion.

The slots on the mother board for the ADC boards are wired so that the controller on the board in channel two controls the A/D conversion process on both boards. The master/slave circuit on each board consists of an inverter (U503d) with a pull up resister on the input. The mother board connects the output of this circuit of the board in the channel two slot to the input of the same circuit on the board in the channel one slot (they both control buffers U604 and U505 on their respective boards, too). When boards are installed in both slots, the board in slot two has a low level on the master/slave line which feeds the input of the inverter on the board in slot one, resulting in its master/slave line being high. When the channel two ADC board slot is empty the ADC board in channel one automatically becomes the "master"; it takes control of its own conversion process.

Internal Signal Descriptions

+6.2R
−6.2R ±-6.2 REFERENCE
This is the analog digital converter's tracking voltage reference generated by the conversion DAC. It provides the voltage reference for the A/D converter, converter IC, the track and hold circuit, and the over range/half range circuit.

CLADC CLEAR ADC
Signal from the controlling ADC controller to the process switch on each board. It works with GSW to determine the input to each of the A/D converter ICs.

CONTOUT
CONTIN CONTROL OUT
Control out is part of the connection between the A32 analog digital converter board and A34 analog digital converter board. This signal determines which board is in control. If both boards are installed, A32 is in control.

EOC END OF CONVERSION
When both analog digital converter boards are installed, A32's controller tells A34's controller it is done with a conversion.

GSW PROCESS SWITCH SIGNAL
Signal from the controlling ADC controller to the process switch on each board. It works with CLADC to determine the input to the A/D converter ICs. When both boards are installed, the GSW is also used as an input for timing to the A34 analog digital converter's controller.

LCNV LOCAL A/D CONVERT
The ADC controller's command to the A/D converter IC to start conversion. When both boards are installed, the LCNV signal goes to the A34 analog to digital converter's A/D converter IC.

TRH TRACK AND HOLD
Signal from the controlling ADC controller to the track and hold switch on each board. This signal determines when the track and hold switches are open and closed.

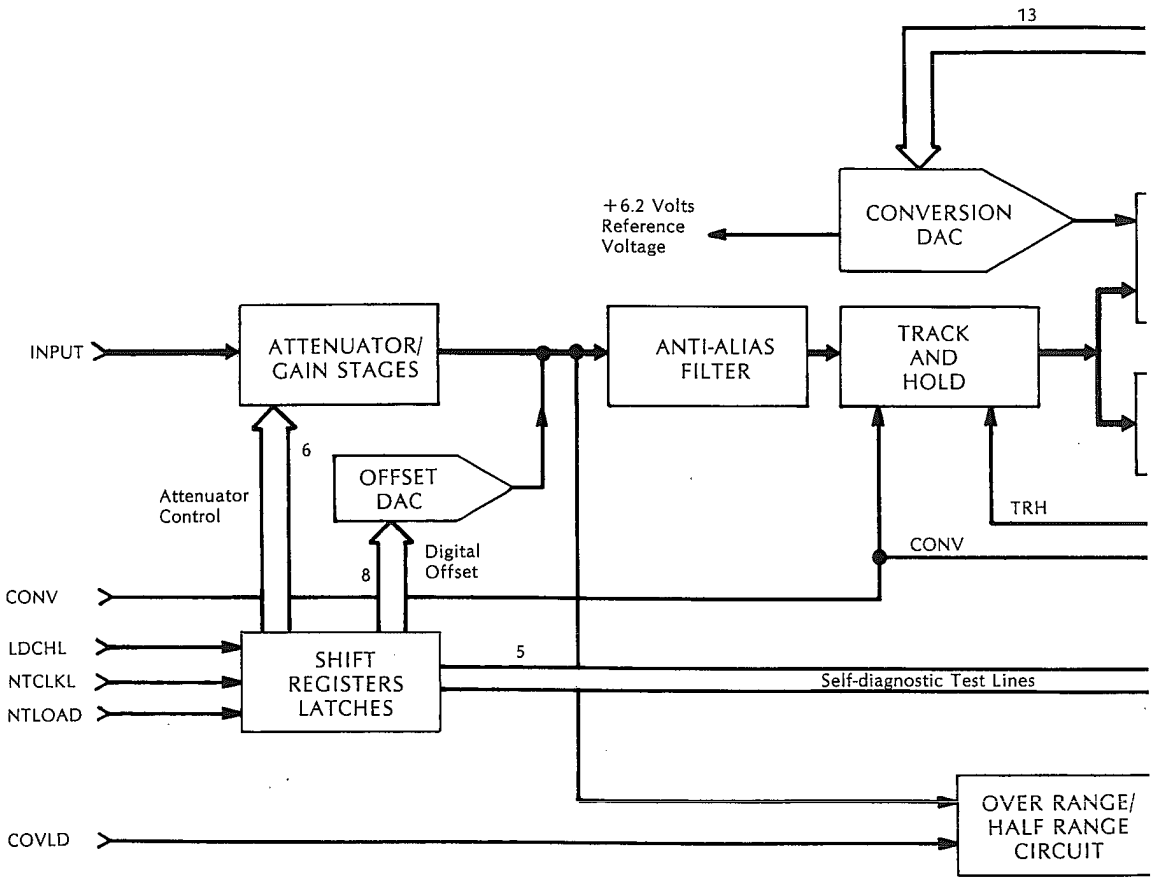
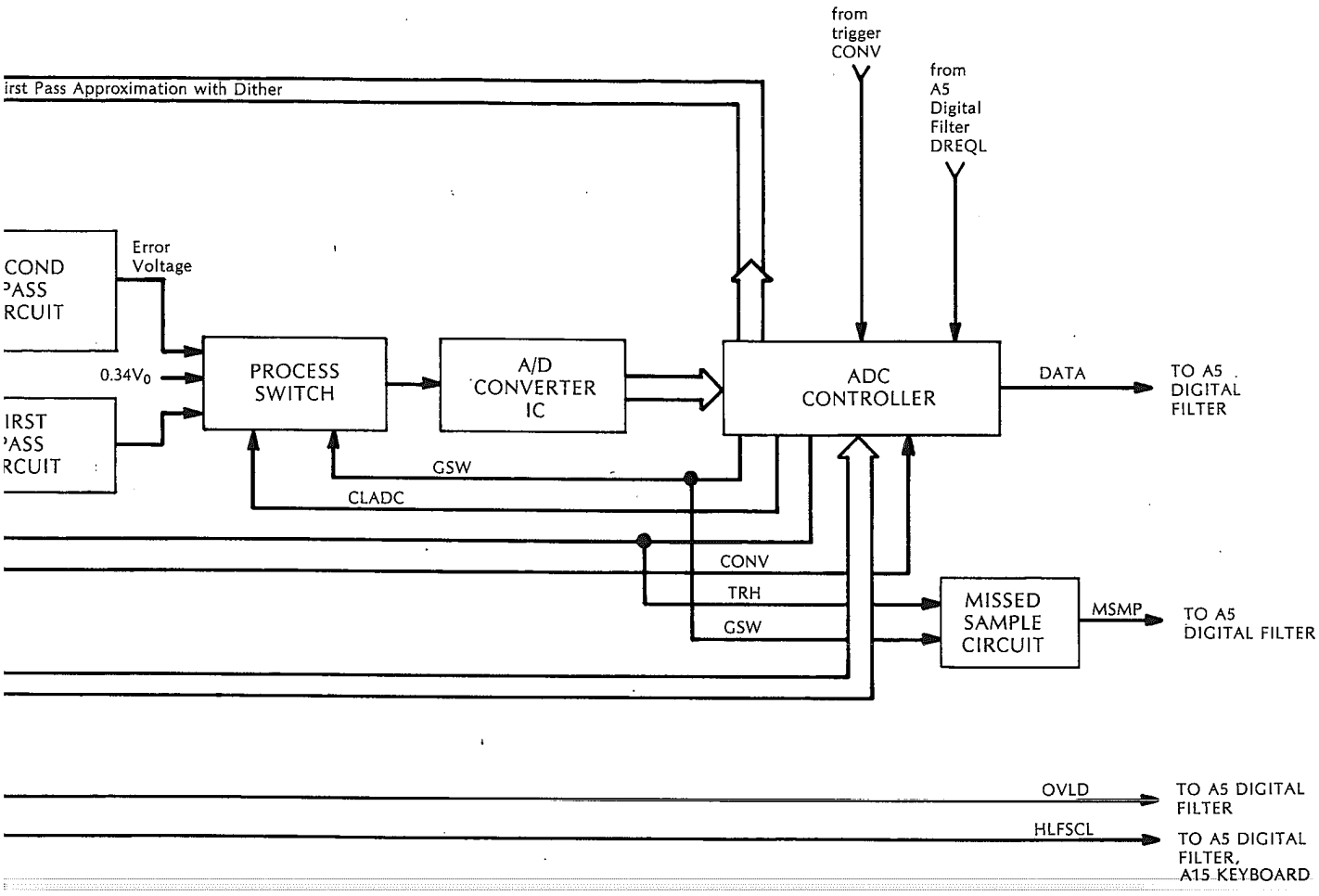

13
+6.2 Volts
Reference
Voltage
CONVERSION
DAC
INPUT
ATTENUATOR/
GAIN STAGES
ANTI-ALIAS
FILTER
TRACK
AND
HOLD
6
Attenuator
Control
OFFSET
DAC
TRH
CONV
8
Digital
Offset
CONV
LDCHL
NTCLKL
NTLOAD
SHIFT
REGISTERS
LATCHES
5
Self-diagnostic Test Lines
OVER RANGE/
HALF RANGE
CIRCUIT
COVLD

Figure 6-A32



alog Digital Converter Block Diagram

6-16 A33, A35 INPUT

The input assembly (along with the ADC) implements the voltage ranges and conditions the input signals. The input overload detect circuit warns the operator that the reference voltage is excessively high. The common mode rejection DAC compensates for differences between the HIGH input and the LOW input circuits.

The block diagram of the input assembly is shown in figure 6-A33. The HP 3562A has two channels of balanced differential inputs; the A33 Input assembly is identical to the A35 Input assembly. Each assembly has a HIGH input and a LOW input. The HIGH input is the channel's BNC center conductor and the LOW input is the channel's BNC shell conductor. The HIGH and LOW input signals are attenuated by a ladder attenuators. The input attenuators use resistors for low frequency attenuation and adjustable capacitors for high frequency flatness response. An internal analog signal (STIM@) from the A30 Analog Source assembly is put into the HIGH signal path. The instrument uses this signal for self-tests and calibration.

After the signal is attenuated, it goes into a buffer. The buffer's power supplies are bootstrapped to allow for a 20V common mode signal. After the HIGH input and LOW input signals are attenuated and buffered, they are subtracted using a difference amplifier. The output of the difference amplifier is sent to a times three amplifier which is adjustable for gain and dc offset.

After the difference amplifier, three attenuator/gain stages provide the 2 dB intermediate gain and attenuation steps. One of the stages is on the input assembly and the other two stages are on the ADC assembly. Each stage contains a multiplexer and a times three amplifier.

The input assembly is controlled by two serial-in parallel-out shift registers and relay drive circuits. The serial control data word (CNTLD) from the A1 Digital Source is shifted into the registers and then the output is latched by the load channel signal (LDCHL). This control word determines which of the relays are set, the settings for the multiplexers in the attenuator/gain stages, the common mode rejection DAC output value, and the dc offset value (circuit on the ADC assembly). The input sends the ADC its control data word (CNTLD AD) from the interface shift registers.

Table 6-A33 Control Word

IC Pin No.	Description	Function	
		If bit = "1"	If bit = "0"
7	ac/dc Coupling	dc	ac
8	Input Enable	Disconnected	Connected if Source Enable is low
9	Internal Source Enable	Disables inputs and connects internal source	Inputs can be connected
10	Ground Low	Return signal shorted to chassis ground	
11 12 13	Attenuation Select	0 dB 20 dB 40 dB	Note Only one should be selected at a time.

For attenuator settings refer to table 6-A32a.

Attenuators and Buffers

The input relay switches perform the following functions: isolate the input connectors when the internal source is connected, provide ac/dc coupling, and select 0 dB, 20 dB, or 40 dB input attenuation. The attenuated signal leads to a FET source-follower buffer and then a unity gain operational amplifier (U351) with the FET in its feedback loop. As a result, any offsets in the source follower are eliminated.

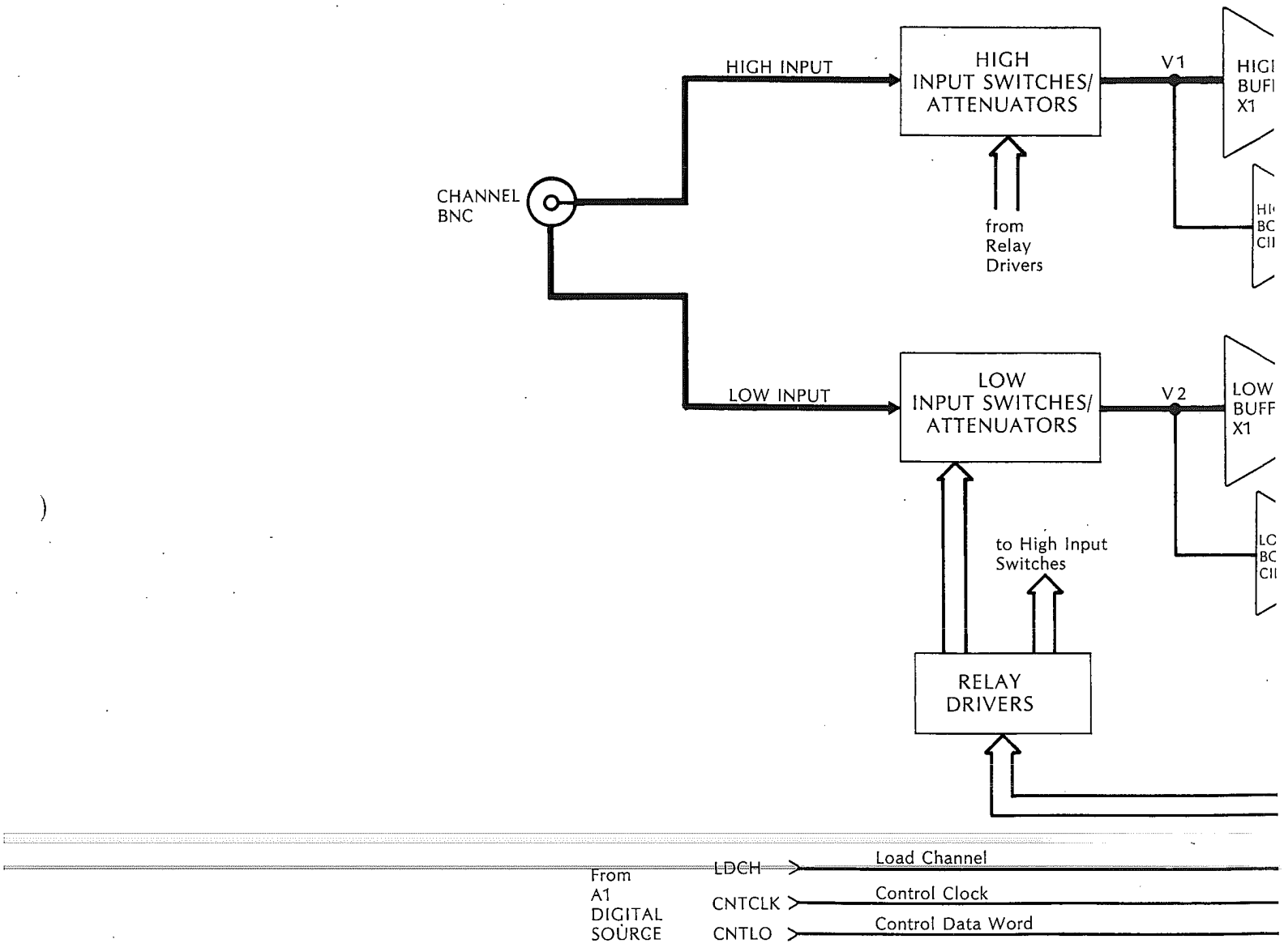
The bootstrapping of the power supplies consists of two current sources, one positive and one negative, with two emitter followers. The emitter follower provides the power to the buffer while the current source keeps the voltage across the zener at 5.6V above the input. This creates a stable power supply for the buffer so it has unity gain for a wide voltage range even at high frequencies. The 30V protection diodes are also bootstrapped to the power supply to avoid distortion. The LOW side of the input has the same configuration.

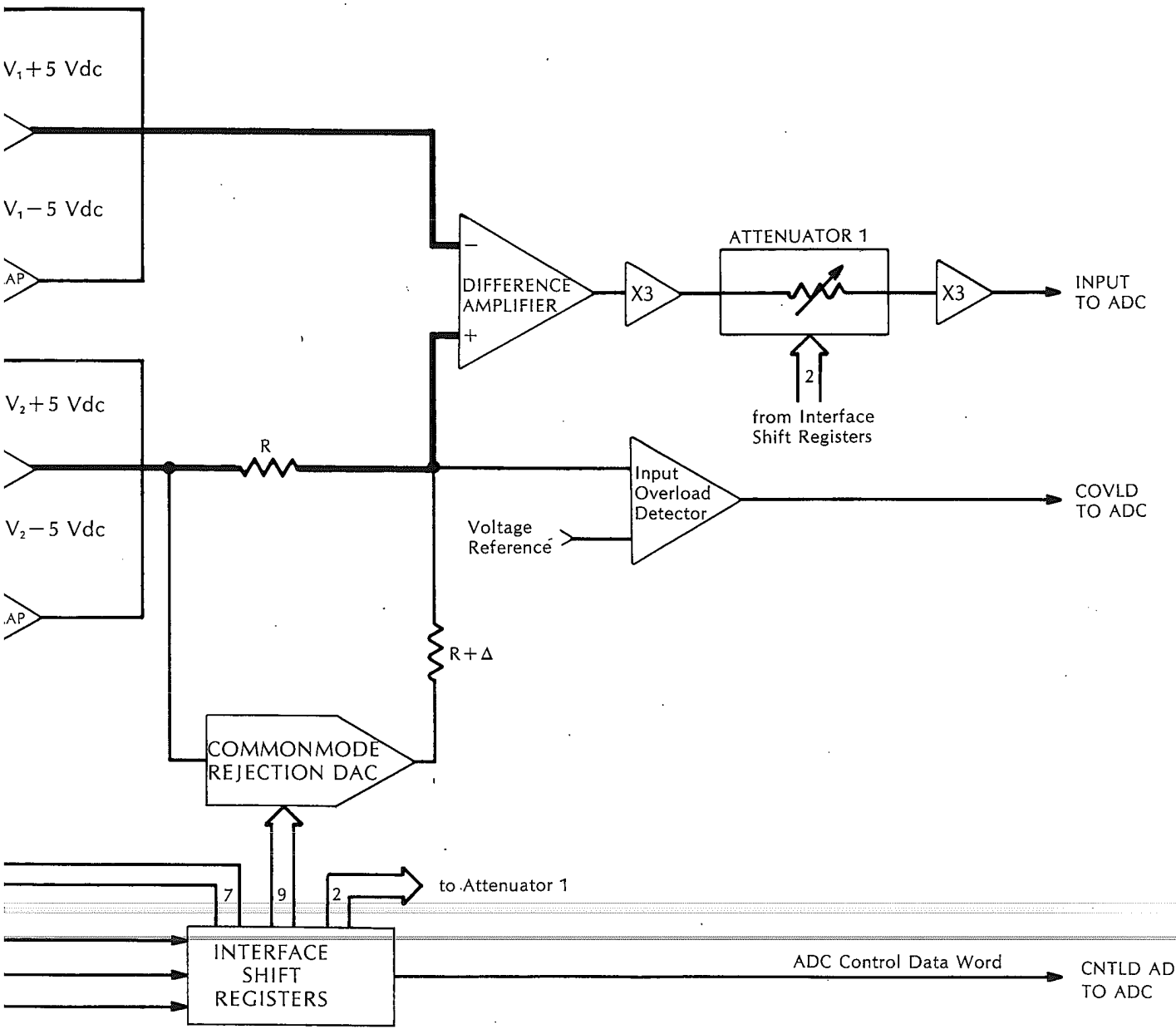
Input Overload Detector

The input overload detector circuit receives its input from the HIGH signal path. It is active when the input signal to ground is over the limit of 20V with no attenuation. Resistors R503 and R502 attenuate the signal for the comparators (U501A, U501B). The attenuated signal is compared to a positive and negative reference voltage. If the value is greater than the reference level, the input overload signal (COVLD) is sent to the overload circuit on the ADC assembly.

Common Mode Rejection DAC

The common mode rejection DAC is a discrete DAC composed of operational amplifiers, FETs, and a resistor network. The DAC receives its digital input from the interface shift registers. The common mode rejection DAC's output is an effective resistance value which compensates for differences between the HIGH input and the LOW input circuits.


HIGH INPUT
HIGH
INPUT SWITCHES/
ATTENUATORS
V1
HIGI
BUFI
X1
CHANNEL
BNC
from
Relay
Drivers
LOW INPUT
LOW
INPUT SWITCHES/
ATTENUATORS
V2
LOW
BUFF
X1
to High Input
Switches
RELAY
DRIVERS
From
A1
DIGITAL
SOURCE
LDCH
Load Channel
CNTCLK
Control Clock
CNTLO
Control Data Word



e 6-A33 Input Block Diagram

6-17 SIGNAL DESCRIPTIONS

This section describes the signal names between assemblies. All signals with a mnemonic ending in an L are active low.

±15A ± 15 ANALOG VOLTS
+15A A18 J1-3)
−15A A18 J1-4)
Voltage output from the A18 Power Supply that goes to the following assemblies:

A30	Analog Source
A31	Trigger
A32	ADC (CHAN 1)
A34	ADC (CHAN 2)
A33	Input (CHAN 1)
A35	Input (CHAN 2)

±15S ±15 VOLTS
(+15S A18 J1-9)
(−15S A18 J1-10)
Voltage output from the A18 Power Supply that goes to the following assemblies:

	HP 1345A Display
A1	Digital Source
A5	Digital Filter
A2	System CPU (not used)

+2.6V +2.6 VOLTS
(A18 J1-6)
Voltage output from the A18 Power Supply that goes to the termination networks on the A12 Mother Assembly.

±30V ± 30 VOLTS
(+30V A18 J1-1)
(−30V A18 J1-2)
Voltage output from the A18 Power Supply that goes to the following assemblies:

A33	Input (CHAN 1)
A35	Input (CHAN 2)

+5FNTEND +5 VOLTS FRONTEND
(A18 J1-5)
This signal goes to the A32 ADC 1, A34 ADC 2, A33 Input 1, and A35 Input 2. It is the same signal as +5S which is the main five volt output from the A18 Power Supply.

+5S +5 VOLTS
(A18 J1-5, A2 TP2)
Main five volt output from the A18 Power Supply that goes to all the assemblies and the HP 1345A digital display.

+8S1 +8 VOLTS ONE
(A18 J1-7)
Voltage output from the A18 Power Supply that goes to the A5 Digital Filter.

+8S2 +8 VOLTS TWO
(A18 J1-8)
Voltage output from the A18 Power Supply that goes to the A5 Digital Filter.

±FAN ± FAN VOLTS
Power supply to the fan. The fan supply is derived from the +8 V output and the −15 V output:

(+8) + (−15) = 23 Vdc

8MHz 8 MHz CLOCK
(A2 TP5)
Clock from the A2 System CPU to the following assemblies:

A3	Program ROM
A7	Floating Point Transform Processor
A8	Global RAM/Display

10.24MHz 10.24 MHz CLOCK
(A4 TP18)
(A1 TP4)
Clock form the A31 Trigger assembly to the following assemblies:

A1	Digital Source
A4	Local Oscillator
A5	Digital Filter
A6	Digital Filter Controller
A30	Analog Source
A32	ADC 1
A34	ADC 2

Serial data from the A32, A34 Analog Digital Converters and sine/cosine data from the A4 Local Oscillator to the A5 Digital Filter is synchronized to this clock. This signal is terminated by A12 R3 and A12 R4.

20.48MHz 20.48 MHz CLOCK
(A31 TP10)
Clock from the A31 Trigger assembly to the A32, A34 Analog Digital Converter assemblies.

A1L to A23L SYSTEM ADDRESS BUS
Active Low
These address lines from the A2 System CPU are part of the system bus. These addresses along with VIOL, ASL, UDSL, and LDSL are used to access various registers within the following assemblies:

Lines	Assemblies
A1 to A2	A15 Keyboard
A1 to A8	A1 Digital Source
	A3 Program ROM
	A4 Local Oscillator
	A6 Digital Filter Controller
	A7 Floating Point Transform Processor
	A8 Global RAM
	A9 Fast Fourier Processor
A9 to A23	A3 Program ROM

ARML ARM
(A1 J705-1)
Active Low Low Signal from the A6 Digital Filter Controller to the A1 Digital Source to start a triggered measurement process. ARML stays asserted until the rising edge of BFST.

ASL ADDRESS STROBE
Active Low
This is the system address bus strobe from the A2 System CPU assembly. When the Address strobe signal is low, a valid address is on the system bus.

ATN ATTENTION
Signal to and from the A2 System CPU to the A22 HP-IB. This is the control line that places the HP-IB in the "Command Mode".

B2GDSL HP 1345A GLOBAL DATA STROBE
Active Low
This signal is from the A8 Global RAM to the A17 Display Interface. It is similar to GDSL, except B2GDSL is only active during a global bus transfer to the display. When this signal goes from low to high, global data is put into the registers on the A17 Display Interface assembly.

BA1L to BA4L BUFFERED ADDRESS LINES
Active Low
These signals are the buffered version of the lower four system address lines of the A6 Digital Filter Controller. They are used by the A5 Digital Filter assembly for command decoding.

BFST BUFFER START
(A1 TP9)
This signal from the A1 Digital Source goes to the A6 digital filter and the A4 Local Oscillator. When the instrument is in the triggered mode, BFST marks the first sample of the data block. After a trigger and sample clock are received by the digital source it sends the BFST signal to the digital filter controller telling it to start taking data. The local oscillator uses this signal to latch the phase of the sinusoidal output to the A5 Digital Filter.

BLDSL BUFFERED LOWER DATA STROBE
Active Low
This signal is the buffered version of the LDS line of the A6 Digital Filter Controller. It is used by the A5 Digital Filter assembly for command decoding.

BLK1FULLH BLOCK 1 FULL
BLK2FULLH BLOCK 2 FULL
BLK3FULLH BLOCK 3 FULL
Active high
These signals are from the A5 Digital Filter to the A6 Digital Filter Controller. When the imaginary filter auxiliary data block (BLK2FULL) or the unfiltered data block (BLK3FULL) is full, the positive going transition of these signals sets the corresponding interrupt flag flip-flop on the A6 Digital Filter Controller.

BRESETL BUFFERED RESET
Active Low
This signal is from the A6 Digital Filter Controller to the A5 Digital Filter assembly. It is the buffered version of the system bus line RESETL.

BUDSL BUFFERED UPPER DATA STROBE
Active Low
This signal is from the A6 Digital Filter Controller to the A5 Digital Filter assembly. It is the buffered version of the system bus line UDSL.

BURSTEN BURST ENABLE
Signal from the A1 Digital Source to the A30 Analog Source that enables the A30 Analog Source when in burst mode.

BWRITEL BUFFERED WRITE
Active Low
This signal is from the A6 Digital Filter Controller to the A5 Digital Filter assembly. It is the buffered version of the system bus line WRITEL. The A5 Digital Filter uses this signal for command decoding and register reading and writing.

CALTRIG CAL TRIGGER
Signal from the A30 Analog Source to the A32 trigger assembly. This signal is a pulse which is synchronous with the calibrator. It is used in the calibration to calculate phase.

CH1BG1L CHANNEL 1 BUS GRANT 1
CH2BG1L CHANNEL 2 BUS GRANT 1
Active Low
These signals are from the A5 Digital Filter assembly to the A6 Digital Filter Controller. They go low each time the A5 Digital Filter outputs a data sample to the A8 Global RAM. The A6 Digital Filter Controller primarily uses these signals to format the data block size.

CH1BR1L CHANNEL 1 BUS REQUEST 1
CH2BR1L CHANNEL 2 BUS REQUEST 1
Active Low
The A5 Digital Filter sends these signals to the A6 Digital Filter Controller. The A6 Digital Filter Controller uses CH1BR1L and CH2BR1L to determine when to start and stop outputting data to the A8 Global RAM. When the A5 Digital Filter is ready to output real filtered data, the corresponding signal (CH1BR1L or CH2BR1L) goes low. If the transfer is a real data transfer, CH1BR1L or CH2BR1L goes high when the A5 Digital Filter gets the grant signal (CH1BG1L or CH2BG1L) from the A6 Digital Filter Controller. If the transfer is a complex operation (zoom), CH1BR1L or CH2BR1L goes high after the second grant signal.

CH1LOSELH CHANNEL 1 LOCAL OSCILLATOR SELECT BITS
CH2LOSELH CHANNEL 2 LOCAL OSCILLATOR SELECT BITS
Active High
The A6 Digital Filter Controller outputs these signals from its command register to the A5 Digital Filter assembly. The A5 Digital Filter assembly uses them to select the input to the digital filters. The input can be either the sine/cosine data from the local oscillator or a locally generated constant.

CH1STOP1 CHANNEL 1 STOP 1
CH2STOP1 CHANNEL 2 STOP 1
Active High
These signals are from the A6 Digital Filter Controller to the A5 Digital Filter. During measurements CH1STOP1 and CH2STOP1 are used to control the data output section of A5 Digital Filter. When the signals go high, the corresponding A5 Digital Filter output section is shut off. When these signals are low, the A5 Digital Filter is able to output filtered data.

CHANNEL 1 CHANNEL 1
CHANNEL 2 CHANNEL 2
(A33, A35 J300)
These are the input signals from the front panel to the A33 Input 1 and A35 Input 2 assemblies. The BNC center is the HIGH INPUT and the BNC shell is the LOW INPUT.

CHASSIS CHASSIS
This input from the front panel is connected to the frame of the instrument.

CLADC CLEAR A/D
(A32, A34 TP603)
This signal is used by the A32 ADC 1 and the A34 ADC 2. CLADC is from the ADC controller to the ADC process switch. This signal is used with GSW to determine the input to the A/D Converter IC. When both assemblies are installed, the CLADC signal goes to the A32 ADC 1 assembly's process switch.

CNTCLK CONTROL CLOCK
(A1 TP11)
Signal from the A1 Digital Source which clocks the command data word CNTLD into the following assemblies:

A33, A34	Input
A32, A34	Analog Digital Converter
A31	Trigger
A30	Analog Source

CNTLD CONTROL DATA WORD
(A1 TP10)
This is the serial command data word from the A1 Digital Source to the following assemblies:

A33, A34	Input
A31	Trigger
A30	Analog Source

CNTL DAD1 CONTROL DATA WORD TO ADC 1
CNTL DAD2 CONTROL DATA WORD TO ADC 2
These are the serial command data words from the A33, A35 Input assemblies to the A32, A34 Analog Digital Converters. CNTL DAD1 and CNTL DAD2 are part of the data word CNTLD from the A1 Digital Source.

CONECTL CONNECT GROUND
A15 Keyboard ground to A12 Mother Assembly ground.

CONT IN CONTROL IN
CONT OUT CONTROL OUT
(A32, A34 TP504)
This line connects the A32 ADC 1 to A34 ADC 2. This connection determines whether the A32 analog digital converter or the A34 analog digital converter is in control. If an assembly's CONT IN is either high or floating, it is in control. If A34 ADC 2 is plugged in, the CONT IN of A32 ADC 1 is low and A34 ADC 2 is in control.

CONV CONVERT
The signal from the A31 Trigger assembly to the A32 and A34 analog digital converter assemblies telling the ADCs to start the conversion process. This signal is 256 kHz except when EXT SAMPLE IN is used. This signal is the same frequency as EXT SAMPLE IN as long as EXT SAMPLE IN is less than or equal to 256 kHz. If the external sample in signal is greater than 256 kHz, the CONVERT signal is then 256 kHz.

COS COSINE
(A4 TP24)
This is a digital signal from the A4 Local Oscillator to the A5 Digital Filter. When in a frequency shifting mode this signal represents a cosine signal. When in the real mode, COS corresponds to 1 + j0.

COVLDL1 INPUT OVERLOAD CHANNEL 1
COVLDL2 INPUT OVERLOAD CHANNEL 2
(A32, A34 TP501)
Active Low
The signals from the A33, A35 Input assemblies to the A32, A34 Analog Digital Converters indicating the front panel input voltage to chassis ground is too high.

D0L to D15L SYSTEM DATA BUS
Active Low
The system data bus is a bidirectional bus that serves as a general purpose data path for the following assemblies:

A1	Digital Source
A2	System CPU/HP-IB
A3	Program ROM
A4	Local Oscillator
A6	Digital Filter Controller
A7	Floating Point Transform Processor
A8	Global RAM/Display
A9	Fast Fourier Processor
A15	Keyboard

DACCLK DAC CLOCK
This clock signal is used by the A1 Digital Source to shift the serial data DACDAT into the A30 Analog Source.

DACDAT DAC DATA
This is the serial data out of the A1 Digital Source to the A30 Analog Source.

DACLD DAC LOAD
Signal from the A1 Digital Source that latches the serial data DACDAT into the A30 Analog Source.

DATA1
DATA2
DATA1, DATA2
(A32, A34 TP610)
These two signals are the serial data streams from the A32, A34 Analog Digital Converters to the A5 Digital Filter. Data transfer begins three clock cycles after the assertion of DREQL and occurs at a 10.14 MHz rate. The first bit is the data valid bit, followed by the overload status bits, then the 13 bit serial data with the LSB first.

DAV
DATA VALID
Signal to and from the A2 System CPU to the A22 HP-IB. This line is used in the HP-IB handshake sequence.

DAVL
DATA AVAILABLE
Active Low
The A8 Global RAM sends the A17 Display Interface this control signal after it writes the data for the HP 1345A into the A17 Display Interface registers. The A17 Display Interface then sends DAVL to the HP 1345A which tells the display that data is available. DAVL works with RFDL (Ready For Data) to transfer data to the HP 1345A display. Refer to the HP 1345A service manual section 3-6 for the handshake timing information.

DISPLAY OUTPUT X, Y, Z
These signals are outputs of the HP 1345A display. Refer to the HP 1345A operating and service manual for troubleshooting and adjusting the display.

DMADTACKL
DMA DATA TRANSFER ACKNOWLEDGE
Active Low
This signal is from the A5 Digital Filter to the A6 Digital Filter Controller. When a 'read filter status' command or a read/write to a A5 DMA controller register is completed, DMADTACKL goes low. The A6 Digital Filter Controller then sends DTACKL to the A2 System CPU to indicate the command is completed.

DREQL
DATA REQUEST
(A1 J703-1)
Active Low
When the A5 Digital Filter is ready for data, it sends the DREQL signal to the A32, A34 Analog Digital Converters. The digital filter expects the data back on the forth clock cycle after the DREQL. This signal is also sent to the A1 Digital Source. The digital source uses the DREQL to synchronize the buffer start signal (BFST) going to the A6 Digital Filter Controller with the sample signal (SAMP) from the A34 Analog Digital Converter.

DSA SS
DSA START/STOP
(A5 TP13, A6 TP7)
This signal corresponds to bit 2 of the A5 Digital Filter assembly command register. The A5 Digital Filter and the A6 Digital Filter Controller use the DSA SS signal for diagnostic testing.

DSHIFTEN DATA SHIFT
Shift clock from the A1 Digital Source to the A30 Analog Source that is used to shift in the DACDAT data.

DTACKL DATA TRANSFER ACKNOWLEDGE
Active Low
This is an open collector signal that is pulled up to +5V on the A2 System CPU. After an assembly receives the data strobes (UDSL, LDSL, or ASL) and has performed the appropriate read or write operation, it sends the A2 System CPU the handshake signal DTACKL. This signal indicates that the data has been transferred. The CPU puts the bus cycle in the wait mode until it receives the DTACKL signal or 1 ms has passed and BERRL is asserted. The following assemblies use the asynchronous DTACKL signal for data transfer:

A1	Digital Source
A3	Program ROM
A6	Digital Filter Controller
A7	Floating Point Transform Processor
A8	Global RAM/Display
A9	Fast Fourier Processor
A15	Keyboard

EOC END OF CONVERSION
(A32, A34 TP605)
This signal is used by the A32 ADC 1 and the A34 ADC 2. When both assemblies are installed, ADC 2 tells ADC 1 when it is done with a conversion.

EOI END
Signal to and from the A2 System CPU to the A22 HP-Interface Bus. This line is used to indicate the end of a multiple-byte message on the bus. It is also used in parallel polling.

ENBLL ENABLE
Active Low
This is the enable clock for the system bus from the A2 System CPU. It is high for 750 ms and low for 500 ms with a period of 1.25 ms. ENBLL is used to interface synchronous 68000 peripherals (A1 Digital Source, A3 Program ROM, A4 Local Oscillator) to the 68000 (A2 U100).

EXT SAMPLE IN EXTERNAL SAMPLE INPUT
(A31 J501)
Sample rate from the rear panel to the A31 Trigger assembly. This signal is active only in external sample mode.

EXT TRIGGER EXTERNAL TRIGGER
(A31 J2)
The external trigger input from the front panel to the A31 Trigger assembly. This input has a 50 kΩ input resistance and a range of ±10V.

FLTRST DIGITAL FILTER MASTER RESET

This signal is from the A5 Digital Filter controller to the A6 digital filter assembly. It goes high when a read filter status command or a read/write to an internal DMA controller register command has been completed. FLTRST is used to synchronize the channel 1 and channel 2 digital filter circuits.

GA1L to GA16L GLOBAL ADDRESS BUS

Active Low

The global address bus consists of 16 lines that allow the A8 Global RAM to be addressed by the following assemblies:

A2	System CPU
A5	Digital Filter
A7	Floating Point Transform Processor
A9	Fast Fourier Processor

GD0L to GD15L GLOBAL DATA BUS

Active Low

The global data bus provides a communication path between the following assemblies:

A2	System CPU
A5	Digital Filter
A7	Floating Point Transform Processor
A8	Global RAM/Display
A9	Fast Fourier Processor
A17	Display Interface

GDSL GLOBAL DATA STROBE

Active Low

When a device reads A8 Global RAM, the low to high edge of the global data strobe signal indicates valid RAM data is on the global data bus. Valid data must be set up a minimum of 30 ns before the rising edge of GDSL and held a minimum of 20 ns afterwards.

GLOBAL GLOBAL BUS

The global bus is controlled by the arbiter on the A8 Global RAM. This bus provides a communication path between the following assemblies:

A2	System CPU
A5	Digital Filter
A7	Floating Point Transform Processor
A8	Global RAM/Display
A9	Fast Fourier Processor
A17	Display Interface

The global bus consists of the following signals:

GD0L to GD15L ..... global data bus
GA1L to GA16L ..... global address bus
GDSL ..... global data strobe
GR/GWL ..... global read/global write

Memory Request lines MRFFTL, MRDF2L, MRDF1L, MR68L, and MRFPPL.

Memory Grant lines MGFFT, MGDF2L, MGDF1L, MG68L, and MGFPPL.

GR/GWL GLOBAL READ/GLOBAL WRITE
Active Low
When low, this open collector signal defines the global data bus transfer as a write cycle. When it is high, the transfer is a read cycle.

GRAMRSTL GLOBAL RAM RESET
Active Low
Signal from the A2 System CPU to the A8 Global RAM. When power is applied to the instrument or A2 S1 is activated, GRAMRSTL goes low and resets the global RAM. This signal is used to reset the global RAM instead of RESETL, so a software reset does not reset the A8 Global RAM

GSMPLL GLOBAL SAMPLE
Active Low
At this time, this signal from the A8 Global RAM is not used by any assembly in the instrument.

GSW PASS GAIN SWITCH
(A32, A34 TP604)
This signal is used by the A32 ADC 1 and the A34 ADC 2. GSW is from the ADC controller to the ADC process switch. It is used with CLADC to determine the input to the A/D Converter IC. When both assemblies are installed, the GSW is used as an input for timing to the A32 ADC 1 assembly's controller.

HD1 to HD8 DATA
These lines are the data lines between the A2 System CPU and the A22 HP-Interface Bus.

HIGH INPUT 1 HIGH INPUT 1
HIGH INPUT 2 HIGH INPUT 2
(A33, A35 J300-1)
These are the input signals from the front panel BNC centers to the A33 Input 1 and A35 Input 2 assemblies.

HLFSCL1 HALFSCALE CHANNEL 1
HLFSCL2 HALFSCALE CHANNEL 2
(A32, A34 TP503)
These signals are status signals from the A32, A34 Analog Digital Converters and are asserted whenever the analog input exceeds half-range in amplitude. They are latched into the A5 Digital Filter and can be read by the A2 System CPU as part of the digital filter status word. HLFSCL1 and HLFSCL2 also go to the A15 Keyboard to turn on the halfscale LED.

HP-IB HP-IB
This is the HP-IB input from the rear panel to the A22 HP-Interface Bus assembly. The A22 HP-IB connects the rear panel input to the A2 System CPU assembly.

INBLKEMPTY PARALLEL INPUT DATA BLOCK EMPTY
This signal is from the A5 Digital Filter to the A6 Digital Filter Controller. INBLKEMPTY is used when parallel data from the A8 Global RAM is used instead of serial data from the A32 ADC 1 or A34 ADC 2 assemblies. This signal goes high when the current input block of the A8 Global RAM data is received by the A5 Digital Filter. The positive transition of this signal sets the corresponding interrupt flag on the A6 Digital Filter Controller.

INPUT1 CHANNEL 1 ANALOG OUT
INPUT2 CHANNEL 2 ANALOG OUT
(A33, A35 TP400)
These signals are the conditioned front panel input signals from the A33, A35 Input assemblies to the A32, A34 Analog Digital Converters.

IFC INTERFACE CLEAR
Signal to and from the A2 System CPU to the A22 HP-IB. When IFC is set all talkers and listeners on the HP-IB are unaddressed, and controllers go to the inactive state.

IRQT2L INTERRUPT REQUEST 2
Active Low
Interrupt request line from the A15 Keyboard to the A2 System CPU. This open collector signal is also used by the A2 programmable timer module.

IRQT3L INTERRUPT REQUEST 3
Active Low
Interrupt request line from the A7 Floating Point Transform Processor to the A2 System CPU. This is an open collector signal.

IRQT4L INTERRUPT REQUEST 4
Active Low
Interrupt request line from the A9 Fast Fourier Processor to the A2 System CPU. This is an open collector signal.

IRQT5L INTERRUPT REQUEST 5
Active Low
Interrupt request line from the A6 Digital Filter Controller to the A2 System CPU. This is an open collector signal.

IRQT6L INTERRUPT REQUEST 6
Active Low
Interrupt request line from the A8 Global RAM to the A2 System CPU. This is an open collector signal.

KYBRDL KEYBOARD
Active Low
Signal from the A2 System CPU which selects the A15 Keyboard. The system processor uses this line along with A1L and A2L to address the keyboard.

LCNV LOCAL A/D CONVERT
(A32, A34 TP606)
This signal is used by the A32 ADC 1 and the A34 ADC 2. The ADC controller sends this signal to the A/D converter IC to start converting. When both assemblies are installed, this signal also goes to the A32 ADC 1 assembly's A/D converter IC.

LD0 to LD15 LOCAL DATA BUS
These bidirectional data lines are used by the A5 Digital Filter and the A6 Digital Filter Controller. During a A5 Digital Filter read/write operation, these data lines are the inverted version of the system data bus.

LDCH1L LOAD CHANNEL 1
LDCH2L LOAD CHANNEL 2
Active Low
Signal from the A1 Digital Source that latches command data word CNTLD into the A33, A35 Input assemblies and the A32, A34 ADC assemblies.

LDSL LOWER DATA STROBE
Active Low
Signal from the A2 System CPU indicating data is transferring on the lower half of the system data bus (D0 to D7). When LDSL goes low for a read cycle, the A2 System CPU is expecting valid data to be placed on the lower half of the data bus. In the write cycle a low on LDSL indicates there is valid data on the lower half of the system data bus.

LDSRCL LOAD ANALOG SOURCE
Active Low
Signal from the A1 Digital Source that latches command data word CNTLD into the A30 analog source's shift register.

LDTRGL LOAD TRIGGER
Active Low
Signal from the A1 Digital Source that latches command data word CNTLD into the A31 Trigger assembly's shift register.

LOW INPUT 1 LOW INPUT 1
LOW INPUT 2 LOW INPUT 2
(A33, A35 J300-3)
These signals are the inputs from the front panel BNC shells to the A33 Input 1 and A35 Input 2 assemblies.

MG68L CPU MEMORY GRANT
Active Low
After the A2 System CPU asserts the memory request line, the A8 Global RAM returns a memory grant. The memory grant signal clears the memory request signal (MR68L), enables the assertion of the global read/write signal (GR/GWL), and allows the A2 System CPU to use the global address bus (GA1L to GA16L)

MGDF1L MEMORY GRANT DIGITAL FILTER CHANNEL 1
MGDF2L MEMORY GRANT DIGITAL FILTER CHANNEL 2
Active Low
The A8 Global RAM responds to bus requests MRDF1L and MRDF2L by assertion of MGDF1L or MGDF2L. The two memory grant signals are asserted for about 410 ns. The global RAM expects valid data to be on the bus within 80 ns after the memory grant is given.

MGFFTL FFT MEMORY GRANT
Active Low
(A9 TP3)
After the A9 FFT asserts the memory request line, the A8 Global RAM returns a memory grant. The memory grant signal clears the memory request signal (MRFFT) and enables the assertion of the global read/write signal (GR/GWL).

MGFPPL FPP MEMORY GRANT
Active Low
After the A7 FPP asserts the memory request line, the A8 Global RAM returns a memory grant. The memory grant signal clears the memory request signal (MRFPP) and enables the assertion of the global read/write signal (GR/GWL).

MR68L CPU MEMORY REQUEST
Active Low
The A2 System CPU asserts the memory request line when it wishes to address the A8 Global RAM.

MRDF1L MEMORY REQUEST CHANNEL 1
MRDF2L MEMORY REQUEST CHANNEL 2
Active Low
These two signals are from the A5 Digital Filter to A8 Global RAM to request use of the global bus for channel 1 data or channel 2 data.

MRFFTL FFT MEMORY REQUEST
Active Low
The A9 FFT asserts the memory request line when it wishes to address the A8 Global RAM.

MRFPPL FPP MEMORY REQUEST
Active Low
The A7 FPP asserts the memory request line when it wishes to address the A8 Global RAM.

MSMP EXTERNAL SAMPLE ERROR
(A32, A34 TP611)
Active High
Status signal from the A32, A34 Analog Digital Converters to the A5 Digital Filter. MSMP is asserted when operating in the external sample mode and the sample frequency is too fast. This signal is latched by the digital filter and can be read by the A2 System CPU as part of the digital filter status word.

MYADDRSL MY ADDRESS
Active Low
The A6 Digital Filter Controller sends the A5 Digital Filter this signal when the A2 System CPU is addressing A5 Digital Filter. MY ADDRESS is used by the A5 Digital Filter for command decoding.

NCLK CHIRP CLOCK
(A4 TP19)
The A1 Digital Source sends this signal to the A4 Local Oscillator at the beginning of chirp to reset the A4 Local Oscillator to the initial frequency of the chirp and to zero the phase. This signal is present when other modes are used, but the A4 Local Oscillator uses NCLK only for the chirp mode.

NDAC DATA NOT ACCEPTED
Signal to and from the A2 System CPU to the A22 HP-IB. This line is used in the HP-IB handshake sequence.

NDAT LOCAL OSCILLATOR DATA
(A4 TP16)
Sine or dc data from the A4 Local Oscillator to the A1 Digital Source.

NDCK DATA CLOCK
(A4 TP14)
The NDCK signal from the A4 Local Oscillator clocks the LO serial data (NDAT) into the the A1 Digital Source.

NLD LOAD DIGITAL SOURCE
(A4 TP17)
Signal from the A4 Local Oscillator that latches the LO's serial data (NDAT) into the A1 Digital Source.

NRFD NOT READY FOR DATA
Signal to and from the A2 System CPU to the A22 HP-IB. This line is used in the HP-IB handshake sequence.

NSYNC NOISE SYNCHRONIZATION
Signal from the A4 Local Oscillator to the A1 Digital Source. The digital source uses this signal for synchronizing the A1 LO receiver data with the chirp clock (NCLK).

OTEMPL OVER TEMPERATURE
(A18 J1-13)
Signal from the A18 Power Supply to the A12 Mother Assembly. This signal from the over temperature circuit on the power supply shuts down the power supply if the temperature exceeds 80° centigrade.

OVLD1 OVERLOAD CHANNEL 1
OVLD2 OVERLOAD CHANNEL 2
(A32, A34 TP502)
Status signals from the A32, A34 Analog Digital Converters that are asserted whenever the analog input exceeds full scale. They are latched by the A5 Digital Filter and can be read by the A2 System CPU as part of the digital filter status word.

PWRDNL POWER DOWN
Active Low
(A18 J1-14, A2 J16)
Signal from the A18 Power Supply to the A30 Analog Source and the A2 System CPU. When this signal is active a power loss is occurring.

PWRUP POWER UP
(A18 J1-15, A2 J15)
When a power failure has occurred the instrument is in the reset mode until the PWRUP signal goes high. This signal from the A18 Power Supply goes to the A2 System CPU. PWRUP is high when +5S is $\geq$ +4.75V.

REF IN EXTERNAL REFERENCE
External clock reference from the rear panel to the A31 Trigger assembly. If the input signal is 1, 2, 5, or 10 MHz ±0.01%, and between 0 and 20 dBm; the internal 10.24 MHz clock phase locks to the input frequency. REF IN has a 50Ω input resistance.

REMTGL REMOTE TRIGGER
Active Low
When a HP-IB trigger is used, the A2 System CPU sends the trigger signal over the remote trigger line to the A1 Digital Source.

REN REMOTE ENABLE
Signal between the A2 System CPU and the A22 HP-IB. This line is used to enable bus compatible instruments to respond to commands from the controller or another talker.

RESETL RESET
Active Low
This signal resets the instrument. The instrument is reset by the A2 System CPU at power-up, when the reset switch A2 S1 is pressed, or by a software reset. RESETL goes to every assembly except the A5 Digital Filter, the A17 Display Interface, the A18 Power Supply, and the A22 HP-Interface bus.

RFDL READY FOR DATA
Active Low
The A17 Display Interface sends the A8 Global RAM this control signal when the HP 1345A is ready for data. RFDL works with DAVL (data available) to transfer data to the HP 1345A display. Refer to the HP 1345A service manual section 3-6 for the handshake timing information.

SAMP SAMPLE
(A32, A34 TP608; A1 TP8)
This is the signal from the A34 ADC 2 to the A1 Digital Source assembly saying a sample has been taken.

SGND SIGNAL GROUND
(A33, A35 J300-2)
A12 Mother Assembly ground; connected to all the assemblies.

SINE SINE
(A4 TP23)
This is a digital signal from the A4 Local Oscillator to the A5 Digital Filter. When in a frequency shifting mode this signal represents a sine signal. When in the real mode, SINE corresponds to 1 + j0.

SMPOUT SAMPLE OUT
(A18 J1-12)
The 256 kHz clock from the A31 Trigger to the A18 Power Supply. This signal is used to synchronize the pulse width modulator on the power supply with the 10.24 MHz clock.

SOURCOUT@ SOURCE OUT ANALOG
(A30 J200)
This is the A30 source output to the front panel.

SRCOUT FALTL SOURCE OUT FAULT
Active Low
Signal from the A30 Analog Source to the A1 Digital Source. This signal goes low when the output of the source is greater than 12 volts.

SRQ SERVICE REQUEST
Signal to and from the A2 System CPU to the A22 HP-IB. This line is set low by any instrument requesting service.

STIM GND STIMULUS GROUND
Ground signal from A30 Analog Source to A33, A35 Input assemblies for stimulus signal.

STIM@ STIMULUS ANALOG
(A30 TP8)
Signal from the A30 Analog Source to the A33, A35 Input assemblies. This signal can be the source output or the calibrator output.

SYNC2 SERIAL DATA ACCEPTED
(A4 TP8)
This signal is from the A5 Digital Filter to the A6 Digital Filter Controller and the A4 Local Oscillator. This signal goes high when the digital filter accepts an input data word. SYNC2 is asserted within 25 ns of the rising edge of the 10.24 MHz clock for about 100 ns. The frequency of SYNC2 is determined by the rate of data acceptance. SYNC2 is used by the local oscillator and digital filter controller to initiate inputting serial sine/cosine data into the digital filter. When the LO receives SYNC2, it sends a complex value to the A5 Digital Filter and a real value to the A1 Digital Source.

SYNC OUT ANALOG PULSE
(A1 J10)
This signal goes to the user output on the rear panel. It comes from the A1 Digital Source. SYNC OUT is high when burst is on and low when burst is off.

SYSCLK SYSTEM CLOCK
(A6 W2-1)
This is a 4.915 MHz clock generated by the A6 Digital Filter Controller. It is used by the A6 Digital Filter Controller and the A5 Digital Filter to clock various sequential circuits.

SYSTEM SYSTEM BUS
The system bus is controlled by the A2 System CPU. The system CPU uses these lines to give commands and receive status from the following assemblies:

A1	Digital Source
A3	Program ROM
A4	Local Oscillator
A6	Digital Filter Controller
A7	Floating Point Transform Processor
A8	Global RAM/Display
A9	Fast Fourier Processor
A15	Keyboard

The system bus consists of the following signals:

A1L to A23L ..... system address bus
D0L to D15L ..... system data bus
ASL ..... address strobe
UDSL ..... upper data strobe
LDSL ..... lower data strobe
WRITEL ..... read/write
DTACKL ..... data transfer acknowledge
VIOL ..... valid I/O address
ENBLL ..... enable
VMAL ..... valid memory address
REMTGL ..... remote trigger
RESETL ..... reset
IRQT2L to IRQT6L .... interrupt request lines
VPAL ..... valid peripheral address

TRH TRACK AND HOLD
(A32, A34 TP609)
This signal is used by the A32 ADC 1 and the A34 ADC 2. TRH is from the ADC controller to the ADC track and hold switch. When both assemblies are installed, the TRH signal from ADC 2 controls the track and hold switch on ADC 1.

TRIG1@ ANALOG TRIGGER CHANNEL 1
TRIG2@ ANALOG TRIGGER CHANNEL 2
(A32, A34 TP303)
Conditioned analog signal from A32, A34 Analog Digital Converters to the A31 Trigger assembly.

TRIGGER TRIGGER
This signal is from the A6 Digital Filter Controller to the A15 Keyboard. TRIGGER controls the front panel trigger LED as follows:

Measurement Mode	Measuring off	Measuring on
Free run	LED off	LED on
Outside Real Time	—	Flash LED
Triggered	Flash LED when input exceeds trigger level	Flash LED when trigger occurs
Time Capture	LED off	Flash LED when trigger occurs

TRIGRO TRIGGER SIGNAL
(A31 TP3)
The trigger signal from the A31 Trigger assembly to the A1 Digital Source and the A6 Digital Filter Controller. This signal is asserted whenever the input has exceeded the trigger level. TRIGRO is used by the digital filter to set the TRIGGER signal.

UDSL UPPER DATA STROBE
Active Low
Signal from the A2 System CPU indicating data is transferring on the upper half of the system data bus (D8L to D15L). When UDSL goes low for a read cycle, the A2 System CPU is expecting valid data to be placed on the upper half of the data bus. In the write cycle, a low on UDSL indicates there is valid data on the upper half of the data bus.

UNLOCK UNLOCK
When this signal from the A31 Trigger assembly is active, the phase lock loop is unlocked. It is only active when an external reference is used. UNLOCK is passed through the A1 Digital Source assembly so the A2 System CPU can read the signal.

VIOL VALID I/O ADDRESS
Active Low
An I/O assembly may be addressed only when this line is low. This signal from the A2 System CPU is part of the address for the following assemblies:

A1	Digital Source
A4	Local Oscillator
A6	Digital Filter Controller
A7	Floating Point Transform Processor
A8	Global RAM/Display
A9	Fast Fourier Processor

VIOL is also used by devices in the A2 System CPU assembly.

VMAL VALID MEMORY ADDRESS
Active Low
Signal from the A2 System CPU to the A4 Local Oscillator indicating the beginning of a synchronous bus transfer. After receiving the valid peripheral address signal (VPAL) from the local oscillator, it asserts VMAL synchronized with the enable clock (ENBLL).

VPAL VALID PERIPHERAL ADDRESS (A4 TP5)
Active Low
Handshake signal from the A4 Local Oscillator to the A2 System CPU. The local oscillator sends the VPAL signal to the system CPU when the LO recognizes that it has been addressed. When the system CPU receives the VPAL signal, it asserts the valid memory address signal (VMAL) which is synchronized with the enable clock (ENBLL).

WRITEL READ/WRITE
This signal defines the system data bus transfer as a read or write cycle. When WRITEL is high the A2 System CPU is reading data from the system data bus. When WRITEL is low the A2 System CPU is writing data onto the system data bus.

SECTION VII
FAULT ISOLATION

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SECTION VII
FAULT ISOLATION

7-1 INTRODUCTION

This section contains the information required to isolate failures to the circuit board level. To accomplish this, extensive use is made of the power-up tests and the self-tests. After isolating the failure to an assembly go to Section VIII, "Service" to continue the failure isolation process.

The fault isolation procedure assumes only one independent failure. Multiple failures may cause false results in the diagnostic tests.

How To Use This Section

Start

If the display and soft keys are operative, go to paragraph 7-7, "Test All".

If the instrument is displaying the 'MONITOR TEST LOG' or 'PROGRAM ROM DEAD', go to paragraph 7-5, "Initial Conditions Test".

If there is no display, incorrect display, or the instrument does not respond when a key is pressed, go to paragraph 7-5, "Initial Conditions Test".

For chirp and noise source failures, go to paragraph 7-9, "Source Failures".

For trigger failures, go to paragraph 7-11, "Isolating Trigger Failures".

For HP-IB failures, go to paragraph 8-6, "A2, A22 System CPU/HPIB".

For intermittent failures, go to paragraph 7-12, "Loop Mode and Intermittent Failures".

Reference

For component locators and schematics refer to Section IX.

For the location of cables and boards refer to figure 4-1 in Section IV.

To find a particular soft key refer to paragraph 7-14, "**SPCL FCTN** Key Map".

To find the software revision code, refer to part B of paragraph 7-15, "Test Log and Fault Log Descriptions"

To understand the self-diagnostic process, refer to paragraph 7-16, "Diagnostic Descriptions".

To understand the self-calibration process, refer to paragraph 7-17, "Self-Calibration".

To understand the instrument's operation and signal mnemonics refer to Section VI.

Verify Use the oscilloscope waveforms in paragraph 7-13 to verify correct operation at various test points in the instrument.

Troubleshooting Hints

1. Intermittent cables can cause hardware failures.
2. Noise or spikes on power supplies can cause instrument failure.
3. Incorrect bias supply voltages can cause false diagnostic messages.
4. Use front panel diagnostics to isolate the problem before extensive troubleshooting.
5. It is possible that one circuit board can load another circuit board causing the wrong one to appear to be defective. This applies to both analog and digital signals.
6. Whenever possible, divide the circuit under test in half (half-splitting).
7. If the name of a nonnumerical key or 'ENTRY Not Enabled' appears in the lower left of the display immediately after the power-up routine, there may be a stuck key or shorted trace on the keyboard (go to 8-15).
8. Do not remove any assembly from the instrument with the power on. There are several sensitive components in the instrument that may be damaged by power supply glitches.
9. To stop the instrument calibration, press soft key S8 (last soft key) just after the display appears. Note: TEST ALL and SELF TEST may not be valid if this key is pressed before these tests are done.
10. A12 Mother Board failures are not isolated in this section. If the mother board is suspected of failing, refer to paragraph 8-14, "A12 Mother Board".
11. Measurements in this section are only approximate (usually ±1 dB or 10%) unless stated otherwise.

NOTE

FFT Global Interface . . . FAILS

This failure message may occur if the instrument is internally set with unknown parameters before running the test (this can be caused by various measurement setups). Before running any of the FFT self-tests, press the HP 3562A keys as follows:

PRESET . . . RESET

7-2 RECOMMENDED TEST EQUIPMENT

The recommended test equipment for troubleshooting is listed in table 1-4. Any item which meets or exceeds the critical requirements can be substituted for the model listed. These procedures are designed to be run with a minimum amount of equipment.

7-3 LOGIC CONVENTIONS

Positive logic convention is used in this manual unless otherwise noted. Positive logic conventions define a logic "1" or "High" as more positive voltage and a logic "0" or "Low" as the more negative voltage.

7-4 SAFETY CONSIDERATIONS

The HP 3562A is a Safety Class 1 instrument (provided with a protective earth terminal). The instrument and manuals should be reviewed for safety markings and instructions before operation. Refer to the safety symbol table in the preface of this manual.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Hazardous voltage and energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3562A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

WARNING

230 Vdc is present in the A18 power supply assembly even with the line switch in the off position and the power cord removed. Be extremely careful when working in the power supply area. This high voltage could cause serious personal injury if contacted. To discharge the capacitors holding this charge perform steps 1 through 3.

1. *Remove the power cord from the rear panel.*

2. *Remove the bottom cover and power supply shield.*

3. *Wait two minutes after turning the power off to allow the capacitors to discharge.*

7-5 INITIAL CONDITIONS TEST

A. Power Supply Check

1. Disconnect the power cord from the rear panel. Remove the bottom cover.
2. Connect the power cable and press the line switch on.
3. Use table 7-1 to verify the power supply is operating correctly. If any of the values are incorrect start troubleshooting with the A18 Power Supply (go to 8-16).

Table 7-1 Power Supply Nominal Values

Return Location is A18 TP13

Supply Name	Output Location	Nominal Voltage	Voltage Tolerance	Ripple Tolerance
+5	A12 J16-1	+5V	±0.3V	50 mV
+30V	A12 W13-1	+30V	±1.8V	10 mV
−30V	A12 W13-2	−30V	±1.8V	10 mV
+15A	A12 W13-3	+15V	±0.9V	10 mV
−15A	A12 W13-4	−15V	±0.9V	10 mV
+5FNTEND	A12 W13-5	+5V	±0.3V	50 mV
+2.6V	A12 W13-6	+2.6V	±0.16V	50 mV
+8S1	A12 W13-7	+8V	±0.48V	25 mV
+8S2	A12 W13-8	+8V	±0.48V	25 mV
+15S	A12 W13-9	+15V	±0.9V	25 mV
−15S	A12 W13-10	−15V	±0.9V	25 mV
OTEMPL	A12 W13-12	TTL Level High		
PWRDNL	A12 W13-13	TTL Level High		
PWRUP	A12 W13-14	TTL Level High		

B. Keyboard Check

1. Press the line switch off.
2. Disconnect cable W10 (A12 J15) from the A12 Mother Board.
3. Connect the power cable and press the line switch on.
4. Reset the keyboard by putting A15 J9 to the test (T) position, then back to the normal (N) position (see note).

NOTE

On some A15 revisions the A15 J9 jumper is not in a convenient ocation. If this is the case, the keyboard can still be reset using the following procedure:

a. Press the line switch off.

b. Disconnect cable W17 (A12 J16) from the A12 Mother Board.

c. Connect a +5V dc power supply and ground to W17, +5V to the red wire and ground to the black wire.

d. To reset the keyboard, cycle the +5V power supply off, then on.

5. The keyboard should respond as follows when it is reset:
   a. Beeps the beeper and flashes all the LEDs three times except CR12 (Triggering), CR17 (Half Range), and CR19 (Half Range). These LEDs will flash on and stay on since they are controlled by other assemblies.
   b. Beeps the beeper and then lights the LEDs one at a time in a pattern from left to right, top to bottom.
   c. Beeps the beeper again and then all the lights should remain on.
6. If the keyboard does not pass this test start troubleshooting with the A15 Keyboard (go to 8-15).
7. This test only validates part of the keyboard, it does not validate the system bus interface circuits.
8. Press the line switch off.
9. Connect cables W10 and W17 to the A12 Mother Board.

NOTE

The keyboard cable (W10) can easily be connected wrong! After connecting the cable, verify that both rows of pins are connected.

C. Display Check

1. Remove the top cover and press the line switch on.

2. Set jumper A17 W1 (located in hole in display shield) to the test (T) position with the power ON.

3. The pattern displayed should be the same as shown in figure 7-1. The main lines should all connect as shown and the lines in the lower right corner should be parallel. If this pattern is not displayed start troubleshooting with the HP 1345A Display (go to 8-12).

4. Set jumper A17 W1 to the normal (N) position.

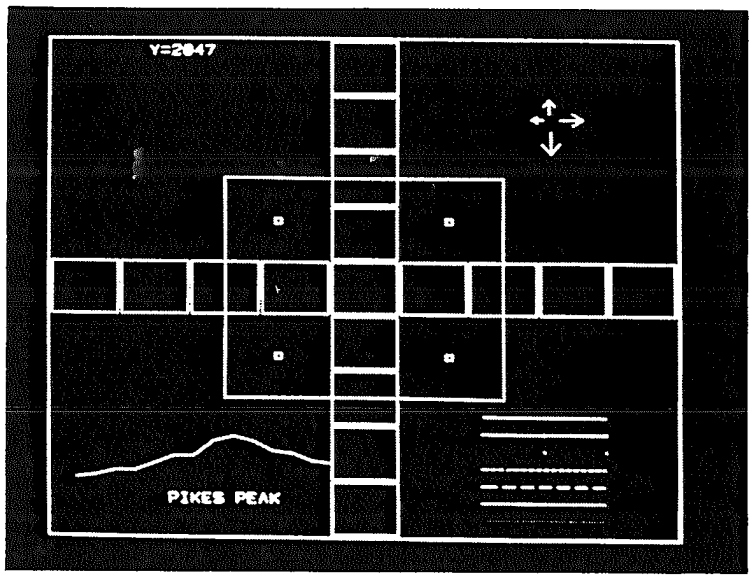


Figure 7-1 Display of Verification Pattern

D. Clock Check

1. Remove the top cover and press the line switch on.
2. Use table 7-2 to verify various clocks in the instrument. If any of the values are incorrect, go to Section VIII.

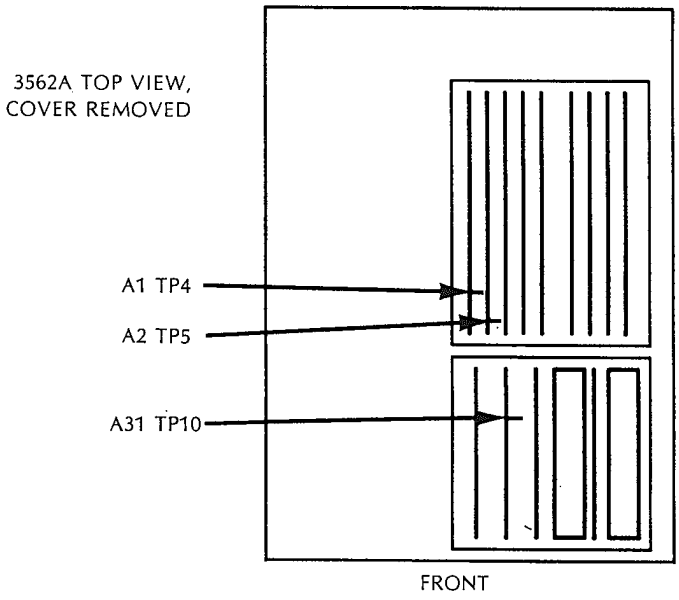


Table 7-2 Clocks

Test Location	Signal Name	Waveform Number	Probable Cause of Failure	Go To
A31 TP10	20.48 MHz	#1	A31 Trigger	8-18
A1 TP4	10.24 MHz	#2	A31 Trigger	8-18
A2 TP5	8 MHz	#3	A2 System CPU	8-6

E. If the fault has not been found, go to paragraph 7-6, "Power-Up Tests".

7-6 POWER-UP TESTS

Introduction

The power-up test procedure is used when there is no display, incorrect display, or the instrument does not respond when a key is pressed. The initial conditions test (paragraph 7-5) must be completed before performing the power-up test procedure.

The power-up tests consist of two sets of tests, low-level and high-level. The low-level tests exercise the A2 System CPU, the A3 Program ROM, the A8 Global RAM, the global bus, and the system bus. Fault and pass codes for these core assemblies are displayed using the A2 System CPU test LEDs (A2 DS3, A2 DS4). The high-level power-up tests exercise the A9 FFT, A7 FPP, A5 DGTL FLTR, and A6 D FLTR CONT assemblies. Faults on these assemblies are displayed in the test log (refer to table 7-6 for the description of these messages). The instrument performs a calibration if the power-up tests pass.

Power-up test failures may be caused by one of the following conditions:

1. A core assembly is defective (A2, A3, A8).

2. An assembly on the system bus or global bus is defective, causing a bus failure.

3. The A15 Keyboard system bus interface circuits are defective. (This may be the case when the display is normal after power-up but the instrument does not respond when a key is pressed.)

4. A control line is defective.

Power-Up Test Procedure

To find the cause of the failure, start by referring to table 7-4 for the location of the A2 Test LEDs and the LEDs to Hex code translation.

A. To verify the core assemblies are operating correctly, perform steps 1 through 6:

1. Remove the top cover.

2. Press the line switch on.

3. Press the reset switch A2 S1 (reset switch on A2 CPU).

4. After the reset switch is pressed, the A2 System CPU should flash the test LEDs (A2 DS3, A2 DS4), light the LEDs one at a time, and cycle through several codes as listed in table 7-3. When finished, A2 DS1 should be off.

Table 7-3 LEDs Pass Sequence

Binary	Hex	≈Time Visible	Description
0000 0101	05	1s	System Processor test
0001 1110	1E	2.5s	Starting Program ROM check sum
1011 0101	B5	3.6s	Starting Global RAM Test
1011 0110	B6	15s	Starting high-level power-up test
1011 0111	B7	Remains Lit	Power-up Tests finished

For A2 System CPU, A3 Program ROM, and system bus test failures, the power-up sequence stops on the first failure and displays the pass/error code, then stops.

For the Global RAM test failures (chart line #22 to #29), the power-up sequence displays Hex B5 while the test tries to isolate the failure (up to 3.5 minutes!), then one of the following occurs:

a. B5 (Hex) continues to be displayed on the A2 Test LEDs.

b. Another Global RAM test pass/error code is displayed and the sequence stops.

5. If the LEDs pass sequence does not occur, A2 DS1 is on, or the instrument does not display the special function menu when SPCL FCTN is pressed; go to part C.

6. If the LEDs pass sequence occurs and the instrument responds when SPCL FCTN is pressed (the special function menu is displayed) but the display is defective, an assembly on the global bus may be defective. To test the global bus when this is occurring, go to part B.

7. If the LEDs pass sequence occurs but the instrument does not respond when SPCL FCTN is pressed, a control line may be defective, go to paragraph 7-10, "Control Line Test".

B. Perform this procedure (steps 1 through 13) if the display is defective but the LEDs pass sequence occurs and the instrument responds when SPCL FCTN is pressed:

1. Press the line switch off.

2. Remove the following assemblies:

A5 Digital Filter
A7 FPP
A9 FFT

3. Press the line switch on and the HP 3562A keys as follows:

SPCL
FCTN . . . . . SERVIC
TEST . . . . . TEST
MEMORY . . . . . GLOBAL
RAM

If the display does not appear as in figure 7-2, start troubleshooting with the A8 Global RAM (go to 8-11).

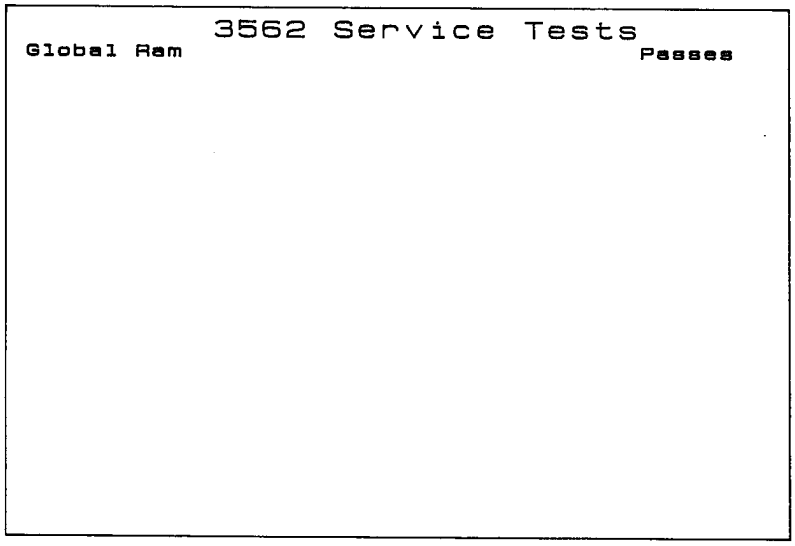


Figure 7-2 Global RAM test passes

4. Press the line switch off.

5. Replace the A7 FPP assembly.

6. Press the line switch on and the HP 3562A keys as follows:

SPCL
FCTN . . . . . SERVIC
TEST . . . . . TEST
PROC . . . . . TEST
FPP . . . . . FPP
FUNCTION

If this test fails, start troubleshooting with the A7 FPP (go to 8-10).

7. Press the line switch off.

8. Replace the A9 FFT assembly.

9. Press the line switch on and the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
PROC ..... TEST
FFT ..... FFT
FUNCTION

If this test fails, start troubleshooting with the A9 FFT (go to 8-13).

10. Press the line switch off.

11. Replace the A5 DGTL FLTR assembly.

12. Press the line switch on and the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
PROC ..... TEST
DFA ..... FILTER
TEST

If this test fails, start troubleshooting with the A5 DGTL FLTR (go to 8-9).

13. If the cause of the failure has not been found, go to paragraph 7-10, "Control Line Test".

C. Perform this procedure (steps 1 through 20) if the LEDs pass sequence does not occur, A2 DS1 is on, or the instrument does not display the special function menu when SPCL FCTN is pressed:

1. Press the line switch off.

2. Remove the bottom cover.

3. Disconnect cable W10 from the A12 Mother Board.

4. Remove the following assemblies:

A1 Digital Source
A3 Program ROM
A4 Local Oscillator
A5 Digital Filter
A6 Digital Filter Controller
A7 FPP
A8 Global RAM/Display
A9 FFT

5. Pull the following assemblies up in their card nests so they are no longer connected to the A12 Mother Board:

   A30 Analog Source
   A31 Trigger
   A32 ADC 1
   A33 Input 1
   A34 ADC 2
   A35 Input 2

6. Press the line switch on. The LEDs pass sequence should stop on Hex B1 and A2 DS1 should be on. If Hex B1 is not displayed, start troubleshooting with the A2 System CPU (go to 8-6).

7. Press the line switch off.

8. Replace the A3 Program ROM assembly.

9. Press the line switch on. The LEDs pass sequence should stop on Hex B5 and A2 DS1 should be off. If Hex B5 is not displayed, go to part E.

10. Press the line switch off.

11. Replace the A8 Global RAM.

12. Press the line switch on. The Global RAM and Global Bus tests are now performed. The LEDs pass sequence should now occur (it takes about 40s to complete) and A2 DS1 should be off. If the LEDs pass sequence does not occur go to part E.

13. The display should now appear as shown in figure 7-3. If the display is defective, the probable cause of the failure is the A8 Global RAM or A17 Display Interface (go to 8-11).

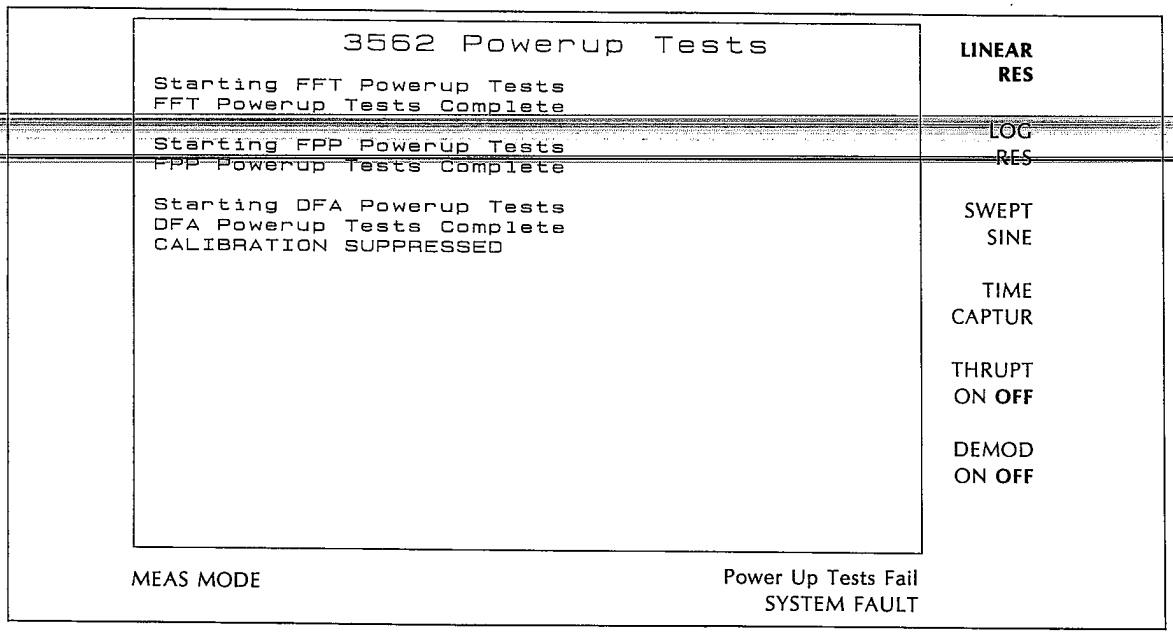


Figure 7-3 Display Active

14. Press the line switch off.

15. Connect the A15 Keyboard cable (W10) to the A12 Mother board.

NOTE

The keyboard cable (W10) can easily be connected wrong! After connecting the cable, verify that both rows of pins are connected.

16. Press the line switch on. The LEDs pass sequence should occur (it takes about 40s to complete) and A2 DS1 should be off. If the LEDs pass sequence does not occur, the probable cause of the failure is the A15 Keyboard system bus interface circuits (go to 8-15).

17. The soft keys should now be active and the display appear as shown in figure 7-3. Only the GLOBAL RAM and TEST KEYBD tests are valid. If the soft keys are not active or the display is defective, either the A8 Global RAM, A15 Keyboard, or A17 Display Interface is probably defective. If possible, press the keys as follows:

NOTE

If the display is blank or garbled, the soft key menus may be unreadable. The number of the soft key (S1 through S8 from top to bottom) for this procedure appears in parentheses after the soft key name.

SPCL FCTN ..... SERVIC
TEST (S2) ..... TEST
PROC (S3) ..... TEST
KEYBD (S4)

..... RETURN (S8) ..... TEST
MEMORY (S2) ..... GLOBAL
RAM (S1)

If these tests pass, the A8 Global RAM (except for the display controller subblock) and the A15 Keyboard system bus interface circuits are probably working correctly. If a test fails, go to Section VIII.

18. The A17 Display Interface or the display controller subblock on the A8 Global RAM may be causing the failure (the self-tests do not verify these circuits). If the display does not appear as shown in figure 7-3, refer to paragraph 8-11 to test the display interface and display controller circuits.

19. Press the line switch off and replace the A9 FFT.

20. Press the line switch on. The LEDs pass sequence should occur and A2 DS1 should be off. If the LEDs pass sequence does not occur, go to part E. If the fault has not been found, continue with part D.

D. Perform steps 1 through 3 as follows for each of the remaining assemblies. Replace the assemblies in the following order:

A6 Digital Filter Controller
A7 FPP
A1 Digital Source
A4 Local Oscillator
A31 Trigger
A5 Digital Filter
A34 ADC 2
A35 Input 2
A30 Analog Source
A32 ADC 1
A33 Input 1

1. Press the line switch off.

2. Replace the assembly.

3. Press the line switch on. The LEDs pass sequence should occur and A2 DS1 should be off. If the LEDs pass sequence does not occur, go to part **E.**

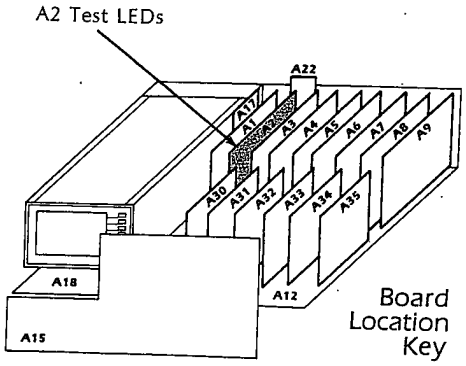
E. Power-Up Tests Code Table

After the power-up tests are completed, use table 7-4 to help determine the cause of the failure. (Refer to the beginning of this section for the description of the power-up test sequence). The table lists the tests in the order they are run. The A2 Test LEDs Hex code is listed on the vertical axis of the table. The assemblies and subblocks tested or used by the power-up tests are listed on the horizontal axis of the table.

There are two symbols used in table 7-4: **O** and **X**. When the symbol "**O**" is used in the table, the assembly or subblock is used in the test but is not a likely cause of the failure. When the symbol "**X**" is used in the table, the assembly or subblock is the probably the cause of the failure. No symbol means the assembly or subblock is not used in the test.

EXCEPTION NOTE

Shorts on the system bus, the global bus, an interrupt line, or the reset line, can cause false error codes. If an error code is caused by the last assembly inserted, it is probably the assembly defective.



Example:

LEDs ooo● ●●●●

Binary 0001 1111

Hex 1 F

Chart Line #21

LED ON = 1

LED OFF = 0

Binary	Hex
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

Hex Error Code	to	Chart Line #
01 to 04	.....	2
05 to 06	.....	3
07 to 0B	.....	1
0C to 0F	.....	6
10 to 1C	.....	4
1D	.....	1
1E	.....	7
1F	.....	21
20 to 33	.....	12
34 to 3F	.....	1
40 to 53	.....	13
54 to 59	.....	1
5A	.....	9
5B	.....	10
5C	.....	11
5D to 5F	.....	1
60 to 73	.....	14
74 to 79	.....	1
7A	.....	10
7B	.....	9
7C	.....	11
7D to 7F	.....	1
80	.....	1
81	.....	23
82	.....	24
83	.....	25
84 to 86	.....	15
87	.....	17
88	.....	18
89	.....	19
8A to 8C	.....	16
8D	.....	20
8E to 8F	.....	1
90 to 9F	.....	26
A0 to AF	.....	27
B0	.....	1
B1	.....	8
B2 to B4	.....	1
B5	.....	22
B6	.....	30
B7	.....	31
B8 to BF	.....	1
C0 to CF	.....	5
D0 to DF	.....	28
E0 to EF	.....	29
F0 to FF	.....	1

Table 7-4 Power-up Test Codes

Th
th

Th
us
ca

No
us

No

Chart Line No.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31

* No info

ıbol X means the assembly or subblock is
ıt likely cause of the failure message.

ıbol O means the assembly or subblock is
ı the circuit but is not the most likely
ıf the failure message.

ol means the assembly or subblock is not
the test.

hese tests are run in order starting
ith the monitor ROM test. The error code
s for the first test that fails. A pass
ode indicates a failure on the next test.

Hex /Error ode	Test Description	A2 8 MHz Clock	A18 +5S	A2 U100 System Processor	A2 CPU Monitor ROM	A2 CPU Monitor RAM	A2 CPU Assembly	A12 Mother Board	- System Bus	A3 Program ROM high	A3 Program ROM low	A9 FFT System Interface	- Global Bus, go to part F	A8 Global RAM high	A8 Global RAM low
	SYSTEM CPU TEST														
efined	Initial Power Up	X	O	X	O	O	X								
to 04	Monitor ROM	O	O	O	X	O	O								
to 06	System Processor	O	O	X	O	O	O								
to 1C	Monitor RAM Test Failure	O	O	O	O	X	O								
to CF	Monitor RAM Address Failure	O	O	O	O	X	O								
to 0F	Timer and Interrupt Failures	O	O	O	O	O	X								
	PROGRAM ROM AND SYSTEM BUS TESTS														
1E	Start Program ROM Check Sum	O	O	O	O	O	O	O	X	X	X				
B1	Program ROM Installed ?	O	O	O	O	O	O	O	O	X	X				
7A*	Program ROM failure, low byte	O	O	O	O	O	O	O	X		X				
7B*	Program ROM failure, high byte	O	O	O	O	O	O	O	X	X					
7C*	Program ROM failure, both bytes	O	O	O	O	O	O	O	X	X	X				
to 33	Program ROM, chip failure, high byte	O	O	O	O	O	O	O	O	X					
to 53	Program ROM, chip failure, low byte	O	O	O	O	O	O	O	O		X				
to 73	Program ROM, chip failure, both bytes	O	O	O	O	O	O	O	O	X	X				
to 86	Program ROM failure, System bus good	O	O	O	O	O	O	O	O	X	X				
to 8C	Program ROM failure, System bus good	O	O	O	O	O	O	O	O	X	X	O			
87	System bus failure, high byte	O	O	O	O	O	O	O	X	O	O				
88	System bus failure, low byte	O	O	O	O	O	O	O	X	O	O				
89	System bus failure, both bytes	O	O	O	O	O	O	O	X	O	O				
8D	No ROM passes check sum, system bus good, Check system address bus	O	O	O	O	O	O	O	X	X	X				
F	Program ROM and System bus tests pass	O	O	O	O	O	O	O	O	O	O				
	GLOBAL RAM TEST														
5	Starting Global RAM Test	O	O	O	O	O	O	O	O	O	O		X	O	O
1	Global RAM failure, both bytes	O	O	O	O	O	O	O	O	O	O		O	X	X
2	Global Ram failure, high byte	O	O	O	O	O	O	O	O	O	O		O	X	
3	Global RAM failure, low byte	O	O	O	O	O	O	O	O	O	O		O		X
o 9F	Global bus failure, bit "N"	O	O	O	O	O	O	O	O	O	O		X	O	O
o AF	Global RAM address failure, bit "N", Check global address bus	O	O	O	O	O	O	O	O	O	O		X	X	X
o DF	Global RAM failure, bit "N"	O	O	O	O	O	O	O	O	O	O		O	X	X
o EF	Global RAM refresh failure, bit "N"	O	O	O	O	O	O	O	O	O	O		O	X	X
6	Executing high level power-up tests	O	O	O	O	O	O	O	O	O	O	O	O	O	O
7	Power-up tests finished														

ion about system bus

F. Global Bus Test

This test is used for power-up test code failures 90 to 9F. The 9"N" error code indicates a global bus line is defective. For example, if N=5, then a Hex 95 failure indicates the global bus line GD5 is defective.

1. Press the line switch off.

2. Remove the following assemblies:

   A5 Digital Filter
   A7 FPP
   A8 Global RAM/Display
   A9 FFT
   A17 Display Interface

3. Place the A2 System CPU on the 03562A-66540 extender board.

4. Put jumpers A2 J8, A2 J12, A2 J13, and A2 J17 in test (T) position. This forces the system CPU to execute the Global RAM test.

5. Press the line switch on. The LEDs sequence should stop on Hex B5 for about 1.3 minutes and then display Hex AF.

6. If the pass/error code is still 9"N", start troubleshooting with the A2 System CPU (go to 8-6).

7. Perform steps (a) through (c) for each of the assemblies. Replace the assemblies in the following order:

   A8 Global RAM/Display
   A17 Display Interface
   A9 FFT
   A7 FPP
   A5 Digital Filter

   (a) Press the line switch off.

   (b) Replace the assembly.

   (c) Press the line switch on. The LEDs sequence should read Hex B5 for about 1.3 minutes and then display Hex AF. If this sequence is not displayed, start troubleshooting with this assembly (go Section VIII).

8. Put jumpers A2 J8, A2 J12, A2 J13, and A2 J17 in normal (N) position.

G. If the fault has not been found, go to paragraph 7-10, "Control Line Test".

7-7 TEST ALL

Introduction

The Test All sequence thoroughly exercises the digital and the analog hardware in the instrument. This self-diagnostic actually does several types of measurements to determine what is operating correctly. When a fault is found the self-diagnostic exercises suspected circuits using digital signals generated internally, reading status registers, and using the internal analog source and calibrator. The Test All sequence then uses logic to determine the most likely failure based on the results of these measurements.

All failure messages are displayed in the Test Log (refer to 7-15 for test log description). If the Test All sequence does not isolate the defective assembly, the individual self-tests for the suspected assemblies can be done individually to help isolate the failure. Use table 7-6 as a reference when running any of the service tests. When a test passes the assemblies and subblocks exercised are most likely operating correctly.

The Test All feature does not isolate failures on the following assemblies:

Core Assemblies
A32 Trigger
A15 Keyboard
A18 Power Supply
A12 Mother Board
A17 Display Interface
HP 1345A Display
System and global control lines

If a keyboard related problem is suspected, go to 8-15 after performing TEST ALL. If the instrument does not respond when a key is pressed or the display is defective, go to paragraph 7-5, "Initial Conditions Test". The Test All diagnostic does not use or test the following circuits:

A22 HPIB (refer to 8-6 for HP-IB failures)

Trigger mode circuits (refer 7-11 for trigger failures)

Burst and noise source circuits (refer to 7-9 for burst and noise failures)

Follow the Test All procedure starting with part A to isolate the failure.

Test All Procedure

A. Start

1. Press the line switch on.

2. Press the HP 3562A keys as follows:

PRESET ..... RESET (S8)

SPCL
FCTN ..... SERVIC TEST ..... TEST RESULT ..... TEST LOG

3. If the FPP, FFT, and Global RAM passed the power-up test, then these assemblies are probably operating correctly. If any of these assemblies failed the power-up test, refer to table 7-5.

4. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC TEST ..... TEST ALL

If there are no failures, this test takes about two minutes to complete. If there is a failure, it may take three minutes to complete. The test log is displayed when the self-tests are completed.

5. Refer to figure 7-4 to verify the normal Test All result.

6. **Use table 7-5 after running the Test All diagnostic.**

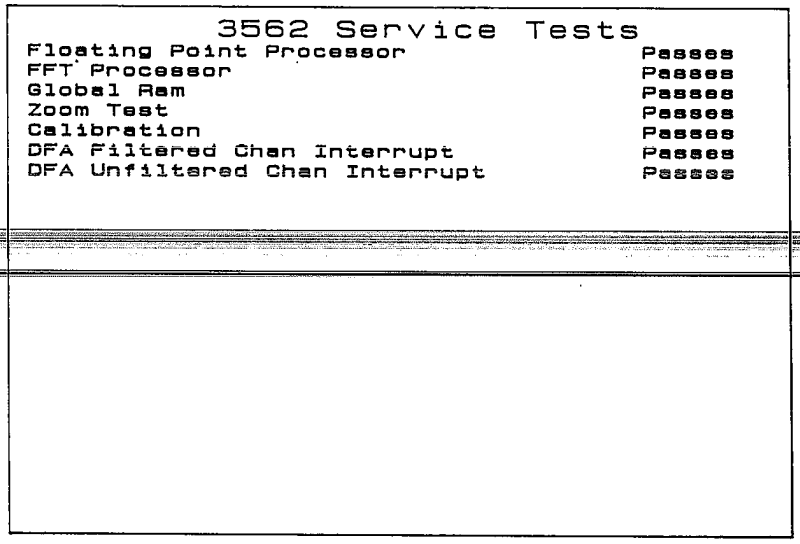


Figure 7-4 TEST ALL Passes

Table 7-5 TEST ALL Results

Test All Result Tests not listed may either pass or fail (don't cares). To use table, start with first line.	Go to Paragraph
1. Test All passes	7-7, part B, "Test All Table"
2. Test All does not complete self-tests (test log is not displayed)	7-7, part C, "Test All Does Not Complete"
3. FPP Fails	8-10 A7 FPP
4. FFT Fails	8-13 A9 FFT
5. Global RAM Fails	8-11 A8, A17 Global RAM and Display Interface
6. Keyboard Status Test Fails	8-15 A15 Keyboard
7. DFA Interrupt Fails	7-8 Isolating Front End Failures
8. DFA Unfiltered Chan Interrupt Fails	7-8 Isolating Front End Failures
9. Source Test Fails, Calibration Fails, Front End Passes	7-9 Source Failures
10. Calibration Fails, Front End Passes, Source Test Passes	8-17 A30 Analog Source
11. Calibration Fails, Front End Fails only on one channel, Source Test Passes	7-8, part C, "A5, A6 Digital Filter Check"
12. Source Test Fails, Front End Fails, Calibration Fails	7-8 Isolating Front End Failures

B. Test All Table

Use table 7-6 to help determine the failure after running the Test All diagnostic or any individual self-tests. The table lists the self-tests in the order the Test All diagnostic executes them. A pass message indicates the assemblies and subblocks tested are probably operating correctly. The pass/fail messages are listed on the vertical axis of the table. The assemblies and subblocks tested or used by the self-tests are listed on the horizontal axis of the table. (Refer to the introduction of paragraph 7-7 for the list of assemblies not tested by Test All.)

There are two symbols used in table 7-6: **O** and **X**. When the symbol "**O**" is used in the table, the assembly or subblock is used in the test but is not a likely cause of the failure. When the symbol "**X**" is used in the table, the assembly or subblock is probably the cause of the failure. No symbol means the assembly or subblock is not used in the test.

The symbol X means the assembly or subblock is the most likely cause of the failure message.

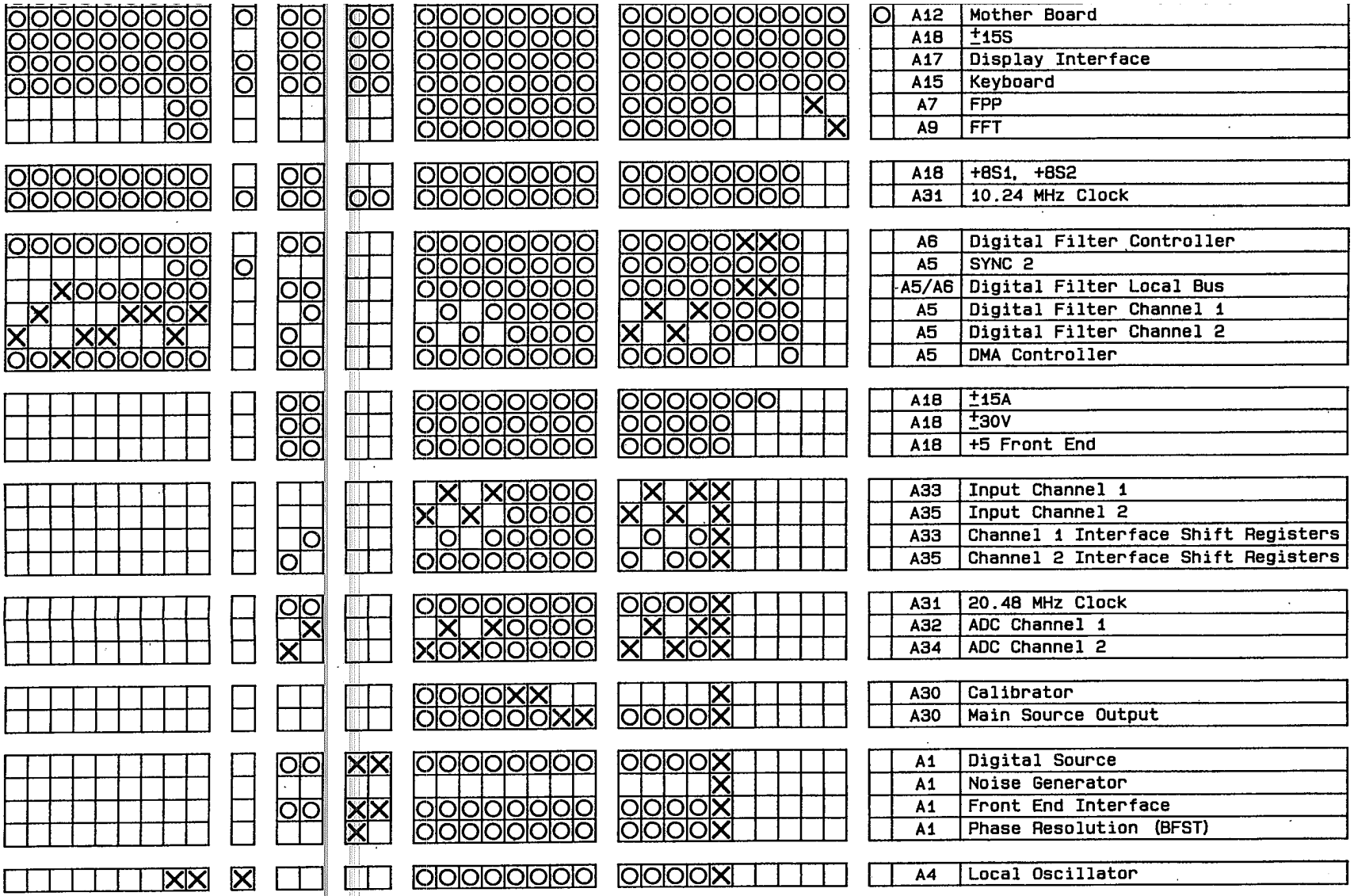
The symbol O means the assembly or subblock is used in the circuit but is not the most likely cause of the failure message.

No symbol means the assembly or subblock is not used in the test.

Note: Press **SELF TEST**....SERVIC TEST....TEST ALL to run all of the tests. To run individual tests press the key listed under the "Press Key" column.

Pass / Fail Messages	Description	Press Key / Assembly / Subblock	8 MHz Clock A2	+5S A18	System CPU A2	System Bus -	Program ROM A3
Power-Up Test Codes	See Table 7-4 for Pass/Error Codes	A2 S1 (Reset)	O	O	O	O	O
FFT "messages"	FFT Self-Tests	FFT FUNCTN	O	O	O	O	O
FPP "messages"	FPP Self-Tests	FPP FUNCTN	O	O	O	O	O
DFA Interrupt "messages"	DFA Interrupt Test	-----	O	O	O	O	O
DFA Counter "bit#"	DFA Local Bus Echo	LOCAL BUS	O	O	O	O	O
DFA Local Bus "bit#"	DFA Local Bus Echo	LOCAL BUS	O	O	O	O	O
Calibration "messages"	Self-Calibration	TEST ALL	O	O	O	O	O
Channel 1 Zoom Signal	Zoom Test	ZOOM	O	O	O	O	O
Channel 2 Zoom Signal	Zoom Test	ZOOM	O	O	O	O	O
Channel 1 Zoom Noise	Zoom Test	ZOOM	O	O	O	O	O
Channel 2 Zoom Noise	Zoom Test	ZOOM	O	O	O	O	O
Source Distortion	Source Test	SOURCE FUNCTN	O	O	O	O	O
Source Signal Level	Source Test	SOURCE FUNCTN	O	O	O	O	O
Calibration Distortion	Source Test	SOURCE FUNCTN	O	O	O	O	O
Calibration Signal Level	Source Test	SOURCE FUNCTN	O	O	O	O	O
Channel 1 Operation	Front End Test	FR END FUNCTN	O	O	O	O	O
Channel 2 Operation	Front End Test	FR END FUNCTN	O	O	O	O	O
Channel 1 Distortion	Front End Test	FR END FUNCTN	O	O	O	O	O
Channel 2 Distortion	Front End Test	FR END FUNCTN	O	O	O	O	O
Digital Souce F/E Interface "bit#"	Digital Source Self Test	FR END INTFCE	O	O	O	O	O
Digital Source Main Test "bit#"	Digital Source Self Test	SOURCE MAIN	O	O	O	O	O
ADC Channel 1 "messages"	ADC Tests	DIGTAL TEST	O	O	O	O	O
ADC Channel 2 "messages"	ADC Tests	DIGTAL TEST	O	O	O	O	O
LO "messages"	LO Functional	LO FUNCTN	O	O	O	O	O
DFA Functional Channel 1	Zoom with Square Wave Test	DFA FUNCTN	O	O	O	O	O
DFA Functional Channel 2	Zoom with Square Wave Test	DFA FUNCTN	O	O	O	O	O
DFA Channel 1 Real Filter	DFA Data Echo	FILTER TEST	O	O	O	O	O
DFA Channel 1 Imaginary Filter	DFA Data Echo	FILTER TEST	O	O	O	O	O
DFA Channel 2 Real Filter	DFA Data Echo	FILTER TEST	O	O	O	O	O
DFA Channel 2 Imaginary Filter	DFA Data Echo	FILTER TEST	O	O	O	O	O
DMA "messages"	DFA DMA Bus Echo	DMA BUS	O	O	O	O	O
DFA Filter Bus 1 "bit#"	DFA Filter Bus Test	FILTER BUS	O	O	O	O	O
DFA Filter Bus 2 "bit#"	DFA Filter Bus Test	FILTER BUS	O	O	O	O	O

Table 7-6 TEST ALL Messages



	A12	Mother Board
	A18	±15S
	A17	Display Interface
	A15	Keyboard
	A7	FPP
	A9	FFT
	A18	+8S1, +8S2
	A31	10.24 MHz Clock
	A6	Digital Filter Controller
	A5	SYNC 2
	A5/A6	Digital Filter Local Bus
	A5	Digital Filter Channel 1
	A5	Digital Filter Channel 2
	A5	DMA Controller
	A18	±15A
	A18	±30V
	A18	+5 Front End
	A33	Input Channel 1
	A35	Input Channel 2
	A33	Channel 1 Interface Shift Registers
	A35	Channel 2 Interface Shift Registers
	A31	20.48 MHz Clock
	A32	ADC Channel 1
	A34	ADC Channel 2
	A30	Calibrator
	A30	Main Source Output
	A1	Digital Source
	A1	Noise Generator
	A1	Front End Interface
	A1	Phase Resolution (BFST)
	A4	Local Oscillator

C. Test All Does Not Complete

Use this procedure when the test log is not displayed within 5 minutes after pressing TEST ALL.

1. Press the line switch off.

2. Remove the following assemblies:

   A5 Digital Filter
   A7 FPP
   A9 FFT

3. Press the line switch on and the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
MEMORY ..... GLOBAL
RAM

If test fails or the display does not appear as in figure 7-5, start troubleshooting with the A8 Global RAM (go to 8-11).

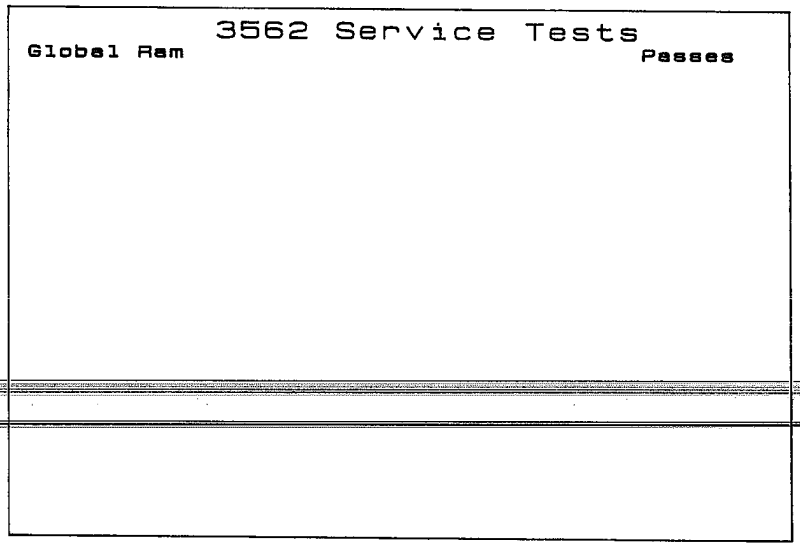


Figure 7-5 Global RAM Test Passes

4. Press the line switch off.

5. Replace the A7 FPP assembly.

6. Press the line switch on and the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
PROC ..... TEST
FPP ..... FPP
FUNCTN

If this test fails, start troubleshooting with the A7 FPP (go to 8-10).

7. Press the line switch off.

8. Replace the A9 FFT assembly.

9. Press the line switch on and the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
PROC ..... TEST
FFT ..... FFT
FUNCTN

If this test fails, start troubleshooting with the A9 FFT (go to 8-13).

10. Press the line switch off.

11. Replace the A5 DGTL FLTR assembly.

12. Press the line switch on and the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
PROC ..... TEST
DFA ..... FILTER
TEST

If this test fails, start troubleshooting with the A5 DGTL FLTR (go to 8-9).

13. If the display is normal and the fault has not been found, go to paragraph 7-8, "Isolating Front End Failures".

14. If the display is defective and the fault has not been found, go to paragraph 7-10, "Control Line Test".

7-8 ISOLATING FRONT END FAILURES

This procedure assumes the core assemblies are operating correctly and the Test All procedure was done. The self-diagnostic message 'Front End Fails' can be caused by the following assemblies:

A1 Digital Source
A4 Local Oscillator
A5 Digital Filter
A6 Digital Filter Controller
A30 Analog source
A32 Analog Digital Converter Channel 1
A33 Input Channel 1
A34 Analog Digital Converter Channel 2
A35 Input Channel 2

NOTE

For some failures it takes up to three minutes to complete a test. If a test takes more than five minutes to terminate (the test log is displayed), the test has failed.

A. Signal Check

1. Press the line switch off.
2. Remove the top cover.
3. Press the line switch on.
4. After the power-up tests are completed, use a scope to verify the signals listed in table 7-7. If all the signals are operating correctly, go to step 5.

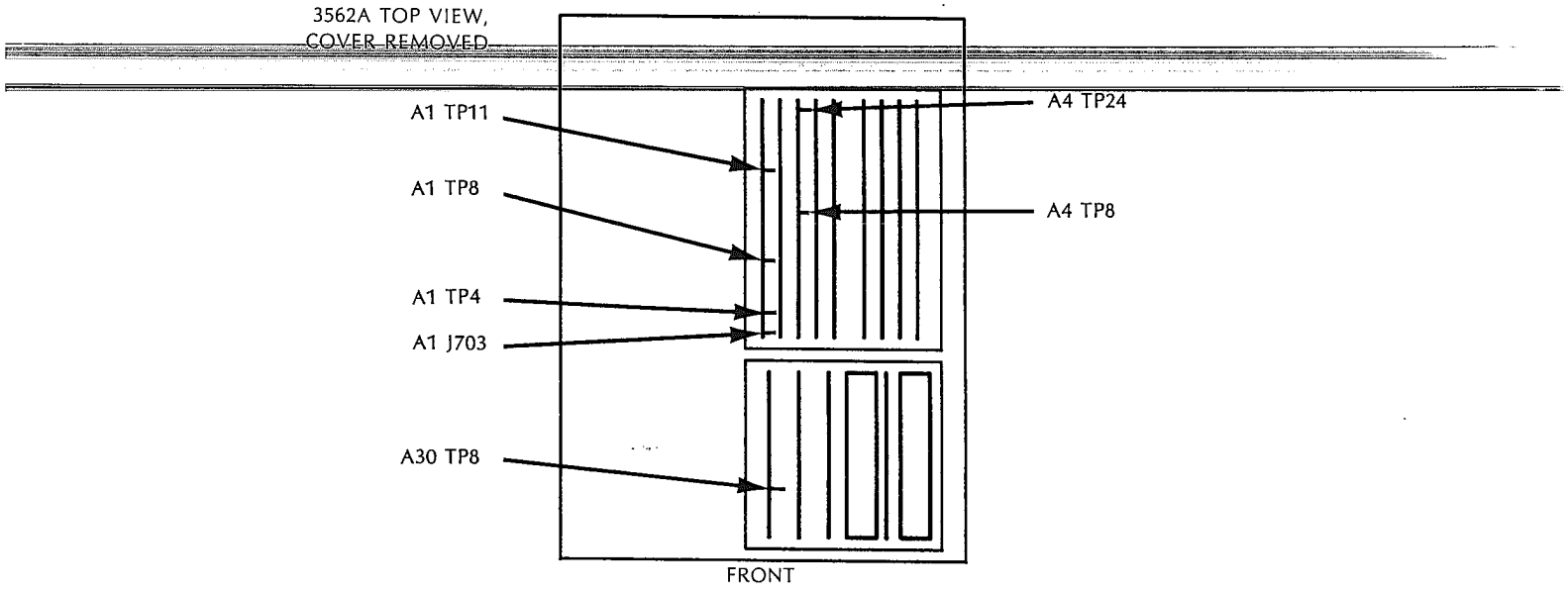


Table 7-7 Front End Signal Check

Test Location	Signal Name	Waveform Number	Probable Cause of Failure	Go To
A1 TP4	10.24 MHz	#2	A31 Trigger	8-18
A1 TP8	SAMP	#5	A34 ADC 2	8-19
A1 J703-1	DREQL	#5	A5 Digital Filter A6 D FLTR CONT	8-9
A4 TP8	SYNC2	#6	A5 Digital Filter A6 D FLTR CONT A4 LO	7-8, part G
A4 TP24	COS	#6	A4 LO	8-8
Refer to step 5 for key presses to view CNTCLK.				
A1 TP11	CNTCLK	#4	A1 Digital Source	8-5
Press A2 S1 to view the STIM@ waveform (STIM@ is disabled when calibration is done).				
A30 TP8	STIM@	#8	A30 Analog Source	8-17

5. Press the HP 3562A keys as follows:

SPCL FCTN . . . . SERVIC
TEST . . . . . LOOP
ON

. . . . . TEST
SOURCE . . . . . FR END
INTFCE

After Viewing the waveform, press A2 S1 (reset switch on A2 CPU).

B. A4 LO Check

1. Press the HP 3562A keys as follows:

SPCL
FCTN . . . . . SERVIC
TEST . . . . . TEST
SOURCE . . . . . LO
FUNCTN

2. If this test fails, start troubleshooting with the A4 Local Oscillator (go to 8-8).

3. If this test passes, the A4 Local Oscillator is probably working correctly.

C. A5, A6 Digital Filter Check

1. Press the line switch off.

2. Pull the following assemblies up in their card nests:

   A32 ADC 1
   A33 INPUT 1
   A34 ADC 2
   A35 INPUT

3. Press the line switch on.

4. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
PROC

..... TEST ..... DFA
DFA FUNCTN

5. If this test fails, start troubleshooting with the A5 Digital Filter and A6 Digital Filter Controller (go to 8-9).

6. If this test passes, the A5 Digital Filter and A6 Digital Filter Controller assemblies are probably operating correctly. Replace all assemblies in their card nests.

7. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
INPUT ..... ADC ..... DIGTAL
TEST

8. If the ADC Gate Array test passes, the data path from the ADC to the digital filter is probably functioning correctly.

9. If only one channel is failing and the DFA Functional test (DFA FUNCTN) passed for both channels, go to part F.

D. A1 Digital Source Check

1. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
SOURCE ..... SOURCE
MAIN

2. When this test is finished press the keys as follows:

..... FR END
INTFCE

3. If the Source Main test or the Digital Source F/E Interface test fails, start troubleshooting with the A1 Digital Source (go to 8-5).

4. If these tests pass, the A1 Digital Source interface circuits to the A33/A35 Inputs, the A32/A34 ADCs, and the A30 Analog Source are probably operating correctly (see exception note). If the digital source check passes, go to part E.

EXCEPTION NOTE

If the following is occurring:

a. Result of TEST ALL is:

Floating Point Processor	*Passes*
FFT Processor	*Passes*
Digital Source F/E Interface	*Passes*
Digital Source Main Test	*Passes*
Digital Source Counters	*Passes*
Global RAM	*Passes*
ADC Channel 1 Gate Array	***Fails***
ADC Channel 2 Gate Array	***Fails***
Source Test	***Fails***
Chan 1 Input Operation	***Fails***
Chan 2 Input Operation	***Fails***
Calibration	***Fails***
LO Functional Test	*Passes*
DFA Filtered Chan Interrupt	*Passes*
DFA Unfiltered Chan Interrupt	*Passes*

b. The signals in table 7-7 are correct.

The probable cause of the failure is the A1 Digital Source shift registers (A1 U206, A1 U207). There is one failure mode of these shift registers that is not detected by the self-test.

E. Output Sine Check

1. Connect a scope to the source output on the front panel. Set the scope as follows:

CH1 V/Div	2 V/Div
Coupling	dc
Time/Div	500 μs/Div
Trigger	CH1

2. Press the HP 3562A keys as follows:

SOURCE . . . . . SOURCE
LEVEL . . . . . **5** V

. . . . . FIXED
SINE . . . . . **1** kHz

3. Refer to figure 7-6 to verify the correct result.

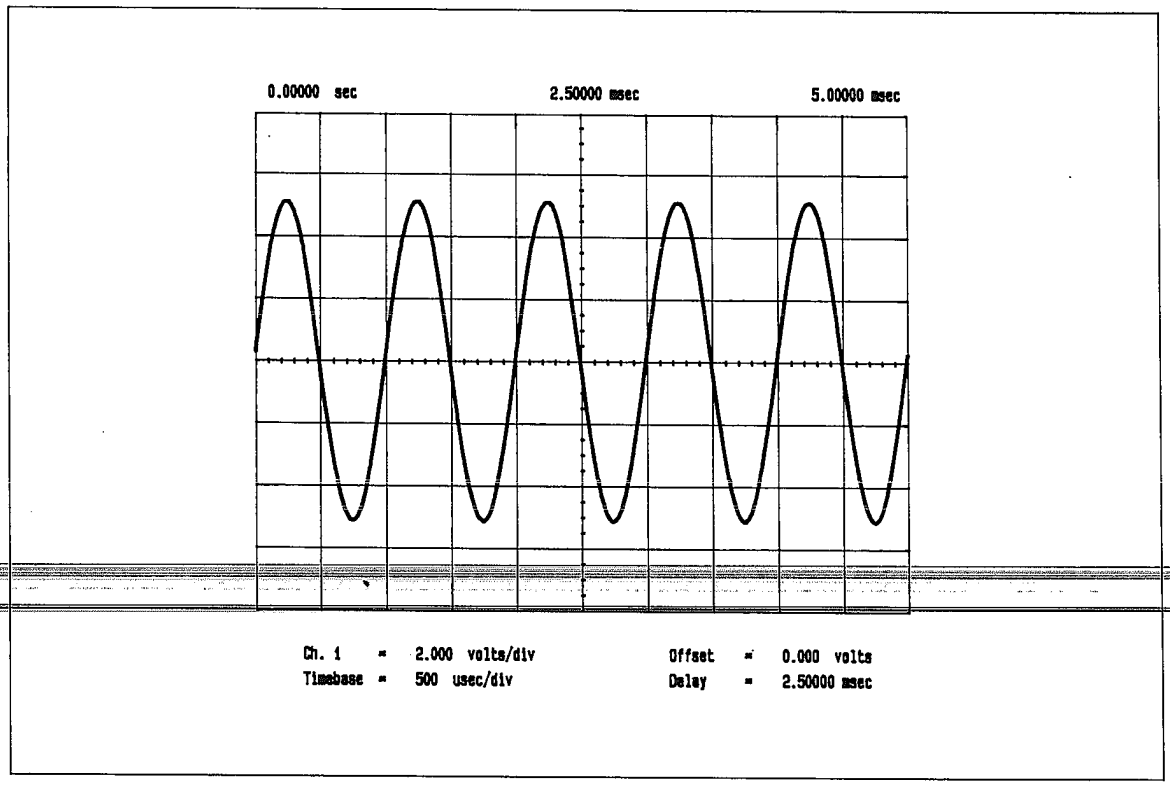


Figure 7-6 Sine Wave

4. If this test passes, the A4 Local Oscillator, the A1 Digital Source, and the A30 Analog Source are probably operating correctly, (except for chirp, noise, and trigger circuits).

F. Input and ADC Failures

This procedure isolates failures between the following assemblies:

A32 ADC1
A33 INPUT 1
A34 ADC 2
A35 INPUT 2

The HP 3562A has two sets of identical assemblies: A32 is identical to A34 and A33 is identical to A35. This procedure interchanges these assemblies to aid in troubleshooting.

NOTE

A failure on the A34 ADC2 may cause ***both*** *channels to fail.*

1. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
INPUT ..... FR END
FUNCTN

2. If this test passes the A32/34 ADC and the A33/A35 Input assemblies are probably operating correctly.

3. Press the line switch off.

4. Exchange A32 ADC1 with A32 ADC2.

5. Press the line switch on and repeat step 1.

6. If the same channel fails as failed before the exchange, start troubleshooting with the input assembly for that channel (go to 8-20).

7. If the other channel now fails, start troubleshooting with the ADC assembly for that channel (go to 8-19).

8. If both channels failed before the exchange and also after the exchange, the A33, A35 Input and A32, A34 ADC assemblies are probably not the cause of the failure. Go to paragraph 7-10, "Control Line Test".

G. SYNC2 Test

The A4 Local Oscillator will function without the A5 Digital Filter if the SYNC2 signal is activated. Perform this procedure to determine if the A5 Digital Filter is the cause of the failure.

1. Press the line switch off.

2. Remove the A5 Digital Filter.

3. Put the 03562-66540 extender board in the A5 Digital Filter's card nest.

4. Connect a square wave to pin 16 on the extender board as follows:

Function	Square Wave
Frequency	250 kHz
Amplitude	5 Vp-p
dc Offset	2.5 V

5. Press the line switch on and press the HP 3562A keys as follows:

SOURCE ..... SOURCE
LEVEL ..... **5** V

..... FIXED
SINE ..... **1** kHz

6. Use a scope to verify COS at A4 TP24, Waveform #7. If this signal is not correct, start troubleshooting with the A4 LO (go to 8-8).

7. Connect the scope to the source output on the front panel. Set the scope as follows:

CH1 V/Div	2 V/Div
Coupling	dc
Time/Div	500 ,s/Div
Trigger	CH1

8. Refer to figure 7-7 to verify the correct result.

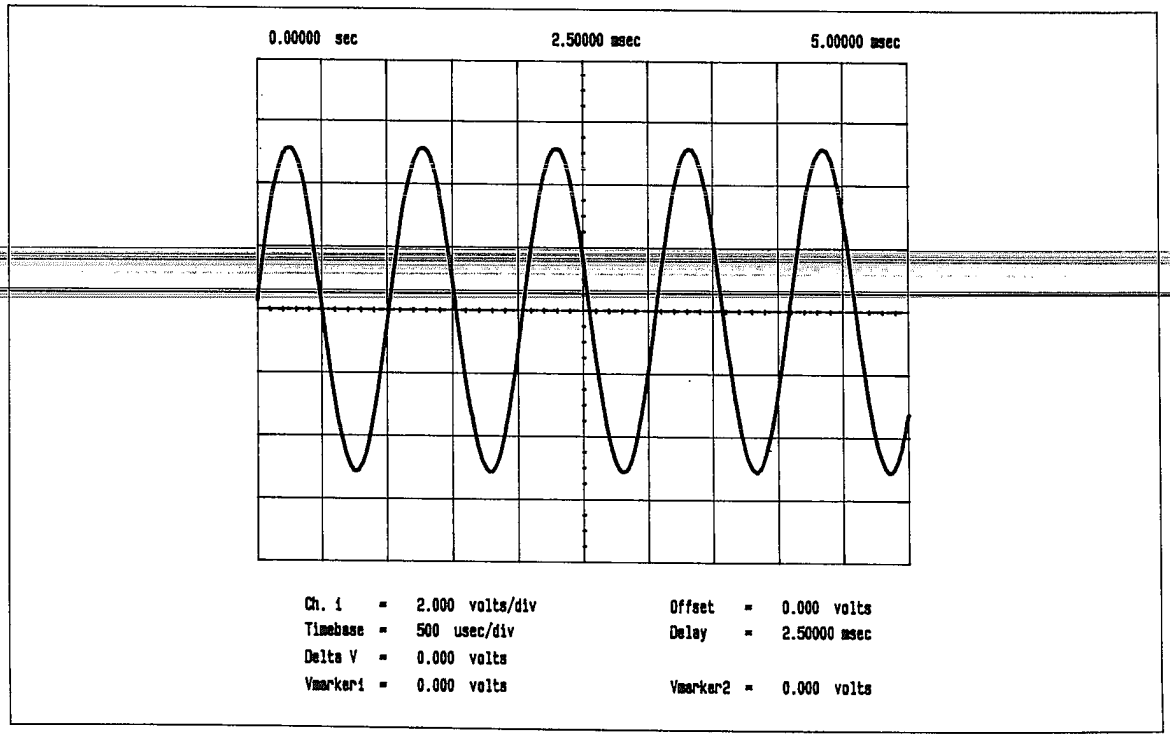


Figure 7-7 SYNC 2 Test Sine Wave

9. If this test fails, start troubleshooting with the A4 Local Oscillator (go to 8-8).

10. If this test passes, the A4 Local Oscillator, the A1 Digital Source, and the A30 Analog Source are probably operating correctly, (except for chirp, noise, and trigger circuits). If this test passes, start troubleshooting with the A5 Digital Filter and A6 Digital Filter Controller assemblies (go to 8-9).

NOTE

If the cause of the failure has not been found, go to paragraph 7-10, "Control Line Test".

7-9 SOURCE FAILURES

Source output failures can be caused by the A1 Digital Source, the A4 Local Oscillator, or the A30 Analog Source. Follow the Source Failures procedure starting with part A to isolate the defective assembly.

A. Start

1. If all the source functions are operating except the random noise and burst random, start troubleshooting with the A1 Digital Source (go to 8-5).

2. If all the source functions are operating except burst random, periodic chirp, or burst chirp, go to part D.

3. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
SOURCE ..... LO
FUNCTN

4. If this test fails, start troubleshooting with the A4 Local Oscillator (go to 8-8).

5. If this test passes, the A4 Local Oscillator is probably working correctly.

6. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
SOURCE ..... SOURCE
MAIN

7. When this test is finished press the keys as follows:

..... FR END
INTFCE

8. If the Source Main test or the Digital Source F/E Interface test fails, start troubleshooting with the A1 Digital Source (go to 8-5).

9. If these tests pass, the A1 Digital Source is probably working correctly.

B. Use a logic probe or scope to verify the signals in table 7-8 are toggling between TTL level high and TTL level low. If any of the values are incorrect, go to 8-8.

Table 7-8 Source Data

Test Location	Signal	In/Out	Waveform Number	Probable Cause of Failure
A4 TP24	COS	A4 Out	#6	A4 Local Oscillator
A4 TP16	NDAT	A4 Out	#9	A4 Local Oscillator
A4 TP17	NLD	A4 Out	#11	A4 Local Oscillator
A4 TP14	NDCK	A4 Out	#11	A4 Local Oscillator

C. If part B passed, start troubleshooting with the A30 Analog Source (go to 8-17).

D. Burst Failures

1. Press the line switch off.

2. Place the A1 Digital Source on the 03562-66540 extender board. Connect the source output to the channel 1 input.

3. Press the line switch on.

4. Press the HP 3562A keys as follows:

SOURCE . . . . . SOURCE
LEVEL . . . . . 5 V

. . . . . BURST
CHIRP

MEAS
DISP . . . . . FILTRD
INPUT . . . . . TIME
REC 1

5. Refer to figure 7-8 to verify a normal burst chirp.

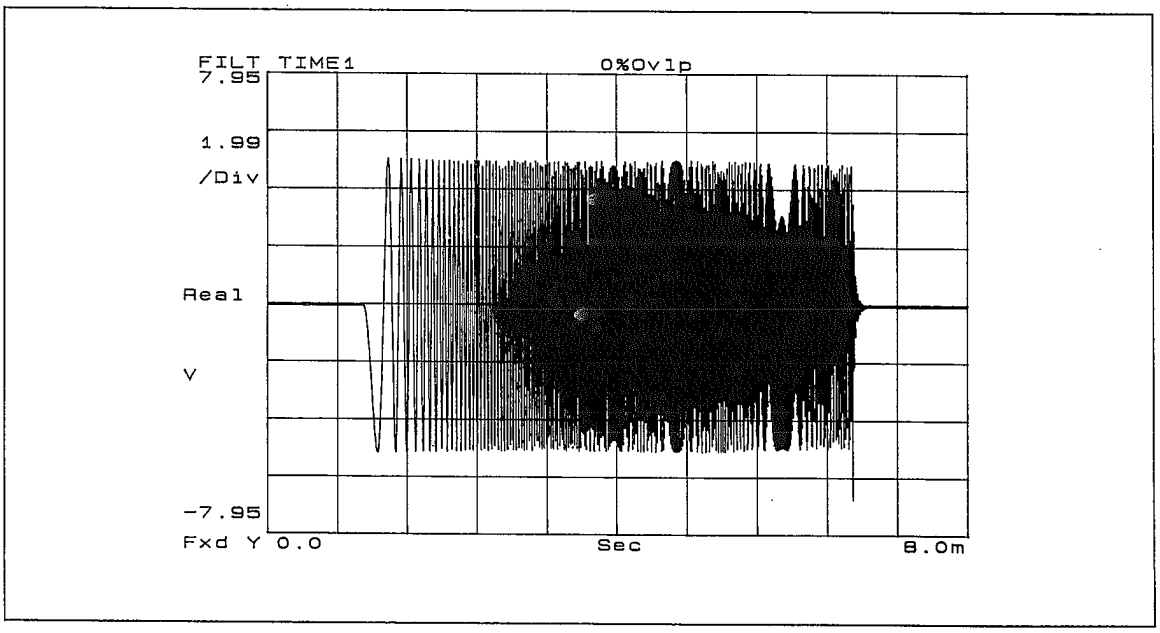


Figure 7-8 Burst Chirp

6. Use a scope and logic probe to verify the signals in table 7-9 are toggling between TTL level high and TTL level low. If any of the values are incorrect, go to Section VIII.

Table 7-9 Burst Mode Signals

Test Location	Signal	In/Out	Waveform Number	Probable Cause of Failure
A1 J701-3	NCLK	A1 Out	#13	A1 Digital Source
A1 J701-1	NSYNC	A4 Out	#13	A4 Local Oscillator
A1 J1-1	DACDAT	A1 Out	—	A1 Digital Source
A1 J1-5	BURSTEN	A1 Out	—	A1 Digital Source

NOTE

If NCLK fails, NSYNC also fails. Start troubleshooting with the A1 Digital Source (go to 8-5).

7. If the signals in table 7-9 are correct, start troubleshooting with the A30 Analog Source (go to 8-17).

7-10 CONTROL LINE TEST

Control line failures can cause false error codes and multiple failure messages. This procedure determines if a control line is defective.

A. Perform steps 1 through 7:

1. Press the line switch off.
2. Place the A2 System CPU on the 03562-66540 extender board.
3. Press the line switch on.
4. Verify the RESETL line is a TTL level high at test point A2 U604-16.
5. After the power-up sequence is completed, use a logic probe to verify the signals in table 7-10 are toggling between TTL level high and TTL level low.
6. If a line is TTL level stays low, go to part **B**.
7. Use table 7-10 to determine which assembly is defective.

Table 7-10 Control Lines Set #1

Test Location	Signal	In/Out	Probable Causes of Failure
A2 U500-1	IRQT4L	A9 Out	A2 CPU, A9 FFT
A2 U500-2	IRQT5L	A6 Out	A2 CPU, A6 D FLTR CONT
A2 U500-3	IRQT6L	A8 Out	A2 CPU, A8 RAM
A2 U500-13	IRQT3L	A7 Out	A2 CPU, A7 FPP
Press any key to toggle KYBRDL.			
A2 U604-3	KYBRDL	A2 Out	A2 CPU, A15 KEYBD
A2 U604-5	ASL	A2 Out	Any assembly on the system bus: A2 CPU A1 DGTL SCE A3 ROM A4 LO A6 D FLTR CONT A7 FPP A8 RAM/DSPL A9 FFP A15 KEYBD
A2 U604-7	WRITEL	A2 Out	
A2 U604-9	UDSL	A2 Out	
A2 U604-12	LDSL	A2 Out	
A2 U604-14	VIOL	A2 Out	
A2 U508-4	DTACKL	A2 In	
A2 P1-11	ENBLL	A2 Out	A2 CPU, A1 DGTL SCE, A3 ROM, A4 LO
A2 U604-18	VMAL	A2 Out	A2 CPU, A4 LO
A2 U508-2	VPAL	A4 Out	A2 CPU, A4 LO
A2 U508-5	MR68L	A2 Out	A2 CPU, A8 RAM

B. Perform steps 1 through 6 for each of the following assemblies:

A1 Digital Source
A3 Program ROM
A6 Digital Filter Controller (also remove the A5 Digital filter)
A7 FPP
A8 Global RAM (MR68L should remain low with the RAM removed)
A9 FFT
A15 Keyboard (disconnect cable W10 from the A12 Mother Board)

1. Press the line switch off.
2. Remove the assembly.
3. Press the line switch on.
4. If the failing control line in table 7-10 is now toggling or TTL level high, start troubleshooting with this assembly (go to Section VIII).
5. Press the line switch off.
6. Replace the assembly.

C. Perform steps 1 through 6 as follows:

1. Press the line switch off.
2. Replace the A2 System CPU in its card nest. Place the A8 Global RAM on the 03562-66540 extender board.
3. Press the line switch on.
4. After the power-up sequence is completed, use a logic probe to verify the signals in table 7-11 are toggling between TTL level high and TTL level low.
5. If a line is TTL level stays low, go to part D.
6. Use table 7-11 to determine which assembly is defective.

Table 7-11 Control Lines Set #2

Test Location	Signal	In/Out	Probable Causes of Failure
A8 U306-8	GDSL	A8 Out	Any assembly on the global bus:
A8 U608-11	GR/GWL	A8 Out	A2 CPU, A5 DGTL FLTR A7 FPP, A8 RAM A9 FFT, A17 DSPL
A8 U608-12	RFDL	A17 Out	A8 RAM, A17 DSPL
A8 U608-14	MRFPPL	A7 Out	A8 RAM, A7 FPP
A8 U608-16	MRDF2L	A5 Out	A8 RAM, A5 DGTL FLTR
A8 U608-17	MRDF1L	A5 Out	A8 RAM, A5 DGTL FLTR
A8 U608-18	MRFFTL	A9 Out	A8 RAM, A9 FFT
A8 U509-7	MGDF2L	A8 Out	A8 RAM, A5 DGTL FLTR
A8 U509-12	MGFFTL	A8 Out	A8 RAM, A9 FFT
A8 U509-14	MGDF1L	A8 Out	A8 RAM, A5 DGTL FLTR
A8 U509-16	MGFPPL	A8 Out	A8 RAM, A7 FPP
A8 U301-8	B2GDSL	A8 Out	A8 RAM, A17 DSPL
A8 U406-8	DAVL	A8 Out	A8 RAM, A17 DSPL

D. Perform steps 1 through 6 for each of the following assemblies:

A2 System CPU
A5 Digital Filter
A7 FPP
A9 FFT
A17 Display Interface

1. Press the line switch off.
2. Remove the assembly.
3. Press the line switch on.
4. If the failing control line in table 7-11 is now toggling or TTL level high, start troubleshooting with this assembly (go to Section VIII).
5. Press the line switch off.
6. Replace the assembly.

E. Perform steps 1 through 5 as follows:

1. Press the line switch off.

2. Replace the A8 Global RAM in its card nest. Place the A6 Digital Filter Controller on the 03562-66540 extender board.

3. Press the line switch on.

4. After the power-up sequence is completed, use a logic probe to verify the signals in table 7-12 are toggling between TTL level high and TTL level low.

Table 7-12 Control Lines Set #3

Test Location	Signal	In/Out
A6 U304-6	BLDSL	A6 Out
A6 U304-7	BWRITEL	A6 Out
A6 U304-9	BUDSL	A6 Out

5. If any of the lines are not toggling, start troubleshooting with the A6 Digital Filter Controller (go to 8-9).

6. Replace the A6 Digital Filter Controller in its card nest.

7-11 ISOLATING TRIGGER FAILURES

This procedure assumes the instrument operates correctly in the free run mode, but does not operate correctly in the trigger mode. Follow this procedure starting with part A to isolate the defective assembly.

A. Start

1. If the trigger operates correctly except in external (EXT) trigger mode, start troubleshooting with the A31 Trigger assembly (go to 8-18).

2. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
ALL

3. If any self-tests fail, go to paragraph 7-7.

Table 7-11 Control Lines Set #2

Test Location	Signal	In/Out	Probable Causes of Failure
A8 U306-8	GDSL	A8 Out	Any assembly on the global bus: A2 CPU, A5 DGTL FLTR A7 FPP, A8 RAM A9 FFT, A17 DSPL
A8 U608-11	GR/GWL	A8 Out	
A8 U608-12	RFDL	A17 Out	A8 RAM, A17 DSPL
A8 U608-14	MRFPPL	A7 Out	A8 RAM, A7 FPP
A8 U608-16	MRDF2L	A5 Out	A8 RAM, A5 DGTL FLTR
A8 U608-17	MRDF1L	A5 Out	A8 RAM, A5 DGTL FLTR
A8 U608-18	MRFFTL	A9 Out	A8 RAM, A9 FFT
A8 U509-7	MGDF2L	A8 Out	A8 RAM, A5 DGTL FLTR
A8 U509-12	MGFFTL	A8 Out	A8 RAM, A9 FFT
A8 U509-14	MGDF1L	A8 Out	A8 RAM, A5 DGTL FLTR
A8 U509-16	MGFPPL	A8 Out	A8 RAM, A7 FPP
A8 U301-8	B2GDSL	A8 Out	A8 RAM, A17 DSPL
A8 U406-8	DAVL	A8 Out	A8 RAM, A17 DSPL

D. Perform steps 1 through 6 for each of the following assemblies:

A2 System CPU
A5 Digital Filter
A7 FPP
A9 FFT
A17 Display Interface

1. Press the line switch off.
2. Remove the assembly.
3. Press the line switch on.
4. If the failing control line in table 7-11 is now toggling or TTL level high, start troubleshooting with this assembly (go to Section VIII).
5. Press the line switch off.
6. Replace the assembly.

E. Perform steps 1 through 5 as follows:

1. Press the line switch off.

2. Replace the A8 Global RAM in its card nest. Place the A6 Digital Filter Controller on the 03562-66540 extender board.

3. Press the line switch on.

4. After the power-up sequence is completed, use a logic probe to verify the signals in table 7-12 are toggling between TTL level high and TTL level low.

Table 7-12 Control Lines Set #3

Test Location	Signal	In/Out
A6 U304-6	BLDSL	A6 Out
A6 U304-7	BWRITEL	A6 Out
A6 U304-9	BUDSL	A6 Out

5. If any of the lines are not toggling, start troubleshooting with the A6 Digital Filter Controller (go to 8-9).

6. Replace the A6 Digital Filter Controller in its card nest.

7-11 ISOLATING TRIGGER FAILURES

This procedure assumes the instrument operates correctly in the free run mode, but does not operate correctly in the trigger mode. Follow this procedure starting with part A to isolate the defective assembly.

A. Start

1. If the trigger operates correctly except in external (EXT) trigger mode, start troubleshooting with the A31 Trigger assembly (go to 8-18).

2. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
ALL

3. If any self-tests fail, go to paragraph 7-7.

4. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
SOURCE ..... SOURCE
MAIN

5. When this test is finished press the keys as follows:

..... FR END
INTFCE

6. If the Source Main test or the Digital Source F/E Interface test fails, start troubleshooting with the A1 Digital Source (go to 8-5).

7. If the trigger operates correctly except in remote HP-IB trigger mode and the A1 Digital Source self-tests passed, start troubleshooting with the A2 System CPU (go to 8-6).

B. Use a BNC Tee to connect the front panel source output to channel 1 and channel 2.

Press the HP 3562A keys as follows:

SOURCE ..... SOURCE
LEVEL ..... **5** V

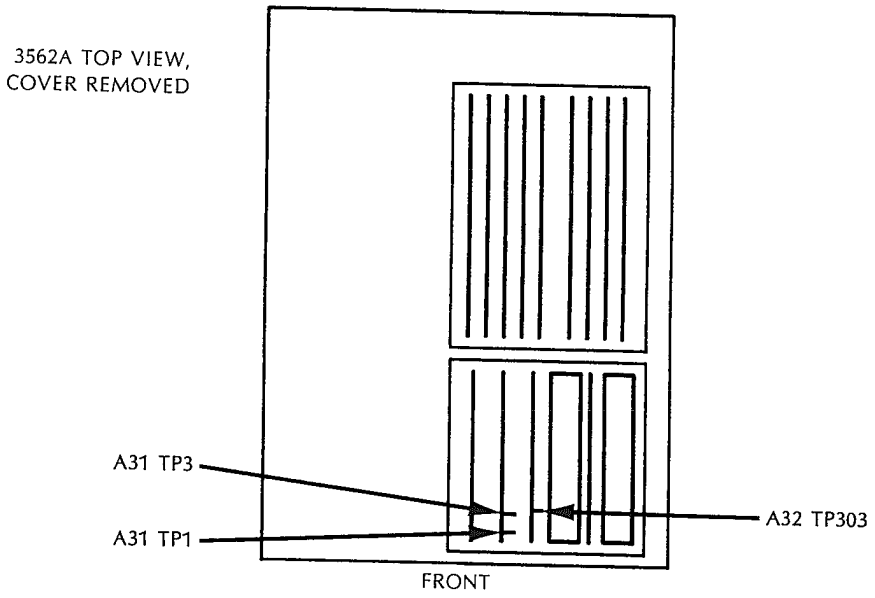
..... FIXED
SINE ..... **125** Hz

SELECT
TRIG ..... CHAN 1
INPUT

MEAS
DISP ..... FILTRD
INPUT ..... TIME
REC 1

SCALE ..... Y FIXD
SCALE ..... −7, 7 V

Refer to figure 7-9 to verify the correct result.



D. Use a scope to verify the signals TRIG IN and TRIGRO are operating correctly as shown in waveform -14 (refer to 7-13). If these signals are correct go to part G.

E. Perform steps 1 through 5 as follows:

1. Press the line switch off.
2. Put A32 ADC 1 on the 03562-66541 extender board.
3. Press the line switch on.
4. Repeat part **B**.
5. Use a scope to verify the signals in table 7-13 are operating correctly.

Table 7-13 Trigger Signal Check #1

Test Location	Signal	In/Out	Waveform Number	Probable Cause of Failure
A32 TP303	TRIG1@	A32 Out	#15	A32 ADC 1 (go to 8-19)
A31 TP3	TRIGRO	A31 Out	#15	A31 Trigger (go to 8-18)

F. Perform steps 1 through 5 as follows:

1. Press the line switch off.
2. Put A32 ADC 2 on the 03562-66541 extender board.
3. Press the line switch on.
4. Repeat part C.
5. Use a scope to verify the signals in table 7-14 are operating correctly.

Table 7-14 Trigger Signal Check #2

Test Location	Signal	In/Out	Waveform Number	Probable Cause of Failure
A34 TP303	TRIG2@	A34 Out	#16	A34 ADC 2 (go to 8-19)
A31 TP3	TRIGRO	A31 Out	#16	A31 Trigger (go to 8-18)

G. Perform steps 1 through 4 as follows:

1. Press the line switch off.
2. Put A30 Analog Source on the 03562-66541 extender board.
3. Press the line switch on.
4. Use a scope to verify the signals in table 7-15 are operating correctly. Press A2 S1 (reset switch on A2 CPU) to view the STIM@ and CALTRIG waveforms (these signals are disabled when calibration is finished).

Table 7-15 Trigger Signal Check #3

Test Location	Signal	In/Out	Waveform Number	Probable Cause of Failure
Press A2 S1 to view waveforms.				
A30 TP8	STIM@	A30 Out	#17	A30 ANLG SCE (go to 8-17)
A30 J30-19	CALTRIG	A30 Out	#17	A30 ANLG SCE (go to 8-17)

H. Perform the following steps:

1. Press the line switch off.
2. Put the A1 Digital Source on the 03562-66540 extender board.
3. Press the line switch on.

4. Repeat part B.

5. Use a logic probe or scope to verify the signals in table 7-16 are toggling between TTL level high and TTL level low.

Table 7-16 Trigger Signal Check #4

Test Location	Signal Name	In/Out
A1 TP9	BFST	A1 Out
A1 J1-83	ARML	A6 Out

6. Press the PAUSE/CONT key. ARML should now remain at TTL level high.

7. If ARML and BFST are operating correctly, start troubleshooting with the A6 Digital Filter Controller (go to 8-9).

8. Connect A1 TP12 to A1 J705-2.

9. Repeat part B.

10. If the instrument now triggers (the waveform may move around on the display), start troubleshooting with the A6 Digital Filter Controller (go to 8-9).

11. If the instrument still does not trigger, start troubleshooting with the A1 Digital Source (go to 8-5).

7-12 LOOP MODE AND INTERMITTENT FAILURES

Loop mode is used for some signature analysis tests and to find intermittent failures. Many intermittent failures can be isolated by running the self-tests in this mode. When the loop mode is activated, the instrument continually repeats a test until power is cycled, the loop mode is shut off, or a failure is found. Most of the self-tests can be run in loop mode. Run one of the following self-tests in loop mode to help isolate intermittent failures:

TEST ALL
HP-IB DIAG
DFA FUNCTN
FILTER TEST
FFT FUNCTN
FPP FUNCTN
GLOBAL RAM
PROG ROM
SOURCE FUNCTN
LO FUNCTN
FR END FUNCTN
DIGTAL TEST

Use paragraph 7-14 for the location of the service test keys.

To turn the loop mode on press the following keys:

SPCL
FCTN ..... SERVIC
TEST ..... LOOP
ON

Press the keys to start a self-test. Failures of a test are entered in the test log, the self-test stops, and the test log is displayed.

To turn the loop mode off press A2 S1 (reset switch on A2 CPU) or press the keys as follows:

RETURN ..... LOOP
OFF

Troubleshooting Hints

1. Common causes of intermittent failures are:

   Cold solder joints
   Loose cables
   ICs loose in sockets
   Loose screws on power supply
   An assembly partially out of its card nest

2. An intermittent failure in the instrument can be caused by an assembly's bottom connector that attaches the assembly to the A12 Mother Board. Check for loose pins on the connector.

3. If the instrument intermittently fails to power up, the most likely cause is the power supply control circuits (go to 8-16).

4. Intermittent keyboard failures can be caused by the ribbon cable (W10) between the A15 Keyboard and A12 Mother Board.

7-13 WAVEFORMS

Use these waveforms to verify operation at various test points in the instrument. All oscilloscope measurements are taken using a 10:1 probe. Notes unique to a measurement are written next to the waveform.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

Table 7-17 Instrument Waveforms

All jumpers should be in normal position
Probe 10:1

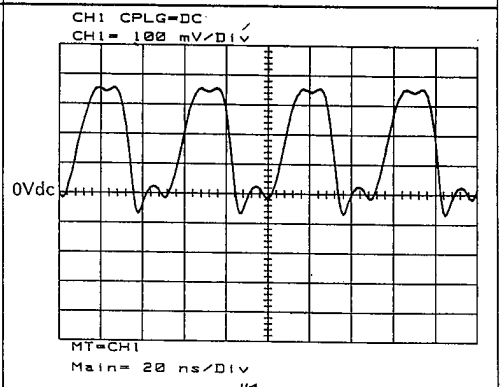
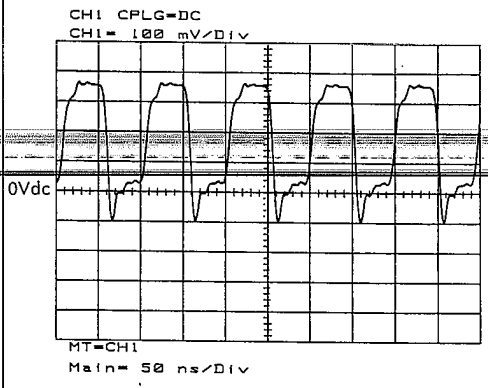
Setup	Important Parameters	Waveform
20.48 MHz Connect CH1 to A31 TP10 Oscilloscope: CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 20 ns/Div Trigger CH1	Time Pulse shape	 #1
10.24 MHz Connect CH1 to A1 TP4 Oscilloscope: CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 50 ns/Div Trigger CH1	Time Pulse shape	 #2

Table 7-17 Instrument Waveforms cont.

All jumpers should be in normal position
Probe 10:1

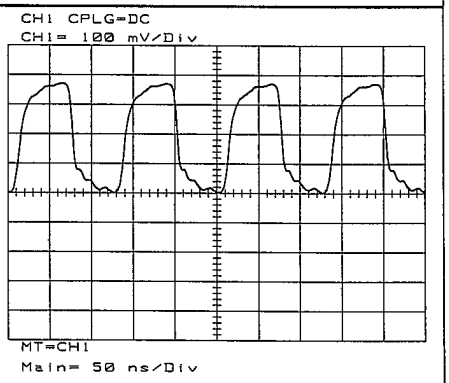
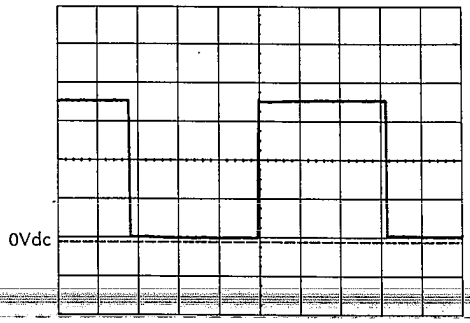
Setup	Important Parameters	Waveform
8 MHz Connect CH1 to A2 TP5 Oscilloscope: Bandwidth Limit: ON CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 50 ns/Div Trigger CH1	Time Pulse shape	 #3
Press the keys as follows to view CNTCLK: **SPCL FCTN** ..... SERVIC TEST..... LOOP ON ..... TEST SOURCE ..... FR END INTFCE		
CNTCLK Connect CH1 to A1 TP11 Oscilloscope: Bandwidth Limit: ON CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 10 µs/Div Trigger CH1	Time	 #4
Press A2 S1 (reset switch on A2 CPU) after viewing waveform.		

Table 7-17 Instrument Waveforms cont.

All jumpers should be in normal position
Probe 10:1

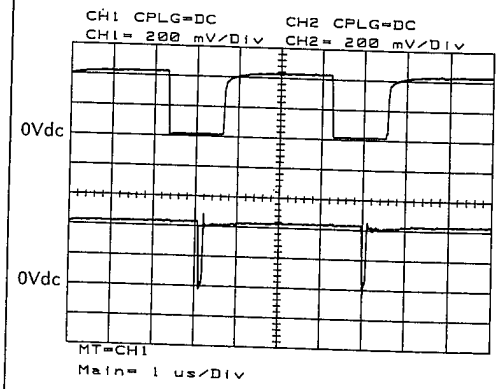
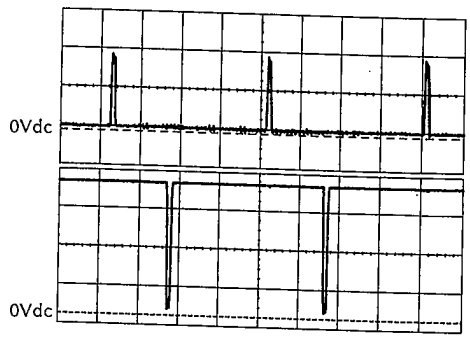
Setup	Important Parameters	Waveform
SAMP and DREQL Connect CH1 to A1 TP8 Connect CH2 to A1 J703-1 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 µs/Div Trigger CH1	Time relationship	 #5
SYNC2 and COS Connect CH1 to A4 TP8 Connect CH2 to A4 TP24 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 100 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 µs/Div Trigger CH1	Time relationship Pulse shapes	 #6

Table 7-17 Instrument Waveforms

All jumpers should be in normal position
Probe 10:1

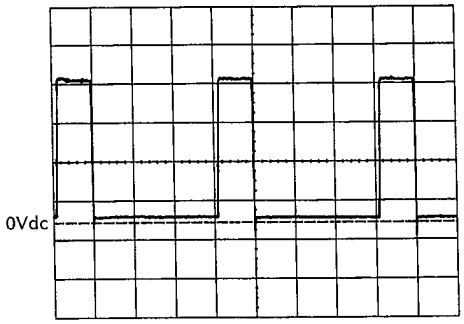
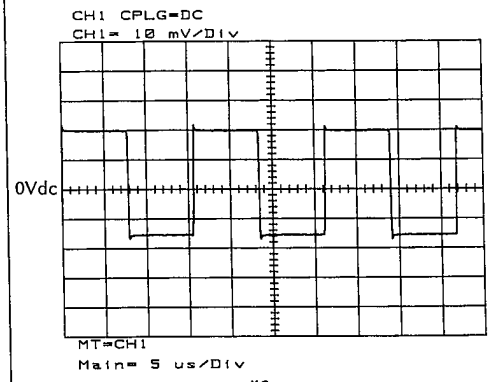
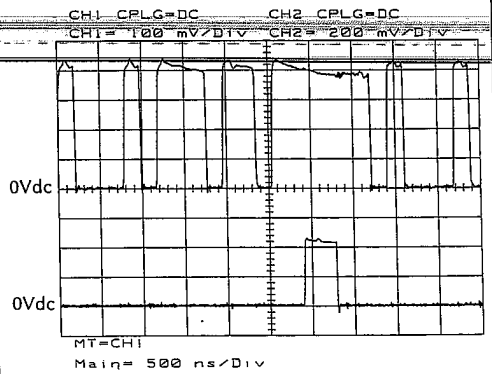
Setup	Important Parameters	Waveform
Refer to the SYNC2 Test for setup (7-8, part G).		
COS (no DFA) Connect CH1 to A4 TP24 Oscilloscope: CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 1 μs/Div Trigger CH1	Time Pulse shape	 #7
Press A2 S1 to view STIM@.		
STIM@ Connect CH1 to A30 TP8 Oscilloscope: Bandwidth Limit: ON CH1 V/Div 10 mV/Div CH1 Coupling dc Time/Div 5 μs/Div Trigger CH1	Time Pulse shape Amplitude	 #8
NDAT and NLD Connect CH1 to A4 TP16 Connect CH2 to A4 TP17 Oscilloscope: CH1 V/Div 100 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH1 Coupling dc Time/Div 500 ns/Div Trigger CH1	Time relationship	 #9

Table 7-17 Instrument Waveforms

All jumpers should be in normal position
Probe 10:1

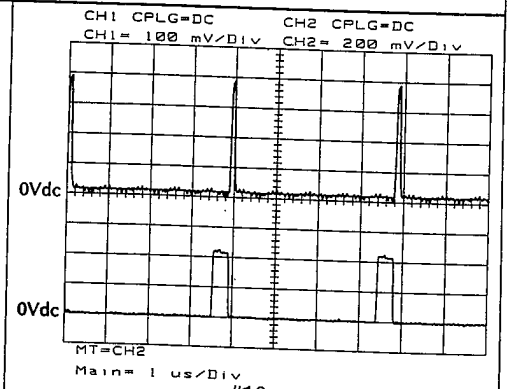
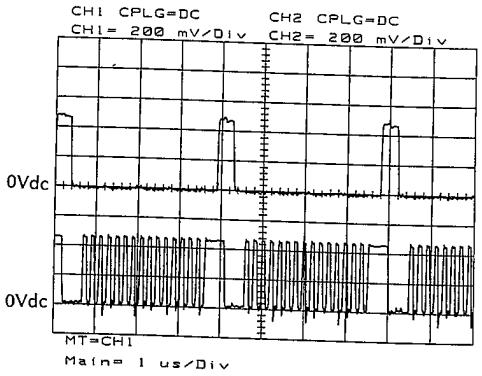
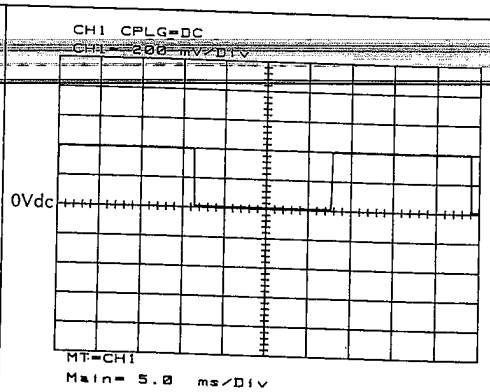
Setup	Important Parameters	Waveform
SYNC2 and NLD Connect CH1 to A4 TP8 Connect CH2 to A4 TP17 Oscilloscope: Bandwidth Limit: ON CH1 V/Div 100 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 µs/Div Trigger CH2	Time relationship	 #10
NLD and NDCK Connect CH1 to A4 TP17 Connect CH2 to A4 TP14 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 µs/Div Trigger CH1	Time relationship	 #11
Set A8 J3 in test (T) position to view Display Refresh.		
Display Refresh Connect CH1 to A8 TP3 Oscilloscope: CH1 V/Div 200 mV/Div CH1 Coupling dc Time/Div 5 ms/Div Trigger CH1	Time Pulse shape	 #12
Set A8 J3 to normal (N) position after viewing waveform.		

Table 7-17 Instrument Waveforms

All jumpers should be in normal position
Probe 10:1

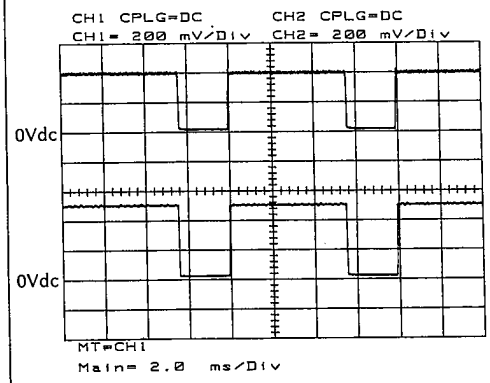
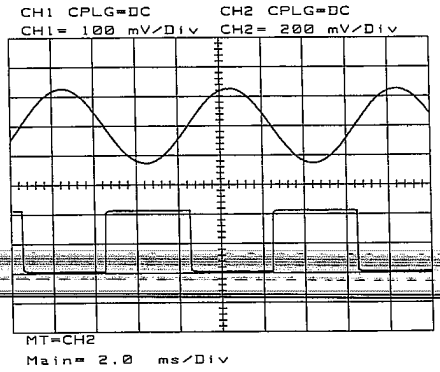
Setup	Important Parameters	Waveform
Press the keys as follows to view NSYNC and NCLK: **SOURCE** ..... **SOURCE LEVEL** ..... 5 V ..... BURST CHIRP		
NSYNC and NCLK Connect CH1 to A1 J701-1 Connect CH2 to A1 J701-3 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 ms/Div Trigger CH1	Time	 #13
Refer to paragraph 7-11 for the HP 3562A input and key presses to view TRIG IN and TRIGRO.		
TRIG IN and TRIGRO Connect CH1 to A31 TP1 Connect CH2 to A31 TP3 Oscilloscope: Bandwidth Limit: ON CH1 V/Div 100 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 ms/Div Trigger CH2	Time Relationship Pulse shape	 #14

Table 7-17 Instrument Waveforms

All jumpers should be in normal position
Probe 10:1

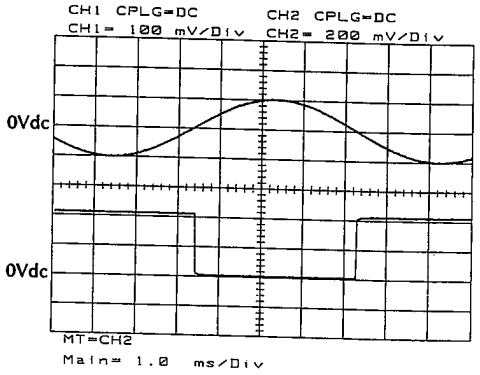
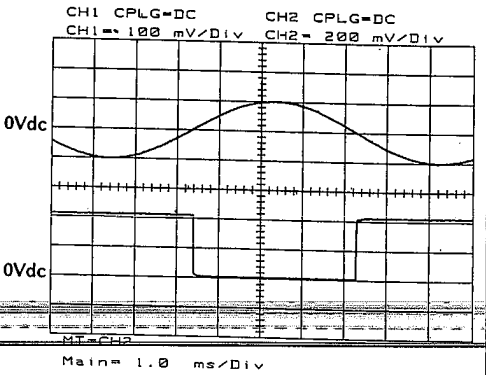
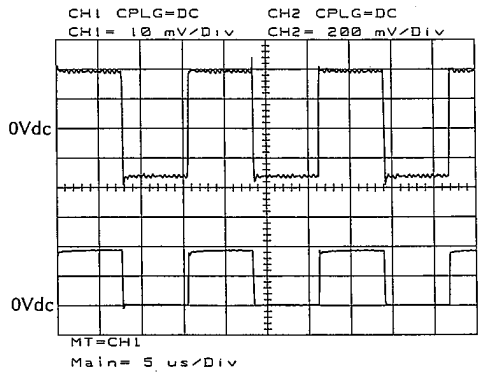
Setup	Important Parameters	Waveform
Refer to paragraph 7-11 for the HP 3562A input and key presses to view TRIG1@ and TRIGRO.		
TRIG1@ and TRIGRO Connect CH1 to A32 TP303 Connect CH2 to A31 TP3 Oscilloscope: Bandwidth Limit: ON CH1 V/Div 100 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 ms/Div Trigger CH2	Time Relationship Pulse shape	 #15
Refer to paragraph 7-11 for the HP3562A input and key presses to view TRIG2@ and TRIGRO.		
TRIG2@ and TRIGRO Connect CH1 to A34 TP303 Connect CH2 to A31 TP3 Oscilloscope: Bandwidth Limit: ON CH1 V/Div 100 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 ms/Div Trigger CH2	Time Relationship Pulse shape	 #16

Table 7-17 Instrument Waveforms

All jumpers should be in normal position
Probe 10:1

Setup	Important Parameters	Waveform
Press A2 S1 to view STIM@ and CALTRIG.		
STIM@ and CALTRIG Connect CH1 to A30 TP8 Connect CH2 to A30 J30-19 Oscilloscope: Bandwidth Limit: ON CH1 V/Div 10 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 5 µs/Div Trigger CH1	Time Relationship Pulse shape	 #17

7-14 SPCL FCTN KEY MAP

This paragraph shows the location of all the service test keys. Use the key map to find the key for a particular self-test. All keys marked in bold perform a self-test or a group of self-tests. Other soft keys are either used to reach the next level of soft keys or are used for other purposes such as adjustments and signature analysis.

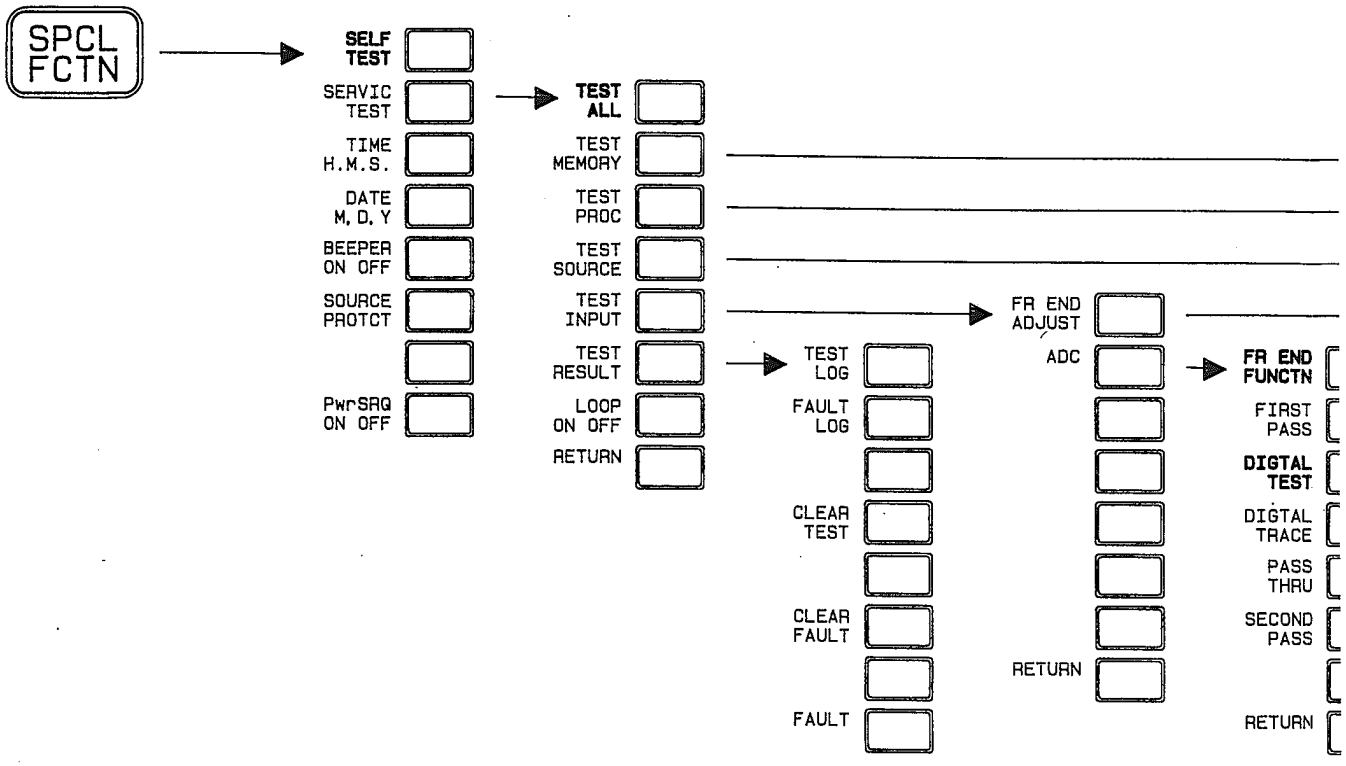
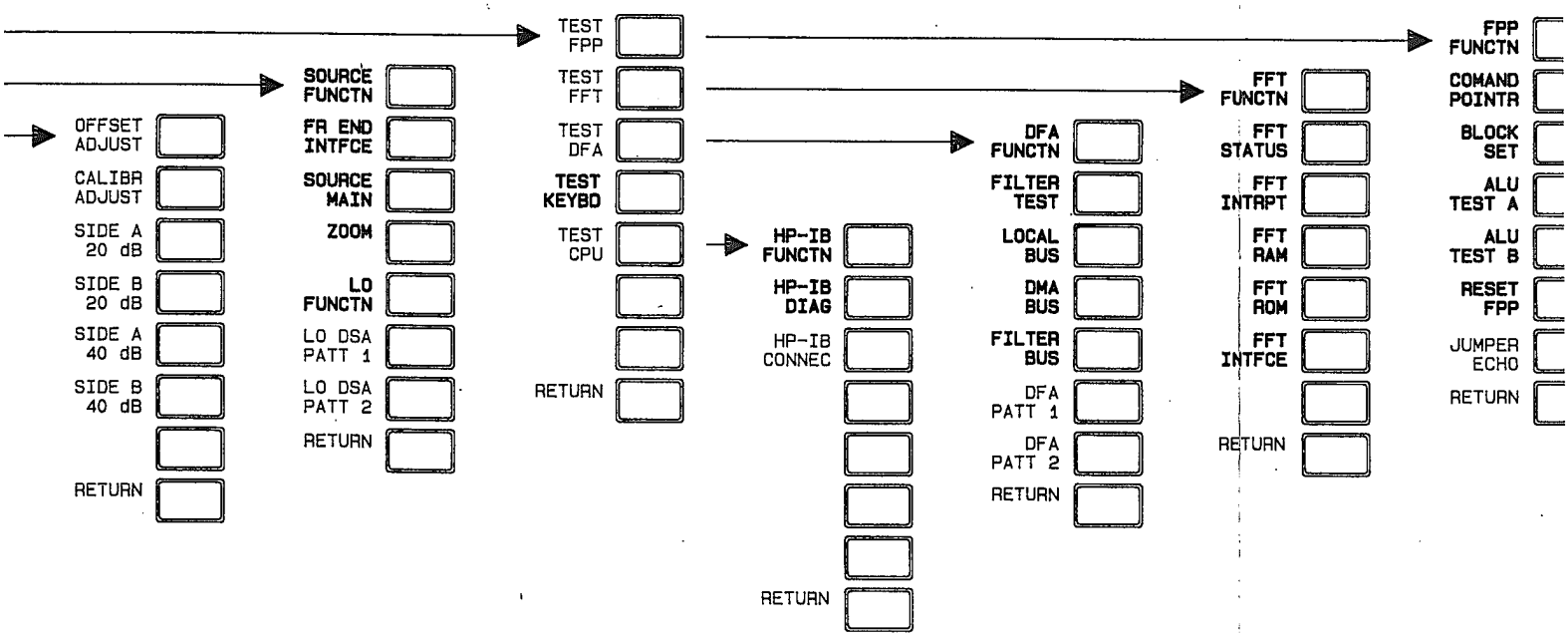


Figure 7-10 SPCL FCTN Key Map


OFFSET ADJUST
CALIBR ADJUST
SIDE A 20 dB
SIDE B 20 dB
SIDE A 40 dB
SIDE B 40 dB
RETURN
SOURCE FUNCTN
FR END INTFCE
SOURCE MAIN
ZOOM
LO FUNCTN
LO DSA PATT 1
LO DSA PATT 2
RETURN
TEST FPP
TEST FFT
TEST DFA
TEST KEYBD
TEST CPU
RETURN
HP-IB FUNCTN
HP-IB DIAG
HP-IB CONNEC
RETURN
DFA FUNCTN
FILTER TEST
LOCAL BUS
DMA BUS
FILTER BUS
DFA PATT 1
DFA PATT 2
RETURN
FFT FUNCTN
FFT STATUS
FFT INTRPT
FFT RAM
FFT ROM
FFT INTFCE
RETURN
FPP FUNCTN
COMAND POINTR
BLOCK SET
ALU TEST A
ALU TEST B
RESET FPP
JUMPER ECHO
RETURN

7-15 TEST LOG AND FAULT LOG DESCRIPTIONS

A. Test Log

The test log is a record of the results of the last self-test run. Pass and fail messages are entered in the test log while a self-test is running. The results of the power-up tests are also entered in the test log. If a self-test stops before finishing or to verify the result of the power-up tests, the test log can be read by pressing the keys as follows:

SPCL
FCTN ..... SERVICE
TEST ..... TEST
RESULT ..... TEST
LOG

If a self-test fails, error messages are listed for each test, then the test name is listed. For example (figure 7-11), the Gate Array Test only failed on channel 1 when the test was performed in the TEST ALL sequence.

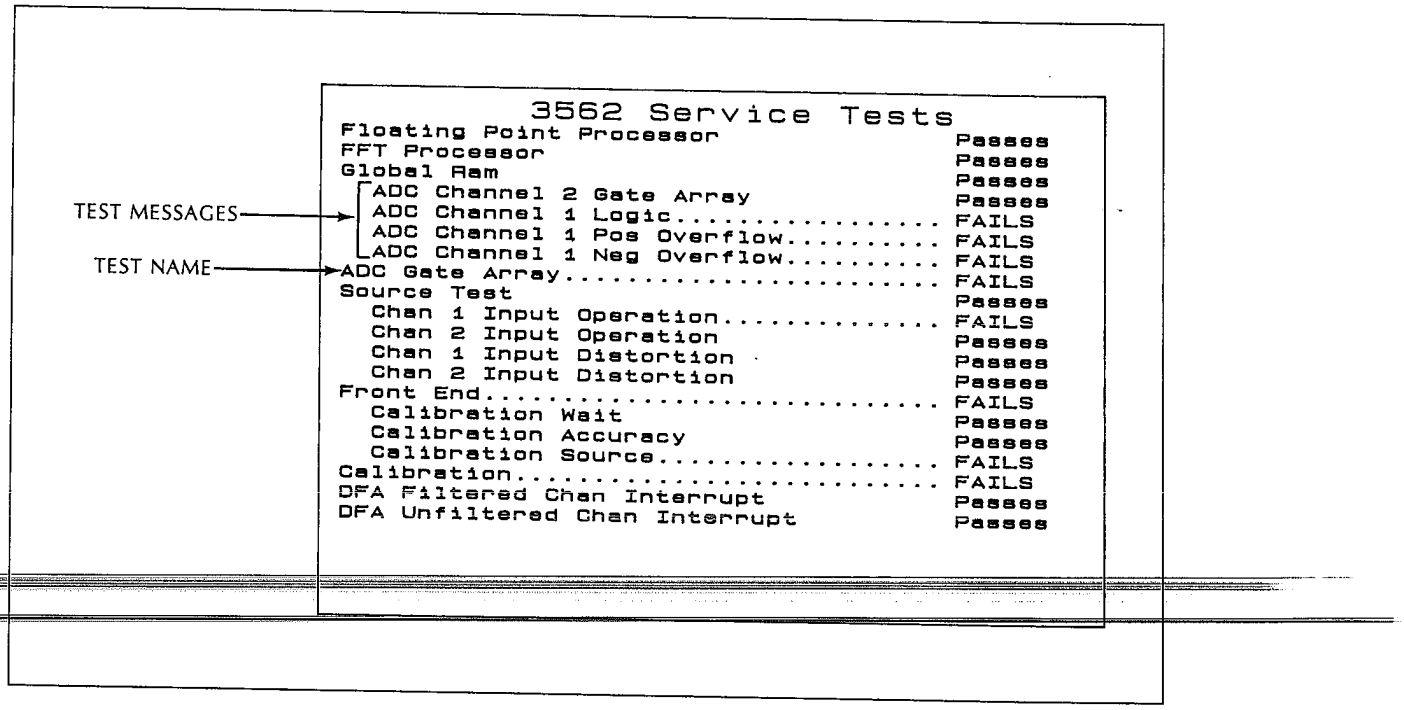


Figure 7-11 Test Log Example

B. Fault Log

The fault log lists the A2 System CPU run-time errors or discrepancies. It also gives the revision code of the software that is in the instrument. Only assemblies that use the system bus generate fault log error messages, however, a failure on any assembly may cause a fault log entry. Use the fault log as a supplement to the fault isolation procedure. To read the test log press the keys as follows:

SPCL
FCTN ..... SERVICE
TEST ..... TEST
RESULT ..... FAULT
LOG

Fault log messages accumulate in the fault log until the log is cleared. Use table 7-18 to interpret fault log messages.

NOTE

Using beeper commands other than those specified in this manual may result in a 'software fault' entry in the fault log.

Table 7-18 System CPU Address Map

Data Address		Description		
From	To	Fault	Assembly Generating Message	Possible Assemblies Failing
000000000	000007FFF	Monitor ROM	A2	A2
00003D000	000040FFF	Program RAM	A2	A2
000060000	00007FFFF	Data RAM	A8	A2, A8
000D00000	000E3FFFF	Program ROM	A3	A2, A3
OFFFF8001	OFFFF800F	HPIB	A2	A2, A22
OFFFF8011	OFFFF801F	Programmable Timer	A2	A2
OFFFF8100	OFFFF8104	Display	A8	A2, A8, A17
OFFFF8121	OFFFF8127	Keyboard	A15	A2, A15
OFFFF8140	OFFFF8142	FPP	A7	A2, A7
OFFFF8160	OFFFF817E	IBC	A6	A2, A5, A6, A31
OFFFF8180	OFFFF818F	Front End CONA Timeout Trig Phase Error	A1	A1, A2, A3, A4, A5, A6
OFFFF81A1	OFFFF81AF	LO Lcl Oscil.	A4	A1, A2, A3, A4, A5, A6, A31, A32, A34
OFFFF81C0	OFFFF81CE	FFT	A9	A2, A9
—	—	Cal Failure	—	Any assembly

7-16 DIAGNOSTIC DESCRIPTIONS

The self-tests consist of approximately 40 different tests that are run either in groups or individually to test a particular assembly, a function, or the entire instrument. The power-up tests are executed on turn-on, and the rest of the self-tests are invoked by pressing soft keys. This section describes the sequence of tests executed in groups and the SERVIC TEST soft key tests. Refer to table 7-4, "Power-up Test Codes" and table 7-6, "TEST ALL Messages" for a general description of the test result messages. For a detailed explanation of test result messages, refer to the troubleshooting paragraph for the assembly failing.

A. Power-Up Tests

The power-up tests consist of two sets of tests, low-level and high-level. The low-level tests exercise the A2 System CPU, the A3 Program ROM, the A8 Global RAM, the global bus, and the system bus. Fault and pass codes for these assemblies are displayed using the A2 System CPU test LEDs (A2 DS3, A2 DS4). The high-level tests exercise the A9 FFT, A7 FPP, A5 DGTL FLTR, and A6 D FLTR CONT assemblies. Faults on these assemblies are displayed in the test log. The instrument performs a calibration if the power-up tests pass. Refer to figure 7-12 for the power-up sequence.

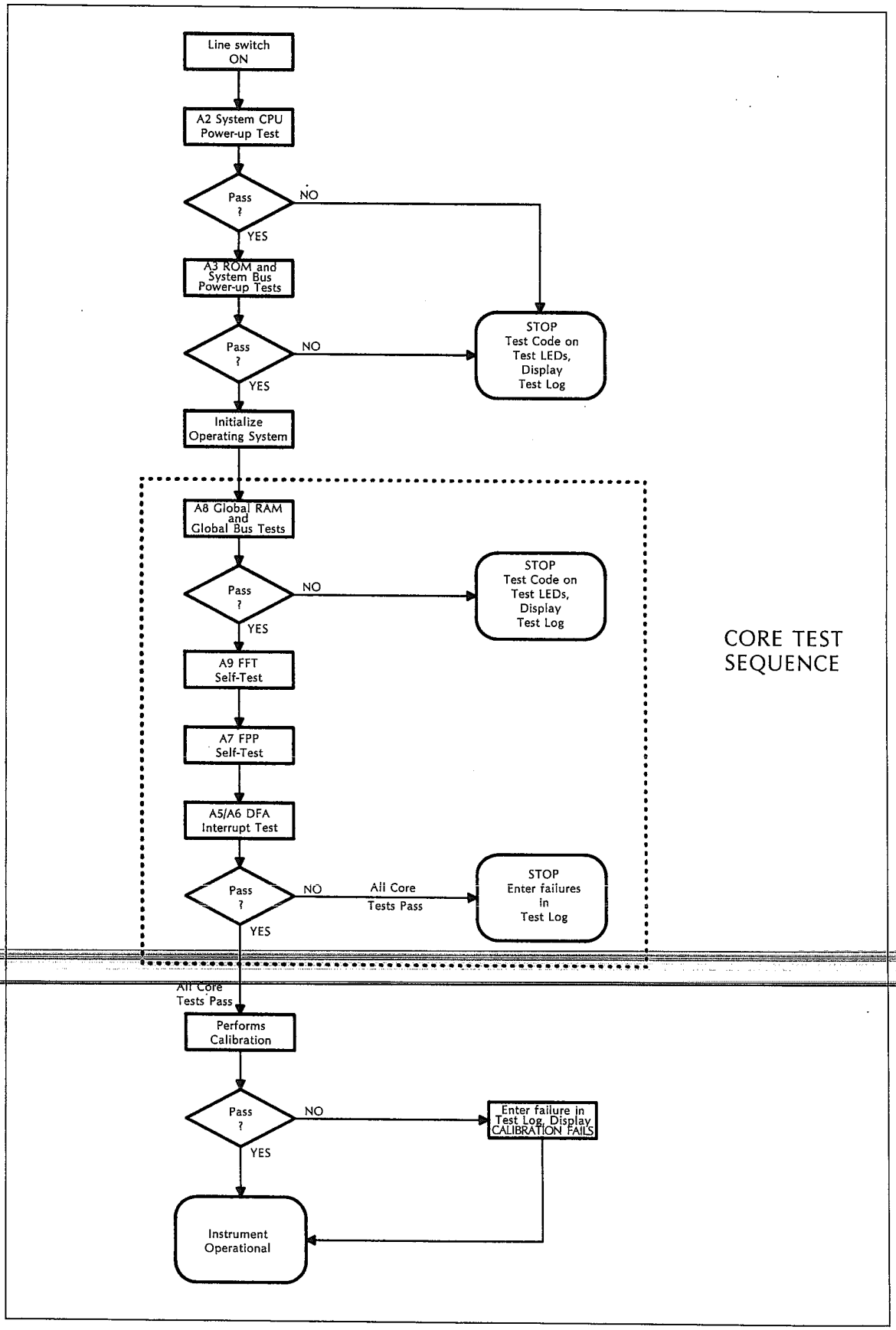


Figure 7-12 Power-up Sequence

B. Service Test Soft Keys

This section describes the function of each of the service test soft keys. Refer to figure 7-10, "**SPCL FCTN** Key Map" for the location of each of the soft keys. Refer to Section VII and Section VIII for information on how to use the service test soft keys to isolate a failure.

SELF TEST

The SELF TEST key invokes a sequence of self-tests that thoroughly exercises the digital and analog hardware of the instrument. This test is designed to be used by the user to determine if the instrument is functioning correctly. If this self test sequence fails, the failure is entered in the test log and 'Self Test Fails' is displayed. Refer to figure 7-13 for the SELF TEST sequence.

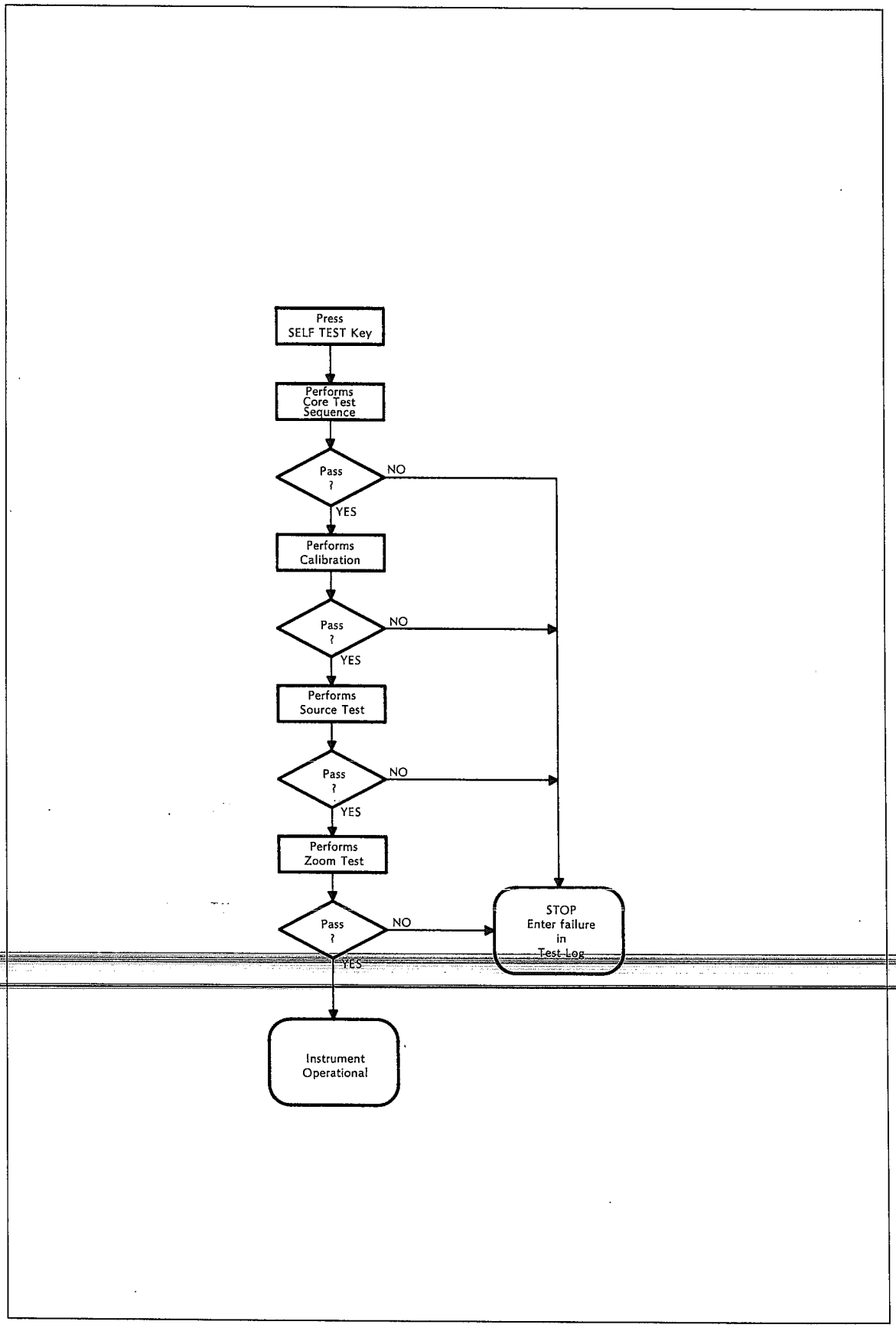


Figure 7-13 SELF TEST Sequence

SERVIC TEST

This key displays the first level of soft keys used in servicing the HP 3562A.

TEST ALL

The TEST ALL key invokes a sequence of self-tests that thoroughly exercises the digital and the analog hardware in the instrument. Each of the self-tests in the TEST ALL sequence can be run individually to help isolate the failure (Refer to paragraph 7-7, "TEST ALL"). As the TEST ALL sequence is executed the results of each self-test is entered in the test log. When the sequence is completed the test log is displayed. Refer to figure 7-14 for the TEST ALL sequence.

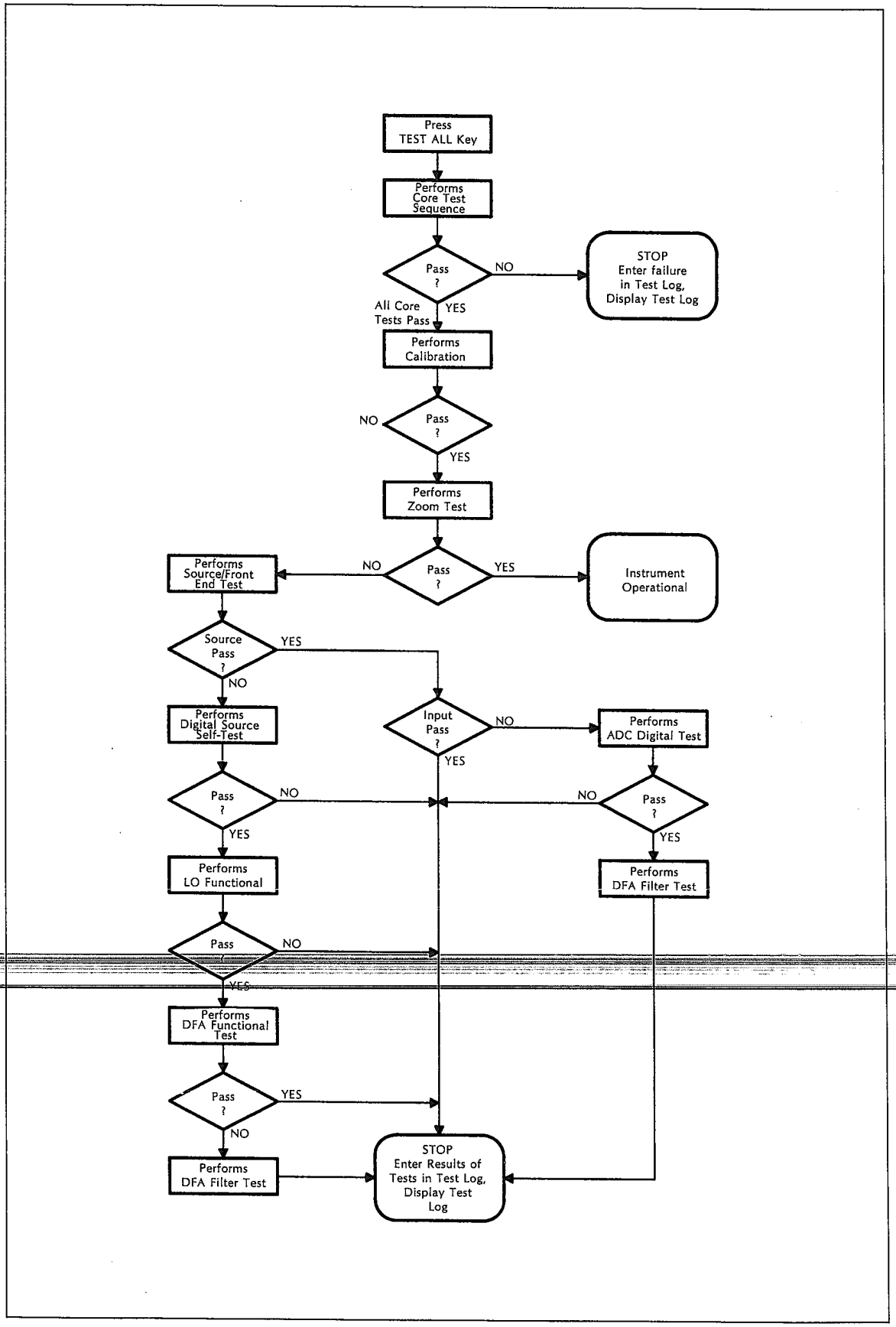


Figure 7-14 TEST ALL Sequence

TEST MEMORY

This key displays the menu of soft keys used in testing the A8 Global RAM and A17 Display Interface.

GLOBAL RAM

This key initiates the global functional test (this test is done on power-up). The global bus is tested by echoing data over the bus. If this test passes, a 'marching pattern' test is done to TEST ALL of the A8 Global memory. In the marching pattern test, data is written into each memory location and then read from the the memory location. The global RAM test also isolates problems on the address lines and in the refresh circuits. To find address failures, the memory is initialized by writing the address of each location into the location. The contents are then read out and verified. (Refer to 8-11)

PROG ROM

At this time, this test has no function. A complete test of the A3 Program ROM is done on power-up.

DSPINT TEST 1, DSPINT TEST 2, DSPINT TEST 3, DSPINT TEST 4

These keys are used to isolated failures in the display interface circuits on the A8 Global RAM and A17 Display Interface assemblies (refer to 8-11). When one of these keys is pressed the HP 1345A display is disabled.

TEST PROC

This key displays the menu of soft keys used to test processing assemblies in the instrument.

TEST FPP

This key displays the menu of soft keys used to test the A7 Floating Point Processor. The FPP function test performs a complex multiplication on internally generated data. For a complete description of the FPP self-tests refer to paragraph 8-10, part C. The 'JUMPER ECHO' test requires jumper A7 J2B to be set to the test position.

TEST FFT

This key displays the menu of soft keys used to test the A9 Fast Fourier Transform Processor. The FFT function test exercises the FFT functions by performing a forward and a reverse FFT, and exponential, Hanning, uniform, flattop, and user-defined windows on a known block of data. For a complete description of the FFT self-tests refer to paragraph 8-13, part A. The instrument needs to be preset before running any of the FFT self-tests. Several measurement setups can cause the FFT self-tests to fail by setting parameters used by the FFT to unknown values.

TEST DFA

This key displays the menu of soft keys used to test the A5 Digital Filter and the A6 Digital Filter Controller. The DFA functional test performs a zoom test using each channel on an internally generated square wave. This test does not use the inputs, ADCs, or analog source assemblies. For a complete description of the DFA self-tests, refer to paragraph 8-9. The DFA PATT 1 test requires jumper A5 J7 to be set to test position. The DFA PATT 1 test is used for self-test and for signature analysis. The DFA PATT 2 is used only for signature analysis. When DFA PATT 2 is pressed 'System Fault' is displayed.

TEST KEYBD

This key tests the A15 Keyboard system interface circuits. The A2 System CPU reads the keyboard status register and compares the result with a known good value. At the same time, the front panel LEDs are flashed on, then off.

TEST CPU

This key displays the menu of the soft keys used to test the HP-IB circuits on the A2 System CPU and the A22 HP-Interface Bus. The HP-IB FUNCTN key tests the General Purpose Interface Bus Adapter (A2 U412) by writing data to its registers and reading the data back. This test does not disturb devices connected to the HP-IB connector. The HP-IB DIAG key tests all of the HP-IB circuits and must not be run with devices attached to the HP-IB connector. The HP-IB CONNEC test is used to troubleshoot the A22 HP-IB connector. Refer to paragraph 8-6, part D for instructions to use the HP-IB Connector test.

TEST SOURCE

This key displays the menu of soft keys used in testing the A1 Digital Source, A4 Local Oscillator, and the A30 Analog Source.

SOURCE FUNCTN

The SOURCE FUNCTN key is used to test the A30 Analog Source (including the calibrator), the A32, A34 ADCs, and the A33, A35 Inputs. This test enables the analog source output and then the calibrator output into the input channels. The results are compared to known values. This test is the same test as the front end functional test (FR END FUNCTN).

FR END INTFCE

This key initiates the Front End Interface test (A1 Digital Source Test test). The A2 System CPU loads the A1 Digital Source with test data for the front end interface circuits (control registers subblock). The system CPU then reads the contents of the digital source's status registers. Failed bits of the status registers are entered in the test log. The front end interface test verifies the circuits on the digital source used to set up the A30 Analog Source, A31 Trigger, A32, A34 ADCs, and the A33, A35 Input assemblies. (Refer to 8-5)

SOURCE MAIN

This key initiates the Digital Source Self Test. The A2 System CPU loads the A1 Digital Source with test data to test most of the digital source's subblocks. The system CPU then reads the contents of the digital source's status registers. Failed bits of the status registers are entered in the test log. (Refer to 8-5)

ZOOM

This key initiates the Zoom Test. A zoomed measurement is done using a test signal from the A30 Analog Source. If this test passes, the A30 Analog Source main output, A4 LO, A5 Digital Filter, A6 Digital Filter Controller, A7 FPP, A9 FFT, and the A8 Global RAM are verified.

LO FUNCTN

This key initiates the LO Functional test. This test causes the LO to output phase and sine values to the A2 System CPU. The system CPU then compares the values to known good values. This test first executes using external clocks (SYNC2 and 10 MHz) and then runs again substituting internal clocks for the SYNC2 and 10 MHz clocks. (Refer to 8-8)

LO DSA PATT 1

This key is used in the A4 Local Oscillator signature analysis tests. (Refer to 8-8)

LO DSA PATT2

This key is used in the A4 Local Oscillator signature analysis tests. (Refer to 8-8)

TEST INPUT

This key displays the menu of soft keys used in testing and adjusting the A30 Analog Source, A32, A34 Analog Digital Converter and the A33, A35 Input assemblies.

FR END ADJUST

This key displays the menu of soft keys used in adjusting the instrument. For a complete description of the adjustments, refer to Section III, "Adjustments".

ADC

This key displays the menu of soft keys used in testing the A32, A34 Analog Digital Converter. The A5 Digital Filter status words are displayed when DIGTAL TRACE, PASS THRU, or SECOND PASS keys are pressed.

FR END FUNCTN

The FR END FUNCTN key is used to test the A30 Analog Source (including the calibrator), the A32, A34 ADCs, and the A33, A35 Inputs. This test enables the analog source output and then the calibrator output into the input channels. The results are compared to known values. This test is the same test as the Source Test (SOURCE FUNCTN).

FIRST PASS

This key displays the result of the first conversion pass of the ADCs. (Refer to 8-19)

DIGTAL TEST

This key initiates a test of the ADC's digital section. The ADC Controller (A32 U602) outputs test patterns to the A5 Digital Filter. The A2 System CPU reads the results from the A5 Digital Filter and compares the results with known good values.

DIGTAL TRACE

When this key is pressed, a test pattern is generated. By running the Digital Trace test in loop mode, a logic probe or oscilloscope can be used to trace digital signals on the A32, A34 assemblies.

PASS THRU

When this key is pressed, the ADC's outputs are displayed in the test log.

SECOND PASS

This key displays the result of the second conversion pass of the ADCs. (Refer to 8-19)

TEST RESULT

This key displays the menu for the Test and Fault Logs. Refer to paragraph 7-15 for a complete description of the Test Log and the Fault Log. The CLEAR TEST key is used to clear the Test Log (press twice to clear log). The CLEAR FAULT key is used to clear the Fault Log (press twice to clear log).

LOOP ON OFF

This key activates and disables the loop mode. The loop mode is used for signature analysis tests and to find intermittent failures. Refer to paragraph 7-12, "Loop Mode and Intermittent Failures" for a complete description of the loop mode and how to use it.

7-17 SELF-CALIBRATION

The HP 3562A has a stable internal calibration source which is used periodically to calibrate the input circuits. The calibration signal is generated on the A30 Analog Source circuit board. The self-calibration runs at the following times if the 'AUTO' calibration key is on: power-on, 8 minutes after power-on, 12 minutes after power-on, 40 minutes after power-on, and every two hours thereafter.

The self-calibration process consists of taking various measurements then generating calibration curves. These curves are used to correct measurements before they are displayed (the A7 FPP includes in its measurement process a complex multiply by a calibration correction curve). Since the calibration adjustments are done to the measurement after it is taken, the input assemblies remain unchanged by the calibration process (except for the value put in the common mode rejection DAC, refer to 6-7 for a description of the common mode rejection DAC). The following measurements are taken to produce the calibration curves:

Free-run measurement using the fixed sine from the analog source (this measurement is used to set the common mode rejection DAC on the A33, A35 Input assemblies)

Single channel triggered measurements using the calibrator (Pseudo Random Noise Source subblock (PRN), the inverse of the PRN, and the 64 kHz square wave)

Free-run frequency response measurement using the periodic chirp from the analog source

Free-run measurement using the fixed sine from the analog source

Press the HP 3562A keys as follows to display an example of the calibration curves:

PRESET ..... RESET

RANGE ..... **0** dBVrms

SOURCE ..... SOURCE
LEVEL ..... **0** dBVrms

WINDOW ..... UNIFRM
(NONE)

A & B

PAUSE/CONT

SPCL
FCTN ..... BEEPER
ON OFF ..... **−516** ..... ENTER
(toggle key)

SCALE ..... Y FIXD
SCALE ..... **−1.5**, **1.5** dB

Refer to figure 7-15 to see the example of the calibration curves. The range and source level can be varied to display calibration curves for different ranges.

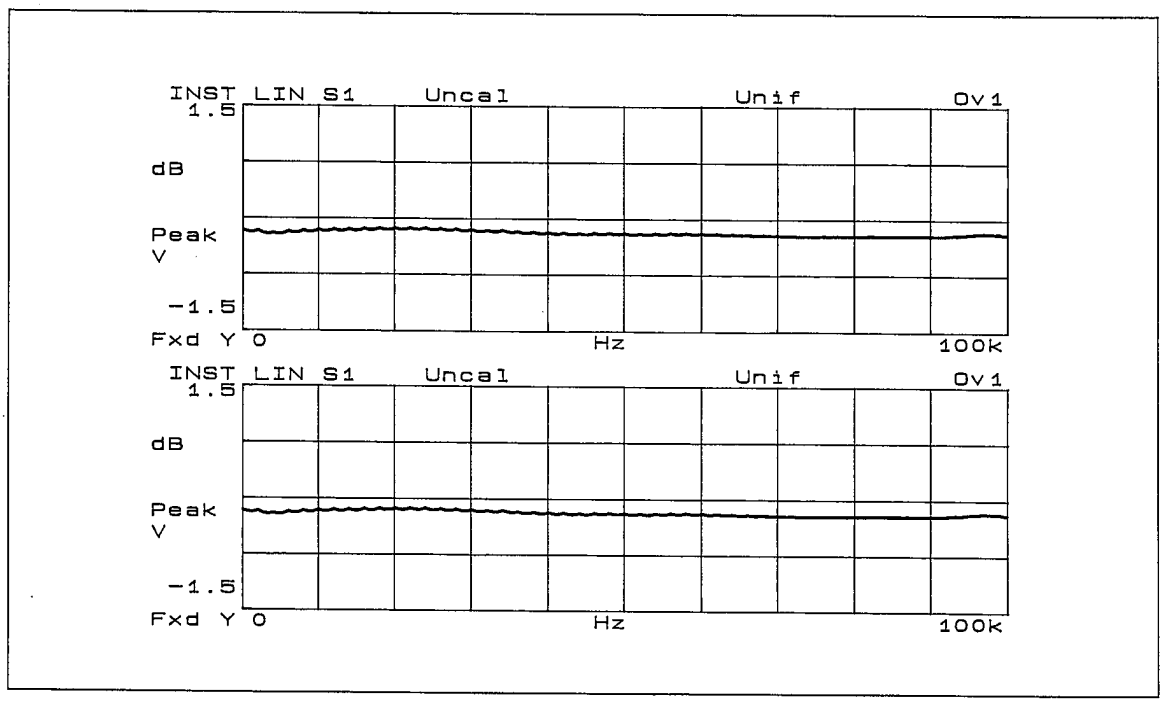


Figure 7-15 Calibration Curves

Calibration Failures

There are three type of calibration failures: calibration wait, calibration accuracy, and calibration source. Calibration failure messages are entered in the test log on power-up and when self-test or TEST ALL are run. A calibration wait failure means the calibration measurement did not complete within the specified time. A calibration accuracy failure means the magnitude or phase values exceeded the following calibration limits:

Single Channel Flatness

±1.5 dBVpk,

Frequency Response

±3.0 dBVpk, ±40°

Single Channel Phase at 0°

±1.5°

If the calibration accuracy failure occurs, the failure is entered in the test log and the calibration curves are used in measurement reading. Any assembly in the instrument can cause a calibration failure. If calibration fails, run the TEST ALL diagnostic to isolate the failing assembly (refer to 7-7). It is also possible that all the assemblies pass their self-tests and there still is a calibration failure.

If the assemblies self-tests pass but there is a 'Calibration Wait' failure, the measurement may not be triggering. Verify the trigger circuits in the instrument (go to 7-11).

If the assemblies self-tests pass but there is a 'Calibration Accuracy' failure, the following may be occurring:

a. The A30 Analog Source, A31 Trigger, A32, A34 ADCs, or the A33, A35 Input assemblies need adjustment (refer to Section III).

b. The A30 Analog Source, A31 Trigger, A32, A34 ADCs, or the A33, A35 Input assemblies are failing. Follow the procedure in paragraph 7-8, "Isolating Front End Failures" and look for amplitude variations.

If the assemblies self-tests pass but there is a 'Calibration Source' failure, check the instrument's trigger circuits (refer to 7-11) and the Pseudo Random Noise Source subblock on the A30 Analog Source.

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Hewlett-Packard France
125, rue du Faubourg Bannier
F-45000 **ORLEANS**
Tel: 16 (38) 68 01 63

Hewlett-Packard France
Zone Industrielle de Courtaboeuf
Avenue des Tropiques
F-91947 Les Ulis Cedex **ORSAY**
Tel: (6) 907-78-25
Telex: 600048F
A,CH,CM,CS,E,MP,P

Hewlett-Packard France
Paris Porte-Maillot
15, Avenue de L'Amiral Bruix
F-75782 **PARIS** CEDEX 16
Tel: 16 (1) 502-12-20
Telex: 613663F
CH,MS,P

Hewlett-Packard France
124, Boulevard Tourasse
F-64000 **PAU**
Tel: 16 (59) 80 38 02

Hewlett-Packard France
2 Allée de la Bourgonnette
F-35100 **RENNES**
Tel: 16 (99) 51-42-44
Telex: 740912F
CH,CM,E,MS,P*

Hewlett-Packard France
98 Avenue de Bretagne
F-76100 **ROUEN**
Tel: 16 (35) 63-57-66
CH**,CS

Hewlett-Packard France
4 Rue Thomas Mann
Boite Postale 56
F-67033 **STRASBOURG** Cedex
Tel: 16 (88) 28-56-46
Telex: 890141F
CH,E,MS,P*

Hewlett-Packard France
Le Péripole
20, Chemin du Pigeonnier de la Cépière
F-31083 **TOULOUSE** Cedex
Tel: 16 (61) 40-11-12
Telex: 531639F
A,CH,CS,E,P*

Hewlett-Packard France
9, rue Baudin
F-26000 **VALENCE**
Tel: 16 (75) 42 76 16

Hewlett-Packard France
Garolor
ZAC de Bois Briand
F-57640 **VIGY** (Metz)
Tel: 16 (8) 771 20 22
CH

Hewlett-Packard France
Immeuble Péricentre
F-59658 **VILLENEUVE D'ASCQ** Cedex
Tel: 16 (20) 91-41-25
Telex: 160124F
CH,E,MS,P*

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Geschäftsstelle
Keithstrasse 2-4
D-1000 **BERLIN** 30
Tel: (030) 24-90-86
Telex: 018 3405 hpbln d
A,CH,E,M,P

Hewlett-Packard GmbH
Geschäftsstelle
Herrenberger Strasse 130
D-7030 **BÖBLINGEN**
Tel: (7031) 14-0
Telex:
A,CH,CM,CS,E,MP,P

Hewlett-Packard GmbH
Geschäftsstelle
Emanuel-Leutze-Strasse 1
D-4000 **DUSSELDORF**
Tel: (0211) 5971-1
Telex: 085/86 533 hpdd d
A,CH,CS,E,MS,P

Hewlett-Packard GmbH
Geschäftsstelle
Schleefstr. 28a
D-4600 **DORTMUND**-Aplerbeck
Tel: (0231) 45001

Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 **FRANKFURT** 56
Tel: (0611) 50-04-1
Telex: 04 13249 hpffm d
A,CH,CM,CS,E,MP,P

Hewlett-Packard GmbH
Geschäftsstelle
Aussenstelle Bad Homburg
Louisenstrasse 115
D-6380 **BAD HOMBURG**
Tel: (06172) 109-0

Hewlett-Packard GmbH
Geschäftsstelle
Kapstadtring 5
D-2000 **HAMBURG** 60
Tel: (040) 63804-1
Telex: 021 63 032 hphh d
A,CH,CS,E,MS,P

Hewlett-Packard GmbH
Geschäftsstelle
Heidering 37-39
D-3000 **HANNOVER** 61
Tel: (0511) 5706-0
Telex: 092 3259
A,CH,CM,E,MS,P

Hewlett-Packard GmbH
Geschäftsstelle
Rosslauer Weg 2-4
D-6800 **MANNHEIM**
Tel: (0621) 70050
Telex: 0462105
A,C,E

Hewlett-Packard GmbH
Geschäftsstelle
Messerschmittstrasse 7
D-7910 **NEU ULM**
Tel: 0731-70241
Telex: 0712816 HP ULM-D
A,C,E*

Hewlett-Packard GmbH
Geschäftsstelle
Ehrlicherstr. 13
D-8500 **NÜRNBERG** 10
Tel: (0911) 5205-0
Telex: 0623 860
CH,CM,E,MS,P

Hewlett-Packard GmbH
Geschäftsstelle
Eschenstrasse 5
D-8028 **TAUFKIRCHEN**
Tel: (089) 6117-1
Telex: 0524985
A,CH,CM,E,MS,P

GREAT BRITAIN

See United Kingdom

GREECE

Kostas Karaynnis S.A.
8 Omirou Street
***ATHENS** 133*
Tel: 32 30 303, 32 37 371
Telex: 215962 RKAR GR
A,CH,CM,CS,E,M,P

PLAISIO S.A.
G. Gerardos
24 Stournara Street
ATHENS
Tel: 36-11-160
Telex: 221871
P

GUATEMALA

IPESA
Avenida Reforma 3-48, Zona 9
GUATEMALA CITY
Tel: 316627, 314786
Telex: 4192 TELTRO GU
A,CH,CM,CS,E,M,P

HONG KONG

Hewlett-Packard Hong Kong, Ltd.
G.P.O. Box 795
5th Floor, Sun Hung Kai Centre
30 Harbour Road
HONG KONG
Tel: 5-8323211
Telex: 66678 HEWPA HX
Cable: HEWPACK HONG KONG
E,CH,CS,P

CET Ltd.
1402 Tung Wah Mansion
199-203 Hennessy Rd.
*Wanchia, **HONG KONG***
Tel: 5-729376
Telex: 85148 CET HX
CM

Schmidt & Co. (Hong Kong) Ltd.
Wing On Centre, 28th Floor
Connaught Road, C.
HONG KONG
Tel: 5-455644
Telex: 74766 SCHMX HX
A,M

ICELAND

Elding Trading Company Inc.
Hafnarnvoli-Tryggvagotu
P.O. Box 895
IS-REYKJAVIK
Tel: 1-58-20, 1-63-03
M

INDIA

Computer products are sold through Blue Star Ltd. All computer repairs and maintenance service is done through Computer Maintenance Corp.

Blue Star Ltd.
Sabri Complex II Floor
24 Residency Rd.
***BANGALORE** 560 025*
Tel: 55660
Telex; 0845-430
Cable: BLUESTAR
A,CH,CM,CS*,E*

Blue Star Ltd.
Band Box House
Prabhadevi
***BOMBAY** 400 025*
Tel: 422-3101
Telex: 011-3751
Cable: BLUESTAR
A,M

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
***BOMBAY** 400 025*
Tel: 422-6155
Telex: 011-4093
Cable: FROSTBLUE
A,CH,CM,CS*,E,M*

Blue Star Ltd.
Kalyan, 19 Vishwas Colony
*Alkapuri, **BORODA**, 390 005*
Tel: 65235
Cable: BLUE STAR
A

Blue Star Ltd.
7 Hare Street
***CALCUTTA** 700 001*
Tel: 12-01-31
Telex: 021-7655
Cable: BLUESTAR
A,M

Blue Star Ltd.
133 Kodambakkam High Road
***MADRAS** 600 034*
Tel: 82057
Telex: 041-379
Cable: BLUESTAR
A,M

Blue Star Ltd.
Bhandari House, 7th/8th Floors
91 Nehru Place
***NEW DELHI** 110 024*
Tel: 682547
Telex: 031-2463
Cable: BLUESTAR
A,CH,CM,CS*,E,M*

Blue Star Ltd.
15/16:C Wellesley Rd.
***PUNE** 411 011*
Tel: 22775
Cable: BLUE STAR
A

Blue Star Ltd.
2-2-47/1108 Bolarum Rd.
***SECUNDERABAD** 500 003*
Tel: 72057
Telex: 0155-459
Cable: BLUEFROST
A,E

Blue Star Ltd.
T.C. 7/603 Poornima
Maruthankuzhi
***TRIVANDRUM** 695 013*
Tel: 65799
Telex: 0884-259
Cable: BLUESTAR
E

Computer Maintenance Corporation Ltd.
115, Sarojini Devi Road
***SECUNDERABAD** 500 003*
Tel: 310-184, 345-774
Telex: 031-2960
*CH***

4 SALES & SUPPORT OFFICES

Arranged alphabetically by country

INDONESIA

BERCA Indonesia P.T.
P.O.Box 496/Jkt.
Jl. Abdul Muis 62
JAKARTA
Tel: 21-373009
Telex: 46748 BERSAL IA
Cable: BERSAL JAKARTA
P

BERCA Indonesia P.T.
P.O.Box 2497/Jkt
Antara Bldg., 17th Floor
Jl. Medan Merdeka Selatan 17
JAKARTA-PUSAT
Tel: 21-344-181
Telex: BERSAL IA
A,CS,E,M

BERCA Indonesia P.T.
P.O. Box 174/SBY.
Jl. Kutei No. 11
SURABAYA
Tel: 68172
Telex: 31146 BERSAL SB
Cable: BERSAL-SURABAYA
A,E,M,P*

IRAQ

Hewlett-Packard Trading S.A.
Service Operation
Al Mansoor City 9B/3/7
BAGHDAD
Tel: 551-49-73
Telex: 212-455 HEPAIRAQ IK
CH,CS

IRELAND

Hewlett-Packard Ireland Ltd.
82/83 Lower Leeson Street
DUBLIN 2
Tel: 0001 608800
Telex: 30439
A,CH,CM,CS,E,M,P

Cardiac Services Ltd.
Kilmore Road
Artane
***DUBLIN** 5*
Tel: (01) 351820
Telex: 30439
M

ISRAEL

Eldan Electronic Instrument Ltd.
P.O.Box 1270
***JERUSALEM** 91000*
16, Ohaliav St.
***JERUSALEM** 94467*
Tel: 533 221, 553 242
Telex: 25231 AB/PAKRD IL
A

Electronics Engineering Division
Motorola Israel Ltd.
16 Kremenetski Street
P.O. Box 25016
TEL-AVIV 67899
Tel: 3 88 388
Telex: 33569 Motil IL
Cable: BASTEL Tel-Aviv
CH,CM,CS,E,M,P

ITALY

Hewlett-Packard Italiana S.p.A
Traversa 99C
Via Giulio Petroni, 19
I-70124 **BARI**
Tel: (080) 41-07-44
M

Hewlett-Packard Italiana S.p.A.
Via Martin Luther King, 38/III
I-40132 **BOLOGNA**
Tel: (051) 402394
Telex: 511630
CH,E,MS

Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43G/C
I-95126 **CATANIA**
Tel: (095) 37-10-87
Telex: 970291
C,P

Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio 9
I-20063 **CERNUSCO SUL NAVIGLIO**
(Milano)
Tel: (02) 923691
Telex: 334632
A,CH,CM,CS,E,MP,P

Hewlett-Packard Italiana S.p.A.
Via C. Colombo 49
I-20090 **TREZZANO SUL NAVIGLIO**
(Milano)
Tel: (02) 4459041
Telex: 322116
C,M

Hewlett-Packard Italiana S.p.A.
Via Nuova San Rocco a
Capodimonte, 62/A
I-80131 **NAPOLI**
Tel: (081) 7413544
Telex: 710698
A,CH,E

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 **GENOVA PEGLI**
Tel: (010) 68-37-07
Telex: 215238
E,C

Hewlett-Packard Italiana S.p.A.
Via Pelizzo 15
I-35128 **PADOVA**
Tel: (049) 664888
Telex: 430315
A,CH,E,MS

Hewlett-Packard Italiana S.p.A.
Viale C. Pavese 340
I-00144 **ROMA EUR**
Tel: (06) 54831
Telex: 610514
A,CH,CM,CS,E,MS,P*

Hewlett-Packard Italiana S.p.A.
Via di Casellina 57/C
I-50018 **SCANDICCI-FIRENZE**
Tel: (055) 753863

Hewlett-Packard Italiana S.p.A.
Corso Svizzera, 185
I-10144 **TORINO**
Tel: (011) 74 4044
Telex: 221079
CH,E

JAPAN

Yokogawa-Hewlett-Packard Ltd.
152-1, Onna
ATSUGI, Kanagawa, 243
Tel: (0462) 28-0451
CM,C*,E

Yokogawa-Helwett-Packard Ltd.
Meiji-Seimei Bldg. 6F
3-1 Hon Chiba-Cho
CHIBA, 280
Tel: 472 25 7701
E,CH,CS

Yokogawa-Hewlett-Packard Ltd.
Yasuda-Seimei Hiroshima Bldg.
6-11, Hon-dori, Naka-ku
HIROSHIMA, 730
Tel: 82-241-0611

Yokogawa-Hewlett-Packard Ltd.
Towa Building
2-3, Kaigan-dori, 2 Chome Chuo-ku
KOBE, 650
Tel: (078) 392-4791
C,E

Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi 82 Bldg
3-4 Tsukuba
KUMAGAYA, Saitama 360
Tel: (0485) 24-6563
CH,CM,E

Yokogawa-Hewlett-Packard Ltd.
Asahi Shinbun Daiichi Seimei Bldg.
4-7, Hanabata-cho
KUMAMOTO,860
Tel: (0963) 54-7311
CH,E

Yokogawa-Hewlett-Packard Ltd.
Shin-Kyoto Center Bldg.
614, Higashi-Shiokoji-cho
Karasuma-Nishiiru
Shiokoji-dori, Shimogyo-ku
KYOTO, 600
Tel: 075-343-0921
CH,E

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg
4-73, Sanno-maru, 1 Chome
MITO, Ibaraki 310
Tel: (0292) 25-7470
CH,CM,E

Yokogawa-Hewlett-Packard Ltd.
Sumitomo Seimei 14-9 Bldg.
Meieki-Minami, 2 Chome
Nakamura-ku
NAGOYA, 450
Tel: (052) 571-5171
CH,CM,CS,E,MS

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.,
4-20 Nishinakajima, 5 Chome
Yodogawa-ku
OSAKA, 532
Tel: (06) 304-6021
Telex: YHPOSA 523-3624
A,CH,CM,CS,E,MP,P*

Yokogawa-Hewlett-Packard Ltd.
27-15, Yabe, 1 Chome
SAGAMIHARA Kanagawa, 229
Tel: 0427 59-1311

Yokogawa-Hewlett-Packard Ltd.
Daiichi Seimei Bldg.
7-1, Nishi Shinjuku, 2 Chome
Shinjuku-ku,**TOKYO** 160
Tel: 03-348-4611
CH,E

Yokogawa-Hewlett-Packard Ltd.
29-21 Takaido-Higashi, 3 Chome
Suginami-ku **TOKYO** 168
Tel: (03) 331-611
Telex: 232-2024 YHPTOK
A,CH,CM,CS,E,MP,P*

Yokogawa-Hewlett-Packard Ltd.
Daiichi Asano Building
2-8, Odori, 5 Chome
UTSUNOMIYA, Tochigi 320
Tel: (0286) 25-7155
CH,CS,E

Yokogawa-Hewlett-Packard Ltd.
Yasuda Seimei Nishiguchi Bldg.
30-4 Tsuruya-cho, 3 Chome
YOKOHAMA 221
Tel: (045) 312-1252
CH,CM,E

JORDAN

Mouasher Cousins Company
P.O. Box 1387
AMMAN
Tel: 24907, 39907
Telex: 21456 SABCO JO
CH,E,M,P

KENYA

ADCOM Ltd., Inc., Kenya
P.O.Box 30070
NAIROBI
Tel: 331955
Telex: 22639
E,M

KOREA

Samsung Electronics HP Division
12 Fl. Kinam Bldg.
San 75-31, Yeoksam-Dong
Kangnam-Ku
Yeongdong P.O. Box 72
SEOUL
Tel: 555-7555, 555-5447
Telex: K27364 SAMSAN
A,CH,CM,CS,E,M,P

KUWAIT

Al-Khaldiya Trading & Contracting
P.O. Box 830 Safat
KUWAIT
Tel: 42-4910, 41-1726
Telex: 22481 Areeg kt
CH,E,M

Photo & Cine Equipment
P.O. Box 270 Safat
KUWAIT
Tel: 42-2846, 42-3801
Telex: 22247 Matin kt
P

LEBANON

G.M. Dolmadjian
Achrafieh
P.O. Box 165.167
BEIRUT
Tel: 290293
*MP**

Computer Information Systems
P.O. Box 11-6274
BEIRUT
Tel: 89 40 73
Telex: 22259
C

LUXEMBOURG

Hewlett-Packard Belgium S.A./N.V.
Blvd de la Woluwe, 100
Woluwedal
B-1200 **BRUSSELS**
Tel: (02) 762-32-00
Telex: 23-494 paloben bru
A,CH,CM,CS,E,MP,P

MALAYSIA

Hewlett-Packard Sales (Malaysia)
Sdn. Bhd.
1st Floor, Bangunan British
American
Jalan Semantan, Damansara Heights
KUALA LUMPUR 23-03
Tel: 943022
Telex: MA31011
A,CH,E,M,P*

SALES & SUPPORT OFFICES

Arranged alphabetically by country

MAYLAYSIA (Cont'd)

Protel Engineering
P.O.Box 1917
Lot 6624, Section 64
23/4 Pending Road
Kuching, ***SARAWAK***
Tel: 36299
Telex: MA 70904 PROMAL
Cable: PROTELENG
A,E,M

MALTA

Philip Toledo Ltd.
Notabile Rd.
MRIEHEL
Tel: 447 47, 455 66
Telex: Media MW 649
E,P

MEXICO

Hewlett-Packard Mexicana, S.A. de C.V.
Av. Periferico Sur No. 6501
Tepepan, Xochimilco
16020 **MEXICO D.F.**
Tel: 6-76-46-00
Telex: 17-74-507 HEWPACK MEX
A,CH,CS,E,MS,P

Hewlett-Packard Mexicana, S.A. de C.V.
Ave. Colonia del Valle 409
Col. del Valle
Municipio de Garza Garcia
MONTERREY, Nuevo Leon
Tel: 78 42 41
Telex: 038 410
CH

ECISA
José Vasconcelos No. 218
Col. Condesa Deleg. Cuauhtémoc
MEXICO *D.F. 06140*
Tel: 553-1206
Telex: 17-72755 ECE ME
M

MOROCCO

Dolbeau
81 rue Karatchi
CASABLANCA
Tel: 3041-82, 3068-38
Telex: 23051, 22822
E

Gerep
2 rue d'Agadir
Boite Postale 156
CASABLANCA
Tel: 272093, 272095
Telex: 23 739
P

NETHERLANDS

Hewlett-Packard Nederland B.V.
Van Heuven Goedhartlaan 121
NL 1181KK **AMSTELVEEN**
P.O. Box 667
NL1180 AR **AMSTELVEEN**
Tel: (020) 47-20-21
Telex: 13 216 HEPA NL
A,CH,CM,CS,E,MP,P

Hewlett-Packard Nederland B.V.
Bongerd 2
NL 2906VK **CAPELLE A/D IJSSEL**
P.O. Box 41
NL 2900AA **CAPELLE A/D IJSSEL**
Tel: (10) 51-64-44
Telex: 21261 HEPAC NL
A,CH,CS,E

Hewlett-Packard Nederland B.V.
Pastoor Petersstraat 134-136
NL 5612 LV **EINDHOVEN**
P.O. Box 2342
NL 5600 CH **EINDHOVEN**
Tel: (040) 326911
Telex: 51484 hepae nl
A,CH**,E,M

NEW ZEALAND

Hewlett-Packard (N.Z.) Ltd.
5 Owens Road
P.O. Box 26-189
Epsom, **AUCKLAND**
Tel: 687-159
Cable: HEWPACK Auckland
CH,CM,E,P*

Hewlett-Packard (N.Z.) Ltd.
4-12 Cruickshank Street
Kilbirnie, **WELLINGTON 3**
P.O. Box 9443
Courtenay Place, **WELLINGTON 3**
Tel: 877-199
Cable: HEWPACK Wellington
CH,CM,E,P

Northrop Instruments & Systems Ltd.
369 Khyber Pass Road
P.O. Box 8602
AUCKLAND
Tel: 794-091
Telex: 60605
A,M

Northrop Instruments & Systems Ltd.
110 Mandeville St.
P.O. Box 8388
CHRISTCHURCH
Tel: 486-928
Telex: 4203
A,M

Northrop Instruments & Systems Ltd.
Sturdee House
85-87 Ghuznee Street
P.O. Box 2406
WELLINGTON
Tel: 850-091
Telex: NZ 3380
A,M

NORTHERN IRELAND

See United Kingdom

NORWAY

Hewlett-Packard Norge A/S
Folke Bernadottes vei 50
P.O. Box 3558
N-5033 **FYLLINGSDALEN** (Bergen)
Tel: 0047/5/16 55 40
Telex: 16621 hpnas n
CH,CS,E,MS

Hewlett-Packard Norge A/S
Österndalen 16-18
P.O. Box 34
N-1345 **ÖSTERÅS**
Tel: 0047/2/17 11 80
Telex: 16621 hpnas n
A,CH,CM,CS,E,M,P

OMAN

Khimjil Ramdas
P.O. Box 19
MUSCAT
Tel: 722225, 745601
Telex: 3289 BROKER MB MUSCAT
P

Suhail & Saud Bahwan
P.O.Box 169
MUSCAT
Tel: 734 201-3
Telex: 3274 BAHWAN MB

PAKISTAN

Mushko & Company Ltd.
1-B, Street 43
Sector F-8/1
ISLAMABAD
Tel: 51071
Cable: FEMUS Rawalpindi
A,E,M

Mushko & Company Ltd.
Oosman Chambers
Abdullah Haroon Road
KARACHI *0302*
Tel: 524131, 524132
Telex: 2894 MUSKO PK
Cable: COOPERATOR Karachi
*A,E,M,P**

PANAMA

Electrónico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA 5
Tel: 63-6613, 63-6748
Telex: 3483 ELECTRON PG
A,CM,E,M,P

PERU

Cía Electro Médica S.A.
Los Flamencos 145, San Isidro
Casilla 1030
LIMA *1*
Tel: 41-4325, 41-3703
Telex: Pub. Booth 25306
CM,E,M,P

PHILIPPINES

The Online Advanced Systems Corporation
Rico House, Amorsolo Cor. Herrera Street
Legaspi Village, Makati
P.O. Box 1510
Metro ***MANILA***
Tel: 85-35-81, 85-34-91, 85-32-21
Telex: 3274 ONLINE
A,CH,CS,E,M

Electronic Specialists and Proponents Inc.
690-B Epifanio de los Santos Avenue
Cubao, ***QUEZON CITY***
P.O. Box 2649 Manila
Tel: 98-96-81, 98-96-82, 98-96-83
Telex: 40018, 42000 ITT GLOBE MACKAY BOOTH
P

PORTUGAL

Mundinter
Intercambio Mundial de Comércio S.A.R.L.
P.O. Box 2761
Av. Antonio Augusto de Aguiar 138
P-LISBON
Tel: (19) 53-21-31, 53-21-37
Telex: 16691 munter p
M

Soquimica
Av. da Liberdade, 220-2
1298 ***LISBOA*** *Codex*
Tel: 56 21 81/2/3
Telex: 13316 SABASA
P

Telectra-Empresa Técnica de Equipmentos Eléctricos S.A.R.L.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-LISBON *1*
Tel: (19) 68-60-72
Telex: 12598
CH,CS,E,P

PUERTO RICO

Hewlett-Packard Puerto Rico
Ave. Muñoz Rivera #101
Esq. Calle Ochoa
HATO REY, Puerto Rico 00918
Tel: (809) 754-7800

Hewlett-Packard Puerto Rico
Calle 272 Edificio 203
Urb. Country Club
RIO PIEDRAS, Puerto Rico
P.O. Box 4407
CAROLINA, Puerto Rico 00628
Tel: (809) 762-7255
A,CH,CS

QATAR

Computearbia
P.O. Box 2750
DOHA
Tel: 883555
Telex: 4806 CHPARB
P

Eastern Technical Services
P.O.Box 4747
DOHA
Tel: 329 993
Telex: 4156 EASTEC DH

Nasser Trading & Contracting
P.O.Box 1563
DOHA
Tel: 22170, 23539
Telex: 4439 NASSER DH
M

SAUDI ARABIA

Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 22015
Thuobah
AL-KHOBAR
Tel: 895-1760, 895-1764
Telex: 671 106 HPMEEK SJ
Cable: ELECTA AL-KHOBAR
CH,CS,E,M

Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 1228
Redec Plaza, 6th Floor
JEDDAH
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SERVICE MANUAL

MODEL 3562A
DYNAMIC SIGNAL ANALYZER

Serial Number: 2435A00101

IMPORTANT NOTICE

This manual applies to instruments with the above serial number and greater. As changes are made in the instrument to improve performance and reliability, the appropriate pages will be revised to include this information.

WARNING

To prevent potential fire or shock hazard, do not expose instrument to rain or moisture.

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HEWLETT PACKARD

CERTIFICATION

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

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

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

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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 that 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

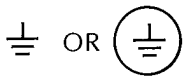
Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

SAFETY SYMBOLS

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

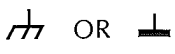
Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

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.

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

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SECTION VIII
SERVICE

8-1 INTRODUCTION

This section contains all the information required to isolate failures to the component level. Use this section after using the fault isolation procedures in Section VII. This section is used to isolate a failure to the subblock level. Each functional subblock consists of a small number of components, and the technician's expertise is relied upon to isolate the faulty component.

How to Use This Section

Start After isolating the fault to an assembly, go to the troubleshooting procedures for that assembly. The troubleshooting information is listed in order of the circuit board assembly number, A1 through A33.

Reference Use the component locators and schematics in Section IX with each of the troubleshooting procedures.

For the location of cables and boards refer to figure 4-1 in Section IV.

For the circuit block diagrams refer to Section VI.

To understand the instrument's operation and signal mnemonics refer to Section VI.

Keys There are two types of keys on the HP 3562A, hard keys and soft keys. In this section the hard keys are in bold text, and the soft keys are in regular text.

For example:

FREQ ..... FREQ SPAN ..... **10** kHz

This example instructs you to press the hard key **FREQ** and the soft key FREQ SPAN. After pressing the soft key FREQ SPAN enter 10 kHz.

Loop Mode The loop mode is used for some signatures analysis tests and to find intermittent failures. For description of the loop mode refer to paragraph 7-12, "Loop Mode and Intermittent Failures".

NOTE

After completing a test or repair, check that all jumpers are in the NORMAL or RUN position and that all cables are connected.

8-2 RECOMMENDED TEST EQUIPMENT

The recommended test equipment for troubleshooting is listed in table 1-4. Any item which meets or exceeds the critical requirements can be substituted for the model listed.

8-3 LOGIC CONVENTIONS

Positive logic convention is used in this manual unless otherwise noted. Positive logic conventions define a logic "1" or "High" as more positive voltage and a logic "0" or "Low" as the more negative voltage.

8-4 SAFETY CONSIDERATIONS

The HP 3562A is a Safety Class 1 instrument (provided with a protective earth terminal). The instrument and manuals should be reviewed for safety markings and instructions before operation. Refer to the safety symbol table in the preface of this manual.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Hazardous voltage and energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3562A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

WARNING

230 Vdc is present in the A18 power supply assembly even with the line switch in the off position and the power cord removed. Be extremely careful when working in the power supply area. This high voltage could cause serious personal injury if contacted. To discharge the capacitors holding this voltage perform steps 1 through 3.

1. *Remove the power cord from the rear panel.*
2. *Remove the bottom cover and power supply shield.*
3. *Wait two minutes after turning the power off to allow the capacitors to discharge.*

8-5 A1 DIGITAL SOURCE

The information in this section should be used to isolate faulty subblocks in the A1 Digital Source assembly. All procedures assume the Fault Isolation procedures of Section VII have been used to determine which board has failed, and the circuit descriptions of Section VI are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Hazardous voltage and energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3562A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

How to Use This Section

Start The primary method for troubleshooting the digital source assembly is to use signature analysis and the waveforms provided in parts E and F. Start troubleshooting by using part A, "Digital Source Diagnostics" to isolate the failure to a subblock.

Reference For the component locator and schematic refer to Section IX. For the location of cables and boards refer to figure 4-1 in Section IV.

Verify Use the oscilloscope waveforms in table A1-10 to see correct operation at various test points in the assembly.

After-Repair Use table A1-11 to determine which adjustments and tests need to be done to complete instrument service.

A. Digital Source Diagnostics

The digital source is tested using two self-tests; the front end interface test and the source main test. When either of these tests are initiated, the test registers and control registers are loaded with test data and the TEST signal to the test registers goes low. The test is performed and the contents of the status registers is read and verified by the A2 System CPU. Any failed bits are annunciated on the display. These tests are also used in loop mode for signature analysis patterns.

1. To perform the self-tests, press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
SOURCE ..... FR END
INTFCE
..... SOURCE
MAIN

2. Refer to table A1-2 for single bit failures to determine the probable subblock failing.

3. Go to part B for multiple bit failures.

4. If both tests pass but a source function or a trigger mode is failing, use table A1-1 to determine the probable subblock failing.

Table A1-1 Digital Source Functions

Function Failing or Defective	Probable Cause of Failure
Triggered Mode	Phase Resolution Circuit (go to part E)
Single Channel Phase	Phase Resolution Circuit (go to part E)
CNTCLK	Control Registers (go to part E, step 7)
Sine Wave Output	LO Input Receiver (go to part E)
Source Energy Measurement fails (2-41) but random noise operates at full span	Effective Sample Rate Generator (go to part D)
Random Noise Output	Noise Generator (go to part E, step 8)
Burst Mode	Burst Control Circuit (go to part E, step 5)
SYNC OUT output	Burst Control Circuit (refer to waveform #5
Periodic Chirp	Effective Sample Rate Generator (go to part D)

Table A1-2 Digital Source Diagnostics

Bit #	Signal Name	From Component	Subblock Returning Status Bit Probable subblock failing
0	LDCH1L	U208-6	Control Registers (Go to part E, step 7)
1	LDCH2L	U208-7	
2	LDTRL	U208-5	
3	LDSRCL	U208-4	
4	SRCOUTFALTL	—	Status Registers (Go to part E)
5	UNLOCK	—	
6	C10FSE	U101-7	Timing Control Circuit (Go to part D)
7	CNTLD	U206-9	Control Registers (Go to part E, step 7)
8	NCLK	U202-12	Burst Control Circuit (Go to part E, step 5)
9	DOUT	U209-6	Multiplier (Go to part E)
10	DMID	U13-13	LO Input Receiver (Go to part E)
11	NSR	U311-11	Noise Generator (Go to part E, step 8)
12	CNTRL BUSY	U106-8	Control Registers (Go to part E, step 7)
13	BUSYL	U5-14	Phase Resolution Circuit (Go to part E)
14	TRIGGERED	U8-9	
15	ARMEDL	U5-15	
—	Digital Source Counters Fail	U305, U7, U107, U108	These counters are used in the following subblocks: Phase Resolution Circuit Timing Control Circuit Burst Control Circuit (Go to part E)

B. Subblock Verification Tests

The digital source performs several functions including generating band-limited random noise, interfacing the local oscillator with the analog source, sychronizing trigger operations, and interfacing the front end assemblies (inputs, ADCs, trigger, and analog source) with the A2 System CPU. Most functions use only a few of the DS subblocks. To isolate the failure to a subblock, use table A1-3 after performing the following steps:

1. Connect the front panel source output to channel 1.

2. Connect the rear panel SYNC OUT output to channel 2.

3. Press the HP 3562A keys as follows:

PRESET . . . . . RESET

RANGE . . . . . **5.6** V

SOURCE . . . . . SOURCE
LEVEL . . . . . **5** V

. . . . . FIXED
SINE . . . . . **1** kHz

MEAS
DISP . . . . . FILTRD
INPUT . . . . . TIME
REC1

SCALE . . . . . Y FIXD
SCALE . . . . . **6, –6** V

Refer to figure A1-1 to verify result.

NOTE

The free-run mode is used for most of the following waveforms. This is done to isolate failing functions to a subblock. When the trigger mode is not used, the waveforms move around on the display. The trigger mode is verified in step 7.

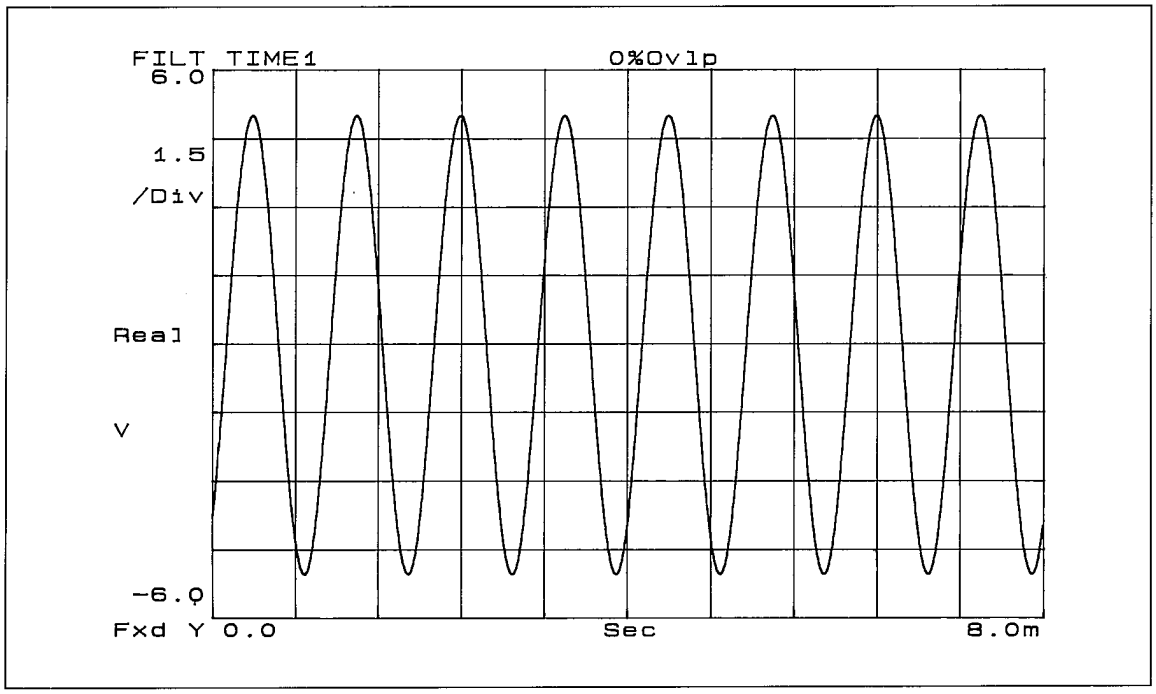


Figure A1-1 Sine Wave

If the figure A1-1 is correct, the following subblocks are verified:

LO Input Receiver

Multiplier

Timing State Machine (U3)

4. Press the HP 3562A keys as follows:

SOURCE . . . . . RANDOM
NOISE

Refer to figure A1-2 to verify result.

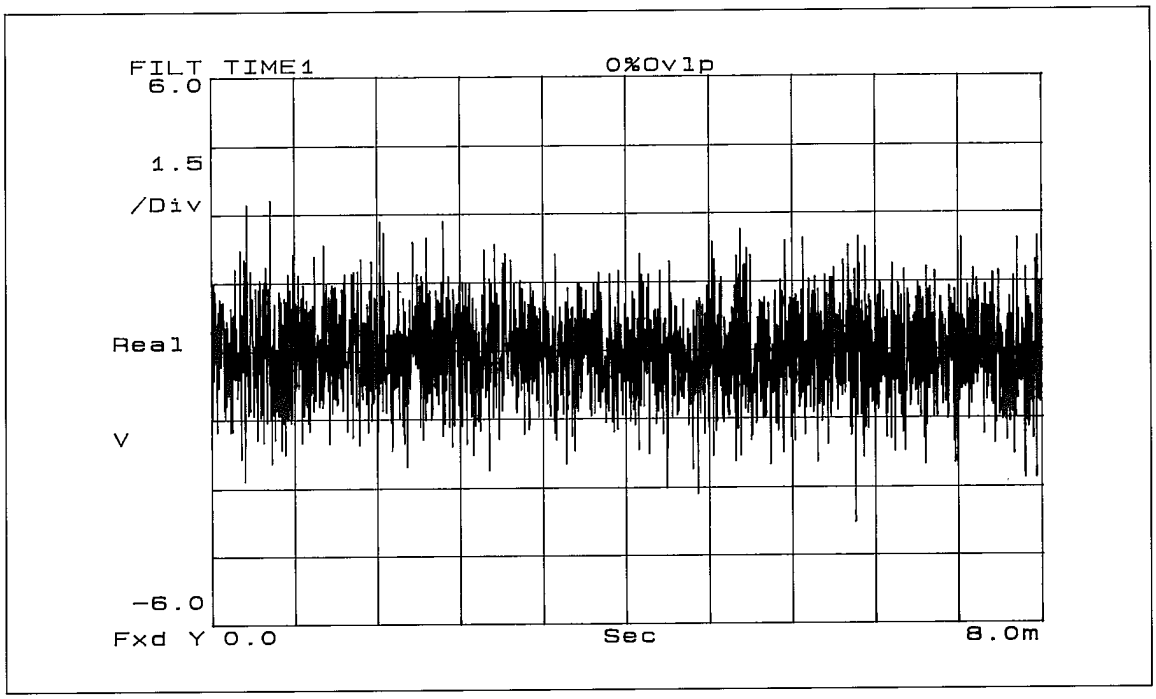


Figure A1-2 Random Noise

If figure A1-2 is correct the following subblock is verified:

Noise Generator

5. The random noise should follow the frequency span as it is changed. The display should appear similar to figure A1-2 as the frequency span is changed. To change frequency spans, press the HP 3562A keys as follows:

FREQ ..... FREQ
SPAN ..... **1** kHz
..... **10** kHz
..... **50** kHz

If the random noise follows the frequency span, the following subblock is verified:

Effective Sample Rate Generator

6. Press the HP 3562A keys as follows:

FREQ ..... MAX
SPAN

B

MEAS
DISP ..... FILTRD
INPUT ..... TIME
REC 2

SCALE ..... Y FIXD
SCALE ..... **6, –6** V

A & B

SOURCE ..... BURST
RANDOM

Refer to figure A1-3 to verify result.

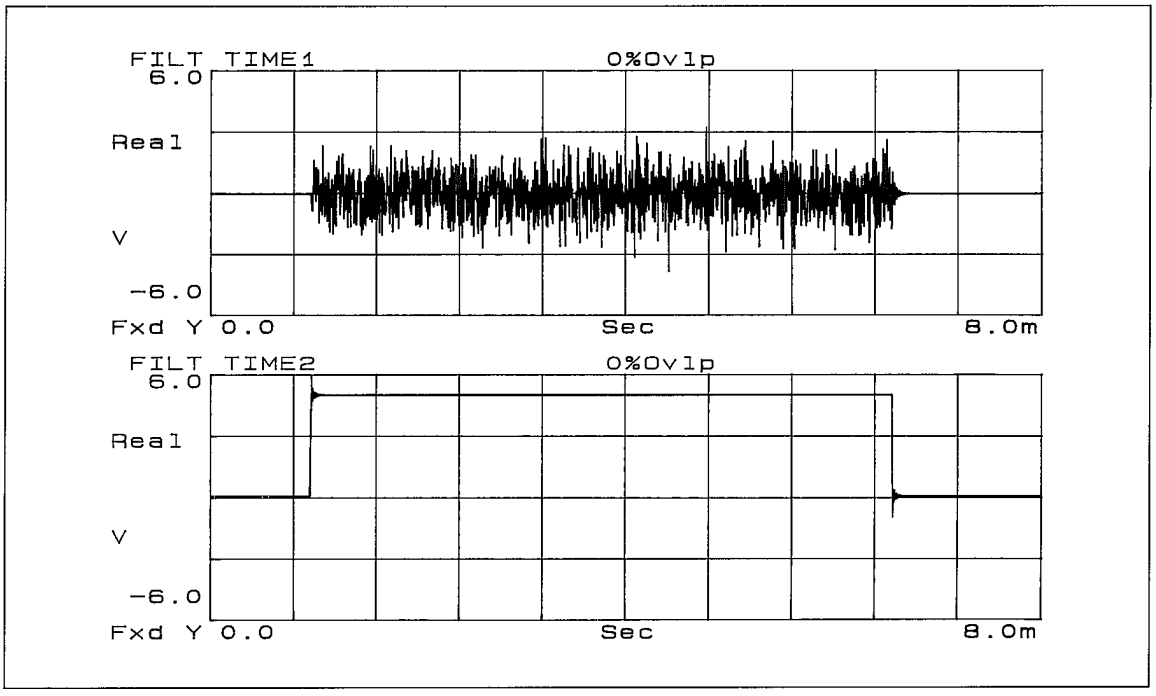


Figure A1-3 Burst Random #1

Press the HP 3562A keys as follows:

SOURCE . . . . . BURST
RANDOM . . . . . **25** . . . . . ENTER

Refer to figure A1-4 to verify result.

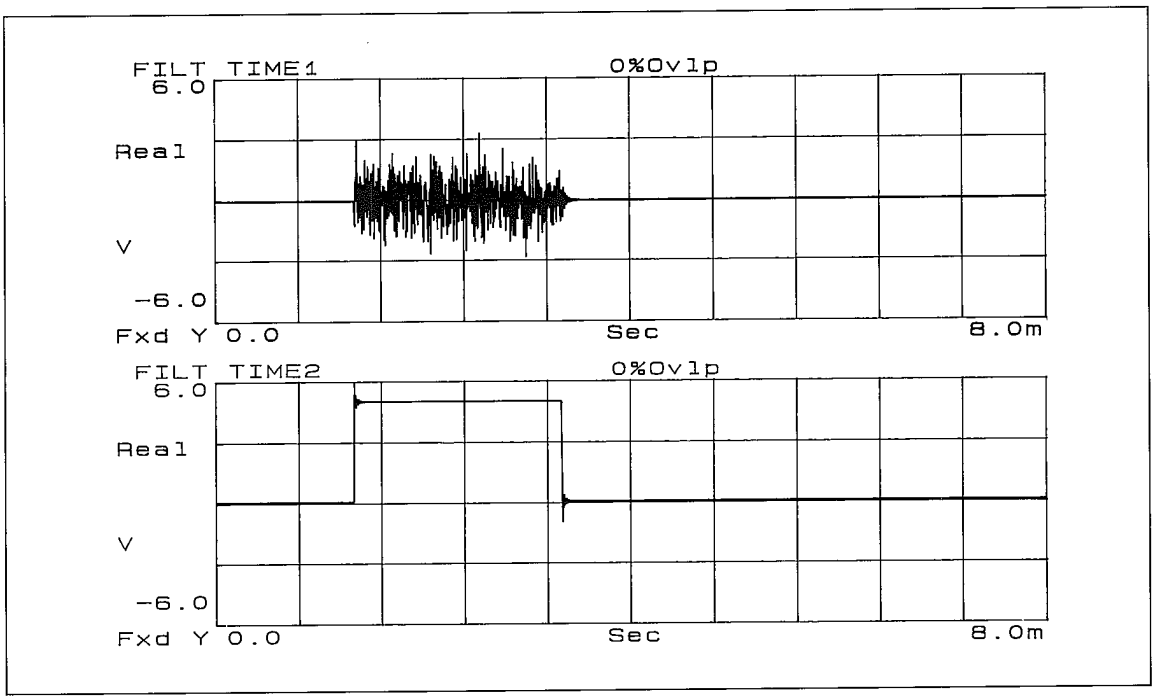


Figure A1-4 Burst Random #2

If figures A1-3 and A1-4 are correct, the following subblock is verified:

Burst Control Circuit

7. Press the HP 3562A keys as follows:

SOURCE . . . . . FIXED
SINE . . . . . **1** kHz

SELECT
TRIG . . . . . SOURCE
TRIG

The source trigger point may vary on the sine wave, but the trigger point on the SYNC OUT waveform should be the same as displayed in figure A1-5.

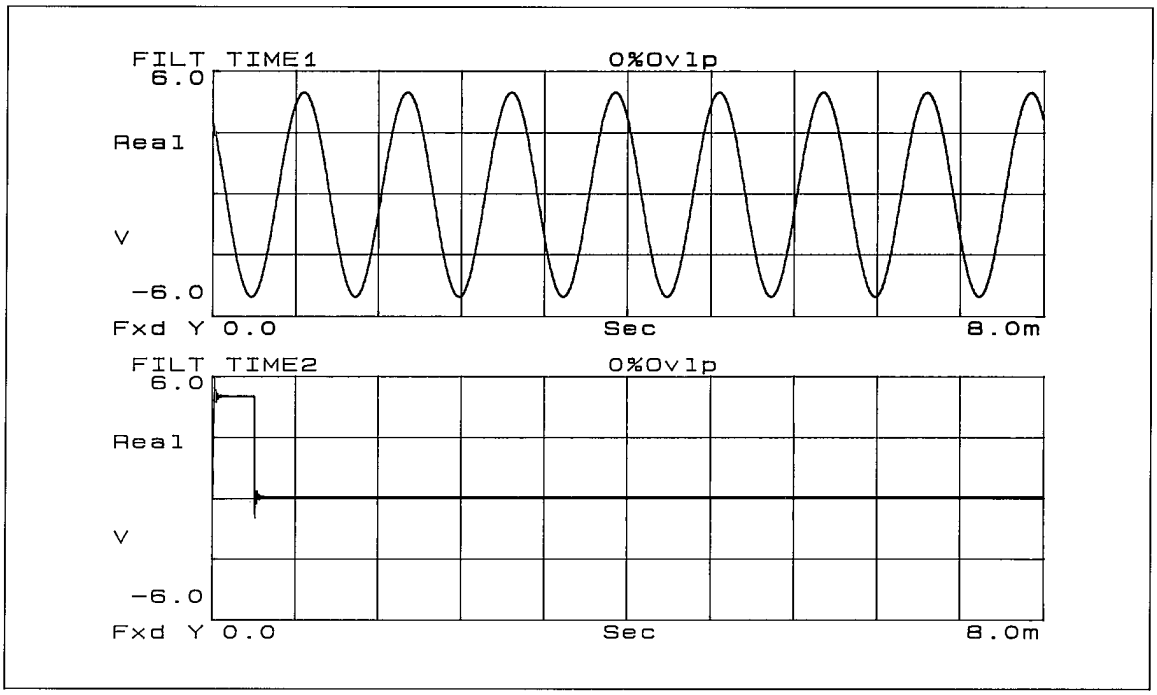


Figure A1-5 Source Trigger

If figure A1-5 is correct, the following subblock is verified:

Phase Resolution Circuit

Table A1-3 Digital Source Failures

Test Results	Most Likely Cause of Failure Troubleshoot subblocks in order listed.
Digital Source Main Test Passes Digital Source Counters Passes Digital Source F/E Interface Fails Bits: 0,1,2,3,7, or 12	Control Registers (Go to part E, step 7)
Digital Source F/E Interface Passes Digital Source Counters Pass or Fail Digital Source Main Test Fails Bits: 6,9,10	Timing Control Circuit LO Input Receiver Multiplier (Go to part E)
Digital Source F/E Interface Passes Digital Source Counters Pass Digital Source Main Test Fails Bits: 9,10 Functions: Sine Output is defective, but Burst Random and SYNC OUT operate	LO Input Receiver (Go to part E)
Digital Source F/E Interface Passes Digital Source Counters Pass or Fail Digital Source Main Test Fails Bits: 9,10 Functions: Source Output Defective Random Noise Defective	Timing Control Circuit LO Input Receiver Multiplier (Go to part E)
Digital Source F/E Interface Passes Digital Source Counters Pass or Fail Digital Source Main Test Fails Bits: 13, 14, or 15	Phase Resolution Circuit (Go to part E)

Table A1-3 Digital Source Failures cont.

Test Results	Most Likely Cause of Failure Troubleshoot subblocks in order listed.
Digital Source F/E Interface Passes Digital Source Counters Pass or Fail Digital Source Main Test Fails Bits: 6,9,10 and one or more of the following bits: 11, 12, 13, 14, 15	Programmable Counters Phase Resolution Circuit Timing Control Circuit (Go to part E)
Digital Source F/E Interface Fails Digital Source Main Test Fails Bits: Multiple Failures Functions: No functions operate	DS Data Bus System Interface Device Decoder PAL or Buffer Programmable Counters Status Registers Test Registers Control Registers' Latches (Go to part C)

C. Multiple Failures Test

This test verifies the DS data bus, the system interface, and the device decoder PAL and buffer.

1. Press the line switch off. Place the A1 Digital Source on the 03562-66540 extender board.

2. Use a logic probe to verify the system interface lines are toggling between TTL level high and TTL level Low. Use the following test locations:

   U404-19

   U403 pins 11, 13 through 18

3. Press the HP 3562A keys as follows:

   SPCL
   FCTN ..... SERVICE
   TEST ..... LOOP
   ON
   ..... TEST
   SOURCE ..... SOURCE
   MAIN

4. To verify the device decoder PAL and buffer, use a logic probe to check the following signals are the correct TTL level:

U303	pin	12 Toggling	U401	pin	2 Toggling
		13 Toggling			7 Toggling
		14 Toggling			10 Toggling
		15 Toggling			11 Toggling
		16 Toggling			
		17 High			
		18 Toggling			
		19 Toggling			

5. Press the HP 3562A keys as follows:

RETURN..... LOOP
OFF

..... LOOP
ON ..... TEST
SOURCE ..... FR END
INTFCE

6. Use a logic probe to verify the following signals are the correct TTL level:

U303	pin	12 High
		13 Toggling
		14 High
		15 High
		16 Toggling
		17 Toggling
		18 Toggling
		19 Toggling

7. Use a logic to verify the DS data lines are togging (FR END INTFCE in loop mode). Some of the lines will toggle slowly. Use the following test locations:

U406 pins 1 and 11 through 19

U405 pins 11 through 18

8. Press A2 S1. After the power-up tests are complete, verify the following signals are the correct TTL level:

Test Location	Signal Name	TTL Level
U203-2	TEST	Low
U304-6	NRSTL	High
U304-9	BRST	High
U302-4	RESETL	High

9. If the fault has not been found, go to part E.

D. Effective Sample Rate Generator Test

Use table A1-4 to verify the components in the effective sample rate generator. In table A1-4, a '0' represents a TTL level low and a '1' represents a TTL level high. Set the frequency span by pressing the HP 3562A keys as follows:

FREQ ..... FREQ
SPAN ..... To frequency span in table

Table A1-4 Effective Sample Rate Generator Test

Frequency Span	DA (U1-3)	DB (U4-12)	DSEL (U101-2)	TP12
1 kHz	0	0	1	25.6 kHz
3.125 kHz	0	1	1	80.0 kHz
10 kHz	1	0	1	256 kHz
100 kHz	1	1	0	5.12 MHz

If the fault has not been found, go to part E.

E. Digital Source Signature Analysis Tests

Use these tests and the waveforms in part F to isolate a failure on the digital source assembly. Only the components in the failing subblocks need to be tested.

1. Press the line switch off.

2. Connect the Signature Analyzer as follows:

Table A1-5 DS Signature Analyzer Setup

Signal	Polarity	Connection
Ground		A1 J2-1
Clock	Positive edge	A1 J2-3
Stop	Positive edge	A1 J2-4
Start	Positive edge	A1 J2-5

3. Press the line switch on.

4. To start signature analysis test #1, press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... LOOP
ON
..... TEST
SOURCE ..... SOURCE
MAIN

NOTE

When finished with the test, turn the loop mode off by pressing the keys as follows:

RETURN . . . . . LOOP OFF

Table A1-6 DS Signature Analysis Test #1

Source Main Test
Source Main Test in loop mode
Jumpers in normal (N) position: All jumpers
Signature Analyzer Setup: Refer to table A1-5
+5 V Signature = H166

Component	Pin	Signature
U1	11	U233
	12	40C9
	13	C9FH
	14	7467
	15	PO9H
U2	11	9765
	12	9206
	13	HA1F
	14	6P24
	15	41CF
U3	12	AU9H
	13	460C
	14	12C3
	15	49H2
	16	C26H
	17	2F90
	18	H166
	19	2FP4
U4	3	36UF
	6	H166
	8	OUH3
	11	HPC5
U5	12	H10F
	13	5791
	14	H10F
	15	9AUF
	16	6866
	17	97C4
	18	H166
	19	3486
U6	3	H10F
	6	H10F
	8	21F2
	11	H166
U7	8	0000
	9	H166
	10	5791
	12	H166
	13	H10F
U8	5	615F
	6	CO3A
	8	006A
	9	H10F
U9	5	F4U5
	6	1593
	8	C88U
	9	69P9
U10	3	93AH
	4	7003
	5	01H4
	6	C93U
	10	654A
	11	0C70
	12	CF6H
	13	67P3
U11	12	5612
	13	2FU6
	14	UHAP
	15	858P
	16	5612
	17	2FU6
	18	UHAP
U12	12	127P
	13	8340
	14	7716
	15	43A6
	16	127P
	17	8340
	18	7716

Table A1-6 DS Signature Analysis Test #1 cont.

Component	Pin	Signature
U13	13	5730
U101	7	C2H9
U102	12	811H
	13	8315
	14	C957
	15	02PU
	16	5UA9
	17	PA58
	18	H166
	19	H166
U103	2	10AH
U105	4	C367
	5	H166
	7	C367
	9	0000
	14	0000
U106	5	A75U
	6	7639
	8	0000
	9	H166
U107	9	H166
	10	5791
	12	H166
	13	H10F
U108	9	H166
	10	5791
	12	H10F
	13	H10F
U109	6	H166
	8	H166
U110	3	1AUA
	4	C4A8
	5	6381
	6	8815
	10	UHHU
	11	F73A
	12	HA48
	13	54U1
U111	12	5612
	13	2FU6
	14	UHAP
	15	858P
	16	5612
	17	2FU6
	18	UHAP
	19	858P
U112 Δ Rev. A	12	127P
	13	8340
	14	7716
	15	43A6
	16	127P
	17	8340
	18	7716
	19	43A6
U113	12	5UPH
U201	1	31UC
	4	F6P2
	10	304P
	13	0000
U202	6	HPC5
	10	2C66
U203	2	H166
	6	0000
	9	47HH
	12	465U
	16	UA00
U204	2	C367
	5	653U
	15	P79A
	16	0000
U209	6	7H1U
U302	4	H166
	8	H166
	10	2C66

Δ See backdating.

Table A1-6 DS Signature Analysis Test #1 cont.

Component	Pin	Signature
U304	1	H166
	2	F11P
	5	7557
	6	5FF3
	8	47HH
	12	OUH3
	13	465U
	16	HPC5
	17	UA00
	19	1078
U305	2	UA00
	4	465U
	5	47HH
	9	A75U
	10	F2HP
	11	5FF3
	13	A392
	14	811H
	15	F6P2
	16	811H
	17	77P7
	18	304P
U306	6	H166
U307	15	465U
	16	47HH
U308	4	UA00
	7	465U
	12	H166
U407	1	H166
	6	47HH
	7	47HH
U409	12	H166
	13	FC55
	14	H166
	15	95C3
	16	FAH9
	17	PFH9
	18	H9C3
	19	0000

5. To start signature analysis test #2, perform the following steps:

   a. Press the line switch off.

   b. Set A1 J3 to test position.

   c. Press the line switch on.

   d. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... LOOP
ON

..... TEST
SOURCE ..... SOURCE
MAIN

NOTE

DS Signature Analysis Test #2 disables the feedback loop between the burst state machine (U102) and the burst control circuit's counters (U305).

Table A1-7 DS Signature Analysis Test #2

Burst Control Circuit
Source Main Test in loop mode
Jumpers in normal (N) position: All jumpers except A1 J3
Jumpers in test (T) position: A1 J3
Signature Analyzer Setup: Refer to table A1-5
+5 V Signature = H166

Component	Pin	Signature	Component	Pin	Signature
U102	P75H		U305	13	7U6P
	13	19C5		17	PHF6
	14	45C7			
	15	02PU			
	16	5UA9			
	17	PA58			
	18	H166			
	19	H166			

6. Put jumper A1 J3 in normal (N) position.

7. To start signature analysis test #3, perform the following steps:

   a. Set A1 J3 in normal (N) position.

   b. Press A2 S1.

   c. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... LOOP
ON
..... TEST
SOURCE ..... FR END
INTFCE

Table A1-8 DS Signature Analysis Test #3

Front End Interface Test
Front End Interface in loop mode
Jumpers in normal (N) position: All jumpers
Signature Analyzer Setup: Refer to table A1-5
+5 V Signature = 088C

Component	Pin	Signature
U4	6	H359
U6	11	H359
U104	3	6F76
	4	HCH2
	5	5289
	6	P7CC
	8	0000
	9	3U2P
	10	7FP2
	11	6H62
U106	8	C49A
U109	3	083A
U204	1	088C
	2	0000
	5	8FFP
	6	OUA9
	9	UO39
	12	CCC3
	15	0000
	16	0000
	19	0000
U205	11	088C
	13	FC45
U206	7	6574
	9	6HUU
U207	7	F472
	9	FFU9
U208	4	95HH
	5	99C5
	6	UOH8
	7	UF01
U302	8	CF11

8. To start signature analysis test #4, perform the following steps:

   a. Press the line switch off.

   b. Connect U311 pin 10 to TP15.

   c. Press the line switch on.

   d. Press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... LOOP
ON

..... TEST
SOURCE ..... SOURCE
MAIN

Table A1-9 DS Signature Analysis Test #4

Random Noise Generator Test
Source Main Test in loop mode
Jumpers in normal (N) position: All jumpers
Connect U311-10 to TP15
Signature Analyzer Setup: Refer to table A1-5
+5 V Signature = H166

Component	Pin	Signature
U208	9	C139
	10	A38A
	11	U732
	12	34P7
	13	12C3
	14	460C
U209	6	1764
U210	2	0000
	5	2HP4
	6	0000
	9	7P38
	12	F2CC
	15	08P1
	16	4H58
	19	1AA4
U212	1	7CCO
	4	6HU7
	10	F4PF
	13	F322
U310	2	CO3A
	5	8CO4
	6	05FC
	9	6678
	12	9508
	15	2777
	16	4CP8
	19	HOFU
U311	2	0000
	3	A431
	11	H166
U312	1	23CH
	4	60FC
	10	37PF
	13	UA63
U313	9	7753
	10	HH05
	11	5C09
	13	1PF9
U313 cont.	14	4F13
	15	2F4F
	16	09HF
	17	2F4F
U410	1	09FA
	2	4UH7
	3	4UH7
	4	18AC
	5	18AC
	6	P9P2
	7	P9P2
	9	7A61
	15	09FA
U411	1	09FA
	2	4UH7
	3	4UH7
	4	18AC
	5	18AC
	6	P9P2
	7	P9P2
	9	5FU5
	15	09FA
U412	1	09FA
	2	4UH7
	3	4UH7
	4	18AC
	5	18AC
	6	P9P2
	7	P9P2
	9	5828
	15	09FA
U413	1	09FA
	2	4UH7
	3	4UH7
	4	18AC
	5	18AC
	6	P9P2
	7	P9P2
	9	8200
	15	09FA

F. Oscilloscope Signal Waveforms

The oscilloscope plots are used for troubleshooting the A1 Digital Source. Note that all the measurements are taken with a 10:1 probe. Other notes unique to a measurement are written next to the waveform.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

Table A1-10 Digital Source Waveforms

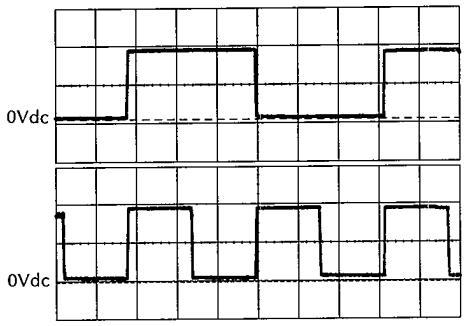
All jumpers should be in normal position

Connect ground to A1 TP1 or A1 TP15
Probe: 10:1

Press the keys as follows:

SPCL FCTN ..... SERVIC TEST ..... LOOP ON

..... TEST SOURCE ..... FR END INTFCE

Setup	Important Parameters	Waveform
CNTLD and CNTCLK Connect CH1 to A1 TP10 Connect CH2 to A1 TP11 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 20 us/Div Trigger CH1	Time Relationship	 #1

After viewing waveform, press A2 S1.

Table A1-10 Digital Source Waveforms cont.

All jumpers should be in normal position

Connect ground to A1 TP1 or A1 TP15
Probe: 10:1

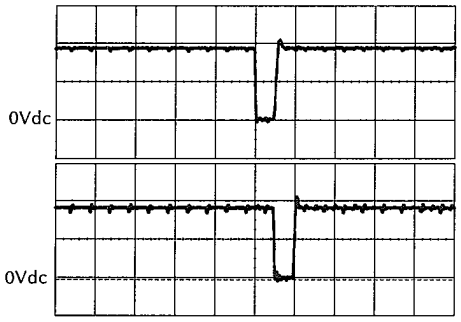
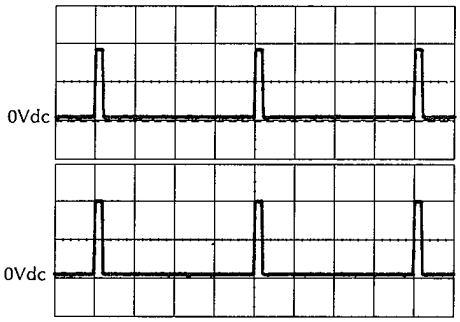
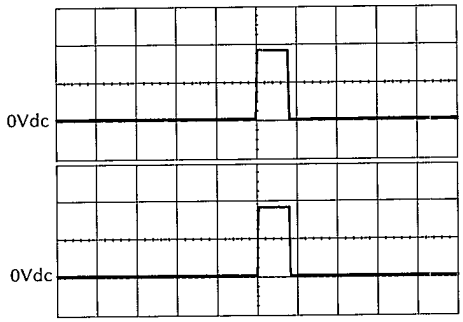
Setup	Important Parameters	Waveform
LOL Connect CH1 to A1 TP2 Oscilloscope: CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 1 μs/Div Trigger CH 1	Time	 #2
LOL and CLRL Connect CH1 to A1 TP2 Connect CH2 to A1 TP3 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 200 ns/Div Trigger CH1	Time Relationship Duty Cycle	 #3
NCLK and NSYNC Connect CH2 to A1 J701-3 Connect CH2 to A1 U11-2 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 2 ms/Div Trigger CH1	Time Relationship	 #4

Table A1-10 Digital Source Waveforms cont.

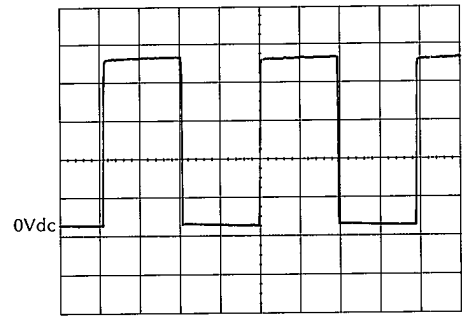
All jumpers should be in normal position

Connect ground to A1 TP1 or A1 TP15
Probe: 10:1

Setup	Important Parameters	Waveform
BSNC and SYNC OUT Connect CH1 to A1 U103-12 Connect CH2 to A1 U301-1 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 500 µs/Div Trigger CH1	Time Relationship	 #5

Press the keys as follows:

FREQ . . . . FREQ SPAN . . . **1** kHz

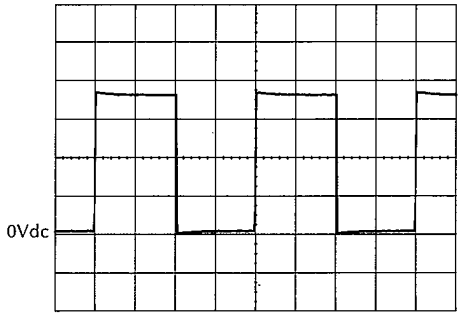
10x Effective Sample Rate Connect CH1 to A1 TP12 Oscilloscope: CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 10 µs/Div Trigger CH1	Time Duty cyle	 #6

After viewing waveform, press MAX SPAN.

Table A1-10 Digital Source Waveforms cont.

All jumpers should be in normal position

Connect ground to A1 TP1 or A1 TP15
Probe: 10:1

Setup	Important Parameters	Waveform
Connect the front panel source output to external trigger and channel 1. Press the keys as follows: **SOURCE** . . . SOURCE LEVEL . . . **5** V . . . FIXED SINE . . . **125** Hz **SELECT TRIG** . . . EXT		
TRIG Connect CH1 to A1 U5-7 Oscilloscope: CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 2 ms/Div Trigger CH1	Time Duty Cycle	 #7

G. After-Repair Adjustments and Tests

Table A1-11 After-Repair Adjustments and Tests

Perform the following:	Section
Diagnostic Tests: FR END INTFCE SOURCE MAIN TEST ALL	VII
Adjustments: None	III
Performance Tests: If the noise generator subblock was repaired, perform the Source Energy Measurement test.	II
Operational Verification: If the phase resolution circuit was repaired, perform the Signal Channel Phase Accuracy test. If the LO Input Receiver was repaired, perform the Source Amplitude Accuracy and Flatness test.	II

8-6 A2, A22 SYSTEM CPU/HPIB

The information in this section should be used to isolate faulty subblocks in the A2 and A22 System CPU/HPIB assemblies. All procedures assume the Fault Isolation procedures of Section VII have been used to determine which board has failed, and the Circuit Descriptions of Section VI are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Hazardous voltage and energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3562A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

How to Use This Section

Start Start troubleshooting by using figure A2-1. This procedure diagram describes the best order to perform the troubleshooting tests based on the symptoms observed.

Reference For the component locator and schematic refer to Section IX. For the location of cables and boards refer to figure 4-1 in Section IV.

Verify Use the oscilloscope waveforms in table A2-5 to see correct operation at various test points in the assembly.

After-Repair Use table A2-6 to determine which adjustments and tests need to be done to complete instrument service.

Troubleshooting Hints

1. Only +5 Vdc and ground are required to troubleshoot the A2 CPU/HPIB assembly. To run the A2 CPU/HPIB assembly without the rest of the instrument, put jumpers A2 J15 and A2 J16 in test (T) position.

2. The A2 CPU/HPIB can be run on an external clock by grounding A2 TP3 and connecting a TTL level, 8 MHz clock to A2 TP4.

3. Undefined failures are most likely caused by stuck bits. This is occurring if the status LEDs (A2 DS2) are a steady state value instead of changing rapidly. Go to the initial conditions test (A).

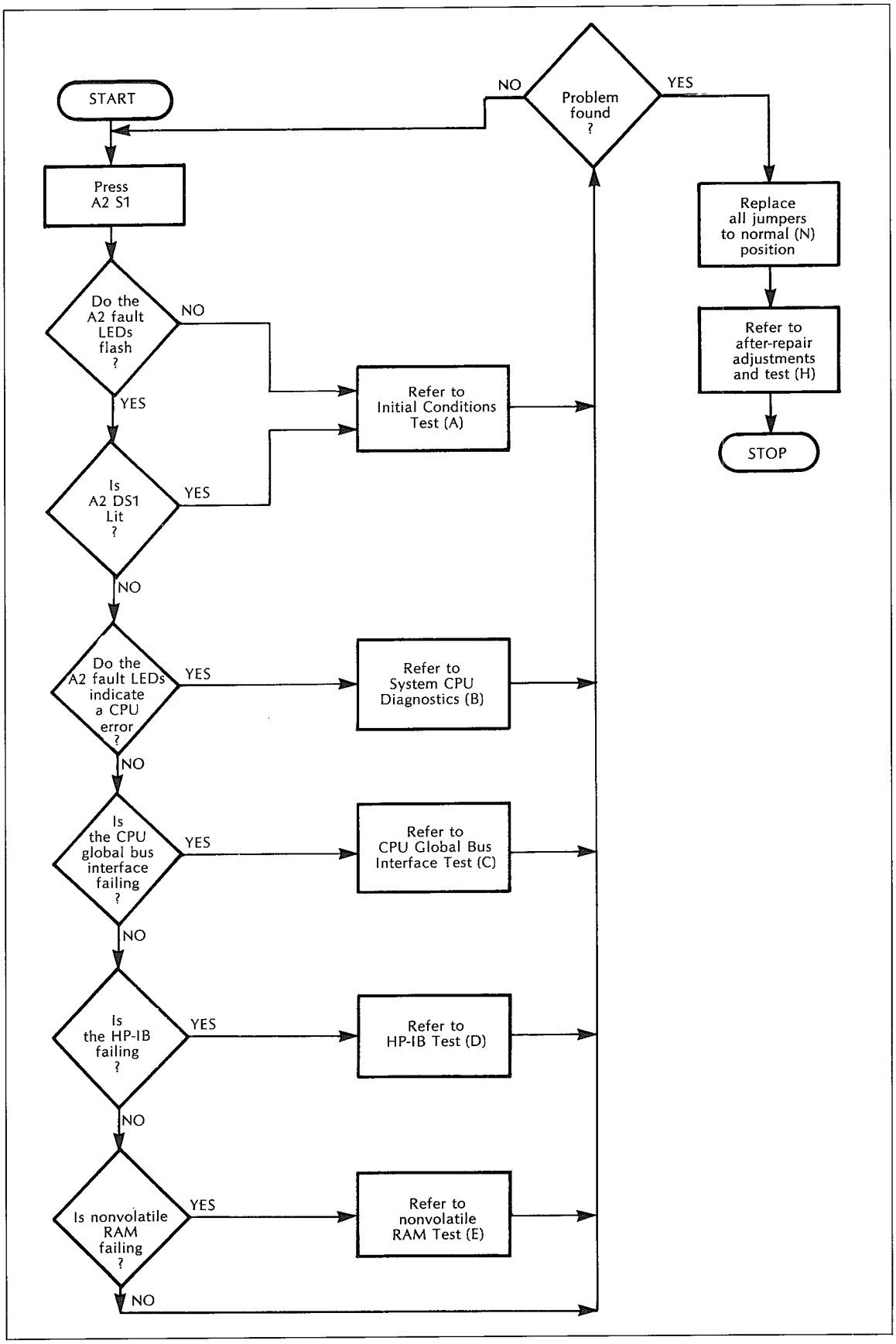


Figure A2-1 Troubleshooting Procedure Diagram

A. Initial Conditions Test

1. Disconnect the power cable from the rear panel and remove the top cover. Place the A2 CPU/HPIB on the 03562-66540 extender board.

2. Connect the power cable and press the line switch on.

3. Check the following for correct value:

Signal	Location	Value
+5S	A2 TP2	+5 ±0.3V
PWRUP	A2 J15-2	TTL logic 1
PWRDNL	A2 J16-2	TTL logic 1
HALTL	A2 U100-17	TTL logic 1
RESETL	A2 U100-18	TTL logic 1
8 mHz Clock	A2 TP5	Refer to waveform #1 (G)

4. If the +5S, PWRUP, or PWRDNL are not the correct values, go to paragraph 8-16, "A18 Power Supply Assembly."

5. If the cause of the failure is still not found, go to the signature tests (F).

B. System CPU Diagnostics

The CPU diagnostics do the following at power up or when the CPU is reset by pressing A2 S1:

1. Flashes the LEDs and then turns each one on starting with DS3-1 (MSB).

2. Clears the test log.

3. Stores address and contents of NVRAM.

4. Check sums the monitor ROM.

5. Exercises several system processor (U100) instructions.

6. Tests the monitor RAM by writing and reading patterns to and from it.

7. If an error was found in the RAM test, the address decoder is exercised by writing addresses to several locations and reading the contents.

8. Tests the NVRAM using a write/read/restore sequence on each memory location.

9. Tests the timer and interrupt circuits.

The CPU diagnostics stop when a fault is found and display the error code on the test LEDs (A2 DS3, A2 DS4). If no error is found on the A2 CPU/HPIB assembly, the power-up sequence continues. Use table A2-1 to determine the most likely failure causing an A2 CPU/HPIB error code.

Table A2-1 System CPU/HPIB Diagnostics

Hex Error Code	Test Description	Hex Code Explanation	Most Likely Failure
Undefined	Initial Power Up	Low level fault	Go to Initial Conditions Test (A)
01	Monitor Rom Check sum	Upper byte failure, Lower byte passes	A2 U105
02	Monitor Rom Check sum	Lower byte failure Upper byte passes	A2 U205
03	Monitor Rom Check sum	Both bytes fail	Go to SA (F)
04	Monitor Rom Check sum	Both bytes pass	Go to SA (F)
05	Instruction Test	U100 test passes	Go to SA (F)
06	Instruction Test	U100 test fails	A2 U100
10	Monitor RAM Test	High byte, MEM0L fails	A2 U110
11	Monitor RAM Test	Low byte, MEM0L fails	A2 U210
12	Monitor RAM Test	Both MEM0L bytes fail	A2 U110, U210
13	Monitor RAM Test	High byte, MEM1L fails	A2 U109
14	Monitor RAM Test	Low byte, MEM1L fails	A2 U209
15	Monitor RAM Test	Both MEM1L bytes fail	A2 U109, U209
16	Monitor RAM Test	High byte, MEM2L fails	A2 U107
17	Monitor RAM Test	Low byte, MEM2L fails	A2 U207
18	Monitor RAM Test	Both MEM2L bytes fail	A2 U107, U207
19	Monitor RAM Test	Multiple Monitor RAM failures	Go to SA (F)
1A	Monitor RAM Test	NVRAM, high byte fails	A2 U212
1B	Monitor RAM Test	NVRAM, low byte fails	A2 U211
1C	Monitor RAM Test	Both NVRAM bytes fail	A2 U212, U211
C"N"	Monitor RAM Test	RAM address test fails	Line A"N"

Table A2-1 System CPU/HPIB Diagnostics cont.

Hex Error Code	Test Description	Hex Code Explanation	Most Likely Failure
0C	Timer and Interrupt Test	Unexpected timer interrupt	A2 U500, U413
0D	Timer and Interrupt Test	Timer interrupt failure	A2 U500, U413, A2 U100
0E	Timer and Interrupt Test	Timer Failure	A2 U413
0F	HP-IB Test	HP-IB Failure	HPIB subblock

C. CPU Global Bus Interface Test

1. Press the line switch off.
2. Remove the following assemblies:

   A5 Digital Filter
   A7 Floating Point Processor
   A8 Global RAM/Display
   A9 Fast Fourier Processor

3. Press the line switch on.
4. Put A2J8, A2J12, A2J13, and A2J17 in test (T) position.
5. Repeatedly press the reset switch S1 while checking for TTL levels of the global bus drivers, latches, and control subblocks.

D. HP-IB Test

1. To test the HP-IB subblock press the HP 3562A keys as follows:

   SPCL
   FCTN ..... SERVIC
   TEST ..... TEST
   PROC
   ..... TEST
   CPU ..... HP-IB
   DIAG

2. If this test passes, all signal paths and the pass through registers (A2 U112, A2 U113) are all right.

3. To check the HP-IB connector press the following keys:

SPCL
FCTN ..... SERVIC
TEST ..... LOOP ON
..... TEST PROC
..... TEST CPU ..... HP-IB CONNEC

4. Using a small jumper, short each of the control pins to the HP-IB connector ground. When a pin is grounded, the corresponding pin shown in the display should have a dot in it.

5. If this test passes, the HP-IB connector is functioning properly.

NOTE

Remove the fan (MP209) before attempting to remove the A22 HP-IB board.

E. Nonvolatile RAM Test

1. Check the following for correct value:

Location	Value
U211-28	≥4.5V
U212-28	≥4.5V
U211-26	TTL logic 1
U212-26	TTL logic 1

2. Press the line switch off. With the power off, U211-28 should be greater than 3V.

3. Connect the signature analyzer according to table A2-2.

4. Check the signatures of A2 U408-6 and A2 U305-15, they should be the same.

F. CPU Signature Analysis Tests

These tests are used when the previous tests fail to find the problem.

1. Disconnect power cable.

2. Put the following jumpers in test (T) position:

   A2J4, A2J5, A2J6, A2J7, A2J9, A2J10, A2J18

3. Put A2 J11 and A2 J14 in position "2".

4. Connect the signature analyzer according to table A2-2.

Table A2-2 CPU Signature Analyzer Setup

Signal	Polarity	Connection
Ground		A2 J2-1
Clock	Positive edge	A2 J2-3
Stop	Negative edge	A2 J2-4
Start	Negative edge	A2 J2-5

5. Connect the power cable and press the line switch on.

Table A2-3 CPU Signature Analysis Test #1

Address Test
Jumpers in test (T) position: A2J4, A2J5, A2J6, A2J7, A2J9, A2J10, A2J18
Jumpers in position "2": A2J11, A2J14
Jumpers in normal (N) position: A2J1, A2J8, A2J17, A2J12, A2J13
Jumpers in either normal or test position: A2J15, A2J16
Signature Analyzer Setup: Refer to table A2-2
+5 V Signature = 0001

Component	Pin	Signature	Component	Pin	Signature
U100	29	UUUU	U100	37	HC89
	30	5555		38	2H70
	31	CCCC		39	HPPO
	32	7F7F		40	1293
	33	5H21		41	HAP7
	34	OAFA		42	3C96
	35	UPFH		43	3827
	36	52F8		44	755U

Put jumper J1 in position "1". It takes about 10s for each of the following signatures to stabilize.

+5 V Signature = 6PCP

Component	Pin	Signature	Component	Pin	Signature
U100	45	2595	U305	14	0000
	46	1F8F		15	HUHA
	47	U97F		16	1582
	48	5A34		17	AC4F
	49	6PCP		18	012U
	50	91FC			
	51	3CPF			
	52	A70F			
			U606	13	443U
				15	6PCP
U305	10	4CAH		16	AP18
	11	2H3U		17	A52A
	12	3HFO		18	UA2U
	13	807A			

6. If the signatures in table A2-3 are incorrect, check that A2 U100 pins 12, 13, 21, 22, 23, 24, and 25 are a TTL logic high.

7. Put A2 J1 in position "2". It takes about 10s for each of the signatures in table A2-4 to stabilize.

Table A2-4 CPU Signature Analysis Test #2

Monitor ROM Test
Jumpers in test (T) position: A2J4, A2J5, A2J6, A2J7, A2J9, A2J10, A2J18
Jumpers in position "2": A2J1, A2J11, A2J14
Jumpers in normal (N) position: A2J8, A2J17, A2J12, A2J13
Jumpers in either normal or test position: A2J15, A2J16
Signature Analyzer Setup: Refer to table A2-2
+5 V Signature = 6PCP

Component	Pin	Signature	Component	Pin	Signature
U105	11	9UUU	U205	11	35H3
	12	FH2H		12	6000
	13	HHHH		13	2C18
	15	P488		15	6300
	16	F7CH		16	P9F7
	17	H1HA		17	278F
	18	CF33		18	A936
	19	F108		19	13C9

G. Oscilloscope Signal Waveforms

The oscilloscope plots are used for troubleshooting the A2 CPU/HPIB. Note that all the measurements are taken with a 10:1 probe. Other notes unique to a measurement are written next to the waveform.

Table A2-5 CPU Signal Waveforms

Remove Power
Jumpers in normal (N) position: All jumpers
Connect ground to A2 TP1
Probe: 10:1
Power On

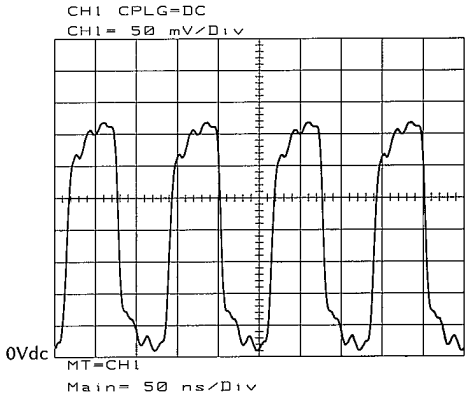
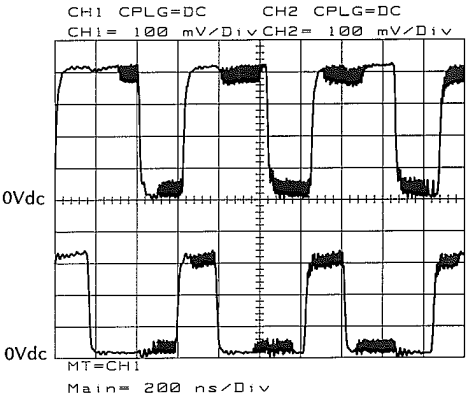
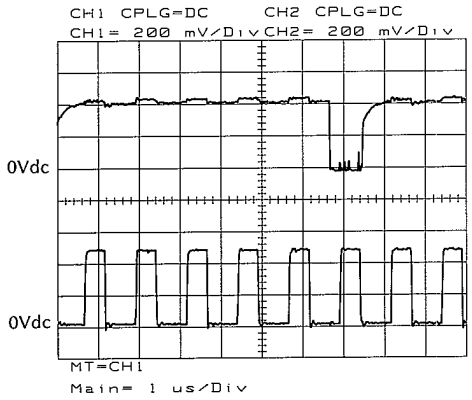
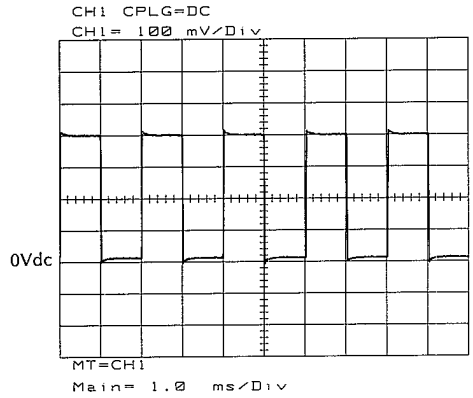
Setup	Important Parameters	Waveform
8 MHz Clock Connect CH1 to A2 TP5 Oscilloscope: Bandwidth Limit: ON Mode A CH1 V/Div 50 mV/Div CH1 Coupling dc Time/Div 50 ns/Div Trigger CH1	Time Pulse shape	 #1
Press A2 S1 switch to see the waveform #2. DTACKL and ASL will stop changing for a short time (≈2s).		
DTACKL, ASL Connect CH1 to A2 U100-10 Connect CH2 to A2 U100-6 Oscilloscope: Bandwidth Limit: ON Mode A & B CH1 V/Div 100 mV/Div CH2 V/Div 100 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 200 ns/Div Trigger CH1	Time relationship	 #2

Table A2-5 CPU Signal Waveforms cont.

Remove Power
Jumpers in normal (N) position: All jumpers
Connect ground to A2 TP1
Probe: 10:1
Power On

To display waveform #3, press the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... LOOP ON
..... TEST SOURCE ..... LO DSA
PATT 1

Setup	Important Parameters	Waveform
VMAL, ENBL Connect CH1 to A2 U100-19 Connect CH2 to A2 U100-20 Oscilloscope: Mode A & B CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1.0 μs/Div Trigger CH1	Time relationship	 #3
Press RETURN . . . LOOP OFF		
ERROUT Connect A2 TP6 to A2 TP1 Connect CH1 to A2 U404-7 Oscilloscope: Mode A CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 1 ms/Div Trigger CH1	Time	 #4

H. After-Repair Adjustments and Tests

Table A2-6 After-Repair Adjustments and Tests

Perform the following:	Section
Diagnostic Tests: TEST ALL	VII
Adjustments: None	
Performance Tests: None	

8-7 A3 PROGRAM ROM

The information in this section should be used to isolate faulty subblocks on the A3 Program ROM assembly. All procedures assume that the Fault Isolation procedures of Section VII were used to determine that this board has failed and that the Circuit Descriptions of Section VI are understood.

WARNING

Service procedures described in this section are performed with protective covers removed and power applied. Hazardous voltages in these circuits can cause personal injury if contacted.

CAUTION

Do not insert or remove any circuit board in the HP 3562A while power is on. Power transients caused by insertion or removal may damage the circuit boards.

How to Use This Section

Start Start troubleshooting with part A, Program ROM Diagnostics.

Reference Refer to Section IX for the component locators and schematics. refer to figure 4-1 in Section IV for location of cables and boards.

After-Repair Use table A3-3 to determine which adjustments and tests need to be performed to complete instrument service.

Troubleshooting Hint

The ROM board is very sensitive to changes in +5 V. Check this voltage before proceeding with the rest of this section.

A. Program ROM Diagnostics

The PROG ROM test runs at turn-on. Table A3-1 lists and explains the A2 LED annunciations of test failures. The test sequence follows:

1. Verifies system bus. This is done by echoing data from the FFT board. If the FFT board is not present, the system bus cannot be verified.

2. Verifies ROM bus. The system CPU reads the contents of two locations in the lowest ROM pair and verifies that they are correct. One number is the complement of the other so that all ROM bus lines are toggled. If this test fails, the LED annunciations also indicate whether the system bus was verified.

3. Verifies check ROM. The correct checksum results for all ROMs are stored at designated locations in the last ROM pair. This step reads and verifies the contents of those locations. If this test fails, one or both of the last ROM pair are the likely cause.

4. Checksums high and low bytes of ROM. The checksum results are compared to the correct values stored in memory.

Table A3-1 A2 LED Display Codes

Test Failed	LED Bank	Probable Failure	Other Information
1	87	System Bus failure, high byte	
1	88	System Bus failure, low byte	
1	89	System Bus failure, both bytes	
2	8A	ROM Bus failure, low byte *	System
2	8B	ROM Bus failure, high byte *	bus
2	8C	ROM Bus failure, both bytes *	good
2	7A	ROM Bus failure, low byte	No information
2	7B	ROM Bus failure, high byte	about system
2	7C	ROM Bus failure, both bytes	bus
3	5A	Check ROM failure, low byte	ROM
3	5B	Check ROM failure, high byte	bus
3	5C	Check ROM failure, both bytes	good
4	40 to 53	ROM IC failure, low byte **	
4	20 to 33	ROM IC failure, high byte **	
4	60 to 73	ROM IC failure, both bytes ***	
4	84	ROM ICs, multiple failures high byte	System
4	85	ROM ICs, multiple failures low byte	bus
4	86	ROM ICs, multiple failures both bytes	good
4	8D	No ROM passes checksum, system data bus good; check system address bus.	
4	1F	Program ROM and System Bus tests pass. This is a normal annunciation.	

* This failure code may result from defective A8 U101 or A8 U201 as well as from a ROM data bus problem.

** See table A3-2 to decode IC number.

*** It is unlikely that both ICs in a ROM pair are faulty. The most likely cause of this failure is a faulty IC enable signal.

Table A3-2 ROM Chip Codes

A2 DS3	A2 DS4	Suspect IC	A2 DS3	A2 DS4	Suspect IC
4	0	U101	2	0	U201
	1	U102		1	U202
	2	U103		2	U203
	3	U104		3	U204
	4	U105		4	U205
	5	U106		5	U206
	6	U107		6	U207
	7	U108		7	U208
	8	U109		8	U209
	9	U110		9	U210
	A	U111		A	U211
	B	U112		B	U212
	C	U113		C	U213
	D	U114		D	U214
	E	U115		E	U215
	F	U116		F	U216
5	0	U117	3	0	U217
	1	U118		1	U218
	2	U119		2	U219
	3	U120		3	U220

B. After-Repair Adjustments and Tests

Table A3-3 After-Repair Adjustments and Tests

Perform the following:	Section
Diagnostic Tests:	
Test All	VII
Adjustments:	
None	
Performance Tests:	
None	

8-8 A4 LOCAL OSCILLATOR

The information in this section should be used to isolate faulty subblocks in the A4 Local Oscillator (LO). All procedures assume the Fault Isolation procedures of Section VII have been used to determine which board has failed, and the circuit descriptions of Section VI are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Hazardous voltage and energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3562A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

How to Use This Section

Start The primary troubleshooting method for the LO assembly is to use the self-tests to determine which subblocks and possible components are failing. Signature analysis is then used to troubleshoot the individual subblocks suspected of failing. Start troubleshooting by using part A, "Local Oscillator Diagnostics".

Reference For the component locator and schematic refer to Section IX. For the location of cables and boards refer to figure 4-1 in Section IV.

Verify Use the oscilloscope waveforms in table A4-5 to see correct operation at various test points in the assembly.

After-Repair Use table A4-6 to determine which adjustments and tests need to be done to complete instrument service.

Troubleshooting Hints

1. If the LO functional tests pass, but the 'Output Sine Check' (7-8, part E) fails, start troubleshooting with the LO Output Buffer (U54). This output buffer is not tested by the self-tests.

A. Local Oscillator Diagnostics

When the LO FUNCTN key is pressed, the LO functional self-tests cause the phase accumulator and the sine ROMs to output a value to the A2 System CPU. The system CPU compares the value to a known good value. The tests are executed twice. The first execution of the tests substitutes clock signals (Int Clock) generated in the LO assembly for the external clock (Ext Clock) signals SYNC2 and 10.24 MHz. The second execution of the self-tests uses the external clocks. Perform the LO functional test by pressing the HP 3562A keys as follows:

SPCL
FCTN ..... SERVIC
TEST ..... TEST
SOURCE ..... LO
FUNCTN

Use the following descriptions to help isolate the failure:

1. LO Interface Test

   This test verifies the System Bus Interface subblock by reading data to and from the PIA (A4 U36). If 'LO Interface Test FAILS' is displayed, start troubleshooting with components A4 U36, U32, U33, U37, and U24 in the System Bus Interface Subblock.

   LO Timeout 'messages'

   An LO timeout message can be caused by one of several components failing in the system bus interface, control, and timing circuits. However, the probable cause of the failure is A4 U36, and U37 in the system bus interface or A4 U55, U56, U68, U46, U51, and U14 in the control and timing circuits.

2. Internal and External Clocks

   The external clock test uses the 10.24 MHz clock from the A31 Trigger and the SYNC2 from the A6 Digital Filter (normal operating clocks). The internal clock test substitutes these clocks for clocks generated on the LO assembly. The internal clocks are significantly slower than the external clock signals.

   If the failure message is 'LO Ext Clock Phase Values FAILS', 'LO Ext Clock Output Values FAILS' and the other LO self-tests pass, the external clocks are failing. Start troubleshooting with the SYNC2 and 10.24 MHz input circuits (A4 U75, U68). This failure can also be caused by timing problems throughout the assembly since the external signals are at a higher frequency than the internal signals.

   If the failure message is 'LO Int Clock Phase Values FAILS', 'LO Int Clock Output Values Fails' and the other LO self-tests pass, the internal clocks are failing. If this occurs, the possible failing components are A4 U32 and U36 in the system bus interface, A4 U68, U72, U74, and U75 in the control and timing circuits.

   If the LO Interface Test passes and both the external and internal clock tests fail, the problem is probably not in the system bus interface or the control and timing circuits.

3. Phase Value Failures

The phase value is read from the phase latchs (A4 U23, U27). If the phase value fails, the output value is probably failing too. (However, if the failure message is 'LO Int Clock Phase Values FAILS', 'LO Ext Clock Phase Values FAILS' and the other LO self-tests pass, the possible cause of the failure is the phase latchs A4 U23 and U27, or A4 U47, U52, U32, U36 in the system bus interface.) If the phase value fails, use signature analysis patterns LO DSA PATT 1 and LO DSA PATT 2 (in part B) as follows to isolate the failure:

LO DSA PATT 1

a. Start by checking the phase accumulator outputs (A4 U5).

b. If the phase accumulator output signatures are correct, check A4 U22 and U26.

c. Check A4 U68, U56, and U58 in the control and timing circuits. Then check A4 U19, U31, and U36 pins 2, 3, 4, 10 through 19 in the system bus interface.

d. If any of the signatures in step c are wrong, check the input signals to the components. If the inputs to the components are correct, the failure is most likely caused by the phase accumulator.

LO DSA PATT 2

The phase accumulator feeds its output back to the input. LO DSA PATT 2 breaks this feed back loop. Start by checking the signatures of A4 U11 and U16. Check the signatures of the other components in the phase accumulator by moving forward and back from A4 U11 and U16.

4. Output Value Failures

The output value in the exclusive OR of the SINE and COS outputs which are shifted into the LO output buffers (A4 U41, U42). If the failure message is 'LO Int Clock Output Values FAILS', 'LO Ext Clock Output Values FAILS', and the other LO functional tests pass, the probable cause of the failure is in the sine ROM, interpolator and adder, or the LO output buffers. Check the signatures at the following points using LO DSA PATT 1:

a. A4 TP16 (NDAT), A4 TP23 (SINE), A4 TP24 (COS)

b. Adder Outputs: A4 U39 pins 8, 9, 11, and 12.

c. Sine ROM Outputs: A4 U39 pins 2, 4, 16, and 18

d. Interpolator Outputs: A4 U39 pins 1, 3, 17, 19

NOTE

If the LO functions properly in all modes but fails the output value test, the test circuits may be failing. Check A4 U41, U42, U48, U59, and U69.

B. A4 Signature Analysis Tests

Use these tests to isolate a failure on the LO assembly. Only the components in failing subblocks need to be tested. The symbol '(T)' refers to a signal continually changing between TTL level high and TTL level low.

1. Press the line switch off.

2. Connect the Signature Analyzer as follows:

Table A4-1 A4 Signature Analyzer Setup

Signal	Polarity	Connection
Ground		A4 J1-1
Clock	Positive edge	A4 J1-3
Stop	Negative edge	A4 J1-4
Start	Positive edge	A4 J1-5

3. Press the line switch on.

4. Signature Analysis Test -1 Setup:

   a. Press the keys as follows:

SPCL
FCTN ..... SERVICE
TEST ..... LOOP
ON

..... TEST
SOURCE ..... LO DSA
PATT 1

Table A4-2 A4 Signature Analysis Test #1

LO DSA PATT 1

Signature Analyzer Setup: Refer to table A4-1

+5 V Signature = P43F

Component	Pin	Signature
TP16	—	732U
TP23	—	CP34
TP24	—	OHC3
U5	2	649U
	5	5101
	6	2806
	9	1197
	12	3FFA
	15	9HPU
	16	9H32
	19	PHHC
U13	1	OCP9
	2	66PC
	3	1F81
	4	3PA1
	5	37C8
	6	O42H
	7	O3AO
	11	A35C
	12	882A
	13	3P1H
	14	A13P
	17	756P
U19	2	OFO6
	3	392U
	4	06UC
	5	3CP5
	6	34H8
	7	9631
	8	45FP
	9	C4A9
	12	6022
	13	14U8
	14	698A
	15	AC37
	17	F792
	18	U534
	19	AC37
Δ U20	11	P1A2
	12	9149
	13	P43P
	15	9C68
	16	12C0
	17	2H8P
	18	6C7P
	19	6PA1
U21	12	4373
	13	U981
	14	7F65
	15	0097
	16	OPF4
	17	ASAP
	18	P32O
	19	8197
U22	12	9148
	13	6303
	14	46FU
	15	3CC9
	16	FF39
	17	4795
	18	8964
	19	0U64
U24	11	P83A
	12	HH13
	13	P2F7
	14	HUH9
	15	HOP4
	16	72OH
	17	A1U2
	18	5O95
U25	15	5A75
	16	H2F9
	18	FHH7
	19	69AO

Δ See backdating.

Table A4-2 A4 Signature Analysis Test #1 cont.

Component	Pin	Signature
U26	12	0C91
	13	3069
	14	2271
	15	4C74
	16	UUH4
	17	199A
	18	2278
	19	14UC
U28	11	U793
	12	PFH8
	13	HPF8
	14	6OH9
	15	1195
	16	34H7
	17	8H5H
	18	5H46
Δ U29	11	UH9P
	12	HF11
	13	11C0
	15	6582
	16	P104
	17	4791
	18	09AF
U31	3	8HC6
	6	8U6F
	10	4U0C
	15	1622
U32	11	U21P
	12	0000 (T)
	13	0000 (T)
	14	P43F (T)
	15	P43F (T)
	16	P43F (T)
	17	0000 (T)
	18	0000 (T)
U33	11	P43F (T)
	12	P43F (T)
	13	0000 (T)
	14	0000 (T)
	15	P43F (T)
	16	P43F (T)
	17	0000 (T)

Component	Pin	Signature
U36	2	3UAH
	3	19H7
	4	A616
	6	1903
	7	H1F3
	8	5263
	9	9AA3
	10	111U
	11	P43F (T)
	12	CCHF
	13	5UP0
	14	23H0
	15	4C0A
	16	93A8
	18	8053
	19	23HO
U39	1	50CA
	2	A00F
	3	CH44
	4	1C6P
	5	6FF9
	8	7U57
	9	A5U0
	11	U9U7
	12	911F
	13	CU33
	14	APUA
	15	5188
	16	F68U
	17	2139
	18	P44H
	19	4756
U41	1	45FP
	2	9631
	3	34H8
	4	3CP5
	5	06UC
	6	392U
	7	OFO6
	11	P43F (T)
	12	0000 (T)
	13	0000 (T)
	14	HFP1
	15	C4A9

Δ See backdating.

Table A4-2 A4 Signature Analysis Test #1 cont.

Component	Pin	Signature
U42	1	6961
	2	HOPC
	3	U5A9
	4	84P5
	5	3AU4
	6	O8P4
	7	13AU
	14	C387
	15	C97A
U43	12	AF9P
	13	FH7P
	14	9UO8
	15	4AP2
	16	3422
	17	16H3
	18	4U84
	19	A53U
U44	12	AA1H
	13	6HHH
	14	OF89
	15	6UH9
	16	2157
	17	OA73
	18	84AO
	19	7U65
U48	12	OA5H
	13	A39C
	14	52PH
	15	C7AP
	16	OHUU
	17	OAA9
	18	F6UH
	19	7874
U49	12	553C
	13	569U
	14	2FF3
	15	22A3
	16	7FPF
	17	AAAC
	18	OUO4
	19	UP9H
U53	5	A451
	6	UFAC
U54	2	OP31
	5	A1C7
	6	732U
U55	1	8956
	2	2278
	3	9398
	4	96A7
	5	O6A8
	6	OF8F
	7	2AU6
	9	14UC
	11	4COA
	13	373H
	14	7261
	15	C1PO
	16	8944
U56	1	96A7
	2	9398
	3	2AU6
	4	0F8F
	5	06A8
	6	4C0A
	7	H6UC
	8	8956
	12	8053
	13	1H3U
	14	1625
	15	8P75
	16	5P6P
	17	280C
	18	U192
	19	165H
U58	2	9398
	3	96A7
	4	648H
	5	P732
	6	4UAF
	7	4331
	8	HH5P
	9	64C9
	12	A451
	13	5271
	14	A1C7
	15	0P31
	16	C6UU
	17	6217
	18	9C28
	19	PUP2
U62	5	5271
	6	64CO

Table A4-2 A4 Signature Analysis Test #1 cont.

Component	Pin	Signature	Component	Pin	Signature
U63	2	9C28	U71	2	64C0
	3	64C9		3	P43F
	6	6217		5	CP34
				9	OHC3
U68	2	9398		11	P43F (T)
	3	96A7		12	UFAC
	4	64C9			
	12	FU1H	U72	1	A7A3
	13	2UF6		2	P43F
	14	101U		5	4PUP
	15	648H			
	16	P732	U75	5	A1C7
	17	4UAF		7	OP31
	18	4331		9	C6AH
	19	HH5P			

6. Signature Analysis Test -2 Setup:

   a. Press the keys as follows:

SPCL
FCTN ..... SERVICE
TEST ..... LOOP
ON

..... TEST
SOURCE ..... LO DSA
PATT 2

Table A4-3 A4 Signature Analysis Test #2

LO DSA PATT 2
Signature Analyzer Setup: Refer to table A4-1
+5 V Signature = AFA7

Component	Pin	Signature
U1	2	0831
	5	A46A
	6	A143
	9	8F4A
	12	988F
	15	56P6
	16	5PCA
	19	8F4A
U2	3	AFA7 (T)
	5	F346
	7	16CP
	9	ACH5
	11	7F34
	14	8627
	15	25FA
U3	5	U3CA
	7	7H68
	9	48A0
	11	7F34
U4	4	APU2
	7	52C8
	9	94AP
	12	P27U
U5	2	CH7A
	5	CH7A
	6	CH7A
	9	CH7A
	12	CH7A
	15	CH7A
	16	CH7A
	19	CH7A
U6	2	0UHU
	5	356P
	6	9P67
	9	3845
	12	F6F8
	15	6HF1
	16	60PA
	19	3845
U7	5	U824
	7	5966
	9	8051
	11	APAC

Component	Pin	Signature
U8	5	4F8H
	7	28F8
	9	035U
	11	APAC
U9	4	6494
	7	P380
	9	83UC
	12	P27U
U10	5	1PCC
	7	1A75
	9	U699
	11	14H2
U11	1	A143
	4	C2P2
	9	161P
	10	897A
	13	0U63
U16	1	A037
	4	2A68
	9	06PH
	10	485A
	13	3HFA
U19	12	1CO6
	13	U75F
	14	8U5C
	15	OHOF
	17	0043
	18	CUA7
	19	OHOF
U57	4	4HA4
	7	25FA
	9	PUFH
	12	8PUA
U65	13	8627
	14	A57H

C. Oscilloscope Signal Waveforms

The oscilloscope plots are used for troubleshooting the A4 Local Oscillator. Note that all the measurements are taken with a 10:1 probe. Other notes unique to a measurement are written next to the waveform.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

Table A4-4 LO Signal Waveforms

Probe: 10:1

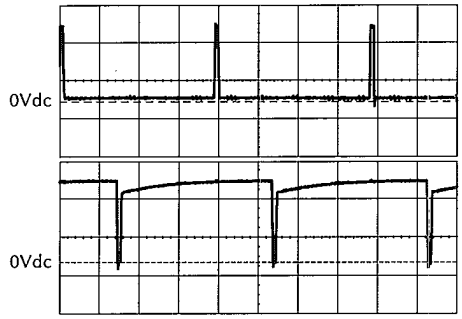
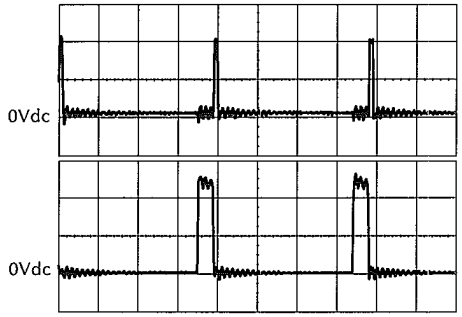
Setup	Important Parameters	Waveform
SYNC2 and COS Connect CH1 to A4 TP8 Connect CH2 to A4 TP24 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 μs/Div Trigger CH1	Time relationship Pulse shapes	 #1
SYNC2 and NLD Connect CH1 to A4 TP8 Connect CH2 to A4 TP17 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 μs/Div Trigger CH1	Time relationship	 #2

Table A4-4 LO Signal Waveforms cont.

Probe: 10:1

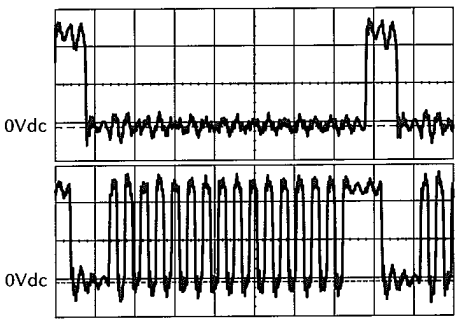
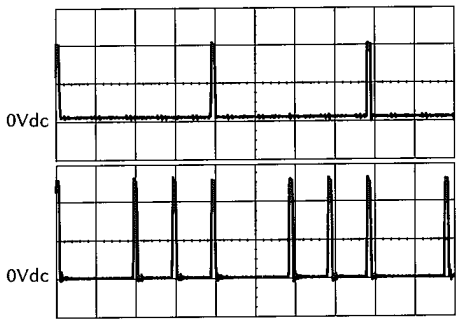
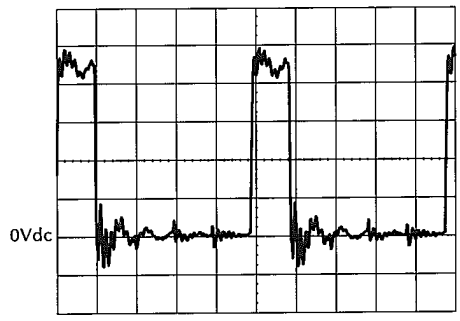
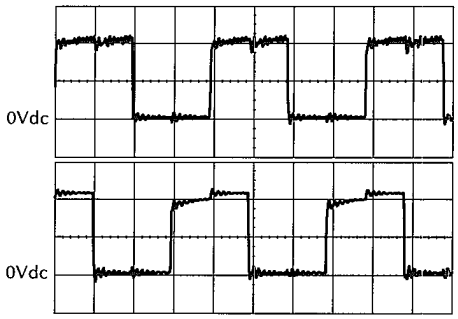
Setup	Important Parameters	Waveform
NLD and NDCK Connect CH1 to A4 TP17 Connect CH2 to A4 TP14 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 500 ns/Div Trigger CH1	Time relationship	 #3
SYNC2 and LDOUT Connect CH1 to A4 TP8 Connect CH2 to A4 TP11 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 μs/Div Trigger CH1	Time relationship	 #4
E Connect CH1 to A4 TP2 Oscilloscope: CH1 V/Div 100 mV/Div CH1 Coupling dc Time/Div 200 ns/Div Trigger CH1	Time	 #5

Table A4-4 LO Signal Waveforms cont.

Probe: 10:1			
Setup		**Important Parameters**	**Waveform**
S1 and S2 Connect CH1 to A4 TP21 Connect CH2 to A4 TP22 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 1 μs/Div Trigger CH1		Time relationship	 #6

D. After-Repair Adjustments and Tests

Table A4-5 After-Repair Adjustments and Tests

Perform the following:	Section
Diagnostic Tests: LO FUNCTN TEST ALL	VII
Adjustments: None	III
Performance Tests: None	II
Operational Verification: None	II

8-9 A5, A6 Digital Filter and Digital Filter Controller

The information in this section should be used to isolate faulty subblocks in the A5 Digital Filter and the A6 Digital Filter Controller. These two boards, referred to as the Digital Filter Assembly (DFA), work together to filter the input signal before it is stored in Global RAM. All procedures assume the Fault Isolation porcedures of Section VII have been used to determine which board has failed and the Circuit Descriptions of Section VI are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Hazardous voltage and energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3562A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

How to Use This Section

Start Begin with troubleshooting hint -1. If the failure is determined to be on the DFA, perform the DFA diagnostic self-tests while keeping track of the subblocks that are verified and the signals that are failing.

Procedure Check the clocks and signals listed in the 'Signal Verification' paragraph. After determining the possible defective subblocks, use signature analysis to isolate the failure.

Reference Refer to Section IX for the component locator and schematic. Refer to figure 4-1 in Section IV for the location of cables and boards.

After-Repair Use table A5-8 to determine which adjustments and tests need to be done to complete instrument service.

Troubleshooting Hints

1. Jumpers are provided to cross-connect the incoming serial bit streams from the ADC boards. Refer to the A5 schematic in Section IX. When A5 J2 and A5 J3 are placed in their test position (T), input data from ADC1 is routed to the channel two digital filter block and input data from ADC2 is routed to the channel one digital filter block. These jumpers may be used to aid in fault isolation.

2. If a channel is continuously overloading, start troubleshooting the Overload Detect subblock on the A5 assembly.

3. If full-span functions correctly but zoom mode fails on both channels, start troubleshooting the LO Signal/Constant Select subblock.

4. If freerun measurements operate correctly, but triggered measurements do not, start troubleshooting the Trigger Control PAL (A6 U409) and the Start/Stop Control PLA (A6 U309).

5. If all the DFA diagnostic tests indicate no failure, yet the instrument still has a problem making a measurement, run the ADC diagnostic called DIGTAL TEST. This test provides data to the DFA from the instrument front end, performs a measurement, and analyzes the results. This allows you to test the input data bit stream from the ADC boards. The key strokes used to access this diagnostic are:

PRESET ..... RESET

SPCL FCTN
..... SERVIC
TEST ..... TEST
INPUT ..... ADC ..... DIGTAL TEST

A. DFA Diagnostics

The diagnostic tests for the Digital Filter Assembly allow you to test groups of circuits to further isolate a problem. A subset of the DFA diagnostic tests run when the nstrument power is turned ON, during SELF TEST, and during TEST ALL. Display the DFA diagnostic test menu using the following sequence of keystrokes:

PRESET ..... RESET

SPCL FCTN
..... SERVIC
TEST ..... TEST PROC
..... TEST DFA

The menu now contains the following entries of DFA diagnostics:

DFA FUNCTN
FILTER TEST
LOCAL BUS
DMA BUS
FILTER BUS
DFA PATT 1
DFA PATT 2

Details of each test follow:

DFA FUNCTN

The DFA function test should be used to test the overall health of the digital filter assembly (A5 & A6). Other diagnostic tests should be used to further isolate problems as described in the following paragraphs.

The DFA functional test performs a zoom measurement on data created by the system CPU and stored in global RAM. The test simulates measuring a 16 kHz square wave with a zoom window 10 kHz wide, centered at 16.5 kHz. The results are processed by the FFT and FPP boards to create a power spectrum. The power spectrum is checked for proper amplitude of the fundamental and noise floor.

This test exercises all circuitry in the DFA except the trigger circuitry in the measurement state machine block and the trigger LED control block on the A6 board. Prior to erforming this measurement, the interrupts used to indicate the end of measurement are tested. If either of the two interrupt tests fail, the zoom measurement is not performed. This rotects against failure of the program to run to completion. When the interrupts are inoperable, the DFA cannot signal the CPU that the measurement is complete and the program waits indefinately.

If the DFA function passes, the following messages are displayed:

DFA Filtered Chan Interrupt	Passes
DFA Unfiltered Chan Interrupt	Passes
DFA Functional Test	Passes

The filtered and unfiltered interrupt tests refer to the types of interrupts used to perform the measurement. Data is transferred from global RAM into the digital filter controller, where it may or may not be filtered, depending on the type of measurement required. There is an interrupt indicating end of measurement for each of the the two cases.

If either of the interrupt tests fail, test the local bus (first) and then the DMA bus with the diagnostic tests of the same name. The descriptions of these tests appear later in this section.

If the DFA functional test fails, begin troubleshooting by running the local bus test; it has to function correctly before anything else can be tested.

If the DFA function test passes, the A5, A6 assemblies are probably functioning correctly with two exceptions: neither the trigger circuitry in the measurement state machine block nor the circuitry in the trigger LED control block on the A6 board are exercised by this test.

If the trigger is failing and the problem has been isolated to the A5, A6 assemblies, start troubleshooting the Trigger Control PAL (A6 U409) and the Start/Stop Control PAL (A6 U309). Other possible problem areas include the AM9513 counter (A6 U109) and the trigger interrupt flag (A6 U303).

If the 'TRIGGERING' or 'MEASURING' LEDs are not functioning correctly, start troubleshooting the Trigger LED Control Subblock.

If at least one channel's functional test passes, the following circuits are probably functioning correctly:

- Global Data Bus Interface for the channel passing the test.
- Global Bus DMA Control except the DMA Controller (A5 U307, U309) for the failing channel.
- The Address Output Registers for the channel passing the test.
- The Digital Filter subblock and associated subblocks on the A5 assembly for the channel passing the test.
- The Parallel Input Control lines associated with the channel passing the test.
- The LO Signal/Constant Select lines associated with the passing channel.
- The A6 assembly except the Command Register and the Start/Stop Control PLA.

FILTER TEST

The filter test should be used, after the DFA functional test is performed, to isolate problems associated with the digital filter blocks on the A5 board. The measurement interrupts are not tested prior to performing this test and the instrument will hang if they do not work correctly.

This test performs the same measurement on the same data as described for the DFA functional diagnostic test except that it uses a constant signal instead of the LO signal for the zoom process. This means that the fundamental signal is outside the zoom window (subharmonics are all that are measured), but the measurement results are predictable to the point that individual bits may be checked .

The results of the filtering are stored in global RAM. The system CPU then performs a checksum on the data and compares it to known values. Errors are reported for bad data from blocks processed by the real and imaginary filter ICs in channels one and two.

If only one of the following fails, start troubleshooting the associated IC in the CHAN 1 Digital Filter or CHAN 2 Digital Filter subblock:

DFA Chan 1 Real Filter
DFA Chan 1 Imag Filter
DFA Chan 2 Real Filter
DFA Chan 2 Imag Filter

If both real and imaginary fail for a given channel, troubleshoot the controller chip or the filter bus interface chip associated with it. The three ICs in the digital filter block of each channel are mounted in sockets and may be switched to verify operation. However, further use of the diagnotic tests is recommended before you begin switching ICs.

If both real or both imaginary filter tests fail, troubleshoot the LO signal selection block on the A5 board.

LOCAL BUS

The local bus test should be used to test the operation of the local data bus and the AM9513 counter in the data point counter block. The local data bus is used by the system CPU to communicate with blocks on both DFA boards. See the block diagrams for the A5, A6 boards in Section VI. On the A6 board these blocks are the interrupts block, the measurement state machine block, and the data pointer block. On the A5 board this bus interfaces to both digital filter busses and the DMA bus.

This test must pass before any other DFA diagnostic self-test can pass. The local bus test uses the AM9513 counter (A6 **U109**) to echo data on the local data bus (LD0 to LD15) through the system data bus interface. The test echos data several times, using a different register in the counter each time. Therefore, the test can tell a bus failure from a counter failure.

Note that, since both DFA blocks exercised in this test (the system interface and the counter) are on the A6 board, the A5 board is not involved in this test other than to demonstrate that bus interface circuits on the A5 board are not inhibiting the bus.

If this test fails, remove the A5 Digital Filter assembly and repeat the test. If the test still fails, start troubleshooting the system data bus interface and data point counter block on the A6 board. If the test passes with the A5 board removed, the failure is on the A5 assembly; replace the A5 assembly and continue with the diagnostic tests.

If a bit passes any of the echos tests, the bus line transmitting that bit is good. If that bit is bad on every test, the bus line is probably defective. Any bit that passes some but not all of the tests indicates a defective counter register.

If this test passes, the following subblocks are probably functioning correctly:

Data Point Counter
System Data Bus Interface
System Address Decoder

DMA BUS

The DMA bus test should be used, after the operation of the local data bus is verified, to test the operation of the interface between the local data bus and the DMA bus and the DMA controller ICs.

This test is similar to the local bus test described previously except that the DMA controller ICs are used to echo data from the system CPU instead of the counter on the A6 board. Refer to the block diagrams in Section VI to visualize the data path. The circuits exercised are the system data interface on the A6 board and the local data/DMA bus interface and DMA controllers on the A5 board.

If this test passes, the following are probably functioning correctly:

Local Data Bus
DMA Bus
Local Data/DMA Bus Interface
DMA controllers

If this test fails and the local bus test passes, the failure is probably in the Global Bus DMA Control or Local Data/DMA Bus Interface. The test message displayed on the screen identifies which of the two should be investigated along with information describing which bit has failed.

FILTER BUS

The filter bus test should be used, after the operation of the local data bus is verified, to test the transfer of data between the digital filter blocks and global RAM.

The filter bus test transfers one word from global RAM, through the digital filter bus, into the digital filter controller IC, and then transfers it back to global RAM. Refer to the block diagrams in Section VI to visualize the data path. This sequence is performed once for each of the two channels. The test checks for either incorrect words or failure to write anything at all.

Failure to write anything, denoted by the message "DFA Chan x Write," indicates a problem with measurement control circuits on A6 or the digital filter control IC corresponding to the channel that failed (the measurement failed to set up). Writing wrong data causes the message "DFA Filter Bus x" to be displayed and indicates a problem with the interface IC associated with the failing channel.

If the filter bus test passes, the following circuits and processes are probably functioning correctly:

Parallel Input Control
Global Bus DMA Control
Global Data Bus Interface
Address Output Registers
Unfiltered channel output of the CHAN 1 and CHAN 2 Filter Controls

NOTE

The message "DFA Filter Bus 1" corresponds to the Chan 1 Digital Filter Data Bus and "DFA Filter Bus 2" corresponds to the Chan 2 Digital Filter Data Bus.

DFA PATT 1

The digital filter pattern test #1 is used for two purposes: with the loop mode off, it is a diagnostic self-test of the digital filter blocks with no inputs; with the loop mode on, it is a signature test for the digital filter data busses and the global data bus interface block. It is intended to be used as follows:

1. Run the diagnostic (loop mode off).

2. If Transient Test #1 fails, perform the test with loop mode on and use the signatures to isolate problems in the output path (from the filter controller IC through the global data bus interface).

3. If Transient Test #1 passes and other transient tests fail, the problem is probably one of the filter ICs. The signature tests cannot be used to verify this, as is explained later in this discussion.

4. Perform the Filter Bus test. If it passes, the problem is probably in a filter IC; switch filter ICs between channels to see if the problem changes channels.

When the test is run **with loop mode off**, the filter ICs execute a test routine that generates five different signals (called transients) within the IC on which measurements are performed. Measurement data is transferred to global RAM through the digital filter busses and the global data bus interface block. The system CPU performs a signature analysis on the data and reports any line with an incorrect signature.

This test allows you to isolate the measurement and data storage processes from the input process. The first four measurements are zoomed (real and imaginary data) and the fifth is baseband (real data, only). Failure messages tell you three things: which of the five tests fail (these are called DFA Transient Tests), which channel and filter IC fail (e.g., CH1 Real Filt), and which bits fail. The filter ICs are duplicate parts mounted in sockets allowing you to switch parts between channels to verify failures.

When the test is run **with loop mode on**, the first transient test (only) is performed, repetitively, so that digital signature analysis may be used to isolate problems in the output path from the filter ICs through the global bus interface to the global bus.

To activate the DFA PATT 1 diagnostic test, move jumper A5 J7 to its test position and press the softkey titled DFA PATT 1.

If this test passes, the following subblocks are probably functioning correctly:

Global Bus DMA Control
Address Output Registers
Global Data Bus Interface
CHAN 1 Digital Filter Data Bus
CHAN 2 Digital Filter Data Bus
CHAN 1 Digital Filter
CHAN 2 Digital Filter

DFA PATT 2

The digital filter pattern #2 diagnostic is a digital signature analysis test. It is used to test the measurement and control circuits on the A6 board. Its use is explained in the signature tables.

B. Signal Verification

Verify the following signals and supply voltages:

1. Check the +5V level at A5 TP5 and the +8V level at A5 U101-7 and A5 U114-7.

2. The phase clocks for channel 1 and channel 2 and their test locations are:

   CH1ϕ1 A5 TP1
   CH1ϕ2 A5 TP2
   CH2ϕ1 A5 TP3
   CH2ϕ2 A5 TP4

   Compare the phase clocks as follows:

   a. The two clocks for each channel should vary between 0 and +8V and should be 90° out of phase. See waveform #1, table A5-1.

   b. Phase clock CH1ϕ1 should be in phase with CH2ϕ1. See waveform #2, table A5-1.

   c. Phase clock CH1ϕ2 should be in phase with CH2ϕ2.

3. Verify the signals CH1SHIFT1 (A5 U401-19) and CH2SHIFT1 (A5 U415-19). (See waveform #3, table A5-1). If each of these signals is a 200 ns pulse at a 256 kHz rate, then the channel 1 and channel 2 digital filters are accepting data. If the digital filters are not accepting data, the pulses occur at a 512 kHz rate.

4. Verify the SYNC2 signal at A5 U401-20 and A5 U415-20 (waveform #4, table A5-1). The SYNC2 signals are only active when the digital filter has accepted a data point.

5. Verify the following bus requests from the filter controls (see waveform #5, table A5-1):

   CH1BR2 A5 U401-47
   CH1BR3 A5 U401-34
   CH2BR2 A5 U415-47
   CH2BR3 A5 U415-34

   If these signals are correct, the filters are asking for the bus.

6. Verify that the MCLK signal (A5 TP20) is changing between TTL levels. This indicates that channel 1 and channel 2 digital filter circuits are being synchronized.

7. Verify that signal CH1IOEN is correct (waveform #6, table A5-1). Verify that signal CH2IOEN is a similar but non-periodic pulse.

8. Verify that signal IRQT5L (A6 U401-6) is changing between TTL levels. This indicates that the interrupt circuits are passing data.

C. Oscilloscope Signal Waveforms

The following table of illustrations are oscilloscope plots of signals to be verified on the A5 and A6 boards. Note that all measurements are taken with a 10:1 probe. Other notes unique to a measurement are written next to the waveform.

Table A5-1 Oscilloscope Signal Waveforms

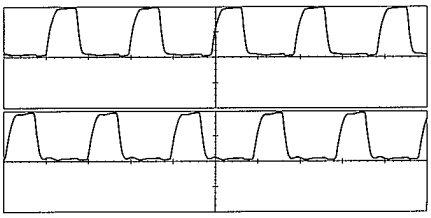
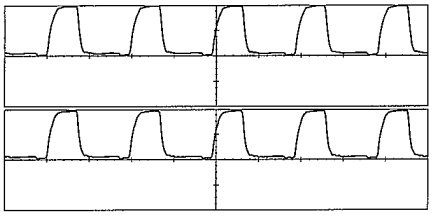
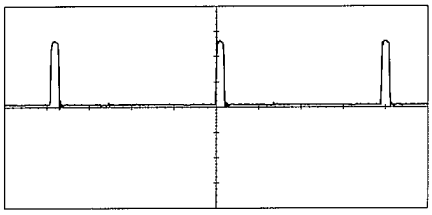
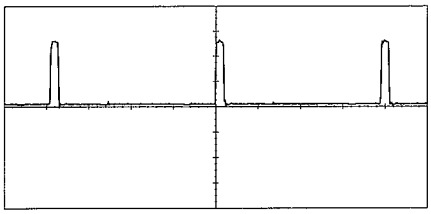
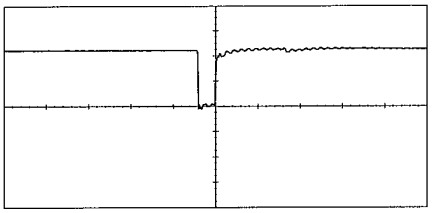
Setup	Important Parameters	Waveform
CH1ϕ1/CH2ϕ2, CH1ϕ2/CH2ϕ2 Channel 1: Connect Ch 1 to A5 TP1 Connect Ch 2 to A5 TP2 Channel 2: Scale 4 V/div Timebase 100 ns/div Offset 0 V Coupling dc	Time Phase Levels	 #1
CH1ϕ1, CH2ϕ1 Connect Ch 1 to A5 TP1 Connect Ch 2 to A5 TP3 Scale 4 V/div Timebase 100 ns/div Offset 0 V Coupling dc	Time Phase Levels	 #2
CH1SHIFT1/CH2SHIFT1 Channel 1: Connect Ch 1 to A5 U401-19 Channel 2: Connect Ch 1 to A5 U415-19 Scale 2 V/div Timebase 1 μs/div Offset 0 V Coupling dc	Time	 #3

Table A5-1 Oscilloscope Signal Waveforms cont.

Setup	Important Parameters	Waveform
SYNC2 Connect Ch 1 to A5 U401-20 Scale 2 V/div Timebase 1 μs/div Offset 0 V Coupling dc		 #4
CH1BR2/CH2BR2, CH1BR3/CH2BR3 Channel 1: Connect Ch 1 to A5 U401-34 or -47 Channel 2: Connect Ch 1 to A5 U415-34 or -47 Scale 2 V/div Timebase 100 ns/div Offset 0 V Coupling dc	Time	 #5
CH1IOEN Connect Ch1 to A5 TP18 Scale 2 V/div Timebase 1 μs/div Offset 0 V Coupling dc	Time	 #6

D. Signature Analysis Tests

The following six signature analysis tests are designed to test circuit blocks of the digital filter assembly. Perform the following steps to configure the 3561A for any of the six tests:

- Disconnect the power cable.
- Put the board under test on an extender card. All jumpers should be in the normal (N) position.
- Connect and configure the signature analyzer as described at the beginning of the test you wish to perform.
- Move jumpers as instructed at the beginning of the test.
- Connect the power cable and turn on power.
- Initiate the DFA PATT test as instructed at the beginning of the test. To put a test in the loop mode, press the SPCL FCTN key, select SERVIC TEST, and press the LOOP menu key to light up ON.

1. Signature Analysis Test A5 #1 System Interface & Control

   a. Put A5J5 and A5J4 in test position. Put A6J2 in test position.

   b. Connect the signature analyzer as follows:

Signal	Polarity	Connection
GND		A5 TP8
START	+	A5 TP13
STOP	−	A5 TP13
CLOCK	+	A5 TP5

   c. Put DFA PATT 1 in Loop Mode

   d. Check the signatures in table A5-2.

Table A5-2 DFA Signature Analysis Test #1

Component	Pin	Signature
+5 v		4CB3
U505	11	8071
	12	AP0A
	13	81C0
	14	FF7H
	15	16F0
U406	2	U7C6
	3	U355
	4	9232
	5	4709
	6	8P7A
	7	4C18
	8	1845
	9	1845
	11	87AP
	12	87AP
	13	9140
	14	87AP
	15	87AP
	16	8325
	17	87AP
	18	83A4
	19	16F0
U411	2	9FAU
	3	08A9
	4	06U2
	5	C970
	6	44UC
	7	65C1
	8	F0A9
	9	4C59
	11	A826
	12	A826
	13	PH9H
	14	PH9H
	15	A826
	16	AA63
	17	A826
	18	AA23
	19	FF7H
U207	12	81C0
	14	HF13
	16	HF13
	17	16F0
U209	12	AP0A
	14	2914
	16	2914
	15	FF7H
U208	13	FF7H
	14	4C63
	15	CP64
	16	16F0
	17	4C63
	18	16F0
U311	14	FC21
	15	53H9
	16	7C0C
	17	P4AU
	18	1A0C
	19	2989
	20	782H
	21	4764
	22	4U19

e. Turn off power. Return all jumpers to normal (N) position.

2. Signature Analysis Test A5 #2 Channel 1 Digital Filters

a. Put J7 in Test Position.

b. Connect the signature analyzer as follows:

Signal	Polarity	Connection
GND		TP8
START	+	A5 TP13 (DSASS)
STOP	+	A5 TP13 (DSASS)
CLOCK	+	A5 U404-1

c. Put DFA PATT 1 in Loop Mode.

d. Check the signatures in table A5-3.

Table A5-3 DFA Signature Analysis Test #2

Component	Pin	Signature
+5 v		6PCP
U401	23	54CA
	24	3C53
	25	911P
	26	7207
	27	CP64
	28	76H1
	29	0738
	30	17C5
	31	34P4
	32	F15P
	45	2595
	53	A0U7
	54	7P05
	55	30P1
	56	C6PF
	57	25AU
	59	2595
	60	2595
	61	2595
	62	2595

e. Return all jumpers to the normal (N) position.

3. Signature Analysis Test A5 -3 Channel 2 Digital Filter

a. Put J7 in Test Position

b. Connect the signature analyzer as follows:

Table A5-4 DFA Signature Analysis Test #3

Component	Pin	Signature
+5 V		6PCP
U415	23	54CA
	24	3C53
	25	911P
	26	7207
	27	CP64
	28	76H1
	29	0738
	30	17C5
	31	34P4
	32	F15P
	45	2595
	53	A0U7
	54	7P05
	55	30P1
	56	C6PF
	57	25AU
	59	2595
	60	2595
	61	2595
	62	2595

e. Return all jumpers to normal (N) position.

4. Signature Analysis Test A5 -4 Channel 1 Global Data Bus Interface

a. Put J7 in test position

b. Connect the signature analyzer as follows:

Signal	Polarity	Connection
GND		TP8
START	+	A5 TP13
STOP	−	A5 TP13
CLOCK	+	A5 TP21

c. Put DFA PATT 1 in Loop Mode.

d. Check the signatures in table A5-5.

Table A5-5 DFA Signature Analysis Test #4

Component	Pin	Signature	Component	Pin	Signature
+5 V		6PCP	U404	13	UUA0
				14	55PH
U304	14	AUP0		15	3A04
	15	5A5A		16	5P5U
	16	790C		17	H852
	17	6986		18	10CC
	18	186U		19	4C11
	19	H0HA		20	FP49
	20	1FC9			

e. Return all jumpers to normal (N) position.

5. Signature Analysis Test A5 -5 Channel 2 Global Data Bus Interface

a. Put J7 in test position

b. Connect the signature analyzer as follows:

Signal	Polarity	Connection
GND		TP8
START	+	A5 TP13
STOP	−	A5 TP13
CLOCK	+	A5 TP22

c. Put DFA PATT 1 in Loop Mode.

d. Check the signatures in table A5-6.

Table A5-6 DFA Signature Analysis Test #5

Component	Pin	Signature	Component	Pin	Signature
+5 V		6PCP	U413	13	UUA0
				14	55PH
U313	14	AUP0		15	3A04
	15	5A5A		16	5P5U
	16	790C		17	H852
	17	6986		18	10CC
	18	186U		19	4C11
	19	H0HA		20	FP49
	20	1FC9			

e. Return all jumpers to normal (N) position.

6. Signature Analysis Test A6 -1 Digital Filter Control

   a. Put J2 in Test (T) position.

   b. Connect the signature analyzer as follows:

Signal	Polarity	Connection
GND		A6 TP3
START	+	A6 TP7
STOP	+	A6 TP7
CLOCK	+	A6 TP5

   c. Put DFA PATT 2 in Loop Mode.

   d. Check the signatures in table A5-7.

Table A5-7 DFA Signature Analysis Test #6

Component	Pin	Signature
+ 5 V		HUHC
U304	1	Toggle
	2	UF43
	3	0H95
	4	12P1
	5	648A
	6	Toggle
	7	Toggle
	8	56A4
	9	Toggle
	11	H24P
	12	Toggle
	13	2398
	14	0H95
	15	3179
	16	49A3
	18	56H7
U406	1	56A4
	2	AFFF
	3	AFFF
	4	FH76
	5	447C
	6	AFFF
	7	AFFF
	8	AFFF
	9	AFFF
U405	1	56A4
	2	8HU8
	3	456C
	4	76H2
	5	07HP
	6	H75A
	7	37F7
	8	1C90
	9	U974
U109	2	7203
	3	4946
	4	0AP1
	5	Toggle
	6	Toggle
	7	Toggle
	8	648A
	9	Toggle
	10	H24P
	11	897U
	34	0AP1
	35	0AP1
	37	C22H
	38	6AU7
	40	255C

Component	Pin	Signature
U107	1	0H95
	2	Toggle
	3	Toggle
	4	H24P
	5	Toggle
	6	Toggle
	7	Toggle
	9	Toggle
	10	0H95
	11	H24P
	12	0H95
	13	0H95
	14	H24P
	15	0H95
U202	9	21C4
	13	0AP1
U203	5	C9FP
U305	5	1604
U207	6	C0HH
	10	P5UU
	15	H28U
U206	3	07C5
	6	0AP1
	8	H28U
U307	6	P884
	9	U01U
	16	U576
U306	2	P5UU
	3	U576
	4	U01U
	5	C9FP
	6	1604
	7	8A3C
	8	C0HH
	12	2726
	13	07C5
	14	2P68
	15	0AP1
	16	6APF
	17	6PU9
	18	H941
	19	67U5

Table A5-7 DFA Signature Analysis Test #6 cont.

Component	Pin	Signature	Component	Pin	Signature
U309	1	0AP1	U303	9	F474
	4	255C		14	49A3
	5	7203	U203	9	3048
	8	H941		13	49A3
	9	07C5	U104	6	49A3
	12	8169		8	49A3
	13	8A3C		11	49A3
	14	H28U			
	15	16P9			
	16	H28U			
	17	8278			
	18	CHCH			
	19	216U			
U308	12	447C			
	13	FH76			
	14	1C90			
	15	37F7			
	16	H75A			
	17	07HP			
	18	76H2			
	19	8HU8			

e. Return all jumpers to normal (N) position.

E. After-Repair Adjustments and Tests

Table A5-8 After-Repair Adjustments and Tests

Perform the following:	Section
Diagnostic Tests: Test All	VII
Adjustments: None	
Performance Tests: None	

8-10 A7 FLOATING POINT PROCESSOR

The information in this section should be used to isolate faulty subblocks in the A7 Floating Point Processor (FPP). All procedures assume the fault isolation procedures of Section VII have been used to determine which board has failed, and the circuit descriptions of Section VI are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Hazardous voltage and energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3562A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

How to Use This Section

Start Start troubleshooting by performing part A, "Initial Conditions Test". The primary troubleshooting method for the FPP is to use the self-tests to determine which subblocks are operating correctly. Signature analysis is then used to troubleshoot individual subblocks suspected of failing.

Reference For the component locator and schematic refer to Section IX. For the location of cables and boards refer to figure 4-1 in Section IV.

Verify Use the oscilloscope waveforms in table A7-8 to verify correct operation at various test points in the assembly.

After-Repair Use table A7-9 to determine which adjustments and tests need to be done to complete instrument service.

Troubleshooting Hints

1. After the power-up tests or reset (A2 S1), the FPP status LEDs should be changing rapidly. If the LEDs are off or the FPP does not respond to any self-tests, the problem is most likely the sequencer, the microcode memory, the ALUs control logic, or the control PALs. Use signature analysis test #4 to isolate the failure (after performing part A).

2. If any board in the HP 3562A has been pulled out of its card nest with the power on, check A7 U504.

A. Initial Conditions Test

1. Disconnect the power cable from the rear panel and remove the top cover. Place the A7 FPP on the 03562-6640 extender board.

2. Connect the power cable and press the line switch on.

3. Check the following for correct value:

Signal	Location	Value
+5S	A7 TP7	+5 ±0.3V
8 MHz	A7 TP3	Refer to waveform #1 (E)
4 MHz	A7 J5-3	Refer to waveform #1 (E)

4. If the +5S is not the correct value, go to paragraph 8-16, "A18 Power Supply Assembly".

5. If the cause of the failure is still not found, go to part B.

B. FPP Diagnostics

The FPP is tested using several self-tests. When a test is initiated, the A2 System CPU loads test data and FPP instructions into the A8 Global RAM (except in the Reset FPP test) and commands the FPP to perform the test. After completing the test, the FPP sends the test results to global RAM and an interrupt (IRQT3L) to the system CPU. Any failed bits and the status of the interrupt are annunciated on the display. Several of these tests are also used in loop mode for signature analysis patterns. Refer to part C for a description of each self-test.

1. To perform the FPP self-tests, press the HP 3562A keys as follows:

PRESET ..... RESET

SPCL FCTN ..... SERVIC
TEST ..... TEST
PROC ..... TEST
FPP

..... FPP
FUNCTN

..... COMAND
POINTR

..... BLOCK
SET

..... ALU
TEST A

..... ALU
TEST B

..... RESET
FPP

NOTE

If a test does not terminate (no message is displayed), press A2 S1 to reset the FPP and continue with the self-tests.

2. If the command pointer test (COMAND POINTR) does not complete, press A2 S1. When the power-up tests are completed, set jumper A7 J2B to test position. Press the HP 3562A keys as follows:

SPCL FCTN ..... SERVIC
TEST ..... TEST
PROC ..... TEST
FPP

..... JUMPER
ECHO

..... JUMPER
ECHO

The FPP status LEDs should display 0000 0001 (0=off, 1=on).

3. Use table A7-1 to determine which signature analysis tests to perform.

Table A7-1 FPP Diagnostics

Test Messages	Passes Subblocks verified	Fails Perform Signature Analysis Tests (D) in order listed
FPP Function Test: Floating Point Processor	All subblocks of the FPP are exercised. If this test passes but an FPP function is failing, perform SA test #2 and #4.	Continue with self-tests
Command Pointer Test: FPP Command Pointer Test Bits correspond to B bus 0 to 15 and Y bus 0 to 23	Command Pointer Registers DTACK Circuit FPP Interrupt Circuit Global Data Bus Output Registers Partial verification of ALUs	SA #1 SA #2 SA #3 SA #4
FPP Interrupt Test	FPP Interrupt Circuit	The FPP did not return IRQT3 to the CPU after running a test. Continue with self-tests.
Jumper Echo Test: FPP Jumper Echo Bits correspond to B bus 0 to 15 and Y bus 0 to 23	Command Pointer Registers DTACK Circuit FPP Interrupt Circuit Global Data Bus Output Registers Partial verification of ALUs	SA #1 SA #2 SA #3 SA #4
Block Set Test: FPP Address Test Bits correspond to B bus 0 to 15	Global Address Registers Global Data Bus Input Registers	SA #1 SA #4
ALU Test A: FPP ALU Test A Bits correspond to Y bus 0 to 23	Partial verification of ALUs	SA #2 SA #3 SA #4
ALU Test B: FPP ALU Test B Bits correspond to Y bus 0 to 23	ALUs Carry Look-ahead subblock Shift PAL (U212) Status Multiplexer (U201) Sequencer	SA #2 SA #3 SA #4
Reset FPP Test: FPP RESET Test	Pipeline Data Bus Partial verification of Sequencer	SA #3 SA #4
If all the self-tests fail, start with signature analysis test #1.		

C. FPP Diagnostics Descriptions

The FPP diagnostics perform the following functions:

1. FPP Function Test

   When the FPP FUNCTN key is pressed, the A2 System CPU loads test data into the A8 Global RAM. The system CPU then commands the FPP to perform a floating point complex multiplication.

2. Command Pointer Test

   The COMAND POINTR key initiates an echo test between the command pointer registers (U505, U506) and the FPP status stored in global RAM. This test verifies the command pointer registers, the DTACK circuit, the FPP interrupt and the global data output registers (U412, U414, U512, U514).

   The system CPU sets up a command stack containing the echo instruction in global RAM. The system CPU then writes the address where the command stack is stored into the command pointer registers. The FPP sends the same address to global Ram using the ALUs and global bus interface circuits. When the FPP is finished with the operation, it sends an interrupt (IRQT3L) to the system CPU. The system CPU tests the FPP status in global RAM and any errors in the status are displayed.

   If the interrupt is not received by the system CPU before a countdown loop is completed, the system CPU tests the FPP status in global RAM. Any errors in the status and an FPP interrupt failure are displayed.

3. Jumper Echo Test

   The jumper echo test is used when the command pointer test does not terminate (no message is displayed). The jumper echo test performs the same test as the command pointer test except the A2 CPU does not load test data in the A8 Global RAM. The jumper echo test is invoked by setting A7 J2B to test position (with the power on) and resetting the FPP. The jumper echo test forces the FPP to perform the echo command. If the command pointer test fails to function, the jumper echo test may function.

4. Block Set Test

   This test uses the 'set constant command' of the FPP to test the global address registers (U510, U511). Complementary patterns are written to global RAM at address locations which differ by one address bit. The system CPU verifies the result. For this test, the global data bus output registers (U412, U414, U512, U514) are assumed to be operating correctly.

5. ALU Test A

   When the ALU Test A key is pressed, patterns are written to the ALUs (U303, U304, U305, U307, U308, U310) and shift PAL (U212). The FPP outputs data to the global RAM which is verified by the system CPU. This test can be run in loop mode by setting A7 J2A and A7 J2B to test position.

6. ALU Test B

   When the ALU Test B key is pressed, the ALUs are thoroughly tested along with the carry look-ahead subblock (U211, U302), the shift PAL (U212), the status multiplexer (U201), and the sequencer (U103).

D. A7 Signature Analysis Tests

Use these tests to isolate a failure on the FPP assembly. Only the components in failing subblocks need to be tested. The term 'toggling' refers to a signal continually changing between TTL level high and TTL level low.

1. Press the line switch off.

2. Put all jumpers in normal (N) position.

3. Connect the Signature Analyzer as follows:

Table A7-2 A7 Signature Analyzer Setup #1

Signal	Polarity	Connection
Ground		A7 J5-1
Clock	Positive edge	A7 J5-3
Stop	Negative edge	A7 J5-4
Start	Positive edge	A7 J5-5

4. Press the line switch on.

5. Signature Analysis Test #1 Setup:

   a. Put jumper A7 J2B in test position with the power on.

   b. Press A2 S1 (reset switch on the A2 CPU). The FPP status LEDs should read 0000 0001 (1 = on, 0 = off). If this test is not stable, use signature analysis tests #3 and #4.

Table A7-3 A7 Signature Analysis Test #1

Jumper Echo Test
Jumpers in test (T) position: A7 J2B
Jumpers in normal (N) position: A7 J1, A7 J2A, A7 J3A, B, C, D, A7 J4, A7 J6A, B, A7 J7, A7 J8, A7 J9A, B
Signature Analyzer Setup: Refer to table A7-2
+5 V Signature = 9515

Component	Pin	Signature
U201	19	Toggling
U209	6	67H9
	7	55FA
	8	6FH9
	9	6FH9
	11	3913
	12	3913
	14	3913
U215	5	0000
U313	12	Toggling
	13	AF06
	14	9515
	15	Toggling
	17	Toggling
	18	0001
	19	9514
U314	13	9514
	14	9514
	15	9515
	16	9515
	17	Toggling
	18	Toggling
	19	Toggling
U401	12	55FA
	13	0A56
	14	9517
	15	55FC
	16	Toggling
	17	9515
	18	Toggling
	19	Toggling
U505	1	FA8A
	12	1471
	13	97HF
	14	F54F
	15	9P32
	16	835C
	17	C988
	18	FF2P
	19	72AA
U506	12	U1U9
	13	5FFF
U506 cont.	14	06A7
	15	U315
	16	5915
	17	0H15
	18	A515
	19	U515
U507	19	Toggling
U412	1	Toggling
	2	1472
	3	U517
	4	A517
	5	0H17
	6	5917
	7	U316
	8	06A5
	9	5FFP
	11	9514
U414	2	UCAP
	3	2H36
	4	F67C
	5	C3HH
	6	890P
	7	9465
	8	9AH3
	9	9H89
U510	11	0001
U512	2	2H35
	3	F67C
	4	C3HH
	5	890P
	6	9467
	7	9AH0
	8	9H89
	9	1P24
U514	2	A431
	3	2761
	4	FF2F
	5	C98A
	6	8359
	7	FCUA
	8	9084
	9	97HP

6. Put all jumpers in normal (N) position.

7. Signature Analysis Test #2 Setup:

   a. . Put jumpers A7 J2A and A7 J2B in test (T) position with the power on.

   b. Press A2 S1. The FPP status LEDs should read 10101010 (1=on, 0=off).

Table A7-4 A7 Signature Analysis Test #2

ALUs Test A
Jumpers in test (T) position: A7 J2A, A7 J2B
Jumpers in normal (N) position: A7 J1, A7 J3A, B, C, D, A7 J4, A7 J6A, B, A7 J7, A7 J8, A7 J9A, B
Signature Analyzer Setup: Refer to table A7-2
+5 V Signature = 5C86

Component	Pin	Signature
U212	1	0001
	2	AC6P
	3	F273
	4	85AU
	5	U484
	6	AC6P
	7	3HAH
	8	C807
	9	A84C
	11	UFFP
	12	97F3
	13	OU3P
	14	A457
	15	5C87
	16	U0P8
	17	5C86
	18	0000
	19	0000
U303	1	97F3
	2	85AC
	3	618U
	4	0P75
	5	618C
	6	0P75
	7	3HAH
	8	6CPA
	9	7CA6
	12	2020
	14	HAC5
	15	85AC
	16	17F8
	17	46C9
	18	17FA
	19	46C9
	20	0U3P
	21	0U38
	22	UFFP
	23	A35U
	24	C270
	25	H51C
	26	C270
	27	160P
	28	76P8
	29	5HA2
U303 cont.	30	4FUF
	31	0000
	32	0001
	33	AC6P
	34	F273
	35	85AU
	37	47HH
	38	CC23
	40	47HH
	41	C807
	42	A84C
	44	3U2A
	45	912A
	46	0F67
	47	A94C
	48	U421
U304	3	618C
	4	0P75
	5	618C
	6	0P75
	10	8133
	12	2026
	14	HAC5
	16	17FA
	17	46C9
	18	17FA
	19	46C9
	21	0U38
	22	UFFP
	23	H51C
	24	C270
	25	H51C
	26	C270
	48	U421

Table A7-4 A7 Signature Analysis Test #2 cont.

Component	Pin	Signature
U305	3	6189
	4	U782
	5	6189
	6	U782
	10	8133
	12	2026
	14	6197
	16	618U
	17	0P75
	18	618C
	19	0P75
	21	0U38
	22	UFFP
	23	2FPP
	24	PUP1
	25	2FPP
	26	PUP1
	48	U421
U307	3	6189
	4	U782
	5	6189
	6	53H5
	10	3A11
	12	2026
	14	6197
	16	618C
	17	OP75
	18	618C
	19	OP75
	21	0U38
	22	UFFP
	23	2FPP
	24	PUP1
	25	2FPP
	26	PUP1
	48	U421
U308	10	8133
	12	2020
	14	6197
	16	6189
	17	U782
	18	6189
	19	U782
	21	0U38
	22	UFFP
	23	5AAA
	24	99A5
	25	5AAA
	26	99A5
	39	P0A5
	40	5C86
	48	U421
U310	10	3A11
	11	Toggling
	12	0000
	14	U484
	16	6189
	17	U782
	18	6189
	19	53H5
	21	5C87
	22	UFFP
	23	5AAA
	24	99A5
	25	5AAA
	26	4C8P
	48	A457

8. Put all jumpers in normal (N) position.

9. Signature Analysis Test #3 Setup:

   a. Put jumper A7 J2A in test position with the power on.

   b. Press A2 S1. The FPP status LEDs should read 1111 0000 (1= on, 0= off).

   c. Put jumpers A7 J1 and A7 J4 in test position. The FPP status LEDs should now read 0011 1111.

Table A7-5 A7 Signature Analysis Test #3

MAP PROM Test
Jumpers in test (T) position: A7 J2A, A7 J1, A7 J4
Jumpers in normal (N) position: A7 J2B, A7 J3A, B, C, D, A7 J6A, B, A7 J7, A7 J8, A7 J9A, B
Signature Analyzer Setup: Refer to table A7-2
+5 V Signature = PFHO

Component	Pin	Signature	Component	Pin	Signature
U209	6	354C	U502	5	7A3F
	7	H837			
	8	99UP			
	11	C5AH			
	12	F636			
	13	PFH0			
	14	PFH0			

10. Put all jumpers in normal (N) position.

11. Signature Analysis Test #4 Setup:

    a. Press the line switch off.

    b. Connect the Signature Analyzer as follows:

Table A7-6 A7 Signature Analyzer Setup #2

Signal	Polarity	Connection
Ground		A7 J5-1
Clock	Positive edge	A7 J5-3
Stop	Positive edge	A7 TP4
Start	Negative edge	A7 TP4

    c. Set jumpers A7 J3A,B,C,D, A7 J6A,B, A7 J7, A7 J8, A7 J9A,B to test (T) position.

    d. Press the line switch on. The FPP status LEDs should read 1111 1111 (1= on, 0= off).

Table A7-7 A7 Signature Analysis Test #4

Sequencer, PROMs, and Control Test
Jumpers in test (T) position: A7 J3A, B, C, D, A7 J6A, B, A7 J7, A7 J8, A7 J9A, B
Jumpers in normal (N) position: A7 J1, A7 J2A, B, A7 J4
Signature Analyzer Setup: Refer to table A7-6
+5 V Signature = 7A70

Component	Pin	Signature
U103	1	P030
	3	4442
	6	0000
	7	7A70
	18	4U2A
	20	0772
	22	9635
	24	1734
	26	8P54
	28	Toggling
	33	H62U
	35	C21A
	37	HA07
	39	H0AA
U104	9	51H2
	10	56U8
	11	41P8
	13	HAP2
	14	U84A
	15	4H76
	16	A29C
	17	PU42
U105	9	70HA
	10	9561
	11	99H0
	13	94A9
	14	C057
	15	F034
	16	AAC3
	17	CU98
U106	9	06C1
	10	13UP
	11	3AHA
	13	UP7C
	14	5C76
	15	CC55
	16	4U7A
	17	36AP
U110	9	H52P
	10	P67U
	11	2443
	13	UP53
	14	51F9
	15	AC1A
	16	PH5P
	17	H4UH
U111	9	28F6
	10	350P
	11	0A71
	13	P674
	14	PA97
	15	2HC0
	16	APU9
	17	4HFA
U112	9	H9P3
	10	9C60
	11	3UC6
	13	CA5A
	14	0U2U
	15	54HA
	16	U51C
	17	AUPP
U113	4	85PF
	5	45F6
	6	F02A
	9	4C4C
	10	H02C
	11	92A8
U114	13	275H
	14	P5AC
	15	F2U6
	16	62PH
	17	2U5H
	18	8P1F
	19	PFU1

Table A7-7 A7 Signature Analysis Test #4 cont.

Component	Pin	Signature	Component	Pin	Signature
U202	9	0F40	U313	13	FFPA
	10	40CF		14	CP3F
	11	48H6		15	7A70
	13	5CP8		17	0000
	14	677H		18	0000
	15	0769			
	16	4PF6	U314	15	7A70
	17	9HC8		16	7A70
U213	2	0797			
	3	7HP7			
	7	2A6H			
	10	7A8H			
	14	2H87			

12. Set all jumpers to normal position.

E. Oscilloscope Signal Waveforms

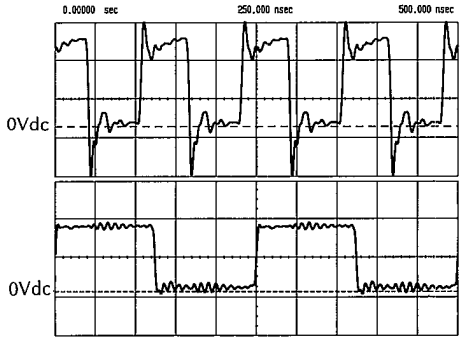
The oscilloscope plots are used for troubleshooting the A7. Note that all the measurements are taken with a 10:1 probe. Other notes unique to a measurement are written next to the waveform.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

Table A7-8 FPP Waveforms

Set all jumpers in normal (N) position
Connect ground to A7 TP6, A7 TP11
Probe type 10:1
Power On

Setup	Important Parameters	Waveform
8 MHz & 4 MHz Connect CH1 to A7 TP3 Connect CH2 to A7 J5-3 Oscilloscope: CH1 V/Div 200 mV/Div CH2 V/Div 200 mV/Div CH1 Coupling dc CH2 Coupling dc Time/Div 50 ns/Div Trigger CH 2	Time	 #1

F. After-Repair Adjustments and Tests

Table A7-9 After-Repair Adjustments and Tests

Perform the following:	Section
Diagnostic Tests: FPP FUNCTN TEST ALL	VII
Adjustments: None	III
Performance Tests: None	II
Operational Verification: None	II

8-11 A8, GLOBAL RAM/DISPLAY CONTROLLER A17, DISPLAY INTERFACE

The information in this section should be used to isolate faulty subblocks on the global RAM and display interface boards. All procedures assume that the fault isolation procedures in section VII have been used to determine that one of these boards has failed and that the circuit descriptions in Section VI are understood.

WARNING

Service procedures described in this section are performed with protective covers removed and power applied. Hazardous voltages in these circuits can cause personal injury if contacted.

CAUTION

Do not insert or remove any circuit board in the HP 3562A while power is on. Power transients caused by insertion or removal may cause damage to circuits on the board being changed or on other boards.

How to use this section

Start Start troubleshooting with part A, Global RAM Diagnostics. Use of this section will isolate the problem to a subblock of A8 or A17.

Reference Refer to Section IX for the component locators and schematics. Refer to figure 4-1 in Section IV for location of cables and boards. Refer to figure 7-4 in Section VII for power-up test codes.

After-Repair Use table A8-10 to determine which adjustments and tests need to be performed to complete instrument service.

Troubleshooting Hints

1. Global RAM or Display Interface problems can blank or garble the display. The following features simplify fault isolation when the display is not functioning properly:

   a. Some diagnostic results are annunciated on the A2 LEDs as well as on the 1345A display. Table A8-1 explains the A2 LED fault codes.

   b. The A2 LEDs will display B7 when the power-up tests and calibration are finished. If this does not occur, refer to section VII, Fault Isolation.

2. The LED at the top of the A8 board (CR1) indicates RFD on the system bus. It is not used to service the A8 board.

A. Global RAM Diagnostics

Disconnect the power cable from the rear panel and remove the top cover. Place the A8 Global RAM on the 03562-66540 extender card. Reconnect the power cord and turn power on. Initiate the Global RAM diagnostic test using the following keystrokes:

PRESET ..... RESET (S8)

SPCL FCTN ..... SERVIC TEST (S2) ..... TEST MEMORY (S2) ..... GLOBAL RAM (S1)

NOTE

If the display is blank or garbled, the softkey menus may be unreadable. Whenever a softkey is used in this section, the softkey number (S1 through S8 from top to bottom) appears in parentheses after the softkey name.

If the GLOBAL RAM test fails, read the test log on the 1345A display and/or the hex code from the A2 LEDs. Use table A8-1 to find the most likely failure or suggested tests to further isolate the problem. Problems in the A8 Display Control section or A17 Display Interface are not detected by the Global RAM test. If the display is blank or garbled but no faults are annunciated on the A2 LEDs or on the display, go to part B, A8/A17 Circuit Block Tests, to further isolate the problem.

Table A8-1 Global RAM Failures

Failure Type	A2 LEDs	Description	Probable Fault Location	Further Tests
—	B7	Power-up tests and calibration done; keys active	—	—
—	B5	Starting Global RAM test	—	—
1	9N	Global data bus failure bit "N"	Global Bus line "N" (GDN) Global Bus Transceivers (A8U609, U610), other assemblies on the global bus	Chapter 7-5-F, Global Bus Test Table A8-9 #8
2	AN	Memory address failure, bit "N"*	A8 U211, U111, U611, U612	B.3.d
3	DN	Repeatable memory failure, bit "N"	Dynamic RAM chip associated with failing bit, GD0 through GD15	—
4	EN	Nonrepeatable memory failure, bit "N"	Dynamic RAM chip associated with failing bit, GD0 through GD15, address circuit, global bus transceivers	—
5	0B	Global RAM refresh failure	Memory Refresh Timer, Arbiter, Refresh Address Counter	B.3.b, B.3.d, B.3.e
—	81	Global RAM all bits failed, both bytes	Memory control circuit, A8 U307, U308	B.3.b, B.3.c, B.3.d, B.3.e
—	82	Global RAM all bits failed, high byte	A8 U610, U307, U308	Table A8-9 #8, #9
—	83	Global RAM all bits failed, low byte	A8 U609, U307, U308	Table A8-9 #8, #9

*If the problem is after the multiplexer, the LEDs will display only one of the two address bits multiplexed to the affected line.

B. A8/A17 Circuit Block Tests

This section includes three groups of tests which will further isolate failures on the A8 and A17 boards. Some of the tests involve signature analysis. The A8 board must be on an extender card for tests 1 and 3.

Test 1, Display Control, tests the Display Direct Memory Access portion of the A8 board. It verifies correct operation of the address and word counters, display refresh counter, and the display controller.

Test 2, Display Interface, covers problems on the A17 board.

Test 3, Global RAM, tests operation of the arbiter, refresh address counter, and memory address sections of A8.

1. Display Control

   a. Display Refresh Timer

   - Turn on power.
   - Using an oscilloscope, check the following clock signals in the Display Refresh Timer circuits block:

Signal	Frequency
CLK	8 MHz
TP3	61 Hz
SYNC	61 Hz

   b. Display Controller

   Check TP5, TP6, and TP7 for the waveforms shown in table A8-9 -1.

   c. Display DMA Address Counters and Drivers

   The following signature analysis test verifies correct operation of the Display DMA circuitry.

   - Connect the signature analyzer according to table A8-2.

Table A8-2 Display Controller Signature Analyzer Setup

Signal	Polarity	Connection
Ground		A8 J1-1
Clock	Negative edge	A8 J1-3
Stop	Negative edge	A8 J1-4
Start	Negative edge	A8 J1-5

- Turn on power.
- Press the 3562A keys as follows:

SPCL FCTN ..... SERVIC TEST (S2) ..... TEST MEMORY (S2) ..... DSPINT TEST 1 (S1)

- Move jumpers A8J3 and A8J4 to the test (T) position.
- Press softkey S6. This initiates freerun DSA. The A2 LEDs should display hex BB.
- Check the Display DMA Address Driver output signatures in table A8-3.

Table A8-3 Display Controller Signature Analysis Test #1

Signal Name	IC (Pin)	Signature
+5	TP2	0001
GA1L	U604(9)	UUUP
GA2L	(8)	5554
GA3L	(7)	CCCA
GA4L	(6)	7F7H
GA5L	(5)	5H20
GA6L	(4)	0AFC
GA7L	(3)	UPFF
GA8L	(2)	52F9
GA9L	U605 (9)	HC88
GA10L	(8)	2H71
GA11L	(7)	HPP1
GA12L	(6)	1292
GA13L	(5)	HAP6
GA14L	(4)	3C97
GA15L	(3)	3826
GA16L	(2)	755P

- If these signatures are correct, proceed to step e, Display DMA Word Counters. If any signatures are incorrect, check the inputs to U604 and U605 as listed in table A8-4.

Table A8-4 Display Controller Signature Analysis Test #2

Signal Name	IC (Pin)	Signature
Address Drivers:		
Inputs:		
	U604(11)	UUUU
	(12)	5555
	(13)	CCCC
	(14)	7F7F
	(15)	5H21
	(16)	0AFA
	(17)	UPFH
	(18)	52F8
	U605(11)	HC89
	(12)	2H70
	(13)	HPP0
	(14)	1293
	(15)	HAP7
	(16)	3C96
	(17)	3827
	(18)	755U

- If the signatures are correct, go to test e, Display DMA Word Counters. If any signatures are incorrect, check the corresponding address counter output. If the signature is correct at the word counter and incorrect at the driver, the problem is a board trace or solder joint. If the signature is also incorrect at the word counter, proceed with step d, Display DMA Address Counters.

d. Display DMA Address Counters

Perform this test only if a failure was found in performing the signature analysis in table A8-4. This test verifies that the address counters are loading correctly. If loading fails, either a data receiver, counter, or board trace is the probable cause of the failure.

- If jumpers A8 J3 and J4 are not in the normal (N) position, turn off power, move jumpers to normal position, and turn power on.

- Press the following key sequence on the HP3562A:

SPCL FCTN ..... SERVIC TEST (S2) ..... TEST MEMORY (S2) ..... DSPINT TEST 1 (S3)

The A2 LEDs should display hex B8.

NOTE

The display will blank during the Display Interface tests and the special function menu will disappear.

- Move jumpers A8J3 and A8J4 to the test (T) position.
- Press softkey S4 (A2 LEDs display B9). This loads a hex A into each of the four display address counters (A8 U600 through U603).
- Probe the output pins of U600 through U603. The output of each counter should be hex A (binary 1010, pins 11, 12, 13, and 14).
- Turn off power.
- Move jumpers A8J3 and A8J4 to the normal (N) position.
- Turn on power.
- Press the 3562A keys as follows:

SPCL FCTN . . . . . SERVIC TEST (S2) . . . . . TEST MEMORY (S2) . . . . . DSPINT TEST 1 (S3)

A2 LEDs should display hex B8

- Move jumpers A8J3 and A8J4 to the test (T) position.
- Press softkey S5 (A2 LEDs display BA). This loads a hex 5 into each of the Display Address Counters (U600 through U603), toggling each bit from the previously loaded hex A.
- Probe the output pins of U600 through U603. The output of each counter should be hex 5 (binary 0101, pins 11, 12, 13, and 14).
- Turn off power.
- Move jumpers A8J3 and A8J4 to the normal (N) position.

e. Display DMA Word Counters

- Check U501 pin 15 (TCL). The signature should be 6U29. If this signature is incorrect, check the signatures in table A8-5. If any word counter signatures are incorrect, verify that data is getting to the counter inputs and that the signal WLOADL is toggling.

Table A8-5 Display Controller Signature Analysis Test #3

Signal Name	IC (Pin)	Signature
Word Counter Outputs:		
	U400(15)	P762
	(14)	UUUP
	(13)	5554
	(12)	CCCA
	(11)	7F7H
	U401(15)	6F9C
	(14)	5H20
	(13)	0AFC
	(12)	UPFF
	(11)	52F9
	U501(14)	HC88
	(13)	2H71
	(12)	HPP1
	(11)	1292

- Turn power off.
- Move jumpers A8J3 and A8J4 to normal (N) position.

f. If these tests pass, the cause of failure is probably on the A17 Display Interface board.

2. Display Interface

Because of the relative cost of the A17 board and troubleshooting time, it is recommended that this board be replaced if defective.

3. Global RAM

a. Setup for Global RAM tests

- Turn off power.
- Move A8J5, J6, J7, J8, and J9 to test (T) position. Jumper J5 disconnects the memory request lines from the arbiter and routes the output from the refresh address counter into the arbiter. This generates every possible combination of requests to the arbiter. The other jumpers affect various control lines (see schematic, figure 9-A8a).
- Connect the signature analyzer according to table A8-6.

Table A8-6 Global RAM Signature Analyzer Setup

Signal	Polarity	Connection
Ground		A8 J2-1
Clock	Negative edge	A8 J2-3
Stop	Negative edge	A8 J2-4
Start	Negative edge	A8 J2-5

- Turn on power.

b. Memory Refresh Timer

- Set up equipment as described in part 3.a above.
- Using an oscilloscope, check the waveforms at the following locations:

Location	Waveform
U405(3)	BUS EN 2, table A8-9 #6
U405(5)	1.06 MHz square wave
U404(14)	1.06 MHz square wave
U404(4)	118 kHz positive pulses
U404(11)	118 kHz negative pulses

c. Global Timing

- Set up equipment as described in part 3.a above.
- Using an oscilloscope, check the following signals in the global timing circuit block:
  - B2GDSL table A8-9 #5
  - GDSL table A8-9 #5
  - GSMP table A8-9 #6

If any of these signals are incorrect, check the inputs (pin 1) and tapped outputs of the delay lines (U311, U312, and U411) for 2.13 MHz square waves.

d. Refresh Address Counters/Memory Address Drivers

- Set up the equipment as directed in section 3.a above.
- Check the signatures in table A8-7.

Table A8-7 Global RAM Signature Analysis Test #1

Signal Name	IC (Pin)	Signature
+5		CC34
Counter Outputs:		
C0	U512(16)	96PF
C1	(15)	725C
C2	(14)	P5PH
C3	(13)	5CP0
C4	U511(16)	7P25
C5	(15)	85PA
C6	(14)	77F7
C7	(13)	6PCP
Memory Address Drivers:		
C0	U111(13)	96PF
C1	(2)	725C
C2	(5)	P5PH
C3	(9)	5CP0
C4	U211(9)	7P25
C5	(12)	85PA
C6	(5)	77F7
C7	(2)	6PCP
MA0	U111(11)	2HH8
MA1	(3)	F96U
MA2	(6)	5PH9
MA3	(8)	P0H4
MA4	U211(8)	F511
MA5	(11)	3PHP
MA6	(6)	FFU3
MA7	(3)	H58A
Memory Address lines:		
MA0*	U110(5)	2HH8
MA1*	(7)	F96U
MA2*	(6)	5PH9
MA3*	(12)	P0H4
MA4*	(11)	F511
MA5*	(10)	3PHP
MA6*	(13)	FFU3
MA7*	(9)	H58A

* These eight signatures should be the same for corresponding pins on U103 through U109 and U203 through U210.

e. Arbiter

- Set up equipment as directed in section 3.a. above.
- Verify that the outputs of U508 (pins 12 through 18) are all high (J5 disables U508).
- Check the clock signals for U506 and U507. The correct waveforms are shown in table A8-9 #6.
- Check the signatures in table A8-8:

Table A8-8 Global RAM Signature Analysis Test #2

Signal Name	IC (Pin)	Signature
IDLE	U509(2)	6493
MGB2D2L	(3)	7820
MGFPP	(4)	CPA9
MG68L	(5)	31H6
MGDF1	(6)	9502
MGDF2L	(7)	0CC1
MGFFT	(8)	96PF
MGRFSHL	(9)	20A7
MGRFSH	(11)	20A7
MGFFTL	(12)	96PF
MGDF2	(13)	0CC1
MGDF1L	(14)	9502
IMG68L	(15)	31H6
MGFPPL	(16)	CPA9
MGB2D2	(17)	7820
IDLEL	(18)	6493
Priority Decoder outputs:		
YA	U506(19)	2HH8
YB	(18)	2P36
YC	(17)	C085
YD	(16)	9C93
YE	(15)	F314
YF	(14)	059H
YG	(13)	8AP2
YH	(12)	HUA7

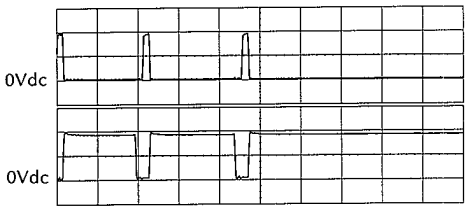
C. Oscilloscope Signal Waveforms

The oscilloscope plots are used for troubleshooting the A8 Global RAM board. Note that all measurements are done with a 10:1 probe. Other notes unique to a measurement are listed next to the waveform.

Table A8-9 Global RAM Signal Waveforms

TP7, TP5 & 6

All jumpers in normal (N) position.
Power on.

Setup	Important Parameters	Waveform
Connect Ch1 to A8 TP7 Connect Ch2 to A8 TP5 or TP6 Scale 2 V/div Timebase 2 µs/div Offset 2 V Trigger Ch 1 Coupling dc	Time Polarity	 #1 This series of pulses repeats every 16.4 ms.

B2D2 DSA STOP/START

Power on.
Press the following HP 3562A key sequence:

SPCL FCTN ..... SERVIC TEST (S2) ..... TEST MEMORY (S2) ..... DSPINT TEST 1 (S3)

Move jumpers A8 J3 and J4 to test (T) position.

Press softkey S6.

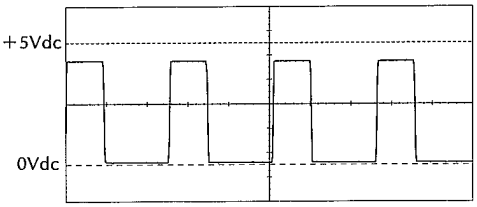
Setup	Important Parameters	Waveform
Connect Ch 1 to A8 J1(4) Scale 1 V/div Timebase 200 ms/div Offset 2 V Trigger Ch 1 Coupling dc	Time	 #2

Table A8-9 Global RAM Signal Waveforms cont.

#3 — #9

Power off.
Jumpers A8 J3 and J4 to normal (N) position.
Jumpers A8 J5, J6, J7, J8, and J9 to test (T) position.
Power on.

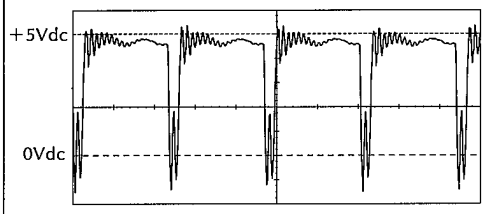
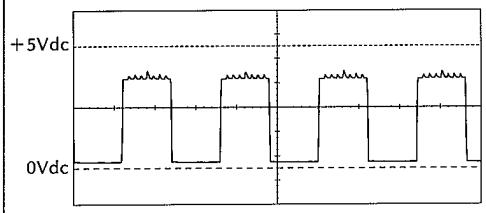
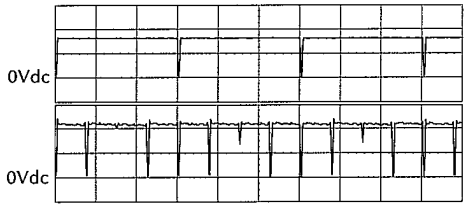
Setup	Important Parameters	Waveform
GRAM DSA CLOCK Connect Ch1 to A8 J2(3) Scale 1 V/div Timebase 200 ns/div Offset 2 V Trigger Ch 1 Coupling dc	Time	 #3
GRAM DSA STOP/START Connect Ch 1 to A8 J2(4) Scale 1 V/div Timebase 50 µs/div Offset 2.5 V Trigger Ch 1 Coupling dc	Time	 #4
B2GDSL, GDSL Connect Ch 1 to U301(8) Connect Ch 2 to U306(8) Scale 2 V/div Timebase 5 µs/div Offset 2 V Trigger Ch 1 Coupling dc	Time	 #5

Table A8-9 Global RAM Signal Waveforms cont.

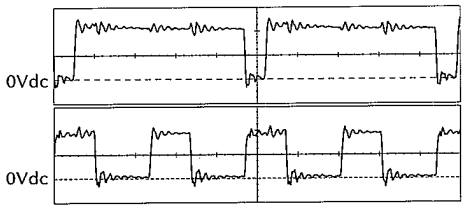
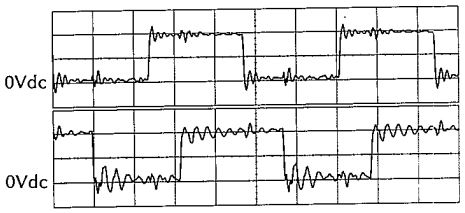
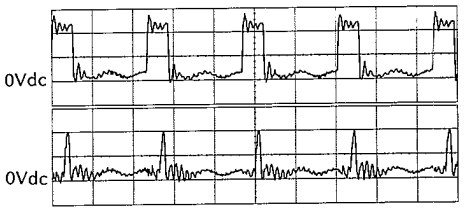
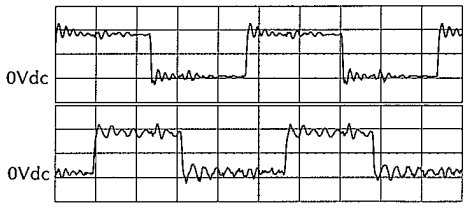
Setup	Important Parameters	Waveform
BUS EN 2, GSMP Connect Ch 1 to U409(8) Connect Ch 2 to U309(3) Scale 2 V/div Timebase 100 ns/div Offset 2 V Trigger Ch 1 Coupling dc	Time Time relationship	 #6
MRAS, MCAS Connect Ch 1 to U307(2) Connect Ch 2 to U308(4) Scale 2 V/div Timebase 100 ns/div Offset 2 V Trigger Ch 1 Coupling dc	Time Time relationship	 #7
CD, RAMGR/GWL Lower byte: Connect Ch 1 to U609(9) Connect Ch 2 to U609(11) Upper byte: Connect Ch 1 to U610(9) Connect Ch 2 to U610(11) Scale 2 V/div Timebase 200 ns/div Offset 2 V Trigger Ch 1 Coupling dc	Time Time relationship	 #8

Table A8-9 Global RAM Signal Waveforms cont.

Setup	Important Parameters	Waveform
RASLL/RASUL, CASLL/CASUL Lower byte (RASLL, CASLL): Connect Ch 1 to U103(4) Connect Ch 2 to U103(15) Upper byte (RASUL, CASUL): Connect Ch 1 to U203(4) Connect Ch 2 to U203(15)9 Scale 2 V/div Timebase 100 ns/div Offset 2 V Trigger Ch 1 Coupling dc	Time Time relationship	 #9

D. After-Repair Adjustments and Tests

Table A8-10 After-Repair Adjustments and Tests

Perform the following:	Section
Diagnostic Tests: Test All	VII
Adjustments: None	
Performance Tests: None	

8-12 HP 1345A DISPLAY

The HP 1345A display is a stand alone digital display. Use the HP 1345A service manual included with the instrument to service the display. To verify the display is failing, set jumper A17 W1 to the test (T) position. The pattern displayed should be the same as shown in figure D-1. To remove the display from the instrument perform steps 1 through 8:

1. Disconnect the main power cord from the rear panel and remove the top cover.
2. Remove the internal shield covering the display unit.
3. Remove the trim strips from the front frame.
4. Remove the front frame and side panel screws as shown in figure D-2.
5. Remove the screws that attach the display to the instrument as shown in figure D-2.
6. Remove the two screws attaching the display adjustments to the rear panel of the instrument.
7. Disconnect the display power cable (W11).
8. Disconnect the display interface cables (W14, W190, W191, W192). The display can now be pulled from the front of the instrument.

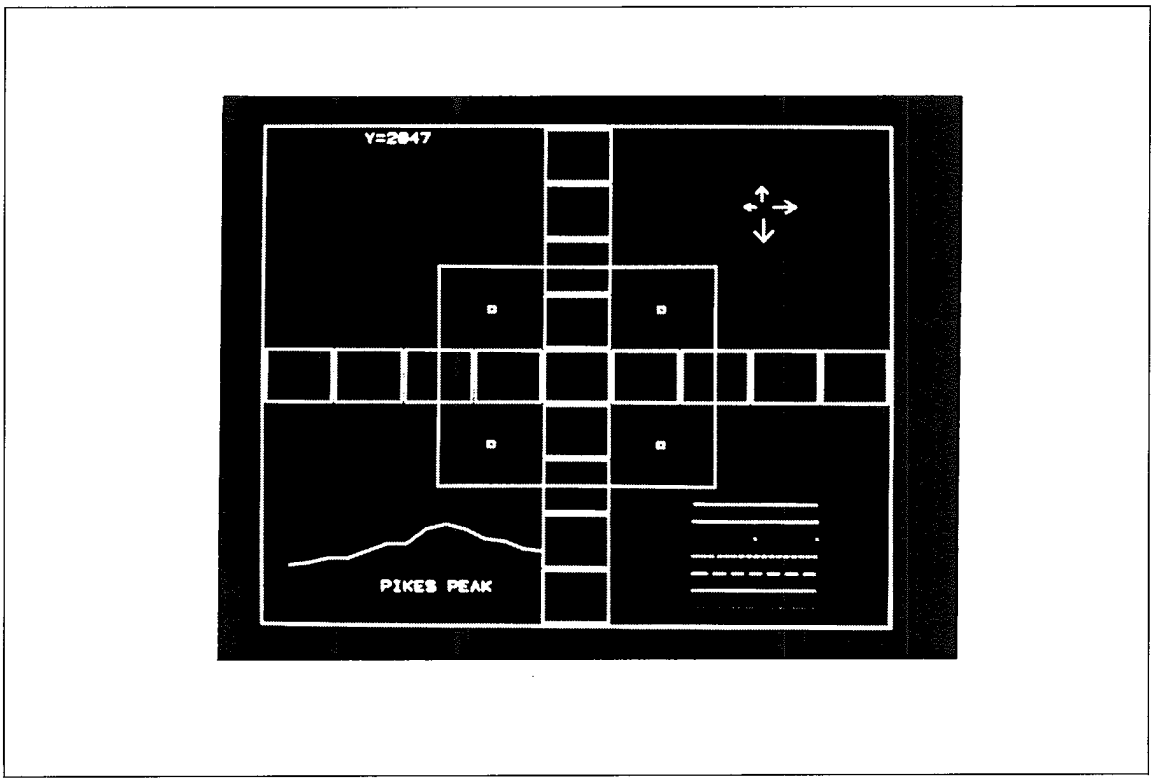


Figure D-1 Display of Verification Pattern

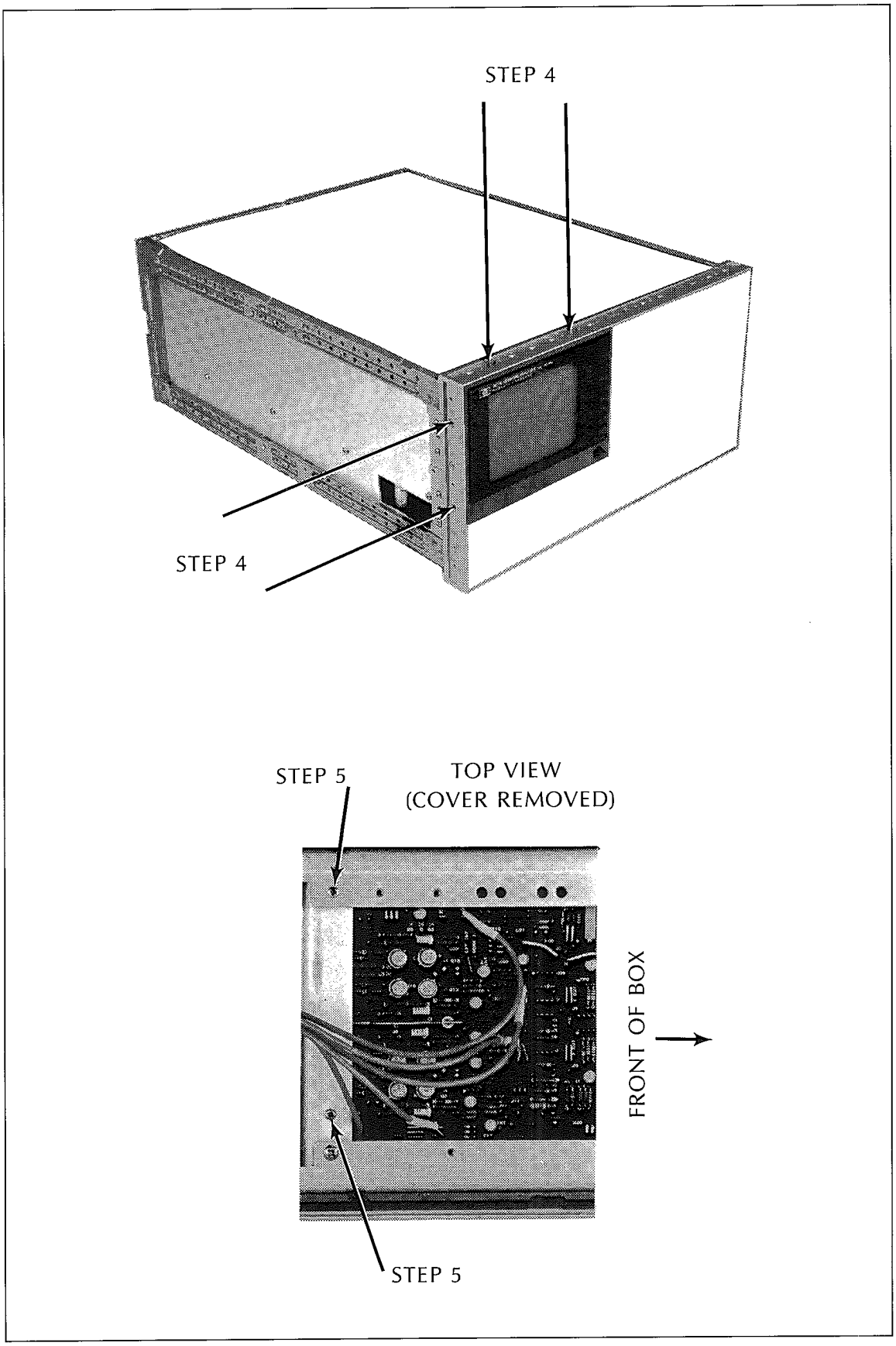


Figure D-2 HP 3562A Removal

8-13 A9, FAST FOURIER TRANSFORM (FFT) PROCESSOR

The information in this section should be used to isolate faulty subblocks on the FFT board. All procedures assume that you have used the fault isolation procedures in Section VII to determine that this board has failed and that you have read and understand the circuit descriptions in Section VI.

WARNING

Service procedures described in this section are performed with protective covers removed and power applied. Hazardous voltages in these circuits can cause personal injury if contacted.

CAUTION

Do not insert or remove any circuit board in the HP 3562A while power is on. Power transients caused by insertion or removal may cause damage to circuits on the board being changed or on other boards.

How to use this section

Start To troubleshoot the FFT board, use the FFT diagnostic tests to further isolate the problem. Circuit descriptions in Section VI provide the background for understanding how the FFT board circuits work.

Procedure Once the problem has been localized to a block of circuits, one of the three digital signature analysis (DSA) tests should be used to troubleshoot individual circuits. Waveforms are provided in table A9-7 to demonstrate the correct appearance of the DSA clock and start/stop signals.

Reference Refer to Section IX for the component locator and schematic. Refer to figure 4-1 in Section IV for the location of cables and boards.

After-Repair Use table A9-8 to determine which adjustments and tests need to be done to complete instrument service.

Troubleshooting Hints

1. The FFT status LEDs should be OFF during normal operation. They are not used to service the board.

2. A major portion of the FFT process is addressing. Be sure you understand which parts of the circuit are part of the addressing block. Refer to the block diagrams in the circuit descriptions in Section VI.

A. FFT Diagnostics

The diagnostic tests for the FFT board allow you to test groups of circuits to further isolate a problem. A subset of the FFT diagnostic tests run when the instrument power is turned ON, during SELF TEST, or during TEST ALL. Display the FFT-diagnostic test menu using the following sequence of keystrokes:

PRESET ..... RESET

SPCL FCTN ..... SERVIC TEST ..... TEST PROC ..... TEST FFT

The menu now contains the following entries of FFT diagnostics tests:

FFT FUNCTN
FFT STATUS
FFT INTRPT
FFT RAM
FFT ROM
FFT GL INTFC

Details of each test follows:

FFT FUNCTION TEST

This test performs all the tests found in the rest of the menu (status, interrupt, RAM, ROM, and global interface tests). It also exercises the FFT functions by performing a forward and a reverse FFT, and Hanning, uniform, flattop, and user-defined windows on a known block of data. The resulting checksum is compared to a known value by the CPU.

If the FFT function test fails but the analyzer appears to work correctly when analyzing a fixed sine signal and all the rest of the diagnostic tests for this board pass, investigate the pseudorandom number generation block. It is reset prior to doing the math for the special functions of this test so that the resultant checksum is repeatable. If the PRN generator is not reset or does not operate correctly, the checksum generated won't always agree with the stored checksum.

The FFT function test is the most extensive diagnostic test available to test the FFT board. It is executed as a subset of the tests performed whenever the SELF TEST and TEST ALL tests are run.

FFT STATUS TEST

This test quickly checks the operation of the system bus operation between the CPU and the FFT boards. The CPU addresses the FFT board and loads a command to it which causes the FFT microprocessor to return the CPU command data. This tests the system interface circuits (in both directions), the internal data bus, the FFT microprocessor system, the transceiver between the TMS320 microprocessor and the internal data bus, and both interrupt circuits. If this test passes you know that the CPU can talk to the FFT microprocessor and the FFT microprocessor can interpret commands and respond (talk) to the system CPU.

FFT INTERRUPT TEST

This test checks the ability of the FFT board to interrupt the main system CPU and exercises the addressing and global bus circuits. The CPU interrupt must occur within a limited time. Two results are listed if this test is successful: the timeout test (called the "Interrupt Registered" results) and the exercise routine results (called the "FFT Interrupt" results). The test runs as follows:

1. The system CPU (A2) loads a command into a register on the FFT board and starts a timer.

This action utilizes the system bus interface circuits and the FFT interrupt circuit on the FFT board.

2. The FFT microprocessor system interprets the command,

3. stores two numbers (5555H and AAAAH) in the scale factor registers in global RAM and

4. activates the CPU interrupt.

This action utilizes the FFT addressing circuitry, the global bus address and data interface circuits, and the CPU interrupt circuit on the FFT board.

5. If the system CPU receives the interrupt from the FFT board before the end of the timer cycle, the "FFT Interrupt Registered" test passes.

6. The CPU checks the numbers stored in RAM against a known number. If the numbers are identical, the "FFT Interrupt" test passes.

FFT RAM TEST

This test is a self-test run by the TMS320 FFT microprocessor on its own internal RAM. The test program resides in ROM in the FFT microprocessor system. The system CPU addresses the FFT board and loads a command to run the RAM test. After the test is complete the FFT board interrupts the system CPU and passes the test results (pass or fail) back to the CPU.

The system interface and both the FFT and CPU interrupt circuits are exercised as a by-product of this test.

FFT ROM TEST

Each of the program and coefficient ROMs have a checksum number in the last byte. When the ROM test is run the system CPU reads the ROMs, generates its own checksum and compares it with the checksum stored in the program and coefficient ROMs.

To read the contents of the FFT ROMs, the CPU sends instructions to the FFT board causing it to place the ROM contents, one word at a time, into a specific location in global RAM where the CPU can access the data. The FFT board changes contents of another location of global RAM to zero each time it completes the transfer of a word. The CPU monitors this second location for an indication of valid data in the first location.

The system and global interface blocks are exercised as a by-product of this test.

GLOBAL INTERFACE TEST

This tests moves (copies) a block of data from one area of global RAM to another area. It exercises both interrupt circuits and the address circuitry besides testing the global interface circuits.

The CPU instructs the FFT to do a block move, waits for the FFT to signal that it has finished the process, and then compares values of the two areas of RAM to determine whether the data copied is identical to the original data.

B. A9 Signature Analysis Tests

There are three digital signature tests designed to test the digital circuits on the FFT board. These tests are referred to by number as tests 1, 2, and 3.

Test 1 tests the program ROMs (U301 and U303) and, to a limited extent, the TMS320 microprocessor. See table A9-2 for the signatures of test 1. With J3 and J4 in the test position (marked with a "T") the ROM output lines are disconnected and the TMS320 data lines are grounded. This test may be used to test the input and output signals of the ROM integrated circuits. The operation of the microprocessor is partially verified by this test because the address line outputs of the TMS320 are identical to the ROM input lines.

Test 2 may be used to test most of the circuits on the FFT board. The only exceptions are the global bus interface circuits. These require a special clock and are covered in test 3.

Test 3 may be used to test the global bus interface circuits (U511 through U516) and the coefficient ROM outputs (U315 and U317). This test uses the memory grant signal on test point 3 as a clock. See the table for test 3.

Perform the following steps to configure the instrument for any of the three digital signature tests:

- Disconnect the power cable.
- Put the FFT board on an extender card. All jumpers should be in the normal (N) position.
- Select the signature test you wish to perform.
- Connect and configure the signature analyzer as described in the table at the beginning of the test you wish to perform.
- Connect the power cable and turn on power.

1. Digital Signature Test 1

Table A9-1 FFT Signature Analyzer Setup #1

Signal	Polarity	Connection
Ground		A7 J5-1
Clock	Neg edge	A7 J5-3
Stop	Neg edge	A7 J5-4
Start	Pos edge	A7 J5-5

Test 1 is activated by performing the following steps:

a. Move jumpers J3 and J4 to the test (T) position.

b. Move jumper J1 to the TST2 position.

c. Press the reset switch on the CPU board (A2 S1).

Table A9-2 FFT Signature Analysis Test #1

Component	Pin	Signature	Component	Pin	Signature
U301 and U303 address (input) lines	8	H62U	U303 only; data (output) lines	9	366P
	7	C21A		10	2UFH
	6	HA07		11	F7A2
	5	H0AA		13	O51O
	4	P030		14	O637
	3	4442		15	2AA9
	2	4U2A		16	CAPA
	1	0772		17	O442
	23	9635			
	22	1734			
	21	8P54			
U301 only; data (output) lines	9	8551			
	10	91CO			
	11	3COC			
	13	U6H7			
	14	6P56			
	15	29C5			
	16	CFPC			
	17	A484			

Return all jumpers to the normal (N) position (either position OK for J1).

2. Digital Signature Test 2

Table A9-3 FFT Signature Analyzer Setup #2

Signal	Polarity	Connection
Ground		A7 J5-1
Clock	Neg edge	A7 J5-3
Stop	Neg edge	A7 J5-4
Start	Pos edge	A7 J5-5

Test 2 is activated by performing the following steps:

a. Move jumper J2 to the test (T) position.

b. Move jumper J1 to the TST1 position.

c. Press the reset switch on the CPU board (A2 S1).

Table A9-4 FFT Signature Analysis Test 2

Signal name	IC (pin)	Signature
TMS320 data lines:		
D0	U103(26)	31HP
D1	(25)	F8F2
D2	(24)	O6FO
D3	(23)	OO1P
D4	(22)	U7P8
D5	(21)	52O4
D6	(20)	O746
D7	(19)	118O
D8	(11)	9376
D9	(12)	P682
D10	(13)	349C
D11	(14)	O53U
D12	(15)	UA51
D13	(16)	HPH7
D14	(17)	FO91
D15	(18)	77HP
Internal data bus:		
IDB0	U503(18)	31HP
IDB1	(14)	F8F2
IDB2	(16)	O6FO
IDB3	(17)	OO1P
IDB4	(15)	U7P8
IDB5	(11)	5204
IDB6	(13)	O746
IDB7	(12)	1180
IDB8	U403(18)	9376
IDB9	(17)	P682
IDB10	(16)	349C
IDB11	(15)	O53U
IDB12	(14)	UA51
IDB13	(13)	HPH7
IDB14	(12)	FO91
IDB15	(11)	77HP

Signal name	IC (Pin)	Signature
Port decoder inputs:		
	U216(1)	1894
	(2)	O8O6
	(3)	9271
	(6)	P23A
	(4)	A712
	(5)	3P7P
	U217(1)	1894
	(2)	O8O6
	(3)	9271
	(6)	P23A
	4)	O865
Port decoder outputs:		
SIRQSYSL	U216(15)	P23A
GDBOUTL	(14)	OHPC
	(13)	29FF
SDBUSOUTL	(12)	P23A
LDHWCRL	(11)	O8O7
LDCTR2L	(10)	5P63
LDPGSL	(9)	PC2U
	(7)	P23A
RIRQSYSL	U217(15)	P23A
GDBINL	(14)	2465
PROMINL	(13)	9CAU
SDBUSINL	(12)	P23A
SABUSINL	(11)	P23A
	(10)	P23A
CLRSCALEL	(9)	AH5F
BFSUBADL	(7)	U8F9

Table A9-4 FFT Signature Analysis Test 2 cont.

Signal name	IC (pin)	Signature
I/O Sequencer:		
SEQSEL0	U117(9)	OCA9
SEQSEL1	(8)	A107
REALDATA	(7)	OCO3
TWOCH	(6)	171A
GDINEMPTY	(5)	6476
GDOUTRDY	(4)	PUH1
PASSDONE	(3)	6O52
DIDONE	(2)	A7C1
FFTMR	(27)	*
FFTMG	(26)	*
WINLOC	(25)	7O3P
PASSBIT0	(22,10)	14AA
CTR1ENL	(21,13)	4POA
	(20)	P23A
	(1)	OOOO
	(19)	PA3H
WINDPGL	(17)	FU43
FFTWR	(16)	9758
POSTINCL	(15)	15FU
REQGBL	(12)	3176
LDCAL	(11)	3H4O
* use test 3 for signatures of these signals		
Sequence decoder:		
SEQSEL1	U115(1)	A1O7
SEQSEL0	(2)	OAC9
CTR2DNL	(3)	8C22
CTR1ENL	(4)	4POA
POSTINCL	(5)	15FU
CLKOUTL	(6)	OOOO
REQGBL	(7)	3176
FFTWR	(8)	9758
CTRB11	(9)	8OUA
W11	(11)	2U78
CLRRDYL	(19)	P8PO
CLREMPTYL	(18)	7228
FA11	(17)	H351
INC1L	(15)	4348
DEC2L	(14)	U42A
INC2L	(13)	A2AH

Signal name	IC (Pin)	Signature
Hardware Control Registers:		
IDB15	U406(2)	77HP
IDB14	(3)	FO91
IDB13	(4)	HPH7
IDB12	(5)	UA51
IDB11	(6)	O53U
IDB10	(7)	349C
IDB9	(8)	P682
IDB8	(9)	9376
LDHWCRL	(11)	O8O7
WINLOC	(19)	7OP3
BNKSEL	(18)	AAF4
SWAP	(17)	P41A
CTR2DNL	(16)	8C22
TWOCH	(15)	171A
REALDATA	(14)	OCO3
SEQSEL1	(13)	A107
SEQSEL0	(12)	OAC9
IDB7	U405(2)	118O
IDB6	(3)	0746
IDB5	(4)	5204
IDB4	(5)	U7P8
IDB3	(6)	OO1P
IDB2	(7)	O6FO
IDB1	(8)	F8F2
IDB0	(9)	31HP
LDHWCRL	(11)	0807
LEV2	(19)	PACU
LEV1	(18)	F167
LEV0	(17)	H441
TBSEL2	(16)	F789
TBSEL1	(15)	815H
TBSEL0	(14)	3A5O
SCALE1	(13)	C1CP
SCALE0	(12)	8H36

Table A9-4 FFT Signature Analysis Test 2 cont.

Signal name	IC (pin)	Signature
Pseudo Scale:		
IDB8	U305(5)	9376
IDB9	(6)	P682
IDB10	(7)	349C
IDB11	(4)	O53U
IDB12	(3)	UA51
IDB13	(2)	HPH7
IDB14	(1)	FO91
IDB15	(15)	77HP
	(12)	8O9O
	(11)	54H8
CLRSCALEL	U208(5,11)	AH5F
GDBOUTL	(4,12)	OHPC
DIVBY4	(7)	1384
DIVBY2	(9)	H4UC
Pseudorandom Number Generator:		
CLRPRNL	U105(9)	P1HF
GDBOUTL	(12)	OHPC
	(11)	284A
PRN	(14)	5828
	U106(11)	8H75
	(5)	21U9
	U107(11)	5H4P
	U108(11)	F61F
	U108(4)	PC89
	U408(11)	FA7O
Test Bit Mux:		
DIVBY4	U206(2)	1384
DIVBY2	(1)	H4UC
PASSDONE	(15)	6052
PRN	(13)	5828
	(5)	A251

Signal name	IC (Pin)		Signature
Global Address Bus Interface:			
FA15	U512(2)		9993
FA14	(3)		2O88
FA13	(4)		3FU7
FA12	(5)		O8P8
FA11	(6)		H351
FA10	(7)		6739
FA9	(8)		1P6P
FA8	(9)		C9O4
REQGBL	(11)		3176
FA7	U511(2)		5C91
FA6	(3)		H289
FA5	(4)		F6C8
FA4	(5)		444H
FA3	(6)		85PP
FA2	(7)		46C7
FA1	(8)		7H94
FA0	(9)		4282
Global Data Bus Interface:			
IDB15	U516(2)	U515(19)	77HP
IDB14	(3)	(18)	F091
IDB13	(4)	(17)	HPH7
IDB12	(5)	(16)	UA51
IDB11	(6)	(15)	O53U
IDB10	(7)	(14)	349C
IDB9	(8)	(13)	P682
IDB8	(9)	(12)	9376
IDB7	U514(2)	U513(19)	118O
IDB6	(3)	(18)	O746
IDB5	(4)	(17)	52O4
IDB4	(5)	(16)	U7P8
IDB3	(6)	(15)	OO1P
IDB2	(7)	(14)	O6FO
IDB1	(8)	(13)	F8F2
IDB0	(9)	(12)	31HP

Table A9-4 FFT Signature Analysis Test 2 cont.

Signal name	IC (pin)	Signature
Counter One:		
	U209(13)	UU11
	(12)	OCA2
	(11)	A172
LDCTR2L	(10)	5P63
PASSDONE	(3)	6O52
DIDONE	(2)	A7C1
	(1)	A512
	(15)	U9F5
	U210(13)	UU11
	(11)	A172
LDCTR2L	(10)	5P63
	(9)	OCA2
	(7)	958O
	(6)	C207
	(5)	859C
	(4)	653O
	(3)	P49O
	(2)	A634
	(1)	4O48
	(15)	6OH1
Counter Two:		
IDB11	U411(9)	O53U
IDB10	(10)	349C
IDB9	(1)	P682
IDB8	(15)	9376
LDCTR2L	(11)	5P63
	(4)	CPH4
	(5)	PP8P
	(13)	3O44
	(12)	9PAC
	(7)	8OUA
	(6)	4673
	(2)	38OO
	(3)	6HOA
IDB7	U410(9)	118O
IDB6	(10)	O746
IDB5	(1)	52O4

Signal name	IC (Pin)	Signature
Counter Two continued:		
IDB4	(15)	U7P8
LDCTR2L	(11)	5P63
	(4)	21AP
	(5)	3HA8
	(13)	CPH4
	(12)	PP8P
	(7)	56O3
	(6)	U4C2
	(2)	662A
	(3)	83C6
IDB3	U409(9)	OO1P
IDB2	(10)	O6FO
IDB1	(1)	F8F2
IDB0	(15)	31HP
LDCTR2L	(11)	5P63
DEC2L	(4)	U42A
INC2L	(5)	A2AH
	(13)	21AP
	(12)	3HA8
	(7)	UAH2
	(6)	9AC9
	(2)	2813
	(3)	FH82

Table A9-4 FFT Signature Analysis Test 2 cont.

Signal name	IC (pin)	Signature
Counter MUX:		
DIDONE	U311(5)	A7C1
	(11)	A512
	(14)	U0F5
	(6)	4673
	(10)	38OO
	(13)	6HOA
ACB10	(7)	7U15
ACB9	(9)	7FAH
ACB8	(12)	AO33
CTR1ENL	(1)	4POA
	U310(2)	958O
	(5)	C2O7
	(11)	859C
	(14)	653O
	(3)	56O3
	(6)	U4C2
	(10)	662A
	(13)	83C6
ACB7	(4)	86H2
ACB6	(7)	O169
ACB5	(9)	OCH4
ACB4	(12)	O152
CTR1ENL	(1)	4POA
	U309(2)	P49O
	(5)	A634
	(11)	4O48
	(14)	6OH1
	(3)	UAH2
	(6)	9AC9
	(10)	2813
	(13)	FH82
ACB7	(4)	349A
ACB6	(7)	6AH1
ACB5	(9)	1U59
ACB4	(12)	4282
CTR1ENL	(1)	4POA
(ACB is address count bus)		

Signal name	IC (Pin)	Signature
Butterfly Type PLA (U207):		
	U207(1)	A7C1
	(2)	A512
	(3)	U9F5
	(4)	958O
	(5)	C207
	(6)	859C
	(7)	653O
	(8)	P49O
LEV0	(9)	H441
LEV1	(11)	F167
LEV2	(12)	PACU
TYPE2BF	(15)	44CP
Butterfly Subroutine Address ROM:		
SCALE0	U502(10)	8H36
SCALE1	(11)	C1CP
PASSDONE	(12)	6052
TYPE2BF	(13)	44CP
BFSUBADL	(15)	U8F9
IDB0	(1)	31HP
IDB1	(2)	FBF2
IDB2	(3)	O6FO
IDB3	(4)	OO1P
IDB4	(5)	U7P8
IDB5	(6)	52O4
IDB6	(7)	O746
IDB7	(9)	118O

Table A9-4 FFT Signature Analysis Test 2 cont.

Signal name	IC (pin)	Signature
Address Translator:		
FFTWR	U307(4)	9758
SWAP	(5)	P41A
	(6)	A7C3
ACB2	U314(1)	6AH1
ACB4	(2)	O152
ACB6	(3)	O169
ACB8	(4)	AO33
	(5)	H8A6
LEV0	(6)	H441
LEV1	(7)	F167
LEV2	(8)	PACU
WINDPGL	(9)	FU43
FFTWR	(11)	9758
FA2	(19)	46C7
FA4	(18)	444H
FA6	(17)	H289
FA8	(16)	C9O4
FA10	(12)	6739
ACB1	U313(1)	1U59
ACB3	(2)	349A
ACB5	(3)	OCH4
ACB7	(4)	86H2
ACB9	(5)	7FA4
FA1	(19)	7H94
FA3	(18)	85PP
FA5	(17)	F6C8
FA7	(16)	5C91
FA9	(12)	1P6P
ACB0	U307(12)	4282
PASSBIT0	(13)	14AA
FA0	(11)	4282
(ACB__ is address count bus; FA__ is FFT address bus)		

Signal name	IC (Pin)		Signature
Coefficient ROM:			
FA0		U412(2)	4282
FA1		(3)	7H94
FA2		(4)	46C7
FA3		(5)	85PP
FA4		(6)	444H
FA5		(7)	F6C8
		(19)	1411
		(18)	2277
		(17)	5P2H
		(16)	A57C
		(15)	U27A
		(14)	6C31
FA6		U413(2)	H289
FA7		(3)	5C91
FA8		(4)	CPO4
FA9		(5)	1P6P
FA10		(6)	6739
FA11		(7)	H351
FA12		(8)	O8P8
FA13		(9)	3FU7
LDCAL		(11)	3H4O
		(19)	F186
		(18)	PU29
		(17)	2U4O
		(16)	6AHA
		(15)	47HH
		(14)	H351
		(13)	O8P8
	U315(10)	U317(10)	1411
	(9)	(9)	2277
	(8)	(8)	5P2H
	(7)	(7)	A57C
	(6)	(6)	U27A
	(5)	(5)	6C31
	(4)	(4)	F186
	(3)	(3)	PU29
	(25)	(25)	2U4O
	(24)	(24)	6AHA
	(21)	(21)	47HH
	(23)	(23)	H351
	(2)	(2)	O8P8

Table A9-4 FFT Signature Analysis Test 2 cont.

Signal name	IC (pin)	Signature
Coefficient ROM continued:		
IDB0	U517(18)	31HP
IDB1	(17)	F8F2
IDB2	(16)	O6FO
IDB3	(15)	OO1P
IDB4	(14)	U7P8
IDB5	(13)	52O4
IDB6	(12)	O746
IDB7	(11)	118O
IDB8	U518(18)	9376
IDB9	(17)	P682
IDB10	(16)	349C
IDB11	(15)	O53U
IDB12	(14)	UA51
IDB13	(13)	HPH7
IDB14	(12)	FO91
IDB15	(11)	77HP

Return all jumpers to the normal (N) position (either position OK for J1).

3. Digital Signature Test 3

Connect the signature analyzer as described in table A9-5.

Table A9-5 FFT Signature Analyzer Setup #3

Signal	Polarity	Connection
Ground		A7 J5-1
Clock	**Pos** edge	A7 **TP3** *
Stop	Neg edge	A7 J5-4
Start	Pos edge	A7 J5-5

* note change from test 2

Test 3 is activated by performing the following steps:

a. Move jumper J2 to the test (T) position.

b. Move jumper J1 to the TST1 position.

c. Press the reset switch on the CPU board (A2 S1).

Table A9-6 FFT Signature Analysis Test 3

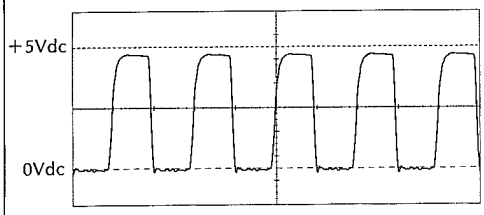
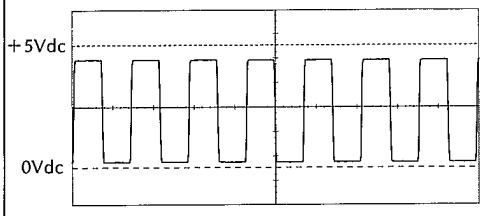
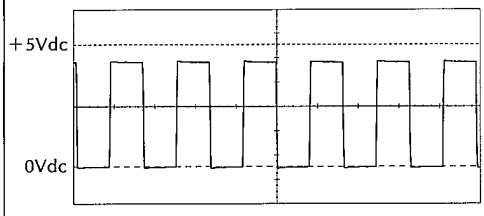
Signal name	IC (pin)		Signature	Signal name	IC (Pin)		Signature
	U315(11)	U517(2)	47FP	Global Data Bus Interface Outputs:			
	(12)	(3)	3246				
	(13)	(4)	HA4U	GD15L	U516(19)	U515(2)	3347
	(15)	(5)	9O3F	GD14L	(18)	(3)	U9FH
				GD13L	(17)	(4)	3347
	(16)	(6)	AP58	GD12L	(16)	(5)	U9FH
	(17)	(7)	OO11				
	(18)	(8)	C668	GD11L	(15)	(6)	3347
	(19)	(9)	3FO8	GD10L	(14)	(7)	U9FH
				GD9L	(13)	(8)	3347
	U317(11)	U518(2)	6P1C	GD8L	(12)	(9)	U9FH
	(12)	(3)	POHU				
	(13)	(4)	CC3C	GD7L	U514(19)	U513(2)	3347
	(15)	(5)	4472	GD6L	(18)	(3)	U9FH
				GD5L	(17)	(4)	3347
	(16)	(6)	PHH1	GD4L	(16)	(5)	U9FH
	(17)	(7)	OHHA				
	(18)	(8)	H231	GD3L	(15)	(6)	3347
	(19)	(9)	OHP6	GD2L	(14)	(7)	U9FH
				GD1L	(13)	(8)	3347
PROMINL	U517(1)	U518(1)	FA8A	GD0L	(12)	(9)	U9FH
Global Address Bus Interface Outputs:				Handshake:			
GA16L		U512(19)	3347			U212(12)	F59A
GA15L		(18)	18C1	FFTMG		(13)	FA8A
GA14L		(17)	4UAU			(11)	OU1O
GA13L		(16)	7FH4	FFTMR		U211(12,13)	OOOO
GA12L		(15)	U839	FFTWR		U501(2)	F59A
GA11L		(14)	A44O	REQGBL		(3)	FA8A
GA10L		(13)	4O2O	LDGDBRL		U214(3)	FA8A
GA9L		(12)	15PP	GR/GWL		U211(8)	OU1O
GA8L		U511(19)	4PP9	MGFFTL		U215(13)	OOOO
GA7L		(18)	U5U7	GDSL		U214(2)	FA8A
GA6L		(17)	4291	MRFFTL		U211(11)	FA8A
GA5L		(16)	6F84				
GA4L		(15)	3831				
GA3L		(14)	A997				
GA2L		(13)	FF53				
GA1L		(12)	P39F				

Return all jumpers to the normal (N) position when testing is complete.

C. Oscilloscope Signal Waveforms

The following table of illustrations are oscilloscope plots of digital signature analysis signals (CLOCK and START/STOP) at J5. These should appear on the test pins when the DSA jumpers are in the positions specified in the waveform setup.

Table A9-7 FFT Signal Waveforms

Setup	Important Parameters	Waveform
Jumpers in normal position		
CLKOUT (5 MHz) Signal at pin 3 of J5 (CLK on DSA connector) Scale 1 V/div Timebase 100 ns/div Offset 2.5 V Delta V 5 V Trigger Ch 1 Coupling dc	Time period and pulse shape	 #1
Put J2 in the test (T) position, J1 in the TST1 position, and press the reset button on the CPU board (A2 S1).		
SRT/STP TST 1 (1.4 Hz) Signal at pin 4 and 5 of J5 (DSA connector) Scale 1 V/div Timebase 500 ms/div Offset 2.5 V Delta V 5 V Trigger Ch 1 Coupling dc	Time period and pulse shape	 #2
Put J3 and J4 in the test position and J2 in the TST2 position		
SRT/STP TST 2 (1.2 kHz) Signal at pins 4 and 5 of J5 (DSA connector) Scale 1 V/div Timebase 500 us/div Offset 2.5 V Delta V 5 V Trigger Ch1 Coupling dc	Time period and pulse shape	 #3

D. After-Repair Adjustments and Tests

Table A9-8 After-Repair Adjustments and Tests

Perform the following:	Section
Diagnostic Tests: Test All	VII
Adjustments: None	
Performance Tests: None	