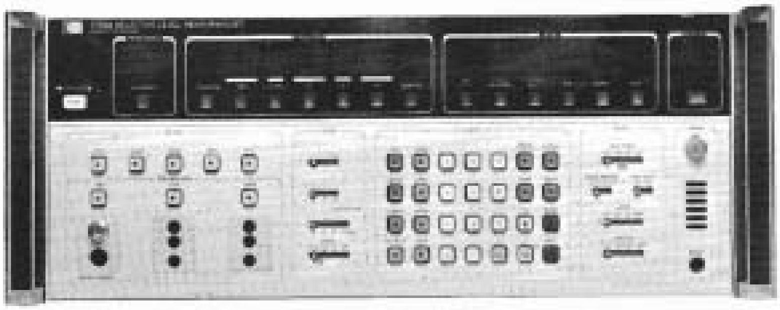
3746A

SELECTIVE LEVEL MEASURING SET



HEWLETT PACKARD

HP 3746A

HEWLETT
PACKARD

SERVICE MANUAL

3746A

SELECTIVE LEVEL MEASURING SET

(Including Options 001, 005, 011,012,013,014, 015 and 016)

SERIAL NUMBER

This manual applies directly to instruments with serial numbers prefixed 2405U

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

Manual Part Number 03746-90002
Microfiche Part Number 03746-90027

Printed: March 1984

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SECTION I
GENERAL INFORMATION

1-1 INTRODUCTION

1-2 This Service Manual contains information required to install, test, adjust and service the Hewlett-Packard Model 3746A Selective Level Measuring Set (SLMS). The instrument together with the accessories supplied are shown in Figure 1-1.

1-3 Full operating instructions are contained in a separate Operating Manual HP 03746-90001.

1-4 On the title page of this manual is a Microfiche Part Number. This number can be used to order 4 x 6-inch microfilm transparencies of the manual. Each microfiche contains up to 96 photo duplicates of the manual pages.

1-5 SPECIFICATION

1-6 Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested.

1-7 SAFETY CONSIDERATION

1-8 This product is a Safety Class B instrument (provided with a protective earth terminal). The instrument and manual should be reviewed for safety markings and instructions before operation. Also read the Warning on Page ii.

1-9 INSTRUMENTS COVERED BY MANUAL

1-10 Attached to the instrument is a serial number plate. This serial number is in the form XXXXUXXXXX. It is in two parts, the first four digits and the letter are the serial prefix and the last five are the suffix. The prefix is the same for all identical instruments, it changes only when a change is made to the instrument. The suffix however is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-11 An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this new instrument is accompanied by a Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

1-12 In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-13 For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-14 DESCRIPTION

1-15 The Hewlett-Packard 3746A Selective Level Measuring Set (SLMS) is a high quality tunable power meter dedicated for use by operators and manufacturers of high density Frequency Division Multiplex (FDM) systems.

1-16 The SLMS has been specifically designed for manufacturers and operators who use either CCITT recommendations or the North American Standards.

1-17 The SLMS is basically a tunable receiver, employing a synthesized local oscillator, controlled by a processor. A keyboard provides the interface between the operator and the processor.

1-18 The SLMS measures signal powers in the range 50Hz to 32MHz at levels between +20dBm and -115dBm, depending upon the measurement bandwidth used.

1-19 Either balanced or unbalanced measurements may be made.

1-20 Measured levels are true RMS values.

1-21 The instrument displays power levels either in dBm or in dB relative to a dBm reference level. Automatic correction ensures that whichever input is selected the display will be correct for the chosen terminating impedance.

1-22 The frequencies at which measurements are required may be entered via the keyboard either directly in kHz, or as a description in a chosen FDM plan.

1-23 This ability to enter FDM descriptions directly into the instrument eliminates the need for FDM charts and line frequency tables to determine the frequencies to which the instrument is to be tuned.

1-24 Tuning to the measurement frequency is accomplished by mixing the received signal with a variable frequency signal from an internal synthesized local oscillator to give a fixed intermediate frequency. To achieve the high degree of selectivity and image rejection required, the SLMS uses multiple intermediate frequency (IF) stages.

1-25 The standard instrument is equipped with selective filters to allow a choice of measurement bandwidth.

1-26 The measurement of narrow bandwidth tones in a wideband measuring set requires extreme accuracy in the local oscillator frequencies used. This requirement is met by the use of a frequency synthesizer as the local oscillator in the SLMS. A master oscillator with a 10MHz crystal source, high spectral purity, and an ageing rate of less than 1.5×10^{8} parts per month is available as an option.

1-27 A processor provides overall control within the instrument, implementing routines which govern the measurement functions of the instrument and calculating from the various autoranging and analog to digital settings the levels to be displayed. The processor also determines the frequency and bandwidth setting required when FDM descriptions are entered.

1-28 The SLMS has a built-in control and drive circuitry which enables the SLMS to control up to 111 Access Switches.

1-29 The processor will accept instructions either from the operator via the keyboard or, if remote control of the instrument is required, through the Hewlett-Packard Interface Bus (HP-IB) connector on the rear panel. A degree of in-built intelligence in the processor enables it to detect if the instrument is required to perform an invalid measurement or if incorrect data is entered. In these circumstances a code number will appear in the TEST-POINT display window.

1-30 The processor performs a calibration of the measuring circuits at periodic intervals, substituting for the incoming signal an accurately defined signal derived from an internal high stability source. The processor stores the result of this measurement and uses any deviation from the expected measurement to modify the results of measurements made on external signals. Thus any inaccuracies resulting from thermal drift or ageing in the measurement stages are greatly reduced.

1-31 OPTIONS

1-32 The following options are available with the SLMS and are covered by this manual:

Option 001 - Siemens series 2.5/6mm (75 ohm) connector substituted for the Unbalanced input connector.

Option 005 - Commercial equivalent of WECO 477B substituted for the Unbalanced and 124 ohm input connectors. Commercial equivalent of WECO 223A substituted for the 135 ohm and 600 ohm input connectors.

Option 011 - Group Filter

Option 012 - Tracking Generator

Option 013 - High Stability Oscillator

Option 015 - Channel Impairments (CCITT) - phase jitter WTD Filter, Noise with Tone, Impulse Noise (single threshold).

Option 016 - Channel Impairments (North America) - phase jitter WTD Filter, Noise with Tone, Impulse Noise (single threshold).

1-33 ACCESSORIES SUPPLIED

1-34 Figure 1-1 shows the HP Model 3746A together with the accessories supplied.

(a) The line power cable is supplied in one of six configurations depending upon the country of destination of the instrument (see Paragraph 2-11).

(b) The following manuals are supplied with each instrument.

1) Service Manual .... HP 03746-90002

2) Operating Manual .... HP 03746-90001

(c) There are four extender boards supplied with each instrument (2 of HP Part No. 03746-60090 and 2 of 03746-60091). They extend PC boards clear of the instrument, allowing maintainance and repair procedures to carried out with power applied to the instrument.

1-35 EQUIPMENT AVAILABLE

1-36 A 25MHz High-Impedance Active Probe (HP Model 15580A) is used in conjunction with the SLMS for bridging measurements. It has a OdBm Insertion Loss and a flatness of <± 0.2dB over the frequency range 50kHz to 20MHz.

1-37 A 25MHz High-Impedance Passive Probe (HP Model 15581B) is used in conjunction with the SLMS for bridging measurements. It has a 20dB Insertion Loss and a flatness of <± 0.2dB over the frequency range 50kHz to 20MHz.

1-38 A Return Loss Kit (HP Model 15582A), in conjunction with a suitable Level Generator, allows the SLMS to make balanced and unbalanced return loss measurements over the frequency range 10kHz to 25MHz.

1-39 A Transit Case (9211-2650) with its custom mould inserts provides the SLMS with maximum protection during transit.

1-40 An Instrument Cart (Hp Model 15589A) carries the SLMS and its auxiliary equipment. Additional shelves can be supplied on request.

1-41 A Directional Bridge (HP Model 8721A OPT 008) with a suitable Level Generator allows the SLMS to make 75 ohm unbalanced return loss measurements over the frequency range 100kHz to 30MHz.

1-42 HP-IB Cables (HP Model 10833A/B/C/D) interface the SLMS with other HP-IB compatible instruments. (The Hewlett-Packard Interface Bus (HP-IB) is Hewlett-Packard's implementation of IEEE Standard 488-1978.)

10833A	1 metres	(3.3 feet)
10833B	2 metres	(6.6 feet)
10833C	4 metres	(13.2 feet)
10833D	0.5 metres	(1.6 feet)

1-43 A Printer (HP Model 5150A OPT 001 or 2631B OPT 046) connected to the SLMS will provide a printed copy of measurement data such as frequency, level, FDM description and time of measurement. The SLMS can instruct the printer to print data for all, or any individual measurements or, if desired, record details of measurements which violate limits set by the operator.

1-44 An X-Y Display (HP Model 37461A) connected to the SLMS will provide a visual display of measurement data such as frequency and level measurements.

1-45 A tracking Frequency Synthesizer/Level Generator (HP Model 3335A or 3336A) is available and can be used in conjunction with the SLMS.

1-46 RECOMMENDED TEST EQUIPMENT

1-47 Equipment required to maintain the 3746A SLMS is listed in Table 1-2. Other equipment may be substituted if it meets or exceeds the critical specification listed in the table.

Table 1-1 Specifications

Except where otherwise indicated, the following parameters are warranted performance specifications. Parameters described as "typical" or "nominal" are supplemental characteristics which provide a useful indication of typical, but non-warranted, performance characteristics. Unless otherwise stated, all specifications are for 0° to 55°C after 30 minute warm-up.

FREQUENCY RANGE

Unbalanced Input (75Ω): 50 Hz to 32 MHz.
Balanced Inputs: 150Ω : 10 kHz to 2 MHz
600Ω : 50 Hz to 100 kHz
124Ω (Option 005) : 10 kHz to 12 MHz
135Ω (Option 005) . 10 kHz to 2 MHz
Minimum Frequency Step Size: 1 Hz.

FREQUENCY TUNING ACCURACY

INTERNAL STANDARD REFERENCE OSCILLATOR

Initial Setting Accuracy + Ageing over 1 year + Temperature Drift: $< \pm 5 \times 10^{-5}$

OPTIONAL HIGH ACCURACY REFERENCE OSCILLATOR (Option 013)

Initial Setting Accuracy: $\pm 1 \times 10^{-7}$.
Ageing Rate: $< \pm 1.5 \times 10^{-7}$/Year.

WITH EXTERNAL REFERENCE OSCILLATOR

Frequency Error: error of external reference oscillator ± 1 Hz.

INTERNAL FREQUENCY COUNTER

(In addition to accuracy of Reference Oscillator)

Counter Accuracy: ± 1 Hz (38 Hz Filter, tone within 3 dB points) or ± 2 Hz (38 Hz, 3.1 kHz, Weighted and Notch Filters, tone within 55 dB points; 48 kHz Filter (Option 011), tone < 25 kHz from tuned frequency), for tone/measured interference ratio > 40 dB*.

* A variation of 0.2 dB pk-pk in the measured level of a tone within the 3 dB bandwidth of the 38 Hz filter at 0.1 dB resolution (AVE 1) would indicate a tone/interference ratio of 40 dB (nominal).

MEASUREMENT RANGES

UNBALANCED INPUT (75Ω)

Filter	Range	Noise Floor including Spurious Products (with open-circuit input)
38 Hz – Pilot	+20 to –115 dBm	< –105 dBm, 250 Hz to 50 kHz; < –115 dBm, 50 kHz to 32 MHz
3.1 kHz – Channel	+20 to –115 dBm	< –105 dBm, 10 kHz to 50 kHz; < –115 dBm, 50 kHz to 32 MHz
48 kHz – Group (Option 011)	+20 to –90 dBm	< –90 dBm, 100 kHz to 32 MHz
Broadband – Input Power	+20 to –55 dBm	< –55 dBm

BALANCED INPUTS†

Filter	Impedance	Range	Noise Floor including Spurious Products (with open-circuit input)
38 Hz – Pilot 3.1 kHz – Channel	124Ω	0 to –113 dBm	–113 dBm, 50 kHz to 10 MHz
	135Ω		–113 dBm, 50 kHz to 2 MHz
	150Ω		–113 dBm, 50 kHz to 2 MHz
	600Ω	0 to –90 dBm	–90 dBm, in basic channel (1.85 kHz)

† Standard input impedances: 600Ω and 150Ω; with Option 005: 600Ω, 124Ω and 135Ω.

INPUT CIRCUITS

UNBALANCED INPUT (75Ω)

Impedance	Return Loss 50 kHz to 32 MHz	Maximum ac Input Power	Maximum Continuous dc Voltage	Connector Type*
75Ω	> 30 dB	+25 dBm	± 0.5V	BNC

* Alternative connector types available – see OPTIONS.

Table 1-1 Specifications (continued)

BALANCED INPUTS†

Impedance	Return Loss	Common Mode Rejection Common Mode Signal < 0 dBm	Maximum ac Input Power	Maximum Continuous dc Voltage	Maximum Longitudinal Voltage	Connector Type
124Ω	> 30 dB, 10 kHz to 12 MHz	> 40 dB, 10 kHz to 2 MHz > 35 dB, 2 MHz to 12 MHz	+25 dBm	± 3V	ac : 3V rms dc : 3V	Accepts WECO Plug 439A or 440A (Pair)
135Ω	> 30 dB, 10 kHz to 2 MHz	> 40 dB, 10 kHz to 2 MHz	+25 dBm	± 3V	ac : 3V rms dc : 3V	Accepts WECO Plug 241A (Pair)
150Ω	> 30 dB, 10 kHz to 2 MHz	> 40 dB, 10 kHz to 2 MHz	+25 dBm	± 3V	ac : 3V rms dc : 3V	Siemens Type 9 REL STP-6AC
600Ω	> 30 dB nominal, dc to 100 kHz	> 35 dB, dc to 100 kHz	+20 dBm	± 3V	ac : 3V rms dc : 3V	Standard: Siemens Type 9 REL STP-6AC Option 005: accepts WECO Plug 241A

† Standard input impedances: 600Ω and 150Ω; with Option 005: 600Ω, 124Ω and 135Ω.

MEASUREMENT ACCURACY

UNBALANCED INPUT (75Ω) – SELECTIVE MEASUREMENT (38 Hz AND 3.1 kHz FILTERS)

Frequency Range	Level Uncertainty over temperature range 10° to 35° C, after autocalibration (See Notes 1, 2, 4 and 5)	
	+20 to –80 dBm	–80 to –100 dBm (nominal)
38 Hz and 3.1 kHz Filters		
200 Hz to 10 kHz	< ± 1 dB (+20 to –70 dBm)	
10 kHz to 50 kHz	< ± 0.45 dB	< ± 0.65 dB
50 kHz to 20 MHz	< ± 0.25 dB	< ± 0.5 dB
20 MHz to 30 MHz	< ± 0.45 dB	< ± 0.7 dB

UNBALANCED INPUT (75Ω) – BROADBAND MEASUREMENT

Frequency Range	Level Uncertainty over temperature range 0° to 55° C, after autocalibration (See Note 3)
50 Hz to 32 MHz	< ± 1 dB, +20 to –45 dBm

UNBALANCED INPUT (75Ω) – GROUP POWER MEASUREMENT (48 kHz FILTER) OPTION 011

Frequency Range	Level Uncertainty over temperature range 0° to 55° C, after autocalibration (See Notes 3 and 5)
100 kHz to 32 MHz	< ± 1 dB, +20 to –75 dBm

Table 1-1 Specifications (continued)

BALANCED INPUTS† – SELECTIVE MEASUREMENT (38 Hz AND 3.1 kHz FILTERS)

Impedance	Frequency Range	Level Uncertainty over temperature range 10° to 35° C, after autocalibration (See Notes 1, 2, 4 and 5)	
		0 to –80 dBm	–80 to –100 dBm (nominal)
124Ω	10 kHz to 50 kHz	< ± 0.5 dB	< ± 0.7 dB
	50 kHz to 12 MHz	< ± 0.3 dB	< ± 0.5 dB
135Ω	10 kHz to 50 kHz	< ± 0.5 dB	< ± 0.7 dB
	50 kHz to 2 MHz	< ± 0.3 dB	< ± 0.5 dB
150Ω	10 kHz to 50 kHz	< ± 0.5 dB	< ± 0.7 dB
	50 kHz to 2 MHz	< ± 0.3 dB	< ± 0.5 dB
600Ω	200 Hz to 100 kHz	< ± 1 dB (0 to –70 dBm)	

BALANCED INPUTS† – GROUP POWER MEASUREMENT (48 kHz FILTER) OPTION 011

Impedance	Frequency Range	Level Uncertainty over temperature range 0° to 55° C, after autocalibration (See Notes 3 and 5)
124Ω	100 kHz to 12 MHz	< ± 1 dB, 0 to –75 dBm
135Ω	100 kHz to 2 MHz	< ± 1 dB, 0 to –75 dBm
150Ω	100 kHz to 2 MHz	< ± 1 dB, 0 to –75 dBm

BALANCED INPUTS† – BROADBAND MEASUREMENT

Impedance	Frequency Range	Level Uncertainty over temperature range 0° to 55° C, after autocalibration (See Note 3)
124Ω	10 kHz to 12 MHz	< ± 1 dB, 0 to –45 dBm
135Ω	10 kHz to 2 MHz	< ± 1 dB, 0 to –45 dBm
150Ω	10 kHz to 2 MHz	< ± 1 dB, 0 to –45 dBm
600Ω	200 Hz to 100 kHz	< ± 1 dB, 0 to –45 dBm

† Standard input impedances: 600Ω and 150Ω; with Option 005: 600Ω, 124Ω and 135Ω.

NOTE 1 To extend temperature range for 0° to 55°C operation, add ± 0.1 dB for all selective measurements in the frequency range 10 kHz to 32 MHz.

NOTE 2 Accuracy specified is for 0.01 dB display resolution. For 0.1 dB resolution, add ± 0.08 dB. For 1 dB resolution, add ± 1.5 dB (nominal).

NOTE 3 Accuracy specified is for 0.1 dB display resolution. For 1 dB resolution, add ± 1.5 dB (nominal).

NOTE 4 Accuracy specified is for single input signal within defined level range.

NOTE 5 Accuracy specified assumes that 3746A is tuned to signal frequency ± 1 Hz.

MEASUREMENT DISPLAY

Resolution: 0.01 dB with Averaging 2 (38 Hz and 3.1 kHz filters only)
0.1 dB with Averaging 1
1 dB with Averaging 0.

FILTERS

PILOT FILTER – 38 Hz

Ripple over 22 Hz Bandwidth: < 0.1 dB pk-pk.
3 dB Bandwidth: 38 Hz, ± 10%.
Adjacent Pilot Rejection (± 60 Hz): > 38 dB.
Rejection at > ± 110 Hz: > 60 dB.
Rejection at > ± 2 kHz: > 80 dB.
Equivalent Noise Bandwidth: 44 Hz (nominal).

CHANNEL FILTER – 3.1 kHz

Ripple over 2.6 kHz Bandwidth: < 0.5 dB pk-pk.
3 dB Bandwidth: 3.1 kHz, ± 10%.
Virtual Carrier Rejection at ± 1.85 kHz: > 65 dB.
Adjacent Channel Rejection (± 4 kHz): > 70 dB.
Equivalent Noise Bandwidth: 3.1 kHz (nominal).

GROUP FILTER – 48 kHz (OPTION 011)

Ripple over 35 kHz: < 1.2 dB pk-pk.
3 dB Bandwidth: 48 kHz, ± 12%.
Adjacent Group Rejection (± 48 kHz): > 25 dB.
Rejection at > ± 80 kHz: > 40 dB.
Equivalent Noise Bandwidth: 52 kHz (nominal).

Table 1-1 Specifications (continued)

NOMINAL MEASUREMENT TIMES

	0.01 dB Resolution		0.1 dB Resolution		1 dB Resolution
	3 dB Separation+	80 dB Separation+	3 dB Separation+	80 dB Separation+	
Pilot Filter	< 1250 ms	< 1600 ms	< 450 ms	< 800 ms	< 500 ms
Channel Filter	< 940 ms	< 1130 ms	< 140 ms	< 330 ms	< 140 ms
Group Filter (Option 011)	–	–	< 200 ms	< 300 ms	< 200 ms

\+ "Separation" is the difference in level (in dB) between adjacent measurements.

INTERMODULATION AND SPURIOUS PRODUCTS

Second Order Intermodulation Rejection: > 63 dB (relative to the total power of two input signals and measured at $|f_1 \pm f_2|$ where this is in band).
Third Order Intermodulation Rejection: > 70 dB (for two tones greater than 50 kHz apart), > 60 dB (for two tones less than 50 kHz apart); relative to the total power of two input signals and measured at $|2f_1 \pm f_2|$ and $|2f_2 \pm f_1|$ where these are in band.

NOMINAL INTERMODULATION PERFORMANCE

Unbalanced Input: On a fully loaded 1800 channel system with a mean channel level of −15 dBm0, the SLMS intrinsic NPR is > 58 dB for all autoranging states.

IMAGE AND IF REJECTION

Description	Frequency	Rejection
½ x 1st IF	25.0078125 MHz	> 60 dB
1st IF (Channel & Pilot Filters)	50.015625 MHz	> 70 dB
1st IF Image	*	> 70 dB
2nd IF (Channel & Pilot Filters)	15625 Hz	> 70 dB
2nd IF Image	**	> 75 dB
3rd IF (Pilot Filter)	919 Hz	> 80 dB
3rd IF Image	***	> 65 dB

* 1st IF Image = Tuned Frequency + (2 x 1st IF) (Channel and Pilot Filters only)

** 2nd IF Image = Tuned Frequency + (2 x 2nd IF) (Channel and Pilot Filters only)

*** 3rd IF Image = Tuned Frequency + (2 x 3rd IF) (Pilot Filter only)

ADDITIONAL INPUTS/OUTPUTS

10 MHz REFERENCE INPUT

Frequency Required to Maintain Lock: 10 MHz, or any integer sub-multiple of 10 MHz, in range 1 to 10 MHz.
Level: −3 dBm to +20 dBm into 50Ω.
Accuracy and Stability: dependent on External Source.
Connector: BNC 50Ω.

10 MHz REFERENCE OUTPUT

Frequency: 10 MHz.
Initial Setting Accuracy
\+
Ageing Rate
\+
Temperature Drift
} **Total Error:** $< \pm 5 \times 10^{-5}$
Level: +6 dBm ± 2 dB into 50Ω, or −30 dBm ± 2 dB into 75Ω, dependent on setting of internal link.

10 MHz OVEN OUTPUT (OPTION 013)

Frequency: 10 MHz.
Initial Setting Accuracy: $\pm 1 \times 10^{-7}$.
Ageing Rate: $< \pm 1.5 \times 10^{-7}$/year.
Level (when oven has reached operating temperature): 0 dBm (nominal) into 50Ω.
Connector: BNC 50Ω.

AUDIO OUTPUTS (REAR PANEL)

Provide demodulated voice channel output when 3.1 kHz Filter is selected. Specifications only apply if 0.1 dB or 0.01 dB Resolution operative. An output is also available when Weighted & Notch Filters (provided by Options 015 and 016) are selected, but specifications relating to frequency response and level no longer apply.
Frequency Response: ± 1 dB (600 Hz to 3.1 kHz).
Nominal Impedance: 600Ω balanced.
Nominal Level (after autoranging): −3 dBm to −13 dBm.
Connector: Siemens type 9 REL STP-6AC (3-pin) and Jack Socket compatible with WECO 347 or ¼" Jack Plug.

AUDIO OUTPUT (FRONT PANEL)

Provides amplified version of rear panel Audio Output to internal loudspeaker or audio jack.
Level: 0 dBm maximum into 600Ω, adjustable by volume control.
Connector: compatible with WECO 347 or ¼" Jack Plug.

PROBE POWER

Voltages: + 15.5V and −12V.
Current: 100 mA maximum (both voltage lines).
Connectors: compatible with Hewlett-Packard standard Probe Power Jack.

Table 1-1 Specifications (continued)

ACCESS SWITCH CONTROLLER

Provides control signals for HP 3754A, 3756A and/or 3757A Access Switches. Provides dc power sufficient for one 3757A Access Switch.

Number of Selectable Signal Ports: 10 with a single Access Switch, up to 1000 with 111 cascaded Access Switches.

Switch Control Path: 2-wire (only) to first level Access Switch; 2-wire or coaxial from first level Access Switch to second and third level switches.

Acceptable dc Resistance of 2-wire Path (between 3746A and first level Access Switch, or between Switches): 100Ω.

Nominal Connect/Disconnect Times using 3754A Access Switch(es):

Connection Time (N = Switch Port Number):

0.9 + (N x 0.05)s/switch, or

0.03 + (N x 0.002)s/switch with Rear Panel "Access Switch Speed" selector set to Normal or Fast respectively.

Input Termination Disconnect Time: 0.5 ms.

Digital Control Signals:

Nominal Pulse Rate: 20 pulses/s ± 15% or 600 pulses/s ± 15%, depending on setting of rear panel switch (Normal or Fast, respectively).

Nominal Mark : Space Ratio: 50 : 50 ± 20%.

Power Supply Output (for 3757A Access Switch):

Voltages: +15.5V ± 1V

−15.5V ± 1V

Current: 100 mA maximum (+ and −).

Connector: 5-screw terminal block (Power Supply and 2-wire output).

PHASE JITTER OUTPUT

Provides access to the sidebands on a 1 kHz tone as selected by Phase Jitter measurement.

Connector: BNC.

CHART RECORDER/METER DRIVE OUTPUT

(activated by special key sequence)

Provides two types of output drive — current or voltage — suitable for connection to an external Chart Recorder or Meter. Changeover between current and voltage drive is by means of internal switches.

Current Drive:

Output: 0 to +5 mA, proportional to measured level of SLMS input signal (after centering within dynamic range).

Dynamic Range: ± 3 dB.

Maximum Load Impedance: 1200Ω.

Voltage Drive:

Output: −3 to +3V dc; proportional to measured level of SLMS input signal (after centering within dynamic range).

Dynamic Range: ± 3 dB.

Nominal Output Impedance: 1000Ω.

Connectors: pair of Binding Posts (Banana Sockets) on 1" (25.4 mm) centres.

HP-IB INTERFACE

Loading: 1 Bus Load, capable of driving up to 14 HP-IB devices.

Interface Functions Subset:

3746A as Controller: SH1 AH1 T4 L4 SRØ RLØ PPØ DCØ DTØ C1 C3 C4 C28.

3746A under remote control: SH1 AH1 T6 L4 SR1 RL1 PPØ DC1 DT1 CØ.

Compatible Peripherals (Bus-Controllable from SLMS):

Tracking Frequency Synthesizers: HP Models 3330B, 3335A and 3336A/B.

Printers: HP Models 82905A, 5150A, 2631B and other HP-IB Printers.

CRT Display: HP Model 37461A.

Standard HP-IB Addresses (decimal):

3746A: 10.

HP-IB Extender: 17.

CRT Display: 03.

Printer: 05.

Synthesizer: 04.

GENERAL

Dimensions:

Height: 190 mm (7.5 in)

Width: 460 mm (18.1 in)

Depth: 495 mm (19.5 in)

(Overall — including handles, feet and connectors).

Weight:

Net: 25 kg (55 lb)

Shipping: 34 kg (75 lb)

Power:

Voltages: 100/120/220/240V

Tolerance: +5%, −10%

Frequency: 48 to 66 Hz

Power Consumption: 200 VA (max).

OPTIONS

CONNECTOR OPTIONS (FRONT PANEL ONLY)

OPTION 001

75Ω Unbalanced Input Connector: Siemens Series 1.6/5.6 mm.

OPTION 005

75Ω Unbalanced Input Connector: commercial equivalent of WECO Type 477B (accepts WECO Plug 358A).

124Ω Balanced Input Connectors (pair): commercial equivalent of WECO Type 477B on 16 mm (0.625 in) centres (accepts WECO Plug 358A).

135Ω Balanced Input Connectors (pair): commercial equivalent of WECO Type 223A on 16 mm (0.625 in) centres (accepts WECO Plug 241A).

600Ω Balanced Input Connectors: commercial equivalent of WECO Type 223A (accepts WECO Plug 241A).

Table 1-1 Specifications (continued)

MEASUREMENT OPTIONS

OPTION 011 – GROUP FILTER

Allows the 3746A to measure power in a 12-channel Group over 48 kHz bandwidth (–3 dB points). Full specification of Group Filter, including measurement range, accuracy and filter shape is provided in the main 3746A Specifications. The Group Filter Option also provides a Supergroup power measurement capability; the SLMS can automatically evaluate and display Supergroup power as the logarithmic sum of 5 Group power measurements.

OPTION 012 – TRACKING GENERATOR

Provides an integral Tracking Generator with output frequency the same as SLMS tuned frequency. Disabled when 48 kHz or Weighted Filters are selected.
Level: –10 dBm ± 0.5 dB (nominal).
Flatness: ± 0.2 dB, 10 kHz to 32 MHz.
Spurious and Harmonic Signals Relative to Main Output: < –40 dB.
Connector: BNC 75Ω.
Return Loss: > 30 dB, 10 kHz to 32 MHz.

OPTION 013 – HIGH STABILITY FREQUENCY REFERENCE

Increases SLMS tuning accuracy.
Initial Setting Accuracy: $\pm 1 \times 10^{-7}$.
Ageing Rate: $< \pm 1.5 \times 10^{-7}$/year.

OPTION 015 – CHANNEL IMPAIRMENTS (CCITT)

Provides a psophometrically weighted filter with selectable 1010 Hz notch, and measurement of Phase Jitter, and Impulse Noise.

WEIGHTED FILTER

Psophometric weighting superimposed on 3.1 kHz Channel Filter, in accordance with CCITT Recommendation P.53.A (Geneva 1980).
Uncertainty of Weighted Noise Measurement: < ± 1 dB.
Measurement Resolution: 1 dB or 0.1 dB.

PHASE JITTER

Measurement of Phase Jitter is performed on a demodulated 1 kHz Channel Test Tone.
Frequency of Demodulated Tone: 1 kHz ± 50 Hz.
Measurement Bandwidth: selectable: 4 Hz to 20 Hz, 20 Hz to 300 Hz or 4 Hz to 300 Hz.
Residual Phase Jitter: ⩽ 0.5° pk-pk.
Accuracy: ± 15% ± 0.5°.

NOTCH FILTER

Adds a 1010 Hz Notch to Weighted Filter response in accordance with CCITT Recommendation 0.132.

IMPULSE NOISE

Provides a single threshold Impulse Noise measurement in accordance with CCITT Recommendation 0.71.
Maximum Measurement Period: 99 minutes 59 seconds.
Maximum Impulse Count: 999.
Counting Rate: 125 ms/count ± 5%.
Threshold Accuracy on 1700 Hz Tone: ± 1 dB for threshold ⩾ –80 dBm, and ⩽ + 20 dBm. Measured channel power should not exceed threshold by more than 54 dB.

OPTION 016 – CHANNEL IMPAIRMENTS (NORTH AMERICA)

Provides a C-message weighted filter with selectable 1010 Hz notch, and measurement of Phase Jitter and Impulse Noise.

WEIGHTED FILTER

C-Message weighting superimposed on 3.1 kHz Channel Filter as specified in BSTR Pub. 41009.
Uncertainty of Weighted Noise Measurement: < ± 1 dB.
Measurement Resolution: 1 dB or 0.1 dB.

PHASE JITTER

Measurement of Phase Jitter is performed on a demodulated 1 kHz Channel Test Tone.
Frequency of Demodulated Tone: 1 kHz ± 50 Hz.
Measurement Bandwidth: selectable: 4 Hz to 20 Hz, 20 Hz to 300 Hz or 4 Hz to 300 Hz.
Residual Phase Jitter: ⩽ 0.5° pk-pk.
Accuracy: ± 15% ± 0.5°.

NOTCH FILTER

Adds a 1010 Hz Notch to Weighted Filter response in accordance with BSTR Pub. 41009.
Rejection: > 50 dB, 995 Hz to 1025 Hz.
< 3 dB at 862 Hz and 1182 Hz.
Out of Band Ripple (< 400 Hz and > 1700 Hz): < ± 0.5 dB.

IMPULSE NOISE

Provides a single threshold Impulse Noise measurement in accordance with BSTR Pub. 41009.
Maximum Measurement Period: 99 minutes 59 seconds.
Maximum Impulse Count: 999.
Counting Rate: 143 ms/count ± 5%.
Threshold Accuracy on 1700 Hz tone: ± 1 dB for threshold ⩾ –80 dBm, and ⩽ +20 dBm. Measured channel power should not exceed threshold by more than 54 dB.

OPTION 907 – FRONT HANDLE KIT

Adds front handles to the SLMS.

OPTION 908 – RACK FLANGE KIT

Enables the SLMS to be secured in a 483 mm (19 in) rack.

OPTION 909 – RACK AND HANDLE KIT

Combination of Options 907 and 908.

OPTION 910 – EXTRA SET OF MANUALS

Table 1-2 Recommended Test Equipment

Instrument Type	Critical Specification	Suggested Model	Use*
Frequency Counter	0 to 125MHz; Resolution 1Hz, Accuracy ±1 digit ± timebase; 250mV Ext Reference Input	HP 5328A	A,O
Power Meter	10kHz to 32MHz; Sensitivity −80dBm (75Ω); Impedance 75Ω	HP 436A/8483A	O,P
0dBm Power Meter	1kHz to 32MHz; Flatness ±0.015dB; Resolution 0.002dB; Impedance 75Ω	Wandel & Golterman EPM-1/TK-10	A,P
75Ω Standard Attenuator	Range 80dB; Uncertainty ±0.02dB/ 10dB step; Impedance 75Ω		P
Frequency Standard	5MHz, Setting Accuracy $<1.2 \times 10^{-10}$ Short term stability (100mS) $<1 \times 10^{-9}$	HP 5065A	P,A (Required for OPT 013 only)
Oscilloscope	DC to 100MHz; Timebase 10nS to 15; 5mV/Division	HP 1740A	P,A,T O
Oscilloscope	Rear Panel connectors for 3040A System	HP 1201B OPT 006	A
Spectrum Analyzer	Range +20dB to −130dBm 50kHz to 200MHz 10Hz resolution bandwidth	HP 8568A or HP 140T/8552B/8553B with HP 3580	P,A,T P,A,T A
Synthesized Signal Generator	10kHz to 125MHz, Resolution 1Hz; DC coupled AM Input, 10MHz Reference Input	HP 8660C/86631B 86601A/866028* (*8660C Mainframe requires HP 11661B)	P
RMS Voltmeter	10Hz to 10MHz, Sensitivity −70dBm Resolution 0.2dB	HP 3403C	P
Network Analyzer System	Unique	HP 3040A	A
Oscilloscope Probe	1:10 Divider	HP 10004D	P,A,T
Calculator	Unique – HP-IB Verification	HP 9825A	P
Network Analyzer	Unique	HP 8421A/8407A	A
Generator Sweeper	Unique	HP 8601A	A
Synthesizer/Level Generator	Unique	HP 3335A	P,A,O
Test Oscillator	10Hz to 10MHz; Balance 600Ω output, Flatness better than ±0.2dB	HP 654B	P,A
Digital Voltmeter	3½ digit display 100mV to 100V dc	HP 3403C	A,T
50Ω/75Ω Matching Pad	Flatness <±0.003dB	HP 85428B	P

Table 1-2 Recommended Test Equipment (continued)

Instrument Type	Critical Specification	Suggested Model	Use*
Matching Resistor	50Ω to 75Ω	HP 11658A	P
HP-IB Cable	Unique	HP 10833A/B/C/D	P
Power Splitter	75Ω balance <±0.05dB Insertion Loss	HP 11652-60019	P
Power Splitter	50Ω, balance <±0.05dB Insertion Loss	HP 11652-60009	P
Power Splitter	Frequency Range 0 to 32MHz Balance <0.005dB	Wandel & Golterman BN595/1	P,A
75Ω Termination	Unique	HP 15522C	P,A
Directional Bridge	Insertion Loss 6dB; Directivity 40dB;	HP 8721A and HP 8721A OPT 008	P,A
Adapter	BNC Plug to 50Ω Conhex Connector	Sealectro 51-073-6800	A
Adapter	BNC Jack to 50Ω Conhex Connector	Sealectro 51-073-6801	A
Oscilloscope Probe	1:1	HP 10007B	A,T
Cables	75Ω	HP 15525A	P,A
Connector	Siemens Type	HP 5060-4444	T
HP-IB Calculator Interface	Unique – HP-IB Verification		P
Adapter	1.6/10mm(M) → BNC(F) 75Ω (two off)	Wandel & Golterman BN 48-68-00	P,A
Adapter	1.6/10mm(F) → BNC(M) 75Ω	Wandel & Golterman 5391	P,A
Adapter	1.6/10mm(F) → BNC(F) 75Ω	Wandel & Golterman 5392	P,A
Active Probe	Frequency Range dc to 100MHz 10MΩ Input Impedance	HP 1124A	A
Return Loss Bridge	50kHz to 12MHz	HP 15590A	P
Termination	75Ω	HP 15522C	P
Termination	67.5Ω	HP 15529A	P
Termination	62Ω	HP 15591A	P
Termination	Short-circuit	HP 1250-0929	P

SECTION II
INSTALLATION

2-1 INTRODUCTION

2-2 This section provides installation instructions for the Hewlett-Packard Model 3746A Selective Level Measuring Set (SLMS) and its accessories. This section also includes information about initial inspection and damage claims, preparation for using SLMS and packaging, storage and shipment.

2-3 INITIAL INSPECTION

WARNING

TO AVOID HAZARDOUS ELECTRICAL SHOCK, DO NOT PERFORM ELECTRICAL TESTS WHEN THERE ARE SIGNS OF SHIPPING DAMAGE TO ANY PORTION OF THE OUTER ENCLOSURE (COVERS, PANELS, METERS).

2-4 Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect or if the SLMS does not pass the Performance Tests, notify the nearest Hewlett-Packard office. If the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carriers inspection. The HP office will arrange for repair or replacement at HPs option without waiting for claim settlement.

2-5 PREPARATION FOR USE

WARNING

TO AVOID THE POSSIBILITY OF INJURY OR DEATH, THE FOLLOWING PRECAUTIONS MUST BE FOLLOWED BEFORE THE INSTRUMENT IS SWITCHED ON.

(A) NOTE THAT THE PROTECTION PROVIDED BY GROUNDING THE INSTRUMENT CABINET MAY BE LOST IF ANY POWER CABLE OTHER THAN THE THREE PRONGED TYPE SUPPLIED IS USED TO COUPLE THE AC LINE TO THE INSTRUMENT.

(B) IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN AUTOTRANSFORMER TO REDUCE OR INCREASE THE LINE VOLTAGE, MAKE SURE THAT THE COMMON TERMINAL IS CONNECTED TO THE NEUTRAL POLE OF THE POWER SOURCE.

(C) THE POWER CABLE PLUG SHALL ONLY BE INSERTED INTO A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

2-6 Power Requirements

2-7 The SLMS requires a power source of 100V, 120V, 220V, or 240V ac, +5%-10%, 48 to 66Hz single phase. The maximum power consumption is 200VA.

2-8 Line Voltage Selection and Fuse

2-9 The line voltage is selected by the rear panel switch labelled 100V, 120V, 220V and 240V.

2-10 Fuse ratings are given in Table 2-1.

Table 2-1 Fuses

Nominal Line	Fuse Rating	HP Part Number
100V 120V	2A	2110-0002
220V 240V	1A	2110-0001

2-11 Power Cables

2-12 This instrument is equipped with a three-wire power cable. When connected to a power outlet, this cable grounds the instrument case. The type of power cable shipped with each instrument depends on the country of destination. Refer to Figure 2-1 for part numbers of the power cable and plug configurations available. The number shown below each plug is the Hewlett-Packard part number of a power cord equipped with that plug. If the appropriate power cord is not included with the instrument, notify the nearest Hewlett-Packard Sales and Service Office and a replacement will be provided.

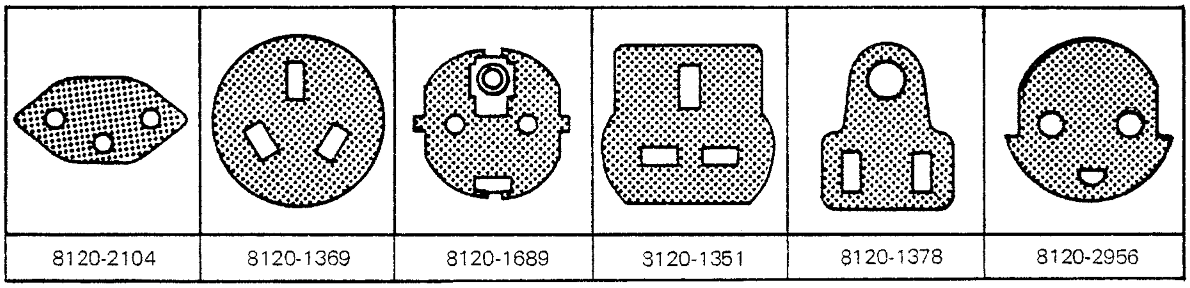


Figure 2-1 Power Receptacles

2-13 The colour code used in each power cable is given below:

Line .... Brown
Neutral .... Blue
Ground .... Green/Yellow

CAUTION

BEFORE CONNECTING THE INSTRUMENT TO A POWER OUTLET ENSURE THAT THE LINE VOLTAGE SELECTOR IS CORRECTLY SET AND THAT A FUSE OF THE CORRECT RATING IS FITTED.

2-14 Operating Environment

2-15 Temperature - The instrument may be operated in temperatures from 0 degrees centigrade to +55 degrees centigrade.

2-16 Humidity - The instrument may be operated in environments with humidity up to 95%. However, the instrument should also be protected from temperature extremes which may cause condensation within the instrument.

2-17 Altitude - The instrument may be operated at altitudes up to 4600m (15,000ft).

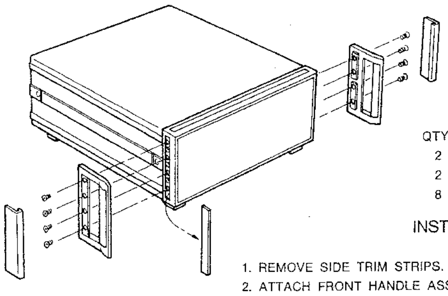
2-18 RACK MOUNTING

2-19 Illustrated in Figure 2-2 are the three Rack Mount Kits available with the SLMS.

7H FRONT HANDLE KIT

[PRODUCT HT. 177.0mm/6.969 in.]

HP PART NUMBER 5061-0090 (OPTION 907)



CONTENTS

QTY.		PART NO.
2	FRONT HANDLE ASS'Y	5060-9900
2	FRONT HANDLE TRIM	5020-8897
8	#8-32 x 3/8 SCREW	2510-0195

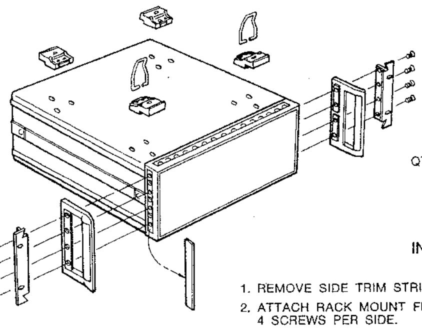
INSTRUCTIONS

1. REMOVE SIDE TRIM STRIPS.
2. ATTACH FRONT HANDLE ASS'Y WITH 4 SCREWS PER SIDE.
3. PRESS FRONT HANDLE TRIM IN PLACE.

7H RACK MOUNT KIT WITH FRONT HANDLES

[PRODUCT HT. 177.0mm/6.969 in.]

HP PART NUMBER 5061-0084 (OPTION 909)



CONTENTS

QTY.		PART NO.
2	RACK MOUNT FLANGE	5020-8875
2	FRONT HANDLE ASS'Y	5060-9900
8	#8-32 x 5/8 SCREW	2510-0194

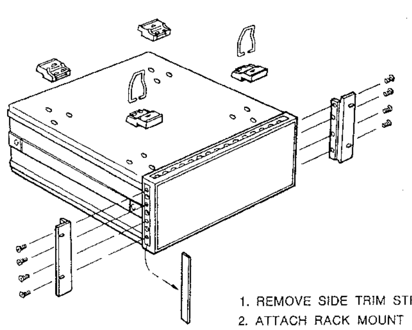
INSTRUCTIONS

1. REMOVE SIDE TRIM STRIPS.
2. ATTACH RACK MOUNT FLANGE AND FRONT HANDLE ASS'Y WITH 4 SCREWS PER SIDE.
3. REMOVE FEET AND TILT STANDS BEFORE RACK MOUNTING.

7H RACK MOUNT KIT WITHOUT FRONT HANDLES

[PRODUCT HT. 177.0mm/6.969 in.]

HP PART NUMBER 5061-0078 (OPTION 908)



CONTENTS

QTY.		PART NO.
2	RACK MOUNT FLANGE	5020-8863
8	#8-32 x 3/8 SCREW	2510-0193

INSTRUCTIONS

1. REMOVE SIDE TRIM STRIPS.
2. ATTACH RACK MOUNT FLANGE WITH 4 SCREWS PER SIDE.
3. REMOVE FEET AND TILT STANDS BEFORE RACK MOUNTING.

Figure 2-2 Rack Mount Kits

2-20 STORAGE AND SHIPMENT

2-21 Environment

2-22 The instrument may be stored or shipped in environments within the following limits:

Temperature .... -40 to +75°C
Humidity 90%
Altitude 15,300m (50,000ft)

2-23 The instrument should also be protected from temperature extremes which may cause condensation within the instrument.

2-24 Packaging

2-25 Tagging for Service - If the instrument is being returned to Hewlett-Packard for service, please complete one of the blue repair tags located at the front of this manual and attach it to the instrument.

2-26 Original Packaging - Containers and material identical to those used in the factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also mark the container "FRAGILE" to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-27 Other Packaging - The following general instructions should be used for re-packing with commercially available materials:

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

(b) Use strong shipping container. A double-walled carton made of 350pound test material is adequate.

(c) Use a layer of shock absorbing material 70 to 100mm (3 to 4inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside the container. Protect the control panel with cardboard.

(d) Seal shipping container securely.

(e) Mark the shipping container "FRAGILE" to ensure careful handling.

(f) In any correspondence, refer to instrument by model number and full serial number.

2-28 ALTERNATIVE OUTPUTS

2-29 The rear panel 10MHz OUTPUT and CHART RECORDER OUTPUT both have two selectable output modes which are determined by the setting of test links and switches within the 3746A. The following paragraphs outline the procedures for converting these outputs.

WARNING

THE FOLLOWING PROCEDURES SHOULD BE PERFORMED BY SERVICE TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED.

2-30 10MHz OUTPUT (+6dBm into 50ohm or -30dBm into 75ohm)

2-31 The 3746A is normally supplied with the rear panel 10MHz OUTPUT in the +6dBm, 50ohm mode. The following procedure modifies the output to -30dBm, 75ohm.

PROCEDURE

1. Disconnect the power cable.

2. Remove the 3746A top cover.

3. Remove Assembly A40 from housing.

4. Remove A40TL1 from the "50" position and put it to the "75" position.

5. Replace items in steps 1, 2 and 3 (in the reverse order) to restore the 3746A ready for use.

2-32 CHART RECORDER OUTPUT (voltage or current drive – H27 instruments)

2-33 The 3746A is normally shipped with the rear panel CHART RECORDER OUTPUT in the voltage drive mode. The following procedure modifies the output to current drive.

PROCEDURE

1. Disconnect the power cable.
2. Remove the 3746A top cover.
3. Remove Assemblies A21 and A60 from their housings.
4. Remove A21TL1 from "V" position and fit it into "I" position.
5. Switch A60S2 switch position 1 to "ON" (or "1" position).
6. Replace items in steps 1, 2 and 3 (in the reverse order) to restore the 3746A ready for use.

2-34 EXTENDING THE CCITT FDM PLANS

2-35 The SLMS CCITT FDM plans 1A and 2 are extended to 4 Super Master Groups and 4 Hypergroups respectively by carrying out the following procedure.

WARNING

BEFORE CARRYING OUT THE FOLLOWING PROCEDURE ENSURE THAT THE POWER CABLE IS DISCONNECTED FROM THE INSTRUMENT.

PROCEDURE

1. Remove the top cover.
2. Remove Assembly A60.
3. Put A60S2(7) to the "0" position (Figure 2-3).
4. Replace Assembly A60 and the top cover.
5. Set the front panel PLAN switch to CCITT (1A or 2 as required) and the MASTER GPS/SYSTEM BW switch to 12MHz position.

2-36 HEWLETT-PACKARD INTERFACE BUS (HP-IB) INSTALLATION

2-37 This section contains information on the installation of the 3746A SLMS into a HP-IB system.

2-38 The HP-IB is Hewlett-Packards implementation of the IEEE Standard 488-1978 (Digital Interface for Programmable Instrumentation). This standard defines a physical interface and protocol which enables the remote control of instrumentation systems.

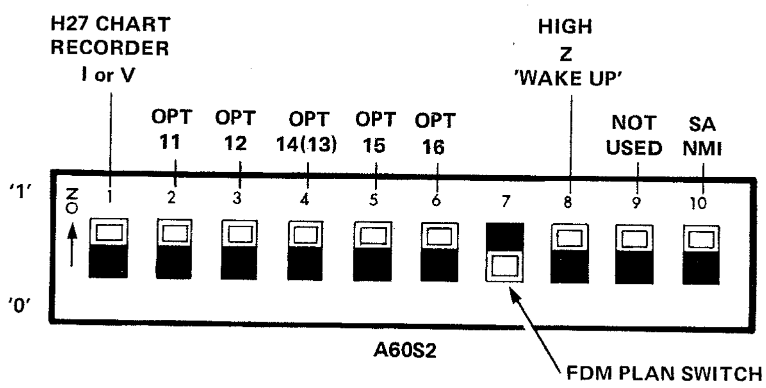


Figure 2-3 Extending FDM Plan

2-39 CONNECTION TO THE HP-IB

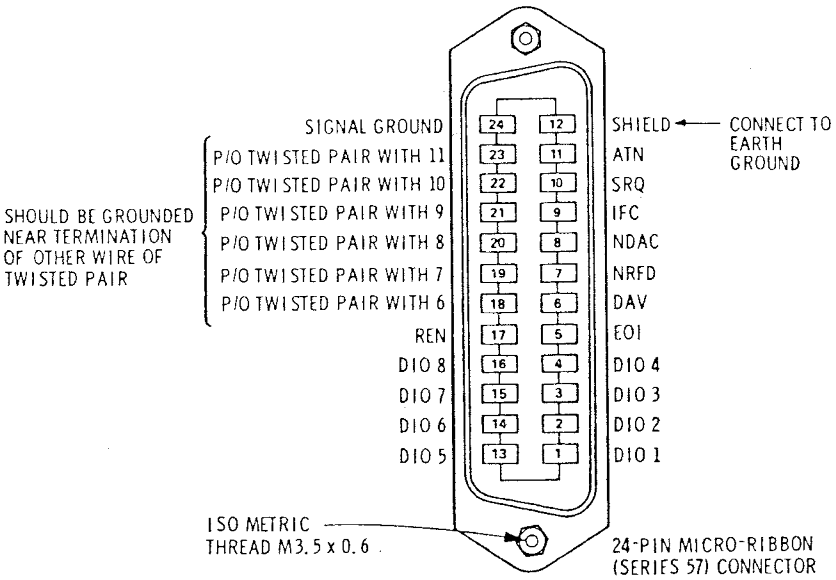


Figure 2-4 HP-IB (rear panel) Connector

2-40 The HP-IB connector on the rear panel of the SLMS provides the physical interface to connect the SLMS into an HP-IB system. Figure 2-4 illustrates the connector pin configuration. Devices in the HP-IB system may be interconnected in any suitable arrangement (star, delta, etc) using the HP-IB cables listed in Table 2-2 provided the restrictions given in Paragraph 2-41 are obeyed.

Table 2-2 HP-IB Interface Cables

HP-IB Part Numbers	Cable Lengths
HP10833A	1m (3.3ft)
HP10833B	2m (6.6ft)
HP10833C	4m (13.2ft)
HP10833D	0.5m (1.6ft)

2-41 To achieve design performance, restrictions are placed on the length of HP-IB system cable as follows:

1. The total length of HP-IB cable used to interconnect devices on the HP-IB must not exceed 2 metres (6 feet) times the number of devices in the system.

2. The total length of HP-IB cable used to interconnect all devices must not exceed 20 metres (65 feet).

2-42 SLMS CONFIGURATION

2-43 The SLMS may be configured either as the system controller in an HP-IB system containing certain selected peripherals or as a device under the remote control of a separate system controller (normally a computer or computing controller). Separate installation information is given as described below depending upon whether the SLMS is configured as the system controller or as a device under the control of a separate system controller. Paragraphs 2-44 to 2-51 describe SLMS installation in an HP-IB system where the SLMS is configured as the system controller. Paragraphs 2-52 to 2-56 describe SLMS installation in an HP-I system where the SLMS is configured as a device under the control of a separate system controller.

2-44 SLMS CONFIGURED AS CONTROLLER

2-45 The setting of the CNTRL switch (see Figure 2-5) on the SLMS rear panel to the CNTRL ON (1) position configures the SLMS as the system controller.

2-46 As the system controller the SLMS has the ability to control the operation of suitable Printers, Frequency Synthesizers, HP-IB Bus Extenders and CRT Displays. A list of suitable HP equipment is given in Table 2-3.

Table 2-3 SLMS As Controller - Suitable HP Equipment

Device	HP Model
Printer	HP 5150A Opt 001 (20 column) HP 2631B Opt 046 (80 column)
Frequency Synthesizer	HP 3330B (0.1-13MHz) HP 3335A (200Hz-80MHz) HP 3336A/B/C (10Hz-21MHz)
CRT Display	HP 37461A CRT Display
HP-IB Bus Extender	HP 37201A Bus Extender

2-47 HP-IB Device Addressing

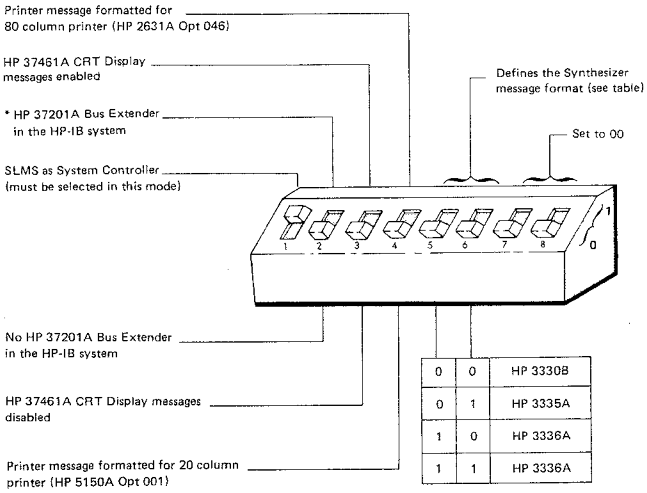
2-48 Each device in an HP-IB system requires a unique address to distinguish it from other devices in the system. An SLMS configured as the system controller has fixed listen and talk addresses as detailed in Table 2-4. Other devices on the HP-IB system must be set to respond to the appropriate address as listed in Table 2-4. Refer to the indiviual instrument operating manual for details on address setting.

Table 2-4 Device Addresses

Device	Listen Address		Talk Address	
	Decimal	ASCII Char	Decimal	ASCII Char
SLMS (Fixed)	42	*	74	J
Printer	05	%	-	-
Synthesizer	04	$	-	-
CRT Display	03	#	-	-
HP-IB Extender	49	1	81	Q

2-49 Rear Panel HP-IB Switches

2-50 With the SLMS configured as the system controller, the switch settings on the rear panel HP-IB switch bank inform the SLMS which message format is required for the particular devices connected into the HP-IB. The switch settings are explained and illustrated in Figure 2-5. For detailed descriptions of the message formats transmitted by the SLMS see 3746A Operating Manual, Section V.



*Note: The HP-IB Extender setting must only be selected if the HP-IB network includes an HP 37201A HP-IB Extender. If this setting is selected and the HP-IB network does not include an HP 37201A HP-IB Extender the SLMS will hang-up. Do not select this position if the HP-IB system contains any bus extender other than the HP 37201A.

Figure 2-5 HP-IB Switches - SLMS as System Controller

2-51 SLMS CONFIGURED AS DEVICE

2-52 The settings of the CNTRL switch (see Figure 2-6) on the SLMS rear panel to the CNTRL OFF (0) position configures the SLMS as an HP-IB device under the remote control of a separate HP-IB controller.

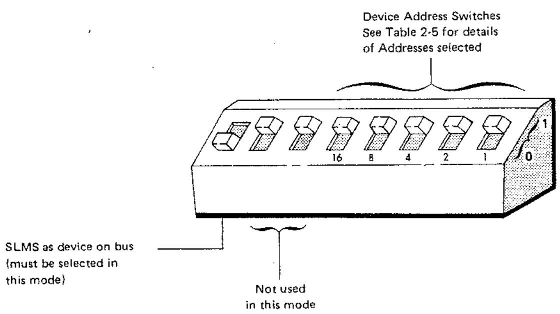


Figure 2-6 HP-IB Switches - SLMS as Device on Bus

2-53 HP-IB Addressing

2-54 Each device in the HP-IB system requires a unique address to enable the system controller to differentiate between devices. The SLMS has one listen address and three talk addresses. The addresses are defined by the setting of the Device Address switches within the HP-IB switch bank on the SLMS rear panel. The setting of these switches and the corresponding listen and talk addresses are illustrated in Figure 2-6 and Table 2-5 respectively. Note that the device address switch must not be set between 29 and 31 inclusive since this will cause invalid addresses.

2-55 Care should be taken to ensure that the listen or talk addresses of any other device in the HP-IB system does not duplicate one of the SLMS listen or talk addresses.

Table 2-5 SLMS Address Setting

Device Address					Device Address	Listen Address			Talk Addresses								
						Octal	Decimal	ASCII	Octal			Decimal			ASCII		
16	8	4	2	1					1	2	3	1	2	3	1	2	3
0	0	0	0	0	0	40	32	Space	100	101	102	64	65	66	@	A	B
0	0	0	0	1	1	41	33	!	101	102	103	65	66	67	A	B	C
0	0	0	1	0	2	42	34	"	102	103	104	66	67	68	B	C	D
0	0	0	1	1	3	43	35	#	103	104	105	67	68	69	C	D	E
0	0	1	0	0	4	44	36	$	104	105	106	68	69	70	D	E	F
0	0	1	0	1	5	45	37	%	105	106	107	69	70	71	E	F	G
0	0	1	1	0	6	46	38	&	106	107	110	70	71	72	F	G	H
0	0	1	1	1	7	47	39	'	107	110	111	71	72	73	G	H	I
0	1	0	0	0	8	50	40	(	110	111	112	72	73	74	H	I	J
0	1	0	0	1	9	51	41	)	111	112	113	73	74	75	I	J	K
0	1	0	1	0	10	52	42	*	112	113	114	74	75	76	J	K	L
0	1	0	1	1	11	53	43	+	113	114	115	75	76	77	K	L	M
0	1	1	0	0	12	54	44	,	114	115	116	76	77	78	L	M	N
0	1	1	0	1	13	55	45	—	115	116	117	77	78	79	M	N	O
0	1	1	1	0	14	56	46	.	116	117	120	78	79	80	N	O	P
0	1	1	1	1	15	57	47	/	117	120	121	79	80	81	O	P	Q
1	0	0	0	0	16	60	48	0	120	121	122	80	81	82	P	Q	R
1	0	0	0	1	17	61	49	1	121	122	123	81	82	83	Q	R	S
1	0	0	1	0	18	62	50	2	122	123	124	82	83	84	R	S	T
1	0	0	1	1	19	63	51	3	123	124	125	83	84	85	S	T	U
1	0	1	0	0	20	64	52	4	124	125	126	84	85	86	T	U	V
1	0	1	0	1	21	65	53	5	125	126	127	85	86	87	U	V	W
1	0	1	1	0	22	66	54	6	126	127	130	86	87	88	V	W	X
1	0	1	1	1	23	67	55	7	127	130	131	87	88	89	W	X	Y
1	1	0	0	0	24	70	56	8	130	131	132	88	89	90	X	Y	Z
1	1	0	0	1	25	71	57	9	131	132	133	89	90	91	Y	Z	[
1	1	0	1	0	26	72	58	:	132	133	134	90	91	92	Z	[	\
1	1	0	1	1	27	73	59	;	133	134	135	91	92	93	[	\	]
1	1	1	0	0	28	74	60	<	134	135	136	92	93	94	\	]	^
1	1	1	0	1	29	DO NOT USE THESE ADDRESSES											
1	1	1	1	0	30												
1	1	1	1	1	31												

SECTION III
OPERATION

3-1 INTRODUCTION

3-2 The operating instructions for this instrument are contained in a separate Operating Manual 03746-90003

SECTION IV
PERFORMANCE TESTS

4-1 INTRODUCTION

4-2 The procedures in this section test the instruments electrical performance using the specifications in Table 1-1 as the performance standard. All tests can be performed without access to the interior of the instrument.

4-3 EQUIPMENT REQUIRED

4-4 Equipment required for the performance tests is listed in Table 1-2 in Section I. Any equipment that satisfies the critical specifications given in Table 1-2 may be substituted for the recommended model(s).

4-5 TEST RECORDS

4-6 Results of the performance tests may be tabulated on Table 4-11 Test Record at the end of the procedures. The Test Record lists all of the tested specifications and their accepted limits. The results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments.

4-7 CALIBRATION CYCLE

4-8 This instrument requires periodic verification of performance. Depending on the use and environmental conditions, the instrument should be checked using the following performance tests at least every six months.

4-9 OPERATION VERIFICATION

4-10 To assure that the SLMS is performing properly without testing all of the specifications listed in Table 1-1; the procedure in Table 4-1 are suggested as an operation verification.

NOTE: Paragraphs 4-11, 4-13, 4-14 and 4-15 in Table 4-1 Operational Verification Procedure may be carried out without test equipment.

Table 4-1 Operational Verification Procedure

Procedure	Adjustment	Troubleshooting
4-11 SWITCH ON		
1. Set the SLMS POWER switch to ON, if necessary switch to STBY then ON to activate the Processor power-on reset sequence. All the DISPLAY and SWITCH indicators should be on and remain on for approximately 2 seconds.		All indicators OFF, check POWER SUPPLY. One or more indicators OFF check PROCESSOR TROUBLESHOOTING.
2. The SLMS should now be initialised with the 75 ohm INPUT, AUTO, and 3.1kHz FILTER selected. The instrument will be in the HALT mode of operation and may have a number displayed in the FREQ/FDM display. This is the frequency (recovered from the non -volatile memory) which the instrument was last tuned to.		
3. Set all the slide switches on the SLMS to the left most position.		
4. On instruments fitted with the High Impedance BRIDGED inputs, press the BRIDGED key to ensure that the inputs are in the low impedance mode.		
5. Press the MEAS key. The SLMS should now execute a CAL cycle and display a frequency of 1000.00kHz. The noise floor of the SLMS is indicated in the LEVEL display and should be <-115dBm. The LEVEL display should have a resolution of 0.1dB (one decimal point displayed).		Error E97 displayed and CAL permanently on. SLMS does not CAL. Check RECEIVER TROUBLESHOOTING. It is assumed that since the instrument has gone through the correct switch-on-sequence the Processor is working correctly and the serial data from the Processor to the Receiver A2 Assembly is correct. Absence of CAL signal must therefore be due to a fault on Assemblies A2 and A4.
6. Press the AVE, 2 keys. The SLMS should now undergo another CAL sequence and display the noise floor LEVEL with a resolution of 0.01dB.		
7. Press TR, 0,9 to initiate the ROM test. The SLMS should have a prom number in the TEST-POINT display and the word PASS in the LEVEL display. Press the ↑ key to advance to the next prom and check the word PASS is in the LEVEL display. Repeat until the initial prom number appears in the TEST-POINT display.		If FAIL appears in the LEVEL display see PROCESSOR TROUBLESHOOTING.
8. Press MEAS to return to the same state as in step 6.		

Table 4-1 Operational Verification Procedure (continued)

Procedure	Adjustment	Troubleshooting
4-12 FREQUENCY ACCURACY		
Note if the SLMS is fitted with OPT 013 or OPT 014 refer to the Performance Checks Paragraph 4-24 FREQUENCY ACCURACY.		
1. Connect an Electronic Counter to the SLMS rear panel 10MHz OUTPUT and check the frequency is 10MHz +–500Hz.	A40R78	
4-13 NOISE FLOOR		
1. Carry out the SWITCH ON procedure in Paragraph 4-11 steps 1 through 5.		
2. Press the STEP key and enter a step size of 314.123kHz and press MEAS.		
3. Hold the ↑ key pressed until the SLMS FREQ/FDM display reaches 32MHz, and check the noise floor indicated in the SLMS LEVEL display is always below –115dBm.		
4. Press the SLMS 38Hz FILTER key, and reset the FREQ to 1000kHz. Press MEAS and repeat steps 2 and 3.		
5. For instruments fitted with OPT 011, press the 48kHz FILTER key, reset the FREQ to 1000kHz and repeat steps 2 and 3. In this case the SLMS LEVEL display should always be below –100dBm.		
4-14 10MHz OUTPUT, COUNTER SENSITIVITY		
1. Carry out the SWITCH ON procedure Paragraph 4-11 steps 1 through 3.		
2. Tune the SLMS to 10MHz [Press FREQ 10,000.00 (kHz) and MEAS].		
3. Connect the SLMS rear panel 10MHz OUTPUT to the 75 ohm INPUT.		
4. The SLMS LEVELS should indicate –30dBm +–2dB or +5.8dBm +–2dB. The amplitude is is determined by the setting of Test Links TL1 and TL2 on the FREQUENCY REFERENCE Assembly A40.		If the SLMS LEVEL reading is incorrect, verify the SLMS 10MHz OUTPUT using a suitable power meter and an electronic counter. If the 10MHz OUTPUT is faulty refer to Assembly A40 Troubleshooting. If the 10MHz OUTPUT is correct refer to OVERALL TROUBLESHOOTING Paragraph 8-62.

Table 4-1 Operational Verification Procedure (continued)

Procedure	Adjustment	Troubleshooting
4-14 (continued). 5. Disconnect the 10MHz signal from the SLMS input and note the level of the noise floor. 6. Re-connect the 10MHz signal, via a suitable attenuator, to the SLMS 75Ω INPUT. 7. Adjust the attenuator level until the SLMS reads 40dB above the noise floor. 8. Re-tune the SLMS to 10,000.100kHz and press MEAS. The level should read the same as the previous step ±0.5dB. 9. Press the following SLMS keys TR, COUNTER and MEAS. 10. The SLMS FREQ/FDM display should change and read 10000.000kHz. **4-15 FILTERS** 3.1kHz FILTER 1. Carry out the SWITCH ON procedure in Paragraph 4-11 steps 1 through 3. 2. Tune the SLMS to 10MHz, [Press FREQ, 10000.000 (kHz) and MEAS]. 3. Connect the SLMS 10MHz OUTPUT to the SLMS 75 ohm INPUT. 4. Press TR, REF and dB/dBm keys to transfer the 10MHz level into a reference register in the SLMS. 5. Press the SLMS MEAS key, the LEVEL display should read 0dB. 6. Press the SLMS STEP key, and enter a step size of 0.01 (kHz). 7. Press MEAS. 8. Use the ↑↓ keys to increment/decrement the SLMS FREQuency. Check the −3dB band points are between: Upper;10,001.4kHz to 10,001.7kHz Lower; 9,998.6kHz to 9,998.3kHz Also check the variation in LEVEL, over the range 9,998.7 to 10,001.3 kHz should not exceed +−0.5dB.		

Table 4-1 Operational Verification Procedure (continued)

Procedure	Adjustment	Troubleshooting
4-15 (continued).		
38Hz FILTER		
9. Press the SLMS 38Hz FILTER key.		
10. Press the STEP key and enter a step size of 0.001kHz.		
11. Retune the SLMS to 10MHz (Press FREQ, 10,000.000 (kHz), and MEAS)		
12. Check the –3dB bandpoints are between: Upper;10,000.017kHz to 10,000.21kHz Lower; 9,999.983kHz to 9,999.979kHz Use the ↑↓keys to increment/decrement the SLMS FREQ. Also check the variation in level from 9,999.989 to 10,000.011kHz should not exceed +–0.1dB.		
48kHz FILTER – OPT 011 INSTRUMENTS ONLY		
13. Press the SLMS 48kHz FILTER key.		
14. Press the STEP key and enter a step size of 0.5kHz.		
15. Press MEAS.		
16. Check the –3dB bandpoints are between: Upper;10,021.9kHz to 10,026.41kHz Lower; 9,978.1kHz to 9,973.6kHz Also check the variation in level from 9,978.5kHz to 10,021.5kHz does not exceed +–1.2dB.		
4-16 MEASUREMENT ACCURACY		
OdBm (1MHz and 32MHz)		
1. Set the SLMS to 1MHz using the SWITCH ON procedure in Paragraph 4-11 steps 3 through 6.		
2. Set the Synthesizer/Level Generator frequency to 1MHz.		
3. Use a suitable Power Meter to set the Synthesizer/Level Generator to OdBm +–0.01dB.		
4. Connect the Synthesizer/Level Generator OUTPUT to the SLMS 75 ohm INPUT.		
5. Connect the Synthesizer/Level Generator 10MHz REF OUTPUT to the SLMS 10MHz REF INPUT.		
6. Check SLMS LEVEL indicates OdBm +–0.25dB. Typically better than +–0.1dB.	If the error exceeds +– 0.2dB but is less than +– 0.3dB. Adjust A4R80 as per Paragraph 5-27.	ERROR >+ –2dB. Check Synthesizer output frequency at A51J2 is 51.015625MHz ± 1Hz, then refer to Receiver Troubleshooting.
7. Press the SLMS 38Hz FILTER key then MEAS. Repeat step 6.		

Table 4-1 Operational Verification Procedure (continued)

Procedure	Adjustment	Troubleshooting
4-16 (continued).		
8. Press the SLMS 48kHz FILTER key then MEAS, check the SLMS level indicates 0dBm +–1dB.	If error is >1dB <2dB Group Filter Adjustment Paragraph 5-30.	Check Synthesizer output frequency at A51J2 is 50 – 05MHz. If synthesizer frequency is correct and steps 1 through 7 are correct refer to A11 troubleshooting.
9. Press the SLMS AVE, 0 keys and check the level remains at 0dBm.		
10. Press the 3.1kHz FILTER key and retune the SLMS to 31.99MHz (Press FREQ, 31990, and MEAS keys).		
11. Press the SLMS AVE, and 2 keys. Repeat step 6.		
12. Retune the Synthesizer/Level Generator to 31.99MHz.	Adjust A2C21, A2R27 as per Adjustment paragraph 5-27.	
13. Repeat steps 3 through 8.		
STEP ATTENUATOR/GAIN STEPS		
14. Decrease the Synthesizer/Level Generator to –30dBm.		
15. Press the SLMS 3.1kHz FILTER key, AVE, 1, keys followed by MEAS.		
16. Press keys TR, 2, 1. This sets the SLMS to a diagnostic test mode d21. The SLMS FREQ/FDM display should indicate **rf atten = 09.** [State 09 is zero attenuation state.]		**rf atten** state less than 09. Refer to adjustments for Assembly A4 to check the threshold limits, then if necessary Troubleshooting.
17. Press key 3 to enter diagnostic test mode d23. This mode displays the output of the A/D converter and should read between 1900 and 2700.	0dBm LEVEL adjustment Paragraph 5-27	A/D converter output incorrect refer to RECEIVER TROUBLESHOOTING.
18. Press key 0 to enter diagnostic test mode d20. This mode displays the receiver gain state between 00 and 19. If necessary press the key ↓ to set the I.F. GAIN=00. Most of the time the IF GAIN state will be at 00 and this step is not necessary.		IF GAIN state >02. Refer to receiver troubleshooting.
19. Press 3 and note the reading on the FREQ/FDM display. The value of the least significant digit, which may be changing rapidly, is not important.		
20. Press key 1, then key ↓ to change the rf Atten to 00. [Maximum attenuation state]		
21. Press key 0, then key ↑ to change the I.F. GAIN = 09.		
22. Press key 3 and check the reading on the FREQ/FDM display. The reading should be the same as in step 20 typically with + –50 counts [e.g. if the reading was 2500 the new reading should not exceed the limits 2450 – 2550.		Error >+ – 100 counts usually indicates either the input attenuator is faulty, or there is a fault A20 or A21 assemblies.

Table 4-1 Operational Verification Procedure (continued)

Procedure	Adjustment	Troubleshooting
4-16 (continued).		
23. In practice however the least significant digit may change so rapidly it is difficult to read.		A separate check for the Input Attenuator is contained in the Receiver Troubleshooting.
24. Press the SLMS MEAS key.		
25. Change the Synthesizer/Level Generator to −60dBm.		
26. Press the SLMS key TR, 23 and note the reading.		
27. Press key 0, note the number displayed in I.F. GAIN=?? (number displayed in LEVEL display).		
28. Press the ↑ to increment the state to I.F. GAIN= 15.		
29. Press key 1, and press the ↓ key to decrement the rf Atten by the number of steps equal to the difference in reading between gain steps 27 and 28.		
30. Press key 3 and check the reading is the same as step 26 typically within +−50 count.		Error >+−100 counts and steps 14 to 23 OK. Assembly A21 gain stages appear faulty.
BROADBAND POWER		
31. Set the Synthesizer/Level Generator to a Frequency of 1MHz and a level of 0dBm.		
32. Press the SLMS AVE and 1 keys.		
33. Press the SLMS I/P POWER key and the MEAS key.		
34. The SLMS LEVEL should read 0dBm +−1dB.	A4R36, A4R39 Paragraph 5-26.	Error >2dB. See Receiver Troubleshooting.
35. Change the Synthesizer/Level Generator frequency to 32MHz and check the SLMS LEVEL reading is 0dBm +−1dB.	A4R90, A4C41 Paragraph 5-26.	
BALANCED INPUTS		
36. Repeat steps 1 through 6.		
37. Press the 150Ω TERMINATION key, then MEAS.		
38. Connect the Synthesizer/Level Generator 75Ω output to a single input port of the 150Ω INPUT on the SLMS.		
39. The SLMS LEVEL display should indicate −3.01dBm ±0.6dB.		
FOR OPT 005 INSTRUMENTS (124/135Ω BAL)		
40. Press the 124Ω/135Ω TERMINATION key then MEAS.		
41. Connect the Synthesizer/Level Generator 75Ω output to a single INPUT port of the 124Ω INPUT on the SLMS.		

Table 4-1 Operational Verification Procedure (continued)

Procedure	Adjustment	Troubleshooting
4-16 (continued). 42. The ALMS LEVEL display should indicate −3.02dBm ± 0.6dB. 43. Connect the Synthesizer/Level Generator 75Ω output to a single INPUT port of the 135Ω INPUT on the SLMS. 44. The SLMS LEVEL display should indicate −3.05dBm ± 0.6dB. 600Ω BALANCED INPUT See Performance Checks MEASUREMENT ACCURACY (BALANCED INPUTS) Paragraph 4-26 steps 45 through 48. **4-17 AUDIO OUTPUT** see Paragraph 4-35 **4-18 TEST POINT SELECTOR** see Paragraph 4-36 **4-19 CHART RECORDER/METER DRIVE OUTPUT** see Paragraph 4-38 **4-20 HP-IB** see Paragraph 4-39 **4-21 CHANNEL IMPAIRMENTS** see paragraph 4-42 through 4-45 **4-22 TRACKING GENERATOR** paragraph 4-45 steps 1 through 11 **4-23 HOT TONE** see paragraph 4-46		

4-21 PERFORMANCE CHECKS

4-22 PRELIMINARY PROCEDURE

NOTE: The Preliminary Procedure is intended to be used in conjunction with individual Performance Tests, and not as a stand alone check.

1. If the SLMS is in the STBY position, set the POWER switch to ON. If the SLMS is in the ON position press keys TR, then CLEAR/SET. Both procedures activate a reset sequence. All the display and switch indicators should be on and remain on for about 2 seconds.

2. The SLMS should now be initialised with the 75 ohm INPUT, AUTO and 3.1kHz FILTER selected. The instrument will be in the HALT mode and may have a number displayed in the FREQ/FDM display.

3. Press the AVE then 2 keys. (This gives the SLMS a resolution of 0.01dB. As the instrument is in the HALT mode when this key sequence is pressed nothing appears to happen. With the instrument in the MEAS mode a calibration sequence would automatically follow each AVE selection.)

4. Set all the slide switches to the leftmost position and, on instruments fitted with BRIDGED inputs, ensure that the Bridged LED is OFF (normal inputs selected).

5. Press the FREQ key and enter 10,000.00kHz.

6. Press the MEAS key. The instrument should now execute the CAL cycle and display a frequency of 10,000.00kHz. In the absence of input signals the noise floor of the instrument is indicated in the LEVEL display and should be <-115dBm.

7. Pressing any of ENTRY, FILTER or TERMINATION keys sends the SLMS into the HALT mode terminating the MEAS sequence.

8. Enter the following measurement parameters.

   REF (level)..0dBm
   START, FREQ..50kHz
   STOP, FREQ..32MHz
   STEP..10kHz

9. Press MEAS (see step 6).

4-23 RETURN LOSS

SPECIFICATION

Return Loss >30dB	50kHz to 32MHz	75 ohm UNBAL INPUT
	10kHz to 2MHz	135/150 ohm BAL INPUTS
	10kHz to 12MHz	124 ohm BAL INPUTS

DESCRIPTION

A Directional/Return Loss Bridge is used to measure the reflected power from the UNBAL INPUT and each BAL input port in turn. Two measurement methods are used. Figure 4-2 shows the equipment set up for frequencies above 500kHz and Figure 4-3 for frequencies below 500kHz.

EQUIPMENT

Spectrum Analyzer....HP 140T/8552B/8553B
Network Analyzer....HP 8421A/8407A
Generator Sweeper....HP 8601A
Power Splitter....HP 11652-60019
Directional Bridge....HP 8721A (OPT 008)

Signal Generator....HP 654B
Return Loss Bridge....HP 15590A
Short Circuit Termination....HP 1250-0929
*75 ohm Termination....HP 15522C
x67.5 ohm Termination....HP 15529A
!62 ohm Termination....HP 15591A

* Used to check 150 ohm balanced input and 75 ohm unbalanced input
x Used to check 135 ohm balanced input only - OPT 005 only
! Used to check 124 ohm balanced input only - OPT 005 only

Balanced to Unbalanced Test Cable....See Figure 4-1

NOTE: This Test Cable comprises two BNC connectors, Connector 5060-4444 and two equal length coax cables. Figure 4-1 below illustrates the construction of the Test Cables.

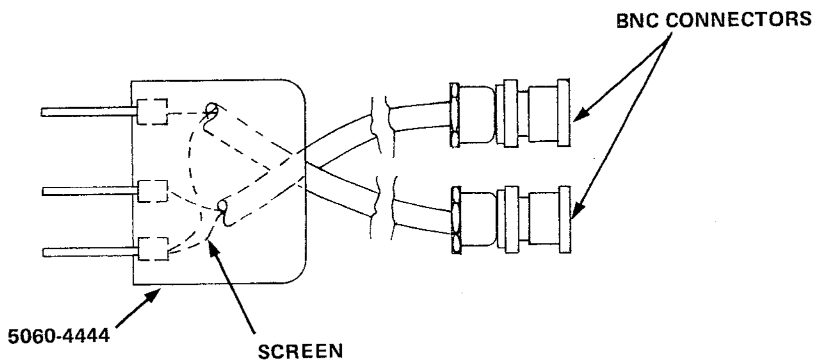


Figure 4-1 Balanced to Unbalanced Test Cable

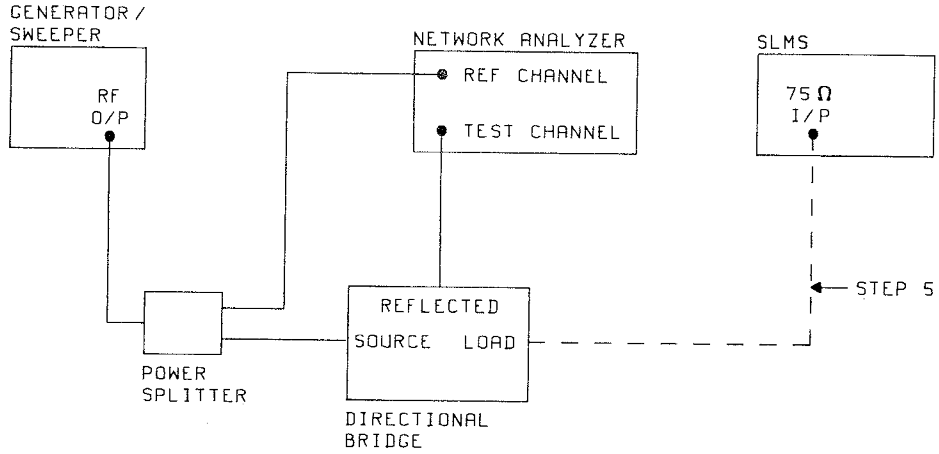
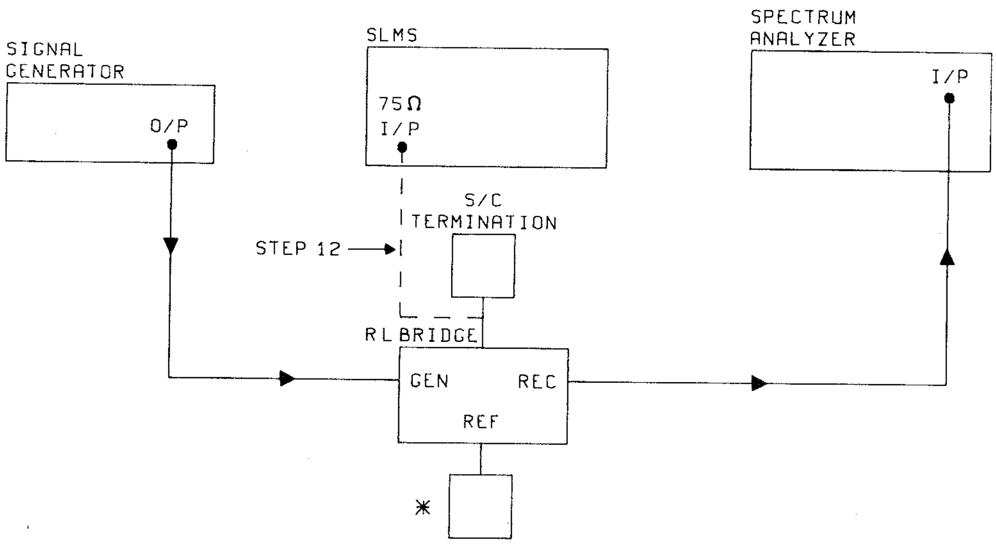


Figure 4-2 Return Loss Test Set-up (>500kHz)



*TERMINATION

* Use 75 ohm Termination for 75 ohm UNBAL and 150 ohm BAL inputs.
Use 62 ohm Termination for 124 ohm BAL inputs.
Use 67.5 ohm Termination for 135 ohm BAL inputs.

Figure 4-3 Return Loss Test Set-up (<500kHz)

PROCEDURE

1. Connect the equipment as shown in Figure 4-2, and press the SLMS 75 ohm TERMINATION key.

2. Press the SLMS keys TR, 2, 1 and ↑ to set the SLMS to diagnostic test mode d21 with "rf Atten = 09" displayed in the SLMS FREQ/FDM and LEVEL windows.

3. Connect the test equipment as shown in Figure 4-2 with the recommended equipment controls set as follows:

HP 8601A Generator/Sweeper
FREQ....32MHz
RANGE....110MHz
SWEEP....VIDEO
OUTPUT LEVEL.... -16dBm
MOD....OFF
CRYSTAL CAL....OFF
SWEEP MODE....FAST
SWEEP VERNIER....Fully anti-clockwise

HP 8470A/8412A Network Analyzer
MODE....AMPLITUDE
AMPL....10dB/div

4. Adjust the Network Analyzer DISPLAY REF control for an on-screen display, with the trace at the top of the CRT display.

5. Remove the Short Circuit Termination from the Directional Bridge, and connect to Bridge via a suitable through connector or a short length of co-ax cable to the 75 ohm UNBAL INPUT.

6. Check that the trace displayed on the Spectrum Analyzer is at least 30dB below the 0dB reference line over the range 100kHz to 32MHz.

7. Connect the Directional Bridge to each port of the 150 ohm BALanced INPUT in turn and check the Spectrum Analyzer trace is at least 30dB below the 0dB reference line over the range 100kHz to 2MHz.

8. Press the SLMS keys TR, 2, 1. Repeat steps 5 through 7 with the rf Atten = 00, 01, 02, 03, 04, 05, 06, 07, 08, 09.

FOR OPT 005 INSTRUMENTS SEE STEPS 15 through 18

Return Loss 50kHz to 500kHz

9. Set up the equipment as shown in Figure 4-3.

10. Tune Signal Generator to a frequency of 50kHz and adjust output level to approximately +10dBm.

11. Set Spectrum Analyzer controls for a SCAN from 0 to 500kHz. Adjust GAIN controls to position tip of 50kHz signal on the top line of the CRT graticule (0dB reference line).

12. Remove the Short Circuit Termination from the Return Loss Bridge and connect it to the 75 ohm UNBAL INPUT via a suitable straight through adaptor, or a short length of low loss co-axial cable.

13. Vary the Signal Generator frequency from 50kHz to 500kHz and check that the signal level displayed on the Spectrum Analyzer remains at least 30dB below the 0dB reference line.

14. Connect the Return Loss Bridge to each port of the 150 ohm BALanced INPUT in turn and repeat step 12.

STEPS 15 through 18 APPLY TO OPT 005 INSTRUMENT ONLY

Return Loss:	50kHz to 2MHz (135 ohm BAL INPUT)
	50kHz to 12MHz (124 ohm BAL INPUT)

15. Replace the 75 ohm load with a 67.5 ohm loads.

16. Connect the Return Loss Bridge to each port of the 135 ohm BALanced INPUT in turn and repeat step 12, except increase the Signal Generator frequency to 2MHz.

17. Replace the 67.5 ohm load with a 62 ohm load.

18. Connect the Return Loss Bridge to each port of the 124 ohm BALanced INPUT in turn and repeat step 12, except increase the Signal Generator Frequency to 12MHz.

4-24 FREQUENCY ACCURACY - OPT 013/014 INSTRUMENTS ONLY

SPECIFICATION

10MHz (REFERENCE) OUTPUT Initial Setting Accuracy ± 1Hz
(ageing rate ± 1.5Hz per year forOPT 013, ± 2Hz for OPT 014)

DESCRIPTION

The 10MHz PRECISION FREQUENCY REFERENCE is phase locked to the SLMS FREQUENCY REFERENCE (rear panel link). The 10MHz OUTPUT of the SLMS is now compared to a suitable House Standard with an absolute accuracy of 1 part in 10-9 or better. The frequency difference between oscillators is checked by monitoring the drift on an Oscilloscope triggered by the House Reference.

EQUIPMENT

Oscilloscope.......................................HP 1740A
Frequency Standard...............................HP 5065A

PROCEDURE

1. Before checking, allow the SLMS to be in either the ON or STBY state for at least 1/2 an hour to allow the master oscillator to stabilise. (Also ensure the rear panel 10MHz OVEN OUTPUT is linked to the 10MHz REF INPUT.)

2. Connect the Frequency Standard to the Oscilloscope EXT TRIGGER INPUT, and the SLMS 10MHz OUTPUT to a suitable vertical INPUT on the Oscilloscope.

3. Adjust the Oscilloscope timebase and external trigger adjust to obtain as stable a waveform as possible with at least 8Hz displayed on screen.

4. Check the sideways movement of the displayed signal is less than 1 cycle per 5 seconds.

4-25 FREQUENCY REFERENCE ACCURACY

NOTE: This check may be omitted if the instrument is fitted with the PRECISION FREQUENCY REFERENCE (OPTION 013/014). Refer to Paragraph 4-24 Frequency Accuracy.

SPECIFICATION

10MHz (REFERENCE) OUTPUT

Frequency: 10MHz ± 500Hz

DESCRIPTION

The frequency reference source is normally phase-locked to an external precision frequency reference. This test measures the internal frequency reference in the absence of a precision frequency reference.

EQUIPMENT

Electronic Counter...HP 5328A

PROCEDURE

1. Remove any connection at the rear panel 10MHz REF INPUT.
2. Connect an Electronic Counter to the 10MHz OUTPUT (rear panel).
3. Check the frequency is 10MHz ± 500Hz.

4-26 MEASUREMENT ACCURACY

SPECIFICATION

(Temperature range 10°C to 35°C)

NOTE: See Specification Table 1-1 for 0°C to -55°C

Broadband Power	Unbalanced Input	<± 1dB	+20	to −45dBm
	Balanced Input	<± 1dB	0	to 45dBm
Selective 48kHz Filter (Option 011)	Unbalanced Input	<± 1dB	+20	to −80dBm
	Balanced Input	<± 1dB	0	to −80dBm
Other Selective Filters with signal at +−1Hz of Tuned Frequency	Unbalanced Input (+20 to −80dBm)	<± 1dB	200Hz	to 10kHz
		<± 0.45dB	10kHz	to 50kHz
		<± 0.25dB	50kHz	to 20MHz
		<± 0.45dB	20MHz	to 30MHz
	Balanced Input(s) (0 to −80dBm)	<± 0.6dB	10kHz	to 50kHz
		<± 0.4dB	50kHz	to *2MHz
	600 ohm Balanced Input (0 to −80dBm)	<± 1dB	200Hz	to 100kHz

*12MHz for 124 ohm balanced input

DESCRIPTION

This test checks the amplitude accuracy of the SLMS over the input frequency range of the instrument. The measurement method uses a highly accurate power meter to set the input level of a Synthesized Signal Generator, via a Standard Attenuator*, to +10dBm. The attenuation of the Standard Attenuator is increased by 90dB, in 5dB steps (+10dBm to -80dBm) and the SLMS measurement error compared with the Standard Attenuator error.

EQUIPMENT

Synthesizer/Level Generator	HP 3335A
OdBm Power Meter	EPM-1 W&G BN564/0
Power Meter Probe	TK-10 W&G BN5720
Test Oscillator	654B
Standard Attenuator	*

*An attenuator recently calibrated, with a certificate of calibration and an itemised table of error and uncertainty, should be used. The attenuator range should be 0-80dB; uncertainty ± 0.02dB/10dB step with an impedance of 75 ohm.

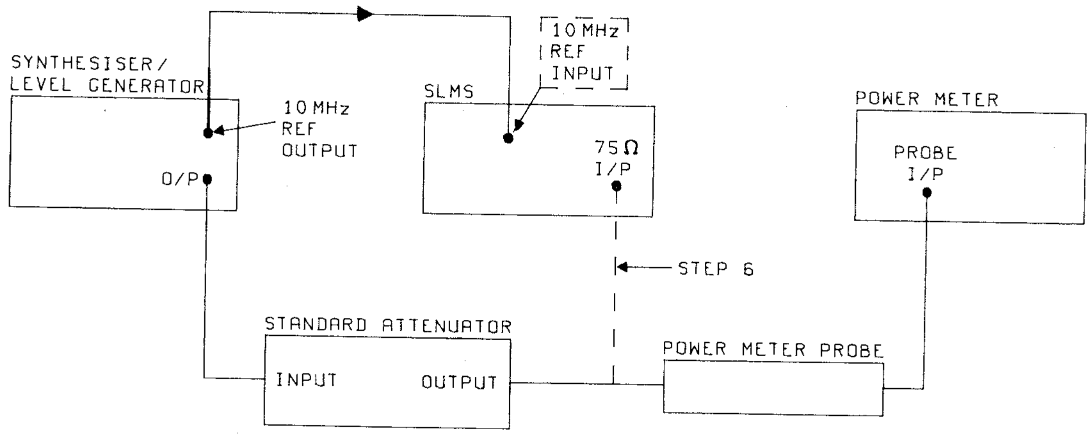


Figure 4-4 Measurement Accuracy Test Set-up (1)

PROCEDURE

UNBALANCED INPUTS

Selective Filters - 3.1kHz and 38Hz

1. Tune the Synthesizer/Level Generator to 10MHz.
2. Set the Synthesizer/Level Generator output level to +0dBm and the Standard Attenuator to 0dB.
3. Connect the test equipment as shown in Figure 4-4.

4. Adjust the Synthesizer output level to give a null on the Power Meter equal to 0dBm ± 0.005dBm.

5. Carry out the Preliminary Procedure Paragraph 4-22.

6. Connect the Standard Attenuator output to the SLMS 75 ohm INPUT.

7. Press the SLMS AVE key followed by numeric key 2.

8. Check that the SLMS LEVEL indicates 0dBm ± 0.25dB.

9. Change the Standard Attenuator from 0 to -80dB in 5dB steps and compare the power reading on the SLMS to the total attenuation in the Standard Attenuator, the difference in reading (including Standard Attenuator error) should be less than ± 0.25dB.

10. Press the SLMS 38Hz FILTER key, followed by the MEAS key.

11. Repeat Step 9.

12. Steps 1 through 11 may be repeated at frequencies in the range 200Hz to 30MHz. Table 4-2 shows the specification limits over this range.

Table 4-2 Measurement Accuracy

Freq.	Accuracy
*200Hz to 10kHz	± 1dB
10kHz to 50kHz	± 0.45dB
50kHz to 20MHz	± 0.25dB
20MHz to 30MHz	± 0.45dB

*38Hz Filter only

NOTE: This accuracy measurement is specified for the temperature range 10 degree C to 35 degree C. For temperatures outside this range 0 to 50 degree C see Specification Table 1-1.

BROADBAND POWER (AND 48kHz FILTER - OPTION 011)

13. Connect the test equipment as shown in Figure 4-5.

14. Set the Synthesizer/Level Generator to 0dBm with the frequency at 1MHz.

15. Press the SLMS AVE key then the numeric 1 key.

16. Press the SLMS I/P POWER followed by the MEAS key.

17. The SLMS should read 0dBm ± 1dB.

18. Tune the Synthesizer/Level Generator to 32MHz in 5MHz steps and check the I/P POWER is 0dBm ± 1dB.

19. Decrement the Synthesizer/Level Generator by 5dB steps to -45dB and check the SLMS LEVEL display

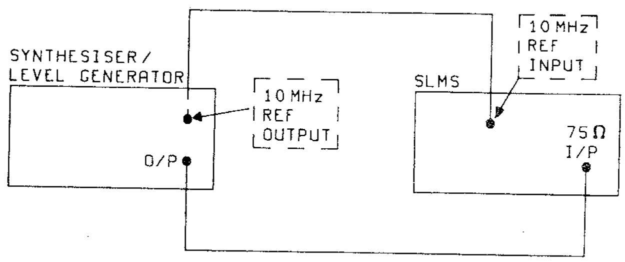


Figure 4-5 Measurement Accuracy Test Set-up (2)

remains within ± 1dB of the Synthesizer/Level Generator.

20. Press the SLMS 48kHz FILTER key.

21. Tune the SLMS to 1MHz (Press FREQ, 000.0kHz, and MEAS keys).

22. Set the Synthesizer/Level Generator to 1MHz and 0dBm.

23. The SLMS LEVEL reading should be 0dBm ± 1dB.

24. Check the SLMS LEVEL remains at 0dBm ± 1dB with the SLMS and Synthesizer/Level Generator tuned to selected spot frequencies between 1MHz and 32MHz.

25. Decrement the Synthesizer/Level Generator in 5dB steps to -75dBm and check the SLMS LEVEL reading remains within ± 1dB of the Synthesizer/Level Generator.

BALANCED INPUTS

150 OHM

26. Disconnect all other inputs.

27. Connect the test equipment up as shown in Figure 4-4.

28. Set the Synthesizer/Level Generator Frequency to 10kHz.

29. Adjust the Synthesizer/Level Generator to give a null on the Power Meter equal to 0dBm ± 0.005dB.

30. Carry out the Preliminary Procedure Paragraph 4-22 steps 1-6. Retune the SLMS to 10kHz (Press FREQ and 10).

31. Press the 150 ohm TERMINATION key, followed by AVE, 2, and MEAS.

32. Connect the Standard Attenuator output to a single input port of the 150 ohm INPUT.

33. The SLMS reading should be -3.01dBm ± 0.6dB.

34. Increase the attenuation in the Standard Attenuator by 80dB.

35. The SLMS LEVEL reading should be -83.01dBm ± 0.6dB ± the Standard Attenuator error.

36. Reset the Standard Attenuator to 0dB.

37. Press the following SLMS keys TR, REF, dB/dBm and MEAS. The SLMS should now indicate a level of 0.00dB.

38. Check the SLMS LEVEL remains 0.00dB ± 0.6dB.

39. Insert 80dB in the Standard Attenuator and check the SLMS LEVEL indicates a reading of -80dB ± 0.6dB.

40. Reset the Standard Attenuator to 0dB.

41. Repeat steps 38 through 40 at frequencies between 10kHz and 50kHz.

42. Repeat steps 38 through 40 at frequencies between 50kHz and 2MHz checking that the error is now less than ± 0.4dB.

600 OHM

43. Disconnect all other inputs and set the Test Oscillator to 600 ohm balanced output. Set the Frequency to 100kHz with the level at 0dBm.

44. Press the SLMS REF, 0, and dB/dBm keys to reset the stored reference value to 0dBm.

45. Press the SLMS 600 ohm TERMINATION key and tune the SLMS to 100kHz (Press FREQ, 100 and MEAS keys).

46. Connect the 600 ohm output of the Test Oscillator to the SLMS 600 ohm INPUT and check the SLMS LEVEL reading is between +10dBm and -60dBm. If this is not the case adjust the tuning of the Test Oscillator until the level is within these limits.

47. Lock the SLMS to the Test Oscillator signal by pressing TR, COUNTER, then MEAS.

48. The SLMS should now be locked to the incoming frequency and indicate a level of 0dBm ± 1dB.

49. Reduce the Test Oscillator frequency to 10kHz slowly enough for the SLMS to track with the changing frequency and check that the SLMS LEVEL reading remains at 0dBm ± 1dB.

50. Press the SLMS 38Hz FILTER key.

51. Retune the SLMS to 200Hz (Press FREQ, 0.200kHz and MEAS).

52. Retune the Test Oscillator to 200Hz until the SLMS LEVEL indicates 0dBm ± 1dB.

53. Press the SLMS TR, COUNTER, and MEAS keys.

54. Check the SLMS LEVEL reading is 0dBm ± 1dB.

55. Slowly increase the Test Oscillator frequency to 1kHz, so that the SLMS tracks the changing frequency. Check that the SLMS LEVEL remains at 0dBm ± 1dB.

For OPTION 005 INSTRUMENTS ONLY (124/135 ohm BAL INPUTS)

The procedure is the same as for 150 ohm input, except that the 124/135 ohm keys and INPUTS are selected. Also in step 33 for 135 ohm the SLMS LEVEL reading should be -3.02dBm ± 0.6dB and for 124 ohm the SLMS LEVEL reading should be -3.05dBm ± 0.6dB. Note also on 124 ohm BALanced INPUTS the frequency range is extended to 12MHz. (On 135 ohm INPUT there is an additional error of 0.01dB due to the 67.5/75 ohm mismatch, giving -3.02dBm when the Synthesizer/Level Generator is at 0dBm. On the 124 ohm INPUT there is an additional error of 0.04dB due to the 62/75 ohm mismatch, giving -3.05dBm when the Synthesizer/Level Generator is 0dBm.)

4-27 3.1kHz CHANNEL FILTER

SPECIFICATION

Ripple over 2.6kHz Bandwidth:	<0.5dB p-p
3dB Bandwidth:	3.1kHz ± 10%
Virtual Carrier Rejection at ± 1.85kHz:	>65dB
Adjacent Channel Rejection (± 4kHz):	>70dB
Equivalent Noise Bandwidth:	3.1kHz (nominal)

DESCRIPTION

A fixed 10MHz signal, obtained from the rear panel 10MHz REF OUTPUT, is applied to the 75 ohm INPUT. With the 3.1kHz FILTER selected, the SLMS is tuned to frequencies about 10MHz and the response of the filter is obtained from the LEVEL display indication.

PROCEDURE

1. Initialise the SLMS using the procedure outlined in Paragraph 4-22 steps 1 through 6.

2. Connect the SLMS 10MHz OUTPUT to the SLMS 75 ohm INPUT.

3. Note the LEVEL display reading. Press TR, REF and dB/dBm keys. This enters the LEVEL reading into the reference level register.

4. Press MEAS, the LEVEL display should read 0dB.

RIPPLE BANDWIDTH

5. Press the 3.1kHz FILTER key to cancel the AUTO FILTER selection and enter the following parameters into SLMS:

START FREQ....................9998.7kHz
STOP FREQ....................10001.3kHz
STEP....................0.05kHz

6. Press SLMS keys SPECT, MEAS to initiate a spectrum sweep. Observe the LEVEL display during the sweep to check that the difference between maximum and minimum levels displayed during the sweep is less than 0.5dB.

3dB BANDWIDTH

7. Press the SLMS FREQ key and enter a frequency of 10,000.00kHz. Enter a STEP Frequency of 0.01kHz.

8. Press AVE followed by 1 keys.

9. Press MEAS.

10. Hold the ↑ key pressed and check the LEVEL display. The LEVEL indicator should cross the -3dB threshold at a frequency between 10,001.4kHz and 10,001.7kHz.

11. Retune the SLMS FREQ to 10,000.00kHz.

12. Hold the ↓ key pressed and check the LEVEL indicator crosses the -3dB threshold at a displayed frequency between 9,998.6kH and 9,998.3kHz.

REJECTION at ± 4kHz and ± 1.85kHz

13. Tune SLMS to each of the frequencies listed in Table 4-3 and check that the LEVEL display reading is less than the value quoted for each frequency.

Table 4-3 3.1kHz Channel Filter Test

SLMS Frequency	Level Display Reading to be less than
9998.15kHz	-65dB
9996kHz	-70dB
10001.85kHz	-65dB
10004kHz	-70dB

4-28 38Hz PILOT FILTER

SPECIFICATION

Ripple over 22Hz Bandwidth:	<0.1dB p-p
3dB Bandwidth:	38Hz ± 3.8Hz
Adjacent Pilot Rejection (± 60Hz):	>38dB
Rejection at >± 110Hz:	>60dB
Rejection at >± 1kHz:	>80dB
Equivalent Noise Bandwidth:	44Hz (nominal)

DESCRIPTION

A fixed 10MHz signal, obtained from the rear panel 10MHz REF OUTPUT, is applied to the 75 ohm INPUT. With the 38Hz FILTER selected, the SLMS is tuned to frequencies about 10MHz and the response of the filter is obtained from the LEVEL display indication.

PROCEDURE

1. Initialise the SLMS using the procedure outlined in Paragraph 4-22 steps 1 through 6.

2. Press the SLMS 38Hz FILTER key then MEAS.

3. Connect the SLMS 10MHz OUTPUT to the SLMS 75 ohm INPUT.

4. Note the LEVEL display reading. Press the TR, REF and dB/dBm keys. This enters the LEVEL reading into the reference level register.

5. Press MEAS, the LEVEL display should read 0dB.

RIPPLE BANDWIDTH

6. Enter the following parameters into the SLMS:

   START FREQ.......................................9,999.989kHz
   STOP FREQ.......................................10,000.011kHz
   STEP.......................................0.001kHz

7. Press SPECT, MEAS keys to initiate a spectrum sweep. Observe the LEVEL display during the sweep to check that the difference between maximum and minimum levels displayed during the sweep is less than 0.1dB.

3dB BANDWIDTH

8. Press the SLMS FREQ key and enter a frequency of 10,000.00kHz. Enter a STEP Frequency of 0.001kHz.

9. Press AVE followed by 1 keys.

10. Press MEAS.

11. Hold the ↑ key pressed and check the LEVEL display. The LEVEL indicator should cross the -3dB threshold at a frequency between 10,000.017kHz and 10,000.021kHz.

12. Retune the SLMS FREQ to 10,000.00kHz.

13. Hold the ↓ key pressed and check the LEVEL indicator crosses the -3dB threshold at a displayed frequency between 9,999.983kHz and 9,999.979kHz.

REJECTION, at ± 100Hz, 1kHz and ± 60Hz

14. Tune the SLMS to each of the frequencies listed in Table 4-4 and check that the displayed level is less than the value quoted.

Table 4-4 38Hz Filter Test

Synthesizer Frequency	Level Display Reading to be less than
999kHz	-80dBm
999.89kHz	-60dBm
999.94kHz	-38dBm
1000.06kHz	-38dBm
1000.11kHz	-60dBm
1001kHz	-80dBm

4-29 48kHz GROUP FILTER - OPTION 011

SPECIFICATION

Ripple over 35kHz bandwidth:	<1.2dB p-p
3dB Bandwidth:	48kHz ± 12%
Adjacent Group Rejection (± 48Hz):	>25dB
Rejection at >± 80kHz:	>40dB
Equivalent Noise Bandwidth:	52kHz (nominal)

DESCRIPTION

A fixed 10MHz signal, obtained from the rear panel 10MHz REF OUTPUT, is applied to the 75 ohm **INPUT.** With the 48kHz FILTER selected, the SLMS is tuned to frequencies about 10MHz and the response of the filter ob- tained from the LEVEL display indication.

PROCEDURE

1. Initialise the SLMS using the procedure outlined in Paragraph 4-22 steps 1 through 6.

2. Press the 48kHz key.

3. Connect the SLMS 10MHz OUTPUT to the SLMS 75 ohm INPUT.

4. Note the LEVEL display reading; press TR, REF and dB/dBm keys to enter the LEVEL display reading into the reference level register.

5. Press MEAS, the LEVEL display should indicate 0dB.

RIPPLE BANDWIDTH

6. Enter the following parameters into the SLMS:

START FREQ....................9,982.5kHz
STOP FREQ....................10,017.5kHz
STEP....................0.5kHz

7. Press SPECT, MEAS to initiate a spectrum sweep. Observe the LEVEL display during the sweep to check

that the difference between maximum and minimum levels displayed during the sweep is less than 1.2dB.

3dB BANDWIDTH

8. Press the SLMS FREQ key and enter a frequency of 10,000.00kHz.

9. Press AVE followed by 1 keys.

10. Press MEAS.

11. Hold the ↑ key pressed and check the LEVEL indicator crosses the -3dB threshold at a displayed frequency between 10,021.12kHz and 10,026.88kHz.

12. Retune the SLMS to 10,000kHz.

13. Hold the ↓ key pressed and check that the LEVEL indicator crosses the -3dB threshold at a displayed frequency between 9,978.88kHz and 9,973.12kHz.

Rejection at ± 80kHz and ± 48kHz

14. Tune SLMS to each of the frequencies listed in Table 4-5 and check that the LEVEL display reading is less than the value quoted.

Table 4-5 48kHz Group Filter Test

SLMS Frequency	Level Display Reading to be less than
9920kHz	-40dB
9952kHz	-25dB
10048kHz	-25dB
10080kHz	-40dB

4-30 IMAGE AND IF REJECTION

SPECIFICATION

The specification is detailed in Tables 4-6 and 4-7.

1st IF Image Frequency = Tuning Frequency + (2 x IF)
All other IF Image Frequencies = Tuning Frequency + (2 x IF)

DESCRIPTION

A Synthesized Signal Generator is tuned to the 1st IF and 1st IF image frequency in turn. The rejection of these signals being the difference between the Signal Generator output level and the level measured by SLMS. The Signal Generator is tuned to the 2nd through 5th IF frequencies and the IF rejection tested. The 2nd through 6th IF Image frequency rejection is tested by tuning the Signal Generator to a fixed frequency. The SLMS is tuned to various frequencies each of which causes the signal generator output to be at an IF image frequency.

EQUIPMENT

Synthesized Signal Generator..........HP 8660C/86602B (with 11661B) 86631B
10kHz to 110MHz Plug-in for 8660C..........HP 86601A
50 ohm to 75 ohm Matching Resistor..........HP 11658A

PROCEDURE

1. Initialise the SLMS using the procedure outlined in Paragraph 4-22 steps 1 through 8.

2. Connect up the equipment as shown in Figure 4-6.

3. Press the 38Hz FILTER key and tune the SLMS to 1234kHz [Press FREQ, 1234.0(kHz), and MEAS].

4. Tune the Synthesized Signal Generator to 1.23MHz and adjust it to give a reading of 0dBm ± 0.5dB on the SLMS LEVEL display.

IF REJECTION

5. Tune the Synthesized Signal Generator to 50.015625MHz and check the SLMS LEVEL is below -70dBm.

6. Press the 3.1kHz FILTER key then MEAS and check the SLMS LEVEL reading remains below -70dBm.

7. Tune the Synthesized Signal Generator to 15.625kHz and check the SLMS LEVEL is below -70dBm.

8. Press the SLMS 38Hz FILTER key then MEAS and check the SLMS LEVEL remains below -70dBm.

9. Tune the Synthesized Signal Generator to 919Hz and check the SLMS LEVEL is below -80dBm.

IF IMAGE REJECTION

10. Tune the Synthesized Signal Generator to 101.26525MHz.

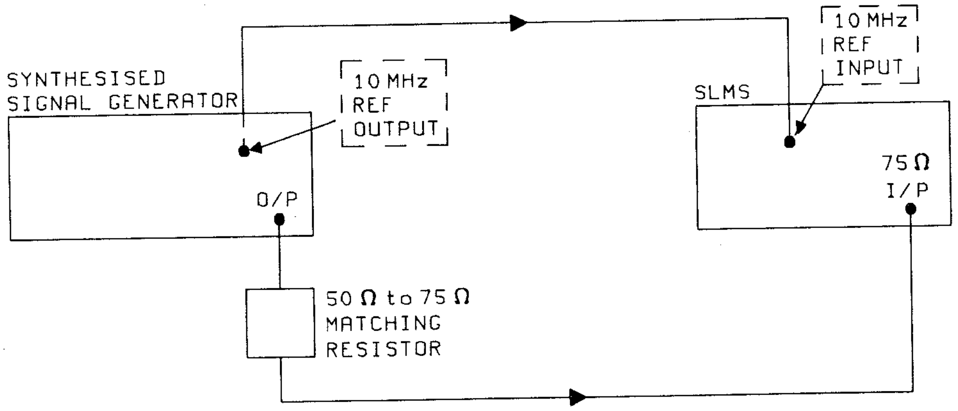


Figure 4-6 Image and IF Rejection Test Set-up

11. Press the SLMS 38Hz FILTER key then MEAS, and check the SLMS LEVEL is below -70dBm.
12. Press the SLMS 3.1kHz FILTER key then MEAS, and check the SLMS LEVEL remains below -70dBm.
13. Tune the Synthesized Signal Generator to 1265.25kHz and check the SLMS LEVEL is below -70dBm.
14. Press the SLMS 38Hz FILTER key then MEAS and check the SLMS LEVEL remains below -70dBm.
15. Tune the Synthesized Signal Generator to 1235.838Hz and check the SLMS LEVEL is below -70dB.

Table 4-6 IF Rejection

Test	Sig. Gen. Freq.	SLMS Freq.	SLMS Level Below
1ST IF	50.015625MHz	1234.0kHz	-75dB
2ND IF	15.625kHz	1234.0kHz	-70dB
3RD IF	919kHz Pilot only	1234.0kHz	-80dB

Table 4-7 IF Image Rejection

Test	Sig. Gen. Freq.	SLMS Freq.	SLMS Level Below
1ST IF IMAGE	101.26525MHz	1234kHz	-70dB
2ND IF IMAGE	1265.25kHz	1234kHz	
3RD IF IMAGE	1235.838kHz Pilot only	1234kHz	-70dB

4-31 NOISE FLOOR & SPURIOUS RESPONSES

SPECIFICATION

BROADBAND (INPUT POWER)	<-55dBm	
3.1kHz/38Hz (75 ohm INPUT)	<-115dBm	50kHz to 32MHz
	<-105dBm	10kHz to 50kHz
38Hz (75 ohm INPUT)	<-105dBm	200Hz to 50kHz
3.1kHz/38Hz (124 ohm INPUT)	<-113dBm	100kHz to 10MHz
(135/150 ohm INPUT)	<-113dBm	100kHz to 2MHz
OPTION 011 - 48kHz 75 ohm INPUT	<-90dBm	100kHz to 32MHz

DESCRIPTION

The following procedure checks the noise floor and any residual spurious generated by signals at various frequencies in the SLMS. The SLMS uses its own level measuring circuits and akn auto sweelp facility which stops whenever the measured level exceeds a previously set limit.

PROCEDURE

1. Initialise the SLMS by carrying out the Preliminary Procedure Paragraph 4-22. In addition enter the following parameters:

   REF (limit) - 0dB
   LOWER (limit) - 160dB
   UPPER (limit) - 115dB
   Press 3.1kHz FILTER key to override AUTO mode

2. Remove all input connections from the SLMS and set all slide switches to the extreme left hand position except:

   LIMITS.........HI
   LIMIT HALT.........ON

3. Press SPECT then MEAS to sweep the SLMS from 50kHz to 32MHz in 10kHz steps. The SLMS will automatically stop measuring at any frequency where the noise floor is greater than -115dBm.

4. If the -115dBm limit is violated and the instrument halts, press the MEAS key to resume.

5. Press 38Hz FILTER key then repeat step 3.

NOTE: Step 6 applies only when OPT 011 48kHz FILTER is fitted.

6. Set the START FREQ to 100kHz. Set the UPPER (limit) to -90dBm. Press the 48kHz filter key. Press SPECT, MEAS to check the noise floor of the 48kHz FILTER. The SLMS will halt whenever the -90dBm limit is violated.

7. Set the UPPER (limit) to -105dBm. Set the START FREQ to 10kHz. Set the STOP FREQ to 50kHz.

8. Press the 3.1kHz FILTER key. Press SPECT, MEAS to check the noise floor between 10kHz and 50kHz on the 3.1kHz FILTER setting.

9. Press the 38Hz FILTER key. Set the START FREQ to .25kHz. Press SPECT MEAS to check the noise floor between 200Hz and 50kHz on the 38Hz FILTER setting.

10. For instruments with 124 ohm BALanced INPUT. Set the START FREQuency to 100kHz. Set the STOP FREQuency to 10MHz. Press the 38Hz FILTER key then SPECT, MEAS to check the noise floor in 38Hz FILTER mode. Repeat with the FILTER set at 3.1kHz.

11. For instruments with 134 ohm or 150 ohm BALanced INPUTS. Set the START FREQuency to 100kHz. Set the STOP FREQuency to 2MHz. Press the 38Hz FILTER key, then SPECT, MEAS to check the noise floor in the 38Hz FILTER mode. Repeat with the FILTER set for 3.1kHz.

4-32 INTERMODULATION

SPECIFICATION

INTERMODULATION

Second Order Intermodulation Rejection: (Relative to the total power of two input signals and measured at [f1 ± f2] where this is in-band).	>63dB
Third Order Intermodulation Rejection: (Relative to the total power of two input signals and measured at [2f1 ± f2] and [2f2 ± f1] where these are in-band).	>70dB (for two tones greater than 50kHz apart). >60dB (for two tones less than 50kHz apart).

DESCRIPTION

Two signals (f1 and f2), at different frequencies, are combined at the input to the SLMS. The SLMS is tuned to the second (f1-f2, f1+f2) and third order (2f1-f2, 2f2-f1) in-band, intermodulation products to ensure rejection is as specified. To avoid the requirement of two Frequency Synthesizers, one of the signal sources is obtained from the 10MHz REFERENCE OUTPUT on the SLMS.

EQUIPMENT

Synthesized Signal Generator	HP 3335A
Directional Bridge	HP 8721A
50/75 ohm Matching Pad	HP 85428B

PROCEDURE

1. Tune the Synthesizer to 8.7MHz and set the level to 0dBm.

2. Connect the equipment as shown in Figure 4-7. Initialise the SLMS using the Preliminary Procedure outlined in Paragraph 4-22 steps 1 through 7.

3. Press the SLMS 38Hz FILTER key then the MEAS key.

4. Press the SLMS keys TR, REF, dB/dBm in that order.

5. Tune the SLMS to 8.7MHz (Press FREQ, 8700 then MEAS).

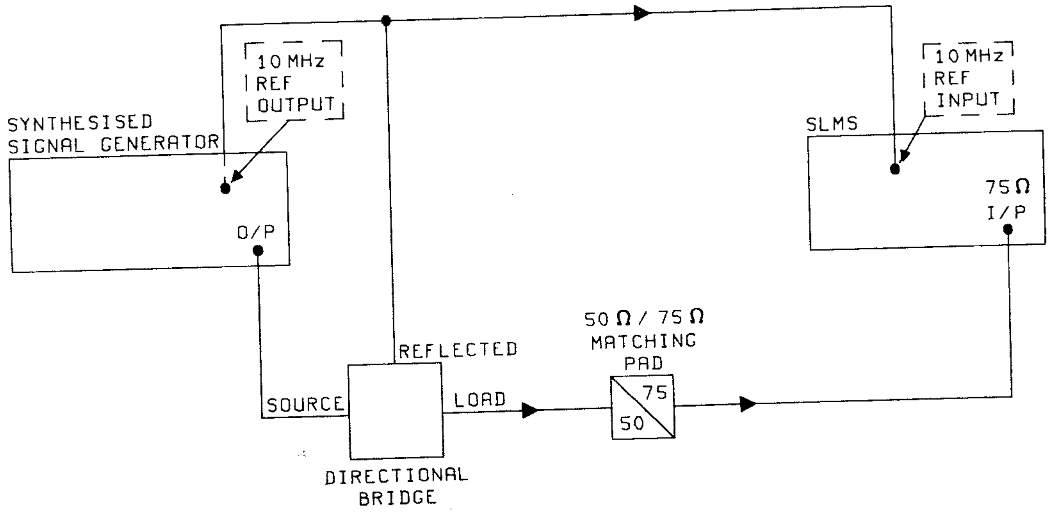


Figure 4-7 Intermodulation Test Setup

6. Adjust the Synthesizer level to obtain a reading of 0dB on the SLMS LEVEL display.

7. Tune the SLMS to each of the frequencies listed in Table 4-8 and check that the level reading is less than the value quoted for each frequency.

Table 4-8 2nd and 3rd Order Intermod Rejection

SLMS Freq.	Level Display Reading to be less than	Intermod
1300kHz	-63dB	2ND ORDER
18700kHz	-63dB	2ND ORDER
7400kHz	-70dB	3RD ORDER
11300kHz	-70dB	3RD ORDER
28700kHz	-70dB	3RD ORDER

8. Tune the Synthesizer to 10025kHz.

9. Tune the SLMS to 10,050kHz and 9,950kHz in turn, checking for a LEVEL display reading of less than -60dB.

4-33 COMMON MODE REJECTION

SPECIFICATION

150 ohm, 124 ohm and 135 ohm Balanced Inputs: >40dB (50kHz to 2MHz)

DESCRIPTION

Common mode rejection is defined as the ratio of power measurements of a true differential or push-pull signal and a common mode or push-push signal. To avoid the use of an unbalanced-to-balanced converter the CMR of the balanced inputs of the SLMS is checked by comparing the measurement results of a common mode signal and and a single-ended reference signal. The common mode rejection result of this measurement will be low by 6dB due to only 1/2 the voltage being measured during the reference measurement.

EQUIPMENT

Synthesized Signal Generator	HP 3335A
Power Splitter	HP 11652-50019
75 ohm Termination	HP 15522C
Balance to Unbalanced Test Cable	See Figure 4-1

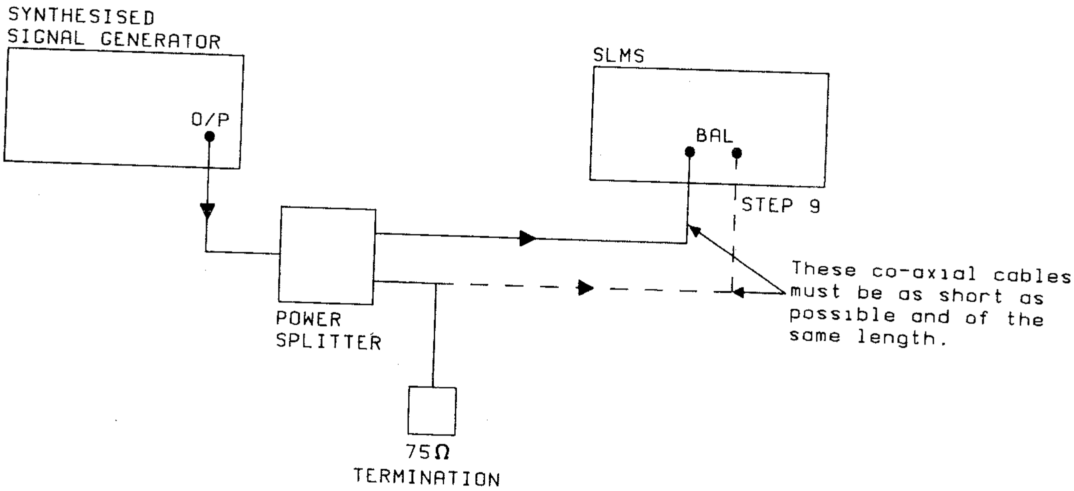


Figure 4-8 Common Mode Rejection Test Setup

PROCEDURE

1. Connect up equipment as shown in Figure 4-8.
2. Initialise the SLMS using the following procedure:

   (a) Set all front panel switces to their leftmost position and press TR then CLEAR keys.

   (b) Select a termination of 124 ohm, 135 ohm or 150 ohm by pressing the appropriate key.
3. Tune SLMS to 50kHz (press FREQ, 50, MEAS).
4. Tune Synthesized Signal Generator to 50kHz and adjust output level to -20dBm.
5. Press TR, REF, dB/dBm, and MEAS keys in that order to store the reference level.
6. The SLMS LEVEL display should indicate 0.0dB ± 0.2dB.

7. Remove 75 ohm termination from Power Splitter and connect Power Splitter output port to the unconnected BAL input.

8. Check that LEVEL display reading is less than -40dB.

9. Retune the SLMS to 1MHz (Press FREQ, 1000, MEAS) and the Synthesized Signal Generator to 1MHz.

10. Check LEVEL display reading is less than -40dB.

11. Repeat steps 11 and 12 with SLMS and Signal Generator tuned through 50kHz to 2MHz in 100kHz steps checking the SLMS LEVEL display reading is less than the value quoted.

12. Select the remaining BALanced INPUTs (except 600 ohm) if any and repeat steps 3 through 11.

4-34 COUNTER SENSITIVITY AND ACCURACY

SPECIFICATION

Sensitivity: Measures with a tone interference ratio of >40dB with the 38Hz FILTER 3dB points.

Accuracy: Depends on EXT oscillator plus ± 1Hz (on 38Hz FILTER).

DESCRIPTION

This test checks the sensitivity of the COUNTER mode of operation and also that any error is within ± 2Hz.

EQUIPMENT

Synthesizer/Level Generator....................HP 3335A
Attenuator (Capable of 20dB Attenuation)....................HP 3550A
Minimum Loss Pad (50 ohm to 75 ohm)....................HP 85428A

PROCEDURE

1. Carry out the Preliminary Procedure in Paragraph 4-22 steps 1 to 8.

2. Frequency lock the Synthesizer to the SLMS by connecting the Synthesizer 10MHz output to the SLMS rear panel 10MHz REF INPUT.

3. Connect the Synthesizer OUTPUT to the INPUT of the Attenuator.

4. Connect the Attenuator OUTPUT to the SLMS 75 ohm INPUT. Set the Attenuator to 20dB.

5. Set the Synthesizer OUTPUT level to 0dBm, and the frequency to 10MHz.

6. Tune the SLMS to 10MHz [FREQ, 10000, then MEAS]. The LEVEL displays on the SLMS should indicate -20dBm ± 3dB.

7. Press the SLMS TR, COUNTER, and MEAS keys in that order. The SLMS should read 10000.000kHz ± 2Hz.

8. Press the 38Hz FILTER key.

9. Press the SLMS FREQ key followed by MEAS.

10. Disconnect the input from the SLMS and note the level of the noise floor.

11. Reconnect the Synthesizer via the Attenuator to the SLMS 75ohm INPUT.

12. Press the SLMS AVE then 1 keys.

13. Adjust the Synthesizer level until the SLMS LEVEL reading is 40dB above the noise floor.

14. Press the SLMS TR, COUNTER and MEAS keys in that order. The SLMS should read the Synthesizer frequency within ± 1Hz.

15. Change the Synthesizer frequency by 10Hz and check that the SLMS retunes to that frequency.

FOR OPT 011 INSTRUMENTS ONLY

SPECIFICATION: with SLMS set to 48kHz FILTER

Sensitivity: Measures with a tone interference ratio of >40dB with the 48kHz FILTER selected.

16. Disconnect the Input Signal at the SLMS 75ohm INPUT.

17. Press the 48kHz FILTER key, and tune the SLMS to 10,000.000kHz (Press FREQ, 10,000.000kHz and MEAS) and note the level of the noise floor.

18. Re-tune the Synthesizer to exactly 10MHz and connect the Synthesizer Output to the SLMS 75ohm INPUT.

19. Adjust the Synthesizer level to give a reading of -40dB above the noise floor.

20. Press the TR, COUNTER and MEAS keys in that order.

21. The FREQ display should indicate the same frequency as the Synthesizer ± 2Hz.

22. Press the SLMS FREQ key followed by MEAS.

23. Change the Synthesizer output frequency to 10,020.000kHz.

24. Adjust the Synthesizer output level until the SLMS LEVEL reads 40dB above the noise floor.

25. Press the SLMS TR, COUNTER and MEAS keys in that order. The SLMS should retune to read 10,020.000kHz ± 2Hz and give a new level indication (the new level is the actual level at the Synthesizer output).

4-35 AUDIO OUTPUT

SPECIFICATION

Frequency Response: 600Hz to 3100Hz ± 1dB

DESCRIPTION

The SLMS is tuned to 10MHz to measure its own 10MHz reference signal. The SLMS tuning frequency is varied about 10MHz by ± 1.25kHz in 0.25kHz steps. The audio output level variation is monitored on a RMS Voltmeter.

EQUIPMENT

RMS Voltmeter.................... HP 3403C
Balanced to Unbalanced
Test Cable.................... see Figure 4-1

PROCEDURE

1. Carry out the Preliminary Procedure outlined in Paragraph 4-22 steps 1 through 6.

2. Connect the 10MHz REF OUTPUT (rear panel) to the SLMS 75 ohm INPUT.

3. Enter a step size of 0.25kHz (Press STEP, .25kHz).

4. Connect one end of the 600 ohm AUDIO OUTPUT (rear panel) to the RMS Voltmeter using the Test Cable.

5. Press MEAS.

6. Hold the ↑ key pressed to increase the frequency to 10,001.25kHz and check the level variation on the RMS Voltmeter does not exceed ± 1dB.

7. Hold the ↓ key depressed to decrease the frequency to 9,998.75kHz and check the level variation on the RMS Voltmeter does not exceed ± 1dB.

4-36 TEST-POINT SELECTOR

SPECIFICATION

Provides + or -15.5V ± 1V @ 100mA max for one 3757A Access Switch. Provides signalling for 3754A, 3756A and 3757A Access Switches at 20Hz ± 3Hz or 600Hz ± 90Hz. (The mark space ratio of the control pulses shall not exceed 40/60).

DESCRIPTION

The TEST-POINT SELECTOR outputs can be verified by connecting a 3757A to the TEST POINT SELECT terminal block (on the SLMS rear panel), and following the procedure outlined in the OPERATING manual. Alternatively the various outputs can be measured/monitored using the procedure detailed below.

EQUIPMENT

Digital Voltmeter.................... HP 3455A
Electronic Counter.................... HP 5328A
Oscilloscope.................... HP 1740A

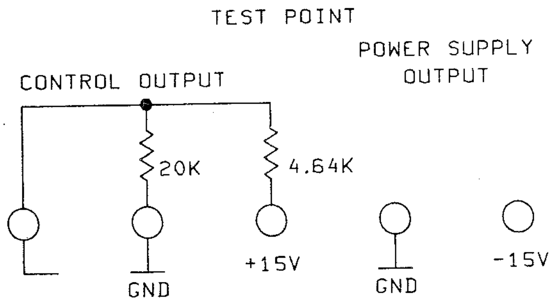


Figure 4-9 Test-Point Rear Panel Configuration

PROCEDURE

1. Connect a 150 ohm resistor between the +15V terminal and GND.

2. Monitor the voltage across the 150 ohm resistor, this should be +15.5V ± 1V.

3. Remove the 150 ohm resistor and connect it across the -15V terminal and GND.

4. Monitor the voltage across the 150 ohm resistor, this should be -15.5V ± 1V.

5. Remove the 150 ohm resistor.

6. Connect a 4.64K resistor and a 20K resistor between +15V and GND. Connect the mid-point of the resistor to the CONTROL OUTPUT terminal (to provide approximately +12V, see Figure 4-9).

7. Set the TEST-POINT SPEED switch (rear panel) to N.

8. Monitor the CONTROL OUTPUT terminal with an Oscilloscope.

9. Press the CLEAR/SET key several times.

10. Check the amplitude of the bursts of pulses is at least 9.5V and the mark space ratio does not exceed 40/60.

11. Connect an Electronic Counter to the CONTROL OUTPUT TERMINAL.

12. Set the counter to a suitable mode to count the number of pulses (START A, adjust the timebase to a 0.1 usec or FREQ RESOLUTION on the 5328A to 1MHz).

13. Press the CLEAR/SET key on the SLMS several times while adjusting the Electronic Counter trigger level control until the Electronic Counter starts to register bursts of 14 pulse.

14. Reset the Electronic Counter.

15. Press the SLMS keys CLEAR/SET, 0,0,0, then MEAS.

16. The Electronic Counter should count a burst of 44 pulses (14 reset pulses and 10 pulses for each zero). With the SLMS TEST-POINT SPEED set to N the individual bursts can sometimes be noticed on the Electronic Counter).

17. Set the SLMS TEST-POINT SPEED to F and repeat steps 14 through 16.

18. Set the Electronic Counter to measure period.

19. Press the CLEAR/SET key several times and check the period is between 1.4 msecs and 2 msecs.

20. Set the SLMS TEST-POINT SPEED to N and press the CLEAR/SET key several times. Check the period is between 43 msecs and 52 msecs.

4-37 EXTERNAL REFERENCE OSCILLATOR

SPECIFICATION

The SLMS frequency reference will lock up to any sub-multiple of 10MHz between 1 and 10MHz if the amplitude is between -3dBm and +20dBm (50 ohm).

DESCRIPTION

The 10MHz reference output from a Synthesizer/Level Generator is connected to the SLMS 75 ohm UNBAL INPUT. The tuned output of the Synthesizer/Level Generator is connected to the SLMS rear panel 10MHz REF INPUT. The Synthesizer/Level Generator output frequency is varied by ± 100Hz. The Synthesizer Level Generator output level is also varied beween -3dBm and +20dBm. The locking range is checked by setting the SLMS into the COUNTER mode.

EQUIPMENT

Synthesizer/Level Generator.. HP 3335A

PROCEDURE

1. Carry out the Preliminary Procedure, Paragraph 4-22 steps 1 through 7.

2. Connect the Synthesizer/Level Generator to 10MHz REF OUTPUT to the SLMS 75 ohm UNBAL INPUT.

3. Set the Synthesizer/Level Generator to 10MHz, with a frequency step size of 50Hz and an output level of -3dBm.

4. Connect the Synthesizer Level Generator output to the SLMS 100MHz REF INPUT (rear panel).

5. Press the SLMS keys, TR, COUNTER, and MEAS.

6. Step the Synthesizer/Level Generator frequency by ± 100Hz and check the SLMS FREQ follows the change - indicating the SLMS remains locked to the Synthesizer/Level Generator.

4-38 CHART RECORDER OUTPUT (SPECIAL OPTION H27 ONLY)

SPECIFICATION

Provides Voltage drive:	-3V to +3V dc proportional to the measured signal at the SLMS INPUT.
or	
Provides Current drive:	0 to 5mA, proportional to the measured signal at the SLMS INPUT.
Dynamic Range:	± 3dB

DESCRIPTION

The drive to the rear panel CHART RECORDER OUTPUT is activated by the key sequence; TR, REF, TR and MEAS. Selection between the Voltage or Current drive is by a Test Link on Assembly A21.

EQUIPMENT

Synthesizer/Level Generator.......HP 3335A Digital Voltmeter (DVM).HP 3403C Resistor (1K ohm 1%)..........HP 0757-0280

PROCEDURE

1. Remove the A21 Assembly and check the Chart Recorder Test Link TL1 is set to V. Replace A21.

2. Carry out the Preliminary Procedure Paragraph 4-22 steps 1 to 4.

3. Connect the DVM to the SLMS CHART RECORDER OUTPUT on the rear panel.

4. Tune the SLMS to 1MHz. (Press FREQ, 1000, MEAS).

5. Set the Synthesizer/Level Generator to 1MHz at 0dBm.

6. Connect the Synthesizer/Level Generator to the SLMS 75 ohm INPUT.

7. Check the SLMS reads 0dBm ± 0.05dB, if necessary adjust the Synthesizer/Level Generator level.

8. Press SLMS keys TR, REF, TR, MEAS.

9. The DVM should read 0V ± 0.1V.

10. Reduce the Synthesizer/Level Generator by –3dBm.

11. Check the DVM reads -3V ± 0.1V.

12. Increase the Synthesizer/Level Generator by +3dBm.

13. Check the DVM reads +3V ± 0.1V.

14. Remove Assembly A21 and set A21TL1 to I. Replace A21.

15. Connect a 1K ohm resistor across the terminals of the CHART RECORDER OUTPUT.

16. Set the Synthesizer/Level Generator to 0dBm.

17. Press MEAS, and check the SLMS measured 0dBm.

18. Press SLMS keys TR, REF, TR MEAS.

19. Check the DVM reads 2.5V ± 0.1V.

20. Change the Synthesizer/Level Generator output to -3dB and check the DVM reads 0V ± 0.1V.

21. Change the Synthesizer/Level Generator output to +3dB and check the DVM reads 5V ± 0.1V.

22. Reset A21TL1 to its original setting.

23. Press TR,7,0. The SLMS FREQ/FDM display should have the letters C.V. if A21TL1 is set to V, or C.I. if A21TL1 is set to I. If the letters on the FREQ/FDM display do not correspond to the setting of the Test Link switch A60 S2-1 to its other setting.

4-39 HP-IB VERIFICATION TEST

SPECIFICATION

HP-IB Compatable

The Hewlett-Packard Interface Bus (HP-IB) is Hewlet-Packards implemen- tation of the IEEE Standard 488-1978, Standard Digital Interface for Programmable Instrumentation. The SLMS can be configured for use in two types of HP-IB system; the first uses the SLMS as the HP-IB controller, while in the second type of system, the SLMS acts as a talker and listener controlled by a computer. The SLMS has the capabilities for operation as the HP-IB as shown in Table 4-9.

Table 4-9 Interface Capability

Code	Interface Function
C1,C3 C4,C28	System controller capability
AH1	Acceptor handshake capability
L4	Listener (basic listener, unaddresses if addressed to talk)
SH1	Source handshake capability
T6	Talker (basic talker, unaddresses if addressed to listen)
SR1	Service Request Capability
RL1	Remote/Local capability
DC1	Device clear capability
DT1	Device trigger capability

The verification procedure checks the HP-IB operation using a 9825B/T Desk Top Computer. The 9825B/T Desk Top Computer Program in Table 4-10 permits the user to check the HP-IB I/O is operating and that the CAL measurement parameters are within specification.

The CALIBRATION SIGNAL MEASUREMENT check is made by programming the SLMS, via the HP-IB, to measure the calibration signal on 3.1kHz, 38Hz and 48kHz, in turn. If any of these three measurements to not give a level of -25dBm (± 2dB) the verification program indicates the SLMS is FAULTY or out of CAL.

Before running the test program first ensure:

1. The desk top computer HP-IB I/O card device address is set to 7 (factory preset).
2. The desk top computer device address is 21 (factory preset).
3. The SLMS device address is set to 10. This can be easily checked by pressing the SLMS keys TR, LOCAL. The SLMS should now indicate the HP-IB address in decimal and octal.

Table 4-10 HP-IB Program

```
0: "***************************************":
1: "HP-IB and SLMS CAL LEVEL CHECKS rev 1":
2: "***************************************":
3:
4: prt "If the 48KHz ","Group Filter OPT","011 isn't fitted"
5: prt "this appears as","a fault in the","48KHz Filter..";spc
6:
7: fmt ;fxd 2
8: fmt 1,"FREQ",f9.3
9: fmt 2,c9,f7.2
10: fmt 3,f9.3,f7.2,b
11: fmt 4,f2.0
12: fmt 5,"LEVEL",f8.2
13: fmt 6,f9.3,x,f7.2,x,b,f3.0
14: fmt 8,"ERROR",f2.0
15: fmt 9,"SYSTEM ERROR: B=",fz2.0
16:
17: clr 7
18:
19: gsb "START"
20:
21: gsb "FREQ"
22:
23: if W#1;prt "SLMS HP-IB I/O","CHECKED","CALS IN SPEC";spc 2
24: gto "END"
25:
26: "START":
27: 3→Z
28: gsb "INIT"
29: wrt 710,"CF AV1  IS13 FR1234"
30: wait 1000
31: if not bit(7,rds(7));gto +2
32: gsb "SRQ"
33: wrt 710,"ME";gsb "SRQ"
34: ret
35:
36: "FREQ":
```

Table 4-10 HP-IB Program (continued)

```
37: 1→Z;0→W
38: gsb "INIT"
39: wrt 710,"CF";prt "3.1Khz Filter";gsb "FIL"
40: gsb "INIT"
41: wrt 710,"PF";prt "38KHz Filter";gsb "FIL"
42: gsb "INIT"
43: wrt 710,"GF";prt "48KHz Filter";gsb "FIL"
44: rds(710)→B
45: if B=65;spc ;prt "END OF","MEASUREMENT";spc
46: ret
47:
48: "FIL":
49: 1→Z
50: wrt 710,"AV2 IS 13 TR 29"
51: gsb "SRQ"
52: ret
53:
54: "INIT":
55: cLi 7
56: rem 7
57: clr 710
58: wrt 710,"CR0 SW62 SW93   AU1"
59: ret
60:
61: "SRQ":
62: if not bit(7,rds(7));jmp 0
63: rds(710)→B
64: if B#65;gto "i66"
65: wrt 0,"END OF MEASUREMENT"
66: gto "iret"
67: "i66":if B#66;gto "i67"
68: if Z=1;red 710.3,F,L,O;wrt 16.2,"CAL LEVEL",L;spc
69: if Z=2;red 710.4,E;prt "SLMS FAULTY OR","OUT OF CAL";wrt 16.8,E;spc ;1→W
70: if Z=3;red 710.3,F,L,O;wrt 16.1,F;wrt 16.5,L;spc
71: gto "iret"
72: "i67":if B#67;gto "i68"
73: cmd 7,"?K$"
74: gto "SRQ"
75: "i68":if B#68;gto "i72"
76: cmd 7,"?U*","IS15PR";2→Z
77: gto "SRQ"
78: gto "iret"
79: "i72":if B#72;gto "i102"
80: cmd 7,"?L#"
81: gto "SRQ"
82: "i102":if B#102;gto "iXX"
83: wrt 0,"ILLEGAL STRING RECEIVED"
84: gto "iret"
85: "iXX":wrt .9,B
86: "iret":ret
87:
88:
89: "END":
90: spc 2
91: end
*25603
```

4-40 CHANNEL IMPAIRMENTS OPT 015 (C1TT) AND OPT 016 (NORTH AMERICA)

4-41 WEIGHTED FILTER

SPECIFICATION

Has a Psophometric weighting in accordance with CCITT recommendation P53A (OPT 015) or C-Message weighting in accordance with BSTR Pub 41009 (OPT 016) superimposed on the 3.1kHz Channel Filter.

DESCRIPTION

The weighted filter is checked by measuring the level of the SLMS 10MHz. Due to the 3.1kHz skirts the weighting is not checked at the low end of the 3.1kHz passband.

EQUIPMENT

Frequency Counter HP 5238A

PROCEDURE

1. Connect the SLMS 10MHz OUTPUT (rear panel) to the 75ohms INPUT.
2. Set all front panel slide switches to their leftmost position and switch the SLMS POWER switch to STBY and then ON to reset the SLMS.
3. Tune the SLMS to 10MHz (Press FREQ and enter 10000.000).
4. Press the MEAS key and check the level is either +6dBm ± 2dB or -30dBm ± 2dB.
5. Press TR REF.
6. Press the dB/dBm to illuminate the dB indicator.
7. Press MEAS and check the reading on the level display is now 0dB.

(Steps 5 and 6 transfers the value of the 10MHz signal into the SLMS reference register.)

8. Press the WTD key.
9. Tune the SLMS to the frequencies listed in Table 4-11 and check the LEVEL display is within the specified tolerances. A frequency counter may be connected to the Audio Output to verify the Audio Output Frequency. Idealy the counter should be gated from the SLMS 10MHz output to ensure frequency accuracy.

   To tune the SLMS through the listed frequencies, enter a STEP SIZE of 0.1kHz and use the ↑ to tune to 10.001.4500 and the ↓ to return. (The SLMS will enter the halt mode the first time the ↓ key is pressed, and decrement on subsequent presses).

NOTE: The level transferred to the reference register at 10MHz may not be accurate at the lower/upper limits of the filter and this may cause an error in the SLMS LEVEL reading on WTD Filter. If a level is out of specification (usually at the upper or lower limit). Press the dB/dBm key and the 3.1kHz Filter key the

MEAS to check the 3.1kHz LEVEL. Now press TR REF and dB/dBm to transfer this as a reference level. Return to the WTD Filter at this same frequency and re-check the LEVEL.

Table 4-11 Weighted Filter Test

SLMS FREQ	SLMS AUDIO O/P (Hz) ± 2Hz	SLMS LEVEL (dB) OPT 015	SLMS LEVEL (dB) OPT 016
10,001.450	400	-6.3 ± 1	-11.4 ± 1
10,001.350	500	-3.6 ± 1	-7.5 ± 1
10,001.250	600	-2.0 ± 1	-4.7 ± 1
10,001.150	700	-0.7 ± 1	-2.7 ± 1
10,001.050	800	0.0 ± 1	-1.5 ± 1
10,000.950	900	+0.2 ± 1	-0.6 ± 1
10,000.850	1000	+1.0 ± 1	0 ± 1
10,000.650	1200	0.0 ± 1	-0.2 ± 1
10,000.550	1300	-0.2 ± 1	-0.5 ± 1
10,000.350	1500	-1.3 ± 1	-1.0 ± 1
10,000.050	1800	-2.4 ± 1	-1.3 ± 1
9,999.850	2000	-3.0 ± 1	-1.4 ± 1
9,999.350	2500	-4.2 ± 1	-1.9 ± 1
9,998.850	3000	-5.5 ± 1	-2.5 ± 1
9,998.550	3300	-7.0 ± 2	-5.5 ± 1

4-42 NOTCH FILTER

SPECIFICATION

Adds a 1010Hz Notch to the 3.1kHz or Weighted Filter response, with a rejection of >50dB at 995 to 1025Hz and <3dB at 862 and 1182Hz.

PROCEDURE

1. Carry out steps 1 through 7 as outlined in 4-41.

2. Press the NWT key, then MEAS.

3. Tune the SLMS to Frequencies listed in Table 4-12 and check the level is as indicated.

Table 4-12 Notch Filter Test

SLMS FREQ	SLMS AUDIO O/P (Hz) ± 2Hz	SLMS LEVEL (dB) OPT 015/016
10,001.450	400	0 ± 0.5
10,000.988	862	>-3
10,000.855	995	<-50
10,000.825	1025	<-50
10,000.668	1182	>-3
10,000.150	1700	0 ± 0.5

4-43 PHASE JITTER

SPECIFICATION

Frequency of demodulate tone: 1kHz ± 50Hz
Measurement bandwidth: 20-300Hz, 4-300Hz or 4-20Hz
Residual Phase Jitter: <0.5 degrees pk-pk
Accuracy: ± 0.5 degrees

DESCRIPTION

Phase Jitter Measurement Technique

A waveform with a known amount of phase jitter can be constructed by adding together two sinewaves of known frequency and amplitude. The voltage amplitude ratio of the two added sinewaves is proportional to the phase jitter. This action is illustrated vectorally in Figure 4-10.

$$\text{Max } \theta = \sin^{-1} V_2/V_1$$

$$\text{Total peak deviation} = 2 \text{ (Max } \theta)$$

The residual phase jitter is measured using the 10MHz REF OUTPUT of the SLMS. The SLMS is tuned 850kHz above the 10MHz REF OUTPUT to give an audio output of 1kHz. The SLMS tuning frequency is then varied ± 50 to check the measurement holds.

The measurement accuracy is checked by mixing the output from a synthesized signal Generator with the 10MHz REF output and checking the phase jitter comes within the calculated value. The Synthesized frequency is then altered to check the bandwidth on each range.

EQUIPMENT

Synthesized Signal Generator.......... HP 3335A
Hybrid.......... HP 15537A
75ohms Termination.......... HP 15522A

PROCEDURE

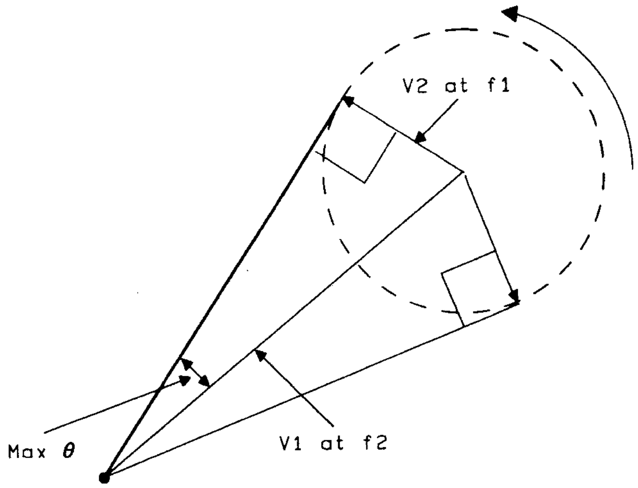


Figure 4-10 Phase Jitter Generation Vector Diagram

(Residual Phase Jitter <0.5 degrees pk-pk on a 1kHz tone ± 50Hz.)

1. Connect the SLMS 10MHz REF OUTPUT (rear panel) to the 75ohms INPUT.

2. Set all the SLMS front panel slide switches to their leftmost position except the MEASUREMENT switch. Set this switch to SINGLE.

3. Switch the SLMS POWER switch to STBY and then to ON.

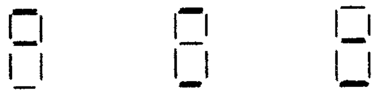
4. Tune the SLMS 10,000.850kHz (Press FREQ and enter 10000.85).

5. Enter a STEP size of 0.050Hz.

6. Press MEAS and check the SLMS LEVEL reads either -30dBm ± 2dB or +6dBm ± 2dB.

7. Press the ϕ JITTER key once to select a 20 to 300Hz bandwidth indicated by the last digit on the level display as shown.

20-300Hz	4-300Hz	4-20Hz



ϕ JITTER key pressed once	ϕ JITTER key pressed twice	ϕ JITTER key pressed three times

8. Press MEAS. After a delay of approximately 12 seconds the LEVEL display should indicate a Phase Jitter measurement of <0.5 degrees.

NOTE: This is the nominal delay when new measurements or measurement updates are made.

9. Press FREQ.

10. Press MEAS. The SLMS will now enter the measure mode and display the LEVEL of the 10MHz signal.

11. Press the ↓ key to tune the SLMS to 10,000.800kHz.

12. Press ϕ JITTER and MEAS. Check the Phase Jitter measurement remains <0.5. (Remember it takes approximately 12 seconds to update the phase jitter reading). If error code E92 appears, the Phase Lock Loop in the Phase Jitter circuit is out of adjustment. Refer to the appropriate adjustment paragraph.

13. Repeat step 9.

14. Press MEAS, followed by the ↑ key to tune the SLMS to 10,000.900kHz.

15. Repeat step 12.

16. Repeat step 9. Retune the SLMS to 10,000.850kHz.

17. Using the procedure outlined in steps 7 and 8 check the residual phase jitter remains <0.5 degrees on 4-30Hz and 4-20Hz bandwidths.

18. Repeat step 9.

19. Press MEAS and check the LEVEL of the 10MHz SIGNAL. If the LEVEL reading is +6dBm ± 2dB miss out the next step, if the reading is -30dBm ± 2dB carry out the next step.

20. Set the SLMS POWER Switch to STBY. Remove Assembly A40 and move TL1 to the 50ohm position (see Assembly Service Sheet A40 - the 50ohm position is adjacent to the 75ohm position at the top left hand side of the assembly). Re-insert A40 and set the SLMS POWER switch to ON. After the switch-on sequence is over press MEAS and verify the 10MHz LEVEL now reads +6dBm ± 2dB.

21. Connect the equipment as shown in Figure 4-11.

22. Disconnect the cable from the Synthesizer to the Hybrid.

23. The SLMS now reads the 10MHz reference at the output of the Hybrid.

24. Transfer this reading into the SLMS REFERENCE register by pressing TR, REF, dB/dBm then MEAS. The SLMS should now read 00.0dB ± 0.1dB.

25. Re-connect the cable from the Synthesizer to the Hybrid and disconnect the 10MHz REF signal at the Hybrid.

26. Set the Synthesizer frequency to 10,000.020 and adjust the output level to give a reading of -21.2dB on the SLMS LEVEL display.

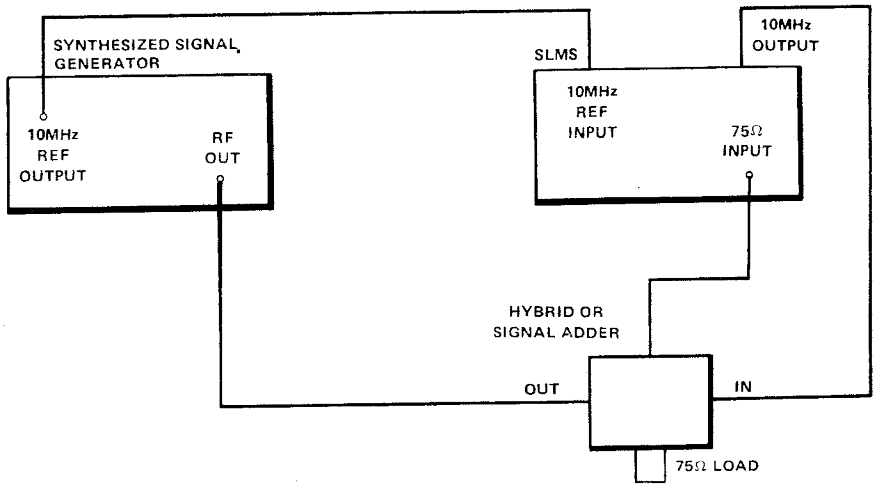


Figure 4-11 Phase Jitter Test

27. Re-connect the 10MHz output to the Hybrid and press ϕ JITT then MEAS.

28. The SLMS should calibrate and after a delay of approximately 12 seconds display a reading of 10 degrees pk-pk ± 2 degrees.

29. Press HALT. Wait until the SLMS HALT indicator is ON and the MEAS indicator OFF.

30. Using the procedure outlined in steps 7 and 8 check the accuracy remains 10 degrees ± 2 degrees on the remaining two bandwidth settings.

31. Reset the MEASUREMENT switch to CONT.

4-44 IMPULSE NOISE

SPECIFICATION

Counting Rate	125 ms/count ± 5% (CCITT OPT 015) 143 ms/count ± 5% (NORTH AMERICA OPT 016)

Threshold Accuracy on a 1700Hz tone ± 1dB for threshold >+80dBm and <+20dBm Measured channel power should not exceed Threshold by more than 54dB.

DESCRIPTION

The counting rate and Threshold limit >-80dB is checked agains a single tone. The ± Threshold accuracy is further checked against the 10MHz tone demodulated at 1700Hz with a higher order signal demodulated at 1010Hz (in band of the notch filter).

1. Connect the Synthesizer output to the SLMS 75ohms INPUT.
2. Tune the Synthesizer to 10MHz with an output level of -80dBm.
3. Press the SLMS 3.1kHz FILTER key and enter a FREQ of 10,000.00kHz.
4. Press MEAS and check the SLMS LEVEL reading is -80dBm ± 1dB.
5. Press TR, REF, dB/dBm, then MEAS. The SLMS should now read a level of 00.0dB.
6. Press IMP NOISE, then TIME.
7. Press keys 1.0 to enter a time interval of 1 minute.
8. Press the THRESH key and enter a level of -1.00dB - do not press the dB/dBm key.
9. Press MEAS.
10. The SLMS TIME display should increment and halt at 1.00 after sixty seconds and the right hand part of the FREQ/FDM display should read 480 ± 24 for OPT 015 instruments and 420 ± 21 for OPT 016 instruments.

STEPS 11, 12 and 13 APPLY to OPT 015 INSTRUMENTS ONLY

11. Press the THRESH key and enter a level of +1.00dB.
12. Press MEAS.
13. The SLMS TIME should increment, but the right hand three digits on the FREQ/FDM display should remain at 000.
14. Switch the SLMS POWER Switch to STBY and remove Assembly A40. Set A40 T11 to the -30dBm position (-see A40 Assembly Service Sheet). Re-insert A40 Assembly and set the POWER switch to ON.
15. Connect the test equipment up as shown in figure 4-11.
16. Disconnect the lead from the SLMS 10MHz OUTPUT (at the hybrid).
17. Tune the SLMS to 10,000.150kHz. (This frequency gives an audio output frequency of 1700Hz for an input frequency of 10MHz).
18. Tune the Synthesizer to 9.999.31kHz. (With the SLMS tuned to 10,000.150kHz, this gives an audio output frequency of 1010Hz - the notch filter frequency
19. Press MEAS and adjust the Synthesizer output to give a reading of -25dB in the SLMS LEVEL window.

20. Press TR, REF, dB/dBm and MEAS. The SLMS should now read 0dB. (The ref level of the SLMS is now set at -25dBm).

21. Re-connect the 10MHz REF OUTPUT to the hybrid.

22. Press IMP NOISE, TIME and enter 1.9 (displayed in the FREQ/FDM window).

23. Press MEAS and note the reading "A" displayed in SLMS LEVEL window.

24. Press IMP NOISE, THRESH and enter a LEVEL reading 1dB less than the reading "A" noted in the previous step {If the reading A was -10dB, enter a threshold of -11dB}.

25. Press MEAS. The numbers in the right hand side of the FREQ/FDM display should increment.

26. Press IMP NOISE, THRESH and enter a LEVEL reading 1dB greater than the reading "A" noted in step 23. For OPT 016 INSTRUMENTS ENTER A THRESHOLD LEVEL 3dB GREATER THAN THE READING "A" NOTED IN STEP 23.

27. Press MEAS. The numbers at the right of the FREQ/FDM display should remain at 000, with the TIME digits incrementing in seconds.

28. Disconnect all test equipment and reset A40 TL1 to its original setting.

4-45 TRACKING GENERATOR (OPT 012)

SPECIFICATION

Level: -10dBm ± 0.5dB
Flatness: ± 0.2dB (nominal) 10kHz to 32MHz
Spurious and Harmonics relative to the main output: <-40dB
Return Loss: >30dB 10kHz to 32MHz

DESCRIPTION

The level and flatness of the Tracking Generator may be checked using the SLMS itself. Spurious and Harmonics are checked using a suitable Spectrum Analyzer. The return loss is checked by the method outlined in paragraph 4-23.

EQUIPMENT

Spectrum Analyzer (Spurious/Harmonics) .... HP 140T/8552B/8553B
Network Analyzer .... HP 8421A/8407A
Generator Sweeper (Return Loss) .... HP 8601A
Power Splitter .... HP 11652-60019
Directional Bridge .... HP 8721A (OPT 008)

PROCEDURE

1. LEVEL and FLATNESS.

2. Connect the SLMS TRACKING OUTPUT to the 75ohm INPUT.

3. Select the 3.1kHz FILTER, AVE 1 and tune the SLMS to 1MHz (press FREQ, 1000 and MEAS).
4. The SLMS should indicate a level of -10dBm ± 0.5dB.
5. Press TR, REF, dB/dBm followed by MEAS. The SLMS should now display a level of 0dB.
6. Press START, FREQ and enter 1000.
7. Press STOP, FREQ and enter 32000.
8. Press STEP and enter 1000.
9. Press 3.1kHz (to ensure the SLMS is not in the Auto mode), then SPECT MEAS.
10. Monitor the LEVEL display and check the variation in level does not exceed ± 0.2dB.
11. If the LEVEL variation exceeds ± 0.2dB check the level at these frequencies using a suitable power meter (HP 436A with an 848A power sensor).
12. SPURIOUS AND HARMONICS
13. Connect the Tracking Generator output to the Spectrum Analyzer input.
14. Check the Spurious and Harmonics are all below -50dBm ± 0.5dB, and remains below -50dBm when the SLMS frequency is varied between 1 and 32MHz.
15. RETURN LOSS
16. Using the procedure in paragraph 4-23 connect the equipment as shown in figure 4-2 and carry out steps 1 through 5.
17. Press 3.1kHz and MEAS. Check the return loss at the TRACKING OUTPUT is better than -30dB.

4-46 HIGH LEVEL SEARCH (HOT TONE TEST)

This test applies to all instruments on and above serial number 2314U-00352, and checks the ability of the instrument to detect a high level tone which exceeds a pre-defined upper limit. The check below detects violations above –30dBm in the frequency range 1MHz to 9MHz.

PROCEDURE

1. Press START, FREQ and enter 1000; STOP, FREQ and enter 9000; STEP and enter 3; REF and enter –40; UPPER and enter 10.
2. Set the LIMITS switch to HI, LIMIT HALT to ON, and all other MODE switches to the left most position.
3. Connect a suitable signal source with a stable frequency to the SLMS 75Ω INPUT. Set the level between –28dBm and +10 and the frequency somewhere between 1MHz and 9MHz.
4. Press SPECT, UPPER, MEAS to start the measurement. The SLMS should make a swept measurement, halt when the violating tone is detected, refresh the FREQ/FDM display with the frequency of the tone, and display the RMS level of the tone.

Table 4-13 Test Record

Hewlett-Packard		Tested by		
		Date		
		Serial No.		

Para No.	Test Description	Result		
		Min.	Actual	Max.
4-23	**RETURN LOSS**			
(2)	SLMS FREQ/FDM and LEVEL display should read 'rf Atten = 09 ' √			
(6)	75Ω UNBAL INPUT <–30dB (100kHz to 32MHz)		....	
(7)	150Ω BAL INPUT <–30dB (100kHz to 2MHz)		....	
(13)	75Ω UNBAL INPUT <–30dB (50kHz to 500kHz)		....	
(14)	150Ω BAL INPUT <–30dB (50kHz to 500kHz)			
	OPTION 005 ONLY			
(16)	135Ω BAL INPUT <–30dB (50kHz to 2MHz)		....	
(18)	124Ω BAL INPUT <–30dB (50kHz to 12MHz)		....	
4-24	**FREQUENCY ACCURACY – OPT 013**			
(4)	Sideways movement <1 cycle per 5 seconds. √			
4-25	**FREQUENCY REFERENCE ACCURACY**			
(3)	10MHz	9.9995MHz	....	10.0005MHz
4-26	**MEASUREMENT ACCURACY**			
(8)	0dBm	–0.25dBm	....	+0.25dBm
(9)	Difference in reading <±0.25dB (0 to –80dB) √			
	38Hz Filter			
(11)	Difference in reading <±0.25dB (0 to –80dB) √		....	
(12)	<±1dB (200Hz to 10kHz)		....	
	<±0.45dB (10kHz to 50kHz)		....	
	<±0.25dB (50kHz to 20MHz)		....	

Table 4-13 Test Record (continued)

Para No.	Test Description	Result		
		Min.	Actual	Max.
4-26 cont. (12) cont.	<± 0.45dB (20MHz to 30MHz)		. . . .	
	Broadband Power – OPT 011			
(17)	0dBm	–1dBm	. . . .	+1dBm
(18)	0dBm 5MH	–1dBm	. . . .	+1dBm
	10MHz	–1dBm	. . . .	+1dBm
	15MHz	–1dBm	. . . .	+1dBm
	20MHz			
	25MHz	–1dBm	. . . .	+1dBm
	30MHz	–1dBm	. . . .	+1dBm
(19)	Difference in reading <± 1dB √			
(23)	0dBm	–1dBm	. . . .	+1dBm
(24)	0dB (1MHz to 32MHz)	–1dBm	. . . .	+1dBm
(25)	Difference in reading <± 1dB √			
	150Ω Balanced Input			
(33)	–3.01dBm	–3.61dBm	. . . .	–2.41dBm
(35)	–83.01dBm	–83.61dBm	. . . .	–82.41dBm
(38)	0dBm	–0.6dBm	. . . .	+0.6dBm
(39)	–80dBm	–80.6dBm	. . . .	–79.4dBm
(41)	0dBm (10kHz to 50kHz) –80dBm (10kHz to 50kHz)	–0.6dBm –80.6dBm	. . . .	+0.6dBm –79.4dBm
(42)	0dBm (50kHz to 2MHz) –80dBm (50kHz to 2MHz)	–0.6dBm –80.6dBm	. . . .	+0.6dBm –79.4dBm
	600Ω Balanced Input			
(48)	0dBm	–1dBm	. . . .	+1dBm
(49)	0dBm	–1dBm	. . . .	+1dBm
(54)	0dBm	–1dBm	. . . .	+1dBm

Table 4-13 Test Record (continued)

Para No.	Test Description	Result Min.	Result Actual	Result Max.
4-26 cont.				
(55)	0dBm	−1dBm	....	+1dBm
4-27	**3.1kHz CHANNEL FILTER**			
(4)	0dBm		....	
(6)	Difference in level <0.5dB		....	
(10)	−3dB threshold point (upper)	10,001.4kHz	....	10,001.7kHz
(12)	−3dB threshold point (lower)	9998.3kHz	....	9998.6kHz
(13)	Frequency Reading			
	9998.15kHz <−65dB		....	
	9996kHz <−70dB		....	
	10,001.85kHz <−65dB		....	
	10,004kHz <70dB		....	
4-28	**38Hz PILOT FILTER**			
(5)	0dB		....	
(7)	Difference in level <0.1dB		....	
(11)	−3dB threshold point (upper)	10,000.017kHz	....	10,000.021kHz
(13)	−3dB threshold point (lower)	9,999.979kHz	....	9,999.983kHz
(14)	Frequency Reading			
	999kHz <−80dBm		....	
	999.89kHz <−60dBm		....	
	999.94kHz <−38dBm		....	
	1000.06kHz <−38dBm		....	
	1000.11kHz <−60dBm		....	
	1001kHz <−80dBm		....	

Table 4-13 Test Record (continued)

Para No.	Test Description	Result		
		Min.	Actual	Max.
4-29	**48kHz GROUP FILTER – OPT 011**			
(5)	0dB			
(7)	Difference in level <1.2dB		....	
(11)	–3dB threshold point (upper)	10,021.9kHz	....	10,026.4kHz
(13)	–3dB threshold point (lower)	9,973.6kHz	....	9,978.1kHz
(14)	Frequency — Reading			
	9920kHz — <–40dBm		....	
	9952kHz — <–25dBm		....	
	10048kHz — <–25dBm		....	
	10080kHz — <–40dBm		....	
4-30	**IMAGE AND IF REJECTION**			
(4)	0dBm	–0.5dBm	....	+0.5dBm
(5)	<–75dBm		....	
(6)	<–75dBm		....	
(7)	<–70dBm		....	
(8)	<–70dBm		....	
(9)	<–80dBm		....	
(11)	<–75dBm		....	
(12)	<–70dBm		....	
(14)	<–75dBm		....	
(15)	<–75dBm		....	
(16)	<–70dBm		....	
(17)	<–70dBm		....	
(18)	<–80dBm		....	
(20)	<–75dBm		....	
(21)	<–70dBm		....	

Table 4-13 Test Record (continued)

Para No.	Test Description		Result Min.	Result Actual	Result Max.
4-31	**NOISE FLOOR & SPURIOUS RESPONSES**				
(3)	Noise floor <–115dBm √				
	Option 011				
(6)	Noise floor <–100dBm √				
(8)	3.1kHz Filter noise floor <–105dBm √				
(9)	38Hz Filter noise floor <–105dBm √				
	124Ω Balanced Input				
(10)	Noise floor <–113dBm √				
(11)	Noise floor <–113dBm √				
4-32	**INTERMODULATION**				
(6)	0dB			....	
(7)	Frequency	Reading			
	1300kHz	<–63dB		....	
	18700kHz	<–63dB		....	
	7400kHz	<–70dB		....	
	11300kHz	<–70dB		....	
	28700kHz	<–70dB		....	
(9)	Frequency	Reading			
	10,050kHz	<–60dB		....	
	9950kHz	<–60dB		....	
4-33	**COMMON MODE REJECTION**				
(6)	0dB		–0.2dB	....	+0.2dB
(8)	<–40dB			....	
(10)	<–40dB			....	

Table 4-13 Test Record (continued)

Para No.	Test Description	Result		
		Min.	Actual	Max.
4-34	**COUNTER SENSITIVITY AND ACCURACY**			
(6)	−100dBm	−103dBm	....	−97dBm
(8)	10,000kHz	9999.998kHz	....	10000.002kHz
(13)	−59.9dBm		....	
(15)	−40dBm	−42dBm	....	−38dBm
	Option 011 only			
(21)	10MHz	9,999.998kHz	....	10,000.002kHz
(24)	−80dBm		....	
4-35	**AUDIO OUTPUT**			
(6)	Level Variation <± 1dB (10,000kHz to 10,001.25kHz) √			
(7)	Level Variation <± 1dB (9,998.75kHz to 10,000kHz) √			
4-36	**TEST POINT SELECTOR**			
(2)	+15.5V	+14.5V	....	16.5V
(4)	−15.5V	−14.5V	....	−16.5V
(6)	+12V nominal √		....	
(10)	+9.5V (mark to space ratio 40/80) √			
(13)	14 pulses √			
(16)	44 pulses √			
(19)	1.4mSec to 2mSec √		....	
4-37	**EXTERNAL REFERENCE OSCILLATOR**			
(6)	SLMS frequency follows Synthesizer frequency √			
4-38	**CHART RECORDER OUTPUT**			
(7)	0dBm	−0.05dBm	....	+0.05dBm
(9)	0V	−0.1V	....	+0.1V

Table 4-13 Test Record (continued)

Para No.	Test Description	Result Min.	Result Actual	Result Max.
4-38 cont				
(11)	−3V	−2.9V	....	−3.1V
(13)	+3V	+2.9V	....	+3.1V
(17)	0dBm	−0.05dBm	....	+0.05dBm
(19)	+2.5V	+2.4V	....	+2.6V
(20)	0V	−0.1V	....	+0.1V
(21)	+5V	+4.9V	....	5.1V
4-39	HP-IB VERIFICATION TEST		Fail Pass	
4-41	WEIGHTED FILTER (OPT 015)			
	(4)	+4dBm	......	+8dBm
	(9)	−7.3dB	......	−5.3dB
		−4.6dB	......	−2.6dB
		−3.0dB	......	−1.0dB
		−1.7dB	......	+0.3dB
		−1.0dB	......	+1.0dB
		−0.8dB	......	+1.2dB
		−1.0dB	......	+1.0dB
		−1.2dB	......	+0.8dB
		−2.3dB	......	+0.3dB
		−3.4dB	......	−1.4dB
		−4.0dB	......	−2.0dB
		−5.2dB	......	−3.2dB
		−6.5dB	......	−4.5dB
		−9.0dB	......	−5.0dB

Table 4-13 Test Record (continued)

Para No.	Test Description	Result Min.	Result Actual	Result Max.
4-41	WEIGHTED (OPTION 016)	−32dBm	......	−28dBm
		−12.4dB	......	−10.4dB
		−8.5dB	......	−6.5dB
		−5.7dB	......	−3.7dB
		−3.7dB	......	−1.7dB
		−2.5dB	......	−0.5dB
		−1.6dB	......	+0.4dB
		−1.0dB	......	+1.0dB
		−1.2dB	......	+0.8dB
		−1.5dB	......	+0.5dB
		−2.0dB	......	0dB
		−3.3dB	......	−0.3dB
		−2.4dB	......	−0.4dB
		−2.9dB	......	−0.9dB
		−3.5dB	......	−1.5dB
		−6.5dB	......	−4.5dB
4-42	NOTCH FILTER		......	
(1)		−32 or +4dB	......	−28 or 8dBm
		-0.5dB	......	+0.5dB
		−3.0dB	......	———
		———	......	−50dB
		———	......	−50dB
		−3.0dB	......	———
		−0.5dB	......	+0.5dB

Table 4-13 Test Record (continued)

Para No.	Test Description	Result		
		Min.	Actual	Max.
4-43	**PHASE JITTER**			
(6)		–32 or 4dBm	. . . . . .	–28 or +8dBm
(8)			. . . . . .	0.5°
(12)			. . . . . .	0.5°
(12)			. . . . . .	0.5°
(17)			. . . . . .	0.5°
(17)			. . . . . .	0.5°
(19)		–32 or +4dB	. . . . . .	–28 or +8dBm
(24)		–0.1dB	. . . . . .	+0.1dB
(28)		8°	. . . . . .	12°
(30)		8°	. . . . . .	12°
(30)		8°	. . . . . .	12°
4-44	**IMPLUSE NOISE**			
(4)		–81dBm	. . . . . .	–79dBm
(5)		00.0dB	. . . . . .	00.0dB
(10)			. . . . . .	
(26)		0dB	. . . . . .	0dB
(23)		———	. . . . . .	———
(27)		000	. . . . . .	000
4-45	**TRACKING GENERATOR**			
(4)		–10.5dBm	. . . . . .	9.5dBm
(5)		0dB	. . . . . .	0dB
(10)		———		+0.2dB
(14)			. . . . . .	–50.5dBm
(17)			. . . . . .	–30.0dB

Table 4-14 Operation Verification Test Record

Hewlett-Packard

Tested by . . . .

Date . . . .

Serial No. . . . .

Para No.	Test Description	Result		
		Min.	Actual	Max.
4-12	Frequency Accuracy	9,999.500kHz	. . . .	10,000.499kHz
	OPT 014	9,999.998kHz	. . . .	10,000,002kHz
4-13	NOISE FLOOR	-115dBm	. . . .	
	OPT 011	-110dBm	. . . .	
4-14	COUNTER SENSITIVITY √		☐	
4-15	FILTERS 3dB BANDPOINTS			
	3.1kHz FILTER			
(8)	–3dB upper threshold	10,001.4kHz	. . . .	10,001.7kHz
	–3dB lower threshold	9998.3kHz	. . . .	9998.6kHz
	Level variation ±<0.5dB		. . . .	
(9)	38Hz FILTER			
	–3dB upper threshold	10,000.017kHz	. . . .	10,000.021kHz
	–3dB lower threshold	9998.979kHz	. . . .	9999.983kHz
	level variation ±<0.1dB		. . . .	

Table 4-14 Operation Verification Test Record (continued)

Para No.	Test Description	Result		
		Min.	Actual	Max.
4-15	**OPT 011 48kHz FILTER**			
(12)	-3dB upper threshold	10,021.9kHz	. . . .	10,026.4kHz
	-3dB lower threshold	9,973.6kHz	. . . .	9,978.1kHz
	level variation <±1.2dB		. . . .	
4-16	**MEASUREMENT ACCURACY**			
	0dBm at 1MHz	−0.25dB	. . . .	+0.25dBm
(6)	3.1kHz FILTER			
(8)	48kHz FILTER (OPT 011)	−1dBm	. . . .	+1dBm
(18)	Atten Steps √			
(31)	Broadband Power √			
(36)	Balanced Inputs √			
4-17	**AUDIO OUTPUT √**		☐	
4-18	**TEST POINT SELECTOR √**		☐	
4-19	**CHART RECORDER/METER DRIVE √**		☐	
4-20	**HP-IB √**			
4-21	**CHANNEL IMPAIRMENTS √**		☐	
4-22	**TRACKING GENERATOR √**		☐	
4-23	**HOT TONE √**		☐	

SECTION V
ADJUSTMENTS

5-1 INTRODUCTION

5-2 This section describes adjustments and checks required to return the instrument to peak operating capabilities when repairs have been made. Included in this section are equipment setups and procedures.

5-3 The power supply adjustment procedures should be performed before repairs are made to any part of the instrument.

5-4 SAFETY CONSIDERATION

5-5 This section contains warnings and cautions that must be followed for your protection and to avoid damage to equipment.

WARNING

MAINTENANCE DESCRIBED HEREIN IS PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT AND THE PROTECTIVE COVERS REMOVED. SUCH MAINTENANCE SHOULD BE PERFORMED ONLY BY SERVICE TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED (FOR EXAMPLE FIRE AND ELECTRICAL SHOCK). WHERE MAINTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED, THE POWER SHOULD BE REMOVED.

5-6 EQUIPMENT REQUIRED

5-7 The equipment required for the adjustment procedures is listed in Table 1-2 of Section I. Any equipment that satisfies the critical specifications in Table 1-2 may be substituted for the recommended models.

5-8 ADJUSTABLE COMPONENTS

5-9 Adjustable components are listed in Table 5-1 along with a brief description of the adjustments.

5-10 RELATED ADJUSTMENTS

5-11 After an assembly repair, it may be necessary to perform more than one adjustment, these related adjustments are listed in Table 5-2.

5-12 ADJUSTMENT LOCATIONS

5-13 The adjustment Locations are shown on the component Layouts in the Service Sheets in Section VIII.

Table 5-1 Adjustable Components

Reference Designator	Paragraph	Description
A1 R27	5-28	Sets 0dBm LEVEL for 124/150Ω BALANCED INPUT
A1 R48	5-29	Sets 0dB LEVEL for 600Ω BALANCED INPUT
A2 L1, L2	5-24	Sets return loss of 75Ω INPUT
A2 C21	5-27	Sets SLMS response at 15MHz
A2 R27	5-27	Sets SLMS response at 32MHz
A4 L6	5-32	Adjust Calibrator waveform symmetry
A4 R80	5-27	Sets Calibration level
A4 R36	5-26	Sets the hardwire HOVERLOAD and HUNDER-LOAD limits from the Broadband Power detector.
A4 R39	5-26	Sets the gain of the Broadband RMS to DC Log Converter.
A4 R90 /C41	5-26	Sets Broadband power flatness at 2kHz and 3MHz
A5 L1	5-36	Sets 98MHz notch on Input Filter
A5 L2	5-36	Sets 57MHz notch on Input Filter
A5 L3	5-36	Sets 50MHz notch on Input Filter
A5 L7	5-39	Tunes 1st IF (at 50.015625MHz)
A5 L12	5-39	Tunes 1st IF (at 50.015625MHz)
A5 C25, C26, C27, R19	5-39	Tunes 50.015625MHz crystal filter
A5 C13, C14, L4	5-37	Tunes Bandpass filter
A5 C8, C11	5-38	Adjusts Input Mixer balance
A10 L2, L7	5-39	Tunes 1st IF (at 50.015615MHz)
A10, C9, C10, C11, R7	5-39	Tunes 50.015625MHz crystal filter
A10 R26	5-33	Sets IF GAIN at output of 2nd Mixer
(OPT 011) A11 L1	5-30	Tunes Group Filter IF (at 50.05MHz)
A11 C8, C9	5-30	Tunes 50.05MHz crystal filter
A11 R43	5-30	Sets absolute value from the Group Power RMS to DC Log Converter
A11 R46	5-30	Sets gain (counts per dB) of the Group Power RMS to DC Log Converter
A20 L3, L4, L5, L6, L7 L8, L9, L10, L11	5-41	Tunes Channel (3.1kHz) Filter
A20 R39, R48, R57, R67	5-42	Tunes Pilot (38Hz) Filter
A21 R3	5-40	Sets the response of the 15625Hz low pass filter
A21 R19	5-27	Sets absolute value from the IF RMS to DC Log Converter
A21 R31	5-27	Sets the Gain (counts per dB) of the IF RMS to DC Log Converter on the AVE 2 mode
A21 R33	5-27	Sets the Gain (counts per dB) of the IF RMS to DC Log Converter on the AVE 0 mode
A21 R65	5-31	Adjust Demodulator mixer balance
A21 R46	5-35	Sets Chart Recorder Voltage output
A21 R50	5-35	Sets Chart Recorder Current output.
A22 R6	5-25	Sets A/D output against a −1V level
A23 R142, R150	5-45	Set RMS to dc Log Connector o/p
A23 R132	5-46	Sets Impulse Count
A23 R23, A43, R53	5-47	Phase jitter adjust
A23 R69, R97, R103	5-48	Notch filter adjustment

Table 5-1 Adjustable Components (continued).

Reference Designator	Paragraph	Description
A31 L4, R4	5-18	Sets Fractional N VCO
A32 R51, R54, R61, R110	5-19	Minimises spurious in Fractional N Loop
A40 R78	5-17	Sets FREQ REF VCO to 50MHz
OPT 013 A41 FREQ ADJUST	5-16	Sets PRECISION FREQ REF
A50 L5	5-20	Adjusts VCO Frequency
A50 R45, R46	5-20	Adjusts VCO Flatness
A51 L8	5-21	Adjusts VCO Frequency
A51 R55, R56	5-21	Adjusts VCO Flatness
A53 R3	5-22	Sets Sum Loop gain
A53 R13	5-22	Sets Sum Loop Offset
A54 R46	5-43	Sets tracking output level to −10dBm
A54 R31	5-43	Set for minimum harmonics/spurious signals
A65 C1	5-23	Adjusts real time clock frequency
A80 R15	5-15	Adjusts +12V supply

Table 5-2 Related Adjustments

Assembly Changed or Repaired	Perform the following Related Adjustments			Paragraph
A1 Input Signal Multiplexer	A1	R27	Sets 0dBm level for 124/135/150Ω Balanced Inputs	5-28
	A1	R48	Sets 0dBm level for 600Ω Balanced Input	5-29
A2 Input Attenuator and Amplifier	A2	L1	Sets Return Loss of 75Ω INPUT	5-24
	A2	L1	Sets Return Loss of 75Ω INPUT	
	A4	R36	Sets Broadband Power detector H OVERLOAD and H UNDERLOAD limits	5-26
	A4	R39	Sets gain of Broadband Power detector RMS to DC Log Converter	5-26
	A10	R26	Sets IF gain at output of 2nd mixer	5-33
	A4	R80	Sets Cal level	5-27

Table 5-2 Related Adjustments (continued).

Assembly Changed or Repaired	Perform the following Related Adjustments	Paragraph
A2 Input Attenuator and Amplifier (cont.)	A21 R19, A21 R31, A21 R33 — Sets IF RMS to DC Log Converter	5-27
	A2 C21, A2 R27 — Sets SLMS response	5-27
	FOR OPT 011 INSTRUMENTS	
	A11 R43, A11 R46 — Sets Group Power RMS to DC Log Converter	5-30
A5 Input Mixer	A5 L1, L2, L3 Tunes Input Filter	5-36
	A5 L7, L12 Tunes 1st IF	5-39
	A5 C25, C26, C27, R19 Tunes XTAL Filter	5-39
	A5 C13, C14, L4 Tunes Bandpass Filter	5-37
	A5 C8, C11 Adjusts mixer balance	5-38
	A10 R26 Sets IF Gain	5-33
	A4 R80 Sets Cal Level	5-27
	A21 R19, A21 R31, A21 R33 — Sets IF RMS to DC Log Converter	5-27
	A2 C1, A2 C21 — Sets SLMS response	5-27
	FOR OPT 011 INSTRUMENTS	
	A11 R43, A11 R46 — Sets Group Power RMS to DC Log Converter	5-30
A4 Calibrator & Broadband Power Detector	A4 R36 Sets Broadband Power Detector H OVERLOAD and H UNDERLOAD limits	5-26
	A4 R39 Sets Broadband Power Detector RMS to DC Log Converter	5-26
	A4 L6 Adjusts Calibration waveform symmetry	5-32
	A4 R80 Sets CAL level	5-27
	A4 R90, C41 Sets INPUT POWER response	
A10 2nd Mixer	A10 L2, L7 Tunes 1st IF	5-39
	A10 C9, C10, C11, R7 Tunes XTAL filter	
	A10 R26 Sets IF gain	5-27
	A4 R80 Sets CAL Level	5-27
	A21 R19, A21 R31, A21 R33 — Sets IF RMS to DC Log Converter	5-27
	A2 C21, A2 R27 — Sets SLMS response	5-27
A11 Group Power (OPT 011)	A11 L1 Tunes Group Filter	5-30
	A11 C8, C9 Tunes XTAL filter	5-30
	A11 R43, A11 R46 — Sets Group Power RMS to DC Log Converter	5-30
A20 Filters Channel Filter Section Pilot Filter Section	A20 L3, L4, L5, L6, L7, L8, L9, L10, L11 Tunes Channel Filter	5-41
	A20 R39, R48, R57, R67 Tunes Pilot Filter	5-42
	A4 R80 Sets CAL Level	5-27
	A21 R19, A21 R31, A21 R33 — Sets IF RMS to DC Log Converter	5-27
	A2 C21, A2 R27 — Sets SLMS Response	5-27

Table 5-2 Related Adjustments (continued).

Assembly Changed or Repaired	Perform the following Related Adjustments			Paragraph
A21 IF Gain/Detection	A21	R65	Adjust Demod mixer balance (no other adjustments affected)	5-31
	A21	R46, R5	Sets Chart Recorder Output levels (no other adjustments affected)	5-35
	A21	R3	Sets response of Low Pass Filter	5-40
	A4	R80	Sets CAL Level	5-27
	A21	R19, R31, R33	Sets IF RMS to DC Log Converter	5-27
A22 A/D Converter	A22	R6	Sets A/D output	5-25
	A4	R39	Sets gain of Broadband Power Detector RMS to DC Log Converter	5-26
	A4	R36	Sets Broadband Power Detector H OVERLOAD and H UNDERLOAD	5-26
	A4	R80	Sets CAL level	5-27
	A4	R19, R31, R33	Sets IF RMS to DC Log Converter	5-27
	FOR OPT 011 INSTRUMENTS			
	A11	R43, R46	Sets Group Power RMS to DC Log Converter	5-30
A23 IMPAIRMENTS	A23	R142, R150	Set RMS to DC Log Converter	5-45
	A23	R132	Set Impulse count	5-46
	A23	R23, R43, R53	Sets Phase Jitter	5-47
	A23	R109, R97, R103	Notch Filter Adjustment	5-48
A31 Fractional N VCO	A31	L4, R4	Sets Fractional N VCO	5-18
A32 Fractional N PSD	A31	L4	Sets Fractional N VCO	5-18
	A31	R4	Sets Fractional N VCO	5-18
	A32	R51, R54, R61, R110	API Current adjustments, minimises spurious in the Fractional N loop	5-19
A40 Frequency Reference	A40	R78	Sets FREQ REF VCO	5-17
A41 Precision Frequency Reference (OPT 013)	A41		FREQ ADJUST	5-16
A50 Step Loop	A50	L1	Sets VCO Frequency	5-20
	A50	R45, R46	Adjusts VCO Flatness	5-20
A51 Sum Loop VCO	A51	L8	Adjusts VC0 Frequency	5-21
	A51	R55, R56	Adjust VCO Flatness	5-21
	A53	R3	Sum Loop Gain	5-22
	A53	R13	Sum Loop Offset	5-22

Table 5-2 Related Adjustments (continued).

Assembly Changed or Repaired	Perform the following Related Adjustments		Paragraph
A52 Sum Loop Mixer	None		
A53 Sum Loop PSD	A53 R3 A53 R13	Sum Loop Gain Sum Loop Offset	5-22 5-22
A54 Tracking Output A54 Tracking Generator	A54 R46 able A54 R31	Set Tracking Output Level −10dBm Set for minimum harmonics	5-43 5-43
A65 Controller Services	A65 C1	Adjusts real time clock frequency	5-23
A80 Power Supply	A80 R15	Sets +12V rail	5-15

5-14 ADJUSTMENTS

5-15 POWER SUPPLY

REFERENCE

Assembly Service Sheet A80

EQUIPMENT

Voltmeter..HP 3403C

PROCEDURE

1. Connect the Voltmeter to A80TP1 (+12V) and check the voltage is +12V ± 0.01V. If necessary adjust A80R15 for +12V ± 0.01V.

2. Connect the Voltmeter to A80TP2 and check the voltage is -12V ± 0.1V.

3. Connect the Voltmeter to A80TP3 and check the voltage is +5.25V ± 0.1V.

The Power Supply Assembly is fitted with over-current protection. Each supply line has a green LED which is ON for normal operation and a red LED which is ON during an over-current trip.)

5-16 PRECISION FREQUENCY REFERENCE-OPTION 013/014

REFERENCE

Assembly Service Sheet A41/A43

EQUIPMENT

Frequency Standard........................House Standard
(10MHz or sub multiples)
Oscilloscope..HP 1740A

PROCEDURE (omit steps 1 and 2 if Assembly A43 is fitted)

1. Remove the A43 Assembly for at least 30 minutes.

2. Insert the A43 Assembly and adjust A43R6 until the LED DS1 goes off, then slowly rotate A43R6 to the threshold point where DS1 comes on.

3. Allow at least 5 minutes warm-up (until the A43 COLD OVEN LED is off).

4. Connect a 10MHz Frequency Standard (House Standard) to the external trigger input of an Oscilloscope. Connect the SLMS rear panel 10MHz OVEN OUTPUT to the Oscilloscope vertical input, and adjust the timebase to display at least 3 cycles.

5. Check the drift displayed on the Oscilloscope is less than 1 cycle in 10 seconds. If necessary adjust the Oscillator FREQ ADJUST for minimum drift (on the A43 Assembly remove the screw and replace it after adjustment).

5-17 FREQUENCY REFERENCE

REFERENCE

Assembly Service Sheet A40

EQUIPMENT

Electronic Counter..HP 5328A

NOTE: With Opt 013/014 ensure the Precision Frequency Reference (Assembly A41) is correct (Paragraph 5-16) prior to carrying out the following procedure.

PROCEDURE

1. Mount the A40 assembly on two extender cards and allow at least a 10 minute warm up.
2. Connect the Electronic Counter to A40J6.
3. Short A40TP4 to A40TP5 and check for a frequency reading of 50MHz ± 10Hz. If necessary adjust A40R78 to achieve this.
4. Remove the shorting link.

5-18 FRACTIONAL N VCO

REFERENCE

Assembly Service Sheet A31

DESCRIPTION

This adjustment sets the VCO operating voltages at the upper and lower frequency limits.

EQUIPMENT

Digital Voltmeter..HP 3403C
Oscilloscope..HP 1740A

PROCEDURE

1. Mount Assembly A31 on an extender board.
2. Connect an Oscilloscope to A32TP1 to monitor the integrator output.
3. Key-in TR30 to tune the SLMS to the upper frequency limit of the VCO indicated by 40.000 000 (MHz) on the SLMS FREQ/FDM display. Press either the ↑ or ↓ key to change the frequency to 20.000 000 (MHz). Sometimes the instrument will initially tune to 20MHz without the need to press ↑ or ↓ keys.
4. Connect the Digital Voltmeter to the cathode of A31CR2 and note the voltage.
5. Connect the Digital Voltmeter to A31TP3 and adjust A31L4 until the voltage reading is +0.1V above the

voltage noted in step 4. Monitor the Oscilloscope while adjusting A31L4 to ensure the displayed waveform does not collapse signifying the oscillator output has decayed.

6. Press either the ↑ or ↓ key to change the FREQ/FDM display to 40.000 000 MHz.

7. Adjust A31R4 for a dc voltage of 0V ± 0.02V at A31TP3. Monitor the Oscilloscope when making this adjustment to ensure the displayed waveform does not collapse.

5-19 FRACTIONAL N PHASE DETECTOR

REFERENCE

Assembly Service Sheet A32

DESCRIPTION

This adjustment minimises the spurious generated by the Fractional-N Loop by adjusting the API (Analogue Phase Interpolation) resistors. In this adjustment the spurious (10kHz) is monitored at A31J1 (TEST) on a suitable Spectrum Analyzer.

NOTE: An alternative procedure using an HP 3580A Spectrum Analyzer is documented at the end of Procedure 1. Whilst it is not possible to determine the absolute level of spurios it is possible to make any adjustment. Procedure 2 may be used in circumstances where a suitable Spectrum Analyzer such as the HP 8568A is not available.

EQUIPMENT

Spectrum Analyzer
(Procedure 1)........................HP 8568A
Spectrum Analyzer
(Procedure 2)........................HP 3580A

PROCEDURE 1

1. Mount the A32 Assembly on an extender board.

2. Press the SLMS TR key followed by 33. The FREQ/FDM Display indicates the frequency of the Fractional N VCO, and should read 30.010000(MHz).

3. Connect the Spectrum Analyzer to A31J1 (TEST).

4. Set the Spectrum Analyzer controls as follows:

CENTRE FREQUENCY........................30.010MHz
FREQUENCY SPAN........................25kHz
RESOLUTION BW........................30Hz
VIDEO BW........................10Hz

5. Adjust the level controls of the Spectrum Analyzer so that the carrier is at full scale on the Spectrum Analyzer display.

6. After the Spectrum Analyzer has made 2 complete sweeps reduce the VIDEO BW to 3Hz.

7. Check that the 10kHz spurious is at least 70dB below the carrier and if necessary adjust A32R51 and A32R110 to null the 10kHz spurious.

8. Press the SLMS ↑ key to tune the Fractional N VCO to 30.00100(MHz) indicated on the FREQ/FDM Display.

9. Alter the Spectrum Analyzer centre frequency to 30.001MHz.

10. Check the 10kHz sideband is at least 70dB below the carrier and if necessary adjust A32R54.

11. Press the SLMS↑key twice to tune the Fractional N VCO to 30.000010(MHz) indicated on the FREQ/FDM Display.

12. Retune the Spectrum Analyzer centre frequency to 30.00001MHz.

13. Check the 10kHz sideband is at least 70dB below the carrier and if necessary adjust A32R61.

14. Press the SLMS keys TR34. This tunes the Fractional N VCO to 40.01MHz. Check with the Spectrum Analyzer, tuned to 40.01MHz that the spurious levels are 70dB below the carrier.

15. Tune the Fractional N loop to 30.011111MHz using the TR 3,3 and ↓ keys Retune the Spectrum Analyzer to 30.011111MHz and check all spurious levels are 70dB below the carrier.

16. Tune the Fractional N loop to 20.011111MHz using the TR, 3, 2 and↓keys. Retune the Spectrum Analyzer to 20.011111MHz and check all spurious levels are 70dB below the carrier.

17. If necessary re-adjust A32R51 to achieve the desired results in steps 15 and 16.

PROCEDURE 2

1. Mount the A32 Assembly on an extender board.

2. Press the SLMS TR key followed by 32. The FREQ/FDM Display indicates the frequency of the Fractional N VCO, and should read 20.010000 (MHz).

3. Connect the low frequency Spectrum Analyzer to A32TP2. Adjust the Spectrum Analyzer frequency to 10kHz and the input sensitivity to -70dB.

4. Adjust A32R51 (API-1) to null the 10kHz spurious.

5. Press the SLMS ↑ key to change the (frequency of the Fractional-N loop) to 20.00100 MHz.

6. Adjust A32R54 (API-2) to null the spurious.

7. Press the ↑ key to change the frequency of the Fractional-N loop to 20.001000MHz), and again press the key to change the frequency to 20.000010MHz.

8. Adjust A32R61 (API-4) to null the spurious.

9. Press the SLMS TR,32 keys to return the frequency to 20.010000MHz.

10. Adjust A32R110 and A32R51 for the best minimum spurious level.

11. Press the SLMS TR,33 keys to change the frequency to 30.010000MHz.

12. Press the SLMS ↑ to decrement the frequency and check the spurious levels are not greater than that obtained in steps 2 through 10.

13. Press the SLMS TR,34 keys to change the frequency to 40.010000MHz.

14. Press the SLMS ↑ key to decrement the frequency and check the spurious levels are not greater than that obtained in step 2 through 10.

15. If necessary adjust the variable resistors for the best compromise.

16. Retune the Spectrum Analyzer to 11.111kHz.

17. Press the SLMS TR,32 keys.

18. Press the SLMS ↑ key 5 times to give a frequency of 20.011111MHz.

19. Check the spurious level is not greater than the level obtained in step 4. If necessary adjust A32R51 to minimise the spurious level.

5-20 STEP LOOP

REFERENCE

Assembly Service Sheet A50

DESCRIPTION

This adjustment sets the VCO frequency and flatness.

EQUIPMENT

Electronic Counter........................HP 5328A
Power Meter................................HP 436A

PROCEDURE

1. Mount Assembly A50 on an extender board.
2. Set A50S1 to the T position.
3. Connect the Electronic Counter to A50J2 and if necessary adjust A50L5 (FREQ) to give a frequency reading of 54MHz ± 0.1MHz.
4. Set A50S1 to the N position.
5. Connect the POWER METER to A50J1.
6. Connect the 10MHz REF from A40J4 to A50J3.
7. Tune the Step Loop to 52MHz by pressing the TR,50 keys,

8. The Electronic Counter should read 52MHz.

9. The Power Meter should read -6dB ± 1dB, if necessary adjust A50R46 (GAIN).

10. Press the ↓ key to step the SLMS to 86MHz, the Electronic Counter should read 86MHz.

11. The Power Meter reading should read -6dB ± 1dB, if necessary adjust A50R45 (FLATNESS).

12. Press the ↓ key to step the SLMS from 86MHz thru 52MHz and check the power variation remains at -6dB ± 2dB, if necessary adjust A50R46 and A50R45 to achieve this.

13. Repeat steps 2 through 4.

5-21 SUM LOOP

REFERENCE

Assembly Service Sheet A51

DESCRIPTION

This adjustment sets the VCO frequency and flatness.

EQUIPMENT

Electronic Counter...HP 5328A
Power Meter...HP 436A

PROCEDURE

1. Mount Assembly A51 on an extender board, and leave A51J1 connected to A52J2.

2. Set A51S1 to the T position.

3. Connect an Electronic Counter to A51J4, and if necessary adjust A51L8 (FREQ) to give a frequency reading of 52MHz ± 0.1MHz.

4. Set A51S1 to the N position and connect a Power Meter to A51J2.

5. Press the TR,30 keys, followed by the ↑ key to set the Fractional N Loop frequency to 20MHz.

6. Tune the Sum Loop to 50MHz by pressing the TR,50 keys. The FREQ/FDM Display should display N Loop = 52.

7. The Electronic Counter should read 50MHz.

8. The Power Meter should read -6dB ± 1dB, if necessary adjust A51R56 (GAIN).

9. Press the ↓ key to tune the Sum Loop to 84MHz, the Electronic Counter should read 84MHz. The FREQ/FDM Display should read N Loop 86.

10. The Power Meter should read -6dB ± 1dB, if necessary adjust A50R55 (FLATNESS).

11. Repeat steps 6 thru 10 as required to obtain the minimum variation between the upper and lower frequencies.

12. Use the ↑ key to step the SUM LOOP across the frequency range 50 - 84MHz and check the Power Meter displays -6dBm ± 2dB, if necessary adjust A50R55 and A50R56 to achieve this.

13. Repeat steps 2 through 4.

5-22 SUM LOOP PHASE DETECTOR

REFERENCE

Assembly Service Sheet A53

DESCRIPTION

This adjustment sets the loop gain and offset in the SUM LOOP PHASE DETECTOR.

EQUIPMENT

Electronic Counter.......................................HP 5328A
Digital Voltmeter...HP 3403C

PROCEDURE

1. Mount Assembly A53 on an extender board.

2. Connect the Digital Voltmeter to A53TP2 and the Electronic Counter to A51J2.

3. Press the ↑,TR,53 keys, the SLMS display should read GAIN and the Electronic Counter should read 50MHz.

4. Press the ↑ key to change the SLMS to read OFFSET and the Electronic Counter to read 78MHz.

5. Adjust A53R13 (OFFSET) for 0V ± 0.05V.

6. Use the ↑ key to set the SLMS for GAIN adjustment.

7. Adjust A53R3 (GAIN) for 0V ± 0.05V.

8. Repeat steps 4 thru 7 until the inter-action is minimal.

9. Press the TR,50 keys to change the frequency to 50MHz.

10. Use the ↑ key to step the SLMS frequency from 50MHz to 80MHz on the Electronic Counter. Check that the voltage at A53TP2 remains at 0V ± 0.25V, if necessary make minor adjustment to A53R13 to maintain 0V ± 0.25V.

5-23 REAL-TIME CLOCK FREQUENCY

REFERENCE

Assembly Service Sheet A65

EQUIPMENT

Electronic Counter....................HP 5328A

PROCEDURE

1. Connect the Electronic Counter to A65TP1.

2. Adjust A65C1 to give a frequency reading of 32,768Hz ± 0.2Hz.

The following procedure outlines how to set the time and/or date. Note if the date is set the clock will be stopped and the time will require re-setting.

3. Press the TR and COUNTER keys, the display should now indicate the time using a 24 hour clock.

4. Press the FREQ/FDM key. The display should now indicate the DAY - MONTH - YEAR.

5. Press the SMG key and enter the day.

6. Press the SG key and enter the month.

7. Press the CH key and enter the year.

NOTE: Even if the month or year is unchanged the value must be re-entered.

8. Press the START key.

9. Press the FREQ/FDM key to return to a TIME display.

10. Press the SMG key and enter the HOUR.

11. Press the SG key and enter the NEXT MINUTE.

12. Press the START key to start the CLOCK. The clock always starts from 00 seconds.

5-24 RETURN LOSS

REFERENCE

Assembly Service Sheet A2

DESCRIPTION

A2L1 and A2L2, part of the Low Pass Filter on Assembly A2, are adjusted to give the best return loss with the SLMS input attenuators set for zero attenuation [Diagnostic test mode d21 rf atten = 09]. A Network Analyzer system is used to measure the return loss. (A Tracking Generator and Spectrum Analyzer may be used instead of the Network Analyzer system.)

EQUIPMENT

Network Analyzer.......HP 8421A/8407A
Generator Sweeper.......HP 8601A
Power Splitter.......HP 11652-60019
Directional Bridge.......HP 8721A (OPT 008)

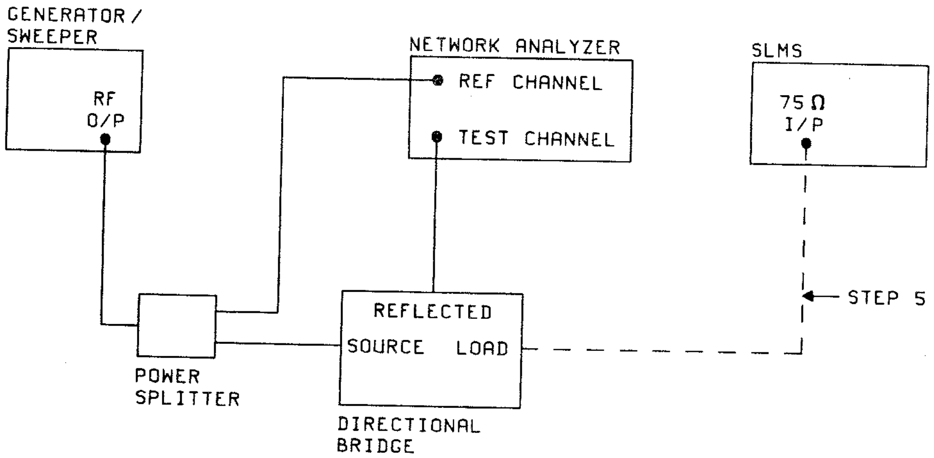


Figure 5-1 Return Loss Adjustment Test Set-up

PROCEDURE

1. Press the SLMS 75 ohm TERMINATION key.
2. Press the SLMS keys TR,2,1 and ↑ to set the SLMS to diagnostic test mode d21 with rf Atten = 09 displayed in the SLMS FREQ/FDM and LEVEL windows.
3. Connect the test equipment as shown in Figure 5-1 with the recommended equipment controls set as follows:

HP 8601A Generator/Sweeper
FREQ.......32MHz
RANGE.......110MHz
SWEEP.......VIDEO
OUTPUT LEVEL.......-16dBm
MOD.......OFF
CRYSTAL CAL.......OFF
SWEEP MODE.......FAST
SWEEP VERNIER.......Fully anti-clockwise

HP 8470A/8412A Network Analyzer
MODE.......AMPLITUDE
AMPL.......10dB/div

4. Adjust the Network Analyzer DISPLAY REF control for an on-screen display, with the trace at the top of the CRT display.

5. Connect the Directional Bridge LOAD output to the SLMS 75 ohm INPUT.

6. If necessary adjust A2L1 and A2L2 for the best return loss, at least 30dB below the reference line.

5-25 A/D CONVERTER

REFERENCE

Assembly Service Sheet A22

NOTE: If the A/D Converter is adjusted carry out the 0dBm LEVEL Adjustment Paragraph 5-27.

DESCRIPTION

By utilising built-in test modes, a -1V reference signal is applied to the input of the A/D Converter. The output level of the A/D Converter is displayed on the SLMS FDM/FREQ display and compared with the input voltage at A22TP5 measured on a DVM. A22R6 is adjusted to give the same reading at the output of the A/D Converter as that displayed on the DVM.

EQUIPMENT

Digital Voltmeter (DVM)..HP 3403C

PROCEDURE

1. Press the SLMS AVE, 2, and MEAS keys.

2. Connect the DVM to A22TP5.

3. Press TR, 22, then ↑ key to select Ad. I.P. = 1 on the SLMS FREQ/FDM display. [The TEST-POINT display should indicate d22].

4. Press key 3 to change the diagnostic mode to d23 (indicated on the TEST POINT display).

5. Adjust A22R6 to set the A/D Reference, indicated on the FREQ/FDM display, to the same reading as obtained on the DVM. e.g. if the DVM reads (-).990V set the SLMS to read 00990X, where X is a number between 0 and 9.

5-26 BROADBAND POWER DETECTOR

REFERENCE

Assembly Service Sheet A4

DESCRIPTION

The Overload (OL) and Underload (UL) Threshold limits are adjusted by A4R36 to give an excursion of between 7dB (minimum) and 8dB (maximum) between threshold points. The gain of the RMS to DC Log Converter is adjusted by A4R39 to give a precise 20dB swing across the mid-operating range.

EQUIPMENT

Synthesizer/Level Generator..HP 3335A

PROCEDURE

1. Connect the Synthesizer/Level Generator OUTPUT to the SLMS 75 ohm INPUT.
2. Press the following SLMS keys; 75 ohm, AVE, 1, I/P POWER and MEAS.
3. Set the Synthesizer/Level Generator output level to -27.5dBm with a frequency of 1MHz and an amplitude step size of 1dB.
4. Check the SLMS LEVEL reading is -27.5dBm ± 1dB.
5. Disconnect the Synthesizer/Level Generator from the SLMS 75 ohm INPUT and check the SLMS LEVEL display is less than -55dBm.
6. Press the SLMS HALT key, and reconnect the Synthesizer/Level Generator to the SLMS 75 ohm INPUT.
7. Increment the amplitude of the Synthesizer/Level Generator (above -27.5dBm) and if necessary adjust A4R36 (BBP THRESHOLD) so that the OL THRESHOLD indicator is flickering at -24dB and ON at -23.5dBm.
8. Decrement the amplitude of the Synthesizer/Level Generator (below) -27.5dBm) and check the UL THRESHOLD indicator comes on between -31.0dBm and -31.5dBm.
9. A4R39 should be adjusted to give an equal swing above and below -27.5dBm for the UL and OL indicators to light. Ensure that the change in level between the OL and UL limits is at least 7dB and not greater than 8dB.
10. Press the SLMS keys, AVE, 0, then MEAS.
11. Press the SLMS keys, AVE 1.
    (Steps 10 and 11 force a CAL cycle).
12. Step the Synthesizer/Level Generator from -25dBm to -45dBm and check the SLMS LEVEL changes by 20dB ± 0.1dB.
13. If necessary adjust A4R39 (BBP GAIN) to obtain this accuracy while stepping between -25dBm and -45dBm (clockwise rotation of R36 increases the range).
14. If A4R39 is adjusted recheck the threshold limits steps 5 through 9.
15. Press INPUT POWER, AVE 1 and MEAS.
16. Set the Synthesizer/Level Generator to a Frequency of 1MHz and adjust the output level to give a reading of 0.0dBm ± 0.1dB on the SLMS. (The synthesizer output is connected to the SLMS 75ohm INPUT).
17. Retune the Sythesizer/Level Generator to 31MHz and adjust A4C41 to give a LEVEL reading the same as

obtained in step 16 ± 0.1dB.

18. Retune the Synthesizer/Level Generator to 2kHz and adjust A4R90 to give a LEVEL reading the same as obtained in Step 16 ± 0.1dBm.

19. Steps 16 through 18 are interactive and some re-adjustment may be necessary.

5-27 0dBm LEVEL

REFERENCE

Assembly Service Sheets A4,A21, and A2.

NOTE: Prior to carrying out this adjustment check out the following adjustments in order.

1. A/D Converter........Paragraph 5-25
2. Broadband Power Detector........Paragraph 5-26
3. IF Gain........Paragraph 5-33

DESCRIPTION

A stable 1MHz reference source is formed as shown in Figure 5-2. The IF signal level is checked at the output of the 2nd MIXER and adjusted as necessary. The calibration signal at the A4 Assembly is adjusted against the 0dBm reference. The IF RMS to DC Log Converter on Assembly A21 is adjusted to set a precise A/D output on AVE 2 (0.01dB resolution), AVE 1 (0.1dB resolution) and AVE 0 (1dB resolution) with the Input at 1MHz. Finally the SLMS frequency response is checked and adjusted as required.

EQUIPMENT

Power Meter........W&G EPM-1
Power Meter Probe........W&G TK10, BN572/0
Synthesizer/Level Generator........HP 3335A
Oscilloscope........HP 1740A

PROCEDURE

1. Set up the equipment as shown in Figure 5-2.

2. Tune the Syntesized/Level Generator to 1MHz and adjust the output level to give 0dBm ± 0.001dB on the Power Meter.

3. Press the following SLMS keys:

   3.1kHz (FILTER)
   75 ohm (TERMINATION)
   FREQ
   1000
   AVE
   2
   MEAS

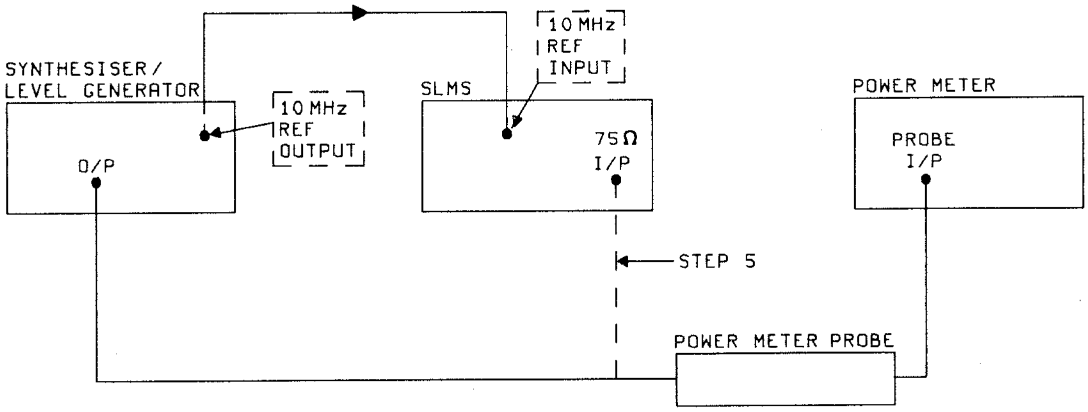


Figure 5-2 0dBm Level Adjustment Test Set-up

4. Connect the Synthesizer/Level Generator to the SLMS 75 ohm INPUT.

5. Check the SLMS LEVEL reading is 0.00dBm ± 0.01dB, if necessary adjust A4R80 as follows:

   Make a slight adjustment of A4R80. Press AVE 1, the SLMS will CAL. Then press AVE 2, the SLMS will CAL again. Re-check for 0.00dBm ± 0.01. Continue adjusting A4R80 and forcing the CAL sequence by pressing AVE 1, AVE 2 until a 0.00dBm ± 0.01dB reading is obtained.

6. Press the TR,2, and 3 keys on the SLMS to set diagnostic test mode d23. In this mode the FREQ/FDM display now shows the A/D output count.

7. If necessary adjust A21R19 to give a count of 21000 ± 100. [If the reading is nearer 26000 ± 100 this usually indicates the SLMS Input Attenuator is set 5dB higher than normal (5000 counts =5dB) indicating that the previous adjustments, particularly the Broadband Power Detector adjustment (paragraph 5-26) is not set precisely. If more that 5dB of gain is in circuit on the A21 assembly - indicated by the LEDs on A21 assembly - a fault condition exists, but not necessarily on the A21 assembly].

8. Decrement the Synthesizer/Level Generator to -10dBm and if necessary adjust A21R31 to give a count difference of 10,000 ± 10 counts on the reading in step 7. (Steps 7 and 8 are interactive).

9. Reset the Synthesizer/Level Generator to 0dBm, re-check the A/D count. Press the 38Hz FILTER key, then MEAS. Press TR,2, 3 and check check the reading is 21000 ± 500 counts.

10. Press AVE, 0 and MEAS on the SLMS.

11. Press TR,2,3 and note the A/D count reading.

12. Decrement the Synthesizer/Level Generator to -30dBm and check the count difference between step 11

and 12 is 300 ± 2 counts, if necessary adjust A21R33 to achieve this.

13. Press AVE, 1 and MEAS.

14. Press TR, 2 and 3.

15. Check that the A/D count is 2100 ± 40 counts when the Synthesizer/Level Generator is at 0dBm.

16. Press AVE, 2 and MEAS.

17. Tune the Synthesizer/Level Generator to 32MHz and adjust the output level to give 0dBm ± 0.001dB on the Power Meter.

18. Re-tune the SLMS to 32MHz. (Press keys FREQ, 32,000 and MEAS).

19. Check the LEVEL is 0dBm ±0.1dBm and, if necessary, adjust A2C21 to achieve this.

20. Tune the Sunthesizer/Level Generator to 15MHz and adjust the output level to give 0dBm ± 0.001dB on the Power Meter.

21. Re-tune the SLMS to 15MHz. [Press SLMS keys FREQ, 15,000 and MEAS].

22. Check the SLMS LEVEL reading is 0dBm ± 0.1dB, and if necessary adjust A2R27 to achieve this.

23. The adjustments in steps 17 through 22 are interactive, and should be repeated as required.

5-28 INPUT SIGNAL MULTIPLEXER - 150/124/135 ohm BALANCED INPUT

REFERENCE

Assembly Service Sheet A1

NOTE: The 0dB Level Adjustment should be checked prior to doing this adjustment (see Paragraph 5-27).

DESCRIPTION

This adjustment sets the 0dBm level of the 150 ohm (or 135/124 ohm) BALANCED INPUTS.

EQUIPMENT

Synthesizer/Level Generator..HP 3335A

PROCEDURE

1. Press the following keys on the SLMS; 75 ohm, 3.1kHz, AVE 2, FREQ, 1000(kHz), and MEAS.
2. Tune the Synthesized/Level Generator to 1MHz and set the output level to 0dBm.
3. Connect the Synthesizer/Level Generator output to the SLMS 75 ohm INPUT.
4. Press the SLMS TR, REF, dB/dBm and MEAS keys in that order to reference the SLMS to 0dB.

5. Press the SLMS 150 ohm TERMINATION key (124/135 ohm TERMINATION key where applicable).

6. Disconnect the Synthesizer output from the SLMS 75 ohm INPUT and connect it to one port of the BALANCED INPUT.

7. Press the SLMS MEAS key.

8. The SLMS LEVEL reading should indicate 3.01dB ± 0.3dB. (3.02dB ± 0.3dB and ± 0.3dB respectively for 135 ohm and 124 ohm BALANCED INPUT).

9. If necessary adjust A1R27 to achieve this.

   For 124 ohm BALANCED INPUT OPT 005 ONLY.

10. Repeat the procedure with the SLMS and Synthesized/Level Generator tuned to 12MHz and if necessary adjust A1R27 to give the best compromise reading between the two frequencies.

5-29 INPUT SIGNAL MULTIPLEXER - 600 OHM BALANCED INPUT

REFERENCE

Assembly Service Sheet A1

NOTE: The 0dB LEVEL Adjustment should be checked prior to doing this adjustment (see Paragraph 5-27).

DESCRIPTION

This adjustment sets the 0dBm level of the 600 ohm BALANCED INPUT.

EQUIPMENT

Test Oscillator.. HP 654B

PROCEDURE

1. Press the following keys on the SLMS; 600 ohm, 3.1kHz, AVE and 1, FREQ and 10(kHz) and MEAS.

2. Tune the Test Oscillator to 10kHz and set the level to 0dBm.

3. Connect the 600 ohm OUTPUT of the Test Oscillator to the 600 ohm INPUT of the SLMS.

4. To tune the SLMS precisely to the Test Oscillator frequency by press- ing keys TR, COUNTER and MEAS.

5. Check the SLMS LEVEL reading is 0dBm ± 1dB if necessary adjust A1R48.

6. Repeat the measurement at 5kHz, 50kHz and 100kHz to check if A1R48 requires adjusting.

5-30 GROUP FILTER - OPTION 011

REFERENCE

Assembly Service Sheet A11

NOTE: The A/D Converter Adjustment, Paragraph 5-25, should be carried out prior to adjusting this assembly.

DESCRIPTION

The inductor A11L1 tunes the Input Amplifier to the Group (48kHz FILTER) intermediate frequency. Variable resistor A11R43 determines the absolute measurement value, while A11R46 determines the number of counts per dB. Capacitors A11C8 and A11C9 are adjusted to make minor compensations to the 48kHz Crystal Filter.

EQUIPMENT

Synthesizer/Level Generator....................HP 3335A
Oscilloscope....................HP 1740A

PROCEDURE

1. Mount Assembly A11 on an appropriate extender board.
2. Press the SLMS 48kHz FILTER key and tune to a frequency of 0kHz by pressing FREQ, 0 and MEAS).
3. Connect an Oscilloscope to A11TP5 and adjust A11L1 for maximum signal.
4. Disconnect the input at A11J1.
5. Connect the Oscilloscope to A11TP2 and adjust A11R11 for minimum signal.
6. Tune the SLMS to 1MHz (Press FREQ, 1000, and MEAS keys). Press the 3.1kHz FILTER, AVE, 1 and then MEAS keys. Press the 48kHz FILTER key then MEAS. This operation is carried out to force a CAL sequence - which normally occurs each time the instrument FILTER setting is changed. AVE 1 ensures the correct AVEraging setting for this test. If the instrument goes into the HALT mode with E97 displayed press MEAS.
7. Set the Synthesizer/Level Generator to 1MHz with a level of -25dBm. Set the Amplitude Increment step to 5dB.
8. Connect the Synthesizer/Level Generator output to the SLMS 75 ohm INPUT.
9. Press TR, 23.
10. Adjust A11R43 to obtain a count of 000750 ± 10 Counts.
11. Decrement the Synthesizer/Level Generator amplitude to -50dB.
12. Adjust A11R46 to give a count 003250 greater than the reading obtained in step 10 ± 2 counts.

13. Reset the Synthesizer/Level Generator to -25dBm and repeat steps 10 through 13 until there is no further interaction.

14. Reconnect A11J1 to A5J2.

15. Connect the SLMS (rear panel) 10MHz OUTPUT to the 75 ohm INPUT (front panel).

16. Tune the SLMS to 10MHz (press FREQ, 10000(kHz) and then MEAS).

17. Press TR, REF, dB/dBm and MEAS to transfer the 10MHz level into memory and give a 0dB reference level on the SLMS.

18. Tune the SLMS to 10025kHz (Press FREQ, 10025 (kHz), MEAS) and adjust A11C8 to give a maximum LEVEL reading on the SLMS (Note -3dB is greater than -4dB).

19. Tune the SLMS to 9975kHz and adjust A11C9 to give maximum LEVEL reading on the SLMS.

5-31 DEMODULATOR MIXER BALANCE

REFERENCE

Assembly Service Sheet A21

DESCRIPTION

Mixer carrier balance is set up by A21R65 when there is no input signal and with the SLMS in diagnostic mode d20. A21R65 is adjusted to minimise the noise of the mixer signal input.

EQUIPMENT

Oscilloscope..HP 1740A

PROCEDURE

1. Mount Assembly A21 on an extender board.
2. Disconnect any signal present at the SLMS INPUT.
3. Press the SLMS keys; 3.1kHz, MEAS, TR, 2 and 0.
4. Press the ↓ key to set the IF GAIN to 0 (indicated by 00 on the SLMS LEVEL display).
5. Connect the Oscilloscope to A21TP6.
6. Adjust A21R65 to minimise the Local Oscillator breakthrough.

5-32 CALIBRATOR WAVEFORM SYMMETRY

REFERENCE

Assembly Service Sheet A4

NOTE: If any adjustment is made to A4L6 it will be necessary to carry out the 0dB LEVEL adjustment Paragraph 5-27.

DESCRIPTION

This adjustment is normally only made after a repair to the A4 Assembly. A4L6 is adjusted to give the best symmetrical waveform of the calibrator output at A4TP11.

EQUIPMENT

Oscilloscope..HP 1740A

PROCEDURE

1. Mount Assembly A4 on an extender board.
2. Press the following SLMS keys TR, 2, 4 to set the CAL signal permanently on (CAL ON displayed in FREQ/FDM window).
3. Connect the oscilloscope to A4TP11.
4. If necessary adjust A4L6 to obtain a symmetrical waveform.

5-33 IF GAIN

REFERENCE

Assembly Service Sheet A10

NOTE: If any adjustment is made to A10R26 check the 0dBm LEVEL adjustment Paragraph 5-27. This is because the IF GAIN adjustment has an effect on the A/D Converter output.

DESCRIPTION

This adjustment sets the signal level at the output of the 2nd MIXER Assembly A10.

EQUIPMENT

Oscilloscope..HP 1740A

PROCEDURE

1. Select the 3.1kHz FILTER.
2. Press keys TR, 2, 9 to set the CAL signal ON.
3. Connect an oscilloscope to A10TP4.
4. If necessary adjust A10R26 to obtain 2Vp-p ± 0.2V.

5-34 CONTROLLER SERVICES

REFERENCE

Assembly Service Sheet A65

DESCRIPTION

This adjustment sets the frequency of the real time clock.

TEST EQUIPMENT

Electronic Counter...HP 5328A

PROCEDURE

1. Monitor the frequency at A65TP1 and if necessary adjust A65C1 to obtain a reading of 32,768Hz ± 1Hz.

5-35 CHART RECORDER DRIVE (SPECIAL OPTION H27)

REFERENCE

Assembly Service Sheet A21

DESCRIPTION

This adjustment utilises a built-in test mode to give a defined voltage to set up the Chart Recorder Output. A21R46 adjusts the output when the Test Link is set for voltage drive, A21R50 adjusts the output when the Test Link is set for current drive.

EQUIPMENT

Digital Voltmeter DVM...HP 3403C

PROCEDURE

1. Mount Assembly A21 on an extender board, and set A21TL1 to "V".
2. Press SLMS keys TR, 2, 5.
3. The FREQ/FDM display should indicate "chart = 08".
4. Press the ↑ key, and check the display now changes to "chart = 80".
5. Connect the DVM to A21TP8. The voltage on the DVM should be 0V ± 0.01V.
6. Press the ↑ and check the FREQ/FDM display now changes to "chart = F8".
7. The DVM should now read 3V ± 0.01V, if necessary adjust A21R46.
8. Press the ↓ twice, (until the FREQ/FDM display indicates "chart = 08").

9. Check the DVM reads -3V ± 0.01V.

10. Set A21TL1 to "1".

11. Connect a 1K 1% resistor across the DVM leads.

12. Check the DVM now reads 0V ± 0.01V.

13. Press the ↑ key to change the FREQ/DVM display to "chart = 80".

14. Check the DVM reads +2.5V ± 0.01V, adjust A21R50 if necessary.

15. Press the ↑ key to change the FREQ/FDM display to "chart = F8" and check the display now indicates 5V ± 0.01V.

16. Ensure the Test Link A21TL1 is set to its original setting.

5-36 INPUT MIXER ASSEMBLY - Input Filter

REFERENCE

Assembly Service Sheet A5

DESCRIPTION

The Input Filter is adjusted using a Network Analyzer and an Active Probe.

EQUIPMENT

Power Splitter	HP 11652-60009
Network Analyzer	HP 8421A/8407A
Generator Sweeper	HP 8601A
Probe	HP 1124A

PROCEDURE

1. Set the Network Analyzer Controls as in Paragraph 5-24 step 3 except FREQ 100MHz, OUTPUT LEVEL +10dBm.

2. Connect the test equipment as shown in Figure 5-3.

3. Adjust the Generator/Sweeper FREQ control as required when carrying out steps 4 through 6.

4. Check the response has notches at the following frequencies, and if necessary adjust the relevant inductor.

   98MHz (adjust L1)
   57MHz (adjust L2)
   50MHz (adjust L3)

5. Adjust the Network Analyzer controls to expand the trace about 37MHz, if necessary adjust A5L1 to give the best roll-off.

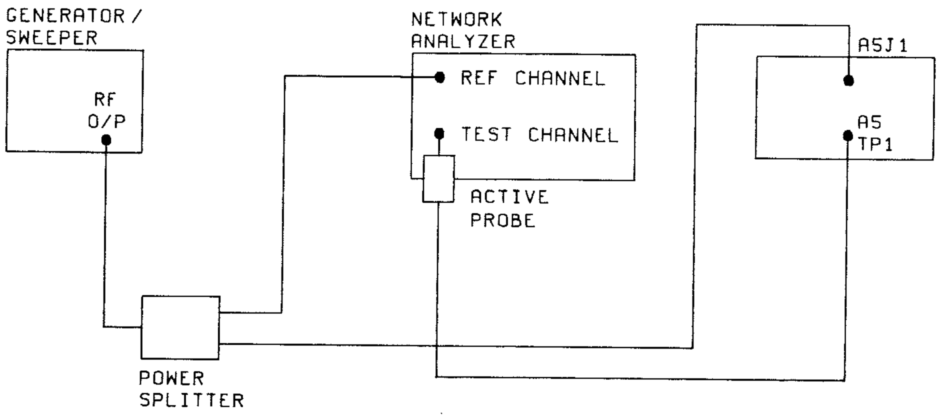


Figure 5-3 A5 Input Filter Adjustment Test Set-up

6. The rejection above 50MHz should be in excess of -55dB.

5-37 INPUT MIXER ASSEMBLY - Bandpass Filter

REFERENCE

Assembly Service Sheet A5

DESCRIPTION

The parallel circuit formed by A5L4 and A5C12 is adjusted to give maximum signal rejection at 50MHz. The series arm of the filter in conjunction with the input circuit of the 8dB Amplifier is adjusted to give the best return loss up to 100MHz.

EQUIPMENT

Network Analyzer	HP 8421A/8407A
Generator Sweeper	HP 8601A
Power Splitter	HP 11652-60009
Directional Bridge	HP 8721A

PROCEDURE

1. Connect the test equipment up as outlined in the Return Loss Adjustment Paragraph 5-24 step 3 and set the 8601A Frequency to 100MHz.

2. Mount Assembly A5 on an extender board.

3. Remove A5TL1 and A5TL2.
4. Connect the Directional Bridge LOAD output to A5TP2.
5. Adjust A5L4 to give a peak at 50MHz.
6. Re-connect A5TL2 and adjust A5C13 and A5C14 for best return loss at 50MHz.
7. Replace A5TL1.

5-38 INPUT MIXER ASSEMBLY - Mixer Balance

REFERENCE

Assembly Service Sheet A5

DESCRIPTION

The mixer balance is adjusted by checking the instrument noise floor at 0kHz.

PROCEDURE

1. Tune the SLMS to 0kHz (Press FREQ, 0 and MEAS).
2. Adjust A5C8 and A5C11 for the best noise floor.
3. Tune the SLMS to 50kHz (Press FREQ, 50, and MEAS) and check the noise floor is <-121dB. If necessary adjust A5C8 and A5C11.

5-39 1ST IF, TUNED AMPLIFIERS, AND CRYSTAL FILTER

REFERENCE

Assembly Service Sheets A5 and A10 and A40.

DESCRIPTION

The SLMS is tuned to 0MHz to set the 1ST LO frequency to 50.01625MHz, A5L7, A5L12, A10L2 and A10L7 are adjusted for minimum signal. The crystal filters are set-up using a 13MHz Network Analyzer system. To accommodate the frequency range the Network Analyzer output is connected to A5J1 where it is mixed with the 1ST LO to produce 60.06125MHz - 10.05MHz at the output of the 1ST MIXER. An auxiliary Synthesizer output (normally connected to the Tracking Generator - OPT 012), is connected to the 2ND MIXER (Assembly A10) as the 2ND LO. The frequency of the 2ND LO is now the same as the first LO providing a 2ND MIXER output at 10.05MHz.

EQUIPMENT

Network Analyzer System	HP 3040A
Oscilloscope	HP 1201B OPT 006

PROCEDURE

1. Set A40TL3 to the TEST position (next to the crystal). (This terminates the 50MHz LO signal at A40 and minimises the possibility of pick-up at the A10 Assembly.)

2. Mount Assembly A5 on an extender board and tune the SLMS to 0.000kHz (Press FREQ, 0, MEAS).

3. Connect an Oscilloscope via a 1:1 probe to A5TP3 and adjust A5L7 for minimum signal, then connect the Oscilloscope to A5TP5 and adjust A5L12 for a minimum signal.

4. Replace Assembly A5 and mount Assembly A10 on an extender board (with the SLMS still tuned to 0.000kHz).

5. Connect an Oscilloscope via a 1:1 probe to A10TP1 and adjust A10L2 for minimum signal level, then connect the Oscilloscope to A10TP2 and adjust A10L7 for minimum signal.

6. Remove A10TL1, A10TL2. Set A10TL4 to Test. Link A10TP9 and A10TP10. Connect A51J2 to A10TP8.

7. Mount Assembly A5 on an extender board.

8. Tune the SLMS to 10.05MHz. (Press FREQ, 10,050.000(kHz) and MEAS).

9. Set the Network Analyzer controls as follows:

FREQ	10.05MHz
FREQ STEP	100Hz
N0. OF STEPS	1000
SWEEP	UP/FREQ
AMPLITUDE	-15dBm
TIME/STEP	3mS
BANDWIDTH	3kHz
MAX VOLT	1V

10. Adjust the Oscilloscope to measure the equivalent of 10dB/div.

11. Connect the Network Analyzer output to A5J1 and the input to A10TP11.

12. Sweep the Network Analyzer.

13. Check for a symmetrical flat response with a notch 40dB down at 10.08MHz. If necessary adjust A5C27/R19 to improve the response, and A5C26 to adjust the notch frequency.

14. Alter the Network Analyzer FREQ STEP to 10Hz, and check the response (across a 4kHz bandwidth) remains symmetrical, making small adjustments to A5C27/R19 as required.

15. Alter the Network Analyzer FREQ STEP to 3Hz and check the flatness (across a 34kHz bandwidth) is better than 0.1dB. If necessary adjust A5C25 for the flattest response.

16. The adjustments in steps 13 through 15 are interactive and should be repeated in cases where adjustments have been made.

17. Replace A10TL2, and set A10TL3 and A10TL4 to the Normal (N) position.

18. Set the Network Analyzer FREQ STEP to 100Hz and check the response. If necessary adjust A10C10 to set the notch frequency 70dB down at 10.08MHz, and A10R7/C11 to ensure a symmetrical flat response.

19. Set the Network Analyzer FREQ STEP to 10Hz and check for a symmetrical flat response (across a 10kHz bandwidth) if necessary adjust A10R7/C11.

20. Set the Network Analyzer FREQ STEP to 3Hz and check the flatness (across a 3kHz bandwidth) is better than 0.1dB. If necessary adjust A10C9 for the flattest response.

21. The adjustments in steps 18 through 20 are interactive and should be repeated when adjustments have been made.

22. Remove the connection from A51J2 (when A54 assembly is fitted reconnect A51J2 to A54J3).

23. Reset A40TL1 to Normal (N) and replace A10TL1.

5-40 15,625Hz LOW PASS FILTER

REFERENCE

Assembly Service Sheet A21

DESCRIPTION

This adjustment sets the response of the LOW PASS FILTER at the input of the A21 Assembly.

EQUIPMENT

Network Analyzer System	HP 3040A
Oscilloscope	HP 1201B OPT 006

PROCEDURE

1. Remove the A20 Assembly, and mount Assembly A21 on an extender board.

2. Set the Network Analyzer controls as follows:

FREQ	15625Hz
STEP	5Hz
NO. OF STEPS	1000
SWEEP	UP
TIME STEP	3
AMPLITUDE	-10dBm
BANDWIDTH	100Hz
Abs/REL	ABs
MAX INPUT	1V

3. Connect the Network Analyzer Output to A21TP1 and the INPUT to A21TP2.

4. Check the reading on the Network Analyzer is -13.5dB ± 1dB.

5. Set the Oscilloscope (which is connected as part of the Network Analyzer system) to measure 0.1dB per

division.

6. Make a continuous swept measurement and check for a symmetrical flat response with a level variation of <0.05dB. If necessary adjust A21R3 to achieve this.

5-41 3.1kHz CHANNEL FILTER

REFERENCE

Assembly Service Sheet A20

DESCRIPTION

This adjustment defines the response of the 3.1kHz Channel Filter in Assembly A20.

EQUIPMENT

Network Analyzer System	HP 3040A
Oscilloscope	HP 1201B OPT 006

PROCEDURE

1. Remove Assembly A10, and mount Assembly A20 on an extender card.

2. Set the Network Analyzer controls as follows:

FREQ	15626Hz
STEP	5Hz
NO. OF STEPS	1000
SWEEP	UP
BANDWIDTH	100Hz
TIME/STEP	3mS
AMPLITUDE	-20dBm

3. Connect the Network Analyzer Output to A20TP1 ground at TP2 and the input to A20TP5 ground TP14.

4. Press the SLMS 3.1kHz FILTER key, then MEAS.

5. Check the overall filter response has a bandwidth of 3.1kHz ± 0.3kHz adjusting A20L1 and A20L2 sharpens the band-edges of the response. A20L8 affects the height of the peaks.

6. Check the ripple over 2.9kHz is less than 0.3dB, if necessary adjust A20L11, A20L1 and A20L2.

7. If after carrying out steps 5 and 6 the filter response is still incorrect carry out steps 8 and 9.

8. Tune the Network Analyzer to the spot frequencies listed below and adjust the appropriate inductor for minimum signal.

Frequency	Adjust Inductor
18854.2	L3
13851.8	L4

17451.6	L5
13767.0	L6
17759.0	L7
13580	L8
17878.7	L9
12820.5	L10
23715.7	L11
10188.3	L12

9. Repeat steps 5 and 6.

5-42 38Hz PILOT FILTER

REFERENCE

Assembly Service Sheet A20

DESCRIPTION

This adjustment defines the response of the 38Hz Pilot Filter on Assembly A20.

TEST EQUIPMENT

Network Analyzer System............HP 3040A
Oscilloscope............HP 1201B OPT 006

PROCEDURE

1. Mount Assembly A20 on an extender board.
2. Set the NETWORK ANALYZER CONTROLS as follows:

FREQ............919.1Hz
STEP............0.5Hz
NO. OF STEPS............100
AMPLITUDE............-20dBm
BANDWIDTH............100Hz
TIME/STEP............300ms

3. Connect the Network Analyzer OUTPUT to A20TP7 and the INPUT to A20TP12 (GND pin 13).
4. Press the SLMS 38Hz FILTER key, then MEAS.
5. Sweep the Network Analyzer system.
6. Check the FILTER response is flat and symmetrical about 919.1MHz.
7. Alter the Network Analyzer controls as follows:

STEP............3Hz
NO. OF STEPS............10

8. Sweep the Network Analyzer and check the ripple response is <0.1dB.

9. Manually step the Network Analyzer and check the -3dB band points occur between 18 and 19Hz from the centre.

10. If the filter response is incorrect proceed with steps 11 through 20.

11. Set A20TL4, A20TL5, A20TL6 and A20TL7 to TEST. Remove A20TL3 and A20TL8.

12. Change the Network Analyzer FREQ to 918.9Hz and the Amplitude to -40dB.

13. Connect the Network Analyzer Output to A20TP10 and the Input to A20TL7. Adjust A20R67 for maximum signal.

14. Reset A20TL7 to NORMAL.

15. Connect the Network Analyzer Output and Input to A20TP10 (make one connection at A20TL6). Adjust A20R57 for maximum signal.

16. Reset A20TL6 to Normal.

17. Connect the Network Analyzer output and input to A20TP9 (make one connection to A20TL5). Adjust A20R48 for maximum signal.

18. Connect the Network Analyzer Output to A20TP7 and Input to A20TL4. Adjust A20R39 for maximum signal.

19. Reset A20TL4 and A20TL5 to NORMAL. Replace A20TL3 and A20TL8.

20. Repeat Steps 2 through 9.

5-43 TRACKING GENERATOR (OPTION 012 INSTRUMENTS ONLY)

DESCRIPTION

The Tracking Generator is checked for correct start up when the SLMS is switched on. The level is adjusted at 1MHz and spurious signals at the output checked on a suitable spectrum analyzer.

EQUIPMENT

Spectrum Analyzer..HP140T/8552B/8553B

1. Tune the SLMS to 1000kHz (Press 1000, MEAS).

2. Switch the SLMS POWER switch to STBY and mount the A54 assembly on a suitable extender card.

3. Switch the SLMS POWER switch to ON and press MEAS.

4. Connect an oscilloscope to A54TP2 to check the circuit is oscillating and the period of the waveform is approximately 20ns. The correct setting of the core is usually 1 half -1 turn inwards from being flush with the former. If this is the case proceed to step 8.

5. If there is no oscillation adjust the coil by a single turn.

6. Switch the instrument to STBY for a few seconds and then to ON and check for an oscillation. This is necessary to start-up the oscillator.

7. Repeat steps 5 and 6.

8. Disconnect the oscilloscope.

9. Connect the TRACKING OUTPUT to the SLMS 75ohms INPUT.

10. Press MEAS and if necessary adjust A54R46 to set the LEVEL reading to -10dBm ± 0.1dB.

11. Switch the SLMS to STBY, re-insert A54, and screw down.

12. Connect a Spectrum Analyzer to the TRACKING OUTPUT and set the SLMS POWER switch to ON.

13. Set the SLMS controls as follows:

    START FREQ........................1MHz
    STOP FREQ........................32MHz
    STEP FREQ........................0.5MHz

14. Press SPECTRUM, MEAS and check the harmonics and spurious signals are -40dB below the main output. (Check the harmonics up to 250MHz; halt the SLMS at selected points and check for spurious signals to within 100kHz fo the signal).

15. Tune the SLMS to 25007.812kHz and check there are no spurious signals within 15kHz of the signal, also check at 50MHz and 100MHz.

16. If necessary re-move A54 and adjust A54R31 to minimise harmonics and spurious signals.

5-44 CHANNEL IMPAIRMENTS (OPTION 015/016 INSTRUMENTS ONLY)

REFERENCE

Assembly Service Sheet A23.

The adjustments on this assembly fall into four distinct categories:

(a) SET the RMS to DC LOG CONVERTER
(b) IMPULSE COUNT
(c) PHASE JITTER para (d) NOTCH FILTER - This adjustment requires the use of a network analyzer. The filter setting can however be verified without the use of a network analyzer by referring to performance test paragraph 4-42.

5-45 SET RMS TO DC LOG CONVERTER

DESCRIPTION

This adjustment sets the slope and linearity of the RMS to DC Log Converter on the A23 Assembly.

EQUIPMENT

Synthesizer/Level Generator..HP 3335A

NOTE: Prior to carrying out the following adjustment procedure the following points should be checked.

(a) Ensure the following adjustments have been carried out:

A/D Converter	Paragraph 5-25
Broadband Power Detector	Paragraph 5-26
IF Gain	Paragraph 5-33
0dB Level	Paragraph 5-27

(b) Check the processor is set to the correct option by pressing TR, 7, 0. The SLMS should display the options fitted, and either 15 or 16 should be present in the LEVEL window. If necessary set A60 S2-5 to ON to set OPT 015 or set A60 S2-6 to ON to set OPT 016.

PROCEDURE

1. Remove any signal connections made to the SLMS during previous tests, and set all the SLMS front panel slide switches to their leftmost position.

2. Tune the SLMS to 1000kHz (Press FREQ, 1000, MEAS).

3. Set the Synthesizer output level to -25dBm and the Frequency to 1000kHz.

4. Connect the Synthesizer to the SLMS 75ohm input.

5. Press 75ohm, 3.1kHz, AVE 2 and MEAS. The SLMS should now display the Synthesizer output level of -25dBm with a resolution of two decimal places.

6. Press TR, 2, 2 followed by the | key to set the A,d, I.P. = 6. This connects the WTD FILTER LOG output to the A/D Converter input.

7. Press TR, 2, 3 to display the A/D output reading. This should be 007500 ± 100 counts. If necessary adjust A23R142 to achieve this.

8. Change the synthesizer level by -30dB to -55dBm.

9. The displayed reading should increase by 30 000 counts ± 100 (to give an actual reading of 037500 ± 1000. If necessary adjust A23 R150 to achieve this.

10. Change the Synthesizer level to -25dBm.

11. Repeat steps 7 through 10 to minimise any interaction between the two adjustments.

5-46 IMPULSE COUNT

DESCRIPTION

The counting rate is adjusted at -81dBm with a threshold limit set at -80dBm.

EQUIPMENT

Synthesizer/Level Generator..HP 3335A

NOTE: To find out if OPT 015 to OPT 016 is fitted press TR, 7, 0. The number 15 or 16 should appear in the LEVEL window either of these options is fitted.

PROCEDURE

1. Connect the synthesizer output to the SLMS 75ohm INPUT.
2. Tune the Synthesizer to 10,000MHz with the output level set to -80dBm.
3. Press the SLMS 3.1kHz filter key and enter a FREQ of 10,000.000kHz.
4. Press the SLMS MEAS key and check the LEVEL reads -80dBm ± 1dB.
5. Press TR, REF, dB/dBm then MEAS. The SLMS should now read a LEVEL of 00.0dB.
6. Press IMP NOISE, then TIME.
7. Press keys., and 1 to enter a time of 10 seconds.
8. Press the THRESH key and enter a level of -1.00dB - do not press the dB/dBm key.
9. Press MEAS.
10. The SLMS TIME display should increment and halt after 10 seconds with the right hand of the FDM/FREQ display reading:

    80 ± 1 count for OPT 015 instruments - 70 ± 1 count for OPT 016 instruments

    If the reading is incorrect adjust A23R132 anti-clockwise to increase the reading, clockwise to reduce the reading, and press MEAS to repeat the count sequence. Repeat the adjustment as necessary.

5-47 PHASE JITTER

DESCRIPTION

The SLMS is tuned to 10,000.85MHz with a 10MHz signal connected to the SLMS INPUT. This gives an audio tone of 1000Hz at the A23 assembly. The frequency lock range is set by varying the SLMS tuning point in 50Hz steps above and below the initial tuning point and adjusting A23R23 to give a phase-lock.

Two signals, within the measurement bandwidth, having different voltage amplitudes are mixed to produce a waveform with a known amount of phase jitter. The amount of phase jitter is directly proportional to the voltage ratio of the two signals.

$$\text{PK-PK } \phi \text{ JITTER} = 2.\sin^{-1}(V_2/V_1)$$

$$= 2.\sin^{-1}(10^{(x-y)/20})$$

Where x-y is the power level difference between the two signals in dB (measured at the output of the mixer).

EQUIPMENT

Synthesizer/Level Generator..HP 3335A
Hybrid..HP 15537A
75ohm Termination...HP 15522A

PROCEDURE

1. Connect the SLMS 10MHz REF OUTPUT (rear panel) to the 75ohm INPUT. Set the MEASUREMENT switch to SINGLE.

2. Tune the SLMS to 10,000850kHz, (Press FREQ and enter 10,000.85) with the 3.1kHz FILTER selected.

3. Enter a step size of 0.050Hz.

4. Press MEAS and check the SLMS LEVEL reads either -30dBm ± 2dB or +6dBm ± 2dB.

5. Connect an oscilloscope to A23TP4 and check the voltage is +4V ± 0.1V, if necessary adjust A23R23 to achieve this, and check the INVALID TONE LED (DSI) is OFF.

6. Press the ↑↓ keys to shift the SLMS frequency by 50Hz above and below 10,000.850kHz and check the INVALID TONE LED DSI remains OFF, if necessary make a slight adjustment to A23R23. Press the ↑↓ keys to shift the SLMS frequency by 100Hz above and below 10,000.850kHz and check the INVALID TONE LED comes ON.

7. Press the ϕ JITTER key once to select a 4 to 300Hz bandwidth indicated by the last digit on the level display as shown.

20-300Hz	4-300Hz	4-20Hz

ϕ JITTER key pressed once	ϕ JITTER key pressed twice	ϕ JITTER key pressed three times

8. Press MEAS. After a delay of approximately 12 seconds the LEVEL display should indicate a Phase Jitter measurement of <0.5 degrees.

NOTE: This is nominal delay when new measurements or measuremnt update are made.

9. Press FREQ.

Phase Jitter Measurement Accuracy

10. Press MEAS and check the LEVEL of the 10MHz SIGNAL. If the LEVEL reading is +6dBm ± 2dB miss out the next step, if the reading is -30dBm ± 2dB carry out the next step.

11. Set the SLMS POWER Switch to STBY. Remove Assembly A40 and move TL1 to the 50ohms position (see Assembly service sheet A40 - the 50ohms position is adjacent to the 75ohms position at the top left hand

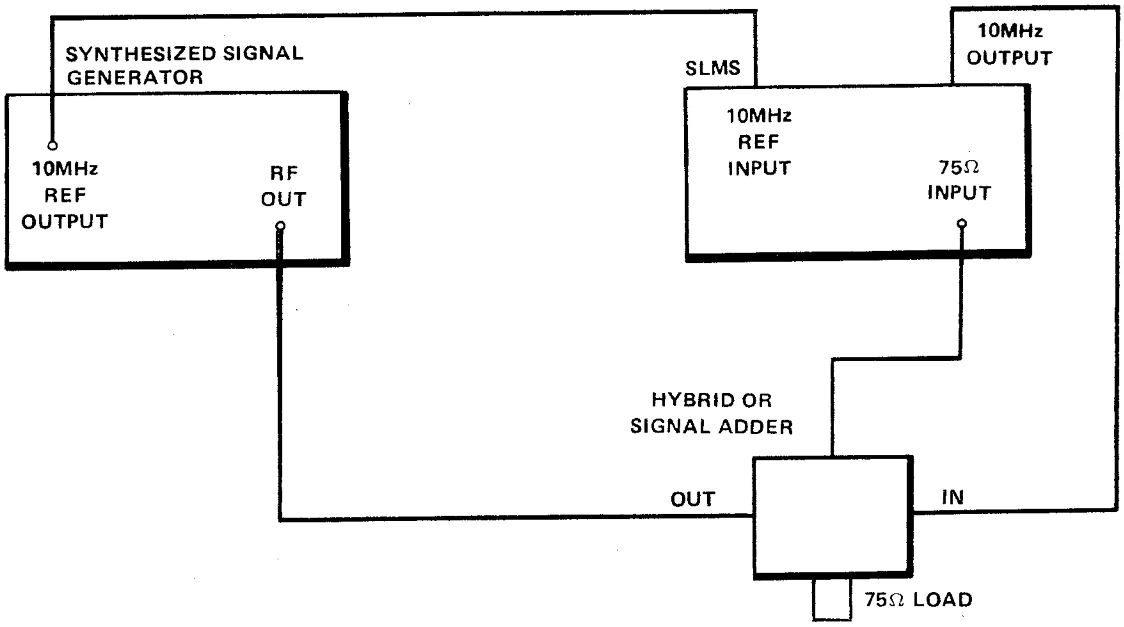


Figure 5-4 Phase Jitter Test

side of the assembly). Re-insert A40 and set the SLMS POWER switch to ON. After the switch-on-sequence is over press MEAS and verify the 10MHz LEVEL now reads +6dBm ± 2dB.

12. Connect the equipment as shown in figure 5-4.

13. Disconnect the cable from the Synthesizer to the Hybrid.

14. The SLMS now reads the 10MHz reference at the output of the Hybrid.

15. Transfer this reading into the SLMS REFERENCE register by pressing TR, REF, dB/dBm then MEAS. The SLMS should now read 00.0dB ± 0.1dB.

16. Re-connect the cable from the Synthesizer to the Hybrid and disconnect the 10MHz REF signal at the Hybrid.

17. Set the Synthesizer frequency to 10,000.012 and adjust the output level to give a reading of -21.2dB on the SLM LEVEL display.

18. Re-connect the 10MHz output to the Hybrid and press ϕ JITT then MEAS.

19. The SLMS should calibrate and after a delay of approximately 12 seconds display a reading of 10 degrees pk-pk. Adjust A23R43 as required (and press MEAS) until the SLMS reads 10 degrees pk-pk ± 0.2 degrees.

20. Press HALT. Wait until the SLMS HALT indicator is ON and the MEAS indicator OFF. Select the 4-20Hz Jitter range as outlined in step 7.

21. Press MEAS and check the reading remains 10 degrees ± 0.2 degrees. If necessary adjust A23R53 and Press MEAS to achieve this.

22. Reset the MEASUREMENT switch to CONT.

5-48 NOTCH FILTER

DESCRIPTION

The notch filter response is adjusted using a Network Analyzer System to have a notched response centred on 1010Hz.

EQUIPMENT

Network Analyzer System....................HP 3040A
Oscilloscope....................HP 181A/1803A/1802C

PROCEDURE

1. Mount the A24 assembly on the extender cards.

2. Press the 3.1kHz FILTER key, NWT, and MEAS keys.

3. Set the Network Analyzer controls as follows:

FREQ	1010
AMP	0dBm
STEP	0.5Hz
No of STEPS	1000
BANDWIDTH	10Hz
TIME/STEP	30
scopes	10dB/div

4. Connect the Network Analyzer input to TP16 and the output to TP1.

5. Sweep the network analyzer and check the overall response is as shown in Figure 5-5.

6. If necessary adjust A23R109 for symmetrical response. Steps 7 through 8 should be carried out if there is a large variation in the response.

7. Connect the Network Analyzer output to TP14 and adjust A23R97 for minimum amplitude at the centre frequency.

8. Connect the Network Analyzer output to TP15 and adjust A23R103 to produce a single notch.

9. Repeat steps 4 through 6.

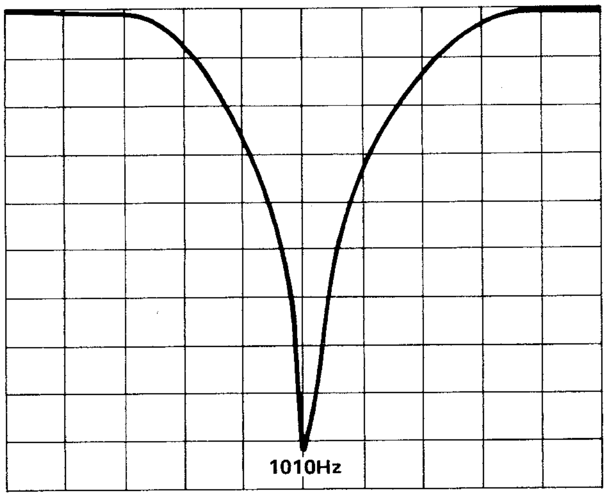


Figure 5-5 Notch Filter Adjustment

SECTION VI
REPLACEABLE PARTS

6-1 INTRODUCTION

6-2 This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designator order and Table 6-3 lists the names and addresses that correspond to the manufacturers code numbers used in the parts list. Figure 6-1 identifies the front panel keys and switches and Figure 6-2 illustrates the chassis mounted and miscellaneous parts.

6-3 ABBREVIATIONS

6-4 Table 6-1 lists all the abbreviations used in the parts list, the schematics and throughout this manual. In some cases, two forms of an abbreviation are given, one all capital letters, the other partial or no capital letters. This occurs because the abbreviations used in the parts list are always all capitals; however in other parts of the manual abbreviations are used with both upper and lower case letters.

6-5 REPLACEABLE PARTS LIST

6-6 Table 6-2 is the list of replaceable parts and is organised as follows:

(a) Electrical assemblies and their components in alpha-numeric order by reference designation.
(b) Chassis-mounted parts in alpha-numeric order by reference designation.
(c) Miscellaneous parts.
(d) Illustrated parts breakdown.

The information given for each part consists of the following:

(a) The Hewlett-Packard part number.
(b) Part number check digit (CD).
(c) The total quantity (QTY) in the instrument.
(d) The description of the part.
(e) A typical manufacturer of the part in a five-digit code.
(f) The manufacturers number for that part.

The total quantity for each part is given only once - at the first appearance of the part in the list.

6-7 ORDERING INFORMATION

6-8 To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number and the check digit, 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.

6-9 To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the decription and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard Office.

6-10 DIRECT MAIL ORDER SYSTEM

6-11 Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are as follows:

(a) Direct ordering and shipment from the HP Parts Centre in Mountain View, California.
(b) No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing).
(c) Prepaid transportation (there is a small handling charge for each order).
(d) No invoices - to provide these advantages, a cheque or money order must accompany each order.

6-12 Mail Order forms and specific ordering information are available through your local HP office. Addresses and phone numbers are located at the back of this manual.

Table 6-1 Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

A ... assembly
AT ... attenuator; isolator; termination
B ... fan; motor
BT ... battery
C ... capacitor
CP ... coupler
CR ... diode; diode thyristor; varactor
DC ... directional coupler
DL ... delay line
DS ... annunciator; signaling device (audible or visual); lamp; LED
E ... miscellaneous electrical part
F ... fuse
FL ... filter
H ... hardware
HY ... circulator
J ... electrical connector (stationary portion); jack
K ... relay
L ... coil; inductor
M ... meter
MP ... miscellaneous mechanical part
P ... electrical connector (movable portion); plug
Q ... transistor: SCR; triode thyristor
R ... resistor
RT ... thermistor
S ... switch
T ... transformer
TB ... terminal board
TC ... thermocouple
TP ... test point
U ... integrated circuit; microcircuit
V ... electron tube
VR ... voltage regulator; breakdown diode
W ... cable; transmission path; wire
X ... socket
Y ... crystal unit (piezo-electric or quartz)
Z ... tuned cavity; tuned circuit

ABBREVIATIONS

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

NOTE

All abbreviations in the parts list will be in upper-case.

Table 6-1 Reference Designations and Abbreviations (continued)

mVp-p . . . millivolt, peak-to-peak
mVrms . . . . millivolt, rms
mW . . . . milliwatt
MUX . . . . multiplex
MY . . . . mylar
μA . . . . microampere
μF . . . . microfarad
μH . . . . microhenry
μmho . . . . micromho
μs . . . . microsecond
μV . . . . microvolt
μVac . . . . . . microvolt, ac
μVdc . . . . . microvolt, dc
μVpk . . . microvolt, peak
μVp-p . . . microvolt, peak-to-peak
μVrms . . . . microvolt, rms
μW . . . . microwatt
nA . . . . nanoampere
NC . . . . . . no connection
N/C . . . . normally closed
NE . . . . neon
NEG . . . . negative
nF . . . . nanofarad
NI PL . . . . . . nickel plate
N/O . . . . . normally open
NOM . . . . nominal
NORM . . . . normal
NPN . . . negative-positive-negative
NPO . . . . negative-positive zero (zero temperature coefficient)
NRFR . . not recommended for field replacement
NSR . . . . . not separately replaceable
ns . . . . nanosecond
nW . . . . nanowatt
OBD . . . order by description
OD . . . . . outside diameter
OH . . . . oval head
OP AMPL . . . operational amplifier
OPT . . . . option
OSC . . . . oscillator
OX . . . . oxide
oz . . . . ounce
Ω . . . . ohm

P . . . . peak (used in parts list)
PAM . . . . pulse-amplitude modulation
PC . . . . . . printed circuit
PCM . . pulse-code modulation; pulse-count modulation
PDM . . . . . pulse-duration modulation
pF . . . . picofarad
PH BRZ phosphor bronze
PHL . . . . Phillips
PIN . . . positive-intrinsic-negative
PIV . . . . peak inverse voltage
pk . . . . peak
PL . . . . phase lock
PLO . . . . phase lock oscillator
PM . . . . phase modulation
PNP . . . positive-negative-positive
P/O . . . . part of
POLY . . . . . . polystyrene
PORC . . . . porcelain
POS . . positive; position(s) (used in parts list)
POSN . . . . position
POT . . . . . potentiometer
p-p . . . . peak-to-peak
PP . . . peak-to-peak (used in parts list)
PPM . . . . . pulse-position modulation
PREAMPL . . . preamplifier
PRF . . . . pulse-repetition frequency
PRR . . . . pulse repetition rate
ps . . . . picosecond
PT . . . . point
PTM . . . . pulse-time modulation
PWM . . . . pulse-width modulation
PWV . . . . . . peak working voltage
RC . . . . resistance-capacitance
RECT . . . . rectifier

REF . . . . reference
REG . . . . regulated
REPL . . . . . . replaceable
RF . . . . . radio frequency
RFI . . . . radio frequency interference
RH . . . . round head; right hand
RLC . . . . resistance-inductance-capacitance
RMO . . . rack mount only
rms . . . . root-mean-square
RND . . . . round
ROM . . read-only memory
R&P . . . . . rack and panel
RWV . . . reverse working voltage
S . . . scattering parameter
s . . . . second (time)
. . ." . second (plane angle)
S-B . . . . . slow-blow (fuse) (used in parts list)
SCR . . . silicon controlled rectifier; screw
SE . . . . selenium
SECT . . . . sections
SEMICON . . . . . semiconductor
SHF . . . . . . superhigh frequency
SI . . . . silicon
SIL . . . . silver
SL . . . . slide
SNR . . signal-to-noise ratio
SPDT . . . . . . single-pole, double-throw
SPG . . . . spring
SR . . . . split ring
SPST . . . . . . single-pole, single-throw
SSB . . . . . single sideband
SST . . . . . . stainless steel
STL . . . . steel
SQ . . . . square
SWR . . standing-wave ratio
SYNC . . . . . . synchronize
T . . timed (slow-blow fuse)
TA . . . . tantalum
TC . . . . temperature compensating
TD . . . . time delay

TERM . . . . terminal
TFT . . thin-film transistor
TGL . . . . toggle
THD . . . . thread
THRU . . . . through
TI . . . . titanium
TOL . . . . tolerance
TRIM . . . . trimmer
TSTR . . . . transistor
TTL . . transistor-transistor logic
TV . . . . television
TVI television interference
TWT . . traveling wave tube
U . . . . . micro (10^{-6}) (used in parts list)
UF . . . microfarad (used in parts list)
UHF . . ultrahigh frequency
UNREG . . . . unregulated
V . . . . volt
VA . . . . voltampere
Vac . . . . volts, ac
VAR . . . . variable
VCO . . . voltage-controlled oscillator
Vdc . . . . volts, dc
VDCW . . volts, dc, working (used in parts list)
V(F) . . . . . . volts, filtered
VFO . . variable-frequency oscillator
VHF . . . . . . very-high frequency
Vpk . . . . volts, peak
Vp-p . . volts, peak-to-peak
Vrms . . . . volts, rms
VSWR . . . voltage standing wave ratio
VTO . . . . . . voltage-tuned oscillator
VTVM . . . . vacuum-tube voltmeter
V(X) . . . . . volts, switched
W . . . . watt
W/ . . . . with
WIV . . . . working inverse voltage
WW . . . . wirewound
W/O . . . . without
YIG . . yttrium-iron-garnet
Z_o . . . . characteristic impedance

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

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

Table 6-2 Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	03746-60001	0	1	INPUT SIGNAL MULTIPLEXER ASSEMBLY	28480	03746-60001
A1C1	0160-0128	3	4	CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A1C2	0160-0128	3		CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A1C3	0160-3486	2	4	CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A1C4	0180-0474	4	16	CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C5	0160-3486	2		CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A1C6	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C7	0160-4491	1	2	CAPACITOR-FXD 8.2PF	28480	0160-4491
A1C8	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C9	0180-2821	9	2	CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A1C10	0180-0552	9	4	CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A1C11	0180-0552	9		CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A1C12	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C13	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C15	0180-0648	4	6	CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A1C16	0160-3879	7	6	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C17	0180-0648	4		CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A1C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C19	0180-0648	4		CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A1C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C21	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C22	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C23	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C24	0160-4493	3	4	CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A1C25	0160-4493	3		CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A1C26	0160-4618	4	2	CAPACITOR-FXD 3.9PF	28480	0160-4618
A1C27	0160-3873	1	2	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER	28480	0160-3873
A1CR1	1901-1098	1	14	DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR2	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR3	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR4	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR5	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR9	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1DS1	1990-0450	4	6	LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A1DS2	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A1DS3	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A1K1	0490-0680	1	6	RELAY 2C 12VDC-COIL 1A 28VDC	28480	0490-0680
A1K2	0490-0680	1		RELAY 2C 12VDC-COIL 1A 28VDC	28480	0490-0680
A1K3	0490-0680	1		RELAY 2C 12VDC-COIL 1A 28VDC	28480	0490-0680
A1L1	9100-1644	3	2	INDUCTOR RF-CH-MLD 330UH 5% .2DX.45LG	28480	9100-1644
A1L2	9140-0210	1	6	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A1L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A1L4	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A1Q1	1853-0271	7	6	TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
A1Q2	1853-0271	7		TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
A1Q3	1853-0271	7		TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
A1Q4	1854-0215	1	6	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A1Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A1Q6	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A1Q7	1853-0036	2	2	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A1R1	0698-3447	4	9	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R2	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R3	0698-3433	8	2	RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A1R4	0698-3433	8		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A1R5	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R6	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R11	0757-0398	4	16	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R12	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R13	0757-0458	7	4	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A1R14	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A1R15	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R16	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R17	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R18	0698-3445	2	2	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A1R19	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R20	0698-3429	2	12	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R21	0698-3439	4	2	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A1R22	0698-0085	0	4	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A1R23	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A1R24	0698-3432	7	4	RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R25	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R26	0757-0397	3	2	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A1R27	2100-0568	1	2	RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	28480	2100-0568
A1R28	0698-3444	1	2	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R29	0757-0422	5	2	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A1R30	0757-0416	7	6	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R31	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R32	0757-0417	8	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A1R33	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R34	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R35	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R36	0698-8525	9	4	RESISTOR 91.67 .1% .125W F TC=0+-50	28480	0698-8525
A1R37	0698-8526	0	2	RESISTOR 371.25 .1% .125W F TC=0+-50	28480	0698-8526
A1R38	0698-8525	9		RESISTOR 91.67 .1% .125W F TC=0+-50	28480	0698-8525
A1R39	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R40	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R41	0757-0280	3	8	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R42	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R43	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R46	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R47	0757-0419	0	2	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A1R48	2100-3383	4	2	RESISTOR-TRMR 50 10% C TOP-ADJ 1-TRN	28480	2100-3383
A1R49	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R50	0757-0200	7	4	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A1R51	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R52	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R53	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A1R54	0757-0346	2	4	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R55	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R56	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R57	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R58	0698-0083	8	6	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R59	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R60	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R61	0698-3154	0	2	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A1U1	1826-0218	5	4	IC OP AMP WB TO-99 PKG	3L585	CA3100T
A1U2	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
				A1 MISCELLANEOUS PARTS		
	1251-0600	0	12	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-2501	4	18	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8	6	WIREFORM BE CU AG	28480	1460-1489

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	03746-60101	1	1	INPUT SIGNAL MULTIPLEXER ASSEMBLY OPTION 005	28480	03746-60101
A1C1	0160-0128	3		CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A1C2	0160-0128	3		CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A1C3	0160-3486	2		CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A1C4	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C5	0160-3486	2		CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A1C6	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C7	0160-4491	1		CAPACITOR-FXD 8.2PF	28480	0160-4491
A1C8	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C9	0180-2821	9		CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A1C10	0180-0552	9		CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A1C11	0180-0552	9		CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A1C12	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C13	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C15	0180-0648	4		CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A1C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C21	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C22	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C23	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A1C24	0160-4493	3		CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A1C25	0160-4493	3		CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A1C26	0160-4618	4		CAPACITOR-FXD 3.9PF	28480	0160-4618
A1C27	0160-3873	1		CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER	28480	0160-3873
A1C76	0180-0648	4		CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A1C97	0180-0648	4		CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A1CR1	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR2	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR3	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR4	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR5	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1CR9	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A1DS1	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A1DS2	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A1DS3	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A1K1	0490-0680	1		RELAY 2C 12VDC-COIL 1A 28VDC	28480	0490-0680
A1K2	0490-0680	1		RELAY 2C 12VDC-COIL 1A 28VDC	28480	0490-0680
A1K3	0490-0680	1		RELAY 2C 12VDC-COIL 1A 28VDC	28480	0490-0680
A1L1	9100-1644	3		INDUCTOR RF-CH-MLD 330UH 5% .2DX.45LG	28480	9100-1644
A1L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A1L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A1L4	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A1Q1	1853-0271	7		TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
A1Q2	1853-0271	7		TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
A1Q3	1853-0271	7		TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
A1Q4	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A1Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A1Q6	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A1Q7	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A1R1	0698-4419	2	2	RESISTOR 210 1% .125W F TC=0+-100	24546	C4-1/8-T0-210R-F
A1R2	0698-4419	2		RESISTOR 210 1% .125W F TC=0+-100	24546	C4-1/8-T0-210R-F
A1R3	0757-0291	6	2	RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A1R4	0757-0291	6		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A1R7	0757-1101	9	2	RESISTOR 360 1% .125W F TC=0+-100	24546	C4-1/8-T0-361-F
A1R8	0757-1101	9		RESISTOR 360 1% .125W F TC=0+-100	24546	C4-1/8-T0-361-F
A1R9	0698-3432	7		RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A1R10	0698-3432	7		RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A1R11	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R12	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R13	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A1R14	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A1R15	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R16	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R17	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R18	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A1R20	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R21	0698-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A1R22	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A1R23	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R24	0698-3432	7		RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A1R25	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R26	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A1R27	2100-0568	1		RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	28480	2100-0568
A1R28	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R29	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A1R30	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R31	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R32	0757-0417	8		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A1R33	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R35	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R36	0698-8525	9		RESISTOR 91.67 .1% .125W F TC=0+-50	28480	0698-8525
A1R37	0698-8526	0		RESISTOR 371.25 .1% .125W F TC=0+-50	28480	0698-8526
A1R38	0698-8525	9		RESISTOR 91.67 .1% .125W F TC=0+-50	28480	0698-8525
A1R39	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R40	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R41	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R42	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R43	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R46	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R47	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A1R48	2100-0568	4		RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	28480	2100-3383
A1R49	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R50	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A1R51	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R52	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R53	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A1R54	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R55	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R56	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A1R57	0698-3429	2		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R58	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R59	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R60	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R61	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A1U1	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
A1U2	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
				A1 MISCELLANEOUS PARTS		
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-2501	4		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	03746-60003			INPUT SIGNAL MULTIPLEXER ASSEMBLY (INSTRUMENTS ABOVE S/N 00411 ONLY)		
A1C001	0160-3879			CAPACITOR-FXD 0.01UF 20% 100V		
A1C002	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C003	0180-2811			CAPACITOR-FXD 10UF 35V TA		
A1C004	0160-4441			CAPACITOR-FXD 0.47UF 10% 50V		
A1C005	0160-4441			CAPACITOR-FXD 0.47UF 10% 50V		
A1C006	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C007	0160-4441			CAPACITOR-FXD 0.47UF 10% 50V		
A1C008	0160-4441			CAPACITOR-FXD 0.47UF 10% 50V		
A1C009	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C010	0160-0196			CAPACITOR-FXD 24PF 5% 300V		
A1C011	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C012	0180-2821			CAPACITOR-FXD 22UF 35V TA		
A1C013	0180-2811			CAPACITOR-FXD 10UF 35V TA		
A1C014	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C015	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C016	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C017	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C018	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C019	0160-3873			CAPACITOR-FXD 4.7PF D 200V		
A1C020	0160-4618			CAPACITOR-FXD 3.9PF 5% 200V		
A1C023	0160-0576			CAPACITOR-FXD 0.1UF 20% 50V		
A1C024	0160-3879			CAPACITOR-FXD 0.01UF 20% 100V		
A1C025	0160-0576			CAPACITOR-FXD 0.1UF 20% 50V		
A1C026	0160-3879			CAPACITOR-FXD 0.01UF 20% 100V		
A1C027	0160-0576			CAPACITOR-FXD 0.1UF 20% 50V		
A1C028	0160-3879			CAPACITOR-FXD 0.01UF 20% 100V		
A1C029	0160-0576			CAPACITOR-FXD 0.1UF 20% 50V		
A1C030	0160-3879			CAPACITOR-FXD 0.01UF 20% 100V		
A1C031	0160-0576			CAPACITOR-FXD 0.1UF 20% 50V		
A1C032	0160-3879			CAPACITOR-FXD 0.01UF 20% 100V		
A1C033	0180-0474			CAPACITOR-FXD 15UF 20V TA		
A1C034	0160-4493			CAPACITOR-FXD 27PF 5% 200V		
A1C035	0160-4493			CAPACITOR-FXD 27PF 5% 200V		
A1C036	0160-4493			CAPACITOR-FXD 27PF 5% 200V		
A1C036	0160-4493			CAPACITOR-FXD 27PF 5% 200V		
A1C037	0160-4491			CAPACITOR-FXD 8.2PF 5% 200V		
A1CR01	1901-0518			DIODE SCHOTTKY -2800		
A1CR02	1901-0518			DIODE SCHOTTKY -2800		
A1CR03	1901-0050			DIODE SWITCHING 200 MA 80V		
A1CR04	1901-0050			DIODE SWITCHING 200 MA 80V		
A1CR05	1901-1098			DIODE SWITCHING 200 MA 50V		
A1CR06	1901-1098			DIODE SWITCHING 200 MA 50V		
A1CR08	1901-1098			DIODE SWITCHING 200 MA 50V		
A1CR09	1901-1098			DIODE SWITCHING 200 MA 50V		
A1CR10	1901-1098			DIODE SWITCHING 200 MA 50V		
A1CR11	1901-1098			DIODE SWITCHING 200 MA 50V		
A1CR12	1901-1098			DIODE SWITCHING 200 MA 50V		
A1CR13	1902-3369			DIODE ZENER 61.9V 5%		
A1CR14	1902-3369			DIODE ZENER 61.9V 5%		
A1CR15	1902-3369			DIODE ZENER 61.9V 5%		
A1CR16	1902-3369			DIODE ZENER 61.9V 5%		
A1K1	0490-0680			RELAY 2C 12V TO5		
A1K2	0490-0680			RELAY 2C 12V TO5		
A1K3	0490-0680			RELAY 2C 12V TO5		
A1K4	0490-0680			RELAY 2C 12V TO5		
A1K5	0490-0680			RELAY 2C 12V TO5		
A1L1	9100-1641			COIL 240 UH 5%		
A1L2	9140-0210			COIL 100 UH 5%		
A1L3	9140-0210			COIL 100 UH 5%		
A1L4	9140-0210			COIL 100 UH 5%		
A1Q001	1855-0081			JFET 2N5245		
A1Q002	1853-0034			TRANSISTOR PNP SI		
A1Q003	1854-0019			TRANSISTOR NPN SI		
A1Q004	1853-0271			TRANSISTOR PNP 2N4403		
A1Q005	1853-0271			TRANSISTOR PNP 2N4403		
A1Q006	1853-0271			TRANSISTOR PNP 2N4403		
A1Q007	1854-0215			TRANSISTOR NPN 2N3904		
A1Q008	1854-0215			TRANSISTOR NPN 2N3904		
A1Q009	1854-0215			TRANSISTOR NPN 2N3904		
A1Q010	1853-0036			TRANSISTOR PNP 2N3906		
A1Q011	1854-0215			TRANSISTOR NPN 2N3904		
A1Q012	1853-0036			TRANSISTOR PNP 2N3906		
A1R001	0698-0082			RESISTOR-FXD 464 1% .125W		
A1R002	0698-8825			RESISTOR-FXD 681K 1% .125W		
A1R003	0698-7284			RESISTOR-FXD 10K 1% .05W		

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R004	0698-7232			RESISTOR-FXD 681 1% .05W		
A1R005	0698-7218			RESISTOR-FXD 178 1% .05W		
A1R006	0698-7239			RESISTOR-FXD 1.33K 1% .05W		
A1R007	0698-7218			RESISTOR-FXD 178 1% .05W		
A1R008	2100-3409			RESISTOR VARIABLE 20 10%		
A1R009	0698-7195			RESISTOR-FXD 19.6 1% .05W		
A1R010	0698-7209			RESISTOR-FXD 75 1% .05W		
A1R012	0757-0284			RESISTOR-FXD 150 1% .125W		
A1R013	0757-0458			RESISTOR-FXD 51.1K 1%		
A1R014	0757-0458			RESISTOR-FXD 51.1K 1%		
A1R015	0698-7195			RESISTOR-FXD 19.6 1% .05W		
A1R016	0698-3439			RESISTOR-FXD 178 1% .125W		
A1R017	0698-7246			RESISTOR-FXD 2.61K 1% .05W		
A1R018	0698-7198			RESISTOR-FXD 26.1 1% .05W		
A1R019	0698-7246			RESISTOR-FXD 2.61K 1% .05W		
A1R020	0698-7209			RESISTOR-FXD 75 1% .05W		
A1R021	0698-7209			RESISTOR-FXD 75 1% .05W		
A1R023	0698-7209			RESISTOR-FXD 75 1% .05W		
A1R024	0698-3445			RESISTOR-FXD 348 1% .125W		
A1R025	0698-3447			RESISTOR-FXD 348 1% .125W		
A1R026	0698-7195			RESISTOR-FXD 19.6 1% .05W		
A1R027	0757-0397			RESISTOR-FXD 68.1 1% .125W		
A1R028	0757-0422			RESISTOR-FXD 909 1% .125W		
A1R029	0757-0416			RESISTOR-FXD 511 1% .125W		
A1R030	0757-0401			RESISTOR-FXD 100 1% .125W		
A1R031	2100-3212			RESISTOR VARIABLE 200 10%		
A1R032	0698-7219			RESISTOR-FXD 196 1% .05W		
A1R033	0757-0727			RESISTOR-FXD 562 1% .25W		
A1R034	0698-7209			RESISTOR-FXD 75 1% .05W		
A1R035	0698-7260			RESISTOR-FXD 10K 1% .05W		
A1R036	0698-4459			RESISTOR-FXD 634 1% .125W		
A1R037	0757-0449			RESISTOR-FXD 20K 1% .125W		
A1R038	0757-0449			RESISTOR-FXD 20K 1% .125W		
A1R039	0757-0442			RESISTOR-FXD 10K 1% .125W		
A1R040	0698-7236			RESISTOR-FXD 1K 1% .05W		
A1R041	0757-0422			RESISTOR-FXD 909 1% .125W		
A1R042	0698-7228			RESISTOR-FXD 464 1% .05W		
A1R043	0757-0442			RESISTOR-FXD 10K 1% .125W		
A1R044	0757-0280			RESISTOR-FXD 1K 1% .125W		
A1R045	0757-0280			RESISTOR-FXD 1K 1% .125W		
A1R046	0698-7260			RESISTOR-FXD 10K 1% .05W		
A1R047	0698-7233			RESISTOR-FXD 750 1% .05W		
A1R048	0698-7260			RESISTOR-FXD 10K 1% .05W		
A1R049	0698-7253			RESISTOR-FXD 5.11K 1% .05W		
A1R050	2100-0567			RESISTOR VARIABLE 2K 10%		
A1R051	0698-7232			RESISTOR-FXD 681 1% .05W		
A1R052	0698-7212			RESISTOR-FXD 100 1% .05W		
A1R053	0698-7195			RESISTOR-FXD 19.6 1% .05W		
A1R054	0698-7209			RESISTOR-FXD 75 1% .05W		
A1R055	0698-7195			RESISTOR-FXD 19.6 1% .05W		
A1R056	0757-0398			RESISTOR-FXD 75 1% .125W		
A1R057	0698-8525			RESISTOR-FXD 91.67 1%		
A1R058	0698-8526			RESISTOR-FXD 371.25 1%		
A1R059	0698-8525			RESISTOR-FXD 91.67 1%		
A1R060	0698-7250			RESISTOR-FXD 3.83K 1% .05W		
A1R061	0698-7195			RESISTOR-FXD 19.6 1% .05W		
A1R065	0698-7212			RESISTOR-FXD 100 1% .05W		
A1R066	0698-7212			RESISTOR-FXD 100 1% .05W		
A1U1	1826-0218			ICL 3100T M08		
A1U2	1826-0218			ICL 3100T M08		
A1U3	1826-0218			ICL 3100T M08		
	0340-0440			INSUL-IC NYLON		
	8159-0005			WIRE 22 WHT		
A1	03746-60103			INPUT SIGNAL MULTIPLEXER ASSY (INSTRUMENTS ABOVE S/N 00411 ONLY)		
PARTS LIST IS THE SAME AS 03746-60003 WITH THE FOLLOWING EXCEPTIONS.						
A1C021*	0160-0576			CAPACITOR-FXD 0.1 UF		
A1C022*	0160-3873			CAPACITOR-FXD 4.7 PF		
A1C023*	0160-0576			CAPACITOR-FXD 0.1 UF		
A1K6*	0490-0680			CAPACITOR-FXD RELAY 2C 12V TO5		
A1R011*	0698-4425			RESISTER-FXD 1.54K		
A1R012*	0698-4410			RESISTOR-FXD 137		
A1R022*	0698-7243			RESISTOR-FXD 1.96K		
A1R062*	0698-7258			RESISTOR-FXD 8.25K		
A1R064*	0757-0428			RESISTOR-FXD 1.62K		
A1Q013*	1854-0477			TRANSISTOR NPN		

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2	03746-60002	1	1	INPUT ATTENUATOR/AMPLIFIER ASSEMBLY	28480	03746-60002
A2C4	0160-3875	3	2	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A2C5	0160-4527	4	2	CAPACITOR-FXD 56PF +-5% 200VDC CER 0+-30	28480	0160-4527
A2C6	0160-4386	3	5	CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A2C7	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A2C8	0180-0552	9	4	CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A2C9	0180-0552	9		CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A2C10	0160-4382	9	1	CAPACITOR-FXD 3.3PF +-.25PF 200VDC CER	28480	0160-4382
A2C11	0160-4381	8	1	CAPACITOR-FXD 1.5PF +-.25PF 200VDC CER	28480	0160-4381
A2C12	0180-0562	1	5	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X0010KA1
A2C13	0160-3508	9	3	CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A2C14	T65650	3	1	CAPACITOR-FXD 100UF 16VDC	28480	T65650
A2C15	0160-0576	5	32	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A2C16	0180-0474	4	14	CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A2C17	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A2C18	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A2C20	0160-4386	3		CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A2C21	0121-0059	7	1	CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A2C22	0160-4618	4		CAPACITOR-FXD 3.9PF +-.25PF 200VDC CER	28480	0160-4618
A2C23	0180-0552	9		CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A2C24	0180-0552	9		CAPACITOR-FXD 220UF+-20% 10VDC TA	28480	0180-0552
A2C25	0180-0562	1		CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X0010KA1
A2C26	0180-0648	4	4	CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A2C27	0160-3879	7	73	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C28	0180-0648	4		CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A2C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C30	0180-0648	4		CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A2C31	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C32	0180-0648	4		CAPACITOR-FXD .1UF+-10% 35VDC TA	90201	TDC104K035NSE
A2C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C35	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C36	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C37	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C38	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A2C39	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A2C40	0180-0562	1		CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X0010KA1
A2CR5	1901-1098	1	1	DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A2DS1	1990-0450	4	7	LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A2DS2	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A2DS3	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A2DS4	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A2J1	1250-1738	5	5	CONNECTOR-RF SM-SNP M PC 75-OHM	28480	1250-1738
A2J2	1250-1738	5		CONNECTOR-RF SM-SNP M PC 75-OHM	28480	1250-1738
A2J3	1250-1738	5		CONNECTOR-RF SM-SNP M PC 75-OHM	28480	1250-1738
A2K1	0490-1262	7	4	RELAY 2C 12VDC-COIL 2A 120VAC	28480	0490-1262
A2K2	0490-1262	7		RELAY 2C 12VDC-COIL 2A 120VAC	28480	0490-1262
A2K3	0490-1262	7		RELAY 2C 12VDC-COIL 2A 120VAC	28480	0490-1262
A2K4	0490-1262	7		RELAY 2C 12VDC-COIL 2A 120VAC	28480	0490-1262
A2L1	03746-80001	2	2	INDUCTOR	28480	03746-80001
A2L2	03746-80001	2		INDUCTOR	28480	03746-80001
A2L3	9100-1625	0	5	INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1625
A2L4	9100-1625	0		INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1625
A2L5	9100-1625	0		INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1625
A2L6	9100-1625	0		INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1625
A2L8	9100-3552	6	1	INDUCTOR RF-CH-MLD 1.5UH 5% .166DX.385LG	28480	9100-3552
A2L9	9140-0094	9	2	INDUCTOR RF-CH-MLD 680NH 10%	28480	9140-0094
A2L10	9100-1625	0		INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1625
A2MP1	03746-04102	4	1	COVER	28480	03746-04102
A2MP2	03746-04199	9	1	COVER-RELAY	28480	03746-04199
A2MP3	03746-20613	6	2	SHIELD	28480	03746-20613
A2Q1	1853-0382	1	1	TRANSISTOR PNP SI TO-72 PD=360MW	28480	1853-0382
A2Q2	1854-0720	3	1	TRANSISTOR NPN SI PD=500MW FT=4GHZ	28480	1854-0720
A2Q3	1854-0247	9	3	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A2Q4	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A2Q5	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R1	0698-8523	7	4	RESISTOR 144.37 .1% .125W F TC=0+-50	28480	0698-8523
A2R2	0698-8524	8	2	RESISTOR 106.73 .1% .125W F TC=0+-50	28480	0698-8524
A2R3	0698-8523	7		RESISTOR 144.37 .1% .125W F TC=0+-50	28480	0698-8523
A2R4	0698-8523	7		RESISTOR 144.37 .1% .125W F TC=0+-50	28480	0698-8523
A2R5	0698-8524	8		RESISTOR 106.73 .1% .125W F TC=0+-50	28480	0698-8524
A2R6	0698-8523	7		RESISTOR 144.37 .1% .125W F TC=0+-50	28480	0698-8523
A2R7	0698-8600	1	2	RESISTOR 267.73 .1% .125W F TC=0+-50	28480	0698-8600
A2R8	0698-8601	2	1	RESISTOR 45.6 .1% .125W F TC=0+-50	28480	0698-8601
A2R9	0698-8600	1		RESISTOR 267.73 .1% .125W F TC=0+-50	28480	0698-8600
A2R10	0683-1025	9	8	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R10	0757-0710	4	1	RESISTOR 75 1% .25W F TC=0+-100	24546	C5-1/4-T0-75R0-F
A2R11	0698-0083	8	3	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A2R12	0757-0398	4	13	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A2R13	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A2R14	0698-3447	4	2	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A2R15	0698-3432	7	4	RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A2R16	0698-3438	3	6	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A2R17	0757-0726	2	1	RESISTOR 511 1% .25W F TC=0+-100	24546	C5-1/4-T0-511R-F
A2R18	0757-0346	2	5	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R19	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A2R20	0757-0180	2	2	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A2R21	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A2R22	0757-0420	3	5	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A2R23	0698-3445	2	3	RESISTOR 348 1% .125W F TC=0+-100	24546	
A2R24	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A2R25	0698-8822	9	1	RESISTOR 6.81 1% .125W F TC=0+-100	28480	0698-8822
A2R26	0757-0382	6	1	RESISTOR 16.2 1% .125W F TC=0+-100	19701	MF4C1/8-T0-16R2-F
A2R27	2100-0552	3	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 1-TRN	28480	2100-0552
A2R28	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A2R29	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A2R30	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A2R31	0698-3442	9	3	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A2R32	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A2R33	0757-0730	8	1	RESISTOR 750 1% .25W F TC=0+-100	24546	C5-1/4-T0-751-F
A2R34	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A2R35	0683-2025	1	5	RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A2R36	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A2R37	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A2R38	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A2R39	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A2R40	0683-3325	6	2	RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R42	0698-5883	6	1	RESISTOR-FXD 19.6 OHM 1/4W	24546	C5-1/4-T0-20R0-J
A2U1	1820-1433	6	1	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A2U2	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A2U3	1858-0047	5	2	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A2U4	1858-0047	5		TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
			1	A2 MISCELLANEOUS PARTS		
	1200-0173	5	3	INSULATOR-XSTR DAP-GL	28480	1200-0173
	1205-0011	0	2	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
	1251-0600	0	44	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-2501	4	27	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8	14	WIREFORM BE CU AG	28480	1460-1489
	1600-0844	5	2	SHIELD 50-1 BRS	28480	1600-0844

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	03746-60004	3	1	CALIBRATOR/BROADBAND POWER DETECTOR ASSY	28480	03746-60004
A4C1	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A4C2	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C3	0180-2821	9	3	CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A4C4	0160-0158	9	1	CAPACITOR-FXD 5600PF +-10% 200VDC POLYE	28480	0160-0158
A4C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C6	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C7	0160-0363	8	1	CAPACITOR-FXD 620PF +-5% 300VDC MICA	28480	0160-0363
A4C8	0180-2698	8	3	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	28480	0180-2698
A4C9	0180-2698	8		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	28480	0180-2698
A4C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C12	0180-2821	9		CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A4C14	0180-2698	8		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	28480	0180-2698
A4C15	0160-4497	7	3	CAPACITOR-FXD 82PF +-5% 200VDC CER 0+-30	28480	0160-4497
A4C16	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C17	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C18	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A4C19	0160-0128	3	1	CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A4C22	0160-3486	2	1	CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A4C23	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C24	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C25	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C26	0160-4389	6	3	CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A4C27	0180-2817	3	1	CAPACITOR-FXD 47UF+-20% 10VDC TA	28480	0180-2817
A4C28	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C30	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A4C31	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C32	0160-4566	1	1	CAPACITOR-FXD 2200PF +-1% 50VDC CER	51642	200-50-NP0-222F
A4C34	0180-2821	9		CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A4C35	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4C36	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A4C37	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A4C38	0180-0562	1		CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X0010KA1
A4C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C40	0160-3877	6	1	CAPACITOR-FXD 100PF +-20% 100VDC CER	28480	0160-3877
A4C41	0121-0475	0	1	CAPACITOR-FXD 2.8PF +/-5PF	20932	5024E0200RD689D
A4C42	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4CR1	1901-0539	3	8	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A4CR2	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A4CR3	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A4CR4	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A4CR5	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4CR6	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A4CR7	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A4CR8	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A4CR9	1901-0040	1	7	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR19	1902-0777	3	2	DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	1N825
A4CR20	1902-0955	9	1	DIODE-ZNR 7.5V 5% DO-35 PD=.4W TC=+.062%	28480	1902-0955
A4DS1	1990-0487	7	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A4DS2	1990-0450	4		LED (RED)	28480	5082-4484
A4DS3	1990-0450	4		LED (RED)	28480	5082-4484
A4J1	1250-1738	5		CONNECTOR-RF SM-SNP M PC 75-OHM	28480	1250-1738
A4L1	9100-1613	6	2	INDUCTOR RF-CH-MLD 470NH 20%	28480	9100-1613
A4L2	9100-1613	6		INDUCTOR RF-CH-MLD 470NH 20%	28480	9100-1613
A4L3	9140-0210	1	13	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4L4	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4L5	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4L6	9100-3560	6	12	INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A4L7	03746-80009	0	1	INDUCTOR	28480	03746-80009
A4MP1	03746-04104	6	1	COVER	28480	03746-04104
A4Q1	1853-0036	2	4	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A4Q2	1853-0354	7	2	TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4Q3	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A4Q4	1854-0401	7	14	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A4Q5	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A4Q7	1854-0215	1	4	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4Q8	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A4Q9	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A4Q10	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A4Q11	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4Q12	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4Q13	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4R1	0683-5635	5	2	RESISTOR 56K 5% .25W FC TC=-400/+800	01121	CB5635
A4R2	0683-5635	5		RESISTOR 56K 5% .25W FC TC=-400/+800	01121	CB5635
A4R3	0683-5125	8	2	RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A4R4	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A4R5	0683-7525	6	1	RESISTOR 7.5K 5% .25W FC TC=-400/+700	01121	CB7525
A4R6	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A4R7	1810-0332	1	1	NETWORK-RES 8-SIP680.0 OHM X 7	01121	208A681
A4R9	0683-4305	4	2	RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A4R10	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A4R11	0683-5105	4	5	RESISTOR 51 5% .25W FC TC=-400/+500	01121	CB5105
A4R12	0683-5105	4		RESISTOR 51 5% .25W FC TC=-400/+500	01121	CB5105
A4R19	0683-2705	4	6	RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A4R20	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A4R21	0683-3015	1	1	RESISTOR 300 5% .25W FC TC=-400/+600	01121	CB3015
A4R22	0757-0449	6	3	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A4R23	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4R24	0698-3444	1	9	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4R25	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A4R26	0683-5105	4		RESISTOR 51 5% .25W FC TC=-400/+500	01121	CB5105
A4R27	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A4R29	0683-1035	1	8	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A4R30	0683-2435	7	2	RESISTOR 24K 5% .25W FC TC=-400/+800	01121	CB2435
A4R31	0683-2435	7		RESISTOR 24K 5% .25W FC TC=-400/+800	01121	CB2435
A4R32	0757-0401	0	7	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R33	0757-0283	6	1	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A4R35	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A4R36	2100-3103	6	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A4R37	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A4R39	2100-3274	2	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A4R40	0698-8517	9	2	RESISTOR 1K 10% .125W F TC=+3000+-250	28480	0698-8517
A4R41	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A4R42	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A4R43	0757-0421	4	3	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A4R44	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A4R45	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R46	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A4R47	0698-4476	1	1	RESISTOR 10.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1022-F
A4R48	0698-4468	1	1	RESISTOR 1.13K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1131-F
A4R49	0757-0280	3	11	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R50	0757-0272	3	1	RESISTOR 52.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5232-F
A4R51	0698-4479	4	1	RESISTOR 14K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1402-F
A4R52	0698-3499	6	1	RESISTOR 40.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4022-F
A4R53	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A4R54	0683-1055	5	2	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A4R55	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A4R56	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A4R57	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A4R58	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A4R59	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A4R60	0757 -0317			RESISTOR 1·33K 5% .25W FC TC=-400/+700		
A4R61	0757-0280	6	9	RESISTOR 1K 5% .25W FC TC=-400/+600		
A4R62	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A4R63	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A4R64	0683-3025	6		RESISTOR 3K 5% .25W FC TC=-400/+600	01121	
A4R65	0683-3025	6		RESISTOR 3K 5% .25W FC TC=-400/+600	01121	
A4R66	0683-3025	6		RESISTOR 3K 5% .25W FC TC=-400/+600	01121	CB5115
A4R67	0683-3025	6		RESISTOR 3K 5% .25W FC TC=-400/+600	01121	CB5115
A4R68	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A4R69	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A4R70	0757-0417	8	1	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4R71	0683-5605	9	1	RESISTOR 56 5% .25W FC TC=-400/+500	01121	CB5605
A4R72	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R73	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R74	0683-7515	4	2	RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A4R75	0683-7515	4		RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A4R76	0683-2035	3	1	RESISTOR 20K 5% .25W FC TC=-400/+800	01121	CB2035
A4R77	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A4R78	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A4R79	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4R80	2100-3122	9	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	02111	43P101
A4R81	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4R82	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A4R83	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A4R83	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A4R84	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4R85	0698-4037	0	4	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A4R86	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4R87	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A4R88	0683-5105	4		RESISTOR 51 5% .25W FC TC=-400/+500	01121	CB5105
A4R89	0683-5105	4		RESISTOR 51 5% .25W FC TC=-400/+500	01121	CB5105
A4R90	2100 -3274			RESISTOR 10K 1% .125W F TC=0+-100		
A4R91	0698-3441	7	2	RESISTOR 215 1% .125W F TC=0+-100		
A4R92	0757-0280			RESISTOR 1K 1% .125WF TC=0+-100		
A4SW1	3101-1977	1	1	SWITCH-SL DPDT SUBMIN .5A 125VAC PC	28480	3101-1977
A4T1	15520-80001	5	4	TOROID	28480	15520-80001
A4T2	03712-80002	3	3	TRANSFORMER	28480	03712-80002
A4U1	1820-2655	6	1	IC-DIGITAL SN74LS625N	01295	SN74LS625N
A4U2	1820-0803	2	1	IC GATE ECL OR-NOR TPL	04713	MC10105P
A4U3	1826-0528	0	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LF356BH
A4U4	1826-0421	2	2	IC CONV RMS/DC 14-DIP-C PKG	24355	AD536AJ
A4U5	1826-0139	9	3	IC OP AMP GP DUAL 8-DIP-P PKG	3L585	CA1458G
A4U6	1826-0139	9		IC OP AMP GP DUAL 8-DIP-P PKG	3L585	CA1458G
A4U7	1820-0810	1	3	IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10116P
A4U8	1826-0139	9		IC OP AMP GP DUAL 8-DIP-P PKG	3L585	CA1458G
				A4 MISCELLANEOUS PARTS		
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-2501	4		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A5	03746-60005	4	1	INPUT MIXER ASSEMBLY	28480	03746-60005
A5C1	0160-4387	4	3	CAPACITOR-FXD 47PF +-5% 200VDC CER 0+-30	28480	0160-4387
A5C2	0160-4498	8	1	CAPACITOR-FXD 5.6PF +-.5PF 200VDC CER	28480	0160-4498
A5C3	0160-4497	7		CAPACITOR-FXD 82PF +-5% 200VDC CER 0+-30	28480	0160-4497
A5C4	0160-4493	3	2	CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A5C5	0160-4497	7		CAPACITOR-FXD 82PF +-5% 200VDC CER 0+-30	28480	0160-4497
A5C6	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A5C7	0160-4494	4	5	CAPACITOR-FXD 39PF +-5% 200VDC CER 0+-30	28480	0160-4494
A5C8	0121-0516	1	2	CAPACITOR-V TRMR-POLYI 1-5PF 50V PC-MTG	28480	0121-0516
A5C9	0160-4619	5	2	CAPACITOR-FXD 2.7PF +-.25PF 200VDC CER	28480	0160-4619
A5C10	0160-4619	5		CAPACITOR-FXD 2.7PF +-.25PF 200VDC CER	28480	0160-4619

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5C11	0121-0516	1		CAPACITOR-V TRMR-POLYI 1-5PF 50V PC-MTG	28480	0121-0516
A5C12	0160-4481	9	1	CAPACITOR-FXD 270PF +-5% 100VDC CER	51642	150-100-NPO-271J
A5C13	0121-0061	1	3	CAPACITOR-V TRMR-CER 5.5-18PF 350V	52763	304322 5.5/18PF NPO
A5C14	0121-0060	0	4	CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304322 2/8PF NPO
A5C15	0160-4494	4		CAPACITOR-FXD 39PF +-5% 200VDC CER 0+-30	28480	0160-4494
A5C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C19	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C25	0121-0522	9	4	CAPACITOR-V TRIMMER-PISTON, AIR .5-3.5PF	28480	0121-0522
A5C26	0121-0522	9		CAPACITOR-V TRIMMER-PISTON, AIR .5-3.5PF	28480	0121-0522
A5C27	0121-0061	1		CAPACITOR-V TRMR-CER 5.5-18PF 350V	52763	304322 5.5/18PF NPO
A5C28	0160-4494	4		CAPACITOR-FXD 39PF +-5% 200VDC CER 0+-30	28480	0160-4494
A5C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C31	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C35	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C37	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C38	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C40	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C41	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C42	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A5C43	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A5CR1	1901-0545	1	8	DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A5CR2	1901-0545	1		DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A5CR3	1901-0545	1		DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A5CR4	1901-0545	1		DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A5J1	1250-1738	5		CONNECTOR-RF SM-SNP M PC 75-OHM	28480	1250-1738
A5J2	1250-1512	3	3	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1512
A5L1	03746-80002	3	1	INDUCTOR	28480	03746-80002
A5L1	9170-0747	2	3	POT CORE ACCESSORY SCREENING CAN; 10.16	28480	9170-0747
A5L2	03746-80003	4	2	INDUCTOR	28480	03746-80003
A5L2	9170-0747	2		POT CORE ACCESSORY SCREENING CAN; 10.16	28480	9170-0747
A5L3	03746-80003	4		INDUCTOR	28480	03746-80003
A5L3	9170-0747	2		POT CORE ACCESSORY SCREENING CAN; 10.16	28480	9170-0747
A5L4	03746-80004	5	1	INDUCTOR	28480	03746-80004
A5L5	9140-0094	9		INDUCTOR RF-CH-MLD 680NH 10%	28480	9140-0094
A5L6	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A5L7	03746-80005	6	4	INDUCTOR	28480	03746-80005
A5L8	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A5L9	9140-0144	0	4	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A5L10	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A5L11	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A5L12	03746-80005	6		INDUCTOR	28480	03746-80005
A5L13	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A5L14	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A5L16	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A5L17	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A5MP1	03746-04105	7	1	COVER	28480	03746-04105
A5MP2	03746-04196	6	1	COVER-COIL	28480	03746-04196
A5MP3	03746-20613	6		SHIELD	28480	03746-20613
A5MP4	03746-20612	5	2	SHIELD-CAN	28480	03746-20612
A5Q1	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A5Q2	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A5Q3	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A5Q4	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A5Q5	1854-0378			TRANSISTOR NPN SI TO-72	28480	1854-0378
A5R1	0698-7205	0	8	RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A5R2	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A5R3	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A5R4	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A5R5	0757-0394	0	22	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R6	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R7	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A5R8	2100-3211	7	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	28480	2100-3211
A5R9	0698-3446	3	2	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A5R10	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5R11	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R12	0698-3432	7		RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A5R13	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A5R14	0757-0419	0	4	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A5R15	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A5R16	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A5R17	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R18	0698-3445			RESISTOR 348 1% .125W F TC = 0 + − 100		
A5R19	2100-3212	8	2	RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	28480	2100-3212
A5R20	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A5R21	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A5R22	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A5R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R24	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A5R25	0698-3432	7		RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A5R26	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A5R27	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R28	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R29	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R30	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R31	0757-0403	2	4	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A5R32	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A5R33	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R34	0698-3441	8	6	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A5R35	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A5R36	0698-3434	9	1	RESISTOR 34.8 1% .125W F TC=0+-100	24546	C4-1/8-T0-34R8-F
A5R37	0757-0178	8	2	RESISTOR 100 1% .25W F TC=0+-100	24546	C5-1/4-T0-101-F
A5R38	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A5R39	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A5R40	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R41	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R42	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R43	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5T1	15520-80001	5		TOROID	28480	15520-80001
A5T2	15520-80002	6	4	TRANSFORMER-RF	28480	15520-80002
A5T3	03746-80006	7	1	INDUCTOR	28480	03746-80006
A5T4	03746-80007	8	2	INDUCTOR	28480	03746-80007
A5T5	15520-80001	5		TOROID	28480	15520-80001
A5T6	03712-80002	3		TRANSFORMER	28480	03712-80002
A5T7	15520-80002	6		TRANSFORMER-RF	28480	15520-80002
A5TP2	1250-0257	1	2	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A5U1	1858-0031	7	2	ICA-TRANSISTOR CER	28480	1858-0031
A5Y1	0410-1289	0	4	CRYSTAL-MATCHED PAIR	28480	0410-1289
A5Y2	0410-1289	0		CRYSTAL-MATCHED PAIR	28480	0410-1289
				A5 MISCELLANEOUS PARTS		
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-2501	4		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1251-2551	4	1	CONNECTOR-SGL CONT SKT .033-IN-BSC-SZ	28480	1251-2551
	1251-4045	5	1	SOCKET-GND SPRING, STL	28480	1251-4045
	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
	9170-0817	7	9	CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
	03746-20612			SHIELD CAN		
A10	03746-60010	1	1	2ND MIXER ASSEMBLY	28480	03746-60010
A10C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C2	0121-0060	0		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304322 2/8PF NPO
A10C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C5	0160-4494	4		CAPACITOR-FXD 39PF +-5% 200VDC CER 0+-30	28480	0160-4494
A10C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C9	0121-0522	9		CAPACITOR-V TRIMMER-PISTON, AIR .5-3.5PF	28480	0121-0522
A10C10	0121-0522	9		CAPACITOR-V TRIMMER-PISTON, AIR .5-3.5PF	28480	0121-0522
A10C11	0121-0061	1		CAPACITOR-V TRMR-CER 5.5-18PF 350V	52763	304322 5.5/18PF NPO
A10C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C14	0160-4494	4		CAPACITOR-FXD 39PF +-5% 200VDC CER 0+-30	28480	0160-4494
A10C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C19	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C20	0160-4001	9	1	CAPACITOR-FXD .047UF +-10% 250VDC	28480	0160-4001

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C25	0160-4547	8	3	CAPACITOR-FXD 150PF +-5% 200VDC CER	28480	0160-4547
A10C26	0160-4387	4		CAPACITOR-FXD 47PF +-5% 200VDC CER 0+-30	28480	0160-4387
A10C27	0160-4547	8		CAPACITOR-FXD 150PF +-5% 200VDC CER	28480	0160-4547
A10C28	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C31	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C35	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C36	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C37	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C38	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A10C39	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A10C40	0180-0562	1		CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X0010KA1
A10C41	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C42	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A10C43	0160-0157	8	1	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A10C44	0160-4386			CAPACITOR-FXD 33PF +-10% 200VDC POLYE	28480	0160-4386
A10CR1	1901-0545	1		DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A10CR2	1901-0545	1		DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A10CR3	1901-0545	1		DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A10CR4	1901-0545	1		DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A10L1	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A10L2	03746-80005	6		INDUCTOR	28480	03746-80005
A10L3	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A10L4	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A10L5	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A10L6	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A10L7	03746-80005	6		INDUCTOR	28480	03746-80005
A10L8	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A10L9	9100-1642	1	1	INDUCTOR RF-CH-MLD 270UH 5% .2DX.45LG	28480	9100-1642
A10L10	9100-0346	0	2	INDUCTOR RF-CH-MLD 50NH 20% .105DX.26LG	28480	9100-0346
A10L11	9100-0346	0		INDUCTOR RF-CH-MLD 50NH 20% .105DX.26LG	28480	9100-0346
A10L12	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A10L13	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A10L14	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A10L15	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A10L16	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A10MP1	03746-04110	4	1	COVER	28480	03746-04110
A10MP2	03746-20612	5		SHIELD-CAN	28480	03746-20612
A10Q1	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A10Q2	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A10Q3	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A10Q4	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A10Q5	1854-0378	7		TRANSISTOR NPN SI TO-72 PD=	28480	1854-0378
A10R1	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A10R2	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10R3	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R4	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R5	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A10R6	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A10R7	2100-3212	8		RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	28480	2100-3212
A10R8	0698-3445	9		RESISTOR 348 1% .125W F TC=0+-100		
A10R9	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A10R10	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A10R11	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A10R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10R13	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R14	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A10R15	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A10R16	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R17	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R18	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A10R19	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A10R20	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A10R21	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A10R22	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A10R23	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A10R24	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A10R25	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10R26	2100-0567	0	2	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	28480	2100-0567
A10R27	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A10R28	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R29	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A10R30	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A10R31	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A10R32	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A10R33	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A10R34	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A10R35	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A10R36	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A10R37	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R38	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R39	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A10R40	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A10R41	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A10R42	0757-0178	8		RESISTOR 100 1% .25W F TC=0+-100	24546	C5-1/4-T0-101-F
A10R43	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A10R45	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A10R46	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A10R47	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A10R48	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A10R49	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A10R50	0698-3432	7		RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A10R51	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A10R52	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A10R53	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A10R54	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R55	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A10R60	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A10R61	0837-0050	5	1	THERMISTOR DISC 1K-OHM TC=-4.4%/C-DEG	28480	0837-0050
A10R62	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A10T1	03746-80008	9	1	INDUCTOR ASSY	28480	03746-80008
A10T2	03746-80007	8		INDUCTOR	28480	03746-80007
A10T3	15520-80002	6		TRANSFORMER-RF	28480	15520-80002
A10T4	15520-80001	5		TOROID	28480	15520-80001
A10T5	15520-80002	6		TRANSFORMER-RF	28480	15520-80002
A10T6	03712-80002	3		TRANSFORMER	28480	03712-80002
A10T7	03746-80010	3	1	INDUCTOR	28480	03746-80010
A10TL1	1251-2501	4		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A10TL2	1251-2501	4		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A10TL3	1251-2501	4		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A10TL4	1251-2501	4		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A10TP8	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A10U1	1826-0715	7	1	IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	NE5534AN
A10U2	1820-0810	1		IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10116P
A10U3	1858-0031	7		ICA-TRANSISTOR CER	28480	1858-0031
A10Y1	0410-1289	0		CRYSTAL-MATCHED PAIR	28480	0410-1289
A10Y2	0410-1289	0		CRYSTAL-MATCHED PAIR	28480	0410-1289
				A10 MISCELLANEOUS PARTS		
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	9170-0817	7		CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
	03746-20612			SHIELD CAN		

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				OPTION 011		
A11	03746-60011	2	1	GROUP POWER ASSEMBLY	28480	03746-60011
A11C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C2	0160-4385	2	1	CAPACITOR-FXD 15PF +-5% 200VDC CER 0+-30	28480	0160-4385
A11C3	0160-4387	4		CAPACITOR-FXD 47PF +-5% 200VDC CER 0+-30	28480	0160-4387
A11C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C5	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C6	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C8	0121-0060	0		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304322 2/8PF NPO
A11C9	0121-0060	0		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304322 2/8PF NPO
A11C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C11	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C14	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C15	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C16	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C17	0160-4389	6		CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A11C18	0160-4389	6		CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A11C19	0160-4386	3		CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A11C20	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C21	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C22	0140-0172	5	2	CAPACITOR-FXD 3000PF +-1% 100VDC MICA	72136	DM19F302F0100WV1CR
A11C23	0140-0172	5		CAPACITOR-FXD 3000PF +-1% 100VDC MICA	72136	DM19F302F0100WV1CR
A11C24	0160-3024	4	1	CAPACITOR-FXD 1700PF +-1% 100VDC MICA	28480	0160-3024
A11C25	0160-3287	1	1	CAPACITOR-FXD 520PF +-1% 100VDC MICA	28480	0160-3287
A11C26	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C29	0160-4547	8		CAPACITOR-FXD 150PF +-5% 200VDC CER	28480	0160-4547
A11C30	0160-4493	3		CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A11C31	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C32	0160-4386	3		CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A11C33	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C34	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C35	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C36	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A11C37	0160-4040	5		CAPACITOR-FXD 1000P +-20% 50VDC CER	28480	0160-4040
A11C38	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C39	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C40	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C43	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C44	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A11C45	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A11C46	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A11C47	0160-4386	3		CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A11C49	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C50	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C51	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C52	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C53	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A11C54	0160-4527	4		CAPACITOR-FXD 56PF +-5% 200VDC CER 0+-30	28480	0160-4527
A11CR2	1901-0044	5	2	DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A11CR3	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A11CR4	1902-0777	3		DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	1N825
A11DS1	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A11E1	9135-0160	9	1	CRYSTAL FILTER - 50.05	28480	9135-0160
A11J1	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A11J2	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A11L1	03746-80011	4	1	COIL ASSY	28480	03746-80011
A11L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A11L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A11L4	9100-3313	7	2	INDUCTOR RF-CH-MLD 22UH 5% .166DX.385LG	28480	9100-3313
A11L5	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A11L6	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A11L7	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A11L11	9100-3313	7		INDUCTOR RF-CH-MLD 22UH 5% .166DX.385LG	28480	9100-3313
A11MP1	03746-04111	5	1	COVER	28480	03746-04111
A11Q1	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A11Q2	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11R1	0757-0316	6	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A11R2	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A11R3	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A11R4	0698-3437	2	1	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R5	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A11R6	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A11R7	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A11R8	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A11R9	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A11R10	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A11R11	2100-3383	4	1	RESISTOR-TRMR 50 10% C TOP-ADJ 1-TRN	28480	2100-3383
A11R12	0698-3132	4	2	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A11R13	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A11R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R16	0757-0288	1	2	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A11R17	0757-0288	1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A11R18	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R19	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R20	0698-4102	0	1	RESISTOR 2.06K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-2061-F
A11R22	0698-4424	9	2	RESISTOR 1.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1401-F
A11R23	0698-4424	9		RESISTOR 1.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1401-F
A11R28	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R29	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A11R30	0683-4315	6	1	RESISTOR 430 5% .25W FC TC=-400/+600	01121	CB4315
A11R33	0699-0750	8	1	RESISTOR-16.783K OHM .1% .125W	28480	0699-0750
A11R34	0698-6362	8	1	RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A11R35	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R36	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R37	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R38	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R39	0683-3915	0	1	RESISTOR 390 5% .25W FC TC=-400/+600	01121	CB3915
A11R42	0757-0458	3	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	
A11R43	2100-3098	1	1	RESISTOR-TRMR 5K 10% C TOP-ADJ 17-TRN		
A11R44	0698-8517	9		RESISTOR 1K 10% .125W F TC=+3000+-250	28480	0698-8517
A11R45	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A11R46	2100-0567	0		RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	28480	2100-0567
A11R47	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A11R48	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R49	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R50	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R52	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R53	0698-3511	3	1	RESISTOR 665 1% .125W F TC=0+-100	24546	C4-1/8-T0-665R-F
A11R54	0837-0119	7	1	THERMISTOR ROD 5K-OHM TC=+.7%/C-DEG	28480	0837-0119
A11R58	0698-3243	8	1	RESISTOR 178K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1783-F
A11R60	1810-0121	6	1	NETWORK-RES 9-SIP1.0K OHM X 8	91637	CSP09C07-102J
A11TL1	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A11TL2	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A11TL3	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A11U1	1826-0598	4	1	IC 14-DIP-P PKG	04713	MC12002P
A11U2	1826-0218	5	3	IC OP AMP WB TO-99 PKG	3L585	CA3100T
A11U3	1826-0217	4	2	IC OP AMP GP DUAL TO-99 PKG	07933	RC4558T
A11U4	1826-0109	3	1	IC OP AMP WB TO-99 PKG	34371	HA2-2625-B0593
A11U5	1826-0476	7	1	IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A11U6	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
A11U7	1826-0421	2		IC CONV RMS/DC 14-DIP-C PKG	24355	AD536AJ
A11U8	1826-0217	4		IC OP AMP GP DUAL TO-99 PKG	07933	RC4558T
A11U9	1820-0810	1		IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10116P
A11U9	1826-0218	5		IC OP AMP WB TO-99 PKG	3L585	CA3100T
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-3205	7	7	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-3205

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20	03746-60020	3	1	IF FILTER ASSEMBLY	28480	03746-60020
A20C1	0160-0576	5	78	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C2	0160-0576	5	•	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C3	0160-5065	7	3	CAPACITOR-FXD 270PF 1% 63VDC	28480	0160-5065
A20C4	0160-5065	7		CAPACITOR-FXD 270PF 1% 63VDC	28480	0160-5065
A20C5	0160-5077	1	1	CAPACITOR-FXD 750PF 1% 63VDC	28480	0160-5077
A20C6	0160-5015	7	1	CAPACITOR-FXD .012UF 1% 63VDC	28480	0160-5015
A20C7	0160-5162	5	6	CAPACITOR-FXD 1600PF 1% 63VDC	28480	0160-5162
A20C8	0160-5062	4	1	CAPACITOR-FXD 5100PF 1% 63VDC	28480	0160-5062
A20C9	0160-5074	8	3	CAPACITOR-FXD 180PF 1% 63VDC	28480	0160-5074
A20C10	0160-5170	5	1	CAPACITOR-FXD 150PF 1% 63VDC	28480	0160-5170
A20C11	0160-5079	3	2	CAPACITOR-FXD 56PF 1% 63VDC	28480	0160-5079
A20C12	0160-5089	5	3	CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A20C13	0160-4386	3	2	CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A20C14	0160-5162	5		CAPACITOR-FXD 1600PF 1% 63VDC	28480	0160-5162
A20C15	0160-5071	5	1	CAPACITOR-FXD 300PF 1% 63VDC	28480	0160-5071
A20C16	0160-5026	0	1	CAPACITOR-FXD 8200PF 1% 63VDC	28480	0160-5026
A20C17	0160-5060	2	1	CAPACITOR-FXD 680PF 1% 63VDC	28480	0160-5060
A20C18	0160-5075	9	1	CAPACITOR-FXD 560PF 1% 63VDC	28480	0160-5075
A20C19	0160-4382	9	1	CAPACITOR-FXD 3.3PF +-.25PF 200VDC CER	28480	0160-4382
A20C20	0160-5089	5		CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A20C21	0160-4498	8	1	CAPACITOR-FXD 5.6PF +-.5PF 200VDC CER	28480	0160-4498
A20C22	0160-5080	6	1	CAPACITOR-FXD 3900PF 1% 63VDC	28480	0160-5080
A20C23	0160-5089	5		CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A20C24	0160-5067	9	1	CAPACITOR-FXD 430PF 1% 63VDC	28480	0160-5067
A20C25	0160-5083	9	1	CAPACITOR-FXD 75PF 1% 63VDC	28480	0160-5083
A20C26	0160-5172	7	2	CAPACITOR-FXD 910PF 1% 63VDC	28480	0160-5172
A20C27	0160-5163	6	1	CAPACITOR-FXD 92PF 1% 63VDC	28480	0160-5163
A20C28	0160-5072	6	1	CAPACITOR-FXD 620PF 1% 63VDC	28480	0160-5072
A20C29	0160-5065	7		CAPACITOR-FXD 270PF 1% 63VDC	28480	0160-5065
A20C30	0160-5164	7	1	CAPACITOR-FXD 390PF 1% 63VDC	28480	0160-5164
A20C31	0160-4493	3	4	CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A20C32	0160-5171	6	1	CAPACITOR-FXD 470PF 1% 63VDC	28480	0160-5171
A20C33	0160-3874	2	5	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A20C34	0160-5162	5		CAPACITOR-FXD 1600PF 1% 63VDC	28480	0160-5162
A20C35	0160-4386	3		CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A20C36	0160-5162	5		CAPACITOR-FXD 1600PF 1% 63VDC	28480	0160-5162
A20C37	0160-4992	7	1	CAPACITOR-FXD 330PF 1% 63VDC	28480	0160-4992
A20C38	0160-5172	7		CAPACITOR-FXD 910PF 1% 63VDC	28480	0160-5172
A20C39	0160-5074	8		CAPACITOR-FXD 180PF 1% 63VDC	28480	0160-5074
A20C40	0160-4383	0	1	CAPACITOR-FXD 6.8PF +-.5PF 200VDC CER	20932	5024E0200RD689D
A20C41	0160-5168	1	1	CAPACITOR-FXD 100PF 1% 63VDC	28480	0160-5168
A20C42	0160-4494	4	3	CAPACITOR-FXD 39PF +-5% 200VDC CER 0+-30	28480	0160-4494
A20C43	0160-5162	5		CAPACITOR-FXD 1600PF 1% 63VDC	28480	0160-5162
A20C44	0160-5079	3		CAPACIOTTOR-FXD 56PF 1% 63VDC	28480	0160-5079
A20C45	0160-5090	8	1	CAPACITOR-FXD 2700PF 1% 63VDC	28480	0160-5090
A20C46	0160-5074	8		CAPACITOR-FXD 180PF 1% 63VDC	28480	0160-5074
A20C47	0160-5162	5		CAPACITOR-FXD 1600PF 1% 63VDC	28480	0160-5162
A20C48	0160-5158	9	1	CAPACITOR-FXD 68PF 1% 63VDC	28480	0160-5158
A20C51	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C52	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C53	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C54	0160-3879	7	12	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C55	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C56	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C57	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C58	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C59	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C60	0160-5378	5	8	CAPACITOR-FXD 0.1UF 1% 50VDC	28480	0160-5378
A20C61	0160-5378	5		CAPACITOR-FXD 0.1UF 1% 50VDC	28480	0160-5378
A20C62	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C63	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C64	0160-5378	5		CAPACITOR-FXD 0.1UF 1% 50VDC	28480	0160-5378
A20C65	0160-5378	5		CAPACITOR-FXD 0.1UF 1% 50VDC	28480	0160-5378
A20C66	0160-5378	5		CAPACITOR-FXD 0.1UF 1% 50VDC	28480	0160-5378
A20C67	0160-5378	5		CAPACITOR-FXD 0.1UF 1% 50VDC	28480	0160-5378
A20C68	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C69	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C70	0160-5378	5		CAPACITOR-FXD 0.1UF 1% 50VDC	28480	0160-5378
A20C71	0160-5378	5		CAPACITOR-FXD 0.1UF 1% 50VDC	28480	0160-5378
A20C72	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20C73	0160-2306	3	1	CAPACITOR-FXD 27PF +-5% 300VDC MICA	28480	0160-2306
A20C74	0140-0191	8	2	CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A20C75	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C76	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C77	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C78	0180-0474	4	8	CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A20C79	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A20C80	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C81	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C82	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C83	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A20C84	0160-4040	6	8	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4040
A20C85	0160-3879			CAPACITOR-FXD 0.01UF + – 5% 100VDC CER		
A20CR1	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
A20L1	03746-80021	6	1	COIL ASSEMBLY	28480	03746-80021
A20L2	03746-80022	7	1	COIL ASSEMBLY	28480	03746-80022
A20L3	03746-80023	8	1	COIL ASSEMBLY	28480	03746-80023
A20L4	03746-80024	9	1	COIL ASSEMBLY	28480	03746-80024
A20L5	03746-80025	0	1	COIL ASSEMBLY	28480	03746-80025
A20L6	03746-80026	1	1	COIL ASSEMBLY	28480	03746-80026
A20L7	03746-80027	2	1	COIL ASSEMBLY	28480	03746-80027
A20L8	03746-80028	3	1	COIL ASSEMBLY	28480	03746-80028
A20L9	03746-80029	4	1	COIL ASSEMBLY	28480	03746-80029
A20L10	03746-80030	7	1	COIL ASSEMBLY	28480	03746-80030
A20L11	03746-80031	8	1	COIL ASSEMBLY	28480	03746-80031
A20L12	03746-80032	9	1	COIL ASSEMBLY	28480	03746-80032
A20L13	9140-0210	1	15	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A20L14	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A20MP1	03746-04120	6	1	COVER	28480	03746-04120
A20Q1	1854-0215	1	14	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A20Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A20Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A20Q4	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A20Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A20R1	0757-0280	3	9	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R2	0757-0401	0	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A20R3	0757-0274	5	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A20R4	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A20R5	0698-0083	8	3	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A20R6	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A20R7	0757-0419	0	2	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A20R8	0698-0085	0		RESISTOR 2·61K % .125W F TC=0+-100	24546	C4-1/8-TO-2611-F
A20R9	0698-3152	8	4	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A20R10	0757-0442	9	38	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R11	0757-0428	9	1	RESISTOR 1·62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A20R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A20R13	0757-0467	8	1	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A20R14	0698-3155	1	7	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A20R15	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A20R16	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A20R17	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A20R18	0698-3432	7	2	RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A20R19	0698-3432	7		RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A20R20	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A20R21	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A20R22	0683-1035	1	16	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A20R23	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A20R24	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A20R25	0757-0441	8	4	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A20R26	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A20R27	0698-0084	9	3	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A20R28	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A20R29	0757-0438	3	9	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R30	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R31	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A20R32	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A20R33	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A20R34	0698-3450	9	9	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A20R35	0698-8958	2	4	RESISTOR 511K 1% .125W F TC=0+-100	28480	0698-8958
A20R36	T65619	7	4	RESISTIVE NETWORK-SIP SPECIAL	28480	T65619
A20R39	2100-3502	9	4	RESISTOR-TRMR 200 10% C TOP-ADJ 17-TRN	32997	3292W-1-201
A20R41	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R42	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A20R43	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20R44	0757-0462	3	4	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A20R45	T65619	7		RESISTIVE NETWORK-SIP SPECIAL	28480	T65619
A20R48	2100-3502	9		RESISTOR-TRMR 200 10% C TOP-ADJ 17-TRN	32997	3292W-1-201
A20R50	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-TO 4220-F
A20R51	0698-8958	2		RESISTOR 511K 1% .125W F TC=0+-100	28480	0698-8958
A20R52	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A20R53	0757-0463	4	2	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A20R54	T65619	7		RESISTIVE NETWORK-SIP SPECIAL	28480	T65619
A20R57	2100-3502	9		RESISTOR-TRMR 200 10% C TOP-ADJ 17-TRN	32997	3292W-1-201
A20R59	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A20R60	0698-8958	2		RESISTOR 511K 1% .125W F TC=0+-100	28480	0698-8958
A20R61	0698-3161	9	2	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A20R62	0698-4495	9		RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A20R63	0698-8958	2		RESISTOR 511K 1% .125W F TC=0+-100	28480	0698-8958
A20R64	T65619	7		RESISTIVE NETWORK-SIP SPECIAL	28480	T65619
A20R67	2100-3502	9		RESISTOR-TRMR 200 10% C TOP-ADJ 17-TRN	32997	3292W-1-201
A20R69	0757-0463	4		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A20R70	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A20R71	0699-0750	8	1	RESISTOR-FXD 16.783K OHM .1%	28480	0699-0750
A20R72	0698-6362	8	1	RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
A20R73	0683-6815	5	1	RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A20R74	0683-2725	8	4	RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A20R75	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A20R76	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A20R77	0757-0419	4	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-TO 681-F
A20TP1	1251-0600	0	55	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP9	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP10	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP11	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP12	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP13	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20TP14	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20U1	1826-0217	4	3	IC OP AMP GP DUAL TO-99 PKG	07933	RC4558T
A20U2	1826-0476	7	13	IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A20U3	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A20U4	1820-2383	7	1	IC CNTR CMOS DIV-X-N DUAL 4-INP	04713	MC14569BCP
A20U5	1820-0938	4	1	IC FF CMOS J-K M/S POS-EDGE-TRIG DUAL	3L585	CD4027BE
A20U6	1826-0532	6	9	IC OP AMP GP QUAD 14-DIP-C PKG	34371	HA1-4605-5
A20U7	1826-0532	6		IC OP AMP GP QUAD 14-DIP-C PKG	34371	HA1-4605-5
A20U8	1826-0532	6		IC OP AMP GP QUAD 14-DIP-C PKG	34371	HA1-4605-5
A20U9	1826-0532	6		IC OP AMP GP QUAD 14-DIP-C PKG	34371	HA1-4605-5
A20U10	1826-0417	6	5	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A20U11	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A20U12	1826-0109	3	4	IC OP AMP WB TO-99 PKG	34371	HA2-2625-B0593
A20U13	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
	1251-3205	7	39	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-3205
	1460-1489	8	18	WIREFORM BE CU AG	28480	1460-1489
A21	03746-60021	4	1	IF GAIN AND DETECTION ASSEMBLY	28480	03746-60021
A21C1	0160-4099	5	2	CAPACITOR-FXD 3300PF +-1% 300VDC MICA	28480	0160-4099
A21C2	0160-4030	4	1	CAPACITOR-FXD 820PF +-5% 100VDC CER	28480	0160-4030
A21C3	0160-4493	3		CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A21C4	0160-4527	4	3	CAPACITOR-FXD 56PF +-5% 200VDC CER 0+-30	28480	0160-4527
A21C5	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C6	0160-2205	1	1	CAPACITOR-FXD 120PF +-5% 300VDC MICA	28480	0160-2205
A21C7	0160-4493	3		CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A21C8	0160-4527	4		CAPACITOR-FXD 56PF +-5% 200VDC CER 0+-30	28480	0160-4527
A21C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C11	0160-4099	5		CAPACITOR-FXD 3300PF +-1% 300VDC MICA	28480	0160-4099
A21C12	0160-4493	3		CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A21C13	0140-0191	8		CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A21C14	0160-4527	4		CAPACITOR-FXD 56PF +-5% 200VDC CER 0+-30	28480	0160-4527
A21C14	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C16	0160-4547	8	1	CAPACITOR-FXD 150PF +-5% 200VDC CER	28480	0160-4547
A21C17	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C18	0160-5468			CAPACITOR-FXD 0.47UF 10% 50VDC CER	28480	0160-5468
A21C19	0160-4455	7	2	CAPACITOR-FXD 10UF +-10% 50VDC MET-POLYC	28480	0160-4455
A21C20	0160-4040	6		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4040
A21C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C23	0160-4040	6		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4040
A21C24	0140-0192	9	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A21C25	0140-0197	4	1	CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A21C26	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C28	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C29	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A21C30	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C31	0180-1746	5	10	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A21C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C33	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C35	0160-0575	7		CAPACITOR-FXD 0.047UF-20% 100VDC CER	28480	0160-0575
A21C36	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A21C37	0160-4614			CAPACITOR-FXD 1500PF +-5PF 200VDC CER		
A21C38	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C39	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C40	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A21C41	0180-2818	4	3	CAPACITOR-FXD 2.2UF+-20% 35VDC TA	28480	0180-2818
A21C42	0180-2144	9	1	CAPACITOR-FXD 200UF+75-10% 25VDC AL	56289	30D207G025DH9
A21C43	0160-0978	1	2	CAPACITOR-FXD 1500PF +-1% 500VDC MICA	28480	0160-0978
A21C44	0160-2537	2	2	CAPACITOR-FXD 360PF +-1% 300VDC MICA	28480	0160-2537
A21C45	0160-2537	2		CAPACITOR-FXD 360PF +-1% 300VDC MICA	28480	0160-2537
A21C46	0160-0978	1		CAPACITOR-FXD 1500PF +-1% 500VDC MICA	28480	0160-0978
A21C47	0180-1706	7	1	CAPACITOR-FXD 100UF+-20% 25VDC TA	06001	69F245G7
A21C48	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C49	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C50	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C51	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C52	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C53	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A21C54	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C55	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C56	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C57	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C58	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A21C59	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A21C60	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A21CR1	1901-0044	5	21	DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A21CR2	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A21CR4	1902-0957	1	1	DIODE-ZNR 9.1V 5% DO-35 PD=.4W TC=+.069%	28480	1902-0957
A21CR5	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A21CR6	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A21CR7	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A21CR8	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A21CR9	1902-0948	0	1	DIODE-ZNR 3.9V 5% DO-35 PD=.4W TC=-.012%	28480	1902-0948
A21DS1	1990-0450	4	6	LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A21DS2	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A21DS3	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A21DS4	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A21DS5	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A21F1	2110-0218	9	1	FUSE .1A 250V .25X.27	28480	2110-0218
A21L1	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A21L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A21L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A21L4	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A21MP1	03746-04121	7	1	COVER	28480	03746-04121
A21Q1	1853-0036	2	4	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A21Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A21Q3	1855-0420	2	4	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A21Q4	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A21Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A21Q6	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A21Q7	1855-0420	2		TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A21R1	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R2	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A21R3	2100-0554	5	3	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
A21R4	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A21R5	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A21R6	0699-0369	5	1	RESISTOR-110.5K OHM .1%	28480	0699-0369
A21R7	0698-6624	5	1	RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A21R8	0698-3136	8	2	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A21R9	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A21R10	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21R11	0683-2235	5	16	RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A21R12	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A21R13	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A21R14	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A21R15	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A21R16	0698-0085	0	2	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A21R17	0757-0439	4	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A21R18	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A21R19	2100-3103	6	2	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A21R20	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A21R21	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A21R22	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A21R23	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A21R24	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A21R25	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A21R26	0698-8517	9	2	RESISTOR 1K 10% .125W F TC=+3000+-250	28480	0698-8517
A21R27	0698-8959	3	2	RESISTOR 619K 1% .125W F TC=0+-100	28480	0698-8959
A21R28	0757-0123	3	2	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
	0683-5115					
A21R30	0698-3449			RESISTOR 28.7K 1% .125W F TC=0+-100	24546	
A21R31	2100-3274	2	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A21R32	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A21R33	2100-0554	5		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
A21R34	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A21R35	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A21R36	0698-8827	4	3	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A21R37	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A21R38	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A21R39	0683-1025	9	7	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A21R40	0757-0443	0	4	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A21R41	0698-6320	8	1	RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A21R42	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A21R43	0698-6360	6	1	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A21R44	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A21R45	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A21R46	2100-0568	1	1	RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	28480	2100-0568
A21R47	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A21R48	0683-1815	5	1	RESISTOR 180 5% .25W FC TC=-400/+600	01121	CB1815
A21R49	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A21R50	2100-0554	5		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
A21R51	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A21R52	0698-5437	6	1	RESISTOR 12K .1% .125W F TC=0+-50	28480	0698-5437
A21R53	0698-3491	8	1	RESISTOR 1K .1% .125W F TC=0+-50	28480	0698-3491
A21R54	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A21R55	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A21R56	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A21R57	0698-3162	0	3	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A21R58	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A21R59	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R60	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R61	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R62	0683-4715	0	1	RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A21R63	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R64	0757-0288	1	2	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A21R65	2100-0567	0	3	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	28480	2100-0567
A21R66	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A21R66	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A21R67	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R68	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R69	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A21R70	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A21R71	0683-1045	3	5	RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A21R72	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A21R73	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A21R74	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A21R75	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A21R77	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A21R78	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A21R79	0683-5135	0	1	RESISTOR 51K 5% .25W FC TC=-400/+800	01121	CB5135
A21R80	0683-1045	3		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A21R81	0683-4725	2	1	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A21R82	0683-0275	9	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A21R83	1810-0364	9	1	NETWORK-RES 6-SIP470.0 OHM X 5	01121	206A471
A21R84	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R85	0757-0489	4	1	RESISTOR 10 1% .25W F TC=0+-100	19701	MF52C1/4-T0-10R0-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21TL1	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A21TL2	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
A21TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21TP9	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A21U1	1826-0021	8	2	IC OP AMP GP TO-99 PKG	27014	LM310H
A21U2	1826-0109	3		IC OP AMP WB TO-99 PKG	34371	HA2-2625-B0593
A21U3	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A21U4	1826-0109	3		IC OP AMP WB TO-99 PKG	34371	HA2-2625-B0593
A21U5	1826-0581	5	2	IC SWITCH ANLG 16-DIP-C PKG	27014	LF13508D
A21U6	5061-0795	5	1	RESISTIVE NETWORK	28480	5061-0795
A21U7	1826-0109	3		IC OP AMP WB TO-99 PKG	34371	HA2-2625-B0593
A21U8	1826-0421	2	2	IC CONV RMS/DC 14-DIP-C PKG	24355	AD536AJ
A21U9	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A21U10	1826-0043	4	3	IC OP AMP GP TO-99 PKG	3L585	CA307T
A21U11	1826-0315	3	1	IC OP AMP GP QUAD 14-DIP-P PKG	27014	LM348N
A21U12	1820-1433	6	5	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A21U13	1820-1433	6		IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A21U14	1820-1730	6	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A21U15	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A21U16	1820-1934	2	2	IC CONV 8-B-D/A 16-DIP-C PKG	06665	DAC-08EQ
A21U17	1826-0102	6	2	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM312H
A21U18	1820-0427	6	1	IC MODULATOR TO-100 PKG	04713	MC1496G
A21U19	1826-0209	4	1	IC AUDIO AMPL 8-DIP-P PKG	27014	LM380N-8
A21U20	1826-0217	4		IC OP AMP GP DUAL TO-99 PKG	07933	RC4558T
A21U21	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A21U22	1826-0021	8		IC OP AMP GP TO-99 PKG	27014	LM310H
	1251-2551	4	2	CONNECTOR-SGL CONT SKT .033-IN-BSC-SZ	28480	1251-2551
	1251-3205	7		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-3205

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22	03746-60022	5	1	A/D CONVERTER ASSEMBLY	28480	03746-60022
A22C1	0160-2203	9	1	CAPACITOR-FXD 91PF +-5% 300VDC MICA 0+70	28480	0160-2203
A22C2	0180-2811	7	1	CAPACITOR-FXD 10UF+-20% 35VDC TA	28480	0180-2811
A22C3	0160-0576	5	11	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C4	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C5	0160-4389	6	1	CAPACITOR-FXD 100PF 5% 200VDC	28480	0160-4389
A22C6	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C7	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C8	0160-3405	5	1	CAPACITOR-FXD 2UF +-10% 50VDC MET-POLYC	28480	0160-3405
A22C9	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C10	0180-0474	4	4	CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A22C11	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A22C12	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C13	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C14	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C20	0160-3486	2	1	CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A22C21	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A22C22	0160-4031	5	1	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4031
A22C23	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C24	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C25	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A22C26	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A22C28	0160-4494	4	2	CAPACITOR-FXD 39PF 5% 200VDC	28480	0160-4494
A22C29	0160-4040	6	2	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4040
A22C30	0160-4494	4		CAPACITOR-FXD 39PF 5% 200VDC	28480	0160-4494
A22C31	0160-4040	6		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4040
A22C32	0160-4617	3	2	CAPACITOR-FXD 180PF 5% 200VDC	28480	0160-4617
A22C33	0160-4617	3		CAPACITOR-FXD 180PF 5% 200VDC	28480	0160-4617
A22CR1	1901-0044	5	6	DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A22CR2	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A22CR3	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A22CR4	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A22CR5	1902-0777	3	1	DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	1N825
A22CR6	1902-0956	0	1	DIODE-ZNR 8.2V 5% DO-35 PD=.4W TC=+.065%	28480	1902-0956
A22CR7	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A22CR8	1902-0948	0	1	DIODE-ZNR 3.9V 5% DO-35 PD=.4W TC=-.012%	28480	1902-0948
A22CR9	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A22L2	9140-0210	1	2	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A22L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A22L4	9100-3560	6	1	INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A22L5	9100-1635	2	1	INDUCTOR RF-CH-MLD 91UH 5% .166DX.385LG	28480	9100-1635
A22L6	9100-1631	8	1	INDUCTOR RF-CH-MLD 56UH 5% .166DX.385LG	28480	9100-1631
A22Q1	1854-0215	1	4	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A22Q2	1853-0066	8	1	TRANSISTOR PNP SI TO-92 PD=625MW	28480	1853-0066
A22Q3	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A22Q4	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A22Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A22Q6	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A22R1	0698-3454	3	1	RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A22R2	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R3	0683-2235	5	8	RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A22R4	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A22R5	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A22R6	2100-3095	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	02111	43P201
A22R7	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R8	0757-0464	5	1	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A22R9	0683-2245	7	2	RESISTOR 220K 5% .25W FC TC=-800/+900	01121	CB2245
A22R10	0683-1035	1	3	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A22R11	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A22R12	0757-0459	8	1	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A22R13	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A22R14	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A22R15	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R16	0757-0200	7	3	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A22R17	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A22R18	0683-4315	6	2	RESISTOR 430 5% .25W FC TC=-400/+600	01121	CB4315
A22R19	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A22R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A22R21	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A22R22	0683-2245	7		RESISTOR 220K 5% .25W FC TC=-800/+900	01121	CB2245
A22R23	0683-5125	8	2	RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A22R24	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A22R25	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22R26	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A22R27	0757-0289	2	2	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A22R28	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A22R30	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A22R31	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A22R32	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A22R33	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R34	1810-0365	0	1	NETWORK-RES 6-SIP2.2K OHM X 5	01121	206A222
A22R35	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A22R36	0683-1025	9	3	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A22R37	0757-0290	5	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A22R38	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A22R39	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A22R40	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A22R41	0683-3915	0	1	RESISTOR 390 5% .25W FC TC=-400/+600	01121	CB3915
A22R42	1810-0206	8	1	NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A22R43	0683-2725	8	1	RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A22R44	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A22R45	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A22R46	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A22R47	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A22R48	0698-7244	7	2	RESISTOR 2.15K 1% .05W F TC=0+-100	24546	C3-1/8-T0-2151-F
A22R49	0698-7257	2	1	RESISTOR 7.5K 1% .05W F TC=0+-100	24546	C3-1/8-T0-7501-F
A22R50	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+-100	24546	C3-1/8-T0-2151-F
A22R51	0683-4315	6		RESISTOR 430 5% .25W FC TC=-400/+600	01121	CB4315
A22R52	0683-7515	4	1	RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A22TL1	1460-1489	8	1	WIREFORM	28480	1460-1489
A22TP1	1251-0600	0	8	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A22TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A22TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A22TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A22TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A22TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A22TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A22TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A22U1	1820-1188	8	1	IC PL LOOP 16-DIP-P PKG	3L585	CD4046AF
A22U2	1820-1122	0	2	IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC14518BCP
A22U3	1820-1991	1	4	IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS390N
A22U4	1820-1198	0	2	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS03N
A22U5	1820-1197	9	5	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A22U6	1820-1122	0		IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC14518BCP
A22U7	1820-1745	3	1	IC GATE CMOS NOR QUAD 2-INP	04713	MC14001BCP
A22U8	1826-0217	4	1	IC OP AMP GP DUAL TO-99 PKG	07933	RC4558T
A22U9	1820-1991	1		IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS390N
A22U10	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A22U11	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A22U12	1820-1970	6	1	IC GATE CMOS OR QUAD 2-INP	04713	MC14071BCP
A22U13	1820-1991	1		IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS390N
A22U14	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A22U15	1826-0222	1	1	IC OP AMP GP QUAD 14-DIP-P PKG	07263	UA4136PC
A22U16	1826-0642	9	1	ICL-1405L (C16)	04713	MC1405L
A22U17	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A22U18	1820-0668	7	1	IC BFR TTL NON-INV HEX 1-INP	01295	SN7407N
A22U19	1826-0175	3	1	IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	LM319N
A22U20	1826-0581	5	1	IC SWITCH ANLG 16-DIP-C PKG	27014	LF13508D
A22U21	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A22U22	1820-1433	6	1	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A22U23	1820-2310	0	1	IC CNTR PMOS DECD UP/DOWN SYNCHRO	50088	MK50399N
A22U24	1820-1198	0		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS03N
A22U25	1820-1991	1		IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS390N
A22U26	1826-0476	7	1	IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A22U27	1820-1146	8	1	IC BFR CMOS NON-INV HEX	3L585	CD4050BE
A22U28	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A22U29	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A22Y1	0410-1209	4	1	CRYSTAL-1.377500 MHZ	28480	0410-1209
A22Y2	0410-1214	1	1	CRYSTAL-1.747500 MHZ	28480	0410-1214
				A22 MISCELLANEOUS PARTS		
	1251-3205	7	4	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-3205
	03746-04122	8	1	COVER-A22 BOARD	28480	03746-04122

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23	03746-60023	6	1	IMPAIRMENTS ASSEMBLY -OPTION 015-	28480	03746-60023
A23C1	0160-4426	2	12	CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C2	0160-5061	3	2	CAPACITOR-FXD 1000PF 1% 63VDC	28480	0160-5061
A23C3	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C4	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C4	0160-5061	3		CAPACITOR-FXD 1000PF 1% 63VDC	28480	0160-5061
A23C6	0160-4040	6	5	CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C7	0160-4389		2	CAPACITOR-FXD 100pF 5% 100VDC		
A23C8	0160-4389			CAPACITOR-FXD 100pF 5% 100VDC		
A23C10	0160-3486	2	2	CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A23C11	0160-4535	4	2	CAPACITOR-FXD 1UF 10% 50VDC	28480	0160-4535
A23C12	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C13	0160-0576	5	21	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C14	0160-3486	2		CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A23C15	0180-2818	4	3	CAPACITOR-FXD 2.2UF 35VDC TA	28480	0180-2818
A23C16	0160-5082	8	1	CAPACITOR-FXD 3000PF 1% 63VDC	28480	0160-5082
A23C17	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C18	0160-3936	7	1	CAPACITOR-FXD 700PF 1% 100VDC	28480	0160-3936
A23C19	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C20	0160-0341	2	1	CAPACITOR-FXD 640PF +-1% 300VDC MICA	28480	0160-0341
A23C21	0160-0686	8	6	CAPACITOR-FXD .47UF +-20% 50VDC CER	8M498	50547W474MP
A23C22	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C23	0160-0686	8		CAPACITOR-FXD .47UF +-20% 50VDC CER	8M498	50547W474MP
A23C24	0160-0686	8		CAPACITOR-FXD .47UF +-20% 50VDC CER	8M498	50547W474MP
A23C25	0160-0686	8		CAPACITOR-FXD .47UF +-20% 50VDC CER	8M498	50547W474MP
A23C26	0160-5273	9	1	CAPACITOR-FXD .056UF 1% 63VDC	28480	0160-5273
A23C27	0160-0686	8		CAPACITOR-FXD .47UF +-20% 50VDC CER	8M498	50547W474MP
A23C28	0160-5070	4	3	CAPACITOR-FXD 4700PF 1% 63VDC	28480	0160-5070
A23C29	0160-0686	8		CAPACITOR-FXD .47UF +-20% 50VDC CER	8M498	50547W474MP
A23C30	0180-2818	4		CAPACITOR-FXD 2.2UF 35VDC TA	28480	0180-2818
A23C31	0160-3402	2	2	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A23C33	0160-3402	2		CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A23C34	0180-0418	6	1	CAPACITOR-FXD 1UF+-20% 35VDC TA	28480	0180-0418
A23C35	0160-5162	5	2	CAPACITOR-FXD 1600PF 1% 63VDC	28480	0160-5162
A23C36	0160-5162	5		CAPACITOR-FXD 1600PF 1% 63VDC	28480	0160-5162
A23C37	0160-5203.	5	2	CAPACITOR-FXD 7500PF 1% 63VDC	28480	0160-5203
A23C38	0160-5203	5		CAPACITOR-FXD 7500PF 1% 63VDC	28480	0160-5203
A23C39	0160-5089	5	5	CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A23C40	0160-5089	5		CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A23C41	0160-5089	5		CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A23C42	0160-5089	5		CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A23C43	0160-5070	4		CAPACITOR-FXD 4700PF 1% 63VDC	28480	0160-5070
A23C44	0160-5070	4		CAPACITOR-FXD 4700PF 1% 63VDC	28480	0160-5070
A23C45	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C46	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C47	0160-3874	2	3	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A23C48	0160-5089	5		CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A23C49	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C50	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A23C51	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C52	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C53	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A23C54	0160-3508	9	3	CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A23C55	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A23C56	0180-2818	4		CAPACITOR-FXD 2.2UF 35VDC TA	28480	0180-2818
A23C57	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C58	0160-3879	7	4	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C59	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C62	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A23C65	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A23C66	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C67	0160-4040	6		CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C68	0160-4535	4		CAPACITOR-FXD 1UF 10% 50VDC	28480	0160-4535
A23C69	0160-4455	7	1	CAPACITOR-FXD 10UF 10% 50VDC	28480	0160-4455
A23C70	0160-4040	6		CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C71	0180-1746	5	6	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C72	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C73	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C74	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C75	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C76	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23C77	0180-2821	9	1	CAPACITOR-FXD 22UF 35VDC TA	28480	0180-2821
A23C78	0160-4040	6		CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C79	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C80	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C81	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C82	0160-6576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C84	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C85	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C87	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C88	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C89	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C90	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C92	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C93	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C94	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C95	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C96	0160-4040	6		CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C97	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C98	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C99	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C100	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C101	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C107	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23CR1	1901-0044	5	12	DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR2	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR3	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR4	1990-0450	4	1	LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A23CR5	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR6	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR7	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR8	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR9	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR10	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR11	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR12	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR13	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23L1	9100-3560		5	INDUCTOR RF-CH-MLD 5.6uH 5% .166DX.385LG		
A23L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A23L3	9100-3560	6	1	INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A23L4	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A23L5	9100-3560			INDUCTOR RF-CH-MLD 5.6uH 5% .166DX.385LG		
A23L6	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A23Q1	1854-0215	1	4	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A23Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A23Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A23Q4	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A23Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A23Q6	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A23R1	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A23R2	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A23R3	0698-3245	0	5	RESISTOR 20.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2052-F
A23R4	0698-3156	2	6	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R5	0698-8969	5	1	RESISTOR 145K 1% .125W F TC=0+-100	28480	0698-8969
A23R6	0698-6880	5	1	RESISTOR 16K .5% .125W F TC=0+-50	28480	0698-6880
A23R7	0698-4504	6	2	RESISTOR 69.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6982-F
A23R8	0757-0433	8	1	RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A23R9	0757-0442	9	32	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R10	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A23R12	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A23R13	0698-3157	3	6	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R14	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A23R15	0683-2235	5	4	RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R16	0683-5125	8	6	RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R17*	0757-0443		3	RESISTOR 10K 1% .125W F TC=0+-100		
A23R18	0698-8961	7	4	RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A23R19	0698-8961	7		RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A23R20	0698-3970		4	RESISTOR 2.61M 1% .125W F TC=0+-100		
A23R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R22	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A23R23	2100-3210	6	2	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	28480	2100-3210
A23R24	0683-1025	9	1	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A23R25	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2373-F
A23R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23R27	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R30	0683-1035	1	4	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A23R31	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A23R32	0683-3315	4	1	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A23R33	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R34	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R35	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R36	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A23R37	0757-0270	1	1	RESISTOR 249K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2493-F
A23R38	0698-3148	2	1	RESISTOR 102K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1023-F
A23R39	0698-3456	5	1	RESISTOR 287K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2873-F
A23R40	0698-4524	0	1	RESISTOR 174K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1743-F
A23R41	0698-4504	6		RESISTOR 69.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6982-F
A23R42	0698-4498	7	1	RESISTOR 53.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5362-F
A23R43	2100-0558	9	2	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A23R44	0757-0462		2	RESISTOR 75K 1% .125W F TC=0+-100		
A23R45	0698-4518	2	1	RESISTOR 137K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1373-F
A23R46	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A23R47	0698-3457	6	2	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A23R48	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23R49	0698-4512	6	1	RESISTOR 88.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8872-F
A23R50	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A23R51	0698-4529	5	1	RESISTOR 226K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2263-F
A23R52	0698-3460	1	1	RESISTOR 422K 1% .125W F TC=0+-100	28480	0698-3460
A23R53	2100-0558	9		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A23R54	0757-0123		1	RESISTOR 34.8K 1% .125W F TC=0+-100		
A23R55	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A23R56	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R57	0757-0463	4	1	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A23R58	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A23R59	0698-8961	7		RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A23R60	0757-0280	3	6	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R61	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A23R62	0698-8961	7		RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A23R63	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R64	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R65	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R67	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R68	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R69	0757-0123	3	3	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A23R70	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A23R71	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R72	0757-0449	6	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A23R73	0698-4502	4	2	RESISTOR 64.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6492-F
A23R74	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R75	0698-3245	0		RESISTOR 20.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2052-F
A23R76	0698-4493	2	2	RESISTOR 34K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3402-F
A23R77	0698-4493	2		RESISTOR 34K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3402-F
A23R78	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A23R79	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R80	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R81	0757-0446	3	1	RESISTOR 15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1502-F
A23R82	0698-3245	0		RESISTOR 20.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2052-F
A23R83	0698-3245	0		RESISTOR 20.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2052-F
A23R84	0757-0443	0	2	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A23R85	0698-3245	0		RESISTOR 20.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2052-F
A23R86	0698-3228	9	3	RESISTOR 49.9K 1% .125W F TC=0+-100	28480	0698-3228
A23R87	0698-3228	9		RESISTOR 49.9K 1% .125W F TC=0+-100	28480	0698-3228
A23R88	0698-3228	9		RESISTOR 49.9K 1% .125W F TC=0+-100	28480	0698-3228
A23R89	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A23R90	0698-4205	4	1	RESISTOR 21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2102-F
A23R91	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R92	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R93	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R94	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R95	0698-4480	7	3	RESISTOR 15.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1582-F
A23R96	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R97	2100-3091	1	2	RESISTOR-TRMR 2K 10% C TOP-ADJ 17-TRN	32997	3292W-1-202
A23R98	0698-4495	4	2	RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A23R99	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R100	0698-4480	7		RESISTOR 15.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1582-F
A23R101	0698-3268	7	1	RESISTOR 11.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1152-F
A23R102	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A23R103	2100-3206	6	2	RESISTOR-TRMR 10K 10% C TOP-ADJ 17-TRN	32997	3292W-1-103

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23R104	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R105	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R106	0698-4480	7		RESISTOR 15.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1582-F
A23R107	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R108	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R109	2100-3091	1		RESISTOR-TRMR 2K 10% C TOP-ADJ 17-TRN	32997	3292W-1-202
A23R110	0698-4495	4		RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A23R111	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R112	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R113	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R114	0698-3155	1	3	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A23R115	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A23R117	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R118	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A23R119	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R120	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R121	0698-4489	6	1	RESISTOR 28K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2802-F
A23R122	0757-0422	5	1	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A23R123	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R124	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R125	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R126	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R127	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R128	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R129	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R130	0698-4196	2	1	RESISTOR 1.07K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1071-F
A23R131	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R132	2100-3213	9	1	RESISTOR-TRMR 200K 10% C TOP-ADJ 1-TRN	28480	2100-3213
A23R133	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A23R134	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A23R135	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A23R136	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A23R137	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R138	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R139	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R140	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R141	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A23R142	2100-3286	6		RESISTOR-TRMR 10K 10% C TOP-ADJ'17-TRN	32997	3292W-1-103
A23R143	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A23R144	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R145	0698-8517	9	1	RESISTOR 1K 10% .125W F TC=+3000+-250	28480	0698-8517
A23R146	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A23R147	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A23R148	0698-8959	3	1	RESISTOR 619K 1% .125W F TC=0+-100	28480	0698-8959
A23R149	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A23R150	2100-3210	6		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	28480	2100-3210
A23R151	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R152	0698-4502	4		RESISTOR 64.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6492-F
A23R153	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R154	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R155	0757-0467	8	2	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A23R156	0757-0467	8		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A23R158	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R159	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R160	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R161	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R162	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A23R163	0757-0443	7	1	RESISTOR 11K 5% .25W CC TC=-900/+1100	01121	CB1065
A23R164	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23R165	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23R166	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R167	0757-1094			RESISTOR 1.33K 1% .125W F TC = 0 + – 100		
A23R168	0757-0428			RESISTOR 1.62K		
A23R169	0698-3457			RESISTOR 316K		
A23R170	0757-0442			RESISTOR 10K		
A23TL1	1460-1489	8	4	WIREFORM	28480	1460-1489
A23TL2	1460-1489	8		WIREFORM	28480	1460-1489
A23TL3	1460-1489	8		WIREFORM	28480	1460-1489
A23TL4	1460-1489	8		WIREFORM	28480	1460-1489
A23TP1	1251-0600	0	23	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP9	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP10	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP11	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23TP12	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP13	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP14	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP15	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP16	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP17	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP18	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP19	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP20	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP21	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP22	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP23	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP24	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23U1	1826-0522	4	2	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL074CN
A23U2	1826-0102	6	3	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM312H
A23U3	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A23U4	1820-0630	3	1	IC MISC TTL	04713	MC4044P
A23U5	1820-2466		1	IC TIMER TTL		
A23U6	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A23U7	1826-0111	7	1	IC OP AMP GP DUAL TO-99 PKG	3L585	CA1458T
A23U8	1826-0410	9	8	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U9	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U10	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U11	1826-0476	7	9	IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U12	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U13	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U14	1826-0417	6	2	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A23U15	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U16	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U17	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U18	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U19	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U20	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A23U21	1826-0522	4		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01275	TL074CN
A23U22	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U23	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U24	1820-1433	6	2	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A23U25	1820-1433	6		IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A23U26	1820-1730	6	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A23U27	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A23U28	1820-1934	2	1	IC CONV 8-B-D/A 16-DIP-C PKG	06665	DAC-08EQ
A23U29	1826-0102	6		IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM312H
A23U30	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A23U31	1820-1422	3	1	IC MV TTL LS MONOSTBL RETRIG	01295	SN74LS122N
A23U32	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U33	1820-3352		1	IC CNTR TTL		
A23U34	1820-0054		1	IC BFR TTL		
A23U35	1026-0421	2	1	IC CONV RMS/DC 14-DIP-C PKG	24355	AD536AJ
A23U36	1826-0102	6		IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM312H
A23U37	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01275	TL601CP
A23U38	1826-0043	4	1	IC OP AMP GP TO-99 PKG	3L585	CA307T
A23U39	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U40	1820-1971	7		IC DIGITAL		
U23U41	1826-0476			IC DIGITAL		
				A23 MISCELLANEOUS PARTS		
	1251-3205	7	9	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-3205
	1480-0116	8	2	PIN-GRV .062-IN DIA .25-IN-LG STL	28480	1480-0116
	1530-1942	7	3	CLEVIS	28480	1530-1942
	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
	4040-0751	8	1	EXTR-PC BD ORN POLYC .062-BD-THKNS	28480	4040-0751
	03746-04170	6	1	COVER-A23 BOARD	28480	03746-04170

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23	03746-60123	7	1	IMPAIRMENTS ASSEMBLY -OPTION 016-	28480	03746-60123
A23C1	0160-4426	2	12	CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C2	0160-5061	3	2	CAPACITOR-FXD 1000PF 1% 63VDC	28480	0160-5061
A23C3	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C4	0160-5061	3		CAPACITOR-FXD 1000PF 1% 63VDC	28480	0160-5061
A23C5	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C6	0160-4040	6	5	CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C7	0160-4389		2	CAPACITOR-FXD 100pF 5% 100VDC	28480	0160-4616
A23C8	0160-4389			CAPACITOR-FXD 100pF 5% 100VDC	28480	0160-4616
A23C10	0160-3486	2	2	CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A23C11	0160-4535	4	2	CAPACITOR-FXD 1UF 10% 50VDC	28480	0160-4535
A23C12	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C13	0160-0576	5	21	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C14	0160-3486	2		CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A23C15	0180-2818	4	3	CAPACITOR-FXD 2.2UF+-20% 35VDC TA	28480	0180-2818
A23C16	0160-5082	8	1	CAPACITOR-FXD 3000PF 1% 63VDC	28480	0160-5082
A23C17	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C18	0160-3936	7	1	CAPACITOR-FXD 700PF 1% 100VDC	28480	0160-3936
A23C19	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C20	0160-0341	2	1	CAPACITOR-FXD 640PF +-1% 300VDC MICA	28480	0160-0341
A23C21	0160-0685	7	6	CAPACITOR-FXD 0.1UF 1% 63VDC	28480	0160-0685
A23C22	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C23	0160-0685	7		CAPACITOR-FXD 0.1UF 1% 63VDC	28480	0160-0685
A23C24	0160-0685	7		CAPACITOR-FXD 0.1UF 1% 63VDC	28480	0160-0685
A23C25	0160-0685	7		CAPACITOR-FXD 0.1UF 1% 63VDC	28480	0160-0685
A23C26	0160-5273	9	1	CAPACITOR-FXD .056UF 1% 63VDC	28480	0160-5273
A23C27	0160-0685	7		CAPACITOR-FXD 0.1UF 1% 63VDC	28480	0160-0685
A23C28	0160-5070	4	3	CAPACITOR-FXD 4700PF 1% 63VDC	28480	0160-5070
A23C29	0160-0685	7		CAPACITOR-FXD 0.1UF 1% 63VDC	28480	0160-0685
A23C30	0180-2818	4		CAPACITOR-FXD 2.2UF+-20% 35VDC TA	28480	0180-2818
A23C31	0160-3402	2	2	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A23C33	0160-3402	2		CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
A23C34	0180-0418	6	1	CAPACITOR-FXD 1UF+-20% 35VDC TA	28480	0180-0418
A23C35	0160-5090	8	2	CAPACITOR-FXD 2700PF 1% 63VDC	28480	0160-5090
A23C36	0160-5090	8		CAPACITOR-FXD 2700PF 1% 63VDC	28480	0160-5090
A23C37	0160-5062	4	2	CAPACITOR-FXD 5100PF 1% 63VDC	28480	0160-5062
A23C38	0160-5062	4		CAPACITOR-FXD 5100PF 1% 63VDC	28480	0160-5062
A23C39	0160-5070	4		CAPACITOR-FXD 4700PF 1% 63VDC	28480	0160-5070
A23C40	0160-5070	4		CAPACITOR-FXD 4700PF 1% 63VDC	28480	0160-5070
A23C41	0160-5089	5	3	CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A23C42	0160-5089	5		CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A23C43	0160-5159	0	2	CAPACITOR-FXD 820PF 1% 63VDC	28480	0160-5159
A23C44	0160-5159	0		CAPACITOR-FXD 820PF 1% 63VDC	28480	0160-5159
A23C45	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C46	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C47	0160-3874	2	3	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A23C48	0160-5089	5		CAPACITOR-FXD 2000PF 1% 63VDC	28480	0160-5089
A23C49	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C50	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A23C51	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C52	0160-4426	2		CAPACITOR-FXD 0.01UF 1% 100VDC	28480	0160-4426
A23C53	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A23C54	0160-3508	9	3	CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A23C55	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A23C56	0180-2818	4		CAPACITOR-FXD 2.2UF+-20% 35VDC TA	28480	0180-2818
A23C57	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C58	0160-3879	7	4	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C59	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C62	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A23C65	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A23C66	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C67	0160-4040	6		CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C68	0160-4535	4		CAPACITOR-FXD 1UF 10% 50VDC	28480	0160-4535
A23C69	0160-4455	7	1	CAPACITOR-FXD 10UF 10% 50VDC	28480	0160-4455
A23C70	0160-4040	6		CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C71	0180-1746	5	6	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C72	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C73	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C74	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C75	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A23C76	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23C77	0180-2821	9	1	CAPACITOR-FXD 22UF+-20% 35VDC TA	28480	0180-2821
A23C78	0160-4040	6		CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C79	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C80	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C81	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C82	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C84	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C85	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C87	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C88	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C89	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C90	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C92	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C93	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C94	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C95	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C96	0160-4040	6		CAPACITOR-FXD 1000PF 5% 100VDC	28480	0160-4040
A23C97	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C98	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C99	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C100	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C101	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A23C107	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23L1 to A23L6				same as for A23 03746-60023		
A23Q1	1854-0215	1	4	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A23Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A23Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A23Q4	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A23Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A23Q6	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A23R1	0757-0199	3	3	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A23R2	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A23R3	0698-3245	0	1	RESISTOR 20.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2052-F
A23R4	0698-3156	2	5	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R5	0698-8969	5	1	RESISTOR 145K 1% .125W F TC=0+-100	28480	0698-8969
A23R6	0698-6880	5	1	RESISTOR 16K .5% .125W F TC=0+-50	28480	0698-6880
A23R7	0698-4504	6	2	RESISTOR 69.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6982-F
A23R8	0757-0433	8	1	RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A23R9	0757-0442	9	31	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R10	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A23R12	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A23R13	0698-3157	3	6	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R14	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A23R15	0683-2235	5	4	RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R16	0683-5125	8	6	RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R17*	0757-0443			RESISTOR 10K 1% .125W F TC=0+-100		
A23R18	0698-8961	7	4	RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A23R19	0698-8961	7		RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A23R20	0698-3970			RESISTOR 2.61M 1% .125W F TC=0+-100		
A23R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R22	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A23R24	0683-1025	9	1	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A23R25	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2373-F
A23R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R27	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R30	0683-1035	1	4	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A23R31	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A23R32	0683-3315	4	1	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A23R33	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R34	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R35	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R36	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A23R37	0757-0270	1	1	RESISTOR 249K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2493-F
A23R38	0698-3148	2	3	RESISTOR 102K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1023-F
A23R39	0698-3456	5	1	RESISTOR 287K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2873-F
A23R40	0698-4524	0	1	RESISTOR 174K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1743-F
A23R41	0698-4504	6		RESISTOR 69.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6982-F
A23R42	0698-4498	7	1	RESISTOR 53.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5362-F
A23R44	0757-0462			RESISTOR 75K 1% .125W F TC=0+-100		
A23R45	0698-4518	2	1	RESISTOR 137K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1373-F
A23R46	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A23R47	0698-3457	6	2	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A23R48	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23R49	0698-4512	6	1	RESISTOR 88.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8872-F
A23R50	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23R51	0698-4529	5	1	RESISTOR 226K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2263-F
A23R52	0698-3460	1	1	RESISTOR 422K 1% .125W F TC=0+-100	28480	0698-3460
A23R54	0757-0123			RESISTOR 34.8K 1% .125W F TC=0+-100		
A23R55	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A23R56	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R57	0757-0463	4	1	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A23R58	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A23R59	0698-8961	7		RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A23R60	0757-0280	3	6	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R61	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A23R62	0698-8961	7		RESISTOR 909K 1% .125W F TC=0+-100	28480	0698-8961
A23R63	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R64	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R65	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R67	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R68	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R69	0757-0445	2	2	RESISTOR 13K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1302-F
A23R70	0757-0445	2		RESISTOR 13K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1302-F
A23R71	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A23R72	0757-0449	6	2	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A23R73	0698-3148	2		RESISTOR 102K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1023-F
A23R74	0698-4507	9	1	RESISTOR 76.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7682-F
A23R75	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R76	0698-4495	4	4	RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A23R77	0698-4495	4		RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A23R78	0698-4482	9	1	RESISTOR 17.4K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1742-F
A23R79	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R81	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A23R82	0757-0451	0	2	RESISTOR 24.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2432-F
A23R83	0757-0451	0		RESISTOR 24.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2432-F
A23R84	0698-3519	1	1	RESISTOR 12.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1242-F
A23R85	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A23R86	0698-3271	2	3	RESISTOR 115K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1153-F
A23R87	0698-3271	2		RESISTOR 115K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1153-F
A23R88	0698-3271	2		RESISTOR 115K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1153-F
A23R89	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A23R90	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A23R91	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R92	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R93	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R94	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R95	0698-4480	7	3	RESISTOR 15.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1582-F
A23R96	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R98	0698-4495	4		RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A23R99	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R100	0698-4480	7		RESISTOR 15.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1582-F
A23R101	0698-3268	7	1	RESISTOR 11.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1152-F
A23R102	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A23R104	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R105	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R106	0698-4480	7		RESISTOR 15.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1582-F
A23R107	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R108	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R110	0698-4495	4		RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A23R111	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R112	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R113	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R114	0698-3155	1	3	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A23R115	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A23R117	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R118	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A23R119	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R120	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A23R121	0698-4489	6	1	RESISTOR 28K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2802-F
A23R122	0757-0422	5	1	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A23R123	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R124	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R125	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R126	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R127	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R128	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R129	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R130	0698-4196	2	1	RESISTOR 1.07K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1071-F
A23R131	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23R133	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A23R134	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A23R135	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A23R136	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A23R137	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R138	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R139	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A23R140	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R141	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A23R143	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A23R144	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R145	0698-8517	9	1	RESISTOR 1K 10% .125W F TC=+3000+-250	28480	0698-8517
A23R146	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A23R147	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A23R148	0698-8959	3	1	RESISTOR 619K 1% .125W F TC=0+-100	28480	0698-8959
A23R149	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A23R151	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A23R152	0698-3148	2		RESISTOR 102K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1023-F
A23R153	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R154	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R155	0757-0467	8	2	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A23R156	0757-0467	8		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A23R158	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R159	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R160	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R161	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R162	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A23R163	0757-0443	7	1	RESISTOR 11K 5% .25W CC TC=-900/+1100		
A23R164	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23R165	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23R166	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R167	0757-1094			RESISTOR 1.33K 1% .125W F TC = 0 + – 100		
A23R168	0757-0428			RESISTOR 1.62K		
A23R169	0698-3457			RESISTOR 316K		
A23R170	0757-0442			RESISTOR 10K		
A23TL1	1460-1489	8	4	WIREFORM	28480	1460-1489
A23TL2	1460-1489	8		WIREFORM	28480	1460-1489
A23TL3	1460-1489	8		WIREFORM	28480	1460-1489
A23TL4	1460-1489	8		WIREFORM	28480	1460-1489
A23TP1	1251-0600	0	23	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP9	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP10	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP11	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP12	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP13	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP14	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP15	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP16	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP17	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP18	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP19	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP20	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP21	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP22	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP23	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23TP24	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A23U1	1826-0522	4	2	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL074CN
A23U2	1826-0102	6	3	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM312H
A23U3	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A23U4	1820-0630	3	1	IC MISC TTL	04713	MC4044P
A23U5	1826-2466	0	1	IC TIMER		
A23U6	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A23U7	1826-0111	7	1	IC OP AMP GP DUAL TO-99 PKG	3L585	CA1458T
A23U8	1826-0410	9	8	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U9	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U10	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U11	1826-0476	7	9	IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U12	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U13	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U14	1826-0417	6	2	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A23U15	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23U16	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U17	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U18	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U19	1826-0410	9		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A23U20	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A23U21	1826-0522	4		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL074CN
A23U22	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U23	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U24	1820-1433	6	2	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A23U25	1820-1433	6		IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A23U26	1820-1730	6	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A23U27	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A23U28	1820-1934	2	1	IC CONV 8-B-D/A 16-DIP-C PKG	06665	DAC-08EQ
A23U29	1826-0102	6		IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM312H
A23U30	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A23U31	1820-1422	3	1	IC MV TTL LS MONOSTBL RETRIG	01295	SN74LS122N
A23U32	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U33	1820-3352		1	IC CNTR		
A23U34	1820-0054		1	IC TTL		
A23U35	1826-0421	2	1	IC CONV RMS/DC 14-DIP-C PKG	24355	AD536AJ
A23U36	1826-0102	6		IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM312H
A23U37	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U38	1826-0043	4	1	IC OP AMP GP TO-99 PKG	3L585	CA307T
A23U39	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U41	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A23U40	1820-1971			IC DIGITAL		
	1200-0638	7	1	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
	1251-3205	7	9	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-3205
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	1530-1942	7	3	CLEVIS	28480	1530-1942

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23	03746-60123	7	1	IMPAIRMENTS ASSEMBLY -OPTION 016-	28480	03746-60123
A23CR1	1901-0044	5	12	DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR2	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR3	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR4	1990-0450	4	1	LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A23CR5	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR6	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR7	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR8	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR9	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR10	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR11	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR12	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23CR13	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A23L1	9140-0210	1	5	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A23L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A23L3	9100-3560	6	1	INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A23L4	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A23L5	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A23L6	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A23R23	2100-3210	6	2	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	28480	2100-3210
A23R43	2100-0558	9	2	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A23R53	2100-0558	9		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A23R97	2100-3091	1	2	RESISTOR-TRMR 2K 10% C TOP-ADJ 17-TRN	32997	3292W-1-202
A23R103	2100-3286	6	2	RESISTOR-TRMR 10K 10% C TOP-ADJ 17-TRN	32997	3292W-1-103
A23R109	2100-3091	1		RESISTOR-TRMR 2K 10% C TOP-ADJ 17-TRN	32997	3292W-1-202
A23R132	2100-3213	9	1	RESISTOR-TRMR 200K 10% C TOP-ADJ 1-TRN	28480	2100-3213
A23R142	2100-3286	6		RESISTOR-TRMR 10K 10% C TOP-ADJ 17-TRN	32997	3292W-1-103
A23R150	2100-3210	6		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	28480	2100-3210
				A23 MISCELLANEOUS PARTS		
	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
	4040-0751	8	1	EXTR-PC BD ORN POLYC .062-BD-THKNS	28480	4040-0751
	03746-04170	6	1	COVER-A23 BOARD	28480	03746-04170

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A30	03746-60030	5	1	FRACTIONAL N -N ASSEMBLY	28480	03746-60030
A30C1	0180-0228	6	13	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A30C2	0180-0229	7	3	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A30C3	0160-3879	7	74	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C15	0140-0191	8	3	CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A30L2	9100-3560	6	12	INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A30L3	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A30MP1	03746-04130	8	1	COVER	28480	03746-04130
A30Q1	1853-0448	0	2	TRANSISTOR PNP SI TO-92 PD=625MW	04713	MPSH81
A30Q2	1854-0019	3	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A30R1	1810-0121	6	2	NETWORK-RES 9-SIP1.0K OHM X 8	91637	CSP09C07-102J
A30R2	0698-3492	9	1	RESISTOR 2.67K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2671-F
A30R3	0757-0280	3	11	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R4	0683-1025	9	20	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A30R5	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A30R6	0683-2705	4	6	RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A30R7	0683-7505	2	1	RESISTOR 75 5% .25W FC TC=-400/+500	01121	CB7505
A30R8	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A30R9	0683-3325	6	1	RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A30R10	0683-5115	6	2	RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A30U1	1820-1251	6	3	IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A30U2	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A30U3	1820-1869	2	1	IC CNTR TTL S DECD ASYNCHRO	01295	SN74S196N
A30U4	1820-0686	9	2	IC GATE TTL S AND TPL 3-INP	01295	SN74S11N
A30U5	1820-0629	0	7	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A30U6	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A30U7	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A30U8	1820-0681	4	2	IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
A30U9	1820-1196	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A30U10	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A30U11	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A30U12	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A30U13	1820-0686	9		IC GATE TTL S AND TPL 3-INP	01295	SN74S11N
A30U14	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A30U15	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
A30U16	1820-2004	9	1	IC MISC NMOS	28480	1820-2004
A30U17	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
A30U18	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
				A30 MISCELLANEOUS PART		
	1251-0600	0	28	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	9170-0817	7	1	CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
A31	03746-60031	6	1	FRACTIONAL N VCO ASSEMBLY	28480	03746-60031
A31C1	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A31C2	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A31C3	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A31C4	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A31C5	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A31C7	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A31C8	0160-0576	5	18	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A31C9	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A31C10	0160-0570	9	3	CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A31C11	0160-0570	9		CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A31C12	0160-0570	9		CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A31C13	0160-3878	6	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A31C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C15	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A31C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31C17	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A31C18	0160-4389	6	1	CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A31C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C21	0180-0197	8	2	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A31C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C26	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A31C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C28	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C31	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C35	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C36	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C37	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C38	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C40	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C41	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C42	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31C43	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A31CR2	1902-3105	7	1	DIODE-ZNR 5.62V 2% DO-35 PD=.4W	28480	1902-3105
A31CR3	1901-0518	8	7	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A31CR4	0122-0089	5	4	DIODE-VVC 29PF 10% C3/C25-MIN=5 BVR=30V	04713	MV109
A31CR5	0122-0089	5		DIODE-VVC 29PF 10% C3/C25-MIN=5 BVR=30V	04713	MV109
A31CR6	0122-0089	5		DIODE-VVC 29PF 10% C3/C25-MIN=5 BVR=30V	04713	MV109
A31CR7	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A31CR8	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A31CR9	1901-0040	1	21	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A31CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A31CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A31CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A31DS1	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A31J1	1250-1512	3	8	CONNECTOR-RF-SMB	28480	1250-1512
A31L1	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A31L2	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A31L3	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A31L4	9140-0350	0	1	COIL-VAR 504NH-616NH Q=140 PC-MTG	28480	9140-0350
A31L5	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A31L6	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A31L7	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A31MP1	03746-04131	9	1	COVER	28480	03746-04131
A31Q1	1854-0345	8	8	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q5	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q6	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q8	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A31Q9	1854-0215	1	4	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A31R1	0698-4421	6	1	RESISTOR 249 1% .125W F TC=0+-100	24546	C4-1/8-T0-249R-F
A31R2	0683-1035	1	12	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R3	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A31R4	2100-3210	6	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	28480	2100-3210
A31R5	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R6	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R7	0683-2025	1	5	RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A31R8	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R9	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A31R10	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R11	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R12	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R14	0683-3315	4	18	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A31R15	0757-0273	4	3	RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A31R16	0698-3497	4	1	RESISTOR 6.04K 1% .125W F TC=0+-100	24546	C4-1/8-T0-604R-F
A31R17	0757-0405	4	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A31R18	0683-3035	5	3	RESISTOR 30K 5% .25W FC TC=-400/+800	01121	CB3035
A31R19	0683-4705	8	23	RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R20	0683-3035	5		RESISTOR 30K 5% .25W FC TC=-400/+800	01121	CB3035
A31R21	0683-3035	5		RESISTOR 30K 5% .25W FC TC=-400/+800	01121	CB3035

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31R22	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R23	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A31R24	0698-3223	4	1	RESISTOR 1.24K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1241-F
A31R25	0757-0416	7	4	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A31R26	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A31R27	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A31R28	0698-4443	2	1	RESISTOR 4.53K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4531-F
A31R29	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R30	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A31R30	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A31R31	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A31R32	0757-0401	0	10	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R33	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A31R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A31R36	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R37	0757-0420	3	3	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A31R38	0698-3443	0	3	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A31R39	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A31R40	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R41	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R42	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A31R43	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A31R44	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R45	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A31R46	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A31R47	0698-3434	9	1	RESISTOR 34.8 1% .125W F TC=0+-100	24546	C4-1/8-T0-34R8-F
A31R48	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R49	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R50	0757-0413	4	1	RESISTOR 392 1% .125W F TC=0+-100	24546	C4-1/8-T0-392R-F
A31R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A31R52	0698-4424	9	1	RESISTOR 1.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1401-F
A31R53	1810-0121	6		NETWORK-RES 9-SIP1.0K OHM X 8	91637	CSP09C07-102J
A31R56	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A31R57	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A31R58	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R61	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R62	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A31R75	0757-0394	0	5	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A31U1	1826-0139	9	2	IC OP AMP GP DUAL 8-DIP-P PKG	3L585	CA1458G
A31U2	1826-0139	9		IC OP AMP GP DUAL 8-DIP-P PKG	3L585	CA1458G
A31U3	1820-1383	5	3	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A31U4	1820-0803	2	3	IC GATE ECL OR-NOR TPL	04713	MC10105P
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A32	03746-60032	7	1	FRACTIONAL N PHASE DETECTOR ASSEMBLY	28480	03746-60032
A32C1	0140-0197	4	2	CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A32C2	0140-0197	4		CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A32C3	0180-0210	6	4	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A32C4	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A32C5	0160-2257	3	1	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	28480	0160-2257
A32C6	0160-2222	2	1	CAPACITOR-FXD 1500PF +-5% 300VDC MICA	28480	0160-2222
A32C7	0160-2250	6	1	CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A32C8	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A32C9	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A32C10	0160-2204	0	2	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A32C11	0160-3533	0	1	CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-3533
A32C12	0160-2236	8	1	CAPACITOR-FXD 1PF +-.25PF 500VDC CER	28480	0160-2236
A32C13	0160-4461	5	1	CAPACITOR-FXD 150PF +-2.5% 160VDC POLYP	28480	0160-4461
A32C14	0160-3910	7	1	CAPACITOR-FXD .1UF +-5% 100VDC MET-POLYC	28480	0160-3910
A32C16	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A32C17	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A32C18	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A32C19	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A32C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C23	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A32C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C26	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C28	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C29	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A32C30	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A32C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C36	0160-3508	9	5	CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A32C39	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A32C80	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A32C81	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32C83	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A32CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR3	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A32CR4	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A32CR5	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A32CR6	1901-0518	8		DIODE-SM SIG SCHOTTKY	28480	1901-0518
A32CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR11	1902-0954	8	1	DIODE-ZNR 6.8V 5% DO-35 PD=.4W TC=+.057%	28480	1902-0954
A32CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR14	1902-3085	2	1	DIODE-ZNR 4.75V 5% DO-35 PD=.4W	28480	1902-3085
A32CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR20	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A32CR39	1902-0680	7	1	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.4W	24046	1N827
A32L1	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A32L2	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A32L3	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A32L80	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A32MP1	03746-04132	0	1	COVER	28480	03746-04132
A32Q1	1853-0089	5	11	TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q2	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q3	1854-0296	2	11	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q4	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q5	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q8	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A32Q10	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q11	1855-0082	2	1	TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A32Q16	1855-0081	1	4	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A32Q17	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A32Q18	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q19	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q20	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q21	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q22	1855-0308	5	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0308
A32Q24	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q25	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q26	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q27	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q28	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q29	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q30	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32Q31	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q32	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A32Q33	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A32Q34	1854-0215	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	2N3904
A32Q80	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q81	1854-0296	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0296
A32R1	0757-0398	4	3	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A32R2	0757-0161	9	4	RESISTOR 604 1% .125W F TC=0+-100	24546	C4-1/8-T0-604R-F
A32R3	0698-3512	4	5	RESISTOR 1.18K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1181-F
A32R4	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R5	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A32R6	0757-0161	9		RESISTOR 604 1% .125W F TC=0+-100	24546	C4-1/8-T0-604R-F
A32R7	0698-3512	4		RESISTOR 1.18K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1181-F
A32R8	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R9	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A32R10	0683-4715	0	16	RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A32R11	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R12	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A32R13	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R14	0757-0161	9		RESISTOR 604 1% .125W F TC=0+-100	24546	C4-1/8-T0-604R-F
A32R15	0757-0407	6	1	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A32R16	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A32R17	0683-2005	7	2	RESISTOR 20 5% .25W FC TC=-400/+500	01121	CB2005
A32R18	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A32R19	0698-3202	9	1	RESISTOR 1.74K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1741-F
A32R21	0698-6467		1	RESISTOR 16.9K 1% .125W F TC=0+-100	24546	

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A32R22	0757-0443	0	4	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A32R23	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A32R24	0698-4431	8	6	RESISTOR 2.05K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2051-F
A32R25	0698-4478	3	1	RESISTOR 10.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1072-F
A32R26	0698-4435	2	3	RESISTOR 2.49K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2491-F
A32R27	0698-3512	4		RESISTOR 1.18K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1181-F
A32R28	0698-3179	9	3	RESISTOR 2.55K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2551
A32R29	0698-4202	1	3	RESISTOR 8.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8871-F
A32R30	0698-4435	2		RESISTOR 2.49K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2491-F
A32R31	0698-3512	4		RESISTOR 1.18K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1181-F
A32R32	0698-3179	9		RESISTOR 2.55K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2551
A32R33	0698-4202	1		RESISTOR 8.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8871-F
A32R34	0698-4435	2		RESISTOR 2.49K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2491-F
A32R35	0698-3512	4		RESISTOR 1.18K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1181-F
A32R36	0698-3179	9		RESISTOR 2.55K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2551
A32R37	0698-4202	1	1	RESISTOR 8.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8871-F
A32R38	0683-1015	7	1	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A32R39	0683-1525	4	8	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A32R40	0757-0442	9	8	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R41	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R42	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R43	0698-4431	8		RESISTOR 2.05K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2051-F
A32R44	0698-4431	8		RESISTOR 2.05K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2051-F
A32R45	0698-4431	8		RESISTOR 2.05K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2051-F
A32R49	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R50	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R51	2100-3354	9	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	28480	2100-3354
A32R54	2100-3211	7	2	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	28480	2100-3211
A32R59	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A32R60	0698-4431	8		RESISTOR 2.05K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2051-F
A32R61	2100-3383	4	1	RESISTOR-TRMR 50 10% C TOP-ADJ 1-TRN	28480	2100-3383
A32R62	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A32R63	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R64	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R65	0683-1065	7	1	RESISTOR 10M 5% .25W CC TC=-900/+1100	01121	CB1065
A32R66	0757-0446	3	2	RESISTOR 15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1502-F
A32R67	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R68	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R69	0757-0446	3		RESISTOR 15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1502-F
A32R70	0698-4431	8		RESISTOR 2.05K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2051-F
A32R71	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A32R72	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R73	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A32R74	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A32R75	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A32R76	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A32R77	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R78	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R79	0757-0273	4		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A32R80	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R81	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R82	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R83	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R84	0683-2005	7		RESISTOR 20 5% .25W FC TC=-400/+500	01121	CB2005
A32R85	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R86	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A32R87	0757-0427	0	2	RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A32R88	0757-0427	0		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A32R89	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A32R90	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A32R91	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R92	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A32R93	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A32R94	0698-4512	6	1	RESISTOR 88.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8872-F
A32R95	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A32R96	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A32R97	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A32R98	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A32R99	0757-0273	4		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A32R100	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A32R101	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A32R102	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A32R103	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A32R105	0757-0161	9		RESISTOR 604 1% .125W F TC=0+-100	24546	C4-1/8-T0-604R-F
A32R106	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A32R107	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A32R110	2100-3211	7		RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	28480	2100-3211
A32R113	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A32U1	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A32U2	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A32U3	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A32U4	1826-0043	4	2	IC OP AMP GP TO-99 PKG	3L585	CA307T
A32U5	1821-0001	4	1	TRANSISTOR ARRAY 14-PIN PLSTC DIP	3L585	CA3046
A32U6	1810-0294	4	1	NETWORK-RESISTOR 16 PIN DIP; RES	28480	1810-0294
A32U7	1826-0021	8	1	IC OP AMP GP TO-99 PKG	27014	LM310H
A32U8	1820-0471	0	1	IC INV TTL HEX 1-INP	01295	SN7406N
				A32 MISCELLANEOUS PARTS		
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-2501	4	13	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8	4	WIREFORM BE CU AG	28480	1460-1489
A40	03746-60040	7	1	FREQUENCY REFERENCE ASSEMBLY	28480	03746-60040
A40C1	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A40C2	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A40C3	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A40C4	0140-0191	8		CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A40C5	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A40C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C7	0140-0210	2	1	CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A40C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C9	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A40C10	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A40C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C12	0160-2206	2	2	CAPACITOR-FXD 160PF +-5% 300VDC MICA	28480	0160-2206
A40C13	0140-0207	7	1	CAPACITOR-FXD 330PF +-5% 500VDC MICA	72136	DM15F331J0500WV1CR
A40C14	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A40C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C31	0180-0309	4	1	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	56289	150D475X0010A2
A40C32	0140-0191	8		CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A40C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C34	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A40C35	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A40C42	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A40C50	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A40C51	0160-3875	3	5	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A40C52	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A40C53	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A40C56	0160-2206	2		CAPACITOR-FXD 160PF +-5% 300VDC MICA	28480	0160-2206
A40C62	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C63	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C64	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A40C65	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A40C66	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C67	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C68	0160-3486	2	2	CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A40C69	0160-0128	3	1	CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A40C70	0180-1746	5	3	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A40C71	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C72	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A40C73	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C74	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C75	0160-3486	2		CAPACITOR-FXD .47UF +80-20% 50VDC CER	28480	0160-3486
A40C76	0160-3877	5	1	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A40C90	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A40C91	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A40C92	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C93	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C94	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C95	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C96	0140-0192	9	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A40C97	0160-2202	8	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	28480	0160-2202
A40C98	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A40C99	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C100	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C101	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A40C102	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C103	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C104	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C105	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C106	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C107	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A40C108	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A40C109	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A40C200	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40C201	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A40CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A40CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A40CR50	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A40CR51	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A40CR52	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A40CR53	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A40CR54	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A40CR55	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A40CR91	0122-0089	5		DIODE-VVC 29PF 10% C3/C25-MIN=5 BVR=30V	04713	MV109
A40DS1	1990-0450	4	2	LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A40J1	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A40J2	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A40J3	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A40J4	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A40J5	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A40J6	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A40L1	9140-0264	5	1	INDUCTOR RF-CH-MLD 1.2UH 5% .166DX.385LG	28480	9140-0264
A40L2	9140-0144	0	16	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L4	9140-0094	9	1	INDUCTOR RF-CH-MLD 680NH 10%	28480	9140-0094
A40L5	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L6	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L7	9140-0399	7	1	INDUCTOR RF-CH-MLD 2.2UH 5% .166DX.385LG	28480	9140-0399
A40L8	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L30	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L31	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L32	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L50	9100-3551	5	1	INDUCTOR RF-CH-MLD 1UH 5% .166DX.385LG	28480	9100-3551
A40L55	9100-0541	7	4	INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A40L56	9100-0541	7		INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A40L57	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L58	9100-1636	3	2	INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A40L59	9100-1636	3		INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A40L60	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L61	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L90	9100-3548	0	3	INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A40L91	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A40L92	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L93	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L94	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L95	9100-3911	1	1	INDUCTOR RF-CH-MLD 220NH 5% .166DX.385LG	28480	9100-3911
A40L96	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L97	9100-3345	5	1	INDUCTOR RF-CH-MLD 2UH 5% .166DX.385LG	28480	9100-3345
A40L98	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A40L99	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A40L100	9100-0541	7		INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A40L101	9100-0541	7		INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A40MP1	03746-04140	0	1	COVER	28480	03746-04140
A40Q1	1853-0036	2	7	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A40Q2	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A40Q30	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A40Q31	1853-0089	5		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A40Q32	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A40Q33	1853-0448	0		TRANSISTOR PNP SI TO-92 PD=625MW	04713	MPSH81
A40Q50	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A40Q51	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A40Q52	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A40Q54	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A40Q55	1855-0386	9	2	TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A40Q56	1855-0386	9		TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A40Q90	1853-0203	5	2	TRANSISTOR PNP SI PD=360MW FT=700MHZ	28480	1853-0203
A40Q91	1853-0203	5		TRANSISTOR PNP SI PD=360MW FT=700MHZ	28480	1853-0203

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A40R1	0757-0277	8	5	RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A40R2	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A40R3	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R4	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R5	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R6	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R7	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R8	0757-0284	7	2	RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A40R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A40R10	0757-0409	8	1	RESISTOR 274 1% .125W F TC=0+-100	24546	C4-1/8-T0-274R-F
A40R11	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R12	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R13	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R14	0757-0399	5	3	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A40R15	0683-4305	4	9	RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R16	0698-3132	4	2	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A40R17	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R18	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R19	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R20	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R21	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R22	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A40R23	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R24	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A40R25	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A40R26	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R27	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R28	0683-6815	5	11	RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R29	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R30	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R31	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R32	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R33	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R34	0698-3178	8	1	RESISTOR 487 1% .125W F TC=0+-100	24546	C4-1/8-T0-487R-F
A40R35	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A40R36	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A40R37	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A40R38	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R39	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R40	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R42	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R43	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R44	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R45	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R46	0683-2035	3	2	RESISTOR 20K 5% .25W FC TC=-400/+800	01121	CB2035
A40R47	0683-2205	9	2	RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A40R48	0683-5125	8	2	RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A40R49	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A40R50	0757-0473	6	1	RESISTOR 221K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2213-F
A40R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A40R52	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A40R53	0698-4450	1	1	RESISTOR 324 1% .125W F TC=0+-100	24546	C4-1/8-T0-324R-F
A40R54	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R55	0757-0284	7		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A40R59	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A40R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A40R67	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R68	0683-2035	3		RESISTOR 20K 5% .25W FC TC=-400/+800	01121	CB2035
A40R69	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R70	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R71	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R72	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R73	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R74	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R75	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A40R76	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A40R77	0698-3499	6	1	RESISTOR 40.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4022-F
A40R78	2100-3338	9	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	68XR5K
A40R79	0698-3215	4	1	RESISTOR 499K 1% .125W F TC=0+-100	28480	0698-3215
A40R80	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R81	0698-8827	4	2	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A40R82	0683-5125	8		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A40R83	0698-3519	1	1	RESISTOR 12.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1242-F
A40R84	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R85	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A40R86	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A40R87	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R88	0698-5094	1	1	RESISTOR 5.1M 5% .25W FC TC=-900/+1100	01121	CB5155
A40R90	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R91	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R92	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R93	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R94	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R95	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R96	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R97	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R98	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R99	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R100	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A40R101	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A40R102	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A40R103	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A40R104	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A40R105	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A40R106	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R107	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R108	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A40R109	0683-6815	5		RESISTOR 680 5% .25W FC TC=-400/+600	01121	CB6815
A40R110	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A40R111	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A40R200	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A40R201	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A40R203	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A40R204	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A40R205	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A40R206	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A40R207	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A40R208	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A40T1	15520-80001	5	1	TOROID	28480	15520-80001
A40TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A40TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A40TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A40TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A40TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A40TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A40TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A40U1	1820-0810	1	2	IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10116P
A40U2	1820-0806	5	7	IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A40U3	1820-0806	5		IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A40U4	1820-0806	5		IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A40U30	1820-1251	6		IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS196N
A40U31	1820-1383	5		IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A40U32	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A40U33	1820-1145	7	1	IC BFR CMOS INV HEX 1-INP	3L585	CD4049UBE
A40U51	1820-0806	5		IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A40U52	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A40U53	1820-1383	5		IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A40U54	1826-0043	4		IC OP AMP GP TO-99 PKG	3L585	CA307T
A40U55	1820-0478	7	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM308H
A40U90	1820-0806	5		IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A40U91	1820-0806	5		IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A40U92	1820-0810	1		IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10116P
A40U93	1820-0806	5		IC GATE ECL OR-NOR DUAL 4-5-INP	04713	MC10109P
A40Y90	0410-0751	9	1	CRYSTAL 50.0000MHZ	28480	0410-0751
				A40 MISCELLANEOUS PART		
	1251-2501	4		CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1460-1489	8		WIREFORM BE CU AG	28480	1460-1489
	1600-0835	4	1	SHIELD-40-3 BRS	28480	1600-0835
	1600-0841	2	1	SHIELD-40-2 BRS	28480	1600-0841
	1600-0842	3	1	SHIELD-40-4 BRS	28480	1600-0842
	1600-0843	4	1	SHIELD-40-1 BRS	28480	1600-0843
A41	03746-60041	8	1	10 MHZ PRECISION REFERENCE ASSEM OPTION 013 NOTE: THE PART NUMBER OF THIS A WITHOUT THE 10 MHZ OSCILLATOR E1 IS (03746-69041)	28480	03746-60041

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A41E1	10811A	0	1	OSCILLATOR CRYSTAL	28480	10811A
A41MP1	03746-04116	0	1	COVER-16 BOARD	28480	03746-04116
A41MP2	03746-01209	6	1	BRACKET-OVEN	28480	03746-01209
A41	03746-69041	6	1	BOARD ASSEMBLY	28480	03746-69041
A41C1	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A41C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A41C3	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A41C4	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A41C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A41C6	0180-0474	4	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A41C7	0180-0474	4		CAPACITOR-FXD 15UF+-10% 20VDC TA	28480	0180-0474
A41CR2	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
A41CR3	1901-1098	1	2	DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A41CR4	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A41DS1	1990-0450	4		LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A41F1	2110-0218	9	2	FUSE .1A 250V .25X.27	28480	2110-0218
A41F2	2110-0218	9		FUSE .1A 250V .25X.27	28480	2110-0218
A41J1	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A41L1	9140-0210	1	2	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A41L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A41Q1	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A41Q2	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A41Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A41Q4	1854-0401	7	2	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A41Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A41Q6	1854-0401	7		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A41R1	0812-0033	2	2	RESISTOR 7 3% 5W PW TC=0+-50	28480	0812-0033
A41R2	0812-0033	2		RESISTOR 7 3% 5W PW TC=0+-50	28480	0812-0033
A41R3	0683-2235	5	1	RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A41R4	0683-1045	3	1	RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A41R5	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A41R6	0683-8215	3	1	RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A41R7	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A41R8	0683-3335	8	1	RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A41R9	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A41R10	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A41R11	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A41R11	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A41R12	0698-4037	0	2	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A41R13	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A41R14	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A41R15	0683-7515	4	2	RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A41R16	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A41R17	0683-7515	4		RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A41R20	0683-3915	0	1	RESISTOR 390 5% .25W FC TC=-400/+600	01121	CB3915
A41R21	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A41R87	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A41R88	0683-2705	4		RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
	0380-0111	0	4	STANDOFF-RVT-ON .25-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
	1251-2551	4	4	CONNECTOR-SGL CONT SKT .033-IN-BSC-SZ	28480	1251-2551
	1251-7136	1	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-7136

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

Table 6-2 Replaceable Parts (continued)

REFERENCE DESIGNATION	HP PART NUMBER			DESCRIPTION	MFR CODE	MFR PART NUMBER
A43	03746-60043	0	1	PRECISION REFERENCE ASSEMBLY	28480	03746-60043
A43C001	0160-0576	5	7	CAPACITOR-FXD 0.1UF 20% 50V	26654	2130BR050R104M
A43C002	0180-2821	9	2	CAPACITOR-FXD 22UF 35V TA	28480	0180-2821
A43C003	0180-2821	9		CAPACITOR-FXD 22UF 35V TA	28480	0180-2821
A43C004	0160-0576	5		CAPACITOR-FXD 0.1UF 20% 50V	26654	2130BR050R104M
A43C005	0180-1746	5	2	CAPACITOR-FXD 15UF 20V TA	56289	1500156X902082
A43C006	0180-1746	5		CAPACITOR-FXD 15UF 20V TA	56289	1500156X902082
A43C007	0160-0576	5		CAPACITOR-FXD 0.1UF 20% 50V	26654	2130BR050R104M
A43C008	0160-0576	5		CAPACITOR-FXD 0.1UF 20% 50V	26654	2130BR050R104M
A43C009	0160-0576	5		CAPACITOR-FXD 0.1UF 20% 50V	26654	2130BR050R104M
A43C010	0160-0576	5		CAPACITOR-FXD 0.1UF 20% 50V	26654	2130BR050R104M
A43C011	0160-0576	5		CAPACITOR-FXD 0.1UF 20% 50V	26654	2130BR050R104M
A43CR001	1990-0450	4	2	LED RED -4484	28480	1990-0450
A43CR002	1990-0450	4		LED RED -4484	28480	1990-0450
A43CR003	1901-0535	9	1	DIO S -2811	28480	1901-0535
A43CR004	1901-0044	5	2	DIO SWG 50MA 50V	28480	1901-0044
A43CR005	1901-0044	5		DIO SWG 50MA 50V	28480	1901-0044
A43E001	0960-0568	1	1	OSC 42-16	28480	0960-0568
A43J001	1250-1512	3	1	CONN-SMD M PRS50	28480	1250-1512
A43L001	9140-0395	3	2	COIL .56UH 5%	28480	9140-0395
A43L002	9140-0395	3		COIL .56UH 5%	28480	9140-0395
A43L003	9100-3560	6	4	COIL 5.6UH 5%	24226	9503
A43L004	9100-3560	6		COIL 5.6UH 5%	24226	9503
A43L005	9100-3560	6		COIL 5.6UH 5%	24226	9503
A43L006	9100-3560	6		COIL 5.6UH 5%	24226	9503
A43Q001	1854-0215	1	2	XSTR NPN 2N3904	04713	SPS3611
A43Q002	1854-0215	1		XSTR NPN 2N3904	04713	SPS3611
A43Q003	1854-0345	8	2	XSTR NPN 2N5179	04713	2N5179
A43Q004	1854-0345	8		XSTR NPN 2N5179	04713	2N5179
						2N5179
A43R001	0813-0029	8	1	RESISTOR 1 3% 3W	07088	
A43R002	0757-0346	2	1	RESISTOR 10 1% .125W	24546	KM-300
A43R003	0698-3446	3	1	RESISTOR 383 1% .125W	16299	C4-1/8-TO-10R0-F
A43R004	0757-0402	1	1	RESISTOR 110 1% .125W	24546	C4-1/8-TO-383R-F
A43R005	0757-0444	1	1	RESISTOR 12.1K 1%	24546	C4-1/8-TO-111-F
A43R006	2100-0558	9	1	RESISTOR VARIABLE 20K 10%	73138	C4-1/8-TO-1
A43R007	0757-0278	9	2	RESISTOR 1.78K 1%	24546	72PR20K
A43R008	0698-0085	0	3	RESISTOR 2.61K 1%	16299	C4-1/8-TO-1781-F
A43R009	0698-0085	0		RESISTOR 2.61K 1%	16299	C4-1/8-TO-2611-F
A43R010	0757-0442	9	2	RESISOTR 10K 1% .125W	24546	C4-1/8-TO-1
A43R011	0757-0442	9		RESISTOR 10K 1% .125W	24546	C4-1/8-TO-1
A43R012	0698-0085	0		RESISTOR 2.61K 1%	16299	CR4-1/8-TO-2611-F
A43R013	0757-0280	3	2	RESISOTR 1K 1% .125W	24546	C4-1/8-TO-1001-F
A43R014	0698-3432	7	2	RESISTOR 26.1 1% .125W	03888	PME55-1/8-TO-26R1
A43R015	0698-3136	8	1	RESISTOR 17.8K 1%	16299	C4-1/8-TO-1782-F
A43R016	0757-0439	4	2	RESISTOR 6.81K 1%	24546	C4-1/8-TO-6
A43R017	0757-0439	4		RESISTOR 6.81K 1%	24546	C4-1/8-TO-6
A43R018	0757-0278	9		RESISTOR 1.78K 1%	24546	C4-118-TO-1781-F
A43R019	0757-0280	3		RESISTOR 1K 1% .125W	24546	C4-1/8-TO-1001-F
A43R020	0698-3432	7		RESISTOR 26.1 1% .125W	03888	PME55-1/8-TO-26R1
A43R021	0698-3447	4	1	RESISTOR 422 1% .125W	16299	C4-1/8-TO-422P-F
A43R022	0757-0398	4	1	RESISTOR 75 1% .125W	24546	C4-1/8-TO-75R0-F
A43U001	1826-0175	3	1	ICL 319N P14	27014	LM319N
MSC	03746-04143	3	1	COVER 43 BD	28480	03746-04143

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A50	03746-60050	9	1	STEP LOOP ASSEMBLY	28480	03746-60050
A50C1	0160-4386	3	4	CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A50C2	0160-3879	7	92	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C3	0160-4386	3		CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A50C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C15	0160-4386	3		CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A50C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C17	0160-4386	3		CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A50C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C19	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C26	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C28	0160-4385	2	2	CAPACITOR-FXD 15PF +-5% 200VDC CER 0+-30	28480	0160-4385
A50C29	0160-4350	1	11	CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A50C30	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A50C31	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A50C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C33	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A50C34	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A50C35	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C36	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C37	0160-4389	6	5	CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A50C38	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C40	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C41	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C42	0180-1746	5	10	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A50C43	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A50C44	0160-0570	9	4	CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A50C45	0160-0570	9		CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A50C46	0160-4389	6		CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A50C47	0160-4389	6		CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A50C48	0160-0164	7	1	CAPACITOR-FXD .039UF +-10% 200VDC POLYE	28480	0160-0164
A50C49	0160-0571	0	6	CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A50C50	0160-4389	6		CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A50C51	0180-0196	7	3	CAPACITOR-FXD 56UF+-10% 15VDC TA	56289	150D566X9015R2
A50C52	0180-0196	7		CAPACITOR-FXD 56UF+-10% 15VDC TA	56289	150D566X9015R2
A50C70	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C71	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C72	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C73	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C74	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C75	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C76	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C77	0160-4389	6		CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A50C78	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C79	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C80	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C81	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C82	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C83	0160-3508	9	5	CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A50C84	0160-2306	3	1	CAPACITOR-FXD 27PF +-5% 300VDC MICA	28480	0160-2306
A50C85	0160-2205	1	1	CAPACITOR-FXD 120PF +-5% 300VDC MICA	28480	0160-2205
A50C86	0160-0571	0		CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A50C87	0160-3533	0	1	CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-3533
A50C88	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C89	0160-0571	0		CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A50C90	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A50C91	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A50C92	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A50C93	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C94	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A50C95	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C96	0180-2780	9	3	CAPACITOR-FXD 470UF+75-10% 16VDC AL	28480	0180-2780
A50C97	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C98	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C99	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C100	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C101	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C102	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C103	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C104	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50C105	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A50CR1 **	0122-0098	6	2	DIODE-VARIABLE CAP, MATCHED SET	28480	0122-0098
A50CR2	0122-0098	6		DIODE-VARIABLE CAP, MATCHED SET	28480	0122-0098
A50CR3	1901-0040	1	11	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A50CR4	1902-0957	1	1	DIODE-ZNR 9.1V 5% DO-35 PD=.4W TC=+.069%	28480	1902-0957
A50CR70	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A50CR71	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A50CR72	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A50CR73	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A50DS70	1990-0486	6	2	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A50L1	9100-2249	6	2	INDUCTOR RF-CH-MLD 150NH 10% .105DX.26LG	28480	9100-2249
A50L3	9100-2249	6		INDUCTOR RF-CH-MLD 150NH 10% .105DX.26LG	28480	9100-2249
A50L4	9100-3560	6	13	INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A50L5	9140-0409	0	1	COIL-VAR 138NH-162NH Q=125 PC-MTG	28480	9140-0409
A50L6	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A50L7	9100-1636	3	8	INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A50L8	9100-1636	3		INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A50L70	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A50L71	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A50L72	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A50L73	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A50L74	9100-1641	0	1	INDUCTOR RF-CH-MLD 240UH 5% .166DX.385LG	28480	9100-1641
A50L75	9100-1636	3		INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A50L76	9100-1636	3		INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A50L77	9100-0541	7	3	INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A50L78	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A50MP1	03746-00604	3		SHIELD	28480	03746-00604
A50MP2	03746-20614	7		SHIELD	28480	03746-20614
A50MP3	03746-00603	2		SHIELD	28480	03746-00603
A50Q1	1854-0345	8	19	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A50Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A50Q5	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A50Q6	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A50Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A50Q8	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A50Q9	1854-0215	1	10	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A50Q10	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A50Q11	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A50Q70	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A50Q71	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A50Q72	1853-0036	2	8	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A50Q73	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A50Q74	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A50Q75	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A50Q76	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A50R1	0757-0398	4	7	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A50R2	0757-0280	3	22	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R3	0683-4705	8	29	RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R5	0757-0420	3	8	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A50R6	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R7	0698-3430	5	5	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A50R7	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A50R8	0757-0407	6	9	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A50R18	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R19	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R21	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A50R22	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R23	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A50R24	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A50R25	0757-0291	6	7	RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A50R26	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A50R27	0757-0279	0	3	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A50R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

** A50CR1, A50CR2, A51CR1 AND A51CR2 ARE A MATCHED SET OF VARICAPS.
HP-PART NUMBER 0122-0098 CONSISTS OF A REPLACEMENT SET OF 4 MATCHED VARICAPS.

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A50R29	0757-0291	6		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A50R30	0698-4443	2	2	RESISTOR 4.53K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4531-F
A50R31	0698-3242	7	3	RESISTOR 357 1% .125W F TC=0+-100	24546	C4-1/8-T0-357R-F
A50R32	0698-3223	4	2	RESISTOR 1.24K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1241-F
A50R33	0757-0464	5	2	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A50R34	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R35	0757-0442	9	17	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A50R36	0757-0277	8	5	RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A50R37	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A50R38	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A50R39	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A50R40	0698-4473	8	2	RESISTOR 8.06K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8061-F
A50R41	0757-0291	6		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A50R42	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A50R43	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A50R44	0757-0200	7	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A50R45	2100-3253	7	4	RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	28480	2100-3253
A50R46	2100-3253	7		RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	28480	2100-3253
A50R47	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A50R48	0757-0462	3	2	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A50R49	0698-4496	5	2	RESISTOR 45.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4532-F
A50R50	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A50R51	0683-2025	1	4	RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A50R52	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A50R53	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A50R54	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R55	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A50R56	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A50R70	0698-3132	4	4	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A50R70	1810-0167	0	3	NETWORK-RES 8-SIP330.0 OHM X 4	01121	208B331
A50R71	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A50R71	1810-0167	0		NETWORK-RES 8-SIP330.0 OHM X 4	01121	208B331
A50R72	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A50R72	1810-0167	0		NETWORK-RES 8-SIP330.0 OHM X 4	01121	208B331
A50R73	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R74	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A50R75	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R76	0683-4715	0	4	RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A50R77	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A50R78	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A50R79	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A50R80	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A50R81	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R82	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A50R83	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R84	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R85	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A50R86	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R87	0757-0346	2	11	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A50R88	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A50R89	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R90	0698-3557	7	2	RESISTOR 806 1% .125W F TC=0+-100	24546	C4-1/8-T0-806R-F
A50R92	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R93	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A50R94	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A50R95	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A50R96	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R97	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R98	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A50R99	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A50R100	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A50R101	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A50R102	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A50R103	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R104	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A50R105	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A50R106	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A50R107	0757-0411	2	4	RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A50RP73	1810-0121	6	1	NETWORK-RES 9-SIP1.0K OHM X 8	91637	CSP09C07-102J
A50RP74	1810-0037	3	1	NETWORK-RES 16-DIP1.0K OHM X 8	11236	761-3-R1K
A50S1	3101-2039	8	2	SWITCH-SL SPDT SUBMIN .5A 125VAC PC	28480	3101-2039
A50U1	1826-0043	4	3	IC OP AMP GP TO-99 PKG	3L585	CA307T
A50U70	1820-0810	1	3	IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10116P
A50U71	1820-1788	4	1	IC CNTR ECL BIN SYNCHRO POS-EDGE-TRIG	07263	F10016DC
A50U73	1826-0346	0	2	IC OP AMP GP DUAL 8-DIP-P PKG	27014	LM358N
A50U74	1820-0817	8	2	IC FF ECL D-M/S DUAL	04713	MC10131P

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A50U75	1820-0802	1	2	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A50U76	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
				A50 MISCELLANEOUS PART		
	1200-0607	0	1	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607
	1205-0338	4	1	HEAT SINK SGL PLSTC-PWR-CS	28480	1205-0338
	1251-0600	0	21	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1600-0844	5	4	SHIELD- 50-1 BRS	28480	1600-0844
	1600-0846	7	1	SHIELD- 50-2 BRS	28480	1600-0846
	9170-0817	7	9	CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
	1600-0845	9	1	SHIELD-50-3	28480	1600-0845
	03746-04150	2	1	COVER	28480	03746-04150
A51	03746-60051	0	1	SUM LOOP/VCO ASSEMBLY	28480	03746-60051
A51C1	0160-3876	4	6	CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A51C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C3	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A51C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C8	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A51C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C10	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A51C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C26	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A51C27	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A51C28	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C31	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C32	0180-0196	7		CAPACITOR-FXD 56UF+-10% 15VDC TA	56289	150D566X9015R2
A51C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C35	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A51C35	0160-4385	2		CAPACITOR-FXD 15PF +-5% 200VDC CER 0+-30	28480	0160-4385
A51C36	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A51C37	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A51C38	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A51C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C40	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A51C41	0160-4350	1		CAPACITOR-FXD 68PF +-5% 200VDC CER 0+-30	28480	0160-4350
A51C42	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C43	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C44	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C45	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C46	0160-2611	3	1	CAPACITOR-FXD 1UF +-10% 50VDC MET-POLYE	28480	0160-2611
A51C47	0160-3877	5	9	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A51C48	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A51C49	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C50	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A51C51	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A51C52	0160-0155	6	1	CAPACITOR-FXD 3300PF +-10% 200VDC POLYE	28480	0160-0155
A51C53	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51C54	0160-0945	2	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A51C55	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A51C56	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A51C57	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A51CR1**	0122-0098	6	2	DIODE-VARIABLE CAP, MATCHED SET	28480	0122-0098
A51CR2	0122-0098	6		DIODE-VARIABLE CAP, MATCHED SET	28480	0122-0098
A51CR3	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A51J1	1250-1512	3	4	CONNECTOR-RF-SMB	28480	1250-1512
A51J2	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A51J4	1250-0257	1	2	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A51L1	9100-3314	8	3	INDUCTOR RF-CH-MLD 150NH 5% .166DX.385LG	28480	9100-3314
A51L2	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A51L3	9100-3314	8		INDUCTOR RF-CH-MLD 150NH 5% .166DX.385LG	28480	9100-3314
A51L4	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A51L6	9100-3314	8		INDUCTOR RF-CH-MLD 150NH 5% .166DX.385LG	28480	9100-3314

** A50CR1, A50CR2, A51CR1 AND A51CR2 ARE A MATCHED SET OF VARICAPS.
HP–PART NUMBER 0122-0098 CONSISTS OF A REPLACEMENT SET OF 4 MATCHED VARICAPS.

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A51L7	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A51L8	9140-0410	3	1	COIL-VAR 166NH-194NH Q=125 PC-MTG	28480	9140-0410
A51L9	9100-1636	3		INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A51L10	9100-1636	3		INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A51L11	9140-0397	5	1	INDUCTOR RF-CH-MLD 9.1UH 5% .166DX.385LG	28480	9140-0397
A51MP1	03746-04151	3	1	COVER	28480	03746-04151
A51Q1	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q1	9170-0817	7		CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
A51Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q3	9170-0817	7		CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
A51Q4	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q8	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q8	9170-0817	7		CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
A51Q9	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q10	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q11	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q12	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A51Q13	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q14	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A51Q14	9170-0817	7		CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
A51R1	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A51R2	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A51R3	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A51R5	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A51R5	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A51R6	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R7	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A51R8	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A51R9	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A51R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A51R11	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A51R13	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A51R14	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R16	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A51R25	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A51R26	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A51R27	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A51R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A51R29	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R30	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R31	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A51R32	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A51R33	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R34	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R35	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A51R36	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A51R37	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A51R38	0757-0291	6		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A51R39	0698-4443	2		RESISTOR 4.53K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4531-F
A51R40	0698-3242	7		RESISTOR 357 1% .125W F TC=0+-100	24546	C4-1/8-T0-357R-F
A51R41	0698-3242	7		RESISTOR 357 1% .125W F TC=0+-100	24546	C4-1/8-T0-357R-F
A51R42	0698-3223	4		RESISTOR 1.24K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1241-F
A51R43	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A51R44	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A51R45	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A51R46	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A51R47	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A51R48	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A51R49	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A51R50	0698-4473	8		RESISTOR 8.06K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8061-F
A51R51	0757-0291	6		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A51R52	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A51R53	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A51R54	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A51R55	2100-3253	7		RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	28480	2100-3253
A51R56	2100-3253	7		RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	28480	2100-3253
A51R57	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A51R58	0757-0180	2	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A51R59	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A51R60	0698-4496	5		RESISTOR 45.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4532-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A51S1	3101-2039	8		SWITCH-SL SPDT SUBMIN .5A 125VAC PC	28480	3101-2039
A51TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	0380-0321	4	4	SPACER-RVT-ON .125-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
	1600-0844	5			28480	1600-0844
	03746-00603	2	3	SHIELD	28480	03746-00603
	03746-00604	3	2	SHIELD	28480	03746-00604
	03746-20614	7	3	SHIELD	28480	03746-20614
A52	03746-60052	1	1	SUM LOOP MIXER ASSEMBLY	28480	03746-60052
A52C1	0160-0570	9		CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A52C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A52C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A52C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A52C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A52C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A52C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A52C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A52C9	0160-0576	5	14	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A52C10	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A52C11	0160-0570	9		CAPACITOR-FXD 220PF +-20% 100VDC CER	20932	5024EM100RD221M
A52C14	0140-0205	5	2	CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E620J0300WV1CR
A52C15	0160-2204	0	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A52C16	0140-0205	5		CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E620J0300WV1CR
A52C17	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A52C18	0160-2266	4	2	CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A52C19	0160-2266	4		CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A52C20	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A52C21	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A52C22	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A52C23	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A52C24	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A52C25	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A52C26	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A52C28	0180-2780	9		CAPACITOR-FXD 470UF+75-10% 16VDC AL	28480	0180-2780
A52CR1	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
A52J1	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A52J2	1250-1512	3		CONNECTOR-RF-SMB	28480	1250-1512
A52L1	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A52L2	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A52L3	9140-0400	1	2	INDUCTOR RF-CH-MLD 8.2UH 5% .166DX.385LG	28480	9140-0400
A52L4	9140-0400	1		INDUCTOR RF-CH-MLD 8.2UH 5% .166DX.385LG	28480	9140-0400
A52L5	9140-0398	6	2	INDUCTOR RF-CH-MLD 12UH 5% .166DX.385LG	28480	9140-0398
A52L6	9140-0237	2	2	INDUCTOR RF-CH-MLD 200UH 5% .166DX.385LG	28480	9140-0237
A52L7	9140-0237	2		INDUCTOR RF-CH-MLD 200UH 5% .166DX.385LG	28480	9140-0237
A52L8	9100-0541	7		INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A52Q1	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A52Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A52R1	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A52R2	0683-4305	4	5	RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A52R3	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A52R4	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A52R5	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A52R6	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A52R7	0683-3005	9	2	RESISTOR 30 5% .25W FC TC=-400/+500	01121	CB3005
A52R8	0683-3005	9		RESISTOR 30 5% .25W FC TC=-400/+500	01121	CB3005
A52R9	0757-0411	2		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A52R10	0757-0291	6		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A52R11	0698-7616	7	1	RESISTOR 80.6 1% .125W F TC=0+-100	19701	MF4C1//8-T0-80R6-F
A52R12	0757-0412	3	1	RESISTOR 365 1% .125W F TC=0+-100	24546	C4-1/8-T0-365R-F
A52R13	0698-4439	6	1	RESISTOR 3.24K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3241-F
A52R14	0698-3511	3	4	RESISTOR 665 1% .125W F TC=0+-100	24546	C4-1/8-T0-665R-F
A52R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A52R17	0683-1515	2	1	RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A52R18	0683-1025	9	8	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A52R19	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A52R20	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A52R21	0698-3511	3		RESISTOR 665 1% .125W F TC=0+-100	24546	C4-1/8-T0-665R-F
A52R23	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A52R24	0698-3511	3		RESISTOR 665 1% .125W F TC=0+-100	24546	C4-1/8-T0-665R-F
A52R25	0757-0291	6		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A52R65	0698-3511	3		RESISTOR 665 1% .125W F TC=0+-100	24546	C4-1/8-T0-665R-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A52U1	1826-0598	4	1	IC 14-DIP-P PKG	04713	MC12002P
A52U2	1820-0810	1		IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10116P
A52Z1	03746-04152	4	1	COVER	28480	03746-04152
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	9170-0817	7		CORE-MAGNETIC (MISC ITEM)	28480	9170-0817
	03746-00603	2		SHIELD	28480	03746-00603
	03746-20614	7	-	SHIELD	28480	03746-20614
A53	03746-60053	2	1	SUM LOOP PHASE DETECTOR ASSEMBLY	28480	03746-60053
A53C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C3	0160-4382	9	1	CAPACITOR-FXD 3.3PF +-.25PF 200VDC CER	28480	0160-4382
A53C4	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A53C5	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A53C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C7	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A53C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C10	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A53C11	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A53C12	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A53C14	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A53C15	0160-0301	4	1	CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0160-0301
A53C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C17	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A53C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C19	0160-0571	0		CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A53C20	0160-0571	0		CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A53C21	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A53C22	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A53C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C24	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A53C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C26	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A53C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A53C28	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A53C29	0160-0571	0		CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A53C30	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A53C31	0180-2780	9		CAPACITOR-FXD 470UF+75-10% 16VDC AL	28480	0180-2780
A53C32	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A53C33	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A53C35	0160-3508	9		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A53CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A53CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A53CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A53CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A53CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A53CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A53DS1	1990-0486	6		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A53J1	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A53L1	9100-3560	6		INDUCTOR RF-CH-MLD 5.6UH 5% .166DX.385LG	28480	9100-3560
A53L2	9140-0398	6		INDUCTOR RF-CH-MLD 12UH 5% .166DX.385LG	28480	9140-0398
A53L3	9100-1636	3		INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A53L4	9100-1636	3		INDUCTOR RF-CH-MLD 110UH 5% .166DX.385LG	28480	9100-1636
A53L5	9140-0144	0	3	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A53L6	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A53L7	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A53L8	9100-0541	7		INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A53MP1	03746-04153	5	1	COVER	28480	03746-04153
A53Q1	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A53Q2	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A53Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A53Q4	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A53Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A53Q6	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A53Q7	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A53R1	0698-6338	8	1	RESISTOR 5K 1% .125W F TC=0+-25	28480	0698-6338
A53R2	0698-7960	4	2	RESISTOR 7.87K 1% .125W F TC=0+-25	19701	MF4C1/8-T9-7871-F
A53R3	2100-3353	8	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	28480	2100-3353
A53R4	0698-6871	4	1	RESISTOR 10K .5% .125W F TC=0+-50	28480	0698-6871
A53R5	0698-7960	4		RESISTOR 7.87K 1% .125W F TC=0+-25	19701	MF4C1/8-T9-7871-F

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A53R6	0757-0449	6	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A53R7	0757-0283	6	5	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A53R8	0757-0469	0	1	RESISTOR 150K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1503-F
A53R9	0698-4493	2	3	RESISTOR 34K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3402-F
A53R10	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A53R11	0698-3264	3	2	RESISTOR 11.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1182-F
A53R12	0683-3315	4	17	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R13	2100-3274	2	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A53R14	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A53R15	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A53R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A53R18	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A53R19	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A53R20	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A53R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A53R22	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A53R23	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A53R24	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A53R25	0757-0411	2		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A53R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A53R27	0698-3264	3		RESISTOR 11.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1182-F
A53R28	0698-4435	2	1	RESISTOR 2.49K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2491-F
A53R29	0698-4493	2		RESISTOR 34K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3402-F
A53R30	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A53R31	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A53R32	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A53R33	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A53R35	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A53R36	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R37	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R38	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A53R39	0698-4493	2		RESISTOR 34K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3402-F
A53R40	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A53R41	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A53R42	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A53R43	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R44	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R45	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A53R46	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R47	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A53R48	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A53R49	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A53R50	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A53R51	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A53R52	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A53R53	0698-3557	7		RESISTOR 806 1% .125W F TC=0+-100	24546	C4-1/8-T0-806R-F
A53R54	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A53R55	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A53R56	0698-3495	2	1	RESISTOR 866 1% .125W F TC=0+-100	24546	C4-1/8-T0-866R-F
A53R57	0757-0411	2		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A53R58	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A53R59	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R60	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R61	0683-2415	3	1	RESISTOR 240 5% .25W FC TC=-400/+600	01121	CB2415
A53R62	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A53R63	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A53R64	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R65	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R66	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R67	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R69	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R70	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R71	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R72	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A53R73	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A53U1	1826-0043	4		IC OP AMP GP TO-99 PKG	3L585	CA307T
A53U2	1826-0043	4		IC OP AMP GP TO-99 PKG	3L585	CA307T
A53U3	1826-0346	0		IC OP AMP GP DUAL 8-DIP-P PKG	27014	LM358N
A53U4	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A53U5	1820-0803	2	1	IC GATE ECL OR-NOR TPL	04713	MC10105P
A53U6	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A53U7	1820-0810	1		IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10116P
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A54	03746-60054	3	1	TRACKING GENERATOR ASSEMBLY -OPTION 012-	28480	03746-60054
A54C1	0160-3879	7	24	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C10	0160-0576	5	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A54C11	0180-2821	9	5	CAPACITOR-FXD 22UF 35VDC TA	28480	0180-2821
A54C12	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A54C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C15	0160-4386	3	1	CAPACITOR-FXD 33PF 5% 200VDC	28480	0160-4386
A54C16	0160-4547	8	1	CAPACITOR-FXD 150PF 5% 200VDC	28480	0160-4547
A54C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C19	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C22	0160-4383	0	1	CAPACITOR-FXD 6.8PF 5% 200VDC	20932	5024E0200RD689D
A54C23	0160-4385	2	2	CAPACITOR-FXD 15PF 5% 200VDC	28480	0160-4385
A54C24	0160-4511	6	1	CAPACITOR-FXD 220PF 5% 200VDC	28480	0160-4511
A54C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C26	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C28	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C31	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A54C34	0180-2815	1	2	CAPACITOR-FXD 100UF 10VDC TA	28480	0180-2815
A54C35	0160-4385	2		CAPACITOR-FXD 15PF 5% 200VDC	28480	0160-4385
A54C36	0160-4498	8	1	CAPACITOR-FXD 5.6PF 5% 200VDC	28480	0160-4498
A54C37	0160-4493	3	2	CAPACITOR-FXD 27PF 5% 200VDC	28480	0160-4493
A54C38	0160-4491	1	1	CAPACITOR-FXD 8.2PF 5% 200VDC	28480	0160-4491
A54C39	0160-4493	3		CAPACITOR-FXD 27PF 5% 200VDC	28480	0160-4493
A54C40	0160-4517	2	1	CAPACITOR-FXD 1.2PF 5% 200VDC	28480	0160-4517
A54C41	0160-4492	2	1	CAPACITOR-FXD 18PF 5% 200VDC	28480	0160-4492
A54C42	0180-2821	9		CAPACITOR-FXD 22UF 35VDC TA	28480	0180-2821
A54C43	0180-2821	9		CAPACITOR-FXD 22UF 35VDC TA	28480	0180-2821
A54C44	0180-2811	7	1	CAPACITOR-FXD 10UF 35VDC TA	28480	0180-2811
A54C45	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A54C46	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A54C47	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A54C48	0180-2815	1		CAPACITOR-FXD 100UF 10VDC TA	28480	0180-2815
A54C50	0180-2816	2	1	CAPACITOR-FXD 68UF 10VDC TA	28480	0180-2816
A54C51	0180-2821	9		CAPACITOR-FXD 22UF 35VDC TA	28480	0180-2821
A54C52	0180-2821	9		CAPACITOR-FXD 22UF 35VDC TA	28480	0180-2821
A54CR1	1901-0535	9	1	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A54CR2	0122-0089	5	1	DIODE-VVC 29PF 10% C3/C25-MIN=5 BVR=30V	04713	MV109
A54CR3	1901-0639	4	1	DIODE-PIN	28480	5082-3080
A54CR4	1901-0545	1	1	DIODE-MATCHED VF DIFF=20MV	28480	5082-2805
A54CR8	1901-0044	5	2	DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A54CR9	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A54K1	0490-1262	7	1	RELAY	28480	0490-1262
A54L1	03746-80035	2	1	COIL ASSEMBLY-350 HZ	28480	03746-80035
A54L2	9140-0142	8	1	INDUCTOR RF-CH-MLD 2.2UH 10% .105DX.26LG	28480	9140-0142
A54L4	9140-0141	7	1	INDUCTOR RF-CH-MLD 680NH 10% .105DX.26LG	28480	9140-0141
A54L5	9100-2259	8	2	INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259
A54L6	9100-0346	0	1	INDUCTOR RF-CH-MLD 50NH 20% .105DX.26LG	28480	9100-0346
A54L7	9100-2258	7	2	INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A54L8	9100-2258	7		INDUCTOR RF-CH-MLD 1.2UH 10% .105DX.26LG	28480	9100-2258
A54L9	9100-2259	8		INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259
A54L10	9100-2265	6	1	INDUCTOR RF-CH-MLD 10UH 10% .105DX.26LG	28480	9100-2265
A54L11	9100-3560	6	3	COIL-5.6UH 5%	28480	9100-3560
A54L12	9100-3560	6		COIL-5.6UH 5%	28480	9100-3560
A54L13	9100-3560	6		COIL-5.6UH 5%	28480	9100-3560

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A54Q1	1854-0401	7	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0401
A54Q2	1854-0247	9	2	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A54Q3	1854-0247	9		TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A54Q4	1853-0271	7	1	TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
A54R1	0757-0394	0	11	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R2	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R3	0698-3437	2	2	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A54R4	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A54R5	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A54R6	0757-0458	7	3	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A54R7	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A54R8	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2373-F
A54R9	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A54R10	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A54R11	0757-0464	5	1	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A54R12	0757-0438	3	4	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A54R13	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A54R14	0757-0422	5	2	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A54R15	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A54R16	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R17	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A54R18	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A54R20	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A54R21	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A54R22	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A54R23	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R24	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R25	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R28	0698-3441	8	3	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A54R29	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R30	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R31	2100-3383	4	1	RESISTOR-TRMR 50 10% C TOP-ADJ 1-TRN	28480	2100-3383
A54R32	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R33	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R34	0698-3132	4	3	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A54R35	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A54R36	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A54R37	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A54R38	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A54R39	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A54R40	0757-0398	4	2	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A54R41	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A54R43	0698-8827	4	3	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A54R44	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A54R45	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A54R46	2100-0554	5	1	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
A54R47	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A54R48	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A54R49	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A54R50	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A54R51	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A54R52	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A54R53	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A54R54	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A54R60	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A54TL1	1460-1489	8	2	WIREFORM	28480	1460-1489
A54TL2	1460-1489	8		WIREFORM	28480	1460-1489
A54U1	1826-0598	4	2	IC 14-DIP-P PKG	04713	MC12002P
A54U2	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A54U3	1826-0599	5	1	IC 16-DIP-P PKG	04713	MC14568BCP
A54U4	1826-0043	4	1	IC OP AMP GP TO-99 PKG	3L585	CA307T
A54U6	1826-0598	4		IC 14-DIP-P PKG	04713	MC12002P
A54U7	1820-0270	7	1	IC WIDEBAND AMPL VID TO-100 PKG	07263	733HC
A54U8	1826-0102	6	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LM312H
A54U9	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A54Y1	0410-1401	8	1	CRYSTAL-50.015625 MHZ	28480	0410-1401
				A54 MISCELLANEOUS PARTS		
	1200-0173	5	2	INSULATOR-XSTR DAP-GL	28480	1200-0173
	1251-0600	0	3	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-2501	4	6	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	9170-0747	2	1	CAN-SCREEN	28480	9170-0747
	9170-0817	7	1	CORE-SHIELD BEAD	28480	9170-0817

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	03746-04112	6	1	COVER-A54 BOARD	28480	03746-04112

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A60	03746-60060	1	1	CONTROLLER ASSEMBLY	28480	03746-60060
A60C1	0160-2055	9	17	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C6	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A60C7	0160-4426	4	1	CAPACITOR-FXD ·001UF +-20% 50VDC CER	28480	0160-0575
A60C8	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A60C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C12	0180-0228	6	3	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A60C13	0160-3508	9	2	CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A60C14	0180-2662	9		CAPACITOR-FXD 10UF +80-20% 50VDC CER	28480	0180-2662
A60C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C18	0180-2815	1	1	CAPACITOR-FXD 100UF+-20% 10VDC TA	28480	0180-2815
A60C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A60C21	0160-4493	3	2	CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A60C22	0160-4493	3		CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	28480	0160-4493
A60CR2	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A60CR3	1901-0535	1	2	DIODE-SCHOTTKY	28480	1901-0535
A60CR4	1901-0535	1		DIODE-SCHOTTKY	28480	1901-0535
A60CR6	1902-0947	9	1	DIODE-ZNR 3.6V 5% DO-35 PD=.4W TC=-.036%	28480	1902-0947
A60CR7	1902-0952	6	1	DIODE-ZNR 5.6V 5% DO-35 PD=.4W TC=+.046%	28480	1902-0952
A60CR8	1902-0943			DIODE-ZNR 2·4V 5% DO-35 PD=.4W TC=+.046%		1902-0943
A60DS1	1990-0450	4	1	LED-LAMP LUM-INT=800UCD IF=50MA-MAX	28480	5082-4484
A60L1	9100-0541	7	4	INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A60L2	9100-0541	7		INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A60Q1	1854-0215	1	2	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A60Q2	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A60Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A60R1	1810-0280	8	5	NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A60R2	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A60R3	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A60R4	0683-4725	2	2	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A60R5	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A60R6	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-T0-178R-F
A60R7	06980-3162	9	6	RESISTOR 46·4K1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R9	0698-3441	7	2	RESISTOR 215K 1% .125W F TC=0+-100		
A60R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R11	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A60R12	0698-0442	3	1	RESISTOR 10K 1% .125W F TC=0+-100	28480	C4-1/8-TO-1002-F
A60R13	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A60R15	0757-0438	7		RESISTOR 5·11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A60R16	0683-2025	1	1	RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A60R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R18	0683-1005	7	2	RESISTOR 10K 5% .25W FC TC=-400/+500	01121	
A60R19	0683-1005	0	1	RESISTOR 10K 5% .25W FC TC=-400/+600	01121	
A60R20	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A60R21	0683-1005	5	1	RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A60R22	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A60R23	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A60R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60R24	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A60R25	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A60R26	0683-1035	1	3	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A60R27	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A60R28	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A60R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A60S2	3101-1989	5	1	SWITCH-SLIDE 10-1A, NS	28480	3101-1989
A60S3	3101-2288	9	1	SWITCH-PUSHBUTTON SPDT	28480	3101-2288
A60U1	1820-1759	9	4	IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A60U2	1818-1370	5	6	IC CMOS 4096 (4K) STAT RAM 320-S 3-S	34371	HM1-6514-5
A60U3	1818-1370	5		IC CMOS 4096 (4K) STAT RAM 320-S 3-S	34371	HM1-6514-5
A60U4	1818-1370	5		IC CMOS 4096 (4K) STAT RAM 320-S 3-S	34371	HM1-6514-5
A60U5	1820-1216	3	3	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A60U6	1820-2151	7	1	IC MICPROC NMOS 8-BIT	04713	MC6802L
A60U6A	1200-0654	7	2	SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0654
A60U7	1820-1759	9		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A60U8	1820-2053	8	1	IC DCDR TTL LS BCD 4-TO-16-LINE	18324	74LS154N
A60U9	03746-81094		1	PROM	28480	03746-80194
A60U9A	1200-0541	1	10	SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U10	03746-8110	4	1	PROM	28480	03746-8110
A60U10A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U11	03746-8111	6	1	PROM	28480	03746-8111
A60U11A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U12	03746-8112	8	1	PROM	28480	03746-8112
A60U12A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U13	03746-8113	0	1	PROM	28480	03746-8113
A60U13A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U14	1820-1481	4	1	IC NMOS	04713	MC6821L
A60U14A	1200-0654	7		SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0654
A60U15	1818-1370	5		IC CMOS 4096 (4K) STAT RAM 320-S 3-S	34371	HM1-6514-5
A60U16	1818-1370	5		IC CMOS 4096 (4K) STAT RAM 320-S 3-S	34371	HM1-6514-5
A60U17	1818-1370	5		IC CMOS 4096 (4K) STAT RAM 320-S 3-S	34371	HM1-6514-5
A60U18	1820-1759	9		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A68U19	1820-1759	9		IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A60U19A	1200-0639	8	1	SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639
A60U20	03746-81204		1	PROM	28480	03746-81204
A60U20A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U21	03746-81214		1	PROM	28480	03746-81214
A60U21A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U22	03746-81222	9	1	PROM	28480	03746-81222
A60U22A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U23	03746-81234		1	PROM	28480	03746-81234
A60U23A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U24	03746-81244		1	PROM	28480	03746-81244
A60U24A	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A60U25	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	01295	NE555P
A60U26	1820-1970	6	1	IC GATE CMOS OR QUAD 2-INP	04713	MC14071BCP
A60U27	1820-1730	6	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A60U28	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A60U29	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A60U30	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A60U31	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A60U32	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A60U33	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A60U34	1820-1201	6	2	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A60U35	1820-1367	5	1	IC GATE TTL S AND QUAD 2-INP	01295	SN74S08N
A60U36	1820-1201	6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A60U37	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A60U38	1820-1238	9	2	IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE DUAL	01295	SN74LS253N
A60U39	1826-0138	8	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A60U40	1820-1238	9		IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE DUAL	01295	SN74LS253N
A60U41	1820-1298	1	4	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS251N
A60U42	1820-1298	1		IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS251N
A60U43	1820-1298	1		IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS251N
A60U44	1820-1298	1		IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS251N
A60X4	1200-0607	0	2	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607
A60X4	1258-0177	0	2		28480	1258-0177
A60X5	1200-0607	0		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607
A60X5	1258-0177	0			28480	1258-0177
A60Y1	0410-1326	6	1	CRYSTAL- 4.0000MHZ	28480	0410-1326
				A60 MISCELLANEOUS PARTS		
	1251-0600	0	13	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1460-1489	8	6	WIREFORM BE CU AG	28480	1460-1489
	4040-0748	3	1	EXTRACTOR-P.C. BOARD (BLACK)	28480	4040-0748
	4040-0754	1	1	EXTRACTOR-P.C. BOARD (BLUE)	28480	4040-0754
A63	03746-60098	5	1	KEYBOARD AND DISPLAY ASSEMBLY	28480	03746-60098
A63C1	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A63C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A63C3	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A63C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A63C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A63C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A63C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A63C8	0180-0562	1	3	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X0010KA1
A63C9	0180-0562	1		CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X0010KA1
A63C10	0180-0562	1		CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X0010KA1

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A63CR35	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR36	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR37	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR38	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
	1200-0507	9	10	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR40	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR41	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR42	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR43	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR44	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A63CR100	1902-0525	9	4	DIODE-ZNR 3.48V 5% DO-15 PD=1W TC=-.073%	28480	1902-0525
A63CR101	1902-0525	9		DIODE-ZNR 3.48V 5% DO-15 PD=1W TC=-.073%	28480	1902-0525
A63CR102	1902-0525	9		DIODE-ZNR 3.48V 5% DO-15 PD=1W TC=-.073%	28480	1902-0525
A63CR103	1902-0525	9		DIODE-ZNR 3.48V 5% DO-15 PD=1W TC=-.073%	28480	1902-0525
A63DS1	1990-0592	5	15	DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0	16	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS2	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS3	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS4	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS5	1990-0681	3	1	DISPLAY-AN-SEG 1-CHAR .408-H RED	28480	5082-7656
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS6	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS7	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS8	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS9	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS10	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS11	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS12	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS13	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS14	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS15	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS16	1990-0592	5		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7653
	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A63DS17-A63DS50	1990-0665	3	34	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0665
A63DS51	1990-0793	8	6	LED-LIGHT BAR MODULE LUM-INT=6MCD	28480	HLMP-2635
A63DS52	1990-0776	7	4	LED-LIGHT BAR MODULE LUM-INT=3MCD	28480	HLMP-2600
A63DS53	1990-0776	7		LED-LIGHT BAR MODULE LUM-INT=3MCD	28480	HLMP-2600
A63DS54	1990-0776	7		LED-LIGHT BAR MODULE LUM-INT=3MCD	28480	HLMP-2600
A63DS55	1990-0793	8		LED-LIGHT BAR MODULE LUM-INT=6MCD	28480	HLMP-2635
A63DS56	1990-0793	8		LED-LIGHT BAR MODULE LUM-INT=6MCD	28480	HLMP-2635
A63DS57	1990-0793	8		LED-LIGHT BAR MODULE LUM-INT=6MCD	28480	HLMP-2635
A63DS58	1990-0793	8		LED-LIGHT BAR MODULE LUM-INT=6MCD	28480	HLMP-2635
A63DS59	1990-0793	8		LED-LIGHT BAR MODULE LUM-INT=6MCD	28480	HLMP-2635
A63DS60	1990-0776	7		LED-LIGHT BAR MODULE LUM-INT=3MCD	28480	HLMP-2600
A63J1	1251-4833	9	1	CONNECTOR 34-PIN M POST TYPE	28480	1251-4833
A63J2	1251-5608	8	1	CONNECTOR 14-PIN M POST TYPE	28480	1251-5608
A63J3	1251-5607	7	1	CONNECTOR 5-PIN M POST TYPE	28480	1251-5607
A63L1	9100-0541	7		INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A63L2	9100-0541	7		INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A63MP1	5041-0031	0	1	KEY CAP- MINT GRAY (POWER)	28480	5041-0031
A63MP2	5041-0408	5	1	KEY CAP- EBY-BLACK	28480	5041-0408
A63MP3	5041-0417	6	11	KEY CAP- BLACK+LIGHT	28480	5041-0417
A63MP4	5041-0285	6	1	KEY CAP	28480	5041-0285
A63MP5	5041-0351	7	1	KEY CAP	28480	5041-0351
A63MP6	5041-0384	6	1	KEY CAP- GRAY+LIGHT	28480	5041-0384
A63MP7	5041-0922	8	2	KEY CAP- SEM GRAY (1)	28480	5041-0922
A63MP8	5041-0943	3	1	KEY CAP- SEM GRAY (LOCAL)	28480	5041-0943
A63MP9	5041-0318	6	1	KEY CAP-GRAY+LIGHT	28480	5041-0318
A63MP10	5041-0788	4	1	KEY CAP- SEM GRAY (0)	28480	5041-0788
A63MP11	5041-0789	5	1	KEY CAP- SEM GRAY (.)	28480	5041-0789
A63MP12	5041-0802	3	1	KEY CAP- SEM GRAY (1)	28480	5041-0802
A63MP13	5041-0803	4	1	KEY CAP- SEM GRAY (2)	28480	5041-0803
A63MP14	5041-0804	5	1	KEY CAP- SEM GRAY (3)	28480	5041-0804
A63MP15	5041-0805	6	1	KEY CAP- SEM GRAY (4)	28480	5041-0805

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A63MP16	5041-0784	0	1	KEY CAP- SEM GRAY (5)	28480	5041-0784
A63MP17	5041-0785	1	2	KEY CAP- SEM GRAY (6,9)	28480	5041-0785
A63MP18	5041-0786	2	1	KEY CAP- SEM GRAY (7)	28480	5041-0786
A63MP19	5041-0787	3	1	KEY CAP- SEM GRAY (8)	28480	5041-0787
A63Q1	1853-0016	8	7	TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A63Q2	1853-0016	8		TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A63Q3	1853-0016	8		TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A63Q4	1853-0016	8		TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A63Q5	1853-0016	8		TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A63Q6	1853-0016	8		TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A63Q7	1853-0016	8		TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A63R1	0757-0278	9	8	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A63R2	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A63R3	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A63R4	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A63R5	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A63R6	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A63R7	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A63R8	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A63R9	0698-3430	5	8	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A63R10	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A63R11	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A63R12	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A63R13	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A63R14	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A63R15	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A63R16	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A63R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A63R18	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A63R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A63R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A63R21	1810-0269	3	3	NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0269
A63R22	1810-0269	3		NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0269
A63R23	1810-0269	3		NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0269
A63R24	1810-0305	8	1	NETWORK-RES 9-SIP4.7K OHM X 8	28480	1810-0305
A63R25	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A63R26	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A63S1	03780-60045	4	6	SLIDE SWITCH ASSEMBLY	28480	03780-60045
A63S1B	5020-3440	7	9	SPRING	28480	5020-3440
A63S1C	5040-0334	4	9	LEVER	28480	5040-0334
A63S2	03760-70072	4	3	SLIDE SWITCH ASSEMBLY	28480	03760-70072
A63S2B	5020-3440	7		SPRING	28480	5020-3440
A63S2C	5040-0334	4		LEVER	28480	5040-0334
A63S3	03780-60045	4		SLIDE SWITCH ASSEMBLY	28480	03780-60045
A63S3B	5020-3440	7		SPRING	28480	5020-3440
A63S3C	5040-0334	4		LEVER	28480	5040-0334
A63S4	03780-60045	4		SLIDE SWITCH ASSEMBLY	28480	03780-60045
A63S4B	5020-3440	7		SPRING	28480	5020-3440
A63S4C	5040-0334	4		LEVER	28480	5040-0334
A63S5	03780-60045	4		SLIDE SWITCH ASSEMBLY	28480	03780-60045
A63S5B	5020-3440	7		SPRING	28480	5020-3440
A63S5C	5040-0334	4		LEVER	28480	5040-0334
A63S6	03760-70072	4		SLIDE SWITCH ASSEMBLY	28480	03760-70072
A63S6B	5020-3440	7		SPRING	28480	5020-3440
A63S6C	5040-0334	4		LEVER	28480	5040-0334
A63S7	03760-70072	4		SLIDE SWITCH ASSEMBLY	28480	03760-70072
A63S7B	5020-3440	7		SPRING	28480	5020-3440
A63S7C	5040-0334	4		LEVER	28480	5040-0334
A63S8	03780-60045	4		SLIDE SWITCH ASSEMBLY	28480	03780-60045
A63S8B	5020-3440	7		SPRING	28480	5020-3440
A63S8C	5040-0334	4		LEVER	28480	5040-0334
A63S9	03780-60045	4		SLIDE SWITCH ASSEMBLY	28480	03780-60045
A63S9B	5020-3440	7		SPRING	28480	5020-3440
A63S9C	5040-0334	4		LEVER	28480	5040-0334
A63S10- A63S60	5060-9436	7	51	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A63S100	3101-2441	6	1	SWITCH-PUSHBUTTON DPDT - NS (POWER SWITCH)	28480	3101-2441
A63U1	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A63U2	1820-1587	1	3	IC DRVR TTL LED DRVR HEX 1-INP	27014	DM8859N
A63U3	1820-1740	8	3	IC DRVR TTL DSPL DRVR	27014	DS8863N
A63U4	1820-1433	6	3	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A63U5	1820-1873	8	3	IC BFR TTL LS INV OCTL 2-INP	27014	DM81LS98N
A63U6	1820-1873	8		IC BFR TTL LS INV OCTL 2-INP	27014	DM81LS98N
A63U7	1820-0471	0	2	IC INV TTL HEX 1-INP	01295	SN7406N
A63U8	1820-0471	0		IC INV TTL HEX 1-INP	01295	SN7406N
A63U9	1820-1433	6		IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A63U10	1820-1740	8		IC DRVR TTL DSPL DRVR	27014	DS8863N

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A63U11	1820-1587	1		IC DRVR TTL LED DRVR HEX 1-INP	27014	DM8859N
A63U12	1820-1740	8		IC DRVR TTL DSPL DRVR	27014	DS8863N
A63U13	1820-1433	6		IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A63U14	1820-1873	8		IC BFR TTL LS INV OCTL 2-INP	27014	DM81LS98N
A63U15	1820-1587	1		IC DRVR TTL LED DRVR HEX 1-INP	27014	DM8859N
	5020-4186	0	16	GUIDE-SWITCH	28480	5020-4186

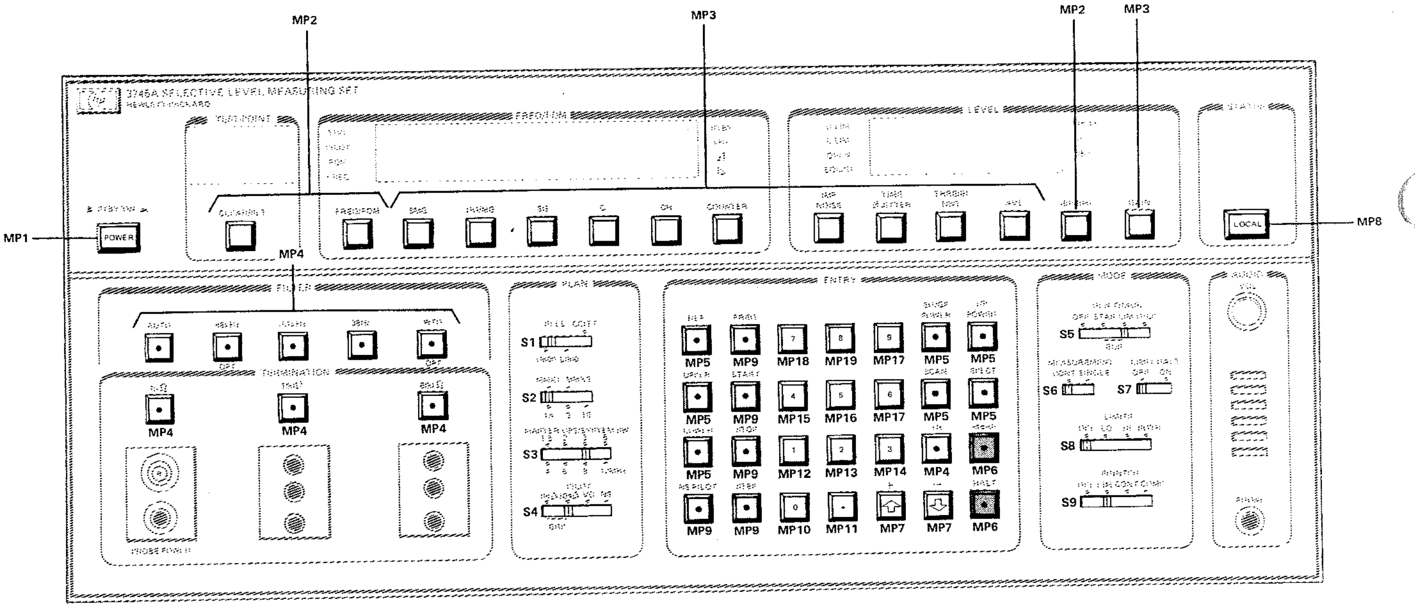


Figure 6-1 A63 Keyboard Keys and Front Panel Switches Identification

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A65	03746-60065	6	1	CONTROLLER SERVICES ASSEMBLY	28480	03746-60065
A65BT1				SEE BT1 ON MAIN LIST		
A65C1	0121-0046	2	1	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304322 9/35PF N650
A65C2	0160-3911	8	1		28480	0160-3911
A65C3	0160-4758	3	1	CAPACITOR-FXD .022F +-5% 63VDC MET-POLYC	28480	0160-4758
A65C4	0160-3879	7	15	CAPACITOR-FXD .01UF +-20% 100VDC CER	28490	0160-3879
A65C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C12	0160-4481	9	1	CAPACITOR-FXD 270PF +-5% 100VDC CER	51642	150-100-NP0-271J
A65C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A65C19	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A65C20	0180-2662	6	1	CAPACITOR-FXD 10UF+-10% 10VDC TA	25088	D4R7GS1A10K
A65CR1	1901-0044	5	2	DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A65CR2	1901-0044	5		DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A65CR3	1901-0535	9	1	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A65J1	1251-4833	9	2	CONNECTOR 34-PIN M POST TYPE	28480	1251-4833
A65J2	1251-4833	9		CONNECTOR 34-PIN M POST TYPE	28480	1251-4833
A65J3	1251-3283	1	1	CONNECTOR 24-PIN F MICRORIBBON	28480	1251-3283
A65L1	9100-3548	0	3	INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A65L2	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A65L3	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A65Q1	1853-0036	2	2	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A65Q2	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A65Q3	1854-0215	1	4	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A65Q4	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A65Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A65R1	0757-0458	7	3	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A65R2	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A65R3	0698-3453	2	2	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A65R4	0757-0401	0	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A65R5	0757-0279	0	3	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A65R6	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A65R7	0698-0083	8	4	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A65R8	0757-0180	2	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A65R9	0698-4498	7	1	RESISTOR 53.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5362-F
A65R10	0757-0349	5	1	RESISTOR 22.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2262-F
A65R11	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A65R12	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A65R13	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A65R14	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A65R15	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A65R16	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A65R17	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A65R18	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A65S1	3101-1977	1	1	SWITCH-SLIDE DPDT - NS	28480	3101-1977
A65S2	3101-2243	6	1	SWITCH-ROCKER 8-1A	28480	3101-2243
A65U1	1820-2623	8	1		28480	1820-2623
A65U2	1820-1918	2	1	IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS241N
A65U3	1820-1195	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A65U4	1820-1197	9	2	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A65U5	1820-1278	7	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS191N
A65U6	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	01295	NE555P
A65U7	1820-1204	9	1	IC GATE TTL LS NAND DUAL 4-INP	01295	SN74LS20N
A65U8	1826-0528	0	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LF356BH
A65Y1	0410-1120	8	1	CRYSTAL- 32.7680 KHZ	28480	0410-1120

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				A65 MISCELLANEOUS PARTS		
	1251-0600	0	20	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-2501	4	3	CONNECTOR-SGL CONT SKT .022-IN-BSC-SZ	28480	1251-2501
	1400-0794	0	2	HOLDER-BAT .531-.65-DIA STL	28480	1400-0794
	1460-1489	8	1	WIREFORM BE CU AG	28480	1460-1489
A68	03746-60068	9	1	HP-IB ASSEMBLY	28480	03746-60068
A68C1	0160-2055	9	9	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C9	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A68C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A68C11	0180-0228	6	2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A68C12	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A68CR1	1902-3036	3	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A68CR2	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
A68L2	9100-0541	7	1	INDUCTOR RF-CH-MLD 250UH 10% .25DX.5LG	28480	9100-0541
A68L3	03746-80050	1	1	TRANSFORMER BALUN ASSEMBLY	28480	03746-80050
A68L3	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A68R1	0683-7505	2	2	RESISTOR 75 5% .25W FC TC=-400/+500	01121	CB7505
A68R2	0683-7505	2		RESISTOR 75 5% .25W FC TC=-400/+500	01121	CB7505
A68R3	0683-1035	1	2	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A68R4	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A68R5	1810-0280	8	5	NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A68R6	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A68R7	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A68R8	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A68R9	1810-0280	8		NETWORK-RES 10-SIP10.0K OHM X 9	01121	210A103
A68R10	1810-0269	3	1	NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0269
A68TL1	1258-0124	7	2	PIN-PROGRAMING DUMPER .30 CONTACT	91506	8136-475G1
A68TL2	1258-0124	7		PIN-PROGRAMING DUMPER .30 CONTACT	91506	8136-475G1
A68U1	1826-0138	8	9	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U2	1820-0629	9	1	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74 S112AN
A68U3	1820-1201	6	2	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A68U4	1820-3329	4	4	IC UART TTL QUAD		
A68U5	1820-3329	4		IC UART TTL QUAD		
A68U6	1820-3329	4		IC UART TTL QUAD		
A68U7	1820-3329	4		IC UART TTL QUAD		
A68U8	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A68U9	1820-1759	9	1	IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A68U10	1820-1491	6	2	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A68U11	1820-1491	6		IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A68U12	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U13	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U14	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U15	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U16	1820-1492	7	1	IC BFR TTL LS INV HEX 1-INP	01295	SN74LS368AN
A68U17	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A68U18	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A68U19	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A68U20	1820-1201	6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A68U21	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U22	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U23	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U24	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A68U25	1820-2176	6	1	IC MICPROC NMOS 8-BIT	28480	1820-2176
A68U25A	1200-0654	7	1	SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0654
A68U26	03746-81264	7	1	PROM	28480	03746-81264
A68U26A	1200-0541	1	1	SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A68U27	1820-1730	6	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A68U28	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A68U29	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A68U30	1820-1997	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A68U31	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
				A68 MISCELLANEOUS PARTS		
	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	1251-1556	7	7	CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
	4040-0747	2	2	EXTRACTOR-P.C. BOARD (GRAY)	28480	4040-0747
	4040-0754	1	1	EXTRACTOR-P.C. BOARD (BLUE)	28480	4040-0754

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A80	03746-60080	5	1	POWER SUPPLY ASSEMBLY	28480	03746-60080
A80C1	0180-2779	6	2	CAPACITOR-FXD 470UF+75-10% 50VDC AL	56289	30D477G050FK2
A80C2	0180-2779	6		CAPACITOR-FXD 470UF+75-10% 50VDC AL	56289	30D477G050FK2
A80C3	0180-0098	8	2	CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A80C4	0180-0309	4	1	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	56289	150D475X0010A2
A80C5	0180-0098	8		CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A80C6	0180-0159	2	1	CAPACITOR-FXD 220UF+-20% 10VDC TA	56289	150D227X0010S2
A80C7	0160-0576	5	6	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A80C8	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A80C9	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A80C10	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A80C11	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A80C12	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A80CR1	1901-0040	1	8	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A80CR3	1902-0579	3	3	DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579
A80CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A80CR6	1901-0662	3	3	DIODE-PWR RECT 100V 6A	04713	MR751
A80CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A80CR8	1902-0777	3	1	DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	1N825
A80CR9	1902-0644	3	3	DIODE-ZNR 1N5363B 30V 5% PD=5W TC=+29MV	28480	1902-0644
A80CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A80CR11	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
A80CR30	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A80CR32	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A80CR33	1902-0644	3		DIODE-ZNR 1N5363B 30V 5% PD=5W TC=+29MV	28480	1902-0644
A80CR35	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A80CR36	1902-0579	3		DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579
A80CR50	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A80CR52	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A80CR53	1902-0644	3		DIODE-ZNR 1N5363B 30V 5% PD=5W TC=+29MV	28480	1902-0644
A80CR55	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A80CR56	1902-0579	3		DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579
A80DS1	1990-0485	5	3	LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A80DS2	1990-0485	5		LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A80DS3	1990-0485	5		LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A80DS4	1990-0486	6	3	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A80DS5	1990-0486	6		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A80DS6	1990-0486	6		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A80Q1	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A80R1	0698-3700	2	1	RESISTOR 715 1% .125W F TC=0+-100	24546	C4-1/8-T0-715R-F
A80R2	0683-1045	3	1	RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A80R3	0683-4725	2	10	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R4	0683-2705	4	1	RESISTOR 27 5% .25W FC TC=-400/+500	01121	CB2705
A80R5	0683-3025	3	2	RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
A80R6	0811-3290	7	2	RESISTOR .1 5% 2W PW TC=0+-800	28480	0811-3290
A80R7	0683-6235	3	2	RESISTOR 62K 5% .25W FC TC=-400/+800	01121	CB6235
A80R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A80R9	0683-7525	6	2	RESISTOR 7.5K 5% .25W FC TC=-400/+700	01121	CB7525
A80R10	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R11	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R12	0683-2025	1	5	RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A80R13	0683-1005	5	3	RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A80R14	0698-8061	8	1	RESISTOR 8.25K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-8251-B
A80R15	2100-3056	8	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A80R16	0698-6360	6	4	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A80R17	0683-3325	6	1	RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A80R18	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A80R20	0686-4725	8	2	RESISTOR 4.7K 5% .5W CC TC=0+647	01121	EB4725
A80R21	0686-4725	8		RESISTOR 4.7K 5% .5W CC TC=0+647	01121	EB4725
A80R22	0683-2725	8	1	RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A80R23	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A80R24	0683-4705	8	3	RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A80R30	0683-3025	3		RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
A80R31	0811-3290	7		RESISTOR .1 5% 2W PW TC=0+-800	28480	0811-3290
A80R32	0683-6235	3		RESISTOR 62K 5% .25W FC TC=-400/+800	01121	CB6235
A80R33	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A80R34	0683-7525	6		RESISTOR 7.5K 5% .25W FC TC=-400/+700	01121	CB7525
A80R35	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R36	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R37	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R38	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A80R39	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A80R40	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A80R41	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A80R42	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A80R43	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A80R50	0757-1094	5	1	RESISTOR 1·47K 5% .25W FC TC=-400/+700	01121	CB2425
A80R52	0683-1545	8	1	RESISTOR 150K 5% .25W FC TC=-800/+900	01121	CB1545
A80R53	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A80R54	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R55	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R56	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R57	0698-3259	6	1	RESISTOR 7.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7871-F
A80R58	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A80R59	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A80R60	0683-6215	9	1	RESISTOR 620 5% .25W FC TC=-400/+600	01121	CB6215
A80R61	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A80R62	0686-1225	7	1	RESISTOR 1.2K 5% .5W CC TC=0+647	01121	EB1225
A80R63	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A80R100	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A80R101	0837-0121	1	1	THERMISTOR BEAD	28480	0837-0121
A80R102	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A80R103	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A80TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A80TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A80TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A80U1	1826-0243	6	3	IC OP AMP GP DUAL TO-99 PKG	04713	MC1558G
A80U2	1826-0243	6		IC OP AMP GP DUAL TO-99 PKG	04713	MC1558G
A80U3	1826-0243	6		IC OP AMP GP DUAL TO-99 PKG	04713	MC1558G
A80U4	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P PKG	S0545	UPC311C
				A80 MISCELLANEOUS PARTS		
	4040-0747	2		EXTRACTOR-P.C. BOARD (GRAY)	28480	4040-0747
	4040-0748	3	1	EXTRACTOR-P.C. BOARD (BLACK)	28480	4040-0748

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A99	03746-60099	6	1	MOTHERBOARD ASSEMBLY	28480	03746-60099
A99C1	0180-0677	9	2	CAPACITOR-FXD 5800UF+75-10% 40VDC AL	28480	0180-0677
A99C2	0180-0677	9		CAPACITOR-FXD 5800UF+75-10% 40VDC AL	28480	0180-0677
A99C3	0180-3371		1	CAPACITOR-FXD 0.014F		
A99C4	0160-0168	1	1	CAPACITOR-FXD .1UF +-10% 200VDC POLYE	28480	0160-0168
A99C5	0160-0576	5	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A99C6	0180-0418	6	2	CAPACITOR-FXD 1UF+-20% 35VDC TA	28480	0180-0418
A99C7	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A99C8	0180-0418	6		CAPACITOR-FXD 1UF+-20% 35VDC TA	28480	0180-0418
A99C10	0180-2811	7	2	CAPACITOR-FXD 10UF+-20% 35VDC TA	28480	0180-2811
A99C11	0180-2811	7		CAPACITOR-FXD 10UF+-20% 35VDC TA	28480	0180-2811
A99C99	0160-3879	7	89	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A99CR1	1901-0662	3	4	DIODE-PWR RECT 100V 6A	04713	MR751
A99CR2	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A99CR3	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A99CR4	1901-0662	3		DIODE-PWR RECT 100V 6A	04713	MR751
A99CR5	1906-0096	7	1	DIODE-FW BRDG 200V 2A	04713	MDA202
A99CR6	1901-0731	7	4	DIODE-PWR RECT 400V 1A	28480	1901-0731
A99CR7	1901-0731	7		DIODE-PWR RECT 400V 1A	28480	1901-0731
A99CR8	1901-0731	7		DIODE-PWR RECT 400V 1A	28480	1901-0731
A99CR9	1901-0731	7		DIODE-PWR RECT 400V 1A	28480	1901-0731
A99F1	2110-0001		2	FUSE 1A 250V NTD 1.25X.25 UL	28480	2110-000
A99F2	2110-0001			FUSE 1A 250V NTD 1.25X.25 UL	28480	2110-000
A99J1	1251-5562	3	1	CONNECTOR 12-PIN M POST TYPE	28480	1251-5562
A99J2	1251-6982	3	1	CONNECTOR 14-PIN M POST TYPE	28480	1251-6982
A99J3	1251-6732	1	1	CONNECTOR 14-PIN M POST TYPE	28480	1251-6732
A99J4	1251-4969	2	1	CONNECTOR 4-PIN M POST TYPE	28480	1251-4969
A99J5	1251-5635	1	1	CONNECTOR 12-PIN M POST TYPE	28480	1251-5635
A99J65	1251-5720	5	1	CONNECTOR 34-PIN M POST TYPE	28480	1251-5720
A99L1	03746-80040	9	17	COIL ASSEMBLY	28480	03746-80040
A99L2	9100-3548	0	42	INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L3	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L4	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L5	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L6	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L7	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L8	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L9	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L10	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L11	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L12	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L13	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L14	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L15	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L16	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L17	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L18	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L19	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L20	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L21	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L22	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L23	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L24	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L25	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L26	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L27	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L28	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L29	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L30	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L31	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L32	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L33	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L34	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L35	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L36	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L37	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L38	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L39	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L40	03746-80040	9		COIL ASSEMBLY	28480	03746-80040

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A99L41	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L42	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L43	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L44	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L45	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L46	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L47	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L48	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L49	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L50	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L51	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L52	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L53	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L54	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L55	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L56	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L57	03746-80040	9		COIL ASSEMBLY	28480	03746-80040
A99L58	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L59	9100-3548	0		INDUCTOR RF-CH-MLD 470NH 5% .166DX.385LG	28480	9100-3548
A99L60	9140-0158			INDUCTOR RF - CH - MLD 1UH 5% .166DX.385LG	28480	9110-0158
A99R1	0698-3407	6	2	RESISTOR 1.96K 1% .5W F TC=0+-100	28480	0698-3407
A99R2	0698-3407	6		RESISTOR 1.96K 1% .5W F TC=0+-100	28480	0698-3407
A99R3	0686-4715	6	1	RESISTOR 470 5% .5W CC TC=0+529	01121	EB4715
A99R4	0698-4468	1	2	RESISTOR 1.13K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1131-F
A99R5	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A99R6	0698-4468	1		RESISTOR 1.13K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1131-F
A99R7	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A99R101	0683-5115	6	1	RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A99R102	0683-1035	1	3	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A99R104	0757-0283	6	2	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A99R105	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A99R106	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A99R107	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A99R110	0698-7205	5	1	RESISTOR 51.1K .125W		
A99R111	0698-7205			RESISTOR 51.1K .125W		
A99T5	9100-1238	1		TRANSFORMER-PULSE XFMR-PULSE,PC MTG	28480	9100-1238
A99T6	9100-4107	9	1	TRANSFORMER-AUDIO IMP, IN & OUT: 600	28480	9100-4107
A99U2	1826-0527	9	1	IC 337 V RGLTR TO-220	27014	LM337T
	0340-0765	6	2	INSULATOR-XSTR KAPTON	28480	0340-0765
A99U3	1826-0393	7	1	IC V RGLTR TO-220	27014	LM317T
	0340-0765	6		INSULATOR-XSTR KAPTON	28480	0340-0765
A99X11	1251-5566	7	1	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-5566
A99X12	1251-2035	9	18	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X14	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X15	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X110	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X111	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X120	1251-1365	6	12	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X121	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X122	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X123	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X130	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X131	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X132	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X140	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X141	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X150	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X151	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X152	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X153	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X154	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X160	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X180	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X223	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X240	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X250	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A99X260	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A99X280	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
				A99 MISCELLANEOUS PARTS		
	2110-0269	0	4	FUSEHOLDER-CLIP TYPE.25D-FUSE	28480	2110-0269
	03746-04706	4	1	HEATSINK-PLATE (FOR U1X2)	28480	03746-04706
	03746-24703	3	1	HEATSINK-MOUNT (FOR U1X2)	28480	03746-24703

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
			1	3746A MAIN LIST		
A1	03746-60001	0	1	INPUT SIGNAL MULTIPLEXER ASSY	28480	03746-60001
A2	03746-60002	1	1	INPUT ATTENUATOR/AMPLIFIER ASSY	28480	03746-60002
A4	03746-60004	3	1	CALIBRATOR/BROADBAND POWER DETECTOR ASSY	28480	03746-60004
A5	03746-60005	4	1	INPUT MIXER ASSY	28480	03746-60005
A10	03746-60010	1	1	2ND MIXER ASSY	28480	03746-60010
A20	03746-60020	3	1	IF FILTER ASSY	28480	03746-60020
A21	03746-60021	4	1	IF GAIN AND DETECTION ASSY	28480	03746-60021
A22	03746-60022	5	1	A/D CONVERTER ASSY	28480	03746-60022
A30	03746-60030	5	1	FRACTIONAL N-N ASSY	28480	03746-60030
A31	03746-60031	6	1	FRACTIONAL N VCO ASSY	28480	03746-60031
A32	03746-60032	7	1	FRACTIONAL N PHASE DETECTOR ASSY	28480	03746-60032
A40	03746-60040	7	1	FREQUENCY REFERENCE ASSY	28480	03746-60040
A50	03746-60050	9	1	STEP LOOP ASSY	28480	03746-60050
A51	03746-60051	0	1	SUM LOOP VCO ASSY	28480	03746-60051
A52	03746-60052	1	1	SUM LOOP MIXER ASSY	28480	03746-60052
A53	03746-60053	2	1	SUM LOOP PHASE DETECTOR ASSY	28480	03746-60053
A60	03746-60060		1	CONTROLLER ASSY	28480	03746-60060
A63	03746-60098	5	2	KEYBOARD/DISPLAY ASSEMBLY	28480	03746-60098
A65	03746-60065	6	1	CONTROLLER SERVICES ASSY	28480	03746-60065
A68	03746-60068	9	1	HP-IB ASSY	28480	03746-60068
A80	03746-60080	5	1	POWER SUPPLY ASSY	28480	03746-60080
A99	03746-60099	6	1	MOTHERBOARD ASSY	28480	03746-60099
B1	3160-0311	9	1	FAN-TBAX 74-CFM 100-125V 50/60-HZ	23936	4800X
BT1	1420-0282	3	1	BATTERY-3.6V .1A (NCD) (LOCATED ON A65)	28480	1420-0282
	1400-0440	1		CABLE CLAMP	28480	1400-0440
C1	0150-0093	0	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0150-0093
C2	0160-0168			CAPACITOR-FXD 01UF +80-20% 100VDC CER	28480	0150-0093
C3	0160-0168			CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0150-0093
C4	0160-0163			CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0150-0093
C5	0160-3402	2	1	CAPACITOR-FXD 1UF +-5% 50VDC MET-POLYC	28480	0160-3402
C6	0180-2508	9	2	CAPACITOR-FXD 2200UF+50-10% 40VDC AL	28480	0180-2508
C7	0180-2508	9		CAPACITOR-FXD 2200UF+50-10% 40VDC AL	28480	0180-2508
C8	0150-0093			CAPACITOR-FXD 0·01UF		
C9	0150-0093			CAPACITOR-FXD 0·01UF		
CR1	0122-0098	6	1	DIODE-VVC MV109M	28480	0122-0098
CR2	1906-0093	4	1	DIODE-FW BRDG 100V 35A	04713	MDA3501
CR3	1902-1438		1	DIODE-ZNR 6.2V		
CR4	1902-0958	2	4	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.075%	28480	1902-0958
CR5	1902-0958	2		DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.075%	28480	1902-0958
CR6	1902-0958	2		DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.075%	28480	1902-0958
CR7	1902-0958	2		DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.075%	28480	1902-0958
F1	2110-0094	8	1	FUSE 1·25A (230V OPERATION)		
	2110-0083	9	1	FUSE 2·5A (FOR 115V OPERATION)		
	2110-0569	3	1	FUSEHOLDER COMPONENT NUT; THREAD M12.7	28480	2110-0569
	2110-0565	9	1	FUSEHOLDER CAP-12A MAX FOR UL	28480	2110-0565
	2110-0564	8	1	FUSEHOLDER BODY 12A MAX FOR UL	H9027	031.1657
J1	1250-1676	0	1	CONNECTOR-RF BNC	28480	1250-1676
J2/J3	1251-5586	1	2	JACK-BNA TRIPLE BLK SLDR-LUG-TERM	28480	1251-5586
J6/J7/J8	1251-5586	1		JACK-BNA TRIPLE BLK SLDR-LUG-TERM	28480	1251-5586
J9	5060-0467	6	1	PROBE-POWER CONNECTOR	28480	5060-0467
J10	1251-2533	2	1	CONNECTOR-TEL JACK 3-CKT	28480	1251-2533
J11	1250-0698	4	1	CONNECTOR-RF BNC FEM SGL-HOLE-FR	28480	1250-0698
J12				P/O W26 (SEE OPTION 012)		
J13				P/O W23		
J14				P/O W25		
J15				P/O W24		
J17	1251-0687	3	1	CONNECTOR-TEL JACK 2-CKT .25-SHK-DIA	28480	1251-0687
J18	1251-5798	9	1	CONNECTOR-TEL JACK 2-CKT	82389	M-114B
K1	0490-1222	9	1	RELAY 6VDC (P/O MP16)	28480	0490-1222
LF1	9100-3910	0	1	LINE FILTER (P/O MP16)	28480	9100-3910
LS1	9160-0229	4	1	LOUDSPEAKER	28480	9160-0229
	0460-1333			ADHESIVE FOAM TAPE		

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
MP1	5060-9834	9	1	COVER-TOP	28480	5060-9834
	0460-1333			ADHESIVE FOAM TAPE		
MP2	5060-9846	3	1	COVER-BOTTOM	28480	5060-9846
MP3	5060-9883	8	1	COVER-SIDE	28480	5060-9883
MP4	5060-9941	9	1	COVER-PERFORATED SIDE	28480	5060-9941
MP5	5060-9900	0	2	FRONT HANDLE ASSEMBLY	28480	5060-9900
MP6	5020-8897	8	2	FRONT HANDLE TRIM	28480	5020-8897
MP7	5040-7202	9	1	TRIM-TOP	28480	5040-7202
MP8	1460-1345	5	2	TILT STAND SST	28480	1460-1345
MP9	1460-0553	5	3	CLIP-WINDOW	28480	1460-0553
MP10	0400-0001	1	1	GROMMET-RND .562-IN-ID .75-IN-GRV-OD	28480	0400-0001
MP11	0460-0970	7	1	TAPE 0.250	28480	0460-0970
MP12	03746-04707	5	1	GASKET-PLATE	28480	03746-04707
MP13	5020-8805	8	1	FRAME-FRONT	28480	5020-8805
MP14	5020-8836	5	1	CORNER STRUT	28480	5020-8836
MP15	5020-8806	9	1	FRAME-REAR	28480	5020-8806
MP17	03746-00215			PANEL SUB (above ser no 411)	28480	03746-00215
MP16	03746-00202	7	1	PANEL-REAR	28480	03746-00202
MP17	03746-00201	6	1	PANEL-SUB (below ser no 00412)	28480	03746-00201
MP18	03746-00501	9	1	GUARD-FAN	28480	03746-00501
MP19	1510-0084	4	1	BINDING POST SGL THD-STUD JGK RED	28480	1510-0084
MP20	1510-0087	7	1	BINDING POST SGL THD-STUD JGK BLK	28480	1510-0087
MP21	0340-0732	7	4	INSULATOR-BDG POST POLYC	28480	0340-0732
MP22	5040-7201	8	4	FEET	28480	5040-7201
MP23	5040-7219	8	2	HANDLE-FRONT STRAP	28480	5040-7219
MP24	5040-7220	1	2	HANDLE-REAR STRAP	28480	5040-7220
MP25	5060-9803	2	2	STRAP-HANDLE	28480	5060-9803
MP26	5040-7695	4	1	SPEAKER-MOUNT	28480	5040-7695
MP27	3150-0218	4	1	FILTER-AIR 32 STD MESH MET SCREEN	28480	3150-0218
MP28	7100-0114	8	1	COVER-TRANSFORMER	28480	7100-0114
MP29	0360-1987	8	1	BARRIER BLOCK (5-WAY)	28480	0360-1987
MP30	1250-1499	5	1	ADAPTOR-COAX BNC	28480	1250-1499
MP31	03746-00601	0	1	SHIELD	28480	03746-00601
MP32	03746-01202	9	1	BRACKET-FRONT	28480	03746-01202
MP33	03746-01205	2	1	BRACKET	28480	03746-01205
MP34	03746-01206	3	1	BRACKET	28480	03746-01206
MP35	03746-01208	5	1	BRACKET-REGULATOR	28480	03746-01208
MP36	03746-01211	0	1	BRACKET	28480	03746-01211
MP37	03746-01212	1	1	BRACKET	28480	03746-01212
MP38	03746-01213	2	1	BRACKET	28480	03746-01213
MP39	03746-01214	3	1	BRACKET	28480	03746-01214
MP40	03746-01215	4	1	DIVIDER-AIR	28480	03746-01215
MP41	03746-01216	5	1	BRACKET-TRANSFORMER	28480	03746-01216
MP42	03746-01217	6	1	BRACKET	28480	03746-01217
MP43	03746-01218	7	1	BRACKET	28480	03746-01218
MP44	03746-04101	3	1	COVER (A1 ASSEMBLY)	28480	03746-04101
MP45	03746-04185	3	1	COVER (PLASTIC)	28480	03746-04185
MP46	03746-04186	4	1	PLATE	28480	03746-04186
MP47	03746-04187	5	1	INSULATOR	28480	03746-04187
MP48	03746-04195	5	1	INSULATOR	28480	03746-04195
MP50	03746-04197	7	1	COVER-REGULATOR	28480	03746-04197
MP51	03746-04198	8	1	COVER-(PLASTIC)	28480	03746-04198
MP52	03746-04702	0	1	SUPPORT JACK	28480	03746-04702
MP53	03746-04703	1	1	BRACE-CAPACITOR	28480	03746-04703
MP54	03746-04704	2	1	BRACE-DIGITAL	28480	03746-04704
MP55	03746-24801	2	1	RETAINER-CAPACITOR	28480	03746-24801
MP56	03746-20201	8	1	PANEL-DRESS UPPER	28480	03746-20201
MP57	03746-04705	3	1	COVER-TERMINAL	28480	03746-04705
MP58	5040-6928	4	1	DIVIDER STRIP	28480	5040-6928
MP59	5061-2009	8	1	KIT-REAR FEET	28480	5061-2009
MP60	03746-60601	6	1	SHIELD BOX ASSY (LARGE)	28480	03746-60601
MP61	03746-60602	7	1	SHIELD BOX ASSY (SMALL)	28480	03746-60602
MP62	03746-00103	7	1	INPUT BOX (CCITT BNC)	28480	03746-00103
MP63	03746-24702	2	1	SPACER-PROBE POWER	28480	03746-24702
MP64	03746-04211	6	1	COVER	28480	03746-04211
MP65	03746-04212	7	1	COVER	28480	03746-04212
MP66	03746-00204	9	1	PANEL-DRESS LOWER (3-HOLE)	28480	03746-00204
MP66	03746-00217					
MP67	0340-0618	8	1	INSULATOR SHEET	28480	0340-0618
MP68	9320-4777			INFORMATION CARD		
MP69	9320-4780			INFORMATION CARD		
Q1	1854-0618	8	2	TRANSISTOR NPN SI DARL TO-3 PD=150W	04713	MJ3000
	0340-0782	7	3	INSULATOR-XSTR KAPTON	28480	0340-0782
	1200-0461	4	3	SOCKET-XSTR 2-CONT TO-3 SLDR-EYE	28480	1200-0461
Q2	1853-0387	6	1	TRANSISTOR PNP SI DARL TO-3 PD=150W	04713	MJ2500
	0340-0782	7		INSULATOR-XSTR KAPTON	28480	0340-0782
	1200-0461	4		SOCKET-XSTR 2-CONT TO-3 SLDR-EYE	28480	1200-0461
Q3	1854-0618	8		TRANSISTOR NPN SI DARL TO-3 PD=150W	04713	MJ3000
	0340-0782	7		INSULATOR-XSTR KAPTON	28480	0340-0782
	1200-0461	4		SOCKET-XSTR 2-CONT TO-3 SLDR-EYE	28480	1200-0461

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R1	2100-0669	3	1	RESISTOR-VAR CONTROL CCP 50K 10% 10CW	28480	2100-0669
	0370-1001	8	1	KNOB-BASE 3/8 JGK .125-IN-ID	28480	0370-1001
R2	0757-0728	4	1	RESISTOR 619 1% .25W F TC=0+-100	24546	C5-1/4-TO-619R-F
S1	3101-2814	1	3	SWITCH-SLIDE DPDT -NS (P/O MP16)	28480	
S2	3101-2814	1		SWITCH-SL DPDT STD 5A 250VAC SLDR-LUG	28480	
S2	3101-2614	1		SWITCH-SLIDE DPDT -NS (P/O MP16)	28480	
S3	T-65671	7	1	SWITCH-THERMAL +100C	28480	3103-0020
T1	03746-80101	2	1	TRANSFORMER-POWER	28480	03746-80101
MSC	03746-60092			EXTENDER BOARD KIT	28480	03746-60092
W1				POWER CORD (SEE SECTION II)		
W2	03746-61611	0	1	HP-IB RIBBON CABLE (FROM A68 TO A65)	28480	03746-61611
	1251-3019	1	3	CONNECTOR 34-PIN F POST TYPE	28480	1251-3019
	1251-3916	7	2	CONNECTOR-PC EDGE 17-CONT/ROW 2-ROWS	28480	1251-3916
W3	03746-61612	1	1	CABLE-RIBBON (FROM A63 TO A60)	28480	03746-61612
	1251-3019	1		CONNECTOR 34-PIN F POST TYPE	28480	1251-3019
	1251-3916	7		CONNECTOR-PC EDGE 17-CONT/ROW 2-ROWS	28480	1251-3916
W4	03746-61613	2	1	CABLE-RIBBON (FROM A65 TO A99J65)	28480	03746-61613
	1251-3019	1		CONNECTOR 34-PIN F POST TYPE	28480	1251-3019
W5	03746-61614	3	1	CAPACITOR CABLE ASSY(FROM C6/7 TO A99J4)	28480	03746-61614
	1251-3277	3	1	CONNECTOR 4-PIN F POST TYPE	28480	1251-3277
	1251-3411	7	34	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-3411
W6	03746-61615	4	1	KEYBOARD/DISPLAY CABLE ASSY(FROM A63J2 TO A99J1)	28480	03746-61615
	1251-0627	1	3	POLARIZING KEY-POST CONN	28480	1251-0627
	1251-3279	5	2	CONNECTOR 12-PIN F POST TYPE	28480	1251-3279
	1251-3411	7		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-3411
	1251-3967	8	16	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-3967
	1251-5610	2	1	CONNECTOR 14-PIN F POST TYPE	28480	1251-5610
W7	03746-61616	5	1	LOUDSPEAKER CABLE ASSY (J18/LS1)	28480	03746-61616
	1251-3967	8		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-3967
	1251-5609	9	1	CONNECTOR 5-PIN F POST TYPE	28480	1251-5609
W8	03746-61617	6	1	REAR PANEL AUDIO CABLE ASSY(FROM J10/J17 TO A99J5)	28480	03746-61617
	1251-0627	1		POLARIZING KEY-POST CONN	28480	1251-0627
	1251-3279	5		CONNECTOR 12-PIN F POST TYPE	28480	1251-3279
	1251-3411	7		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-3411
W9	03746-61618	7	1	REGULATOR CABLE ASSY(FROM Q1-Q3 TO A99J3)	28480	03746-61618
	1251-0627	1		POLARIZING KEY-POST CONN	28480	1251-0627
	1251-3411	7		CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-3411
	1251-5154	9	1	CONNECTOR 14-PIN F POST TYPE	28480	1251-5154
W10	03746-61620	1	1	THERMAL SWITCH (I)CABLE ASSY(ON S3)	28480	03746-61620
	1251-2510	5	1	CONNECTOR 2-PIN M UTILITY	28480	1251-2510
	1251-2599	0	2	CONTACT-CONN U/W-UTIL MALE CRP	28480	1251-2599
W11	03746-61621	2	1	THERMAL SWITCH (II)CABLE ASSY(ON S1/F1)	28480	03746-61621
	1251-2505	8	2	CONNECTOR 2-PIN F UTILITY	28480	1251-2505
	1251-2600	4	2	CONTACT-CONN U/W-UTIL FEM CRP	28480	1251-2600
W12	03746-61631	4	1	75 OHM INPUT CABLE ASSY (IN I/P BOX A1)	28480	03746-61631
	0362-0006	4	2	SLEEVE-METAL CU TIN .199-IN-OD .25-UN-LG	28480	0362-0006
	03702-348	2	2	CABLE BUSHING	28480	03702-348
W13	03746-61641	6	1	INPUT ATTEN./AMPL. CABLE ASSY(A1 TO A2J1)	28480	03746-61641
	0362-0006	4		SLEEVE-METAL CU TIN .199-IN-OD .25-UN-LG	28480	0362-0006
	1250-0931	8	5	CONNECTOR-RF SM-SNP FEM UNMTD 75-OHM	28480	1250-0931
	03702-348	2		CABLE BUSHING	28480	03702-348
W14	03746-61642	7	2	COAX CABLE ASSY (FROM A2J2 TO A4J1)	28480	03746-61642
	1250-0931	8		CONNECTOR-RF SM-SNP FEM UNMTD 75-OHM	28480	1250-0931
W15	03746-61642	7		COAX CABLE ASSY (FROM A2J3 TO A5J1)	28480	03746-61642
	1250-0931	8		CONNECTOR-RF SM-SNP FEM UNMTD 75-OHM	28480	1250-0931
W18	03746-61645	0	3	GRAY COAX CABLE ASSY(FROM A40J4-A50J3)	28480	03746-61645
	1250-0666	6	9	CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0666
W19	03746-61645	0		GRAY COAX CABLE ASSY(FROM A50J1-A52J1)	28480	03746-61645
	1250-0666	6		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0666
W20	03746-61645	0		GRAY COAX CABLE ASSY(FROM A51J1-A52J2)	28480	03746-61645
	1250-0666	6		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0666
W21	03746-61651	8	1	PROBE POWER CABLE ASSY(IN I/P BOX A1)	28480	03746-61651
W23	03746-61674	5	1	10MHZ OUTPUT CABLE ASSY(ORN CABLE TO REAR PANEL)	28480	03746-61674
	1250-0293	5	2	GASKET-RF CONN SERIES BNC/TNC	9D949	31-2123-4
	1250-0297	9	3	INSULATOR CONN SERIES BNC/TNC	9D949	31-2129-3
	1250-0298	0	3	BUSHING-RF CONN SERIES BNC/TNC	9D949	31-2122-3
	1250-0666	6		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0666
	1250-0715	6	4	CONNECTOR	28480	1250-0715
	1250-0804	4	4	CLAMP-RF CONN SER BNC/TNC	9D949	82-2907-2
	1250-0806	6	4	WASHER-RF CONN .118-.122 ID; BR	9D949	82-2909-8
	1250-0807	7	3	CLAMP NUT-RF CONN BNC/TNC: BR: NI	9D949	31-2124-5
	1250-0807	7		CLAMP NUT-RF CONN BNC/TNC: BR: NI	9D949	31-2124-5
	1250-1091	3	3	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1091

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

Table 6-2 Replaceable Parts (continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W24	03746-61675	6	1	10MHZ REF INPUT CABLE ASSY(RED CABLE TO REAR PANEL)	28480	03746-61675
	1250-0293	5		GASKET-RF CONN SERIES BNC/TNC	9D949	31-2123-4
	1250-0297	9		INSULATOR CONN SERIES BNC/TNC	9D949	31-2129-3
	1250-0298	0		BUSHING-RF CONN SERIES BNC/TNC	9D949	31-2122-3
	1250-0666	6		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0666
	1250-0715	6		CONTACT-RF CONNECTOR	28480	1250-0715
	1250-0804	4		CLAMP-RF CONN SER BNC/TNC	9D949	82-2907-2
	1250-0806	6		WASHER-RF CONN .118-.122 ID; BR	9D949	82-2909-8
	1250-0807	7		CLAMP NUT-RF CONN BNC/TNC; BR; NI	9D949	31-2124-5
	1250-1091	3		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1091
W25	03746-61676	7	1	10MHZ OVEN CABLE ASSY(YELLOW CABLE TO REAR PANEL)	28480	03746-61676
	1250-0293	5		GASKET-RF CONN SERIES BNC/TNC	9D949	31-2123-4
	1250-0297	9		INSULATOR CONN SERIES BNC/TNC	9D949	31-2129-3
	1250-0298	0		BUSHING-RF CONN SERIES BNC/TNC	9D949	31-2122-3
	1250-0666	6		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0666
	1250-0715	6		CONTACT-RF CONNECTOR	28480	1250-0715
	1250-0804	4		CLAMP-RF CONN SER BNC/TNC	9D949	82-2907-2
	1250-0806	6		WASHER-RF CONN .118-.122 ID; BR	9D949	82-2909-8
	1250-0870	4	1	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-0870
	1250-1091	3		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1091

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

Table 6-2 Replaceable Parts (continued)

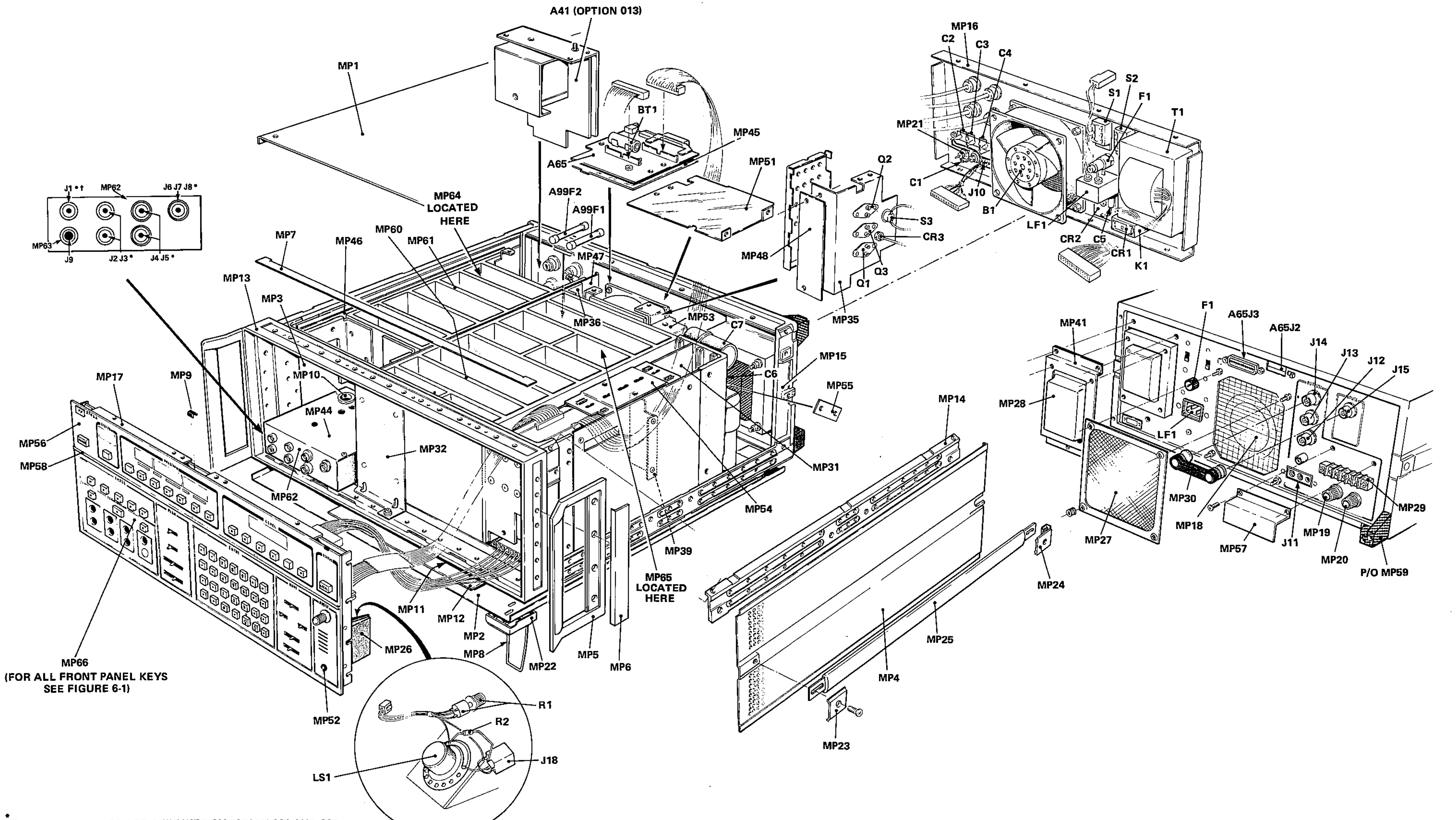
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				OPTION 001 SAME AS STD. INSTRUMENT EXCEPT FOR THE FOLLOWING:		
	03746-00104	8		MP62 INPUT BOX (CCITT SMALL SIEMENS)	28480	03746-00104
				ADD:		
	03746-00205	0		MP66 PANEL-DRESS LOWER(3-HOLE SIEMENS)	28480	03746-00205
	03746-00218	4		MP66 PANEL-DRESS (above serial number 00411)	28480	03746-61631
	03746-61632	5	1	W29 75OHM INPUT CABLE ASSEMBLY	28480	03746-61632
	0362-0006	4	1	W27A SLEEVE METAL	28480	0362-0006
	1250-1077	5	1	W27B CONN-RF 1.6/5.6	28480	1250-1077
	08702-348	2	1	W27D CABLE-BSH	28480	08702-348
				NOTE: CONNECTOR WHICH REPLACES J1 IS P/O W27		
				OPTION 005 SAME AS STD. INSTRUMENT EXCEPT FOR THE FOLLOWING:		
	1250-1053	7		J1,2,3 CONNECTOR-RF (LARGE WECO)	28480	1250-1053
	1251-0687	3		J4,5,6/7/8 CONNECTOR-TEL JACK	28480	1251-0687
	03746-00101	5		MP62 INPUT BOX (WECO BELL)		03746-00101
	03746-00204	9	2	MP66 PANEL-DRESS LOWER(3-HOLE)	28480	03746-00204
	03746-00203	8		MP66 PANEL-DRESS LOWER(4-HOLE)	28480	03746-00203
	03746-00216	0	1	MP66 PANEL-DRESS (above serial number 00411)	28480	03746-60001
	03746-24701	1		MP67 SPACER (WECO)	28480	03746-24701
	03746-60101	1	1	A1 INPUT SIGNAL MULTIPLEXER ASSY	28480	03746-60101

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

#1

Table 6-3 Manufacturers Code List

MFR NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
H9027	SCHURTER A G H	LUZERN	SW	
SO545	NIPPON ELECTRIC CO	TOKYO	JP	
00000	ANY SATISFACTORY SUPPLIER			
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
02111	SPECTROL ELECTRONICS CORP	CITY OF IND	CA	91745
03888	K D I PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85008
06001	MEPCO ELECTRA CORP	COLUMBIA	SC	29063
06665	PRECISION MONOLITHICS INC	SANTA CLARA	CA	95050
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
07933	RAYTHEON CO SEMICOND DIV HQ	MOUNTAIN VIEW	CA	94040
11236	CTS OF BERNE INC	BERNE	IN	46711
13606	SPRAGUE ELECT CO SEMICONDUCTOR DIV	CONCORD	NH	03301
18324	SIGNETICS CORP	SUNNYVALE	CA	94086
19701	MEPCO/ELECTRA CORP	MINERAL WELLS	TX	76067
20932	EMCON DIV ITW	SAN DIEGO	CA	92129
23936	PAMOTOR DIV WILLIAM J PURDY	BURLINGAME	CA	94010
24046	TRANSITRON ELECTRONIC CORP	WAKEFIELD	MA	01880
24355	ANALOG DEVICES INC	NORWOOD	MA	02062
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
25088	SIEMENS CORP	ISELIN	NJ	08830
27014	NATIONAL SEMICONDUCTOR CORP.	SANTA CLARA	CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE	CA	92507
34371	HARRIS SEMICON DIV HARRIS-INTERTYPE	MELBOURNE	FL	32901
50088	MOSTEK CORP	CARROLLTON	TX	75006
51642	CENTRE ENGINEERING INC	STATE COLLEGE	PA	16801
52763	STETTNER-TRUSH INC	CAZENOVIA	NY	13035
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
72136	ELECTRO MOTIVE CORP	FLORENCE	SC	06226
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON	CA	92634
75915	LITTLEFUSE INC	DES PLAINES	IL	60016
82389	SWITCHCRAFT	CHICAGO	IL	60630
8M498	JOHANSON DIELECTRICS INC	BURBANK	CA	91510
9D949	AMPHENOL SALES DIV OF BUNKER-RAMO	BROADVIEW	IL	60153
9N171	UNITRODE COMPUTER PRODUCTS CORP	METHUEN	MA	
90201	MALLORY CAPACITOR CO	INDIANAPOLIS	IN	46206
91506	AUGAT INC	ATTLEBORO	MA	02703
91637	DALE ELECTRONICS INC	COLUMBUS	NE	68601



*THESE CONNECTORS ARE AFFECTED BY OPTION 001 AND 005

† IN OPTION 001 J1 IS P/O W12

Figure 6-2 Miscellaneous Parts

W1

SECTION VII
MANUAL CHANGES

7-1 MANUAL BACKDATING

7-2 This manual applies directly to the SLMS with the serial number 2405U-00412. To make this manual applicable to instruments with serial numbers below 2405U-00412, make the following changes.

Serial Prefix	Make Changes
2314U	1
2250U	1, 2
2242U	1, 2, 3
2240U	1, 2, 3, 4, 5
2125U	1, 2, 3, 4, 5, 6

CHANGE 1

Part numbers for Rev 3 software ROMS.

Page 6-60:
Change A60 to 03746-6

Page 6-61:
Change A60U9 to 03746-81092
A60U20 to 03746-81202
A60U21 to 03746-81212
A60U23 to 03746-81232
A60U24 to 03746-81242

Page 6-66:
Change A68U26 to 03746-08260

CHANGE 2

Page 6-15:
Change A5R18 to 0698-3442 Resistor 237

Page 6-16:
Change A10R8 to 0698-3442 Resistor 237

Page 6-27 & 6-32:
Change A10R8 to 0160-4616 Capacitor 560pF

Page 6-28:
Change A23L1 and A23L5 to 9140-3560 inductor 100uH

Page 6-29:
Change A23R17 to 0757-0438 Resistor 5.11k

Page 6-33
Change A23R20 to 0757-0464 Resistor 90.9k

Page 6-34
Change A23R44 to 0757-0461 Resistor 68.1k
A23R54 to 0698-3159 Resistor 26.1k

Page 6-30 and 6-35:
Change A23R163 to 0683-1065 Resistor 10M

Page 6-31:
Change A23U5 to 1826-0180 IC Timer

Page 6-35, 6-36:
Change A23U33 to 1820-1194 IC Counter
A23U34 to 1820-1491 IC BFR
A23U40 to 1826-0476 IC Switch

A5 Schematic Diagram R18 is 237Ω
A10 Schematic Diagram R8 is 237Ω
A23 Schematic Diagram Part 1, Part 2 and Part 3 replace with drawings 03746-60023/123-P2-A and P-03746-60023/123-P3-A.

Receiver Block Diagram and Instrument Block Diagram: Delete this line connecting A21(B15) to A23(B2).

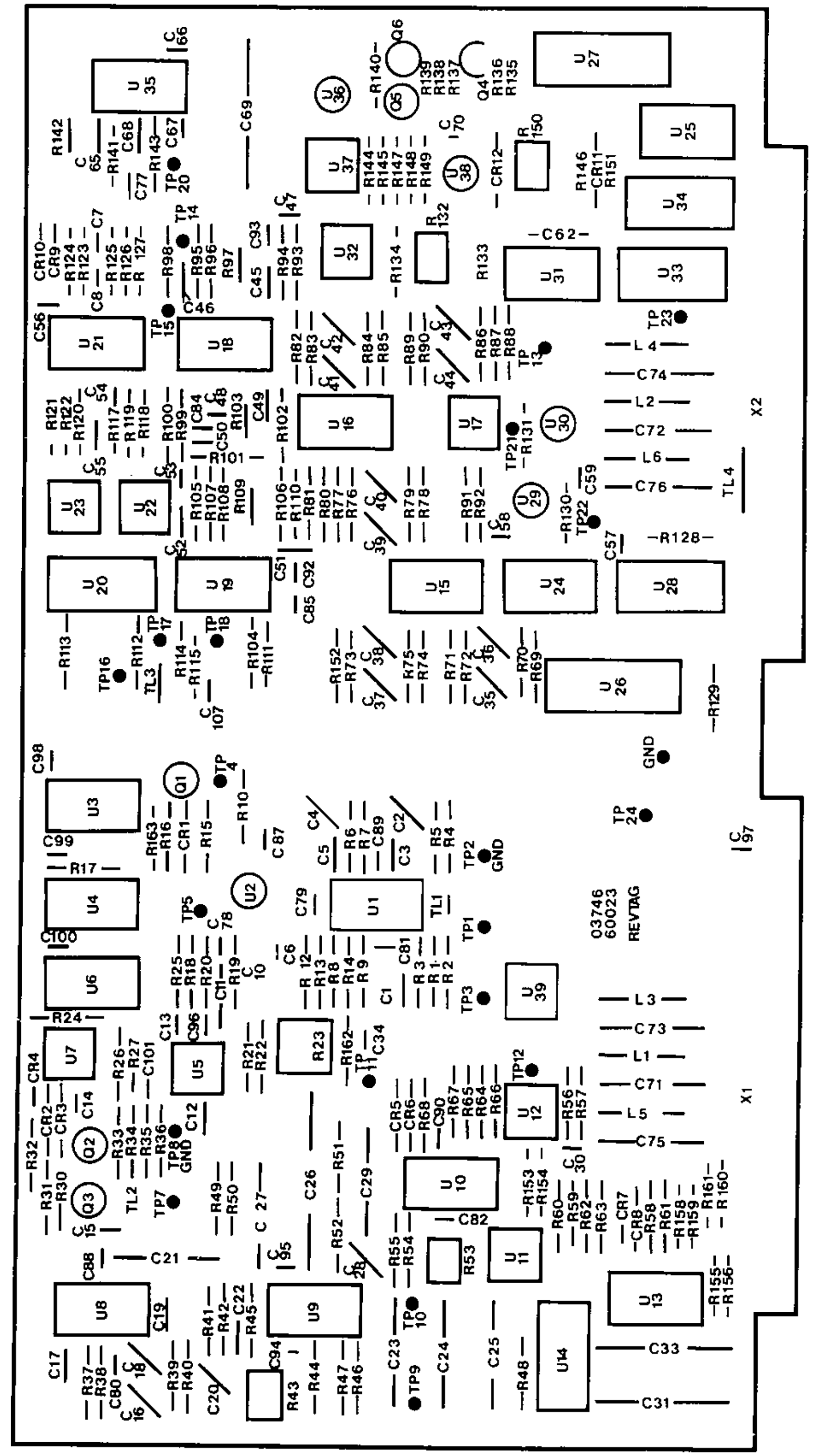


Figure 7-1 A23 Component Location

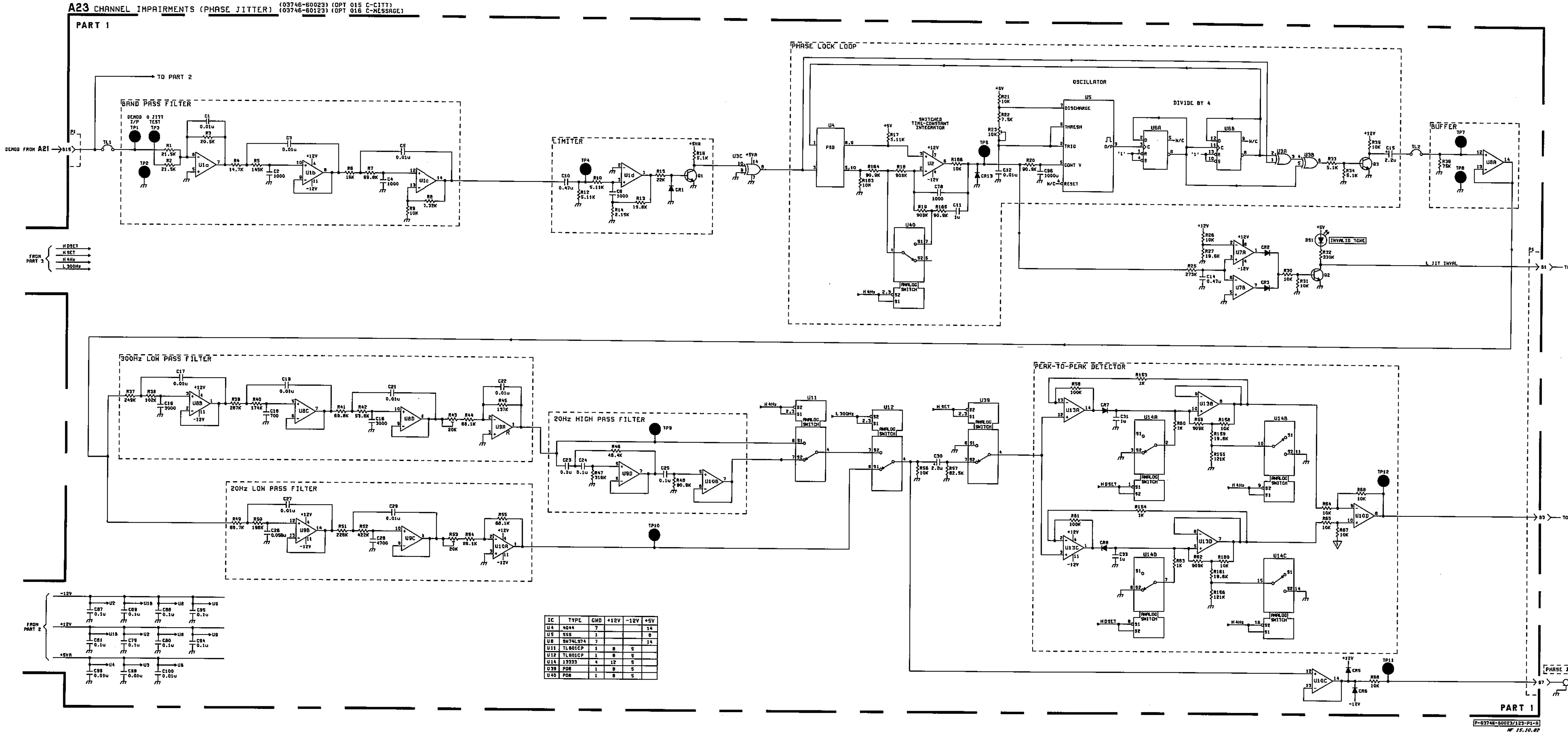
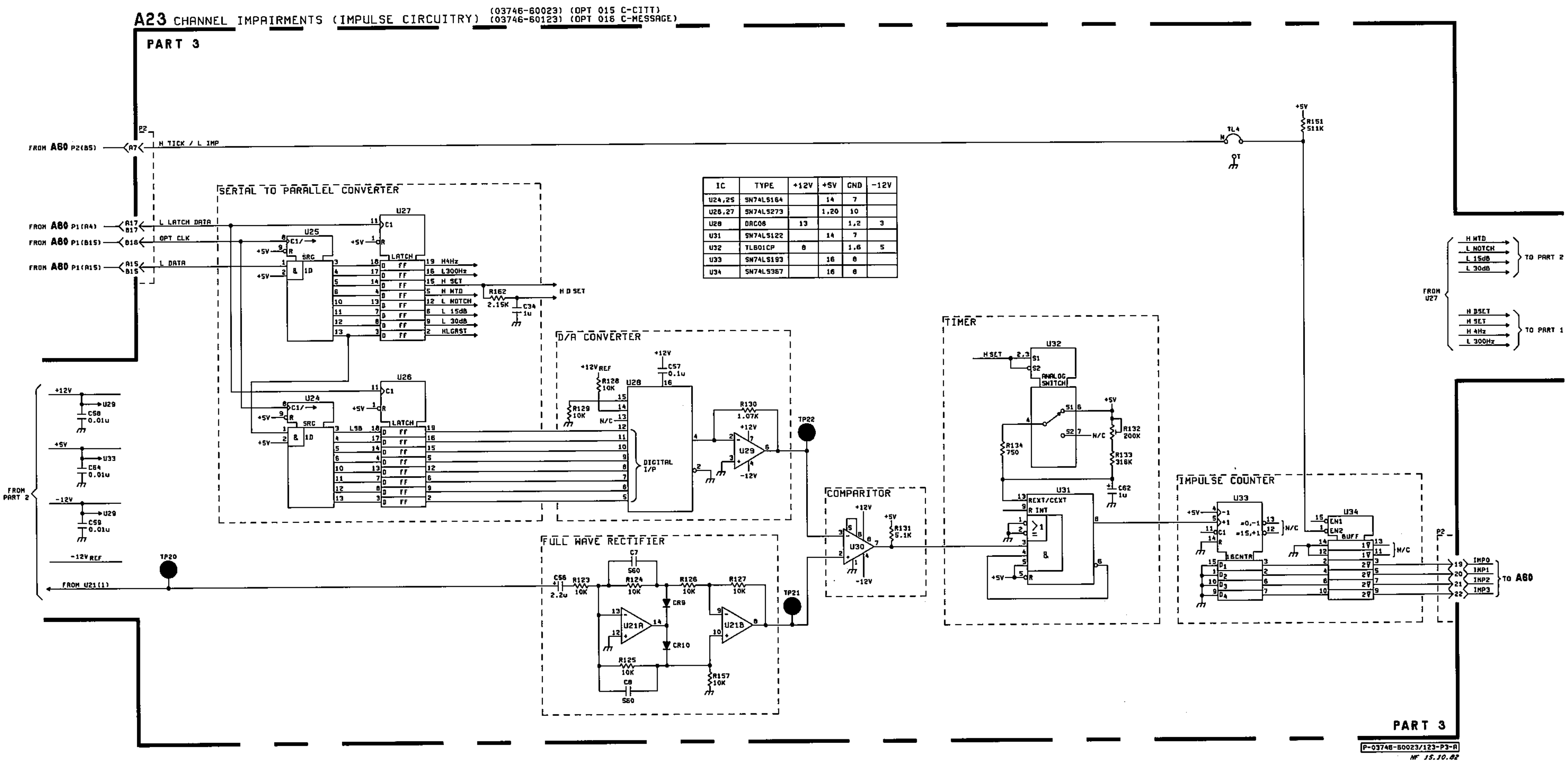


Figure 7-2 A23 Schematic Diagram Part 1

IC	TYPE	+12V	GND	-12V
U20	13333	12	4	5
U22	TL601CP	8	1	5
U23	TL601CP	8	1	5
U35	AD536AJ	14	9,10	3
U37	TL601CP	8	1	5

A23 Component Location
A23 Schematic Diagram Part 1

Figure 7-3 A23 Schematic Diagram Part 2



IC	TYPE	+12V	+5V	GND	-12V
U24,25	SN74LS164		14	7	
U26,27	SN74LS273		1,20	10	
U28	DAC08	13		1,2	3
U31	SN74LS122		14	7	
U32	TL601CP	8		1,6	5
U33	SN74LS193		16	8	
U34	SN74LS367		16	8	

Figure 7-4 A23 Schematic Diagram Part 3

A60 TROUBLESHOOTING

The following troubleshooting applies only to serial numbers below 2250U00332.

KERNEL SIGNATURES

To run the Kernel Signature program:

1. Switch the SLMS POWER switch to STBY.
2. Remove XP4, XP3 and U19. XP4 disconnects the Input data from the micro-processor data bus, XP3 disconnects the RAM data bus, and U19 disconnects the ROM data bus. The no OP code is now forced by the hard-wire resistor pack R3.
3. Set the signature Analyzer controls as follows:

   START STOP CLOCK

4. Connect the START STOP probes to TP2 and the CLOCK probe to TP1.
5. Set the POWER switch to ON.

Check the +5V signature is 0003

The following signatures are independent of any software changes.

U6 Address bus

9	UUUU	(A0)	17	7791	(A8)
10	FFFF	(A1)	18	6321	(A9)
11	8484	(A2)	19	37C5	(A10)
12	P763	(A3)	20	6U28	(A11)
13	1U5P	(A4)	22	4FCA	(A12)
14	0356	(A5)	23	4868	(A13)
15	U759	(A5)	24	9UPI	(A14)
16	6F9A	(A7)	25	0001	(A15)

NOTE: U6 pin 1 is located at the bottom right hand-side of the IC.

U18		U7		U8			
11	UUUU	7	7791	1	9F14	9	4P08
9	FFFF	13	6321	2	25P6	10	12U1
13	8484	9	37C5	3	H602	11	PC03
7	P763	11	6U28	4	25P6	13	F2A4
15	1U5P	3	4FCA	5	HA92	14	6H4C
5	0356	17	4868	6	132H	15	0994
17	U759	5	9UP1	7	P7AA	16	U3H7
3	6F9A	15	0001	8	F4AC	17	P257

A23 Schematic Diagram Part 3

U5				U29			
5	PACU	12	0PP1	11	0PP2	TP3	HA92
7	654H	13	4H39	8	0PP1	TP4	H602
9	F469	14	4CC1			TP6	PACF
10	16C9	15	427U				
11	1737						

U38, U40 through U44. Check the signatures at pin 5 on U41 through U44, signature should register. This signature should change when the appropriate S2- switch (at pin 4 of the IC) is switched. Ensure the switch is returned to its original setting. On IC38 and IC40 the signature at the output pins (9 and 7) should change when the appropriate S2- switch setting is altered.

Note: Sometimes the signature may register as unstable or give 2 signatures. The important part of the check is to ensure the signature changes when the switch S2- is altered. This check does not ensure that the INPUT MULTIPLEXER circuits is functioning 100% correctly, but it does give an indication that the circuitry is working.

PROGRAM SIGNATURES

To run the program signatures - switch the SLMS POWER to STBY;

1. Test links XP4 and XP3 should be removed, and U19 connected in circuit.
2. Connect the Signature Analyzer START to TP3, the STOP to TP4, and the CLK to TP1. 3. Set the Signature Analyzer controls to

   START STOP CLOCK

4. Switch the POWER switch to ON.
5. Switch S2-10 ON and then OFF. This forces an edge at the microprocessor NMI (non maskable interrupt) input and sends the processor to the NMI address location which is the start point for the signature analysis program.

The +5V signature should be HA9P. If this signature is incorrect go to the KERNEL TEST signatures/or replace U19.

6. Set the POWER switch to STBY.
7. Replace XP3.
8. Switch S2-10 ON and then OFF to re-start the SA program.

The +5V signature should now be 3P94. An incorrect signature may indicate the area of the fault.

ROMF U9, and ROM6 U24 contain the SA program, hence a failure of either of these ROMS will prevent the program running.

HA9P indicates RAM 0 - U15 or U2 failure
A7CU indicates RAM 1 - U16 or U3 failure
9PUP indicates RAM 2 - U17 or U4 failure
HPAF indicates ROM 7 - U13 failure
98CF indicates ROM 8 - U23 failure
H129 indicates ROM 9 - U12 failure
4P0A indicates ROM A - U22 failure
A978 indicates ROM B - U11 failure
5U9F indicates ROM C - U21 failure
4F68 indicates ROM D - U10 failure
P74H indicates ROM E - U20 failure

Note: The following signatures check the output circuitry and it is necessary to hold the SA probe on the appropriate IC pin for up to 20 seconds to achieve the correct signature.

U14

2	0UH1	14	457H
3	UC4C	15	4HP3
4	HA32	16	5515
5	UP5H	17	8197
6	43A8	18	-
7	5076	19	2UHC
8	4PC6	22	HIGH
9	HPPH	23	4UF5
10	HU1P	24	HIGH
11	P8CA	25	3P94
12	21C1	39	HIGH
13	1892	40	PULSING

U37			U27		
11	7242			11	40F8
12	3P94	13	0UH1	12	HIGH
15	0000	14	UC4C	15	HIGH
16	0000	17	HA32	16	HIGH
19	0000	18	UP5H	19	0000
2	0526	3	43A8	2	PC5U
5	517C	4	5076	5	P303
6	96FP	7	4PC6	6	2230
9	0U08	8	HPPH	9	8UA8

Program Signatures

U32

7	40F8	1	HU1P
8	LOW	2	P8CA
9	3315	3	21C1
10	29A1	4	1892
11	AC19	5	2UHC
12	2U63		
13	25A9		
14	7242		
15	7889		

U31

7	00P2
8	LOW
9	3099
10	FH58
11	8PAC
12	PH18
13	0CAC
14	C89F
15	FH8F

U36

2	HIGH	4	UC4C
5	HIGH	6	UC4C
10	HIGH	8	HA32
13	HIGH	9	HA32
1	0UH1	11	UP5H
3	0UH1	12	UP5H

U34

1	3P94	8	2A7F
2	11U7	9	PC5U
3	11U7	10	11U7
4	P303	11	CP6H
5	11U7	12	8UA8
6	4P16	13	11U7

U35

1	LOW	8
2	11U7	9
3	LOW	10
4	HPPH	11
5	3P94	12
6	HPPH	13

U33

1	0CAC	8	1735
2,3	353U	9	29A1
4	0CAC	10	958H
5	8197	11	AC19
6	CU03	12	11U7
		13	2U63

CHANGE 3

Page 6-17:
Add: A11C37 0160-0576 Capacitor-Fxd .1uF
Change: A11C34 to 0160-0576 Capacitor-Fxd .1uF
A11C35 to 0160-0576 Capacitor-Fxd .1uF

Page 6-18:
Change: A11R53 to 0698-3511 Resistor 665 1%

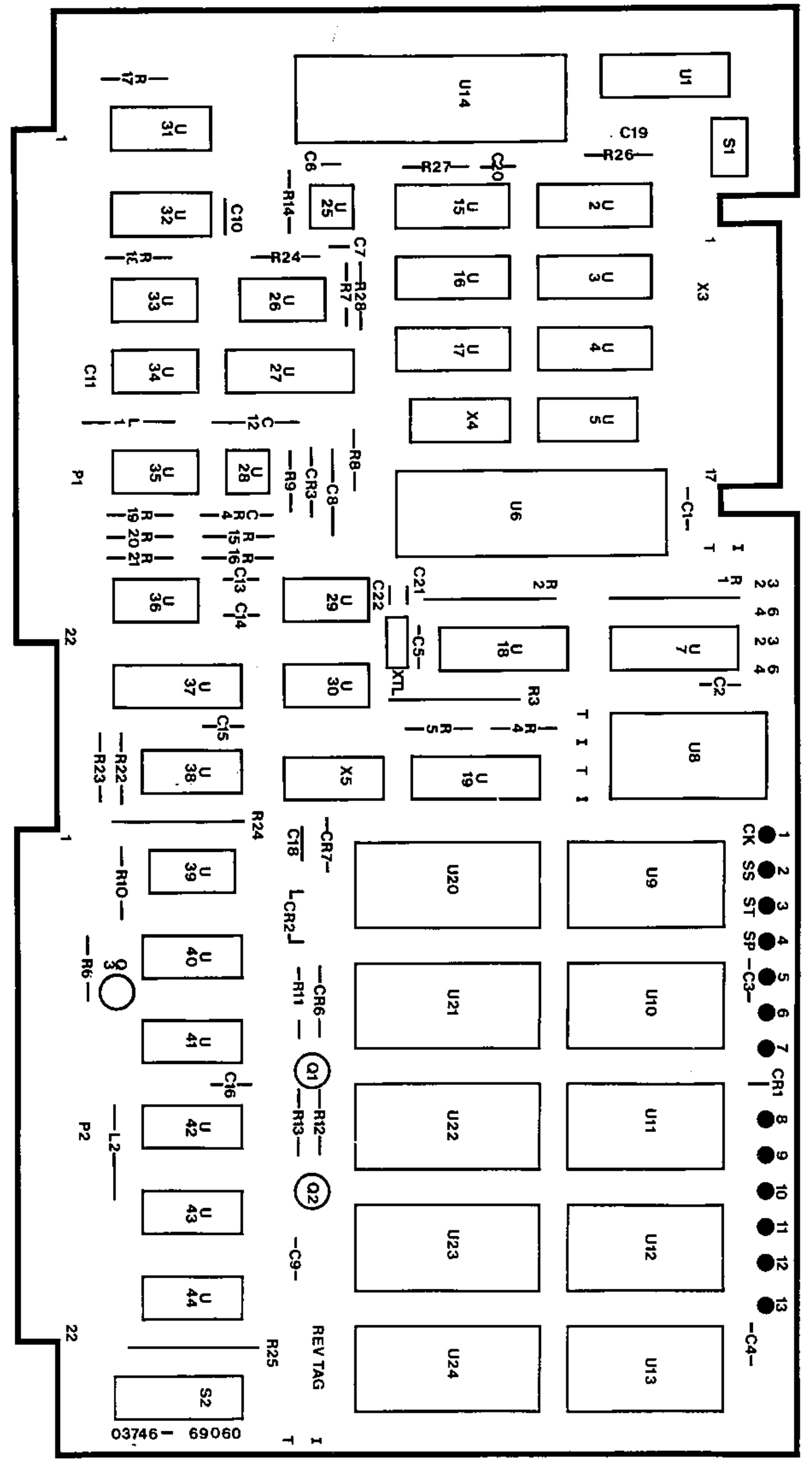


Figure 7-5 A60 Component Location

7-9
7-10

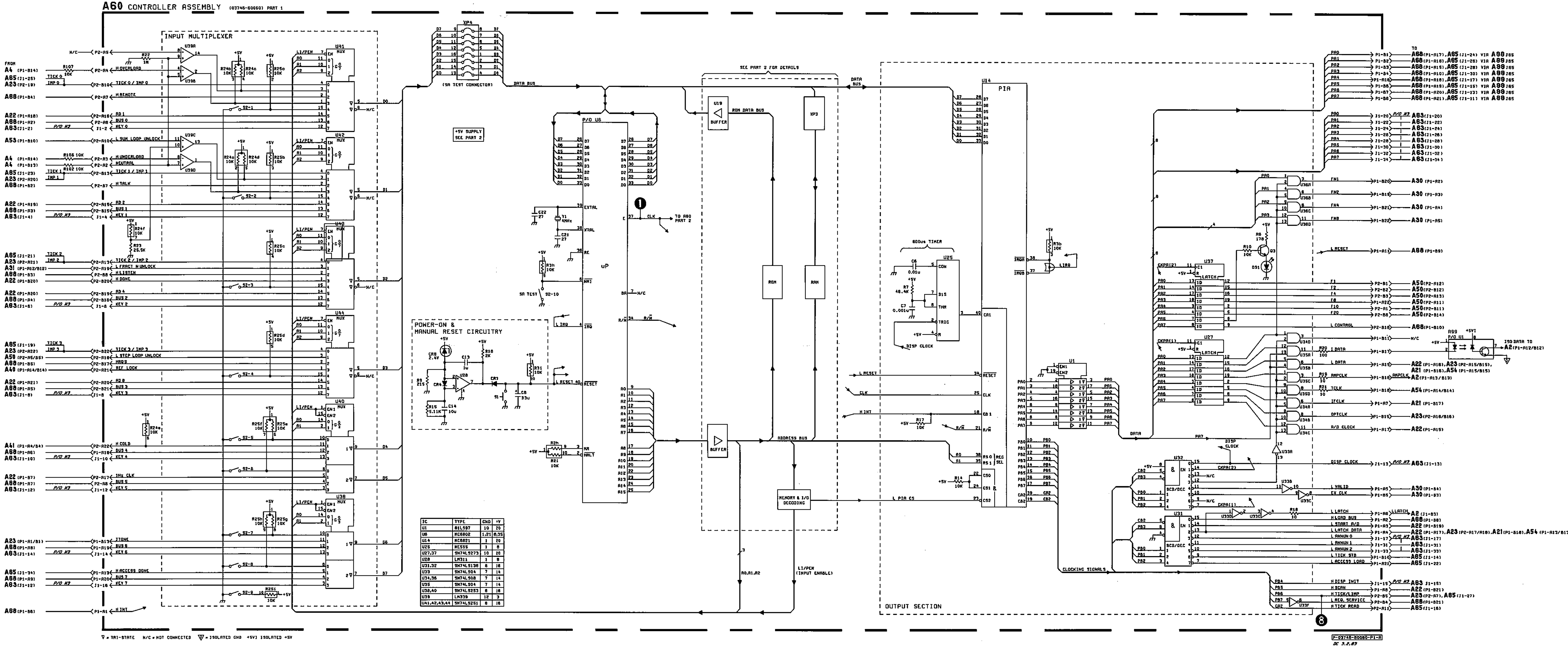


Figure 7-6 A60 Schematic Diagram Part 1

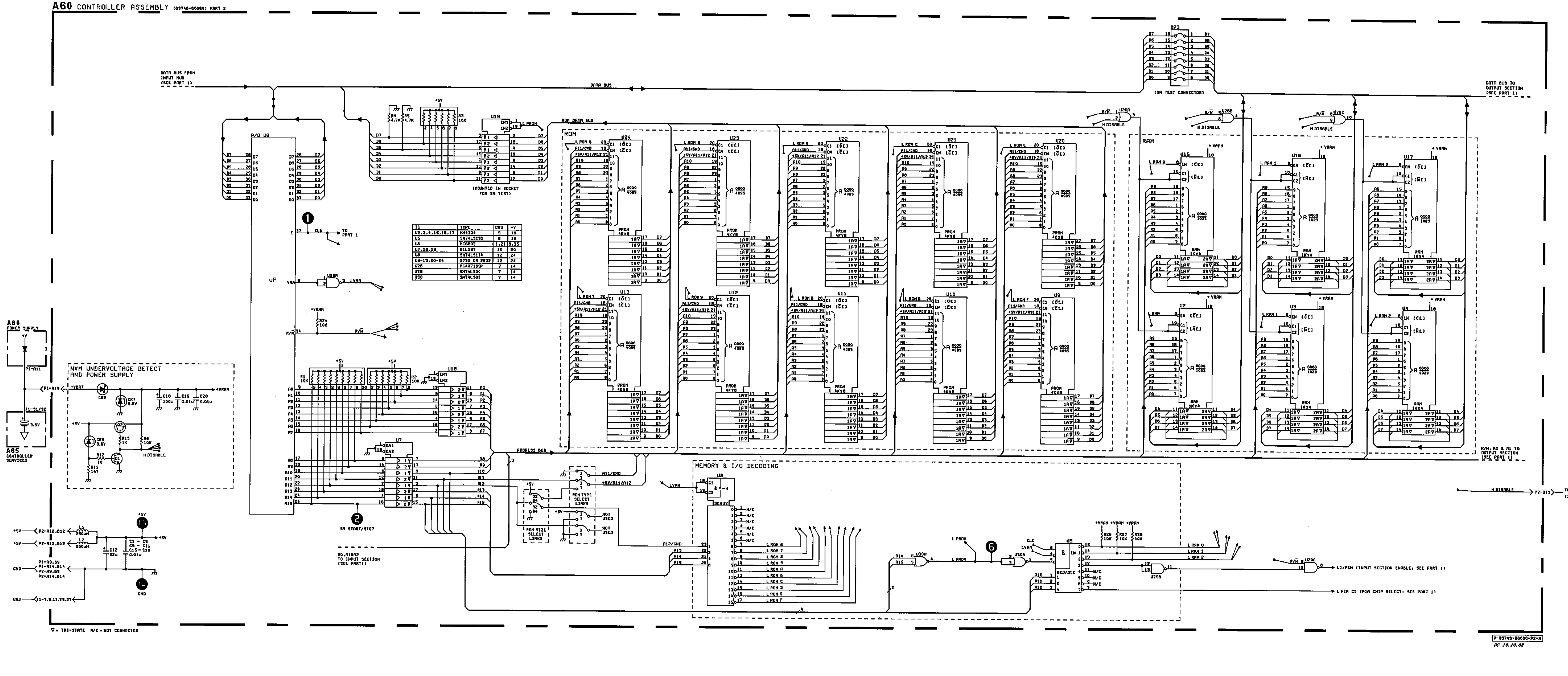


Figure 7-7 A60 Schematic Diagram Part 2

A60 Component Location
A60 Schematic Diagram Part 1

Page 6-26:
Change: A22R30 to 0757-0442 Resistor 10K 1%
A22U16 to 1826-0642 ICL-1405L

Page 6-67:
Change: A80R50 to 0683-2425 Resistor 2.4K 5% .25W

Page 6-68:
Delete: A99CR10, A99CR11, A99L61, A99L62, A99L63

Page 6-69:
Add: A99R101 0683-5115 Resistor 510 5% .25W
A99R102 0683-1035 Resistor 10K 5% .25W
A99R104 0757-0283 Resistor 2K 1% .125W
A99R105 0757-0283 Resistor 2K 1% .25W
A99R106 0683-1035 Resistor 10K 5% .25W
A99R107 0683-1035 Resistor 10K 5% .25W
A99R109 0757-0159 Resistor 1K 1% .5W
A99T1 03746-80110 Transformer - Isolator
A99U1 1990-0461 Opto-Isolator LED-IC Gate

Page 6-59:
Change: A60 to 03746-60060 Controller Assembly

Page 6-60:
Change: A60U8 to 1820-2053 IC DCDR TTL LS BCD 4-TO-16-LINE
A60U9 to 03746-81090 PROM
A60U9A to 1200-0541 Socket-IC 24-Cont
A60U20 to 03746-81200 PROM
A60U20A to 1200-0541 Socket-IC 24-Cont
A60U22 to 03746-81220 PROM
A60U22A to 1200-0541 Socket-IC 24-Cont
A60U23 to 03746-81230 PROM
A60U23A to 1200-0541 Socket-IC 24-Cont
A60U24 to 03746-81240 PROM
A60U24A to 1200-0541 Socket-IC 24-Cont
A60U30 to 1820-1144 IC Gate TTL NOR Quad 2-1up

Add: A60U10 03746-81100 PROM
A60U10A 1200-0541 Socket-IC 24-Cont
A60U11 03746-81110 PROM
A60U11A 1200-0541 Socket-IC 24-Cont
A60U12 03746-81120 PROM
A60U12A 1200-0541 Socket-IC 24-Cont
A60U13 03746-81130 PROM
A60U13A 1200-0541 Socket-IC 24-Cont

Page 6-70:
Change: A60 to 03746-60060 Controller Assembly
C1 to 0150-0093 Capacitor-Fxd .01uF

Page 6-71:

Change:	MP59 to 5061-2009 Kit-Rear Feet		
	MP46 to 03746-04186 Plate		
Delete:	MP46A		
Add:	MP33	03746-01205	Bracket
	MP34	03746-01206	Bracket
	MP37	03746-01212	Bracket
	MP38	03746-01213	Bracket
	MP39	03746-01214	Bracket
	MP40	03746-01215	Divider-Air
	MP42	03746-01217	Bracket
	MP43	03746-01218	Bracket
	MP47	03746-04187	Insulator
	MP60	03746-60601	Shield Box Assy (Large)
	MP61	03746-60602	Shield Box Assy (Small)

A11 Schematic Diagram:
Change: A11C35 and A11C37 to 0.1U
A11R53 to 665

Add: A11C37 1000PF between R43 wiper and ground.

A21 Schematic Diagram:
Change: A21C1 to 3300PF

A22 Schematic Diagram:
Change: A22R30 and A22R31 to 10K

A60 Troubleshooting: Replace with the A60 Troubleshooting in this section

A60 Schematic Diagram Part 2 and Component Location: Replace with the drawings in this section 03746-60060.

A80 Schematic Diagram:
Change: A80R50 to 2.4K

A99 Component Location:
Replace with the drawing in this section.

CHANGE 4

Page 6-8:

Add:	A2C19	0160-3912	Capacitor-Fxd .01uF
	A2L7	9100-3911	Inductor RF 220NH 5%

Page 6-11:

Change:	A4R23 to 0698-3153	Resistor 3.83K 1%
	A4R25 to 0698-3438	Resistor 147 1%

Page 6-22:
Change: A21C37 to 0160-4389 Capacitor-Fxd 100PF

Page 6-70:
Change: C2 to 0150-0093 Capacitor-Fxd .01uF
C3 to 0150-0093 Capacitor-Fxd .01uF
Delete: C10

A2 Schematic Diagram:
Add: A2L7 0.22u and A2C19 0.01uF both in parallel with R25

A4 Shcematic Diagram:
Change: A4R23 to 3.83K
A4R25 to 147

A21 Schematic Diagram:
Delete: C10 (accross the PHONE jack)
Change: A21C37 to 100PF

A80 Schematic Diagram:
Change: C2 and C3 to 0.01uF

CHANGE 5

Page 6-21:
Change: A21C18 to 0160-4535 Capacitor-Fxd 1uF

A21 Schematic Diagram:
Change: A21C18 to 1uF

SECTION VIII
SERVICE
GENERAL SECTION

8-1 INTRODUCTION

8-2 This section contains information to assist in troubleshooting and repair of the Hewlett-Packard Model 3746A Selective Level Measuring Set (SLMS). The Service Section is divided into the following sub-sections:

1 GENERAL
2 RECEIVER
3 SYNTHESIZER
4 PROCESSOR & DISPLAY
5 POWER SUPPLY & MOTHERBOARD

These sections contain Theory of Operation, Block Diagrams and Troubleshooting Information. The Assembly Service Sheets within these sections are listed in numeric order.

8-3 SAFETY CONSIDERATIONS

8-4 Before applying power to the instrument or removing any of the covers, review the following warnings and cautions.

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY TRAINED SERVICE PERSONNEL ONLY. TO AVOID ELECTRICAL SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS QUALIFIED TO DO SO.

WARNING

LINE VOLTAGE IS PRESENT WITHIN THE INSTRUMENT EVEN WHEN THE POWER SWITCH IS IN STBY POSITION. TO PREVENT ELECTRICAL SHOCK, USE CARE WHEN WORKING IN THE VICINITY OF THE INPUT POWER CIRCUITS.

WARNING

TO PROTECT OPERATING PERSONNEL, THE HP 3746A CHASSIS AND CABINET MUST BE GROUNDED. THE HP 3746A IS EQUIPPED WITH A THREE WIRE POWER CORD WHICH, WHEN PLUGGED INTO AN APPROPRIATE RECEPTACLE, GROUNDS THE INSTRUMENT. THE OFFSET PIN ON THE POWER PLUG IS THE GROUND CONNECTION. TO PRESERVE THIS PROTECTION FEATURE, THE POWER PLUG SHALL ONLY BE INSERTED IN A THREE TERMINAL RECEPTACLE HAVING A PROTECTIVE EARTH GROUND CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD OR ADAPTER THAT DOES NOT HAVE THE REQUIRED EARTH GROUND CONNECTION. GROUNDING ONE CONDUCTOR OF A TWO CONDUCTOR OUTLET IS NOT SUFFICIENT PROTECTION.

CAUTION

1. To prevent damage to the instrument power supply circuits, verify that the two line voltage select switches located on the instrument rear panel are selected to the correct line voltage. (Refer to Table 2-1 in Section II for correct line fuse sizes).

2. The HP 3746A contains CMOS devices which may become damaged as a result of static discharge.

3. To prevent equipment damage, do not remove circuit boards when the POWER switch is ON.

4. **The regulated DC supply voltages are not individually fused. Accidentally shorting any of the supply buses together or to ground can cause major damage to the motherboard. In addition, the +15Vdc probe power is present at the front panel probe connector even in the STBY position of the POWER switch.**

8-5 ASSEMBLY SERVICE SHEETS

8-6 The service sheets contain general and detailed circuit descriptions (where applicable) together with troubleshooting information, component layouts, circuit schematics and block diagrams.

8-7 TROUBLESHOOTING

8-8 The troubleshooting information enables fault diagnosis to component level. It is recommended that all troubleshooting should start from the OVERALL TROUBLESHOOTING, Paragraph 8-62. Figure 8-1 illustrates the troubleshooting layout for the instrument.

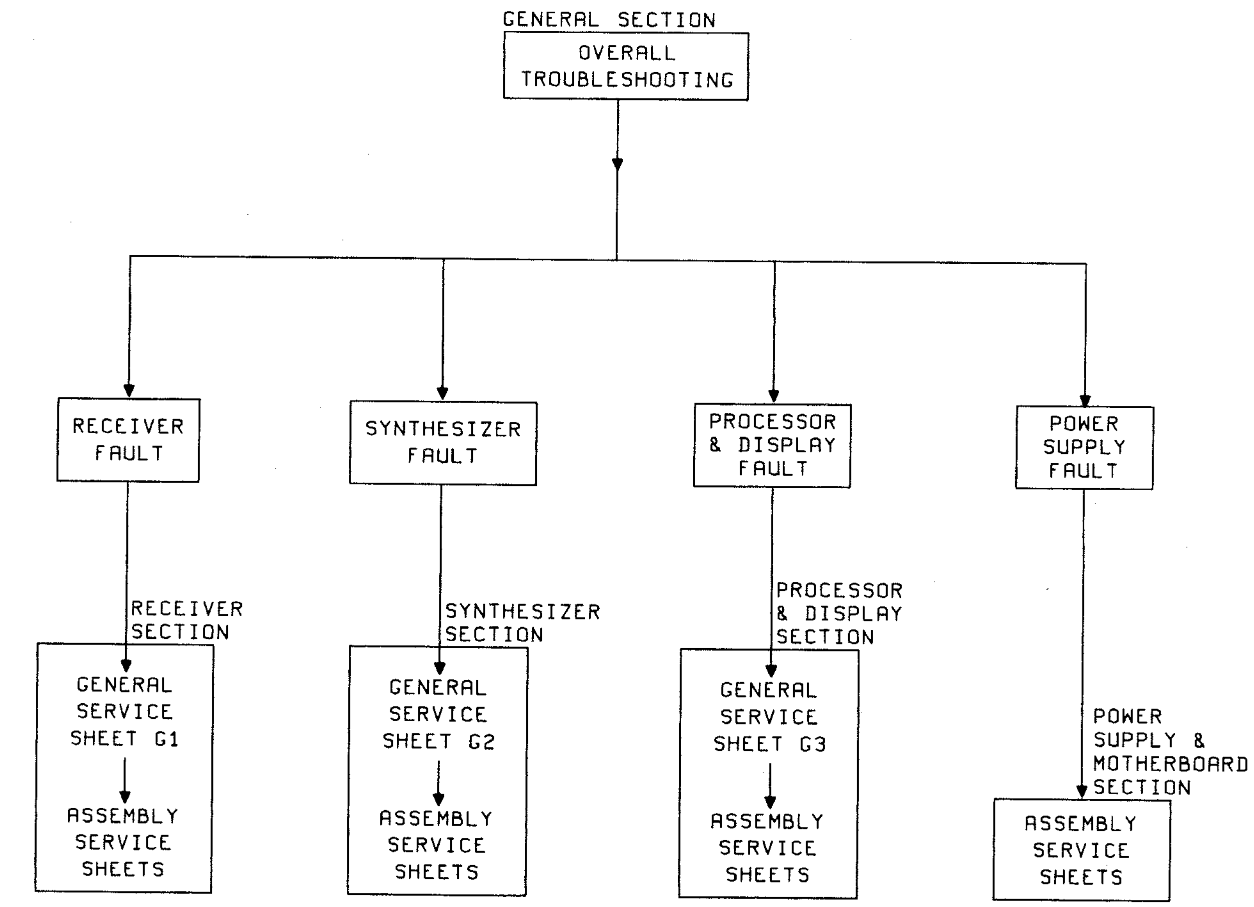
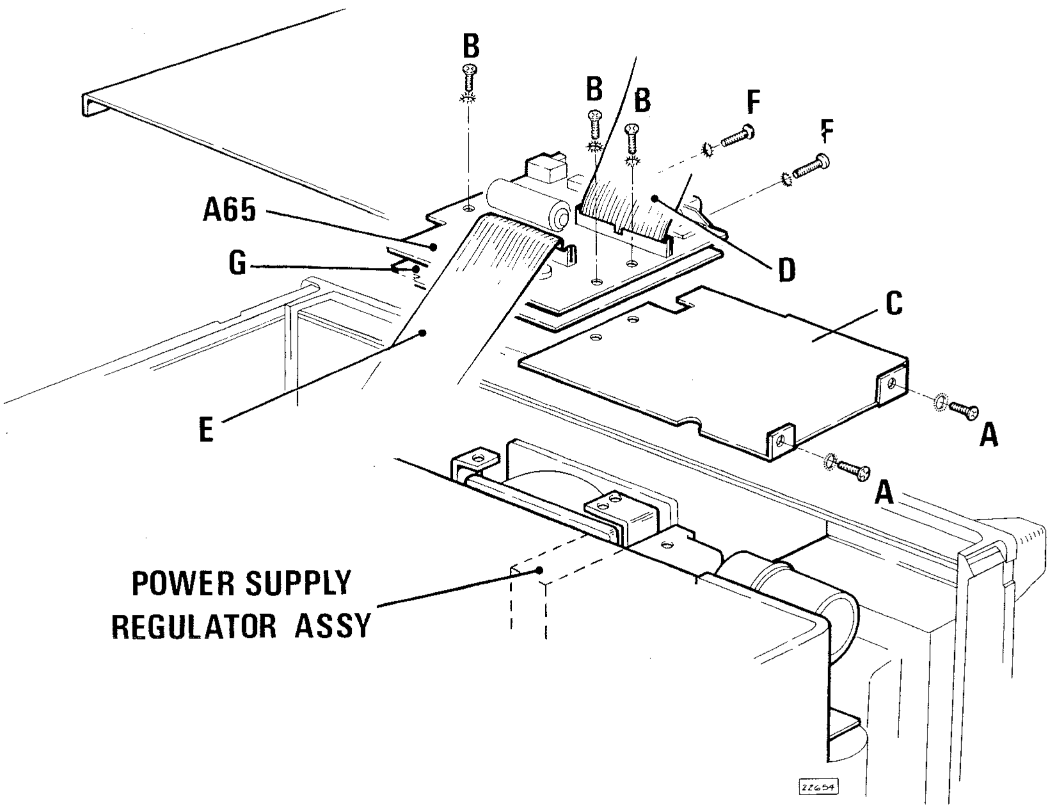


Figure 8-1 Troubleshooting Layout



WARNING

LINE VOLTAGE IS PRESENT BELOW PLASTIC COVER C WHEN INSTRUMENT IS CONNECTED TO MAINS SUPPLY. ENSURE THAT THE MAINS PLUG IS DISCONNECTED BEFORE CARRYING OUT THE FOLLOWING PROCEDURE.

PROCEDURE

1. Remove Top, Bottom and RH side cover.
2. Remove Rear Panel (3 screws on top, 4 on bottom).
3. Remove screws A and B.
4. Remove plastic cover C.
5. Remove ribbon cables D and E.
6. Remove screws F.
7. Remove Assembly A65 and plastic cover G.
8. Remove Regulator Sub-assembly.
9. Replace items in steps 1 to 8 in reverse order to restore instrument for use.

Figure 8-2 Access to Power Supply Regulators

8-9 RECOMMENDED TEST EQUIPMENT

8-10 Test equipment required to maintain the 3746A is listed in Table 1-2 in Section I. Any other equipment which meets or exceeds the critical specification may be used.

8-11 REPAIR

8-12 Power Supply Regulator Repairs

8-13 Access to the Power Supply Regulators is detailed in Figure 8-2.

8-14 After Service Product Safety Checks

8-15 Visually inspect interior of instrument for any signs of abnormal internally generated heat, such as discoloured printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy cause of any such condition.

8-16 Using a suitable ohmmeter, check resistance from instrument enclosure to ground pin on power cord plug. The reading must be less than one ohm. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist.

8-17 Check any indicated front or rear panel ground terminals marked, using the above procedures.

8-18 Check resistance from instrument enclosure to line and neutral (tied together) with the power switch on and the power source disconnected. The minimum acceptable resistance is two megohms. Replace any component which results in a failure.

8-19 Check line fuse(s) to verify that a correctly rated fuse is installed.

8-20 SCHEMATIC DIAGRAMS

8-21 Schematic diagram drawing information is listed in Table 8-1.

8-22 LOGIC SYMBOLS

8-23 The logic symbols used in this manual are based on the American National Standard ANSI Y32.14, "Graphic Symbols for Logic Diagrams (Two-State Devices)".

8-24 Qualifiers

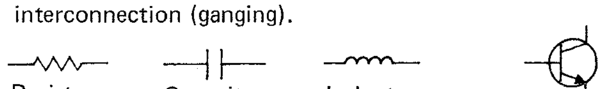
8-25 Qualifiers are that portion of a logic symbol that denotes its logic function. The following qualifiers are used in this manual:

&	- AND.
←→	- BILATERAL SWITCH: A binary controlled circuit which acts as an on/off switch to analog or binary signals flowing in both directions.
X-Y	- CODER: Input code (X) is converted to output code (Y) per weighted values.
mCNTR	- COUNTER with modulus m.
RAM	- RANDOM ACCESS MEMORY.
ROM	- READ ONLY MEMORY.
+m	- COUNT UP INPUT (m is replaced with a number indicating number of shifts or counts).
MUX	- MULTIPLEXER.
3-ST	- THREE STATE OUTPUT: 3 state label is used with F notation to symbolize devices that have an output disconnect ability.
T	- TOGGLE INPUT.
X/Y	- SIGNAL LEVEL CONVERTER: Input levels are different from output levels.
	- Indicates that hysteresis exists in the device.

8-26 Indicator Symbols

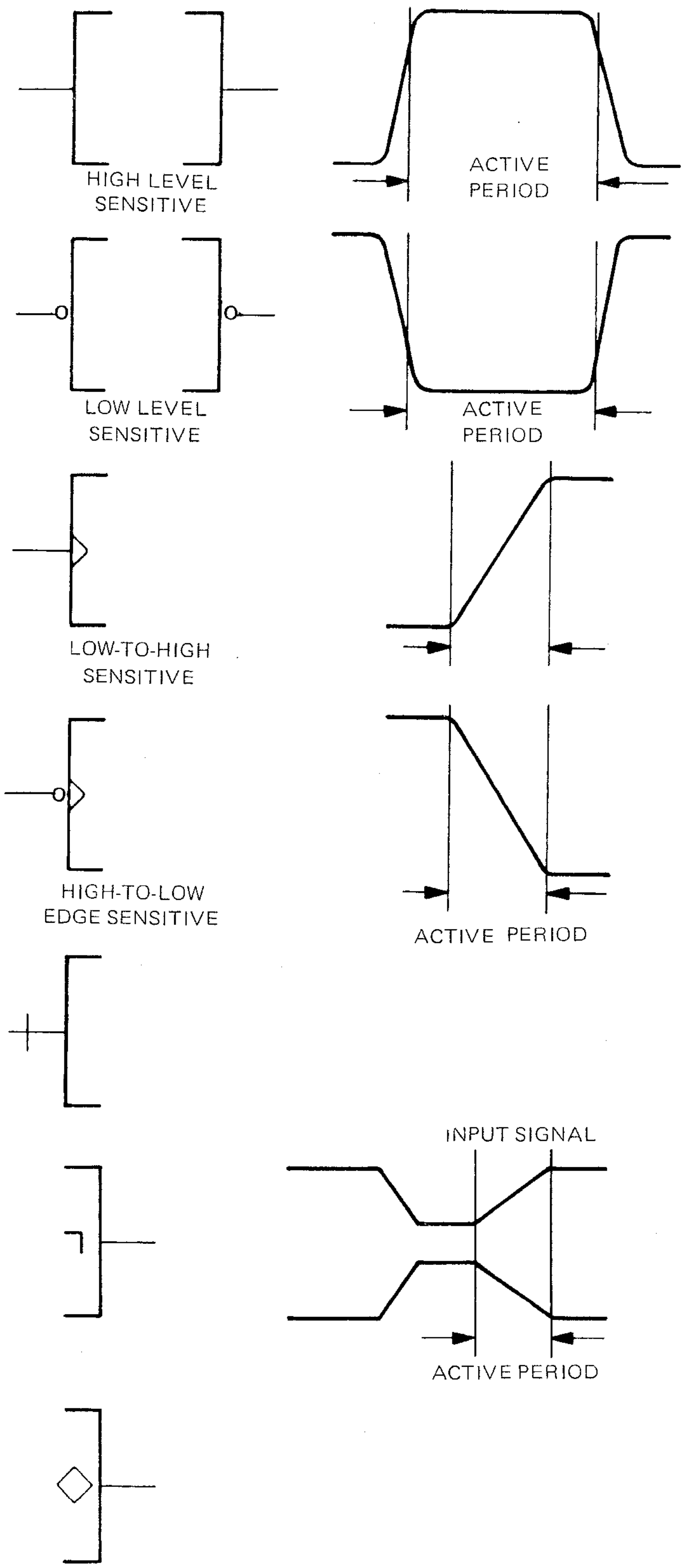
8-27 Indicator Symbols identify the active state or level of a symbols input or output (see Figure 8-3).

Table 8-1 Schematic Diagram Notes

Units		Resistance in ohms, capacitance in picofarads, inductance in millihenries unless otherwise noted.
Factory-selected parts	*	Asterisk denotes a factory-selected value. Value shown is typical. Part may be omitted.
Panel labels		Encloses front-panel designation.
		Encloses rear-panel designation.
Outlines		Circuit assembly borderline.
		Other assembly borderline. Also used to indicate mechanical interconnection (ganging).
Common components		 Resistor Capacitor Inductor Transistor (NPN)
Test points		 Numbered Test point. Measurement aid provided.
Wire colours	( )	Encloses wire colour code. Code used is the same as the resistor colour code. First number identifies the base colour, second number identifies the wider stripe, third number identifies the narrower stripe. E.G. *(947)* denotes white base, yellow wide stripe, violet narrow stripe.
Grounds and commons		A direct conducting connection to the earth, or a conducting connection to a structure that has a similar function (e.g. the frame of an air, sea, or land vehicle).
		A conducting connection to a chassis or frame.
		Isolated GND. All like-designated points are connected.

8-28 Dependency Notation

8-29 Dependency notation is the technique for defining input/output and input/input relationships without showing all the elements and interconnections involved. Logic relationships between inputs and outputs are shown in this manual by using the following notation:



ACTIVE HIGH inputs and outputs are indicated by the absence of the negation indicator symbol (○).

ACTIVE LOW inputs and outputs are indicated by the presence of the negation indicator symbol (○).

EDGE SENSITIVE (Dynamic) inputs are indicated by the presence of the dynamic indicator symbol (▷).

INHIBIT input (+) used when active input inhibits (blocks) the active state outputs of the logic function.

OUTPUT DELAY indicator symbol (⌉) shows that an output becomes effective when the signal that initiated that change returns to its opposite state.

OPEN COLLECTOR OUTPUT. Output that forms part of a distributed connection.

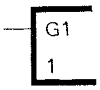
Figure 8-3 Indicator Symbols

mAm - ADDRESS DEPENDENCY: The m prefix should be replaced with a number that differentiates between several address inputs, indicates dependency or indicates demultiplexing and multiplexing of address inputs/outputs. The "m" suffix indicates the number of cells that can be addressed.

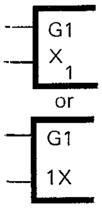
Gm - GATE (AND) DEPENDENCY: The G input gates those inputs or outputs labelled with the same identifier m. The m is replaced with a number.

Cm - CONTROL DEPENDENCY: This is used only with D type Flip-Flops and indicates that the basic function of the Flip-Flop is controlled by inputs with the same identifier. The m is replaced with a number.

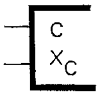
Fm - FREE DEPENDENCY: This is an input that acts as a connect switch when active and a disconnect when inactive. Used for 3-state logic.



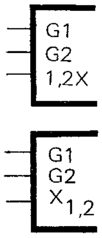
- The input that controls or gates other inputs is labelled with a "C" or a "G", followed by an identifying number. The controlled or gated input or output is labelled with the same number. In this example, "1" is controlled by "G1".



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



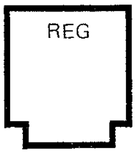
- If a particular device has only one gating or control input then the identifying number may be eliminated and the relationship shown with a subscript.



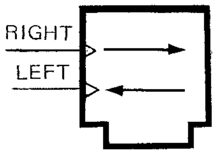
- If the input or output is affected by more than one gate or control input, then the identifying numbers of each gate or control input will appear in the prefix or subscript separated by commas. In this example "X" is controlled by "G1" and "G2".

8-30 Control Blocks

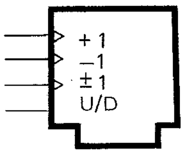
8-31 Control Blocks are used with complex logic to show when common control signals are applied to a group of functionally separate units. Typically examples of control blocks follow.



- REGISTER CONTROL BLOCK: This symbol used with an associated array of flip-flop symbols to provide a point of placement for common function lines, such as a common clear.



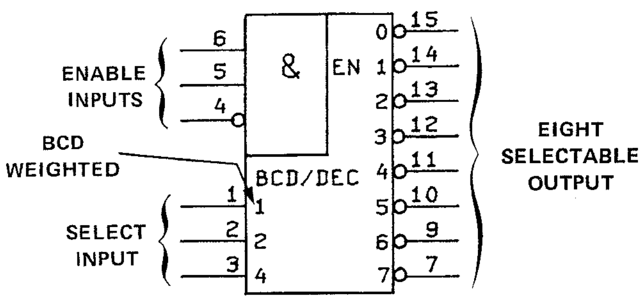
- SHIFT REGISTER CONTROL BLOCK: These symbols are used with an array of flip-flop symbols to form a shift register. An active transition at the inputs causes left or right shifting as indicated.



- COUNTER CONTROL BLOCK: The symbol is used with an array of flip-flops or other circuits serving as a binary or decade counter. An active transition at the +1 or -1 inputs causes the counter to increment one count upward or downward respectively. An active transition at the ±1 input causes the counter to increment one count upward or downward depending on the input at an up/down control.

8-32 EXAMPLES OF LOGIC DEVICES

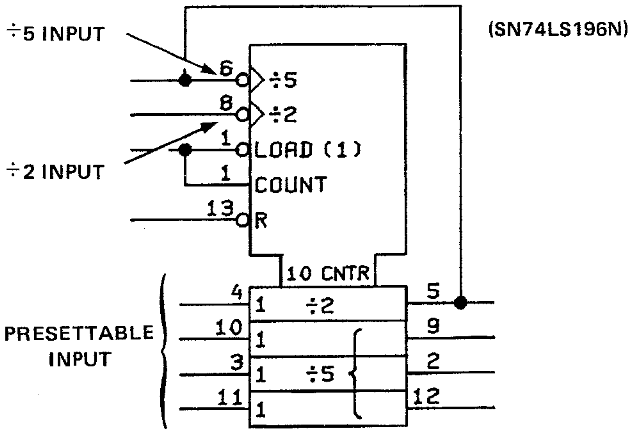
DECODER (SN74LS138N)



DECIMAL WEIGHTED

8-33 This device decodes one of eight lines (0 to 7) depending on the conditions at the three select inputs and the three enable inputs, ie output "5" is selected and set low when the select inputs are 101 and the enable inputs are 110.

PRESETTABLE DECADE COUNTER (÷2, ÷5 OPTION)



8-34 This counter has a divide by 2 or a divide by 5 function. Both the divide by 2 and divide by 5 operations are enabled by positive to negative transition of signals at these respective divide by 2 and divide by 5 inputs.

8-35 The presettable inputs marked "1" are activated when the LOAD (1) input is set low.

8-36 A low on the R input resets all outputs regardless of the other inputs.

8-37 THEORY OF OPERATION

8-38 The 3746A SLMS is basically a tuneable power meter intended primarily for use in telecommunications to measure analog signal levels.

8-39 In simplified terms the instrument is a multi-stage AM superhet receiver tuned by a digitally controlled synthesizer. A processor is used to control the synthesizer tuning and receiver measurement cycle (see Figure 8-4 SLMS Simplified Block Diagram). The instrument may be controlled manually via a front panel keyboard or remotely via the HP-IB.

8-40 The SLMS is designed to measure signals in a frequency range of 50Hz to 32MHz with a choice of measurement modes:

INPUT POWER (Broadband)	50Hz to 32MHz
48kHz FILTER-OPT 011 (Group)	50kHz to 32MH
3.1kHz FILTER (Channel)	10kHz to 32MHz
38Hz FILTER (Pilot)	200Hz to 32MHz

8-41 The following paragraphs give a simplified description of operation of the SLMS. A more detailed block diagram of the SLMS, showing each assembly with all the interconnections, is on Figure 8-6. A block diagram is also contained in an envelope at the rear of this manual. In addition detailed block diagrams with descriptions of the receiver, synthesizer, and processor are contained in the appropriate sub-sections of the manual.

8-42 SIGNAL LEVEL MEASUREMENTS

8-43 The SLMS processor reads data from the keyboard or the HP-IB and ascertains which configuration to set. When the 3.1kHz or 38Hz (Channel or Pilot) FILTERS are selected the processor tunes the synthesizer, autoranges the receiver, and sends data to the A/D MUX SELECTOR to select the output from the RMS to DC LOG CONVERTER in the CH/PILOT signal path - indicated by the heavy dark line on Figure 8-4. The processor reads the value of the A/D CONV output, checks the INPUT ATTENUATOR and RECEIVER GAIN settings (from data stored

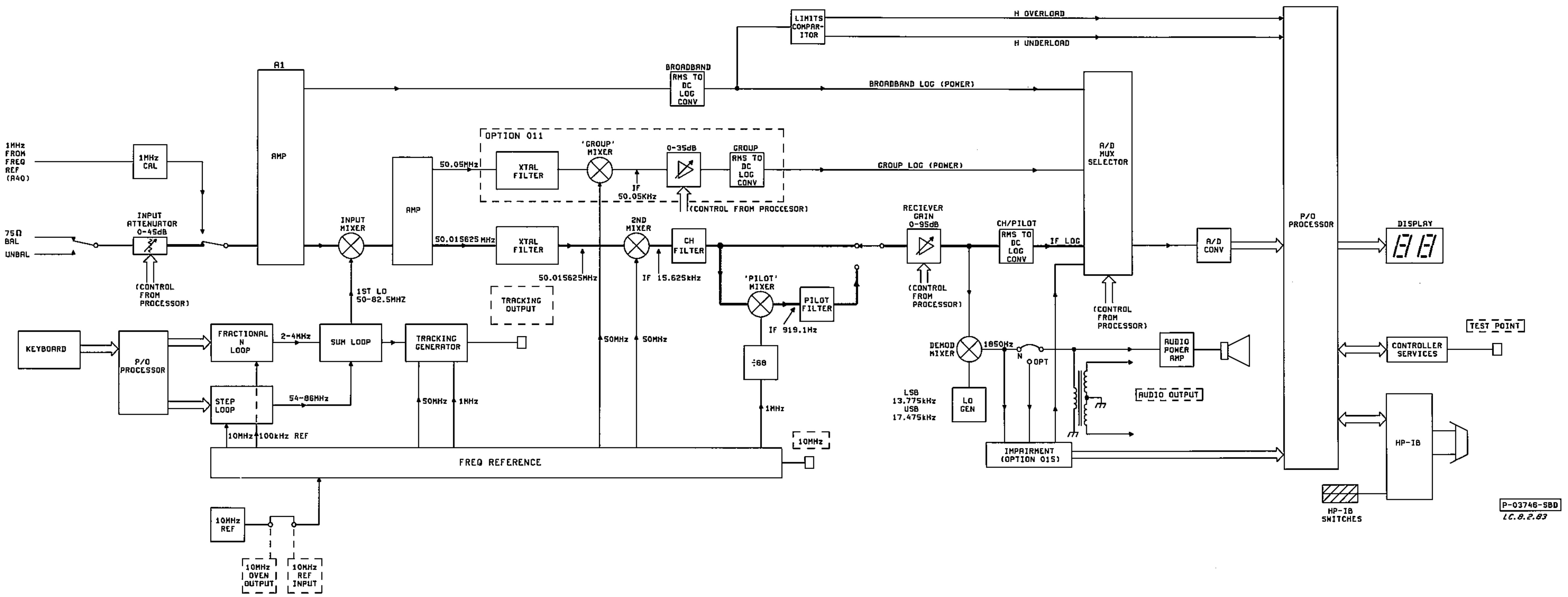


Figure 8-4 SLMS Simplified Block Diagram

8-9
8-10

in internal memory registers after autoranging), and computes the signal level measured at the input of the instrument.

8-44 A calibration cycle occurs at regular time intervals, or when certain instrument measurement parameters are changed. This ensures a high degree of accuracy is maintained.

8-45 Two stages of mixing (three when the 38Hz FILTER is selected) give a good degree of adjacent channel and IF image rejection. The XTAL FILTERS also maintain a high degree of selectivity and allows the number of mixing stages to be kept to a minimum. The upper or lower sidebands of the "3.1kHz signal" are demodulated by mixing the 15.625kHz IF with a L.O. GENerator signal. The frequencies of the LO GEN are set to 13.775kHz for LSB, and 17.4375kHz for USB.

8-46 Provision is made for sending control signals to Access Switches (HP 3754A, 3756A and 3757A). This function is carried out by the Controller Services Assembly.

8-47 TUNING

8-48 The tuning data, from the processor, tunes the synthesizer to a frequency 50.015625MHz above the incoming signal frequency (with OPT 011 instruments, when the 48kHz GROUP FILTER is selected the synthesizer tunes to 50.05MHz above the incoming signal). The SUM LOOP/synthesizer output frequency is equal to the difference between STEP LOOP and FRACTIONAL N LOOP frequencies. The STEP LOOP is "coarse" tuned in multiples of 2MHz to a frequency between 54 and 86MHz while the FRACTIONAL N LOOP is finely tuned (with a resolution of 1Hz) to any frequency between 2 and 4MHz).

8-49 AUTORANGING

8-50 The amount of gain and attenuation required is determined during the instrument autoranging sequence. There are two independent autoranging actions:

1. An INPUT ATTENUATOR is switched between 0 and 45dB, in 5dB steps by control data from the processor. The Processor acts when one of the "hardwire" limits H OVERLOAD and H UNDERLOAD goes (high) true to autorange the INPUT ATTENUATOR.

2. The RECEIVER GAIN is also switched in 5dB steps, between 0 and 95dB, by control data from the processor. In this case the processor monitors the A/D CONVerter output and autoranges the RECEIVER GAIN when the software limits (set in ROM memory) are violated. (This occurs if the signal level in the receiver IF chain goes too low or too high.)

8-51 CALIBRATION

8-52 A calibration cycle occurs each time a different FILTER is selected, or when the measurement resolution is changed (AVE 0, AVE 1, or AVE2) and at 10 minute intervals. The calibration signal is a highly accurate and stable 1MHz reference frequency at a precise level of -25dBm. This signal is switched through the receiver on the signal path of the selected measurement mode, by-passing the Input Attenuator. Any error in the measured CAL level is stored by the processor, and is applied as an automatic correction factor for all measurements until the next calibration cycle.

8-53 OPTIONS

8-54 The following assembly OPTIONS can be added to the SLMS.

8-55 Group Filter (Option 011)

8-56 This option is self-contained on one assembly (A11) shown on the Simplified Block Diagram Figure 8-4. The synthesizer 1st L.O. tuning is altered to 50.05MHz above the incoming signal for 48kHz GROUP FILTER measurements. The Amplifier gain is either 0dB or 25dB, with no intermediate steps.

8-57 Tracking Generator Output (Option 012)

8-58 This option is self contained on one assembly (A54) and is in the synthesizer section of the instrument. The Tracking output frequency is the same as the SLMS front panel frequency except when used in the 48kHz FILTER mode.

8-59 10MHz Ref (Option 013 or 014)

8-60 This is a high stability frequency reference (Assembly A41). A rear panel connector allows the SLMS FREQ to be phase locked to this high stability reference.

8-61 Impairments (Option 015)

8-62 Signal Impairments of Phase Jitter, Weighted/Notched Noise and Impulse Noise can be measured when Assembly A23 is fitted.

8-63 OVERALL TROUBLESHOOTING

8-64 For ease of troubleshooting, the manual has been split into four sections, Receiver, Synthesizer, Processor & Display and Power Supply. Each section contains troubleshooting information to help isolate a fault to an Assembly Service Sheet. Each Assembly Service Sheet contains troubleshooting information, where necessary, to help isolate a fault to component level.

8-65 In certain conditions an error flag will indicate which area of the instrument is faulty. If an error code occurs switch the SLMS OFF then ON again and check if the error is still present after this reset action.

ERROR CODES

SYNTHESIZER TROUBLESHOOTING G2

- E01 FREQUENCY REFERENCE LOOP UNLOCKED
- E02 STEP LOOP UNLOCKED
- E03 FRACTIONAL N LOOP UNLOCKED
- E04 SUM LOOP UNLOCKED
- E05 STEP AND FRAC N LOOPS UNLOCKED
- E06 STEP AND SUM LOOPS UNLOCKED
- E07 FRAC N AND SUM LOOPS UNLOCKED
- E09 STEP, FRAC N AND SUM LOOPS UNLOCKED

REFER TO PROCESSOR TROUBLESHOOTING G3

- E84 HP–IB ROM CHECK SUM INCORRECT

SEE RECEIVER TROUBLESHOOTING G1
SEE PARAGRAPHS 8-70 AND 8-74

- E90 A/D CONVERTER FAULTY ON LEVEL MEASUREMENTS
- E91 A/D CONVERTER FAULTY ON FREQ MEASUREMENTS
- E92 PHASE–JITTER, TONE NOT PRESENT AFTER 5 SECONDS
- E95 A/D CONVERTER NON BCD OR A/D ASSEMBLY A22 NOT PLUGGED IN
- E96 RECEIVER AUTO–RANGING FAULT
- E96 UNABLE TO AUTO–RANGE AFTER 20 ATTEMPTS
- E97 SLMS CALIBRATION SIGNAL MEASUREMENT OUT OF SPECIFIED LIMITS
- E97 CALIBRATION SIGNAL IS OUT OF RANGE
- E98 OVERLOAD DETECTED WITH NO IF GAIN

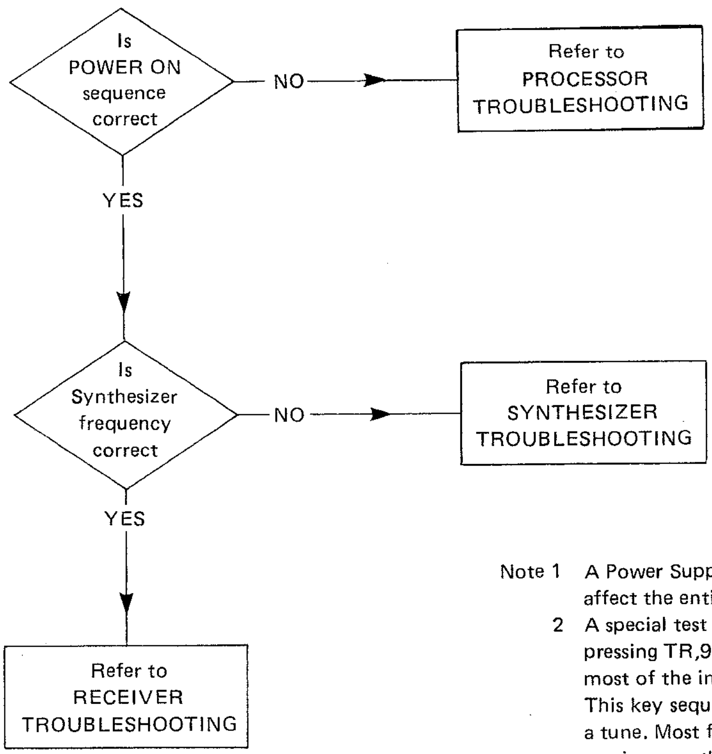
Note: A complete list of Error Codes for Operation and Service requirements can be found in Appendix A.

8-66 FAULT ISOLATION TO POWER SUPPLY, PROCESSOR, SYNTHESIZER OR RECEIVER

8-67 In order to determine which area of the SLMS is faulty, carry out the following checks, in the order shown. Flow Chart Figure 8-5 summarizes the procedure.

8-68 PROCESSOR

8-69 A good check to confirm the processor is working correctly is to switch the instrument POWER switch to STBY and then ON. This activates the processor reset sequence. All the DISPLAY and SWITCH indicators should be on and remain ON for about 2 seconds. After the reset sequence the SLMS should be initialised with the 75 ohm INPUT, AUTO and 3.1kHz FILTER selected. The instrument will be in the HALT mode and have a number displayed in the FREQ/FDM display. This is the number recovered from the non-volatile memory which indicates the frequency the instrument was last tuned to. In cases where there is no number in the memory the SLMS will tune to 1000kHz. Press keys TR, 1 and 9 to display the time, in the format 00-00-00, with the rightmost digit incrementing every second. By reading and displaying the time a further section of the Processor and its I/O (input/output) capability has been checked. If any of the above checks do not work check the POWER SUPPLY first before proceeding to the PROCESSOR TROUBLESHOOTING G3.



Note 1 A Power Supply failure will affect the entire instrument.
2 A special test initiated by pressing TR,9,0 checks out most of the instrument. This key sequence activates a tune. Most faults in the receiver, synthesizer or processor will automatic ally inhibit or alter this tune.
3 HP–IB faults are usually directly associated with A68 or A60 Assemblies.

Figure 8-5 Flow Chart

8-70 SYNTHESIZER

8-71 Incorrect level measurements can sometimes be caused by tuning errors of the synthesizer. With this type of fault, the synthesizer tuning should be checked prior to proceeding to the RECEIVER TROUBLESHOOTING. The synthesizer frequency can be monitored, at A51J2, using a suitable electronic counter frequency locked to the SLMS 10MHz OUTPUT (rear panel). The SLMS OUTPUT FREQUENCY (A51J2) = SLMS frequency on FREQ/FDM display +50,015,625Hz ± 1Hz. Press MEAS then HALT before making each measurement. If the synthesizer frequency is incorrect check the POWER SUPPLY first before proceeding to the SYNTHESIZER TROUBLESHOOTING G2.

8-72 POWER SUPPLY

8-73 The POWER SUPPLY Assembly A80 (identifiable by lift tabs) has three Test Points conveniently located at the top of the board. The red and green LEDS give an instant display of the state of the power lines. The red LEDS come ON when the line is in an overcurrent condition. The green LEDS indicate a voltage is present but does not guarantee the line is within tolerance. The following voltages should be present:

TP1	+12.00V ± 0.1V
TP2	-12.00V ± 0.1V
TP3	+5.25V ± 0.2V

If any of these voltages are missing or out of tolerance refer to the POWER SUPPLY TROUBLESHOOTING (Assembly A80).

8-74 RECEIVER

8-75 If a fault is present on the SLMS, and the PROCESSOR, SYNTHESIZER and POWER SUPPLY all appear to be operating correctly, refer to the RECEIVER TROUBLESHOOTING G1.

RECEIVER SECTION

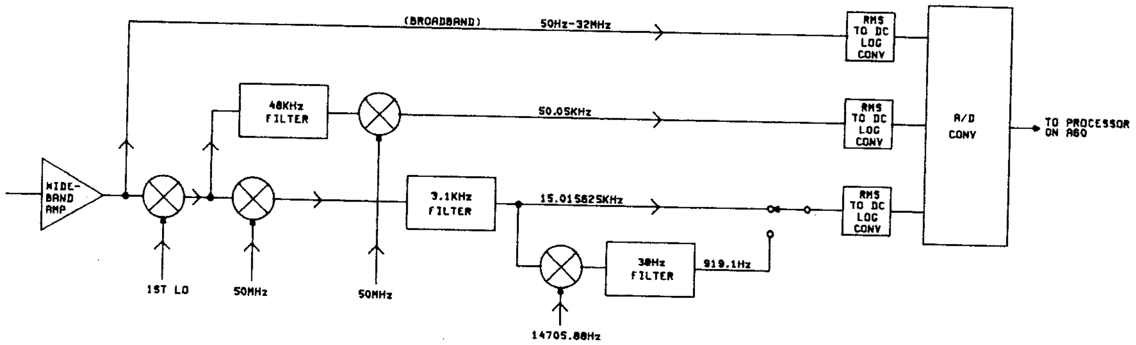


Figure 8R-1 Selectable Filters

8R-1 INTRODUCTION

8R-2 The SLMS receiver is a multi-stage superhet design tuned by the 1st Local Oscillator signal (generated in the Synthesizer Section of the instrument). The SLMS is intended primarily to measure signal power levels. It is therefore often used in one of the selective (filter) modes. There are three selectable filters, 38Hz, 3.1kHz, and an optional 48kHz. There is also a broadband power measurement mode which does not require a filter. The true RMS power levels in the receiver are converted into a digital format and the result processed and displayed as a level in either dB or dBm. In order to maintain a high degree of measurement accuracy, a calibration cycle occurs at regular intervals, and when certain measurement parameters are changed.

8R-3 INPUT POWER (Broadband)

8R-4 In this mode of measurement no instrument tuning is required. A wideband amplifier on the A2 Assembly is equalised to have a flat response from 50Hz to 32MHz with less than 1dB ripple across the band. The measurement range, from +20dBm to -45dBm, is largely determined by the range of the input attenuator (0-20dB on the A1 Assembly plus 0-25dB on the A2 Assembly) and the range of the RMS to DC Log Converter (>25dB) on the A4 Assembly.

8R-5 The control logic which switches the attenuator relays, and selects between balanced and unbalanced inputs is located on the A2 Assembly. The final input attenuator setting is determined by the Processor (on A60 Assembly). The autoranging sequence described in the flow chart (Figure 8R-5) shows how the attenuation is increased or decreased to accomodate changes in input signal level.

8R-6 The RMS to DC log output from the Broadband power detector on the A14 Assembly is digitised at the A/D converter on the A22 Assembly. The processor sums this result (from the A22 Assembly) with the input attenuator settings and displays the power level.

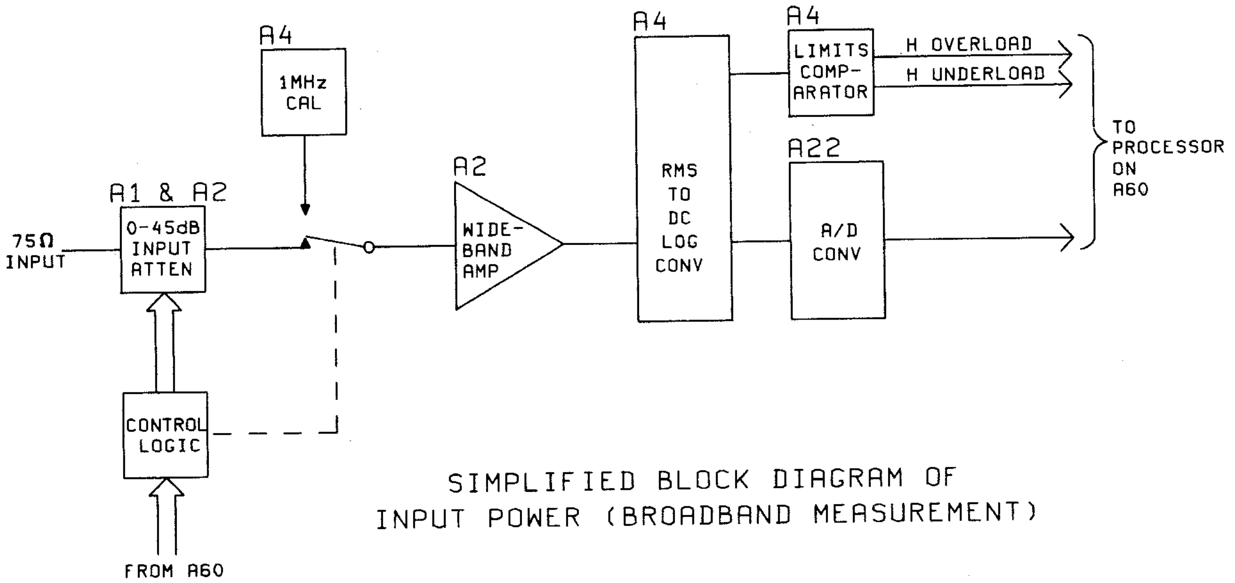


Figure 8R-2 Simplified Broadband Power Measurements

8R-7 38Hz & 3.1kHz FILTERS (selective)

8R-8 In this selective mode of operation the instrument is tuned by setting the Synthesizer output, which is the 1st LO, 50.015625MHz above the tuned frequency. Input and LO signals are mixed on the A5 Assembly to produce a 1st IF signal at 50.015625MHz.

8R-9 A second mixer on the A10 Assembly has a fixed frequency LO of 50MHz (derived on the A40 Assembly in the Synthesizer Section) which mixes with the 1st IF to give a 2nd IF of 15.625kHz.

8R-10 Both the 3.1kHz (Channel) and 38Hz (Pilot) filters are contained on the A20 Assembly. The Channel Filter (3.1kHz) is a passive network centred on 15.625kHz with a 3dB bandwidth of 3.1kHz. Control lines L38Hz and L12kHz (which determine signal routing to the A21 Assembly) are both high in this mode of operation.

8R-11 The pilot filter is an active filter centred on 919.1Hz with a 3dB bandwidth of 38Hz. A futher stage of mixing is necessary to change the 15.625kHz signal to 919.1Hz. This is accomplished by mixing 15625Hz with 14705.88Hz (1MHz/68). The L38Hz switches in the L.O. (14705.88Hz) by going low to enable the Divide by 68 Circuitry (in addition it switches the pilot signal to the A21 Assembly).

8R-12 A test mode of operation by-passes both channel and pilot filters. This is activated by a special key sequence (TR, 3.1kHz) which pulls the L12kHz line low.

8R-13 Switchable stages providing up to 95dB of gain (0-25dB on A20 Assembly and 0-70dB on A21 Assembly) are controlled by an autoranging sequence to determine the signal drive level into the RMS to DC Log Converter (on A21 Assembly). A simplified flow chart in Figure 8R-6 shows the atuoranging of the IF gain stages. On the higher averaging modes, AVE 1 and AVE 2, autoranging maintains the signal drive level to the RMS to DC Log Converter within a 5dB limit. The dynamic range of the RMS to DC Log Converter is limited to 10dB. On the lowest averaging mode AVE 0 the RMS to DC Log Converter gain is changed to give a range of 40dB. The autoranging now maintains the signal level to the RMS to DC Log Converter within a 30dB "window". The SLMS averaging modes are described in Paragraph 8R-26.

8R-14 In addition to the DC log output an IF signal is routed to the A/D converter (Assembly A22). The IF signal output is used for frequency measurements and the DC log output digitised by the A/D converter.

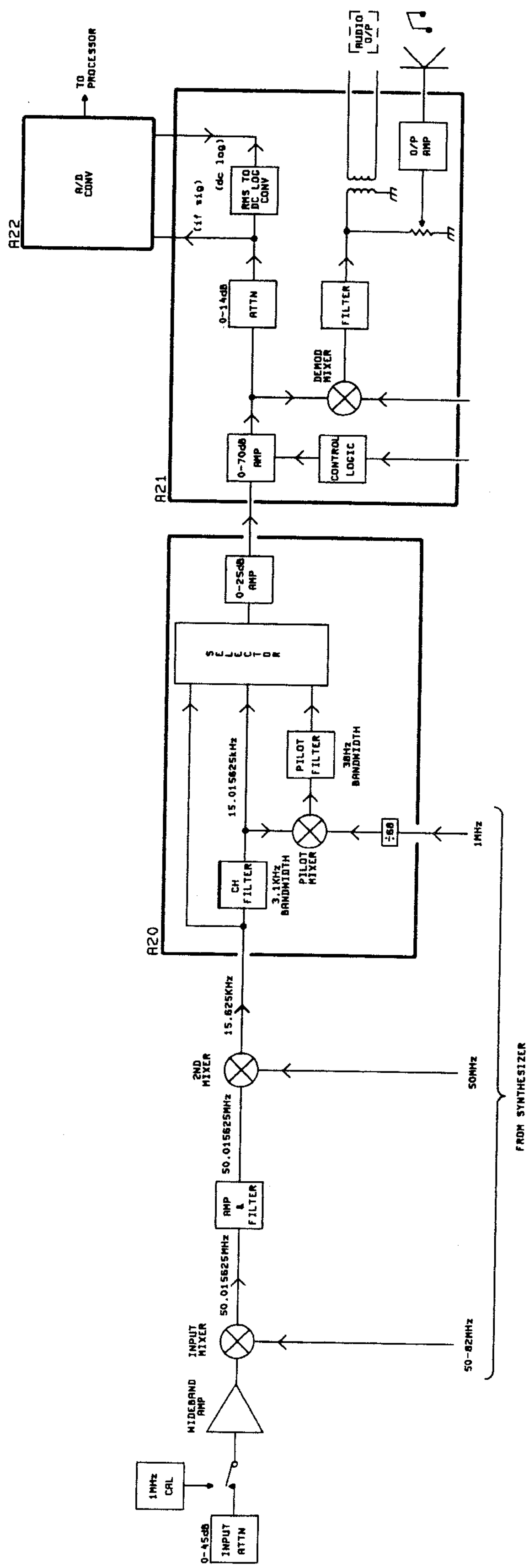


Figure 8R-3 Simplified 38Hz & 3.1kHz Filter

8R-15 The input signal level at the front panel of the SLMS, on selective measurements is calculated by the processor from the setting of the Input Attenuator (on A1 and A2 Assemblies), the setting of the switched gain stages (on A20 and A21 Assemblies) and the reading from the A/D converter (on A22 Assembly).

8R-16 48kHz FILTER (Opt 011)

8R-17 On instruments fitted with OPT 011 when the 48kHz filter is selected the Synthesizer (1st L.O.) tuning is altered. In this case the synthesizer is programmed to have a 1st LO frequency 50.05MHz above the instrument tuning frequency.

8R-18 The input signal is mixed, as before, on the A5 Assembly giving an IF output of 50.05MHz which is routed to the Group Power Assembly (A11). Crystal filters in the 3.1kHz and 38Hz signal paths (at the output of A1 Assembly and the input of A2 Assembly) block any 50.05MHz signal.

8R-19 The Group Power Assembly (A11), in addition to containing the 48kHz Group Filter, has a mixer and as RMS to DC Log Converter. The specially designed (Group) crystal filter is centred on 50.05MHz and has 3dB bandwidth of 48kHz. A mixer stage converts the 50.05MHz IF signal to an IF of 50kHz which is within the frequency range of the RMS to DC Log Converter. The RMS to DC Log Converter range of >40dB is further extended by 25dB gain stage which is switched in circuit if the signal level falls below -50dB. The displayed signal level is computed by summing the A/D value of the RMS to DC Log output (from A11) with the value of the INPUT Attenuator (on A1 and A2 Assemblies) and the state of the switched gain amplifier (on A11 Assembly).

8R-20 A separate IF signal output is connected to the A/D Converter Assembly (A22) for use in frequency counter measurements.

8R-21 CALIBRATION

8R-22 A calibration cycle occurs each time a different FILTER is selected, or when the measurement resolution is changed (AVE 0, AVE 1 or AVE 2), and at 10 minute intervals. The calibration signal is a highly accurate and stable 1MHz reference frequency at a precise level of -25dBm, derived on the A4 Assembly. This signal is switched through the receiver on the signal path of the selected measurement mode, by-passing the Input Attenuator. Any error in the measured CAL level is stored by the processor, and is applied as an automatic correction factor for all measurements until the next calibration cycle.

8R-23 A calibration test mode allows the quality of the receiver to be checked by monitoring and displaying the level of the calibration signal continuously. This mode is accessed by pressing **TR** 29. The displayed calibration level should be -25dBm ± 2dB. Any drift off -25dBm usually indicates there is a drift in either the A/D converter, one of the RMS to DC log converters, or in an individual receiver assembly; this drift is not usually attributable to the calibration signal itself.

8R-24 Should the SLMS drift out of calibration an error code E97 is displayed in the TEST POINT window and the CAL cycle is held up. This error can be overidden by pressing the MEAS key. In such instances the processor uses a correction factor taken from the last good calibration cycle.

8R-25 AUTORANGING

8R-26 The amount of gain and attenuation required is determined during the instrument autoranging sequence. There are two independent autoranging actions:

1. An INPUT ATTENUATOR is switched between 0 and 45dB, in 5dB steps by control data from the processor. The Processor acts when one of the "hardwire" limits H OVERLOAD and H UNDERLOAD goes (high) true to autorange the INPUT ATTENUATOR.
2. The RECEIVER GAIN is also switched in 5dB steps, between 0 and 95dB, by control data from the processor. In this case the processor monitors the A/D CONVerter output and autoranges the RECEIVER GAIN when the software limits (set in ROM memory) are violated. (This occurs if the signal level in the receiver IF chain goes too low or too high).

The two flow charts Figure 8R-5 and Figure 8R-6 show the autoranging routine for the input attenuator and receiver gain.

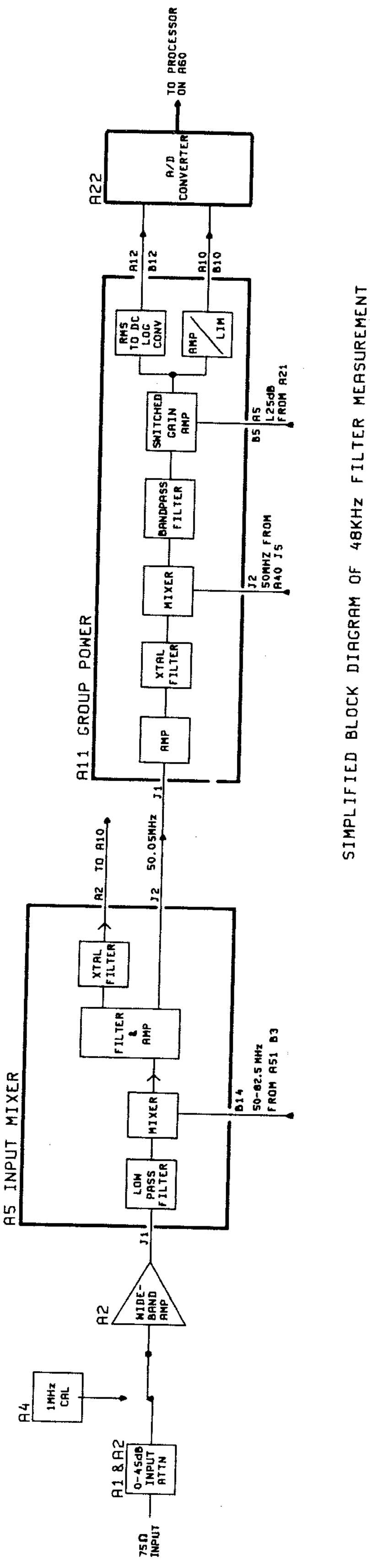


Figure 8R-4 Simplified 48kHz Filter

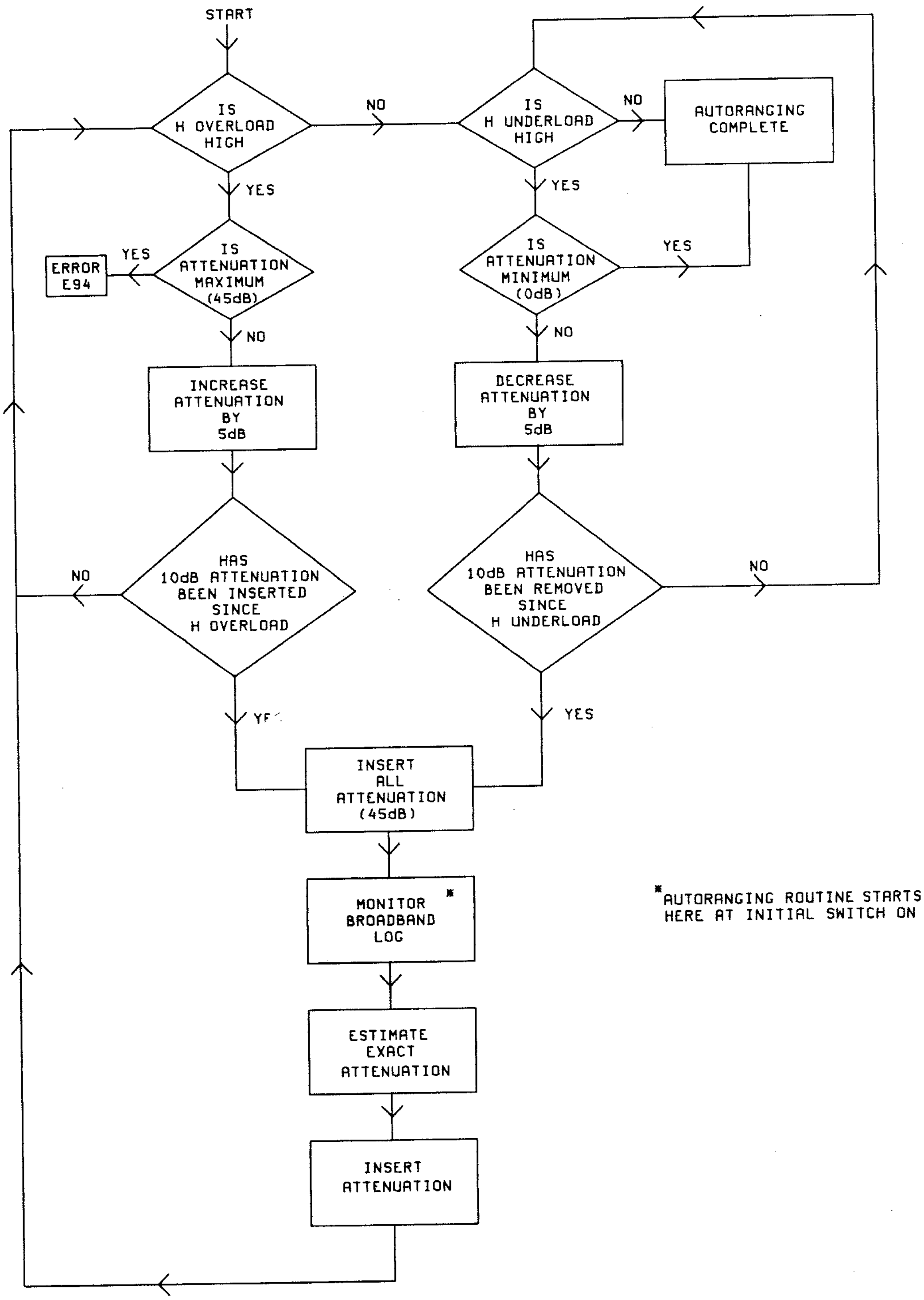


Figure 8R-6 Receiver Autoranging

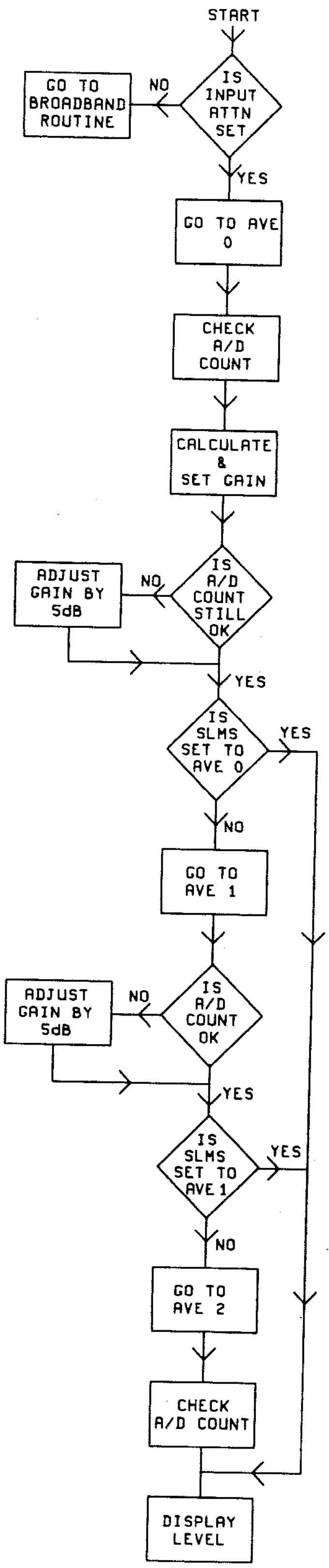


Figure 8R-6 Receiver Autoranging

8R-27 AVERAGING (38Hz and 3.1kHz Filters)

8R-28 There are three averaging modes in the SLMS to allow different resolution of signal levels. AVE 0 is the fastest of three averaging modes and resolves levels to the nearest whold number. AVE 1 resolves levels to one decimal place and AVE 2 resolves to two decimal places. AVE 2 is the slowest mode of operation.

8R-29 In AVE 0, the range of the RMS to DC Log Converter (on the A21 Assembly) is extended to 40dB and the IF Gain Stages are autoranged in 30dB steps. In this mode H SMOOTH (A21) is low, OdB attenuation is inserted in the attenuator preceding the RMS to DC Log Converter, and the output Amplifier following the RMS to DC Log Converter is in its low gain state. The sensitivity at the output of A21 Assembly is 10mV per dB.

8R-30 In AVE 1, the range of the RMS to DC Log Converter is 10dB and the IF Gain stages are autoranged in 5dB steps. The H SMOOTH line is high, 14dB of attenuation is inserted in the attenuator preceding the RMS to DC Log Converter, and the Output Amplifier following the RMS to DC Log Converter is in its high gain state. The sensitivity at the output of A21 Assembly is 100mV per dB on AVE 1 and AVE 2.

8R-31 In AVE 2, the range of the RMS to DC Log Converter is 10dB and the IF gain stages are autoranged in 5dB steps. The H SMOOTH line is high, 14dB of attenuation is inserted in the attenuator preceding the RMS to DC Log Converter, and the output Amplifier following the RMS to DC Log Converter is in its high gain state. In addition the LR100 line goes high to switch in a long time constant circuit changing the slope of the RMS to DC Log Converter. On the A22 Assembly the LR100 line is also high increasing the count resolution of the A/D Converter by a factor of 10.

8R-32 Table 8R-1 summarizes the averaging modes which are available on the different measurements.

Table 8R-1

Measurement	AVE Mode	LR100	HSMOOTH	A/D counts/dB
INPUT POWER	AVE0 AVE1	1 1	dont care	100 100
38Hz & 3.1kHz	AVE0 AVE1 AVE2	0 0 1	0 1 1	10 100 1000
48kHz	AVE0 AVE1	0 1	dont care	100 1000
WTD & NOTCH	AVE0 AVE1	0 1	0 1	100 1000

8R-33 RECEIVER TROUBLESHOOTING

8R-34 RECEIVER DIAGNOSTIC PROGRAMS

8R-35 The following processor test programs are available and may be used to help in testing and troubleshooting the receiver section of the SLMS.

TR 20 ↑	Increments the IF gain of the receiver in steps from 0 to 19 each step represents a 5dB increase in gain.
↓	Decrements the IF GAIN.
TR 21 ↓	Increments the rf ATTEN. The number displayed on the SLMS FREQ/FDM display actually decrements to 00 which corresponds to maximum attenuation.
↑	Decrements the rf ATTEN.
TR 22 ↑	Increments through the various A/D inputs.
↓	Decrements through the various A/D inputs.

Table 8R-2 shows the various A/D inputs.

Table 8R-2 A/D Input Selections
Diagnostic Mode d22 (Press key TR,2,2)

A.d. I.P. =	INPUT SELECTED
0	IF LOG
1	-1V TEST
2	0 JITT
3	GROUP POWER LOG
4	BROADBAND POWER LOG
5	GND
6	WTD FILTER LOG
7	REF GND

NOTE: The numbers at the A.d. I.P. = do not correspond to the BCD numbers or the I/P numbers at A22U20. There is however a relationship, if A_0, A_1, A_2 at A22U20 are weighted in the reverse order then this corresponds with the numbers on the SLMS display A.d. I.P. =.

TR 23	The SLMS FREQ/FDM display indicates the value of the A/D output.
TR 25	The Processor pre-loads the D/A converter on assembly A21 to a pre-defined value.
↑	Shifts the value in the D/A. This facility is used for the adjustment and testing of the chart recorder output.
TR 29	The SLMS measures and displays the value of the CALIBRATION signal.
TR 3.1kHz	The SLMS selects a test mode which by-passes the Channel/Pilot filters. This is internally selected on assembly A20.

Table 8R-3 Receiver Troubleshooting

PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
CHECK A/D CONVERTER (A22), AND POWER SUPPLY A80		
1. With the SLMS in the POWER ON position, press keys TR, 2,2. The SLMS should indicate diagnostic mode d22. Press the ↑ key obtain a FREQ/FDM display A.d. I.P. = 1.		The SLMS powers on in the AVE 1 mode. TR22 ↑ selects I.P. =1 on A22 assembly and sets a -1V level to the A/D converter input.
2. Press key 3 to change to diagnostic mode d23 to read and display the output from the A/D converter (assembly A22).		
3. The SLMS FREQ/FDM should read between 900 and 1100 if the SLMS is in AVE 0 or AVE 1, or 9000 to 11,000 if the SLMS is in AVE 2.	A80 R15 sets +12V, A22 R6 sets A/D converter.	This checks the A/D converter is functioning also that the +12V, -12V and +5V rails are present. If the reading is incorrect see Assemblies A80 and A22 troubleshooting.
CHECK CAL AND BROADBAND POWER A4		
4. Press the SLMS I/P POWER key, then MEAS. The SLMS should CALibrate and display a noise floor of less than -55dBm in the LEVEL window.		If the noise floor exceeds -55dBm (a) Check the screws on assemblies A1, A2 and A4 are tight. (b) Press the 3.1kHz key and MEAS, then the I/P POWER key and MEAS, to force a CAL. Check the CAL LED on assembly A4 is ON each time CAL is displayed in the LEVEL window. (c) If the CAL LED fails to come ON in step (b) set the CAL slide switch on assembly A4 to TEST. If the CAL LED is now ON check Assembly A2 trouble shooting for the presence of LCAL.

PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
		(d) If the instrument does CAL (in step b), disconnect Assembly A1 by A2J1, disconnecting then remove assembly A2 to see if the noise floor improves. If the noise floor remains >-55dBm check Assembly A4 troubleshooting.
5. Press the 3.1kHz FILTER key. Select the SLMS long AVERAGE mode by pressing keys AVE and 2.		
6. Press keys TR,2,9 to to select the CAL measurement mode. The SLMS FREQ/FDM display should indicate 1000.000kHz and the LEVEL window should display the letters CAL followed by the actual signal level. The instrument settles in the MEAS mode if the CAL level displayed is 25dB +- 2dB this gives a good indication that the CAL level through the 3.1kHz signal path is within specification.		In faulty instruments or instruments out of CAL the SLMS indicates 1000.000kHz with CAL permanently displayed in the LEVEL window and an error code of E97 in the TEST POINT window. The instrument in this case settles in the HALT mode *and on no account press the* MEAS *key.* The fault could either lie in the IF signal path or with the CAL signal itself. Steps 7 and 8 check out the CAL signal.
7. Press keys TR,2,2 to change the SLMS to diagnostic mode d22. The SLMS should now indicate A.d. I.P = 0. Press the ↑ key to change to A.d. I.P. =4. This connects the A/D converter to the output of the Broadband Power Detector.		
8. Press key 3 to change to diagnostic mode d23. The SLMS should now read the A/D converter output of the calibration signal	Paragraph 5-26 Broadband Power Detector. Paragraph 5-27 0dBm LEVEL	A/D output not 2300+-250 (a) Set A4 CAL switch to TEST and measure CAL level at A4J1 on a Power Meter, -25dBm +- 1dB.

PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
through the Broadband Power Detector. The number is displayed in the SLMS FREQ/FDM display should be 2300 +- 250.		(b) If Cal level is correct (in step a) check signal level at Assembly A4 pin 11 to isolate the fault to either Assembly A2 or A4.
CHECK INPUT AUTORANGE & BROADBAND POWER DETECTOR RANGE (Assemblies A1, A2 and A4)		
1. Connect a suitable signal Source* to the SLMS 75 ohm INPUT. Set the level output from the signal source to +10 dBm.		
2. Press the SLMS I/P POWER key, then MEAS.		
3. Vary the output level from the signal source from +10dB to -30dBm in 5dB steps. Check the SLMS I/P POWER displayed in the LEVEL display changes in sequence. NOTE: *On instruments on and above Serial Number 00412, it may be necessary to press the BRIDGED key to deselect the high impedance inputs.*		If the SLMS measured LEVEL is incorrect: (a) Set the Signal Source* to -2dBm and connect it to the SLMS 75! INPUT. (b) Press TR,2,1 to enter diagnostic d21, with the SLMS FREQ/FDM display indicating RF ATTEN = XX. (c) Press the ↑ key to set the RF ATTEN =09 (This is *minimum* attenuation state). (d) Connect A2J3 to a 75ohm terminated RMS Voltmeter (Use a hp 3400 terminated via a T piece in 75 ohms). The power level on the Voltmeter should be 866mV +- 150mV which corresponds to a level of +10dBm +-1.5dB.

*Accurate frequency is not important for this test, but an accurate attenuator is. An HP651 or HP654 are both suitable.

PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
		(e) Press the ↓ to insert attenuation. For each key press the FREQ/FDM display should decrement in single steps until a final display of RF atten =00 is reached. (This is the maximum attenuation step). Each step is a 5dB step in attenuation. Verify the 5dB steps on the RMS voltmeter dB scale. If the RMS voltmeter has no dB scale 866mV= +10dB 487mV= + 5dB 274mV= 0dB 154mV= - 5dB 86.6mv= -10dB 48.7mV= -15dB 27.4mV= -20dB 15.4mV= -25dB 8.6mV= -30dB (LED'S on the A2 and A1 assemblies provide a visual indication of the attenuation states being switched. The LED'S on A2 indicate how much attenuation on A2 is inserted when the LED(s) is ON*. The 20dB LED on assembly A1 is OFF when the † 20dB pad is inserted.)
4. Change the signal source from -30dBm to -55dBm and check the I/P POWER reading changes accordingly +- 1dB.		LEVEL does not fall low enough or is not accurate. (a) Press keys TR,2,1 to check the RF ATTEN =09 (b) Press keys TR,2,3 to monitor the A/D output on the SLMS FREQ/FDM display. (c) Change the LEVEL from the Signal source from -30 to -60dB. The A/D reading should change in steps of 100 per 10dB from approximately 2800 to 5800 +-200. (Note this check will only work if I/P POWER has

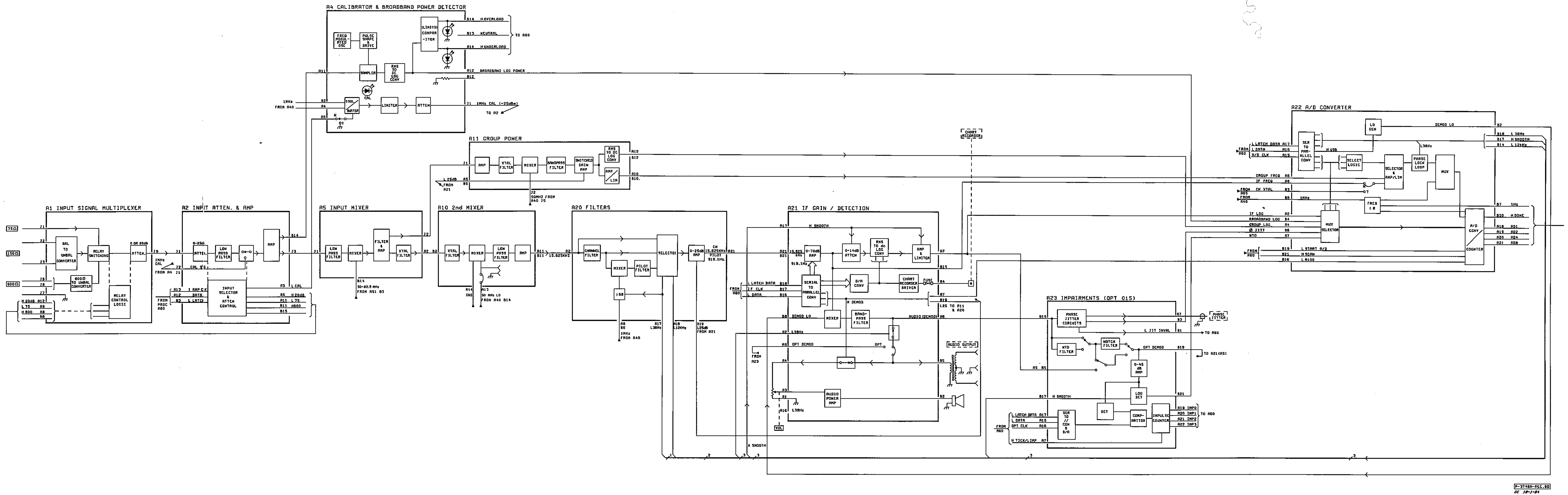
PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
		previously been selected. If a selective filter measurement has been selected instead of I/P POWER, then accidently pressing the MEAS key connects the converter to the power detector of that filter). *NOTE: *The lamp sequence may appear to be random but the 'settled' total atten sum should be correct.* NOTE: *On instruments above Serial Number 00412 there is no LED on the A1 Assembly.*

PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
48 kHz FILTER CHECK 1. Press the SLMS 48kHz FILTER key, and AVE, 1 keys. 2. Press keys TR,2,9. The SLMS should now indicate 1000.000 kHz in the FREQ/FDM window. The letters CAL appear in the LEVEL window followed by the actual signal level. The instrument should settle in the MEAS mode, with a LEVEL of 25dBm +- 2dB. NOTE: *If an error E97 exists in the 48 kHz FILTER mode, check if this error condition also exists in the 3.1kHz filter. This gives an indication as to which signal paths are affected.*	GROUP FILTER adjustment Para. 5-30	SLMS indicates error E97 with FREQ/FDM display at 1000.000kHz and CAL permanently displayed in the LEVEL window. *Do not press the* MEAS *key.* The instument must be kept in the HALT mode. (a) Connect an oscilloscope to A10TP4 and check the level is 2V pk-pk +-0.2V pk-pk. If this level is incorrect refer to the receiver block diagram for details of other signal levels. (The CAL level and assemblies A1, A2 and A4 are checked in the previous paragraphs). (b) Press TR23 to display the A/D Converter reading. This should be 750 +- 20. If this reading is incorrect press SLMS keys TR,2,0 and check the IF GAIN = 00; press TR,21 and check that rf Atten = 09. If either the input attenuator or the IF gain settings were not as stated this could cause an error reading at the A/D converter. If both Attenuator and Gain states are correct, check the signal level at A5J2 is 4.5 pk-pk (with 100% modulating). If the signal level at A5J2 is correct refer to adjustment for GROUP FILTER Para. 5-30

PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
3.1 kHz FILTER CHECK		
1. Press the SLMS 3.1kHz FILTER key, and AVE, 2 keys.		
2. Press keys TR,2,9. The SLMS should now indicate 1000.000kHz in the FREQ/FDM window. The letters CAL appear in the LEVEL window followed by the actual signal level. The instrument should settle in the MEAS mode, with a LEVEL of 25dBm +- 2dB.		SLMS indicates error E97 with FREQ/FDM display at 1000.000kHz and CAL permanently displayed in the LEVEL window. *Do not press the* MEAS *key.* The instrument must be kept in the HALT mode.
NOTE: *If an error E97 exists in the 3.1kHz FILTER mode, check if this error condition also exists in the A20 filter by-pass mode (and the 48kHz FILTER when OPT011 is fitted). This gives an indication as to which signal paths are affected.*		(a)connect an oscilloscope to A10TP4 and check the level is 2V pk-pk +- 0.2V pk-pk. If this level is incorrect refer to the receiver block diagram for details on other signal levels. (The CAL level and assemblies A1, A2 and A4 are checked in earlier paragraphs). (b) Press TR23 to display the A/D Converter reading. This should be 21000 +- 600. If this reading is incorrect press SLMS keys TR,2,0 and check the IF GAIN = 00; press TR,21 and check that rf Atten = 09 If either the input attenuator or the IF gain settings were not as stated this could cause an error reading at the A/D converter. If both the Attenuator and Gain states are correct, check the signal level at A20 pin 21 is 5V pk-pk +- 0.5V. If the signal level at A20 pin 21 is correct adjust A21R19 to give a reading of 21000 +- 100 then refer to adjustment for 0dB LEVEL, Para 5-27.

PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
38 Hz FILTER CHECK 1. Press the SLMS 38Hz FILTER key, and AVE, 2 keys.		
2. Press keys TR,2,9. The SLMS should now indicate 1000.000Hz in the FREQ/FDM window. The letters CAL appear in the LEVEL window followed by the actual signal level. The instrument should settle in the MEAS mode, with a LEVEL of 25dBm +- 2dB. NOTE: *If an error E97 exists in the 38Hz FILTER mode, check if this error condition also exists in 3.1kHz FILTER and the A20 filter by-pass mode (and the 48kHz FILTER when OPT 011 is fitted). This gives an indication as to which signal paths are affected.*		SLMS indicates error E97 with FREQ/FDM display at 1000.000kHz and CAL permanently displayed in the LEVEL window. *Do not press the* MEAS *key.* The instrument must be kept in the HALT mode. (a) Connect an oscilloscope to A10TP4 and check the level is 2V pk-pk +- 0.2V pk-pk. If this level is incorrect refer to the receiver block diagram for details on other signal levels. (The CAL level and assemblies A1, A2 and A4 are checked in earlier paragraphs). (b) Press TR23 to display the A/D Converter reading. This sould be 21000 +- 600. If this reading is incorrect press SLMS keys TR,2,0 and check the IF GAIN = 00+ press TR,21 and check that rf Atten= 09. If either the input attenuator or the IF gain settings were not as stated this could cause an error reading at the A/D converter. If both Attenuator and Gain states are correct, check the signal level at A20 pin 21 is 5V pk-pk +- 0.5V. If the signal level at A20 pin 21 is correct adjust A21R19 to give a reading of 21000 +- 100 then refer to adjustment for 0dB LEVEL, para 5-27.

PROCEDURE	ADJUSTMENT	TROUBLESHOOTING
A20 Filter by-pass mode This is a test condition used to by-pass the Channel and Pilot filters on assembly A20. 1. Press AVE,2, TR, 3.1kHz. 2. Press TR,2,9. The SLMS should now display E97, 1000.000kHz CAL and be in the halt mode. 3. Press TR,23 to give a reading of the A/D output on the SLMS FREQ/FDM display. 4. The reading should be 28000 +- 2000.		



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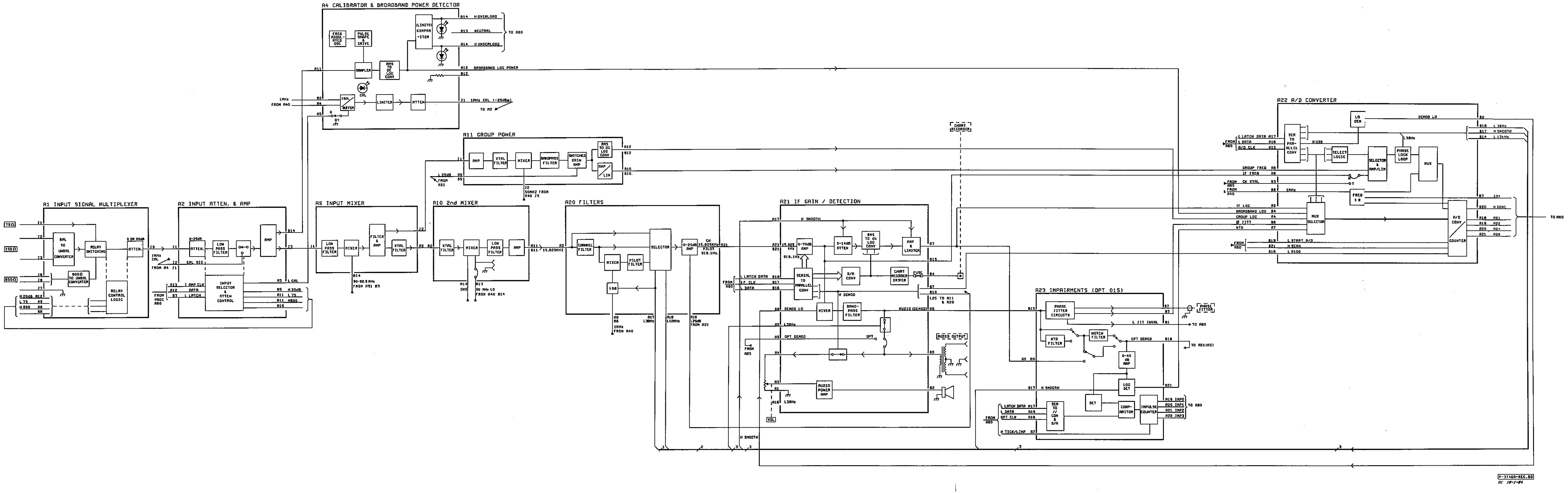
3746A Receiver Block Diagram



3746A Receiver Block Diagram

3746A Receiver Block Diagram

ASSEMBLY SERVICE SHEET A1
INPUT SIGNAL MULTIPLEXER

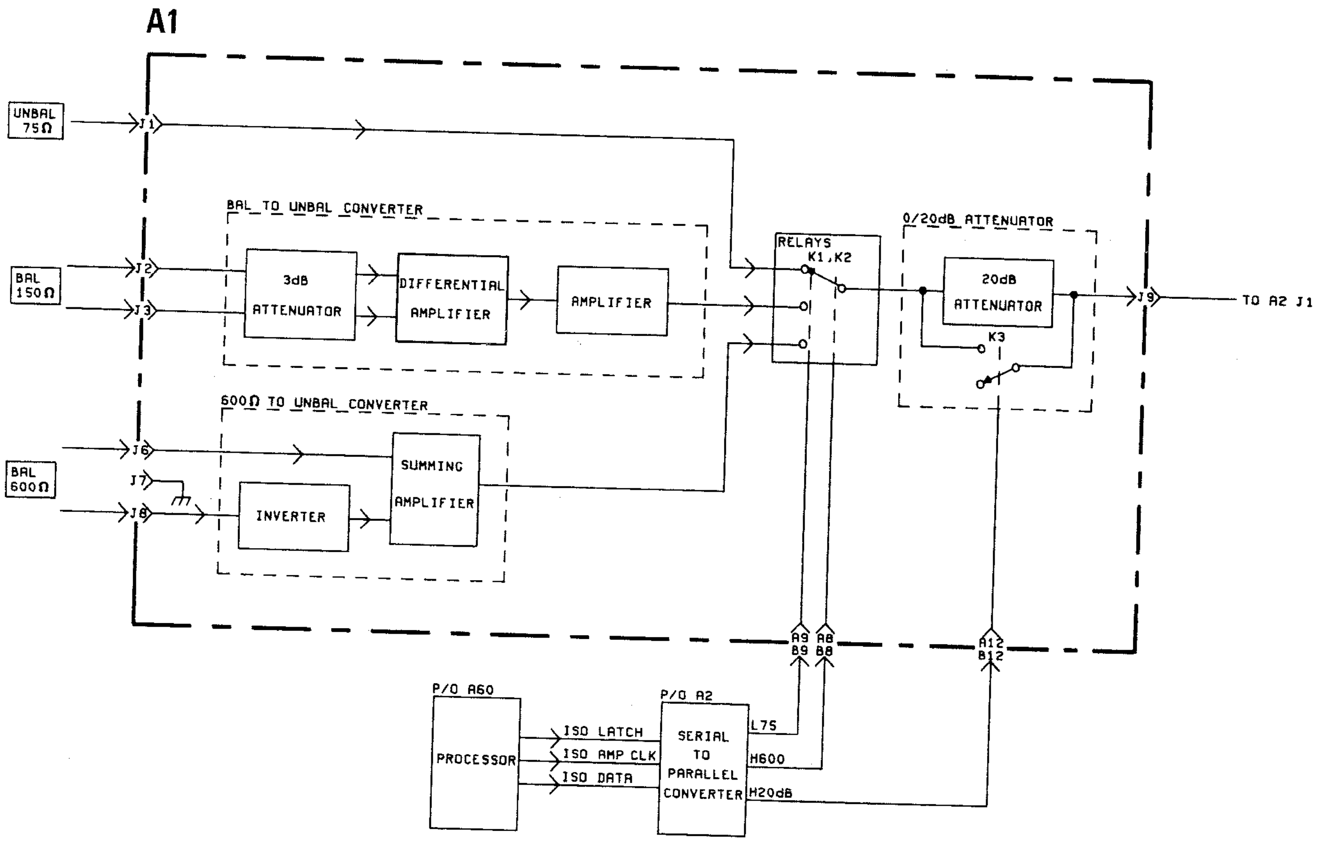


Figure A1-1 A1 Block Diagram

A1-1 INTRODUCTION

A1-2 This assembly is designed to select one of three possible inputs, (four when OPT 005 is fitted) and to convert balanced signals to 75 ohm unbalanced signals. The state of the control lines H600 and L75 at the output of the Serial to Parallel Converter on Assembly A2 determine which TERMINATION input is selected (via relays K1 and K2). The state of the H20dB line (established on completion of the receiver autoranging sequence) determines if the 20dB Attenuator is selected or not.

A1-3 Only one input at a time should be connected to the instrument, as the isolation between adjacent inputs is not high enough to prevent crosstalk affecting measurement accuracy.

A1-4 CIRCUIT DESCRIPTION

A1-5 75 ohm UNBAL INPUT

A1-6 When the 75 ohm UNBAL INPUT (J1) is selected, the input signal is routed via K2 and K3 to Assembly A2. When a BALANCED INPUT is selected the 75 ohm INPUT is terminated in 75 ohm by R35.

A1-7 150 ohm BAL INPUT

A1-8 When the 150 ohm BAL INPUT (J2/J3) is selected, the input is applied to the Differential Amplifier Q1/Q2 via the 3dB Attenuator. The

Differential Amplifier provides an unbalanced output signal at the collector of Q2. The unbalanced signal is further amplified by Q4/Q5. R27 adjusts the gain of amplifier Q4/Q5.

A1-9 The Bal to Unbal Converter converts a balanced input signal at 150 ohm to an unbalanced signal of the same power at 75 ohm.

A1-10 124 and 135 ohm BAL INPUT - Option 005

A1-11 When the 124 ohm (J2/J3) and 135 ohm (J4/J5) BAL INPUTS are fitted, the the Bal to Unbal Convertor operates in a similar manner to the 150 ohm BAL INPUT except that matching pads are fitted in place of the 3dB Attenuator (see Figure A1-4).

A1-12 The Matching Pads impedance match the 124 ohm and 135 ohm BAL INPUTS to the 150 ohm input impedance of the Differential Amplifier. Each Matching Pad has a 3dB loss.

A1-13 600 ohm BAL INPUT

A1-14 When the 600 ohm BAL INPUT (J6/J8) is selected the input signal is applied to the 600 ohm Bal to Unbal Converter.

A1-15 The signal at J8 is inverted by amplifier U1 and summed with the signal from J6. The signal at TP1 is routed via K1, K2 and K3 to Assembly A2.

A1-16 The 600 ohm Bal to Unbal Converter changes a balanced signal at 600 ohm to a unbalanced signal of the same power at 75 ohm.

A1-17 0/20dB Attenuator

A1-18 The 0/20dB Attenuator is controlled by the instrument autoranging sequence. When H20dB goes high, K3 goes to the de-energised position and the 20dB attenuator pad is switched into circuit. The autoranging sequence is described in Paragraph 8R-25.

A1-19 Relays

A1-20 The relay control lines H600, L75 and H20dB from the processer are decoded and latched on Assembly A2.

A1-21 The relationship between K1, K2, H600, L75 and the front panel TERMINATION keys is explained below.

(a) When the 75 ohm TERMINATION key is pressed; L75 goes low and energises K2; ie the 75 ohm UNBAL INPUT selected.

(b) When the 150 ohm TERMINATION key is pressed, L75 goes high and K2 is de-energised , H600 goes low and K1 is energised; ie the 150 ohm BAL INPUT is selected.

(c) When the 600 ohm BAL TERMINATION key is pressed; L75 goes high and K2 is de-energised, H600 goes high and K1 is de-energised; ie the 600 ohm BAL INPUT selected.

A1-22 Test links TL1, TL2, and TL3 are troubleshooting aids for the A1 Assembly and when in the test position (T) energise the relays.

A1-23 TROUBLESHOOTING NOTES

1. Voltages and waveforms are shown on the schematic diagram. The input selected should correspond to the particular circuit being measured as indicated by the notes on the schematic diagram.

2. Built-in LED's provide a double check on the signal path selected, as shown:

Input	DS1 state	DS2 state
75 ohm	ON (L75 low)	ON (H600 high)
150 ohm	OFF (L75 high)	ON (H600 high)
600 ohm	OFF (L75 high)	OFF (H600 high)

DS3 is ON when H20dB is low, energising relay K3 to select the 0dB attenuation path.

Note that correct operation of the LEDs does not guarantee that the relay is working correctly.

3. Test links TL1, TL2 and TL3 allow the relays K1, K2 and K3 to be energised manually, in the absence of processor control over lines H600, L75, and H20dB.

4. Waveforms at TP3, TP4 and TP5 will vary according to the input selected and the state of the 0/20dB ATTENUATOR.

5. Voltages and waveforms for instruments fitted with 124/135 ohm options are similar to those shown on the schematic diagram for the standard instrument.

A1-24 REMOVAL PROCEDURE

WARNING

DISCONNECT THE POWER CORD BEFORE REMOVING THE A1 ASSEMBLY

1. Remove the top and bottom trims and covers.

2. Remove the four screws retaining the front panel (the centre bottom screw need not be removed). Note that the bottom left screw is longer than the others.

3. Remove the front panel assembly.

4. Disconnect the coax cable to the A2 Assembly.

5. Remove the A1 Assembly.

Note: The following paragraphs apply only to instruments after serial number 00411.

A1-25 On instruments above serial number 00411 the A11 assembly is changed to accommodate 'Bridged' inputs. The circuitry is almost identical to the 03746-60061 assembly except for the inclusion of two extra relays, and an amplifier at the 75Ω input.

A1-26 At switch-on the SLMS "wakes up" with the Bridged Inputs selected if A60 S-8 is set to on. If A60 S-8 is set to off, the instrument will power up with all inputs terminated. The A1 assembly schematic shows the configuration when the instrument wakes up in the terminated mode.

A1-27 Relays K4 and K5 select between the high impedance "Bridged" state and the terminated state. When connection is made to the 135Ω balanced input jack, switch S1 at Q13 base opens, relay K6 is enegised altering the input impedance and gain at amplifier Q5, Q6. When the "Bridged" input is selected K5A is open making the operation of K6 redundant.

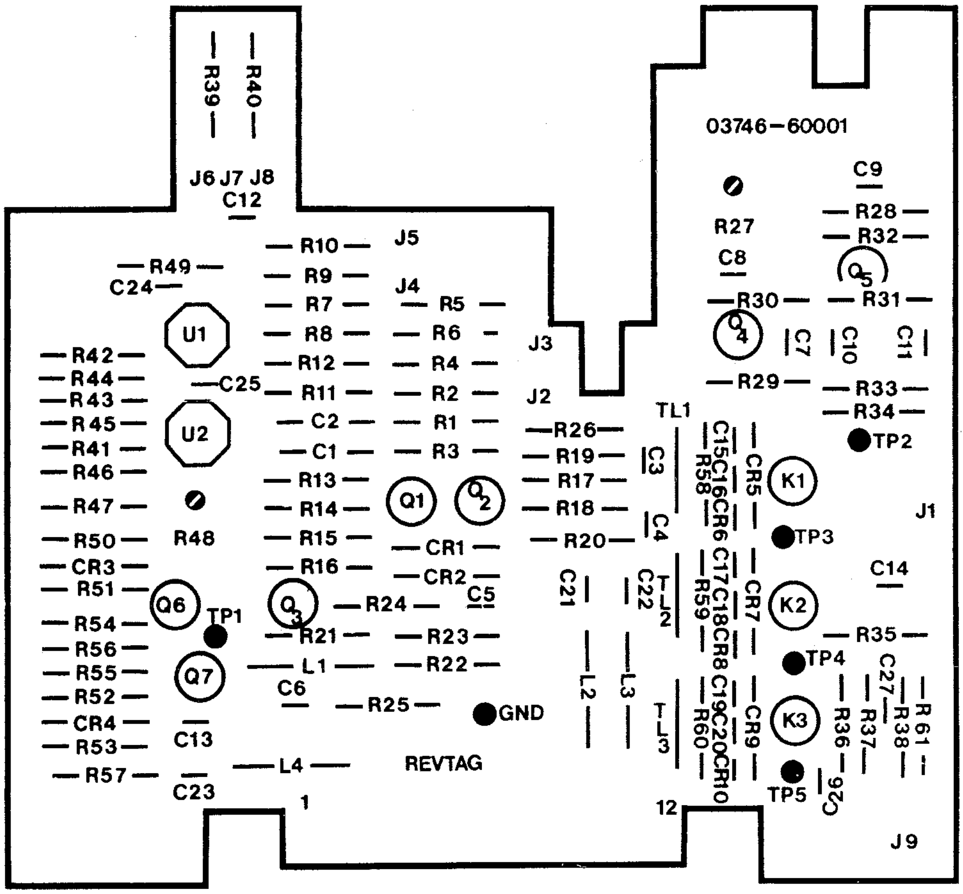
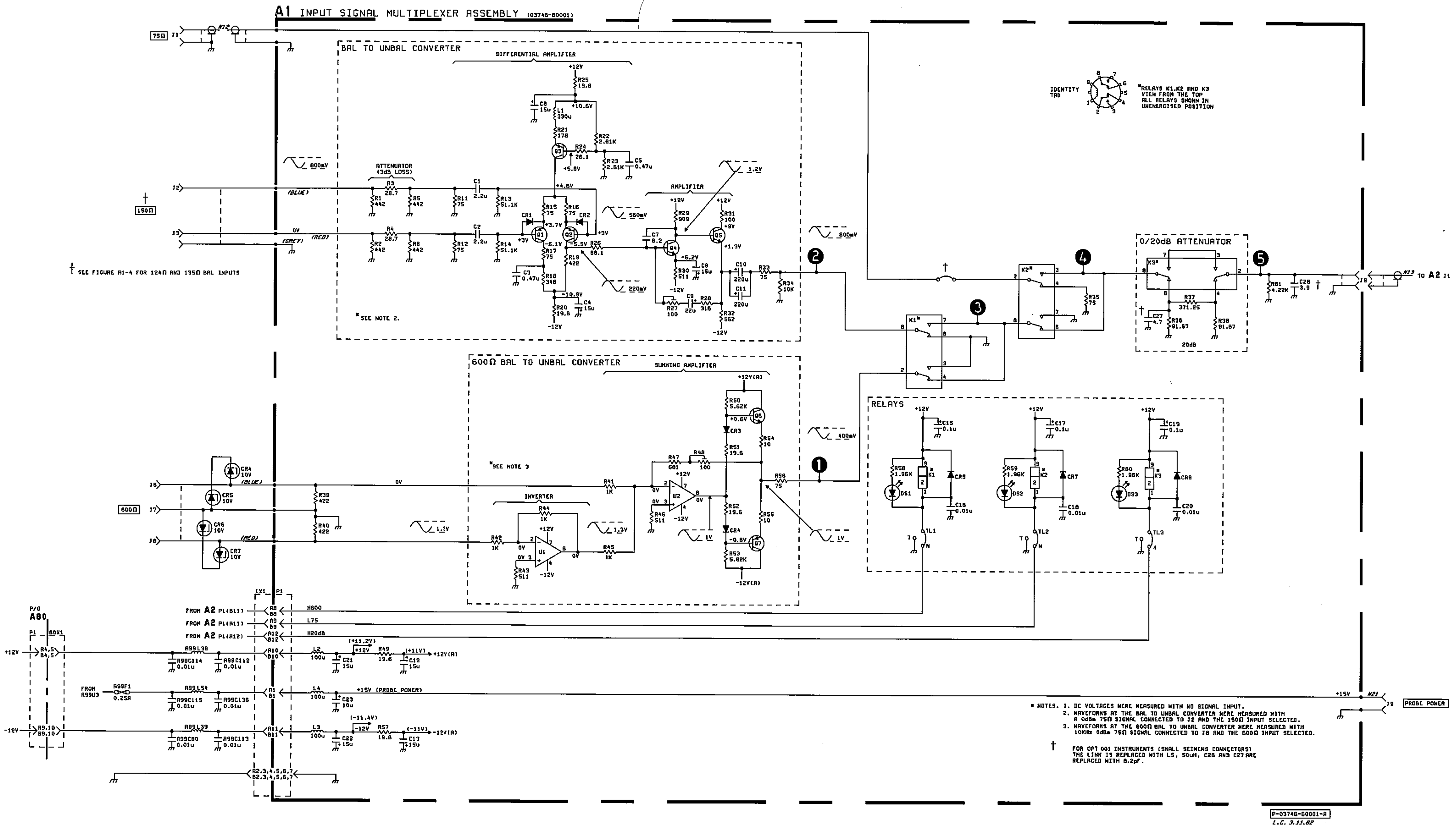


Figure A1-2 A1 Component Location
(for instruments below Serial Number 00412)



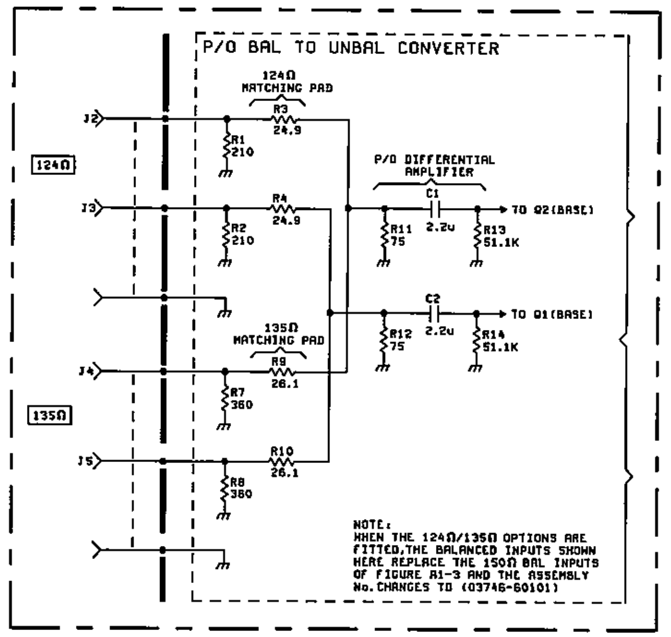


FIGURE A1-4 INDICATES 124Ω /135Ω OPTIONAL CONNECTORS (OPTION 005)

Figure A1-3 A1 Schematic Diagram (for instruments below Serial Number 00412)

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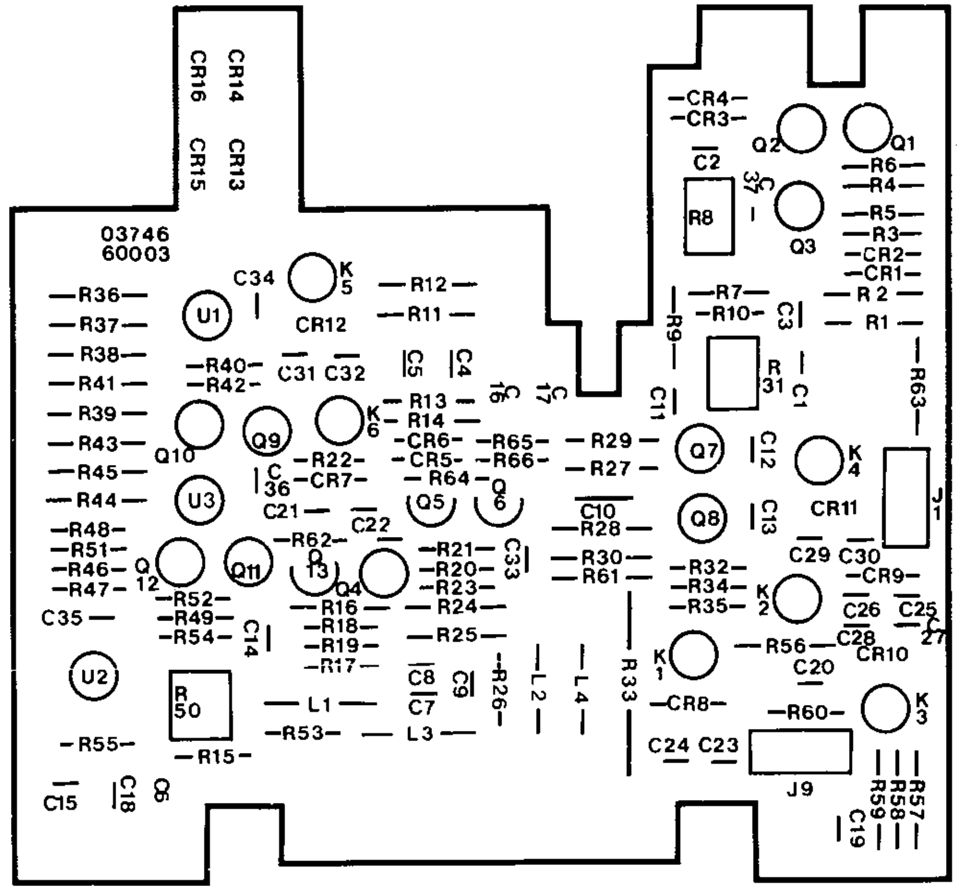

Figure A1-4 A1 Component Location
(for instruments above Serial Number 00411)

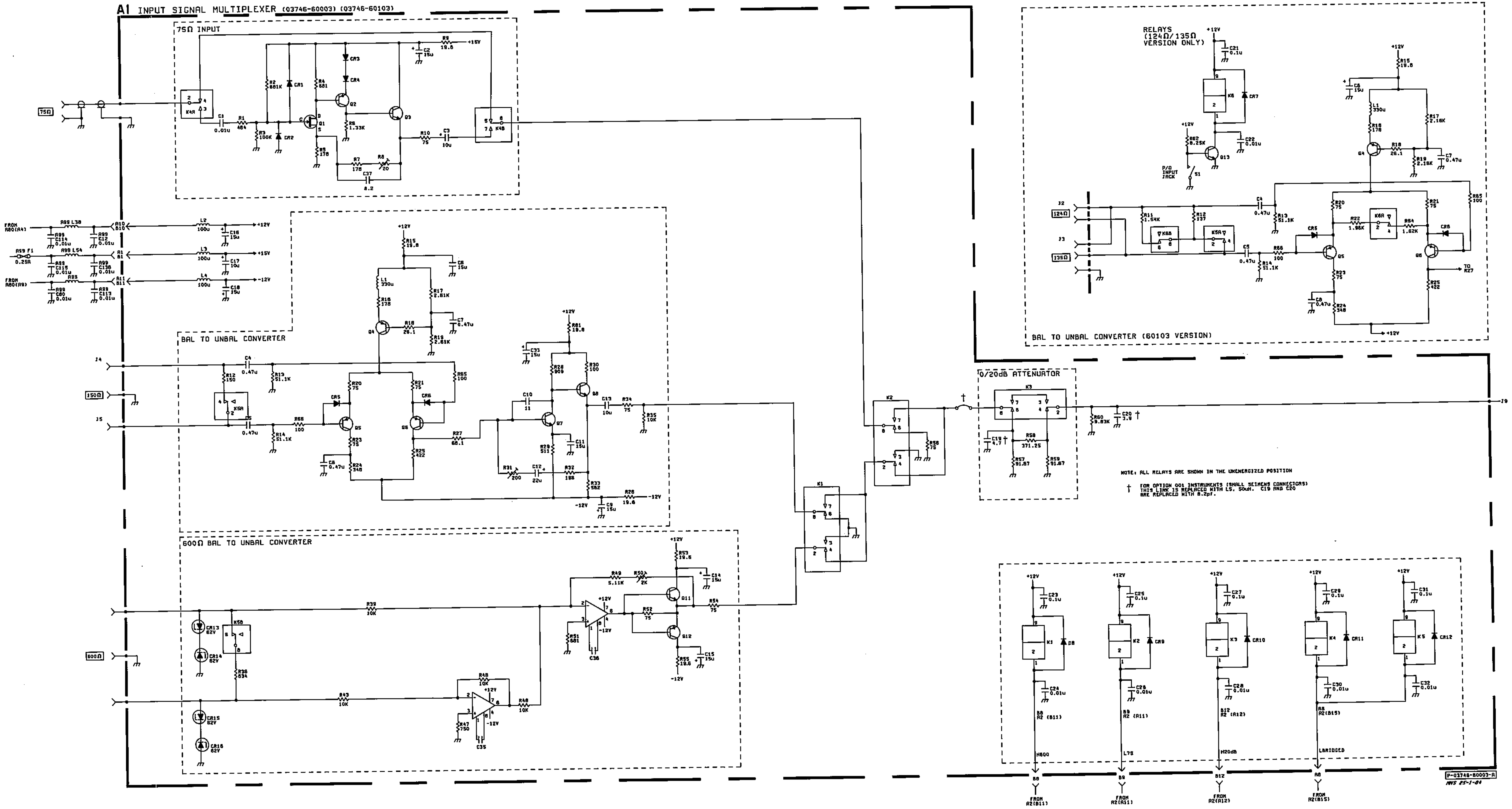

Figure A1-5 A1 Schematic Diagram (for instruments above Serial Number 00411)

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ASSEMBLY SERVICE SHEET A2
INPUT ATTENUATOR AND AMPLIFIER

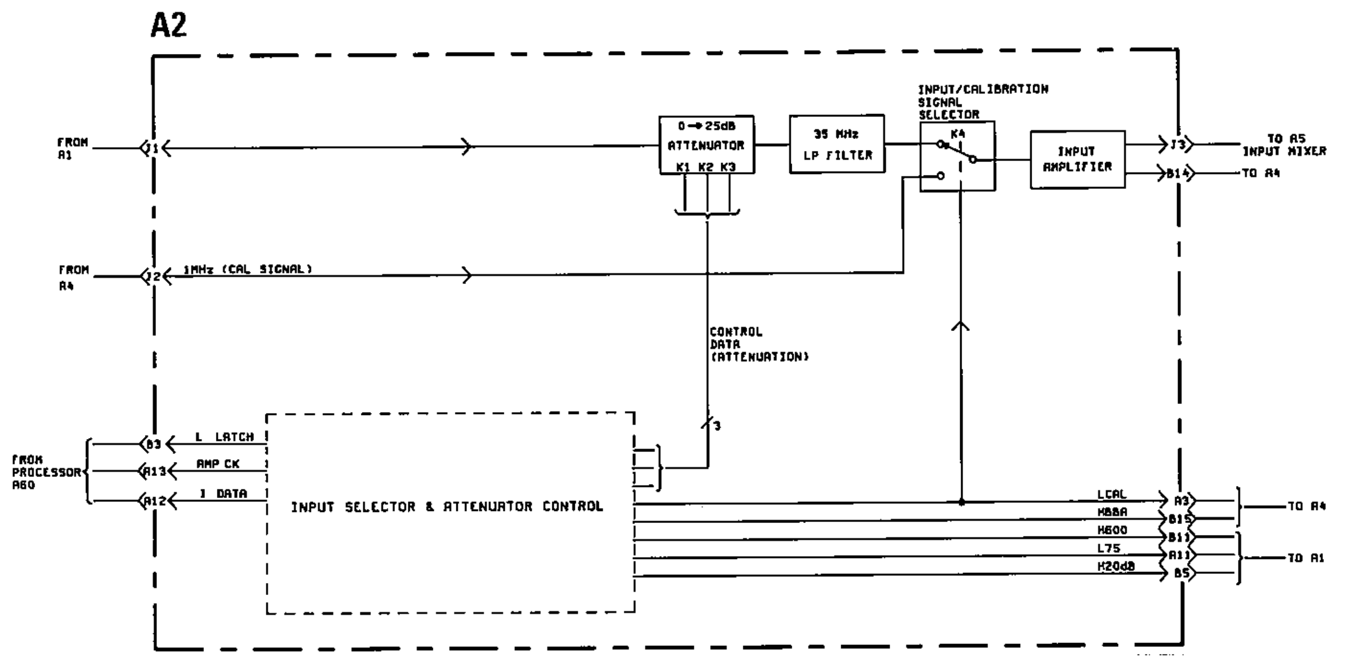


Figure A2-1 A2 Block Diagram

A2-1 INTRODUCTION

A2-2 This assembly contains a 0-25dB Attenuator, a 35MHz Low-Pass Filter, a wideband 12dB Amplifier, and an Input Selector and Attenuator Control circuit which acts an interface between the receiver and the processor.

A2-3 CIRCUIT DESCRIPTION

A2-4 Input Selector and Attenuator Control

A2-5 This circuit consists primarily of a serial-to-parallel converter U1 and U2. Serial control data from the processor (I DATA) is converted to a parallel format by shift register U1 and latched at U2 to provide control data to select:

a. The 75, 150, or 600 ohm INPUT to the A1 Assembly, by means of the H600 or L75 line.

b. A 1MHz CAL signal, by means of the control signal at U2 pin 19.

c. The amount of attenuation by means of the control signals at U2 pins 9, 6, 5 and H 20dB.

A2-6 0-25dB Attenuator

A2-7 Three "pi" Attenuators (10dB, 10dB and 5dB) are switched in 5dB steps in and out of the signal path by relays K1 to K3. Relays K1 to K3 operate in response to control data at U2, established during the input autoranging sequence. (The autoranging sequence is described in Paragraph 8R-25).

A2-8 35MHz Low Pass Filter

A2-9 The purpose of this filter is to reject out-of-band signals. If there is no input attenuation in the previous stage, the filter defines the SLMS return loss. In conjunction with a filter on Assembly A5, it also defines the SLMS image response, providing 80dB of attenuation to signals at (the input frequency + 2 x 1st IF).

A2-10 Input/Calibration Signal Selection

A2-11 Relay K4 connects either the INPUT SIGNAL or the 1MHz CAL SIGNAL to the Input Amplifier.The relay switching is controlled by the signal at U2 pin 19. When U2 pin 19 is high, K4 is de-energised and the 1MHz CAL SIGNAL is applied to the Input Amplifier.

A2-12 Input Amplifier

A2-13 The Input Amplifier has a gain of 12dB. It is designed to have a slight lift in its overall response, as compensation for the roll off in response at the Input Mixer Assembly (A5). C21 is adjusted to set the gain at 32MHz, and R27 is adjusted to set the gain at 12MHz.

A2-14 TROUBLESHOOTING NOTES

1. A description of all the key sequences referred to in these notes will be found in Appendix B.

2. During normal operation the 0-25dB Attenuator is under control of the input autorange loop. The final setting of this attenuator is determined by the input signal level. For signal levels below -25dB, no attenuation is required.

3. Waveforms were measured with the Cal signal permanently energised, achieved by the front panel key sequence TR, 2, 9. With the SLMS in this mode, the input attenuator should be in the zero attenuation state. This can be verified by checking that the A2 LEDS, DS1, DS2, and DS3 are all OFF. If any of these LEDS are ON, press TR, 2, 1, and then press the + key to set the attenuator to the minimum attenuation state (r.F. Attn.= 09).

4. To check each attenuator stage in turn. Switch the POWER switch to STBY, then ON again, then press MEAS. Disconnect the cable at A2J1 and connect the cable from A4J1 to A2J1 (this cable carries the Cal signal). Set the A4 Cal switch to TEST then press TR, 2, 3, the display should now read the A/D Converter Output.

Set TL3 to the TEST position. The A/D reading should change by 500 ±20. Reset TL3 to the NORMAL position.

Set TL2 to the TEST position. The A/D reading should change by 1000 ±20. Reset TL2 to the NORMAL position.

Set TL1 to the TEST position. The A/D reading should change by 1000 ± 20. Reset TL1 to the NORMAL position.

Reconnect A4J1 to A2J2, and A1J9 to A2J1. Reset the A4 Cal switch to NORMAL.

5. A good indication that the Serial to Parallel Converter is working correctly can be obtained by pressing TR, 2, 1. The attenuation values can then be changed by pressing the + or - keys. The total input attenuation should change from 45dB (r.f. Attn.= 00) to 0dB (r.f. Attn.= 09).

The L75 line is low when the 75ohm key is pressed. The H600 line is high when the 600ohm key is pressed.

6. Note that there is 25dB of attenuation on the A2 Assembly, LEDs A2DS1, A2DS2, and A2DS3 (in various combinations) are ON when attenuation is inserted. There is 20dB of attenuation on the A1 Assembly, the A1 20dB LED is OFF when the 20dB Attenuator is ON. In the test mode (TR, 2, 1) the logic levels at the U1 outputs should be the same as the logic levels latched at the U2 outputs.

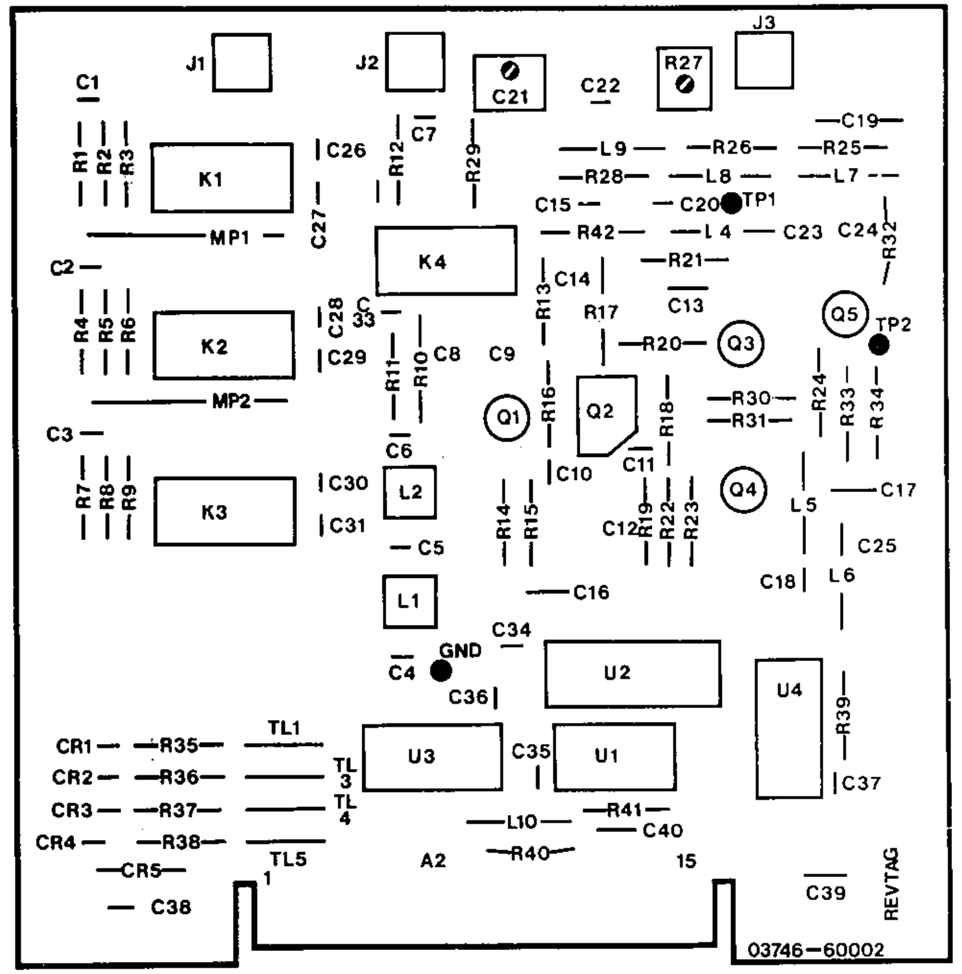


Figure A2-2 A2 Component Location

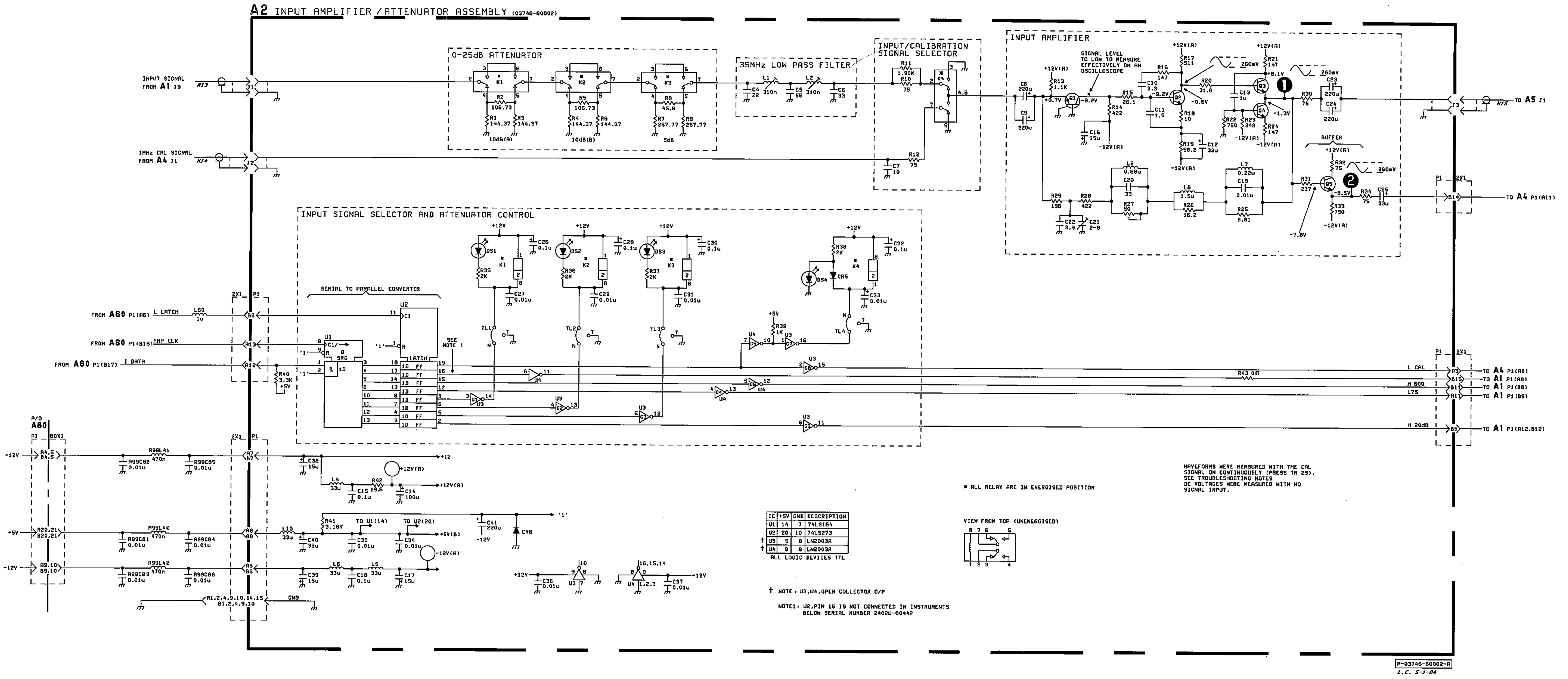


Figure A2-3 A2 Schematic Diagram

8-41
8-42

ASSEMBLY SERVICE SHEET A4
CALIBRATOR AND BROADBAND POWER DETECTOR

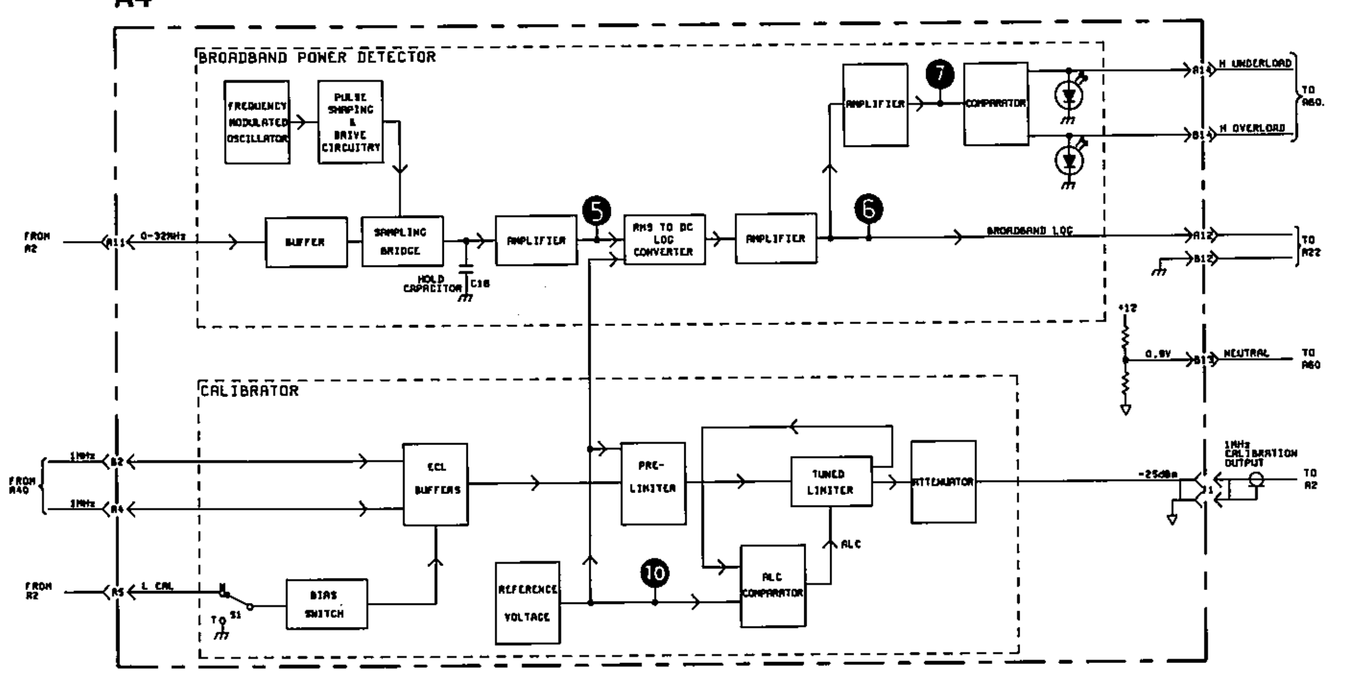


Figure A4-1 A4 Block Diagram

A4-1 INTRODUCTION

A4-2 This assembly provides an accurate -25dBm calibration signal, and detects broadband input power.

A4-3 At ten minute intervals, or whenever the AVEraging mode is changed, or a different input FILTER is selected, the processor initiates a calibration of the measuring circuits. The calibration signal used is a 1MHz reference signal from the synthesizer, precisely adjusted on this assembly to be -25dBm.

A4-4 The broadband input power is detected by a sampling circuit and a rms-to-dc log converter.

A4-5 A comparator on the output of the Broadband Power Detector senses the level and signals the processor when a change in attenuation is required. If a change is required, the processor initiates the autoranging sequence.

A4-6 CALIBRATOR CIRCUIT DESCRIPTION

A4-7 Bias Switch

A4-8 During calibration cycles, the Bias Switch (Q7) is switched off by (low) L CAL, the positive reference voltage V_{BB} then at U7(11) produces a dc offset at the T2 secondary centre tap. This shifts the square wave on the secondary of T2 to within the ECL switching limits of U7. It also, via R91, raises the voltage at the emitters of Q8 and Q9 switching the Pre-Limiter on. DS3 will be on.

A4-9 During measurement cycles, when the calibrator is not required, Q7 is on, and V_{BB} is connected to ground via R62/Q7. This removes the dc offset at the T2 centre tap. The square wave then switches about 0V which is outwith the ECL switching limits of U7. The Q8/Q9 emitters are grounded via R91/Q7, switching the Pre-Limiter off. DS3 will be off.

A4-10 Pre-Limiter

A4-11 This circuit limits the square-wave applied to the Tuned Limiter to be between 0 and +1V.

A4-12 Tuned Limiter, ALC Comp, Ref Voltage

A4-13 The square-wave at the input to the Tuned Limiter is converted to a sine-wave by the resonant circuit L7, R81, and C32 on the collectors of Q11 and Q12.

A4-14 The Comparator U8B provides automatic level control (ALC) of the limiter, by sensing the collector current through R79 and adjusting the current through Q13 to compensate.

A4-15 A Reference Voltage for the ALC Comparator is provided by U8A and zener diode CR19. CR19 is temperature stable and so the ALC Comparator holds the Calibration Signal level over a wide temperature range.

A4-16 Attenuator

A4-17 The output of the Tuned Limiter is attenuated by R82/R83 to provide a -25dBm signal at J1.

A4-18 BROADBAND POWER DETECTOR CIRCUIT DESCRIPTION

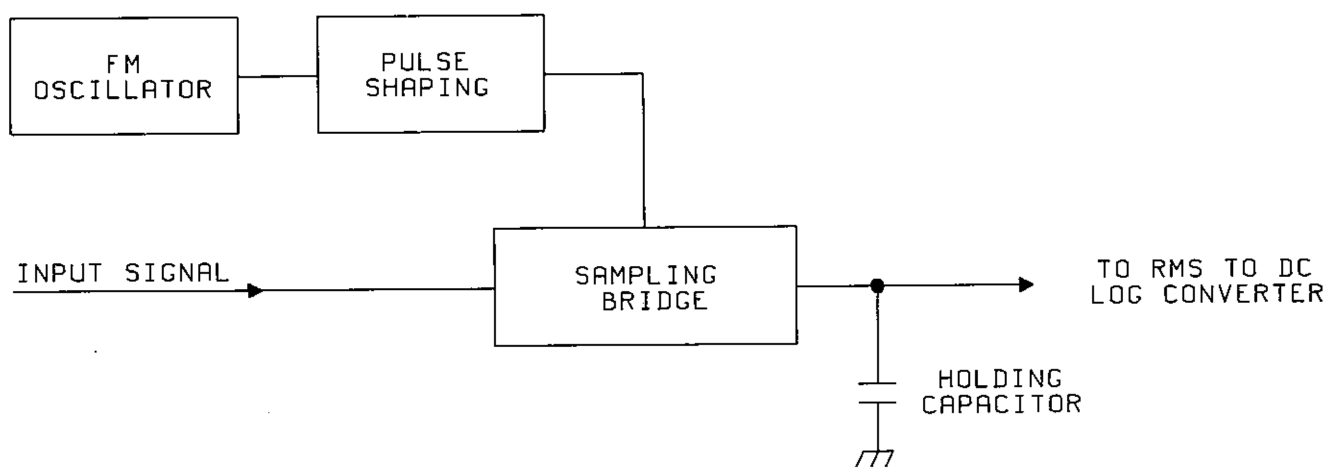


Figure A4-2 Simplified Broadband Power Detector

A4-19 A simplified diagram of the Broadband Power Detector is shown in Figure A4-2. The sampling signal is frequency modulated, so that the input signal is sampled at different points on the waveform, ensuring a true representation of the input signal on the holding capacitor C18.

A4-20 Frequency Modulated Oscillator

A4-21 The low frequency oscillator U1A generates an 80Hz square-wave. This signal is integrated by Q1 and the resulting sawtooth waveform modulates the 50kHz square-wave generator U1B.

A4-22 Pulse Shaping and Drive Circuitry

A4-23 The delay line formed by L1, L2 and C7 delays the input pulse at U2(9) with respect to the pulse at U2(11). The resulting output from U2 is a narrow pulse, the width of which is equal to the delay time of the delay line. Figure A4-3 shows the relationship between unmodulated input and output pulses (TL1 removed). During normal operation, when TL1 is in circuit, the narrow pulses applied to drivers Q1 and Q2 are frequency modulated.

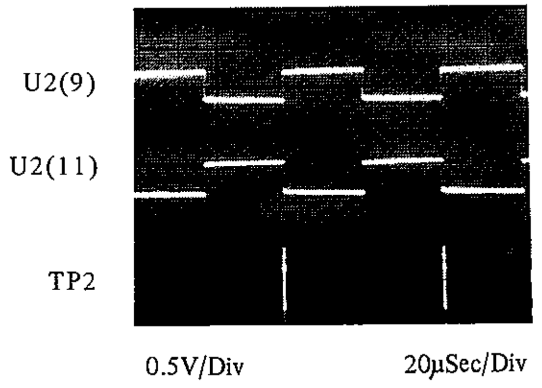


Figure A4-3 Generation of Narrow Pulses

A4-24 Buffer, Sampling Bridge, Hold Capacitor

A4-25 Emitter follower Q5 provides a low impedance drive to the Sampling Bridge. R90 and C41 are adjusted to optimise the INPUT POWER response at 21kHz and 31MHz respectively.

A4-26 Sampling Bridge CR3 through CR6 is switched by Q2 and Q3 to sample the signal level at TP4 and charge the Holding Capacitor C18. CR3 and CR5 are switched by negative pulses, CR4 and CR6 by positive pulses. CR7 and CR8, after ac coupling by C16 and C17, restore the dc levels of the negative and positive pulses.CR1 and CR2 limit the input signal and prevent any transient spikes forward biasing the sampling bridge.

A4-27 Amplifier and RMS to DC Log Converter

A4-28 The dc levels stored by C18 are amplified by a high gain amplifier U3, and coupled to the RMS to DC Log Converter U4 via C19. The output of U4 is a dc voltage proportional to the log of the input power at TP5. By adding an offset to the detected dc, R36 adjusts the threshold limits of the comparator U6A/U6B.

A4-29 The detected dc output of U4 is amplified by U5A. A thermistor R40 compensates for U4 output level variations due to temperature. CR9 defines the dc offset at U5A and compensates for offset voltage variations due to temperature. CR10 prevents the input to U5 becoming reverse biased, and R39 is adjusted to set the gain of the Broadband Power Detector.

A4-30 Comparator

A4-31 The threshold limits of U6A and U6B are set at 6.1V and 4.5V by resistor chain R50, R51, R52. When the Broadband Power Detector output is above 6.1V, H UNDERLOAD is set high, and when below 4.5V, H OVERLOAD is set high.

A4-32 During measurements, the processor monitors H OVERLOAD and H UNDERLOAD determines whether a change in input attenuation is required. If either line goes high, a change is required and the processor activates the autoranging sequence to establish the amount of attenuation required (on Assemblies A1 and A2). The autoranging sequence is described in Paragraph 8R-25.

A4-33 TROUBLESHOOTING NOTES

1. A description of all the key sequences referred to in these notes will be found in Appendix B.

2. Voltages and waveforms are shown on the schematic diagram to assist in troubleshooting.

3. Calibration test modes can be forced in several ways:

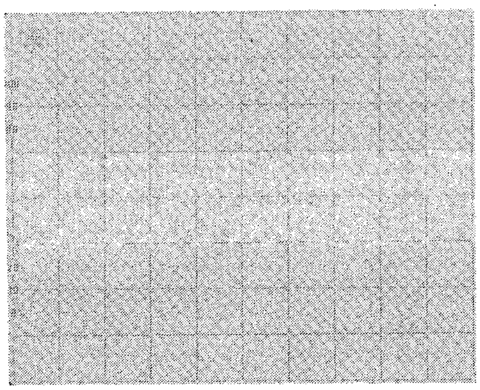
(a) Pressing TR 29 forces the calibration signal to be on continuously and in a good instrument a level of 25dBm ± 2dB is displayed in the level window.

(b) Setting the A4 TEST/NORM switch to TEST enables the CALIBRATION circuits on the A4 assembly. In this mode of operation the calibration signal is routed from the A4 assembly to A2 assembly where it is blocked because the calibration selector relay is in the normal signal path.

(c) Setting the A4 TEST/NORM switch to Test as in Step (b) and connecting A4J1 to A2J1. This routes the calibration signal through the receiver (excluding the A1 assembly). Alternatively instead of connecting A4J1 to A2J1, a test link A2TL4 can be connected to the test position forcing the calibration selector relay to the test position.

4. The photograph below shows a typical input to the RMS to DC LOG CONVERTER when the SLMS is in the test mode with the calibration signal permanently on (press TR, 2, 9).

TP 5



5V/div 0.5ms/div

An alternative method of checking the input circuitry, including the sampling circuit is as follows:

(a) Connect a suitable signal generator (frequency stability not important), with the frequency set 100Hz ± 20Hz and the level set to -30dBm ± 2dB, to the SLMS 75ohm INPUT.

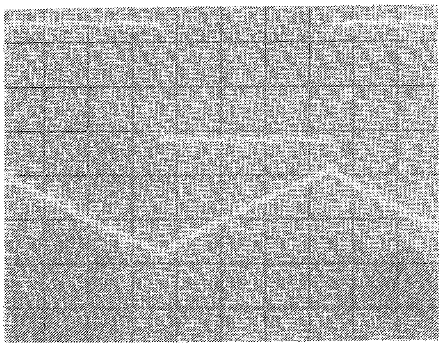
(b) Monitor A4TP5 with an oscilloscope and check a sinewave is displayed. If necessary reduce the frequency of the signal generator. (The level of the sinewave is 5V pk-pk ± 1V for a -30dBm input).

(c) Increase the signal generator frequency and not the waveform starts to break up, until a point is reached when a dot pattern is displayed. (see waveform for TP5).

5. The FREQUENCY MODULATED OSCILLATOR can be readily checked by monitoring the outputs of U1A and U1B with an oscilloscope. U1A output is a TTL squarewave at 70Hz ± 16Hz, U1B output level is reduced to typically 3V at 13kHz ± 3kHz.

U1A(3)

Q1(col)



2V/div 2ms/div

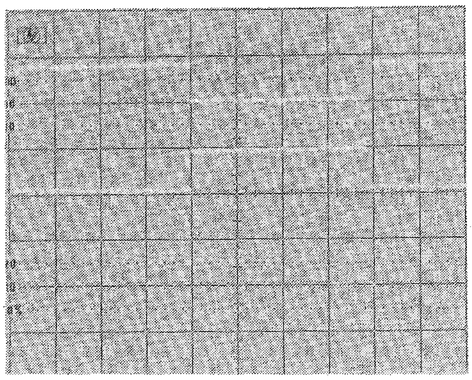
6. The Pulse Shaping and Drive Circuitry should be checked with TL1 removed.

(a)

U2(9)

U2(11)

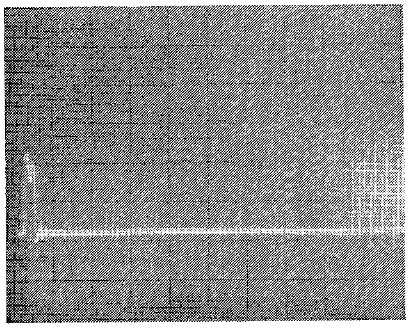
TP 2



0.5V/div 10us/div

(b)

TP2

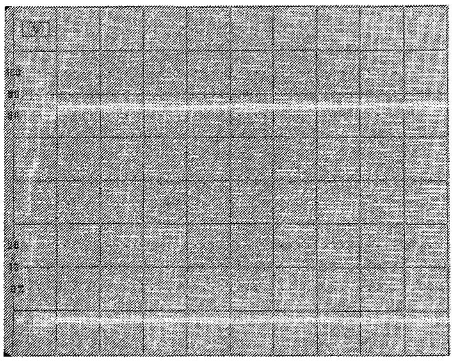


0.5V/div 0.1us/div

(c)

TP 3

TP 2



0.5V/div 0.1us/div

7. The RMS to DC LOG CONVERTER and AMPLIFIER can be checked by monitoring TP6. The voltage at TP6 should change by 100mV per 1dB change in attenuation. The voltage at the output of U4 pin 6 should change by 3mV per dB. These changes can be readily checked using the calibration test switch on A4 and ranging the input attenuator as follows.

(a) Tune the SLMS input frequency to 1000kHz and press the MEAS key to force a calibration cycle. If the SLMS is faulty an error code will appear in the Test Point window and the SLMS may go into the HALT mode. PRESS THE MEAS key to ensure the SLMS goes into the MEAS mode.

(b) Disconnect the cables from A1 at A2J1 and A2J2. Connect A4J1 to A2J1 (this routes calibration signal from A4 to A2 via the 0-25dB attenuator on A2 assembly).

(c) Set the test switch A4S1 to TEST. This switches on the 1MHz -25dB calibration signal.

(d) Press keys TR, 2, 1. The SLMS should now indicate rf ATTEN =09.

(e) Press the ↓ key to insert 5dB of attenuation, indicated by the number in the LEVEL window changing to 08 and check the change in level at TP6 and U4 pin 6. This should be 500mV per 5dB step at TP6 and 15mV per 5dB step at U4 pin 6.

NOTE: If the ↓ key is repeatedly pressed, or held on continuously, RF attenuation is first inserted on the A2 assembly until a point is reached when the Attenuation level is increased to 30dB. At this point 20dB of attenuation is inserted in the A1 assembly and the A2 assembly attenuation reduces to 10dB. Subsequent ↓ key presses will cause a further increase in attenuation on the A2 assembly. WHEN CHECKING THE A4 ASSEMBLY, THE ATTENUATOR SHOULD ONLY BE CHANGED FROM STATE 09 TO 06 TO AVOID ERRONEOUS READINGS AT TP6.

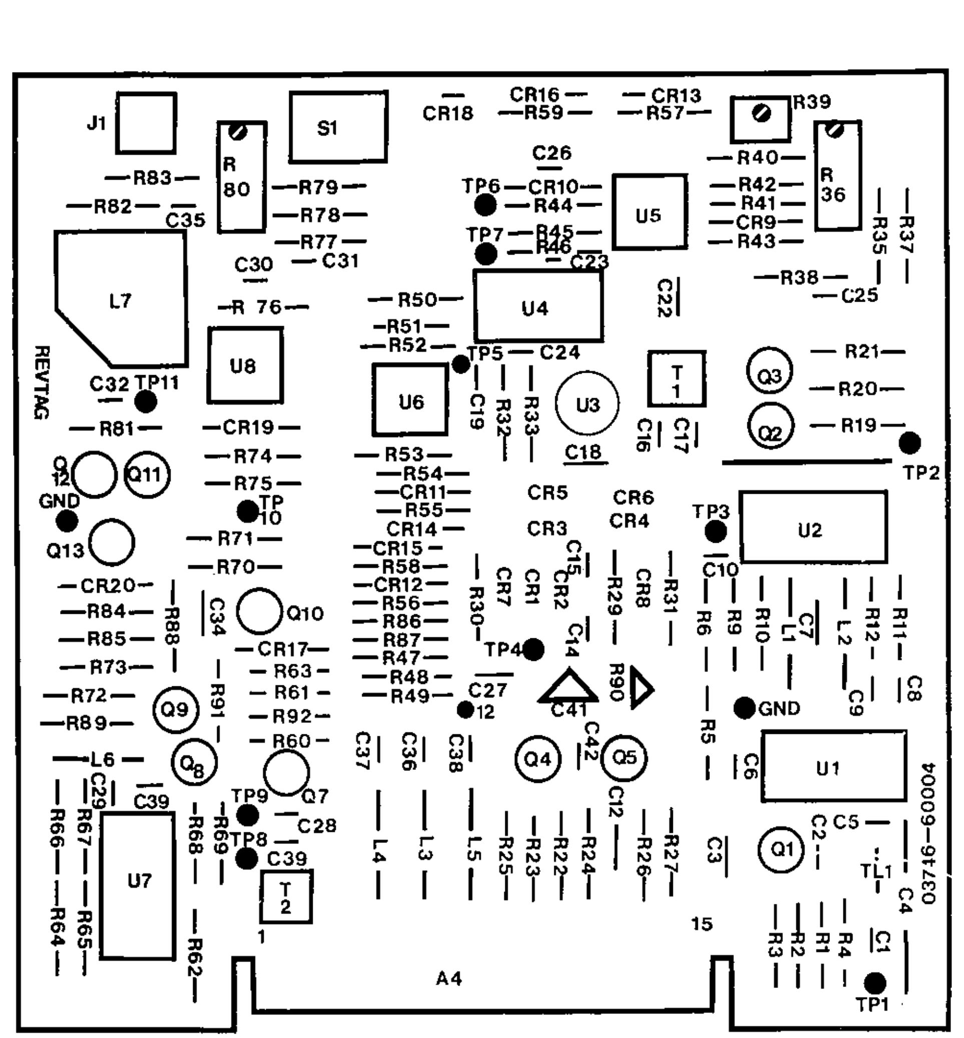


Figure A4-4 A4 Component Location

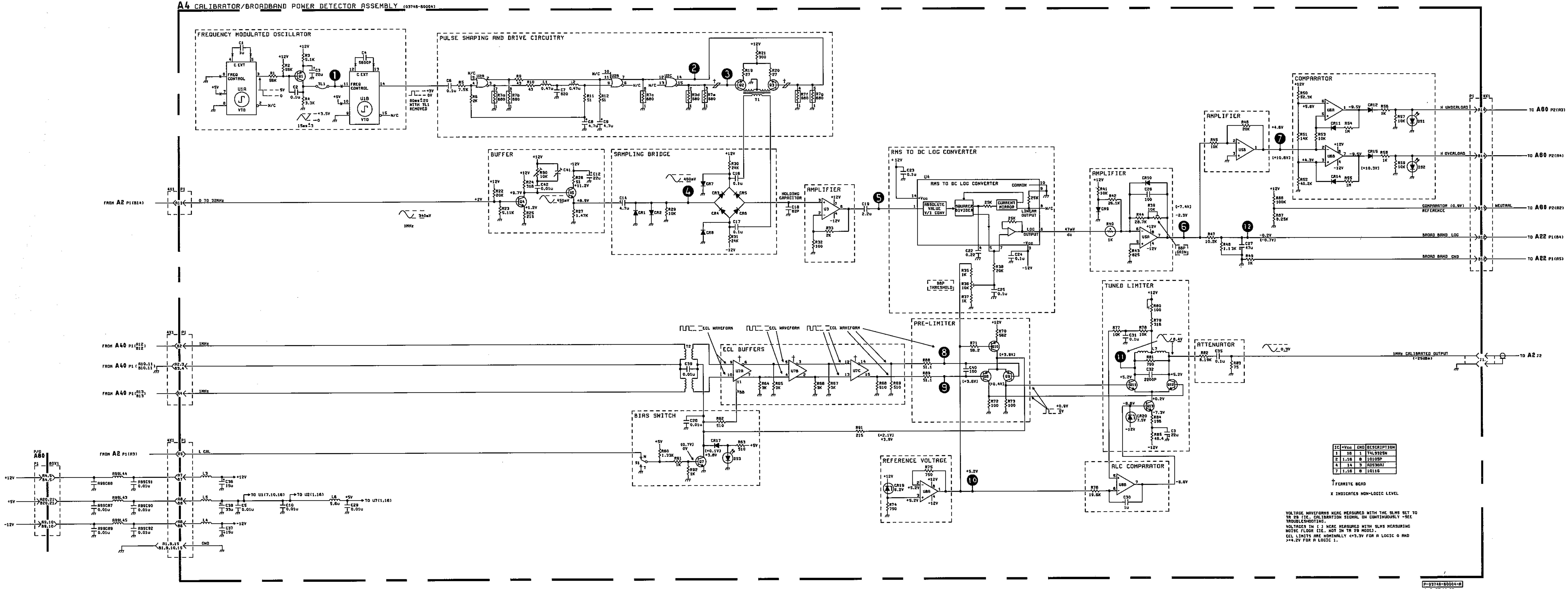


Figure A4-5 A4 Schematic Diagram

8-45
8-46

ASSEMBLY SERVICE SHEET A5
INPUT MIXER

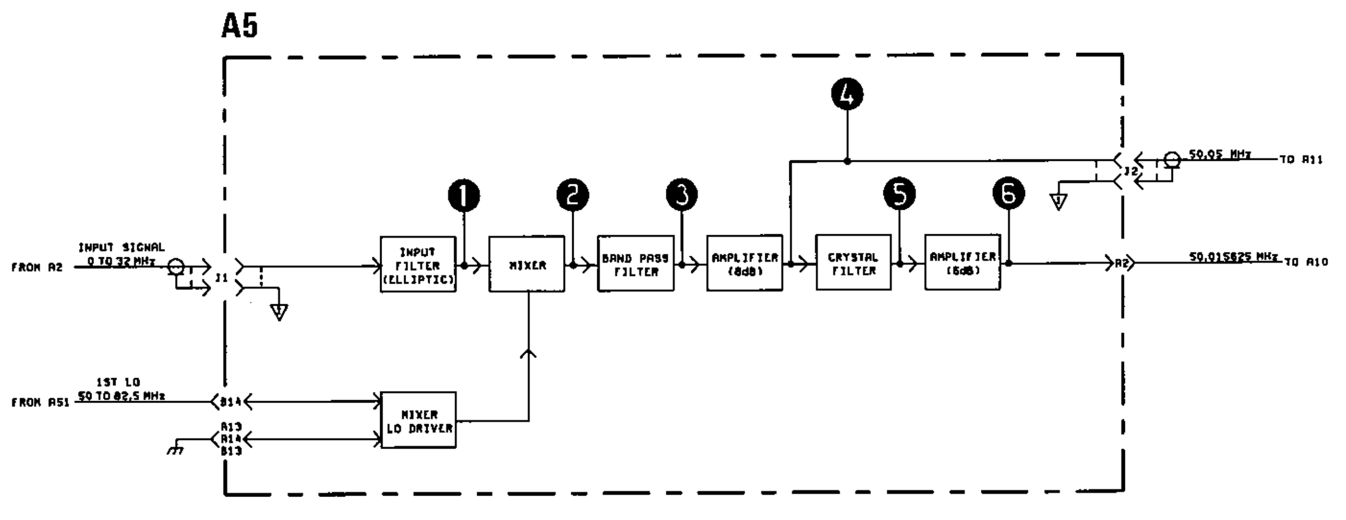


Figure A5-1 A5 Block Diagram

A5-1 INTRODUCTION

A5-2 Assembly A5 is the first mixer stage in the receiver section of the SLMS. In the 38Hz and 3.1kHz FILTER modes, input signals in the range 0 to 32MHz are mixed with a tuneable Local Oscillator (LO) signal (50MHz to 82MHz) to produce an IF signal of 50.015625MHz. When the SLMS is in the 48kHz FILTER mode, the local Oscillator tunes to give an IF signal of 50.05MHz.

A5-3 CIRCUIT DESCRIPTION

A5-4 Input Filter

A5-5 The input filter response rolls off above 35MHz and is 55dB down at 50MHz. Three notches, at 50MHz, 57MHz and 98MHz, are set by L3, L2 and L1 respectively, to produce the required filter reponse and ensure good image and IF rejection.

A5-6 Mixer LO Drive

A5-7 The LO signal from A51 is applied to limiter U1(A) and U1(B). U1(C) and U1(D) provide the drive to switch the mixer.

A5-8 Mixer

A5-9 The mixer is a double-balanced ring type. The voltage drop developed across resistors R2/R3 and R1/R4 improves the reverse bias on the mixer diodes, permitting a large LO drive level. Capacitors C8 through C11 improve the mixer balance and minimise mixer spurious. C8 and C11 are adjusted to give the best overall instrument noise floor. The transformer T2 converts the balanced signal to an unbalanced one.

A5-10 Bandpasss Filter (constant impedance)

A5-11 The Bandpass Filter is tuned to 50MHz by a series LC circuit C13/L5, and a parallel circuit C12/L4. At resonance, the series circuit offers minimum impedance and the parallel circuit a high impedance. At frequencies off-resonance, the impedance of the series LC circuit increases and that of the parallel circuit decreases such that the circuit presents a constant impedance of 50 ohm. L4 tunes the circuit to 50MHz and C13 is adjusted in conjunction with C14 and R8 for the best return loss at 50MHz.

A5-12 Amplifier (8dB)

A5-13 This amplifier, tuned to 50MHz by C14/L7, has an 8dB gain to compensate for the mixer conversion losses. Transformer T3 performs three functions, it defines the amplifier active input impedance, improves the noise figure and in conjunction with R6, R7 and R8 sets the gain. Transistors Q2 and Q3 provide a high current drive to both Assembly A11 (group power measurements) and to the Crystal Filter during channel measurements.

A5-14 Crystal Filter

A5-15 The matched crystals Y1 and Y2 are tuned by L9/C25 and L10/C26 on either side of the 1st IF of 50.015625MHz. When the signal is at the resonant frequency of Y1, all the current flows in the Y1 arm, and none in the Y2 arm. Similarly when the signal is at the resonant frequency of the Y2 arm no current flows in the Y1 arm. At a frequency above and below the Y1 and Y2 resonant frequencies the impedance of both arms will be the same, and equal currents will flow in each arm. These currents are in-phase and so cancel at T4 producing in a sharp notch which is 10kHz wide. R19 and C27 are adjusted in conjunction with C25 and C26 to define the overall response.

A5-16 Amplifier (6dB)

A5-17 This amplifier is tuned to 50MHz by L12. It has a 6dB gain determined by T4 with R20, R21 and R22. T4 also defines the active input impedance and the noise figure of the amplifier.

A5-18 TROUBLESHOOTING NOTES

1. Voltages and waveforms are shown on the schematic diagram.

2. Test links TL1 and TL2, in conjunction with Test Jack TP2 allow the Mixer and Amplifier sections to be checked separately.

3. The Amplifier section is checked using the output at A51J2, which is at the same frequency as the synthesizer output. It is necessary to tune this output to a frequency within the passband of the Crystal Filter Y1/Y2. The following steps outline the procedure:

a. Tune the SLMS to 1kHz, with a step size of 1kHz, then press MEAS.

b. Remove TL1 to isolate the Mixer from the Amplifier.

c. Use the cable at A5J2 to connect A51J2 to A5TP2.

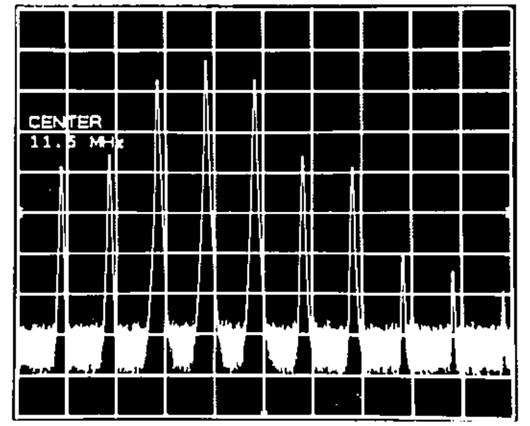
NOTE: The signal level at A51J2 will vary from instrument to instrument, and allowance should be made for input level variations.

4. The Crystal Filter action can be checked by pressing the ↑ key and monitoring TP6. The level should decrease rapidly after the frequency has changed by more than 5kHz.

5. The Mixer should be checked with a spectrum analyzer. It is impossible to verify mixer action with an oscilloscope. Remove TL2 and reconnect TL1. The following waveforms illustrate the mixer action.

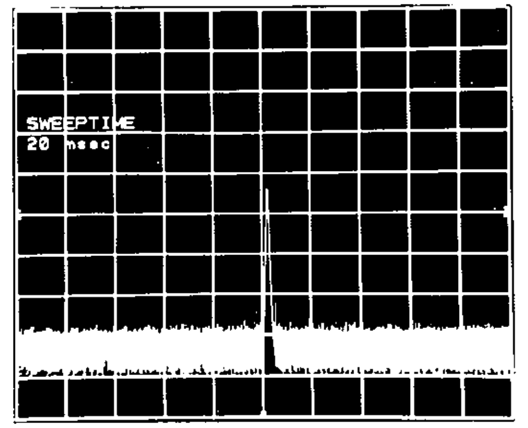
Waveform 1

10MHz Input at A2J3. In this case the 10Hz output from A16J1 was used. If the optional A16 Assembly is not fitted use a separate signal source (not the rear panel 10MHz output).



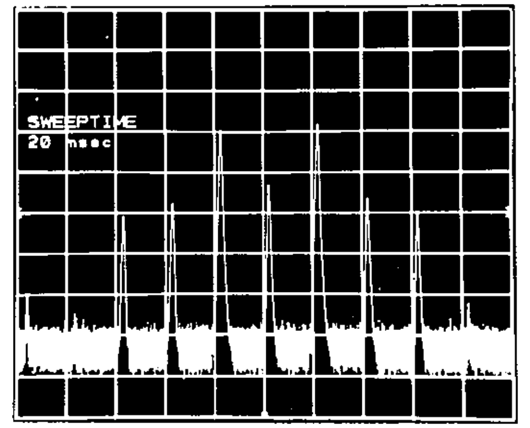
Waveform 2

Tune the SLMS to 1MHz. The 51MHz LO signal (51.015625MHz) measured at TP2 with A5J1 disconnected.



Waveform 3

With 10MHz present at A15J1, LO + upper and lower sidebands of 10MHz. Note that the 10MHz sidebands are 9dB down on the 10MHz level on waveform 1. This is the mixer conversion loss. Typically, if the mixer conversion loss is greater than 16dB there is a mixer fault or one of the drive levels to the mixer is faulty.



A4 Component Location
A4 Schematic Diagram

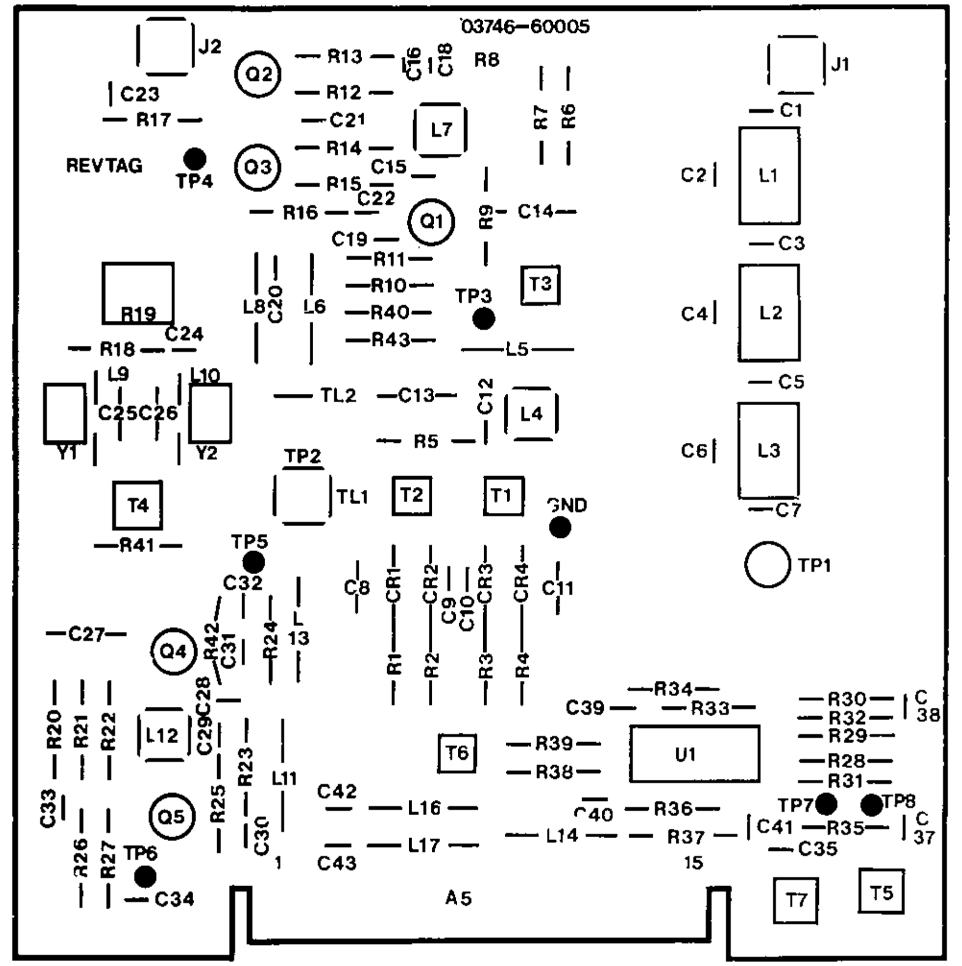


Figure A5-2 A5 Component Location

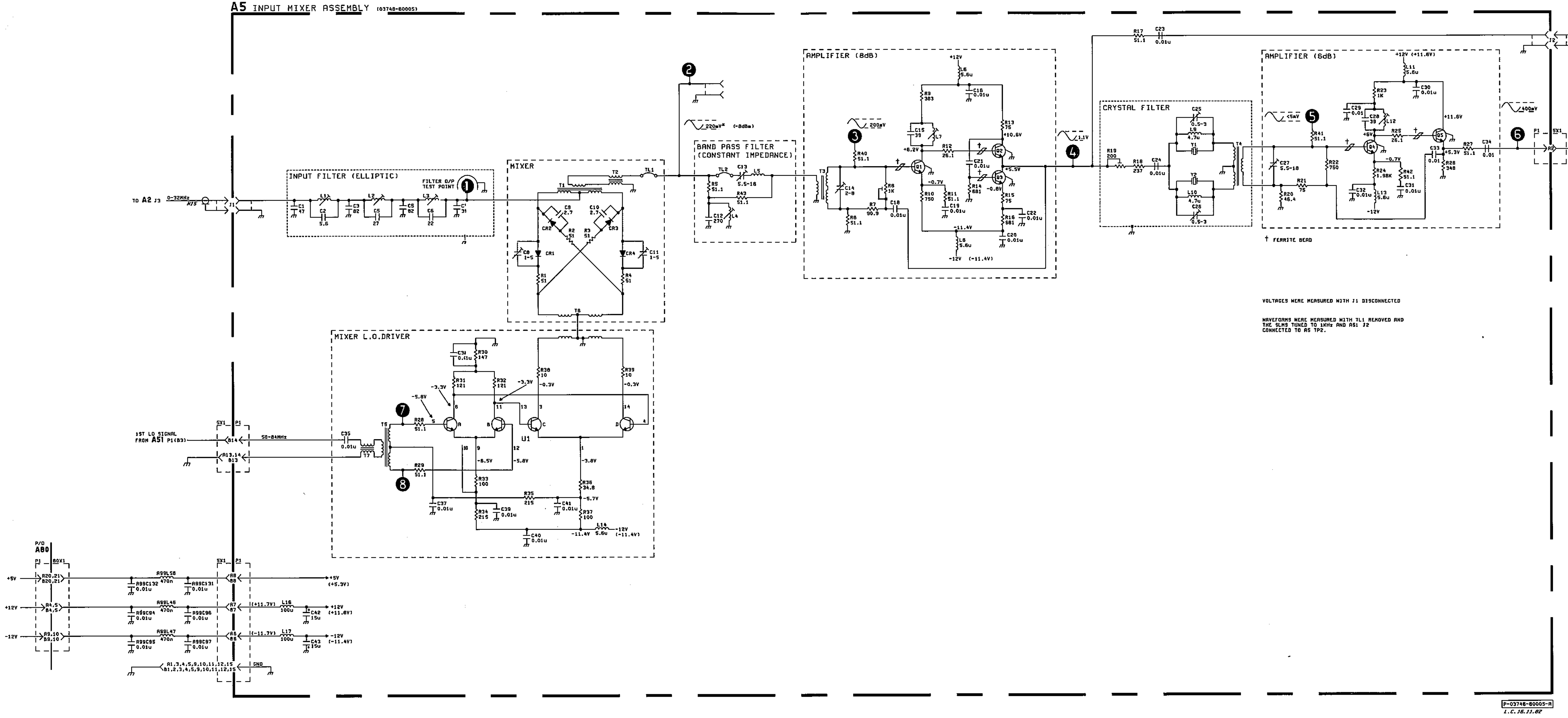


Figure A5-3 A5 Schematic Diagram

8-47
8-48

ASSEMBLY SERVICE SHEET A10
2nd MIXER

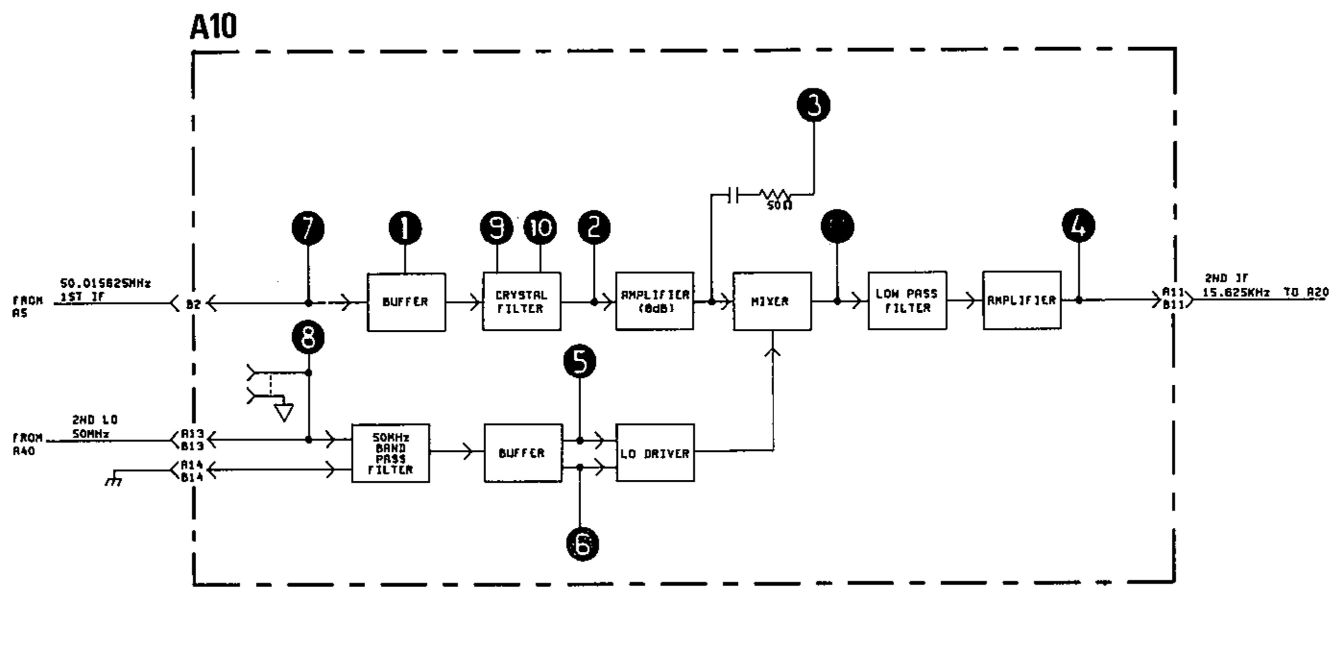


Figure A10-1 A10 Block Diagram

A10-1 INTRODUCTION

A10-2 Assembly A10 is the 2nd mixer stage in the receiver section. It produces a 2nd IF of 15.625kHz by mixing the 1st IF of 50.015625MHz with a 50MHz reference from Assembly A40 in the synthesizer section.

A10-3 CIRCUIT DESCRIPTION

A10-4 Buffer

A10-5 This amplifier, tuned by C5/L2, provides unity gain at 50MHz. The noise figure and return loss of the Buffer are defined by T1 and C2.

A10-6 Crystal Filter

A10-7 This filter tuned to 50.015625MHz. It has a 10kHz bandpass response shaped by R7/C9/C10. The response also contains two notches, positioned one either side of the bandpass range. These notches occur when the impedances of Y1 and Y2 are equal. Under such conditions, equal and in-phase currents are produced which cancel in T2 to produce the notch.

A10-8 Amplifier

A10-9 This amplifier, tuned to 50MHz by L7. It has a gain of 8dB, determined by T2 and R9/R10/R11. T2 and C11 define the active input impedance and the noise figure of the amplifier.

A10-10 Mixer

A10-11 The mixer is a double-balanced ring type. The input signal (50.015625MHz) is applied to T4 and the 50MHz LO signal is applied to T6. The LO signal alternately biases CR1/CR2 and CR3/CR4 on, which effectivly ac ground each end of T4 in turn. This switching process produces the mixed signal at T4.

A10-12 50MHz Bandpass Filter

A10-13 The 50MHz Bandpass Filter purifies the LO signal from Assembly A40.

A10-14 Buffer

A10-15 The three stage MECL amplifier U2 provides the differential drive to the LO Driver.

A10-16 LO Driver

A10-17 The differential signal from U2 is applied to a Limiter (U3A/U3B) prior to driving the Mixer via U3C/U3D. R44 adjusts the symmetry of the LO Driver output and also sets the mixer LO balance.

A10-18 Low-Pass Filter (constant resistance)

A10-19 This filter provides broadband matching at the output of the Mixer.

A10-20 Amplifier

A10-21 The output of the non-inverting amplifier is adjusted by R26 to set the level of the signal to within ±0.1V.

A10-22 TROUBLESHOOTING NOTES

1. Voltages and waveforms are shown on the schematic diagram.

2. Note that U2 may oscillate when TL1 is removed, this is not a fault condition.

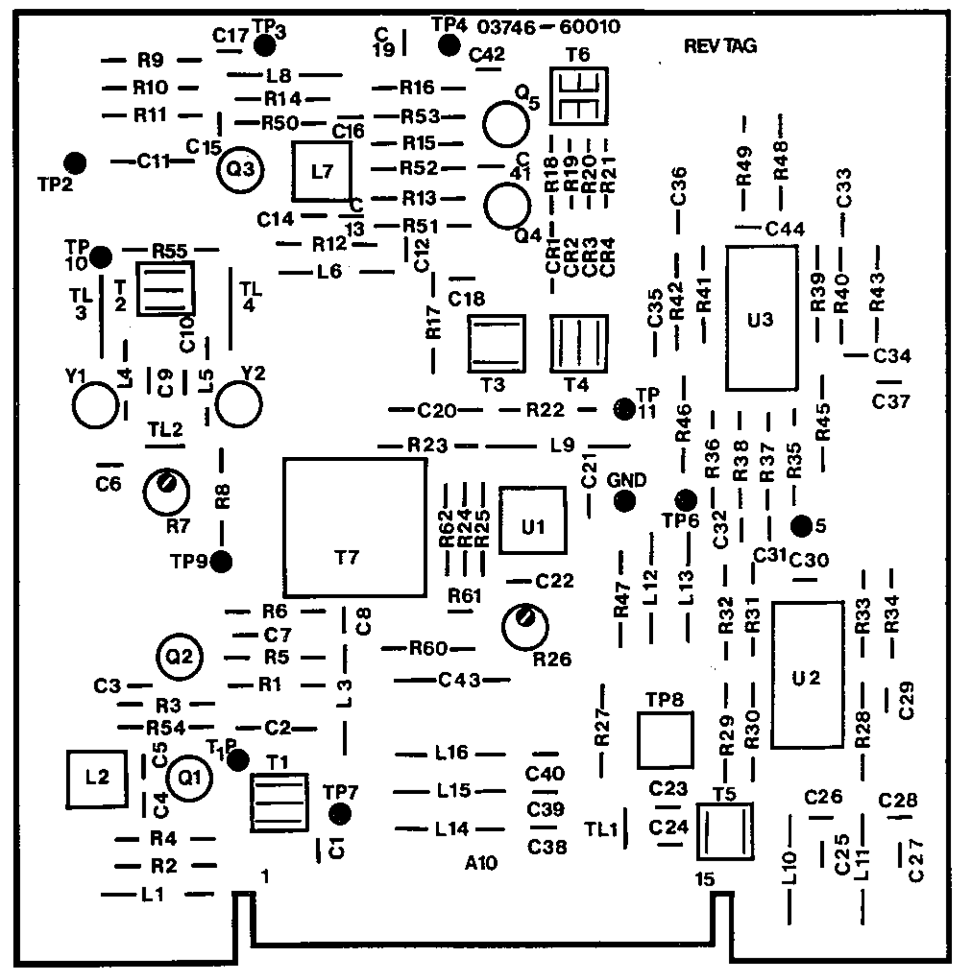


Figure A10-2 A10 Component Location

A5 Component Location
A5 Schematic Diagram

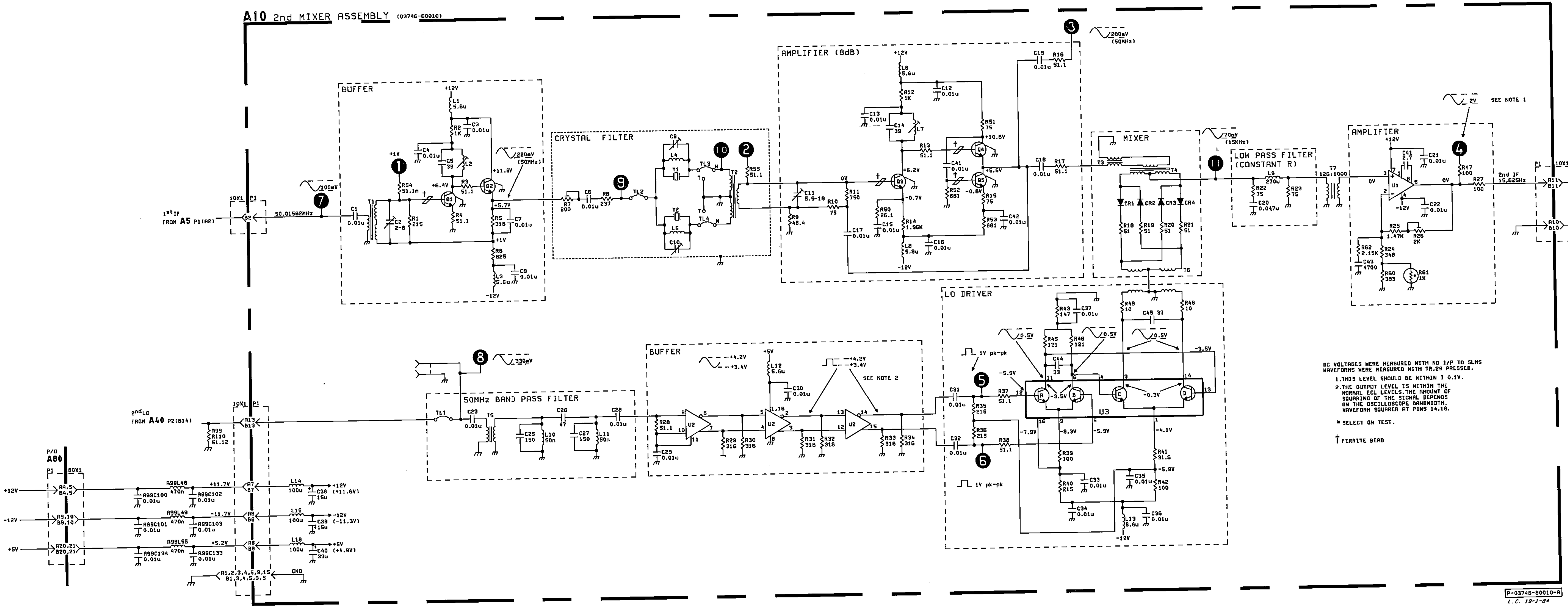


Figure A10-3 A10 Schematic Diagram

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8-50

ASSEMBLY SERVICE SHEET A11
GROUP POWER

A11-1 INTRODUCTION

A11-2 Figure A11-1 is the A11 Assembly Functional Block Diagram. The 50.05MHz 1st IF signal from Assembly A5 is mixed with the 50MHz LO signal from Assembly A40 to produce a 50kHz IF signal. This signal is applied to the RMS DC Log Converter to produce a dc output signal proportional to the power of the input signal.

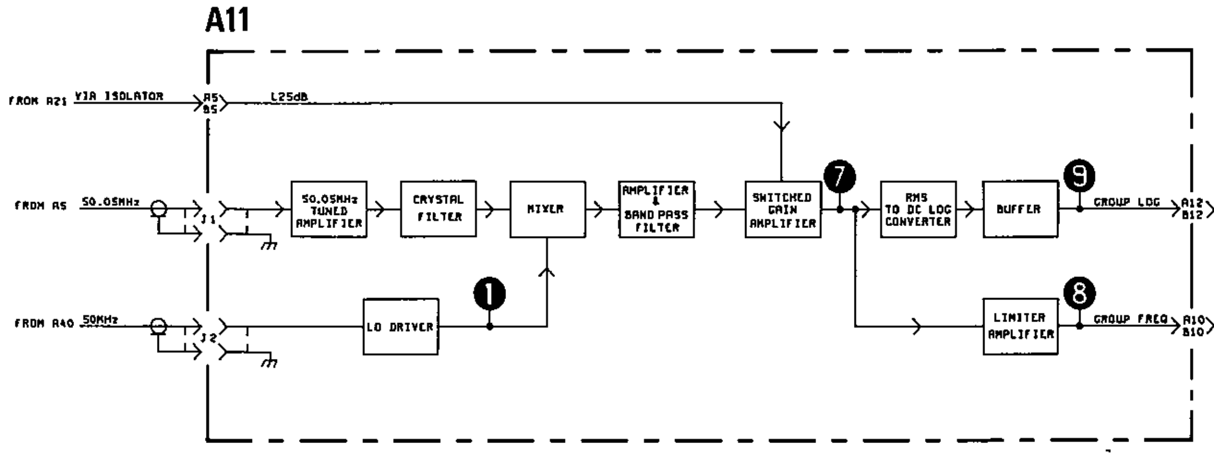


Figure A11-1 A11 Block Diagram

A11-3 CIRCUIT DESCRIPTION

A11-4 LO Driver

A11-5 The LO driver is an ECL triple line receiver which provides an ECL square wave of approximately 1V pk-pk to switch the Mixer U1.

A11-6 Tuned Amplifier

A11-7 This amplifier is tuned to 50.05MHz by L1/C3, and has a voltage gain of approximately 4.

A11-8 Crystal Filter

A11-9 The Crystal Filter E1 is custom designed and has a 48kHz bandpass response centred on 50.05MHz. Capacitors C8 and C9 are adjusted to optimise the filter response.

A11-10 Mixer

A11-11 U1 is a double-balanced mixer which is switched at ECL levels. A 1st IF at 50.05MHz, is mixed with a 50MHz LO signal (from the LO Driver) to produce an IF signal at 50kHz. If signals at the output of the Mixer are suppressed by low pass filters R14/C18 and R15/C17 respectively. LO break through at the output of U1 is minimised by adjusting R11.

A11-12 Amplifier

A11-13 A differential Amplifier U2 boosts the level of the 50kHz IF signal and provides a single-ended output at TP3.

A11-14 Bandpass Filter

A11-15 This is an active filter made up of a high-pass filter at U3A, and a low-pass filter at U3B. This filter band-limits the inherant broadband rise of the preceeding stage.

A11-16 Switched Gain Amplifier

A11-17 At the start of each measurement cycle, L25dB is high, and the switched Gain Amplifier is in its unity gain state as shown on the schematic diagram. It remains in that state for all signal levels greater than -50dBm. If the signal at the INPUT of the SLMS falls below -50dBm the processor (on assembly A60) sets L25dB low and the Amplifier U5 switches to its high gain state. On earlier instruments, below serial number 2250U00332, DS1 would be flashing when the signal level fell below -50dBm. The reason for this was a difference in the measurement alogorithm which set the L25dB line high after each measurement.

A11-18 RMS to DC Log Converter

A11-19 RMS DC Log Converter U7 produces a dc output proportional to the signal input. The reference current applied to U7(5) is derived from CR4 and is set by adjusting R43 to set the reference level of the RMS to DC Log Converter. R46 sets the gain to give 10mV per dB at the GROUP LOG output, TP9.

A11-20 A temperature compensating thermistor R44, along with a high stability zener CR4, minimise drift on this assembly. The thermistor R54 at amplifier U9, compensates for any drift in the input level to this assembly.

A11-21 Limiter Amplifer

A11-22 Diodes CR2 and CR3 limit the output signal of U6 to 1.4V which is then applied to a frequency counter on Assembly A22.

A11-23 TROUBLESHOOTING NOTES

1. A description of all the key sequences referred to in these notes will be found in Appendix B.

2. In addition to the voltages and waveforms shown on the schematic diagram, troubleshooting waveforms are included in these notes to assist in isolating the faulty component.

3. Calibration test modes can be forced in several ways:

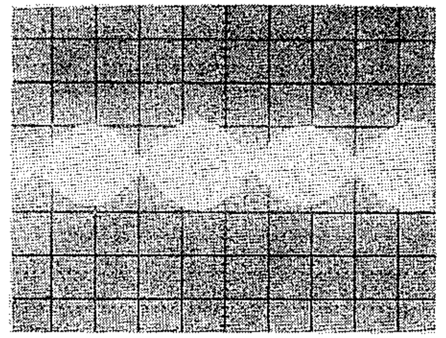
(a) Pressing TR, 2, 9 forces the calibration signal on continuously, and in a good instrument, a level of 25dBm ± 2dB is displayed in the level window.

(b) Setting the A4 TEST/NORM switch to TEST enables the CALIBRATION circuits on the A4 assembly. In this mode of operation the calibration signal is routed from the A4 assembly to A2 assembly where it is blocked because the calibration selector relay is in the normal signal path.

(c) Setting the A4 TEST/NORM switch to TEST as in Step (b) and connecting A4J1 to A2J1. This routes the calibration signal through the receiver (excluding the A1 assembly). Alternatively instead of connecting A4J1 to A2J2, a test link A2TL4 can be connected to the test position forcing the calibration selector relay to the test position.

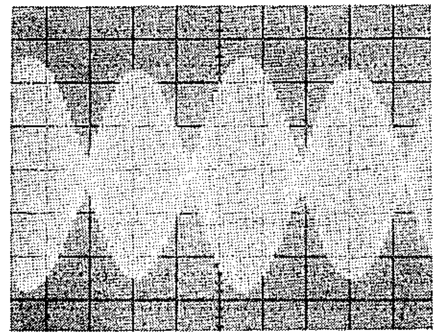
4. The following waveforms were measured with the SLMS in the calibration test mode. Press the 48kHz Filter key and TR, 2, 9 to set the calibration signal on continuously.

J1



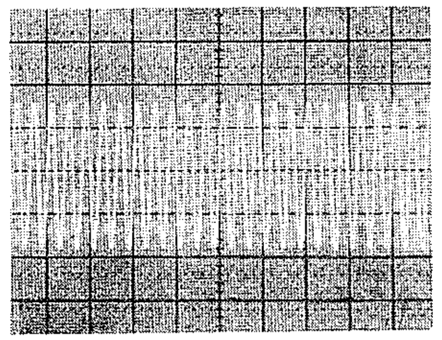
0.2V/div 0.2us/div

Q1(c)
Q2(e)



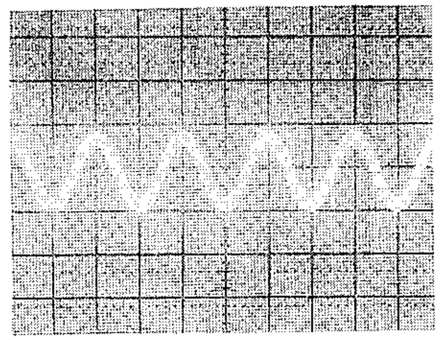
0.2V/div 0.2us/div

E1 output



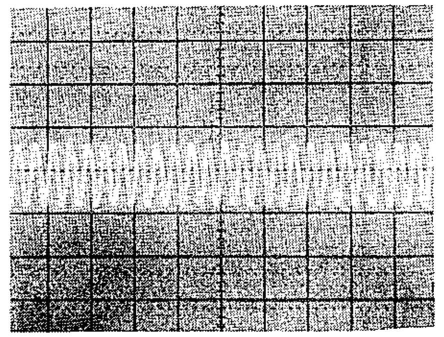
0.005V/div 0.05us/div

TP2



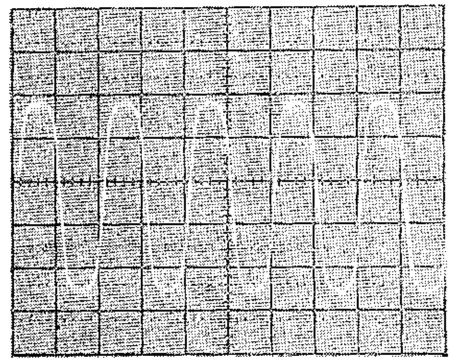
0.1V/div 10us/div

TP1



1V/div 0.05us/div

TP8



0.2V/div 0.01ms/div

5. The RMS to DC LOG CONVERTER and AMPLIFIER can be checked by monitoring TP9. The voltage at TP9 should change by 10mV per 1dB change in attenuation. The voltage at the output of U7 pin 6 should change by 3mV per dB and at U8 pin 1 by 11mV per dB. These changes can be readily checked using the calibration test switch on A4 and ranging the input attenuator as follows:

(a) Tune the SLMS input frequency to 1000kHz and press the MEAS key to force a calibration cycle. If the SLMS is faulty an error code will appear in the Test Point window and the SLMS may go into the HALT mode. Press the MEAS key to ensure the SLMS goes into the MEAS mode.

(b) Disconnect the cables from A1 at A2J1 and A2J2. Connect A4J1 to A2J1 (this routes calibration signal from A4 to A2 via the 0-25dB attenuator on A2 assembly).

(c) Set the test switch A4S1 to TEST. This switches on the 1MHz -25dB calibration signal.

(d) Press keys TR, 2, 1. The SLMS should now indicate rf ATTEN =09.

(e) Press the ↓ key to insert 5dB of attenuation, indicated by the number in the LEVEL window changing to 08 and check the change in level at TP9 and U7 pin 6. This should be 50mV per 5dB step at TP9 and 15mV per 5dB step at U7 pin 6.

NOTE: If the ↓ key is repeatedly pressed, or held on continuously the RF attenuation is first inserted on the A2 assembly until a point is reached when the Attenuation level is increased to 30dB. At this point 20dB of attenuation is inserted in the A1 assembly and the A2 assembly attenuation reduces to 10dB. Subsequent ↓ key presses will cause a further increase in attenuation on the A2 assembly. WHEN CHECKING THE A4 ASSEMBLY, THE ATTENUATOR SHOULD ONLY BE CHANGED FROM STATE 09 TO 06 TO AVOID ERRONEOUS READINGS AT TP6.

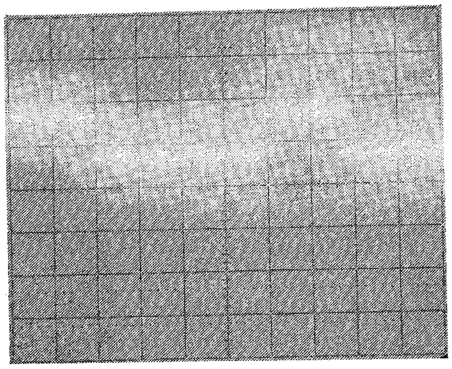
(f) Remember to switch A4S1 back to the NORM operating position and reconnect the cables for normal operation.

6. The Switched Gain Amplifier (U5) can be checked as follows:

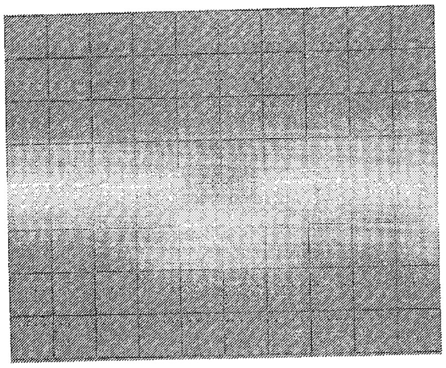
   (a) Select the 48kHz Filter (press 48kHz Filter key).

   (b) Press FREQ and MEAS keys. If the SLMS remains in the HALT mode with an error code in the TEST POINT window, press the MEAS key to override this condition.

   (c) The SLMS should now be measuring the noise floor of the 48kHz filter and the following waveforms should be present:



5V/div 0.05s/div
L25dB line measured at TL3



0.2V/div 0.05s/div
Output of U4 measured at TP7

   (d) To check the switched gain amplifier is exactly 25dB:

   (e) Tune the SLMS input frequency to 1000kHz and press the MEAS key to force a calibration cycle. If the SLMS is faulty an error code will appear in the Test Point window and the SLMS may go into the HALT mode. Press the MEAS key to ensure the SLMS goes into the MEAS mode.

   (f) Disconnect the cables from A1 at A2J1 and A2J2. Connect A4J1 to A2J1 (this routes calibration signal from A4 to A2 via the 0-25dB attenuator on A2 assembly).

   (g) Set the test switch A4S1 to TEST. This switches on the 1MHz -25dBm calibration signal.

   (h) Press keys TR, 2, 1. The SLMS should now indicate rf ATTEN =09.

   (i) Press the ↓ key to insert 5dB of attenuation, indicated by the number in the LEVEL window changing to 08 and check the change in level at TP9 and U7 pin 6. This should be 50mV per 5dB step at TP9 and 15mV per 5dB step at U7 pin 6.

   (j) Monitor A11TP7, note the amplitude.

   (k) Press the ↓ key until the attenuation reaches rf ATTEN =00.

   (l) Press TR, 2, 0.

   (m) Press the ↓ key to set IF GAIN =01 and note the amplitude at A11TP7 is restored to the same level as noted in step (j).

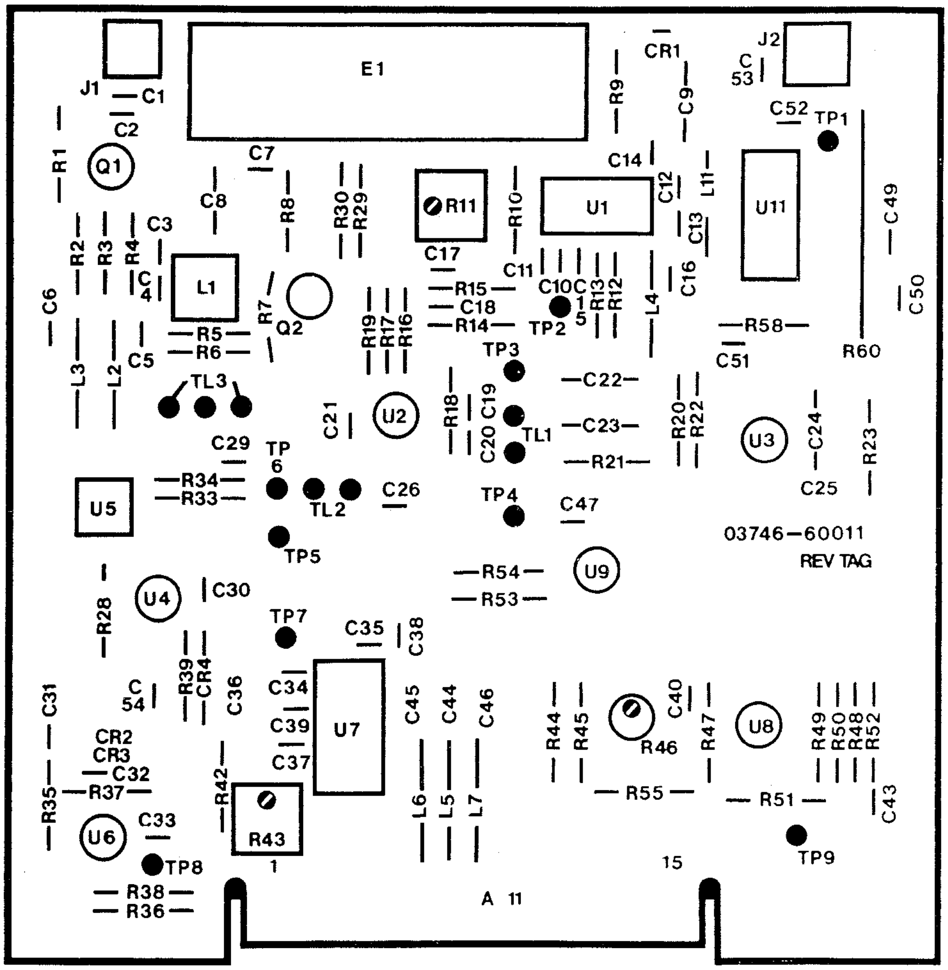


Figure A11-2 A11 Component Location

IC	TYPE	GND	+5V	+12V	-12V
U1	12002	1	14		
U5	TL601CP	1		8	5
U7	AD536AJ	10		14	13

WAVEFORMS AND dc VOLTAGES WERE MEASURED WITH THE 48KHz FILTER SELECTED AND THE CALIBRATION SIGNAL ON CONTINUOSLY (PRESS TR 29).

Figure A11-3 A11 Schematic Diagram

8-53
8-54

ASSEMBLY SERVICE SHEET A20
IF FILTERS

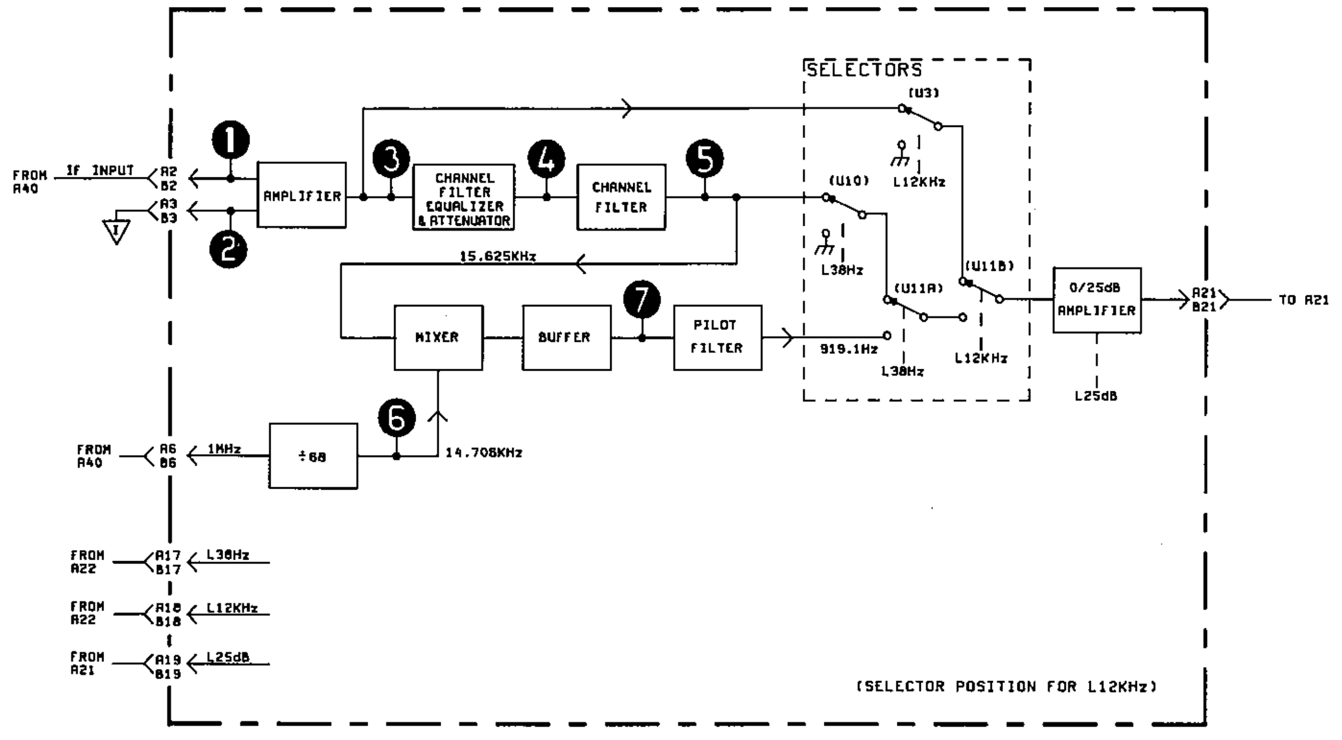


Figure A20-1 A20 Block Diagram

A20-1 INTRODUCTION

A20-2 Assembly A20 contains the Channel and Pilot Filters and provides three signal paths to the A21 Assembly, see Figure A20-1. Switching between paths is controlled by L12kHz and L38Hz.

A20-3 Path 1 by-passes both filters and enables the response of the 1st IF Cyrstal Filter (A10) to be monitered on the front panel LEVEL display. This path is selected by pressing the front panel key sequence TR, 3.1kHz.

A20-4 Path 2 is used when the SLMS is measuring signals over a 3.1kHz bandwidth and is selected by pressing the 3.1kHz FILTER key.

A20-5 Path 3 is used when the bandwidth is 38Hz. It is selected by pressing the 38Hz FILTER key.

A20-6 CIRCUIT DESCRIPTION

A20-7 Channel Filter Equalizer & Channel Filter

A20-8 The Channel Filter Equalizer has a double peaked response defined by L1/C3 and L2/C4, see Figure A20-2(A). The response of the Channel Filter is shown in Figure A-20(B). The combined response of the Channel Filter Equalizer and the Channel Filter produce the required flat response centred on 15.625kHz, see Figure A20-2(C).

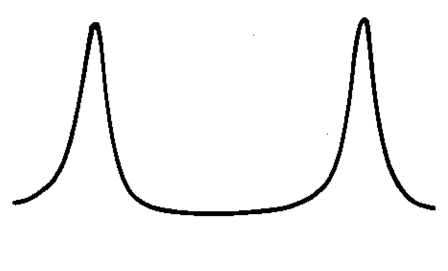


Figure A20-2(A) Equalizer Response

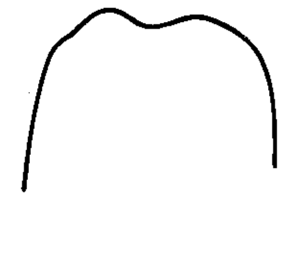


Figure A20-2(B) Filter Response

Figure A20-2(C) Filter/Equalizer Response

A20-9 Amplifier

A20-10 In the Channel Filter measurement mode the IF signal path is via non inverting amplifier U9B. In the Pilot Filter measurement mode U9C/U9D amplify the IF signal and provide differential drive to the Mixer.

A20-11 Divide-by-68 Mixer and Buffer

A20-12 When the Pilot Filter (38Hz) is selected, L38Hz goes low and enables the clock to U4 to divide the incoming 1MHz reference (from A40) by 34. Flip-flop U5A divides the output of U4 by 2 to produce a 14.706kHz LO signal, and provides differential drive to the Mixer. The Mixer output at 919.1Hz is buffered and converted to a single ended output by U6A.

A20-13 Pilot Filter

A20-14 The Pilot Filter is a narrowband flat topped bandpass filter centred on 919.1Hz with a 3db bandwidth of 38Hz, see Figure A20-3(A).

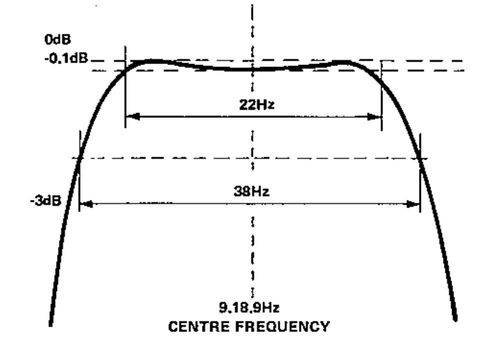


Figure A20-3(A) Pilot Filter Response

The filter is a four-section "leap-frog" active filter, each section behaving like a high Q resonant circuit tuned to 918.9Hz, the filter's geometric centre frequency. For test purposes it is possible to isolate each of these sections by setting test links TL4 through TL7 to their TEST positions, when the damped response of the individual sections is similar to that shown in Figure A20-3(B). Damping, achieved when the test links are in their TEST positions, allows tuning to 918.9Hz using R39, R48, R57 and R67.

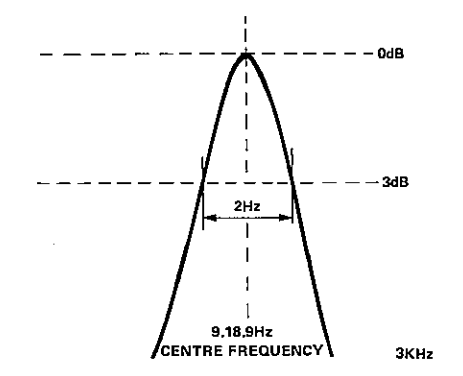


Figure A20-3(B) Section of Pilot Filter (Damped)

A20-15 Analogue Switches & 0/25dB Amplifier

A20-16 Four Analogue Switches U10, U11A, U11B and U3 control the signal switching on this assembly in response to the filter selected by the front panel keys.

A20-17 If the 3.1kHz key is pressed, L38Hz and L12kHz are both high, and the Channel Filter signal is selected (via U10, U11A and U11B). Figure A20-1 shows the Analogue switch setting when L12kHz is low (and L38Hz is high).

A20-18 When L25dB goes low the gain of amplifier U13 is switched from the unity gain position (as shown on schematic) to the 25dB gain position.

A20-19 TROUBLESHOOTING NOTES

1. A description of all the key sequences referred to in these notes will be found in Appendix B.

2. Voltages and waveforms are shown on the schematic diagram to assist in troubleshooting.

3. Faults associated with the Pilot filters are best checked measuring the dc voltages around the associated amplifiers with TL4 through TL7 in the TEST position. In all cases the voltage at the input and outputs should be 0V.

4. Test links TL9, TL10 and TL11 allow the various analogue switches (U3, U10, U11, U13) to be set to a pre-defined state. The operation of these switches can be verified by monitoring TP12.

(a) With the SLMS in the 3.1kHz filter position and the calibration signal on continuously (TR, 29 mode) the signal at TP12 should be as shown on the schematic.

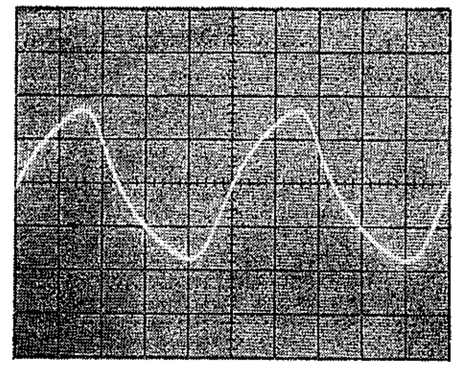
(b) Pressing the 38Hz filter key enables the CLK signal at the divide-by-68 circuit, U11A selects the pilot signal, and the waveform at TP12 changes in freqeuncy from 15.625kHz to 919.1Hz (with a slight increase in amplitude).

(c) Pressing TR, 3.1kHz, selects the 12kHz by-pass mode. U3 and U11B switch the 2V signal at TP3 through to TP12. Momentarily connect TL11 to ground. The signal at TP12 should increase to approx 20V pk-pk with severe limiting.

5. The divide-by-68 circuit is enabled by pressing the 38Hz filter key or setting TL9 to TEST.

(1)

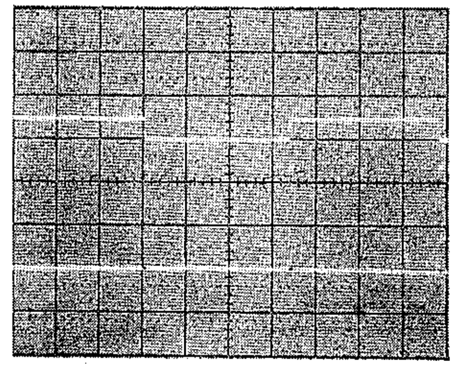
1MHz Input



1V/div 0.2μsec/div

(2)

14706Hz at TP6



2V/div 10μsec/div

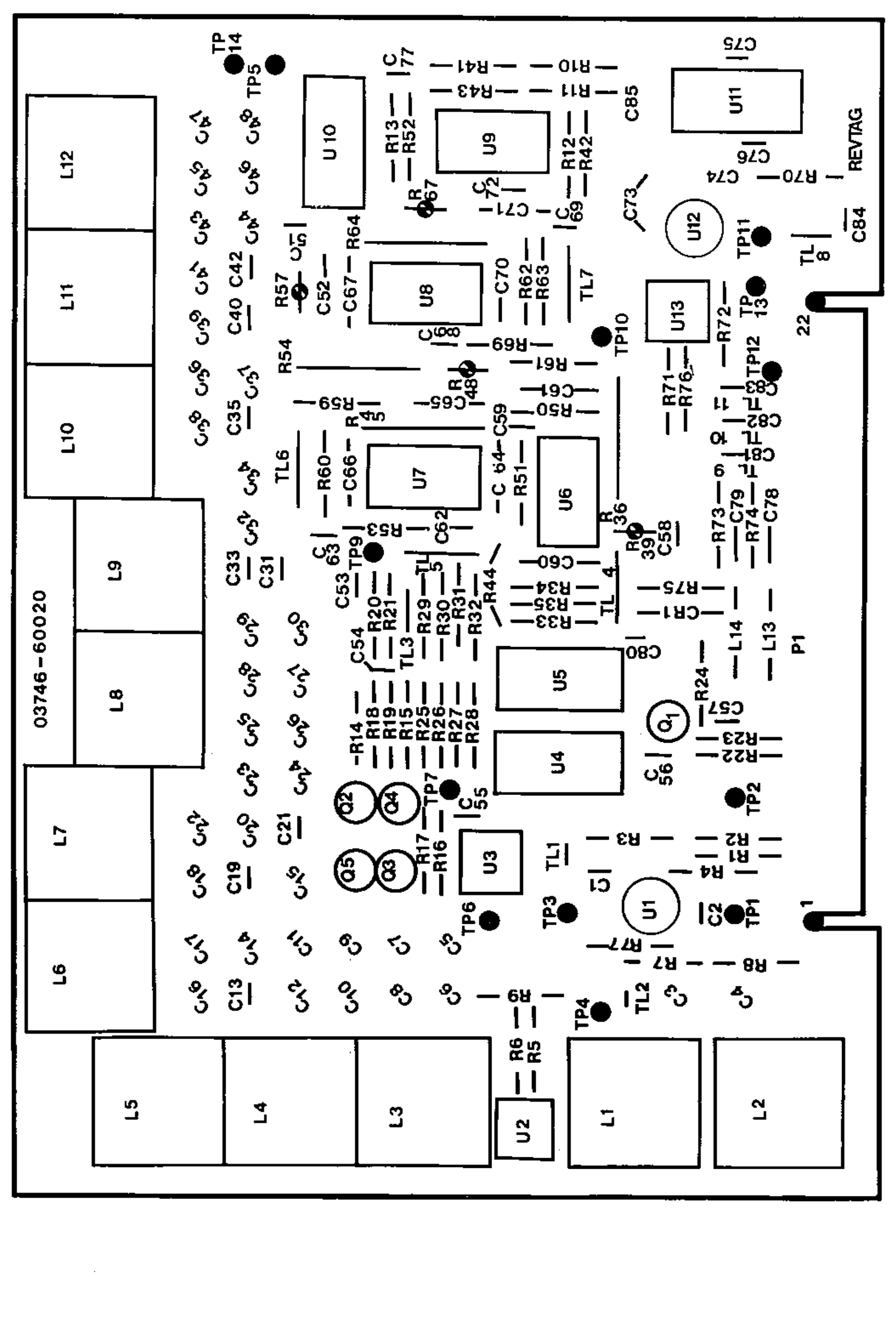


Figure A20-4 A20 Component Location

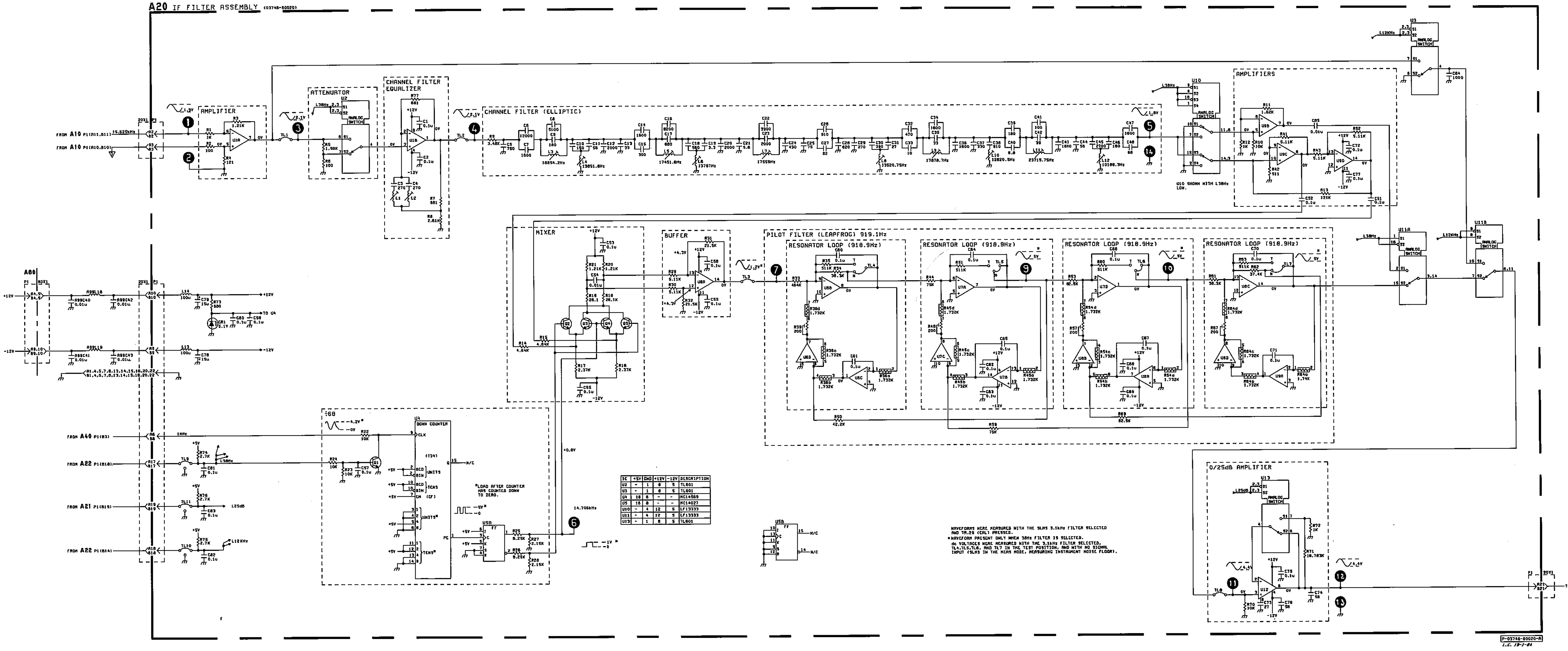


Figure A20-5 A20 Schematic Diagram

8-55
8-56

ASSEMBLY SERVICE SHEET A21
IF GAIN AND DETECTION

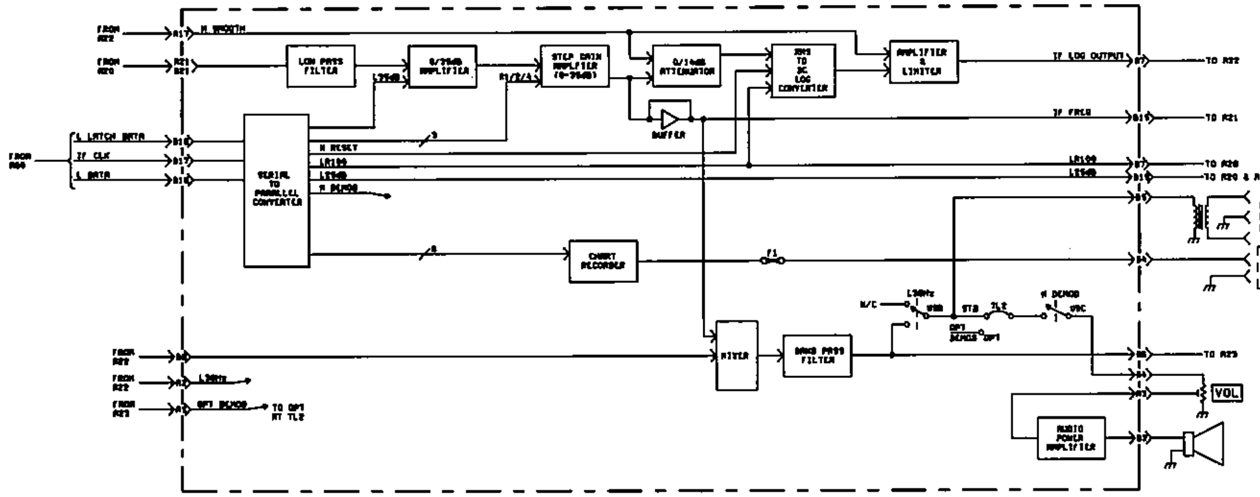


Figure A21-1 A21 Block Diagram

A21-1 INTRODUCTION

A21-2 Assembly A21 converts a 15.625kHz (Channel Filter) or a 919.1Hz (Pilot Filter) IF signal from Assembly A20 to dc log levels and when required demodulates the IF to produce audio signals. A D/A Converter which converts digital power measurement data to an analogue format (to drive a chart recorder) is also contained on this assembly (see Figure A21-1).

A21-3 CIRCUIT DESCRIPTION

A21-4 Low Pass Filter

A21-5 This filter rejects the broadband noise generated on assembly A20. R3 is adjusted to give a flat response between 13.125kHz and 18.125kHz.

A21-6 0/35dB Amplifier

A21-7 When L35dB is low the gain of this amplifier is 35dB.

A21-8 Step-Gain Amplifier (0-35dB)

A21-9 The gain of this amplifier is selected in 5dB steps from 0 to 35dB by the control data on the A1, A2 and A4 lines of the analogue switch U5. Each of the eight gain settings is selected by connecting the appropriate resistor network (within U6) to U4 via U5.

A21-10 0/14dB Attenuator, RMS to DC Log Converter, Amplifier and Limiter

A21-11 The SLMS has three Averaging modes, AVE 0 which has a resolution of 1dB, AVE 1 with 0.1dB and AVE 2 with 0.01dB. In the shortest AVEraging mode, AVE 0, the IF LOG OUTPUT at TP4 has a sensitivity of 10mV per dB (100dB per Volt) and in the longer averaging modes the sensitivity is 100mV per dB (10dB per Volt).

A21-12 In the AVE 0 mode the 0/14dB Attenuator (U7) is at its zero setting and the amplifier U10 is at its lowest gain setting allowing the RMS to DC Log Converter to operate over its entire range (40dB). On the higher averaging modes AVE 1 and AVE 2 14dB of attenuation is inserted at U7 to restrict the operating range of the RMS to DC Log Converter to its most linear portion (giving 10dB range) and the amplifier gain at U10 is increased by a factor of 10 to increase the sensitivity at the output (TP4) to 100mV per dB. See Table A21-1.

Table A21-1 Averaging Modes (38Hz and 3.1kHz Filters only)

AVERAGING MODE	H SMOOTH	ATTEN at U7	U10 GAIN	LR100	O/P at TP4
AVE 0	LOW	0dB	Low Gain	LOW	10mV/dB
AVE 1	HIGH	14dB	High Gain	LOW	100mV/dB
AVE 2	HIGH	14dB	High Gain	HIGH	100mV/dB

A21-13 In the longest averaging mode AVE 2, LR100 goes low and C19 is paralleled with C18 increasing the averaging time of the RMS to DC Log Converter by a factor of 11. In addition to an increase in averaging time LR100 extends the count range of the Counter in the A/D converter (on Assembly A22) by a factor of 10.

A21-14 A unity gain buffer U17 is connected to C19 in the AVE 0 and AVE 1 modes. This allows the voltage on C19 to track the charge on C18 and ensure a fast settling time when C19 is switched in on the AVE 2 mode.

A21-15 With low input levels, or no signal input, the RMS to DC Log Converter output slews slowly, and will not track sudden downward changes in input level. To avoid this, the processor pulses H RESET, Q6 conducts, and the dc output of the RMS to DC LOG Converter slews sharply to a condition which corresponds to an extremely low input level. From this condition the RMS to DC LOG Converter recovers quickly to stabilize at the correct output level.

A21-16 The switched gain amplifier U10 has its output clamped at 0V by U11D and CR1, ensuring only negative levels are applied to the A/D Converter (on assembly A22). Any positive voltage excursion at the output of U10 causes U11D and CR1 to conduct and hold the output of U10 at 0V. C23/R38 prevent any instability due to the feedback. R26 provides temperature compensation for the slope of the RMS to DC LOG Converter output while R27, R28, R40 and CR2 provide temperature compensation for its offset.

A21-17 Mixer and Bandpass Filter

A21-18 The Mixer and Bandpass Filter demodulates the 15.625kHz "channel" signal to provide an audio signal centred on 1.85kHz. The DEMOD LO (from A22) is at 13.775kHz to demodulate the lower sideband, or 17.775kHz to demodulate the upper sideband. R65 adjusts the mixer balance, and is adjusted to minimise carrier break-through. The Bandpass Filter ensures only the audio component of the signal is passed to the subsequent circuits.

A21-19 Audio Power Amp & U9B/U9C

A21-20 When the 38Hz FILTER is selected L38Hz is low and the Audio signal is disconnected from the Audio Power Amplifier at U9B.

A21-21 When the Impairments Assembly A23 (Option 015/016) is fitted, test link TL2 is connected to the "OPT" position.

A21-22 H DEMOD at U9C goes low to disconnect any signal from the Audio Power Amplifier when the 48kHz Filter is selected, at switch-on, during a calibration cycle, and during autoranging.

A21-23 Chart Recorder Drive (Opt H27)

A21-24 Data from the processor (on A60) representing the measured signal is applied to the D/A Converter (U16) via the Serial to Parallel Converter U13 and U15. The output from U11A varies by 1V per dB across a ± 3dB range. U11B and U11C convert the voltage output from U11A to a current drive of 0-0.5mA corresponding to -3dB to +3dB. Test link TL1 is factory preset to the "V" position. CR5 is a protection diode to prevent the FET Q7 becoming reversed biased. CR6, CR7 and F1 provide protection against high voltage supplies being connected to the CHART RECORDER OUTPUT.

A21-25 TROUBLESHOOTING NOTES

1. A description of all the key sequences referred to in these notes will be found in Appendix B.

2. Voltages and waveforms are shown on the schematic diagram to assist in troubleshooting. In addition, extra waveform diagrams are given at the end of these notes.

3. The SERIAL to PARALLEL CONVERTER formed by U12 and U14 can be checked as follows:

(a) Press TR, 2, 0. The SLMS should display IF GAIN = .

(b) Press the | key until state 19 is displayed in the SLMS LEVEL window. All the LEDs (DS1 through DS5) should be ON. Press the | key until the state 00 is reached. All LEDs should now be OFF.

(c) Press the 38Hz FILTER key to set H DEMOD at U14 pin 2 low, and then press the 3.1kHz to set H DEMOD high.

(d) The H RESET line U14(9) should pulse low when AVE, 0, MEAS keys are pressed. If the instrument has a fault it may stick in the HALT mode. Press MEAS once more to override this condition. (The H RESET line will only pulse low when the SLMS is in the MEAS mode.)

(e) The LR100 line U14(6) should be high after pressing AVE, 2, MEAS.

4. The SERIAL TO PARALLEL CONVERTER formed by U13 and U15 and the CHART RECORDER DRIVE circuitry can be checked as follows:

(a) Press TR, 2, 5 to set the SLMS to the Chart Recorder test mode. The SLMS FREQ/FDM display should indicate chArt = 08 (80 or F8). The Serial to Parallel Converter outputs should be as shown.

	chArt=		LSB							MSB
		U13 pin	3	4	5	6	10	11	12	13
		U15 pin	19	16	15	5	12	6	9	2
	F8		0	0	0	1	0	1	1	1
key ↑ ↓	80		0	0	0	0	0	0	0	1
	08		0	0	0	1	0	0	0	0

(b) To measure the voltages at the Chart Recorder Drive circuitry, set the test link TL1 to the "I" position and connect a 1K resistor load between TP8 and ground. The voltages should be as shown.

(c) Remember to re-set the test link TL1 to its original setting.

chArt=	TP8	U11(8)	U11(1)	U11(2)	U11(3)
F8	+4.9V	+0.3V	+8.6V		
80	+2.5V	-2.5V	+8.8V		
08	0V	-9.6V	+9.1V	+8.2V	+8.2V

key ↑ ↓

5. A fault in one of the gain steps in the 0/35dB AMPLIFIER or the STEP GAIN-AMPLIFIER will usually show up as an error in LEVEL at a specific gain setting. The LEDs at the top of the A21 Assembly indicate which gain stage is in circuit. The accuracy of each gain stage can be checked, by comparing each gain stage with the Input Attenuator (on assemblies A1 and A2) using the method outlined in the Operational Verification Procedure 4-16 steps 14 though 30. (This procedure also checkes the 0/25dB Amplifier on the A20 assembly).

6. The RMS to DC LOG CONVERTER and AMPLIFIER can be checked by monitoring TP4. In the AVEraging 1, or AVE2 modes the voltage at TP4 should change by 100mV per 1dB change in attenuation and the output of U8 pin 6 should change by 3mV per dB. These changes can be readily checked using the calibration test switch on A4 and ranging the input attenuator as follows.

(a) Tune the SLMS input frequency to 1000kHz and press the 3.1kHz, AVE 1, and MEAS keys. If the SLMS is faulty an error code will appear in the Test Point window and the SLMS may go into the HALT mode. PRESS the MEAS key to ensure the SLMS goes into the Measure mode.

(b) Disconnect the cables from A1 at A2J1 and A2J2. Connect A4J1 to A2J1 (this routes calibration signal from A4 to A2 in the 0-25dB attenuator on A2 assembly).

(c) Set the test switch A4S1 to TEST. This switches on the 1MHz -25dB calibration signal.

(d) Press keys TR, 2, 1. The SLMS shold now indicate rf ATTEN = 09.

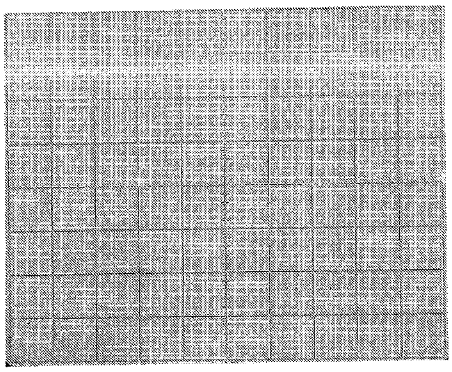
(e) Press the ↓ key to insert 5dB attenuation, indicated by the number in the LEVEL window changing to 08 and check the change in the level at TP4 and U4 pin 6. This should change by 500mV per 5dB step at TP6 and 15mV per 5dB step at U4 pin 6.

NOTE: If the ↓ key is repeatedly pressed, or held on continuously the RF attenuation is first inserted on the A2 assembly until a point is reached when the Attenuation level is increased to 30dB. At this point 20dB of attenuation is inserted in the A1 assembly and the A2 assembly attenuation reduces to 10dB. Subsequent ↓ key presses will cause a further increase in attenuation on the A2 assembly. WHEN CHECKING THE A4 ASSEMBLY, THE ATTENUATOR SHOULD ONLY BE CHANGED FROM STATE 09 TO 06 TO AVOID ERRONEOUS READINGS AT TP6.

(f) Reset A4S1 to the NORM position and re-cable the instrument as before.

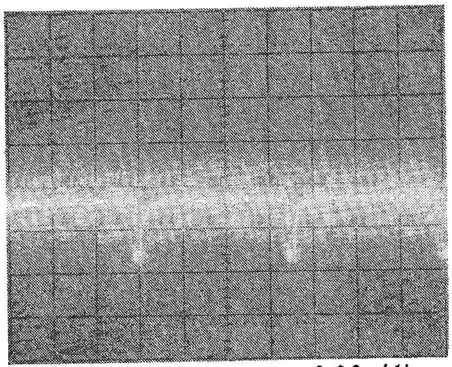
(g) Waveforms 1 and 2 below show the output in the AVE, 0 mode.

Q4(c)



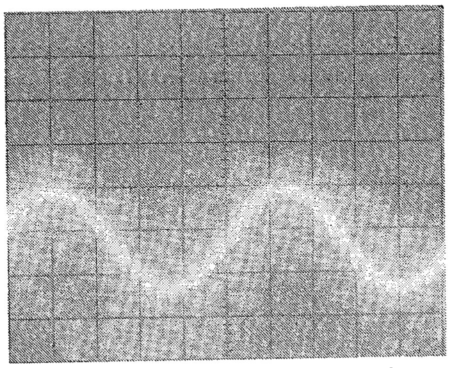
2V/div 0.02s/div

TP4



0.2V/div 0.02s/div

TP6



1V/div 0.1ms/div

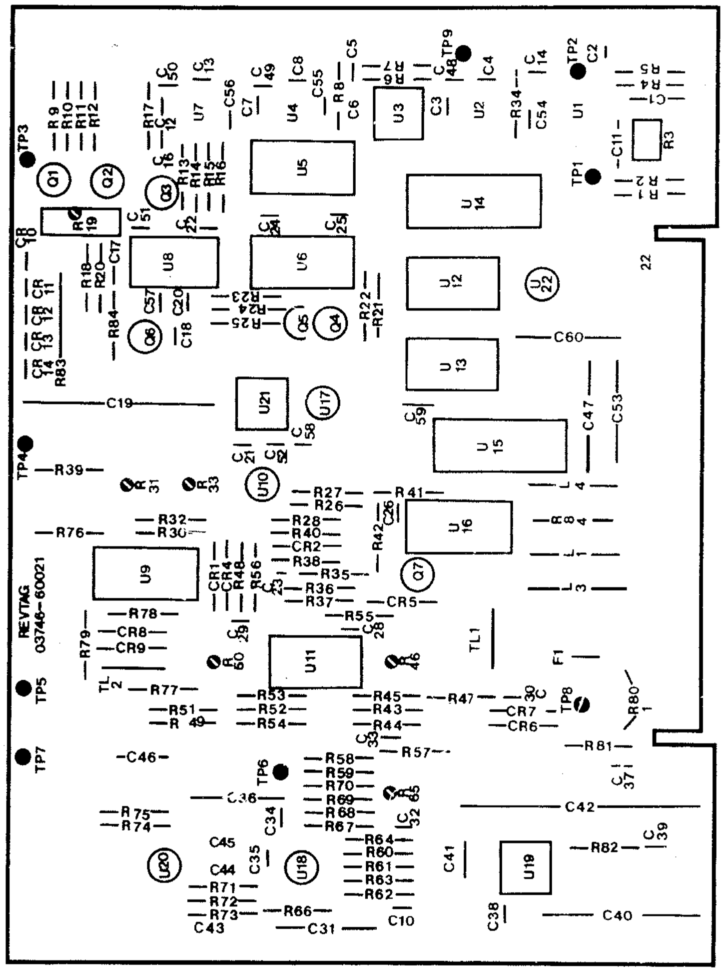


Figure A21-2 A21 Component Location

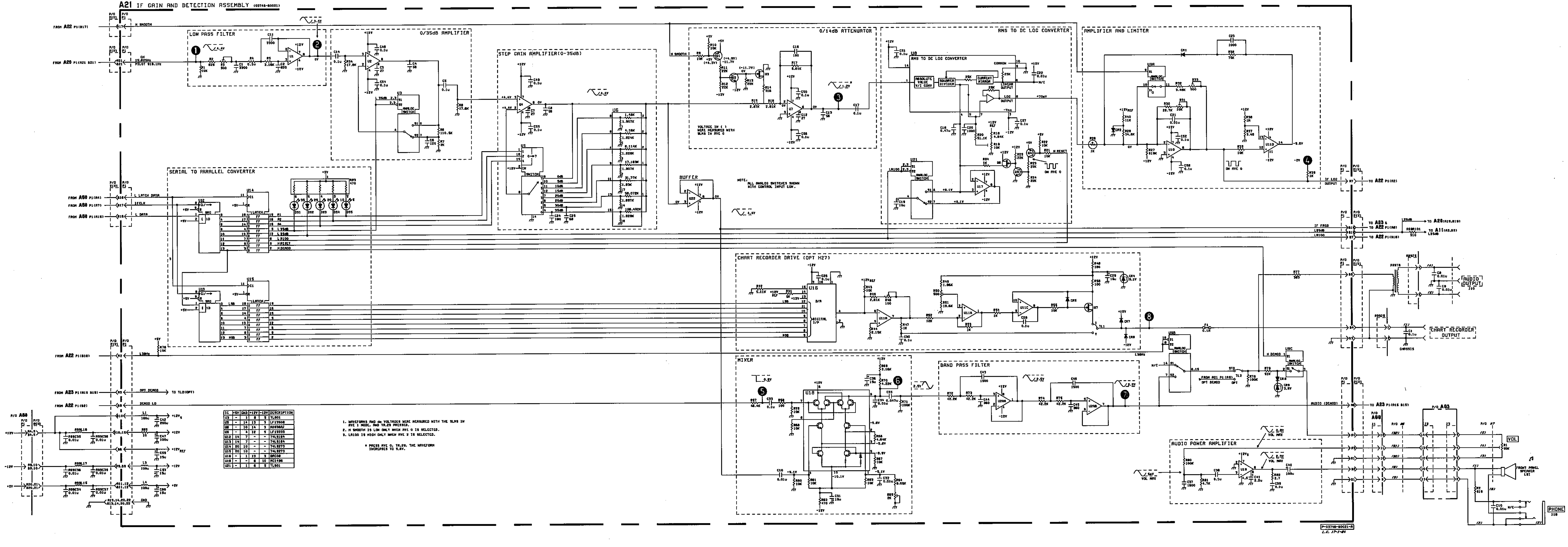


Figure A21-3 A21 Schematic Diagram

8-61
8-62

ASSEMBLY SERVICE SHEET A22
A/D CONVERTER

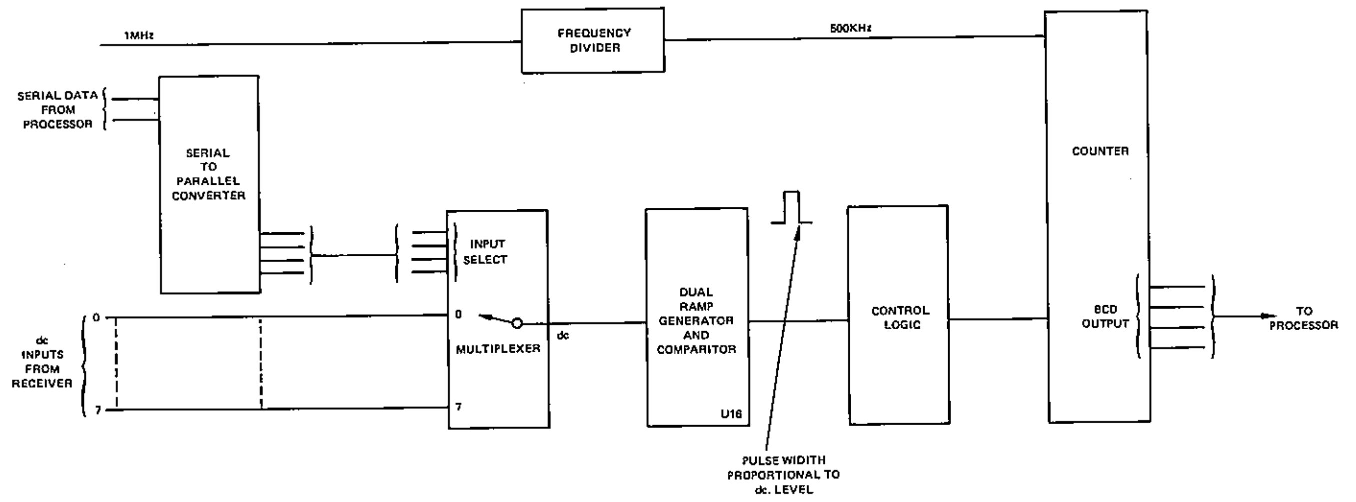


Figure A22-1 Simplified A/D Converter

A22-1 INTRODUCTION

A22-2 This assembly has three main functions,these are:

(1) As a dual slope A/D Converter, to convert analogue dc signals (from the Power Detectors on Assemblies A4, A11 and A21) to digital.

(2) As a Frequency Counter (U23) to measure the IF signal frequency from either the Pilot, Channel or Group Filters.

(3) As a Demod Local Oscillator which produces a LO signal to demodulate either the upper or lower sideband signals on Assembly A21.

A21 Schematic Diagram

A22-3 CIRCUIT DESCRIPTION

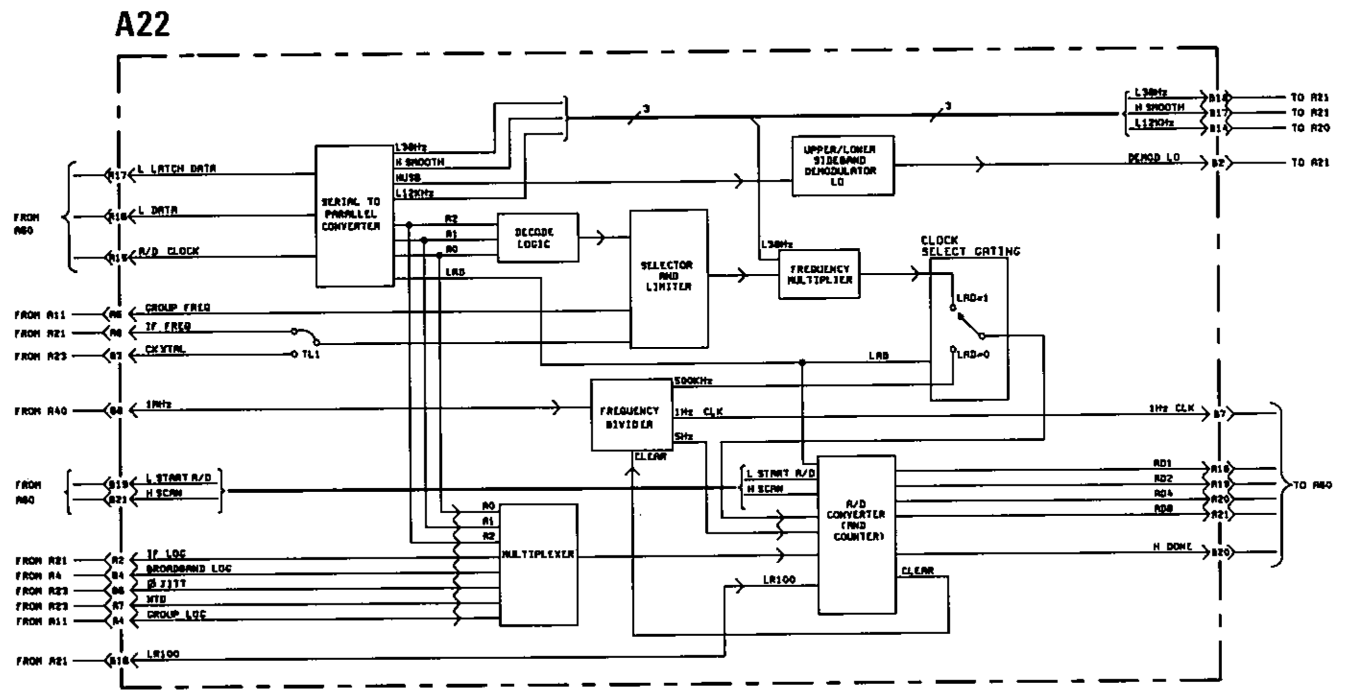


Figure A22-2 Simplified A/D Converter Block Diagram

A22-4 A/D Converter

A22-5 An LSI circuit (U16) containing a dual ramp generator and comparitor produces an output pulse, the width of which is proportional to the dc level at the input. The counter (U23) counts a 500kHz signal for the duration of the pulse, resulting in a BCD output, proportional to the dc level at the input.

A22-6 The code on the Multiplexer (U20) select lines A0, A1 and A2, determines which input is selected, as shown in Table A22-1.

Table A22-1

Control Data			Selected Input
A0	A1	A2	
0	0	0	0
0	0	1	4
0	1	0	2
0	1	1	6
1	0	0	1
1	0	1	5
1	1	0	3
1	1	1	7

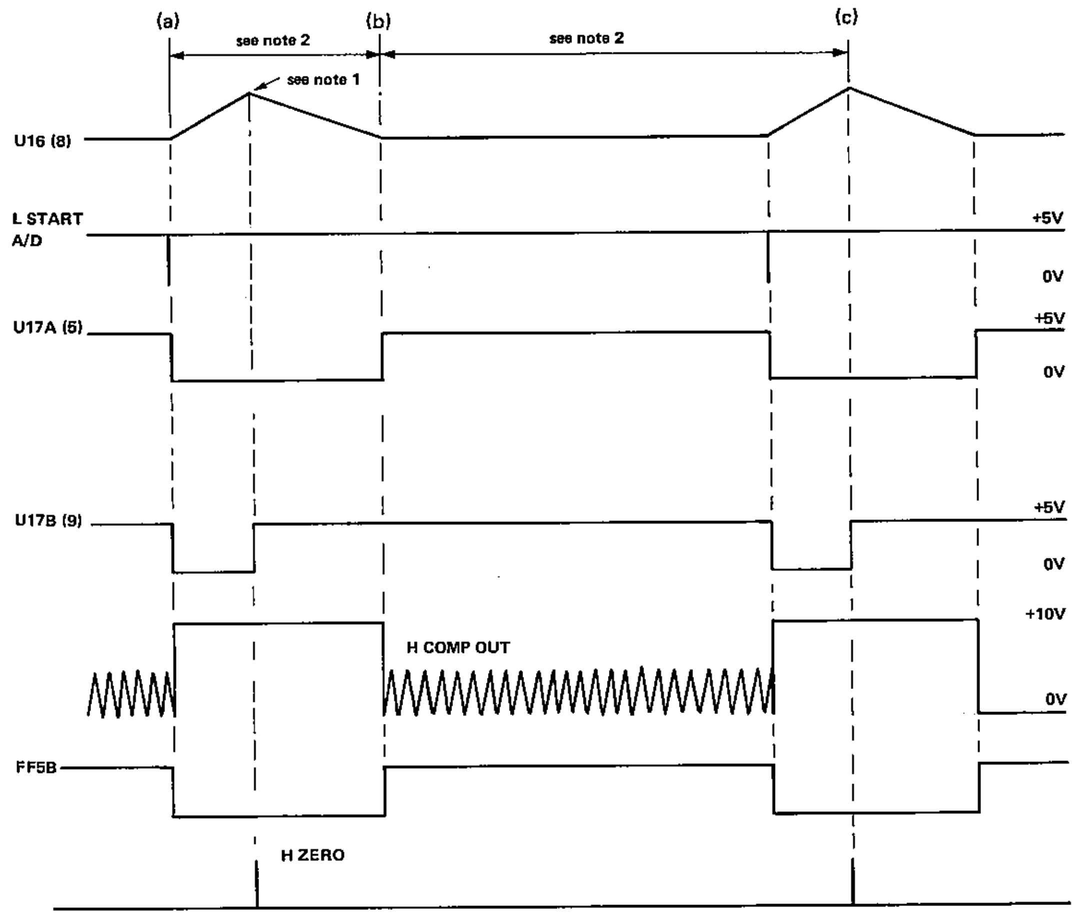


Figure A22-3 Ramp Waveform and Timing Diagram

Note 1. The amplitude of the ramp output varies with the AVE mode and is typically 0.2Vpk on AVE 0, 0.6Vpk on AVE 1 and 4Vpk on AVE 2.

2. The ramp period typically:

AVE 0	*2msec a to b*	
AVE 1	*6msec a to b*	*60msec b to c*
AVE 2	*25msec a to b*	*see figure A22-5*

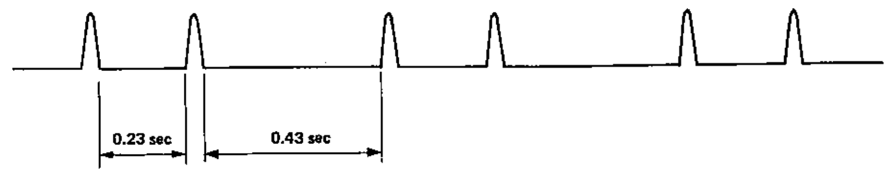


Figure A22-4 AVE 2 Ramp Waveforms

1. THE CONTROL LOGIC IS IN THE IDLE STATE.

2. THE PROCESSOR (ON ASSEMBLY A60) PULSES L START A/D LOW AND L START (AT U29B) GOES LOW TO RESET U17B.

3. U17B GOES LOW, FORCING L RAMP LOW, THE INTEGRATOR RAMP UP PERIOD BEGINS AND A22 C8 BEGINS TO CHARGE.

4. AS THE RAMP CROSSES THE THRESHOLD LEVEL OF THE COMPARITOR (IN U16) H COMP OUT GOES HIGH.

5. L COUNT GOES LOW AND SET INPUT (AT U23 PIN 2) OF THE COUNTER IS PULLED LOW (THIS BLANKS THE BCD OUTPUTS). ALSO THE COUNT INHIBIT AND COUNTER STORE LINES (U23 PIN 25, AND PIN 9) ARE PULLED LOW. THE COUNTER (U23) STARTS TO COUNT THE 500KHz CLOCK PULSES.

6. THE COUNTER REACHES ZERO AND SETS H ZERO HIGH.

7. L RAMP GOES HIGH. THE INTEGRATOR NOW STARTS TO RAMP DOWN AS C8 DISCHARGES.

8. H COMP OUT GOES LOW AS THE RAMP CROSSES THE THRESHOLD LEVEL IN U16.

9. H END SWITCHES Q3 OFF. THE RAMP CONTROL VOLTAGE U16 (10) IS NOW DRIVEN BY THE VOLTAGE AT H COMP OUT TO MAINTAIN AN OSCILLATION ON THE RAMP CONTROL VOLTAGE.

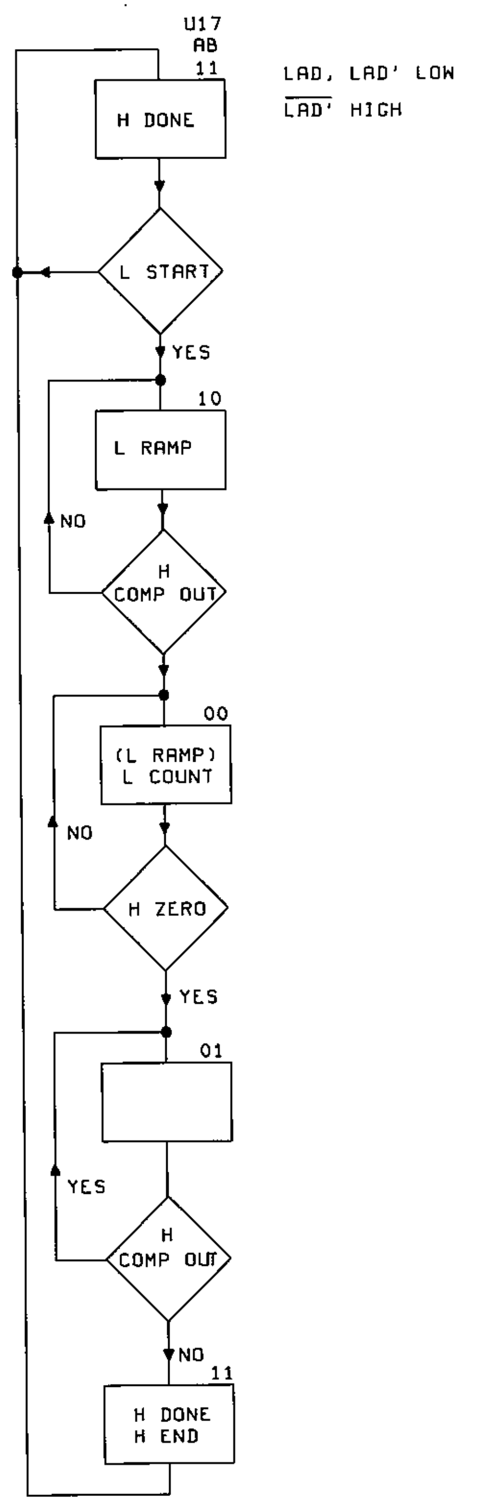


Figure A22-5 Control Logic Flow Chart-A/D Operation

A22-7 The A/D converter is in three distinct parts, a Dual Ramp Generator U16, the Control Logic around U17, and a 10^6 counter U23 (a Six Decade Counter/Display Decoder). The Control Logic action described in Figure A22-3 is accompanied by a timing diagram (Figure A22-2) which illustrates the relationship between the Dual Ramp Generator and the remaining circuitry.

A22-8 At the end of the A/D sequence (state 9 in the Flow Chart of Figure A22-3) the H Done line goes high to inform the Processor that the A/D count is complete. The Processor sends a burst of six pulses on the H SCAN line to strobe the BCD data at the output of U23. The BCD output data from U23 (pins 5,6,7,8) is read into the processor, in bit parallel byte serial format, at the scan rate.

A22-9 The A/D Counter U23 has a resolution of 10^3 counts/volt in the lower averaging modes, or 10^4 counts/volt in the highest averaging mode (AVE 2). Selection of 10^3 or 10^4 counts/volt is determined by the state of the LR100 line.

A22-10 H SCAN strobes the counter "digit stobe lines" D1 to D6 to provide the input data required to load the counter. When D6 (U23 pin 22) is strobed U12B output goes high, setting the counter LOAD INPUTS to 9 (1001), and loading 9 into the counter's most significant decade. Similarly when D5 is strobed 9 is loaded into the counter's 5th decade. When LR100 is low, 9 is loaded into the counter's 4th decade, and the counter is preset to count from 999000 to (1)000000 (i.e. a count of 1000). When LR100 is high the output of U15D is low and the counter is preset to count from 990000 to (1)000000 (i.e. a count of 10,000).

A22-11 The logic state of the LR100 line is determined by the AVEraging mode and the filter selected as shown in Table A22-2. When the LR100 line is high the resolution of the A/D Converter is 10,000 counts per volt, and when low 1,000 counts per volt. In the Input Power mode, the PROCESSOR displays the result of each measurement when in AVE 0, but averages the results of five measurements in AVE 1 despite the fact that the LR100 line is high in both cases. (No matter which filter is selected, the displayed resolution is always the same: AVE 0, zero decimal places; AVE 1, one decimal place; AVE 2, two decimal places).

Table A22-2

Filter	LR100 state		
	AVE 0	AVE 1	AVE 2
38Hz	0	0	1
3.1kHz	0	0	1
WTD/NOTCH	0	1	-
48kHz	0	1	-
INPUT POWER	1	1	-

A22-12 Flip-flop U29A synchronizes the LAD line with the $\overline{\phi CLK}$, and U29B synchronizes the L START A/D line with the $\overline{\phi CLK}$, ensuring that the control lines are synchronized with the ϕCLK.

A22-13 Frequency Counter

A22-14 There are two modes of Frequency Counter operation available to the operator via the front panel keys.

a. Pressing the key sequence TR, COUNTER, MEAS, causes the SLMS to measure the incoming signal frequency and retune to that frequency.

b. Pressing the key sequence COUNTER, MEAS, only measures the incoming signal frequency, it does not retune the SLMS to that frequency.

A22-15 In both frequency measurement modes the 10^6 Counter (U23) time shares between the A/D Converter and Frequency Measurements. During Frequency Measurements, the 10^6 Counter measures the frequency of the IF signal and from this the processor calculates the frequency of the input signal. A Frequency Multiplier multiplies the frequency of the incoming signal to allow the gate time of the counter to be reduced, speeding up of the counting process.

A22-16 The IF signal may be at 50kHz (48kHz FILTER mode) 15.625kHz (3.1kHz FILTER mode) or 919.1Hz (38Hz FILTER mode). To illustrate the Frequency Measurement operation, consider a signal 20Hz below the tuning point (front panel frequency) with the 3.1kHz Filter selected.

A22-17 The 10^6 Counter measures the incoming signal and passes the result to the processor. The processor subtracts the measured IF from 15625Hz

1. THE CONTROL LOGIC IS IN THE IDLE STATE.

2. THE PROCESSOR (ON ASSEMBLY A60) PULSES L START A/D LOW AND L START AT (U29B) GOES LOW TO RESET U17B.

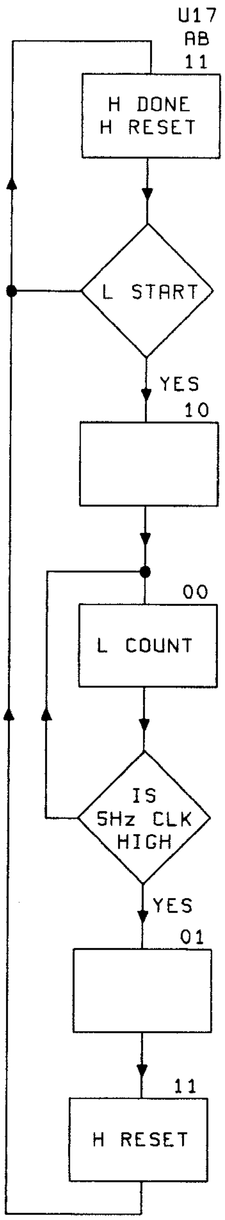
3. THE CONTROL LOGIC ADVANCES TO THIS STATE ON THE TRANSITION OF Ø CLK

4. THE CONTROL LOGIC ADVANCES TO THIS STATE ON THE TRANSITION OF Ø CLK AND THE COUNTER (U23) STARTS TO COUNT THE OUTPUT FROM THE FREQUENCY MULTIPLIER (VIA THE SELECT GATING).

5. 5Hz CLOCK PULSE GOES HIGH AND THE CONTROL LOGIC IS READY TO ADVANCE ON THE NEXT Ø CLK.

6. L COUNT GOES HIGH AND TERMINATES THE COUNT.

7. H RESET RESETS U23 AND THE FREQUENCY DIVIDER (5Hz LINE NOW GOES LOW).



LAD, LAD' HIGH

$\overline{\text{LAD'}}$ LOW
(IN THE A/D MODE LAD IS LOW ALL THE TIME. WHEN THE SLMS IS SET FOR COUNTER OPERATION THE A/D ASSEMBLEY TIME SHARES BETWEEN THE FREQ COUNT MODE AND THE A/D MODE AND THE LAD LINES SWITCHES HIGH FOR FREQ COUNT AND LOW FOR A/D).

Figure A22-6 Control Logic Flow Chart-Cnrt Operation and produces a result of -20Hz. This number (-20) is added to the number stored in the Frequency register. The SLMS is then updated to display a new number in the FREQ/FDM window.

A22-18 When the instrument is in the TR, COUNTER mode, the processor acts on the output data from U23 to retune the synthesizer and the instrument. In the COUNTER mode, no retuning takes place and the measured frequency in the FREQ/FDM window does not necessarily correspond to the instrument tuning point. If there are multiple signals in-band, the Phase Lock Loop in the Frequency Multiplier locks on to the strongest signal (if it is ≥ 3dB up on adjacent signals).

A22-19 The state of the LAD line determines whether the A22 Assembly operates as a frequency counter to measure the IF, or as an A/D converter. When the LAD line is high, the action is as follows:

1. At U29A, LAD' is high and $\overline{\text{LAD}'}$ is low.

2. At the Clock Select Gating, LAD' enables U11A and $\overline{\text{LAD}}'$ disables U11B, selecting the output of the Frequency Multiplier.

3. LAD' enables U5C to produce a H RESET when H DONE goes high. This resets the Counter U23, cancelling any entry at its Load Inputs.

A22-20 The Decode Logic (U28) recognises 1 1 0 on the A2, A1, and A0 lines and pulls the S2 input of U26 low to select the Group Frequency. For all other states of the A2, A1, and A0 lines, U26 S2 input is high, selecting the IF FREQ (or the CLK XTAL by moving TL1).

A22-21 A limiter at U8A and U8B provides the corect square-wave drive level to the C-mos Frequency Multiplier circuit. U8A amplifies the input to a 1.4V pk-pk square-wave which is further amplified by U8B to approx. 12V pk-pk.

A22-22 The Frequency Multiplier employs a Phase Lock Loop and Variable Divider. The VCO runs at 10 times the incoming frequency or 200 times the incoming frequency when the 38Hz Filter is selected. If L38Hz is low, Q1 is off, U2B is held reset and the VCO is divided by 200. If L38Hz is high, U6A is reset and the VCO is divided by 10.

A22-23 When the LAD' line is high, the output of the Frequency Multiplier is connected to the Counter U23(24). When the processor pulls the LAD line low the 500kHz clock is connected to the counter.

A22-24 Demodulator Local Oscillator

A22-25 This circuit comprises two crystal controlled oscillators. (Y1 and Y2) which oscillate at 1.3775MHz and 1.7475MHz respectively. When HDEMOD/HUSB is high the 1.7475MHz signal (upper sideband) is selected at U19A. When HUSB is low the 1.3775MHz signal (lower sideband) is selected at U19B.

A22-26 U25A/U25B divide the selected LO frequency by 100 to accomodate the IF of 15.625kHz (on Assembly A21). 17.475kHz - 15.625kHz = 1.85kHz, 15.625kHz - 13.775kHz = 1.85kHz.

A22-27 TROUBLESHOOTING NOTES

1. A description of all the key sequences referred to in these notes will be found in Appendix B.

2. The A/D CONVERTER assembly has two main functions, A/D conversion and Frequency counting. A large part of the assembly can be quickly verified as follows:

NOTE
THE FOLLOWING CHECKS
CANNOT BE CARRIED OUT ON
SERIAL Nos. BELOW -00332.

(a) Press the 3.1kHz FILTER key.

(b) Press TR, 2, 9 to enter the calibration test mode (with the cal signal on continuously). If error E97 is present, proceed with step c. If error E97 is not present, miss out step c.

(c) If an error E97 is present connect A22TL1 to the CLK XTAL position to ensure a signal is present at the Selector & Limiter U26(4).

(d) Press TR, 2, 4. This sets the A/D COUNTER Assembly permanently in the Frequency Count mode of operation with the LAD line high. For normal counter operations, accessed by pressing COUNTER, MEAS or TR, COUNTER, MEAS the A/D converter assembly time-shares between frequency counter operations and A/D conversions. The LAD line switches high for Counter, and low for A/D.

(e) The FREQ/FDM display should indicate 015625 (or 032768 ± 50 if step c was carried out). If this number is correct it shows most of the A22 assembly is working correctly, only the MULTIPEXER, DUAL RAMP GENERATOR AND DEMOD LO CIRCUITRY have not been checked.

3. Voltages and waveforms are shown on the schematic diagram to assist in checking the A22 assembly. In addition these notes contain information and where necessary, waveforms to give a more complete check on individual circuit blocks.

4. The FREQUENCY DIVIDER can be easily checked by monitoring TP2 to check for a TTL waveform at the 5Hz rate. (The 1MHz input at U13A(15) is successively divided by 10 to give a 1Hz output at U3(9)).

5. The MULTIPLEXER output can be checked by pressing TR, 2, 2 and the | | keys to display "A.d. I.P.= 1". This selects a -1V reference level. TP5 and U15 pin 12 should be at a voltage of -1V ± 0.1V. Table A22-3 shows the relationship between the A.d. I.P. selected and the inputs at U20.

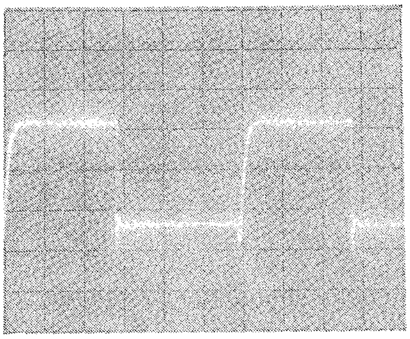
Table A22-3

A.d. I.P. SELECTED	CNT'L DATA (U20)			I/P (U20)
	A0	A1	A2	
0 IF LOG	0	0	0	0 (pin4)
1 -1V TEST	0	0	1	4 (pin12)
2 φ JITTER	0	1	0	2 (pin6)
3 GROUP POWER LOG	0	1	1	6 (pin10)
4 BROADBAND POWER LOG	1	0	0	1 (pin5)
5 GND	1	0	1	5 (pin11)
6 WTD FILTER LOG	0	1	1	3 (pin7)
7 REF GND	1	1	1	7 (pin9)

6. The SERIAL to PARALLEL CONVERTER can be checked by monitoring the outputs of the Latch U21.
L38Hz goes low when 38Hz FILTER, MEAS pressed.
H SMOOTH goes high when AVE 1 is pressed.
H USB goes low when TR, LOWER pressed, and high when TR, UPPER pressed.
L 12kHz goes low when TR, 3.1kHz pressed.
LAD should be low after pressing FREQ, MEAS.
A0, A1 and A2 states are described in step 5.

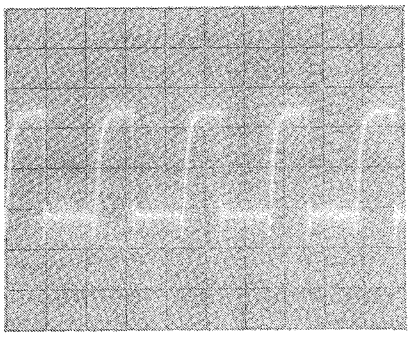
7. The FREQUENCY MULTIPLIER produces an output at 10 times the incoming frequency (at U16 pin 14) except when the 38Hz FILTER is selected when it produces an output at 200 times the incoming frequency.

Q6 collector with 3.1kHz FILTER selected and TL1 connected to CLK XTAL.



2V/div 0.5μsec/div

Q6 collector with 38Hz FILTER selected and TL1 connected to CLK XTAL.



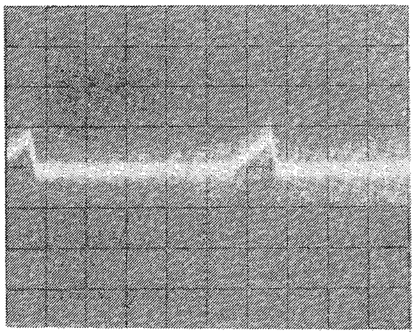
2V/div 0.5μsec/div

The voltage at TP1 should increase when the filter setting is changed from 3.1kHz to 38Hz.

8. A/D (DUAL RAMP GENERATOR, CONTROL LOGIC & COUNTER)

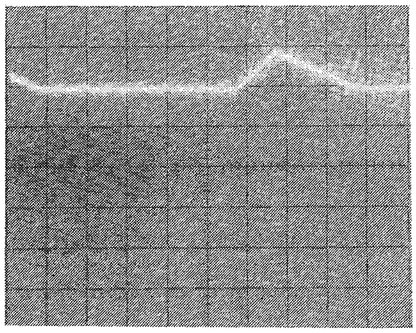
(a) The following three waveforms monitored at C8 (U16 pin 7) show the correct operation of the Dual Ramp Generator. Note that failure of the Control Logic or Frequency counter will automatically prevent correct waveforms.

Press AVE 0, TR, 2, 9 followed by TR 2, 3.



0.05V/div 2msec/div

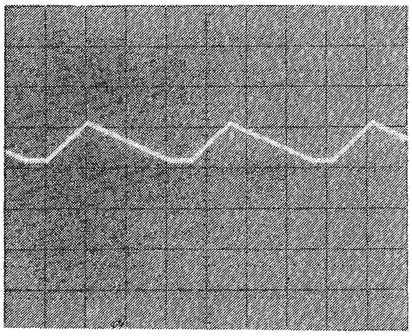
Press AVE 1, TR, 2, 9 followed by TR, 2, 3.



0.5V/div 2msec/div

Note: The rise time on AVE 0/1 is always 2ms.

Press AVE 2, TR, 2, 9 followed by TR, 2, 3.



5V/cm 20msec/div

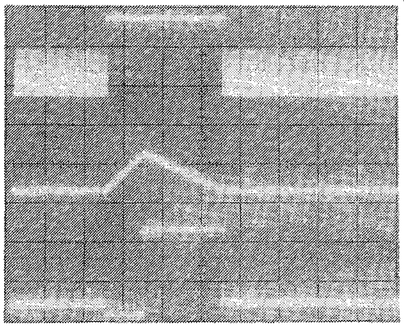
Note: The rise time on AVE 2 is always 20ms. The above waveforms have a dc offset of 1V ± 0.2V. If this offset is incorrect, replace Q2 or U16.

(b) If the Control Logic is suspect use the Control Logic Flow Charts (Figures A22-3 and A22-4) to assist in troubleshooting. Check the states of flip-flops U17A and U17B to find what state the control logic hangs-up in.

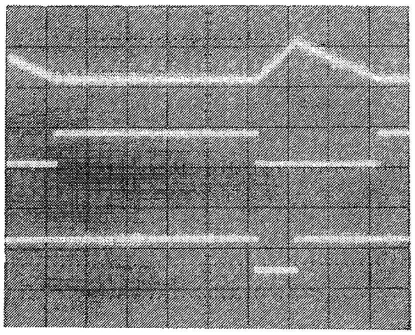
On instruments below serial number -00332 use the Control Logic flow chart for A/D operation (Figure A22-3) and set the SLMS to FREQ, MEAS. On instruments with serial numbers -00332 and above set the SLMS to the count only mode by pressing TR, 2, 4. To ensure the counter has a clock signal, connect A22 TL1 to the CLK XTAL position. The Control Logic Flow Chart for frequency count operation (figure A22-4) can now be used to check the control logic. It is easier to check the control logic in this mode of operation since only two qualifiers (denoted by the diamond shape boxes) are necessary to cause a change of state of the control logic.

(c) The following waveforms show the timing relationship between the ramp at U16(7) other outputs of U16 and the control logic flip-flops (U17A U17B) outputs.

Press TR, 2, 9 followed by TR, 2, 3.



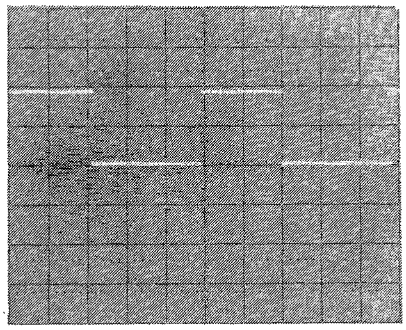
5V/0.5V/.5Vper div 2msec/div



5V /div except U16 which is 0.5V 2msec/div

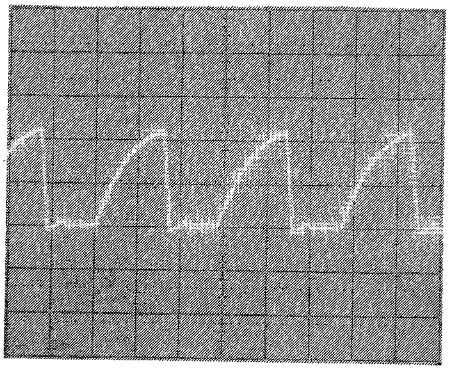
Additional Troubleshooting waveforms.

U29 (pin 9) Press FREQ, 1000, MEAS, followed by COUNTER, MEAS.



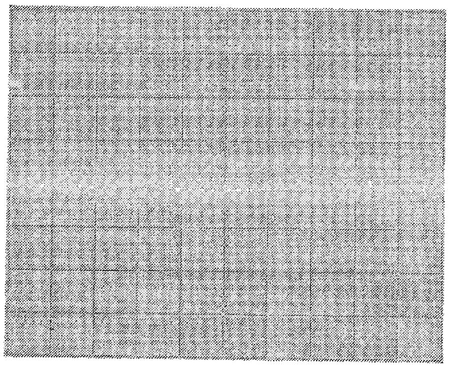
2V/div 50msec/div

TP8
Press 3.1kHz, AVE, 1, TR, 2, 9.



2V/div 0.2μ sec/div

U29(pin 9)
H SCAN
Press FREQ, 1000, MEAS.



U23
(15)

5V/div 2m sec/div

NOTE: If error E97 occurs, the SLMS will automatically go to the HALT mode. Press MEAS to override this condition.

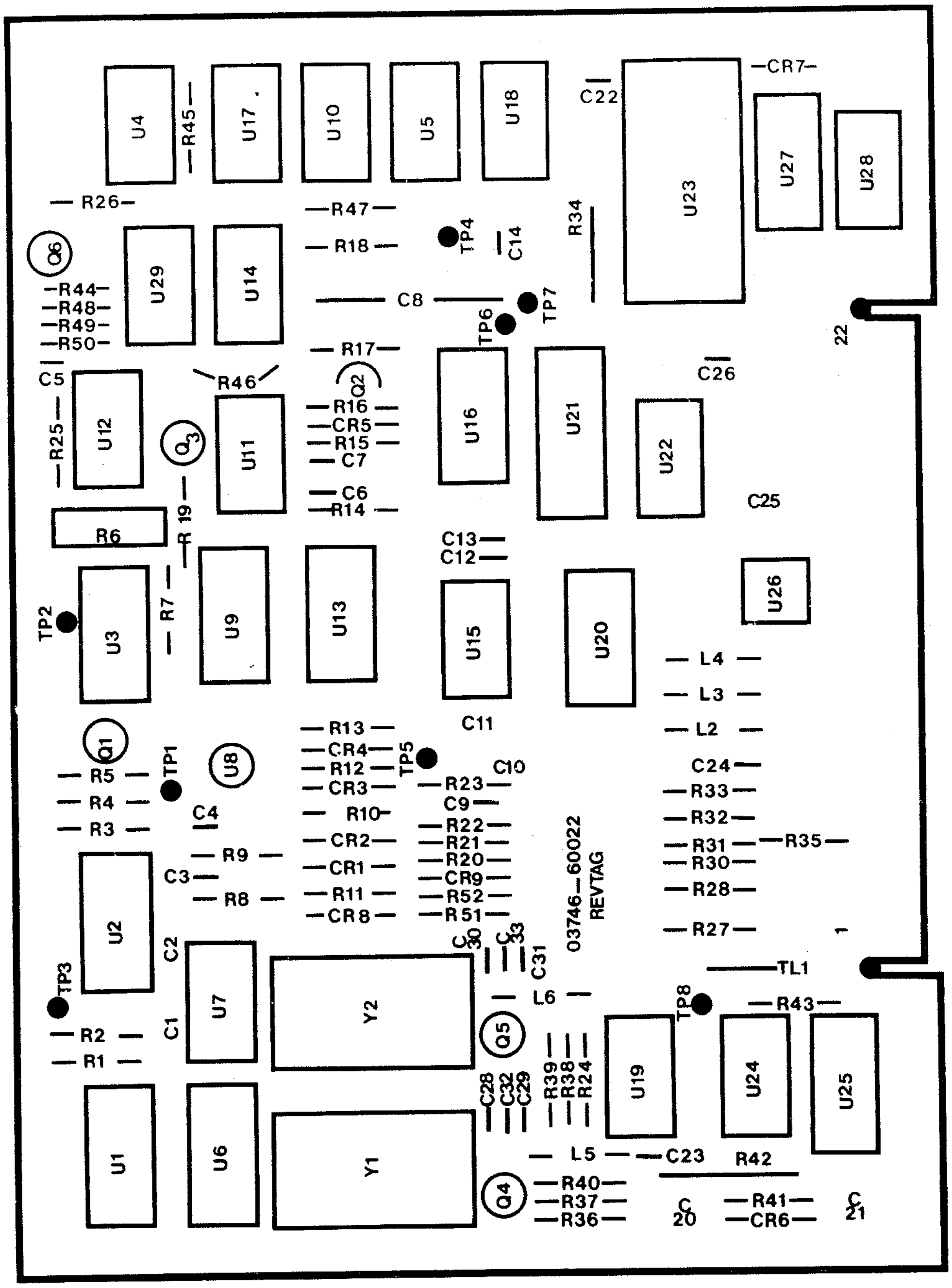
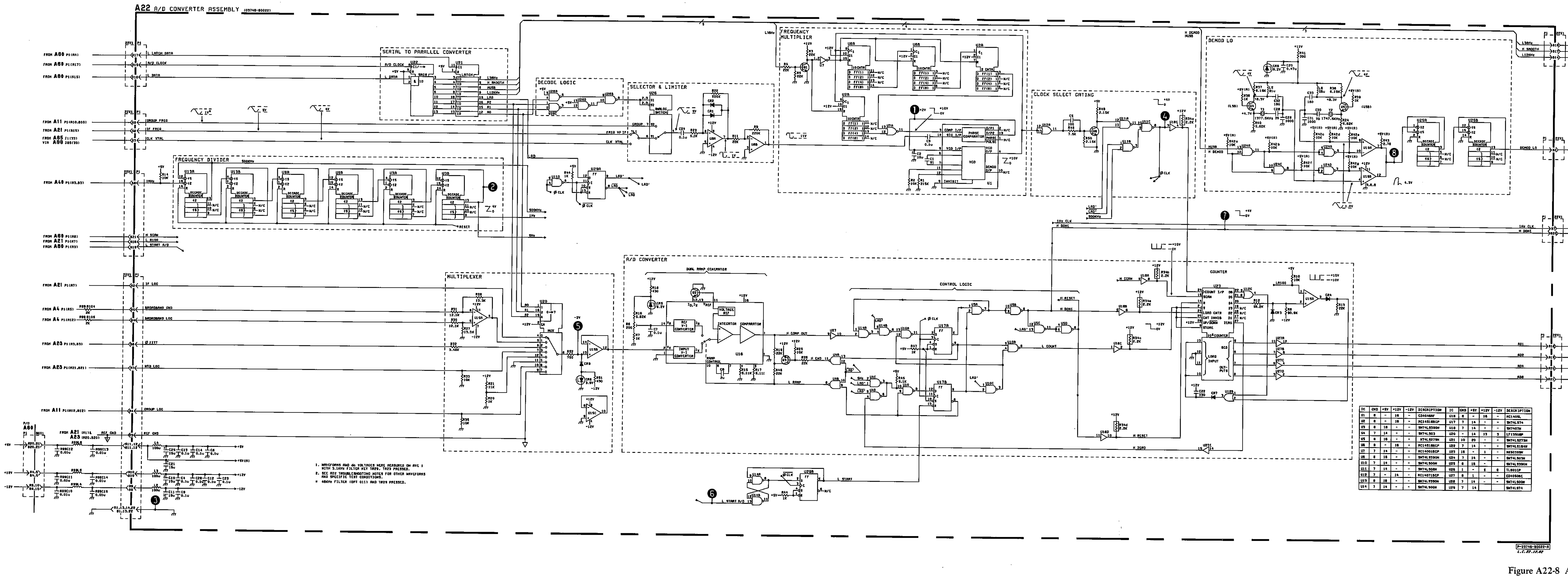


Figure A22-7 A22 Component Location



1. WAVEFORMS AND dc VOLTAGES WERE MEASURED ON AVE 1 WITH 3.1KHz FILTER KEY TR29, TR23 PRESSED.
2. SEE A22 TROUBLESHOOTING NOTES FOR OTHER WAVEFORMS AND SPECIFIC TEST CONDITIONS.

* 48KHz FILTER (OPT 011) AND TR29 PRESSED.

IC	GND	+5V	+12V	-12V	DESCRIPTION	IC	GND	+5V	+12V	-12V	DESCRIPTION
U1	8	-	16	-	CD4046AF	U16	8	-	16	-	MC1405L
U2	8	-	16	-	MC14518BCP	U17	7	14	-	-	SN74LS74
U3	8	16	-	-	SN74LS390N	U18	7	14	-	-	SN7407N
U4	7	14	-	-	SN74LS03	U20	-	14	11	3	LF13508P
U5	8	16	-	-	N74LS279N	U21	10	20	-	-	SN74LS273N
U6	8	-	16	-	MC14518BCP	U22	7	14	-	-	SN74LS184N
U7	7	14	-	-	MC14001BCP	U23	16	-	1	-	NK50399N
U8	8	16	-	-	SN74LS390N	U24	7	14	-	-	SN74LS03N
U10	7	14	-	-	SN74LS00N	U25	8	16	-		SN74LS390N
U11	7	14	-	-	SN74LS08N	U26	1	-	5	8	TL601CP
U12	7	-	14	-	MC14071BCP	U27	8	1	-	-	CD4050BE
U13	8	16	-	-	SN74LS390N	U28	7	14	-	-	SN74LS00N
U14	7	14	-	-	SN74LS00N	U29	7	14			SN74LS74

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Figure A22-8 A22 Schematic Diagram

ASSEMBLY SERVICE SHEET A23
HOT TONE AND CHANNEL IMPAIRMENTS
(OPTION 015/016)

A23-1 INTRODUCTION

A23-2 This optional assembly allows the measurement of signal impairments due to Phase Jitter, Weighted/Notched Noise, and Impulse Noise. For ease of use the schematic diagram has been divided into three parts corresponding to the three different measurement functions.

A23-3 PART 1 - PHASE JITTER

A23-4 A demodulated 1kHz tone from Assembly A21 is applied to the Band Pass Filter U1a, U1b, U1c, via TL1 and TP1. The filter has a pass band of ±300Hz centred on 1kHz. Provision is made to connect a test signal via TP3 when TL1 is removed.

A23-5 Limiter U1d limits the signal from the band pass filter and gives a TTL level square wave via Q1 at the input to the phase lock loop. Feed-back via C6 serves to speed up the slew rate of the limiter. (U3c is a buffer which further ensures that the TTL levels are supplied to the phase lock loop.)

A23-6 The Phase Lock Loop employs a Phase Frequency Detector (U4/U40A) to detect differences between the incoming signal and an internally generated one. The output of U40A drives an integrator (U2). Two of the integrator resistors (R18 and R19) can be switched out of circuit by U40B changing the time constant of the integrator by a factor of eleven, while the gain remains the same. This facility is used on the 4Hz range to slow the circuit down. A 4kHz Oscillator (U5) in its astable mode, is controlled by the integrator output. The oscillator output is divided by four at U6A and U6B so that it can be compared with the incoming 1kHz tone in U4.

A23-7 U3A and U3B form an exclusive OR mixer, which is a phase detector, not a phase/frequency detector as U4 is. The effect on the 1kHz signal from the divider is to shift it by 90 degrees. This is necessary because the PSD (U4) operates at 0 degrees phase difference which means that small errors, such as the Phase Jitter signal produce only narrow spikes unsuitable for the following stages. By shifting the reference by 90 degrees and comparing that signal with the incoming signal what is produced is a square wave which is easier for the following circuitry to handle.

A23-8 As mentioned above, the Phase Jitter signal produces narrow spikes at U4 output. These narrow spikes are also difficult for the Integrator (U2) to handle. To overcome this, R163 draws current from the charge path continuously, which can only be replaced by the PSD U4, which has the effect of running the whole loop at a slight phase offset (of about 40 degrees at 10MHz). On instruments above Serial Number 2314U-00352, the PSD U4 switches a pre-defined charge pump circuit around U40A to achieve the same effect.

A23-9 The output of the Phase Lock Loop therefore, is the difference between the 1kHz reference, and the incoming signal with the phase jitter impressed on it. This signal is Buffered by op-amp U8A. U8A drives two signal paths, a 300Hz Low Pass Filter Path and a 20Hz Low Pass Filter path, to accomodate the three phase jitter ranges, 4 to 300Hz, 20 to 300Hz and 4 to 20Hz.

A23-10 Both 300Hz ranges pass through the 300Hz Low Pass Filter which removes the 1kHz component, leaving only the phase jitter signal. This signal is either switched directly to the Peak-to-Peak Detector by U11, if on the 4 to 300Hz range, or through the 20Hz High Pass Filter if on the 4 to 300Hz range. R43 in the Low Pass Filter adjusts the gain.

A23-11 When on the 4 to 20Hz range, the 1kHz component is removed by the 20Hz Low Pass Filter and the phase jitter signal is switched by U12 and U39 to the Peak-to-Peak Detector. R53 adjusts the gain of this filter.

A23-12 The 4Hz cut-off of both filters is defined inherantly by the loop characteristics and by a combination of C15/R36 and C30/R57.

A23-13 From the band defining filters the phase jitter signal is applied to a the rear panel of the instrument via Buffer U10C and to a Peak-to-Peak Detector. The Peak-to-Peak Detector comprises two peak detectors U13A/B and U13C/D in parallel. The two detectors are symmetrical, one detecting positive peaks and the other negative peaks. Their respective outputs are summed in U10D to give the phase jitter output as a dc level.

A23-14 Consider the detector U13A/U13B. The input is applied to op-amp U13A, the output of which charges C31 in one direction only because of CR7. U13A tries to keep the same voltage on C31 as appears at the input to U13A. If the voltage on the capacitor is less than the input voltage, the next op-amp U13B, a unity gain buffer, feeds back a lesser level to U13A. U13A has a high gain (as defined by R58, R153) so that the inverting input swings sharply positive until the loop is satisfied. When the voltage on the capacitor is greater than the input voltage, U13A cannot charge C31 because of the blocking diode CR7 and the input swings sharply negative. The time constant of the detector is different for the 4Hz and 20Hz ranges as switched by U14B, which effectively changes the point to which leakage current from the holding capacitor is bled. Current is bled from the holding capacitor via R59 to a voltage defined by R158, R159 and R155. When U14B is closed, the division ratio is changed and the capacitor is bled to a voltage nearer ground which discharges the capacitor faster. U14B controls a discharge path for C31 which acts as a reset between measurements. It switches a 1kohm resister R50 to ground to discharge C31 rapidly.

A23-15 The dc level representing the peak-to-peak phase jitter is then applied to the A/D Converter Assembly A22.

A23-16 PART 2 - WEIGHTED/NOTCH FILTER & DETECTOR

A23-17 The demodulated tone from Assembly A21 is also applied to the weighting filters, the first of which is either the C-Message (Option 016) or Phosphometric (Option 015). These are the noise weighting filters which are superimposed on the flat channel filter response.

A23-18 The input tone can either go through the noise weighting filter or bypass it via the amplifier U15D depending on the state of U17. Similarly the tone can either go through the Notch Filter or not depending on the state of U20.

A23-19 The Notch Filter, employs three gyrator circuits instead of large inductors. The first is around C45 which forms a parallel resonant tank circuit with C45 which blocks 1010Hz tones. The next one forms a series resonant circuit with C48. The two together, the parallel resonant circuit followed by a series resonant circuit to ground form a band stop filter centred on 1010Hz. The third gyrator forms a parallel resonant circuit with C51 to ground which gives a band pass filter response. The bandstop filter and the band pass filter feed the inputs of summation amplifier U19B so that at resonance, the inputs are the same and therefore there is zero output from U19B.

A23-20 Virtual earth switch U20 grounds the unused signal path to prevent breakthrough past the notch filter.

A23-21 Following the switch are two switched gain stages (15dB and 30dB) which allows autoranging down the notch if required i.e. if there is a signal in the middle of the notch the gain can be increased to allow the signal to be measured.

A23-22 An RMS to DC Log Converter U35 follows the switched gain stages to convert the signal to a dc log level. The reference current for U35 is taken from a +12V reference supply and is adjusted by R142, setting the dc offset. U35 has a switched time constant, switched by U37. U37 switches C69 in or out of circuit so that the capacitance is either 11uF or 1uF. U36 maintains the same voltage on the 10uF as that on the 1uF capacitor so reducing the settling time required when the 10uF capacitor is switched in. There is a reset function for U35, controlled by the HLGRST line via FET Q6. Q6 resets the converter each time a measurement is made or each time the instrument autoranges.

A23-23 The dc log output is applied to a temperature compensated dc gain stage U38. Thermistor R145 provides the gain compensation. Resistor network R146, R147, R148 provides offset compensation by biasing U38 input with a current derived from a diode drop above ground. CR12 is a clamp to prevent the output from going positive and so protect the A/D Converter on Assembly A22. The gain of the amplifier is adjusted with R150 to obtain the correct dB/volt slope of the assembly.

A23-24 PART 3 - IMPULSE CIRCUITRY

A23-25 After the two switched gain stages on part 2, the notched and/or weighted signal is also taken to a threshold detector which is used for doing an impulse count. The threshold used is setup on the D/A Converter by the processor. The 16-bit serial input L LATCH DATA is converted to parallel format by the Serial to Parallel Converter. The D/A Converter current output is changed to a voltage by U29 which drives the inverting input of the Comparator U30. The signal to be measured is Full Wave Rectified by U21A and U21B and then compared with the threshold in U30. If it exceeds the threshold the comparator output is a TTL one which fires the One Shot Monostable U31 which runs at 7Hz for Option 016 or 8Hz for Option 015 as defined by the time constant R132, R133, C62. The time constant can be switched by U32 to run at 1kHz in the calibration mode.

A23-26 The output of U31 drives a 4-bit binary counter U33. The processor reads the count every second and compares it with the last output to count the number of impulses there have been. U34 is a tri-state buffer which drives the lines IMP0 to IMP3 which are sent to the processor.

A23-27 HOT TONE MEASUREMENTS

A23-28 On instruments on and above Serial Number 2314U-00352, a HOT TONE assembly (A23) is fitted as standard. The circuitry on this assembly is identical to the circuitry described as for PART 3–IMPULSE CIRCUITRY. The IF signal level A21 is compared with the pre- defined limits set at the D/A converter.

A23-29 On instruments fitted with a channel impairments option, the IF signal for hot tone measurements is selected at U41 (Part 2). The comparitor output level clocks U33 via U34B and U34D, (by-passing the timer).

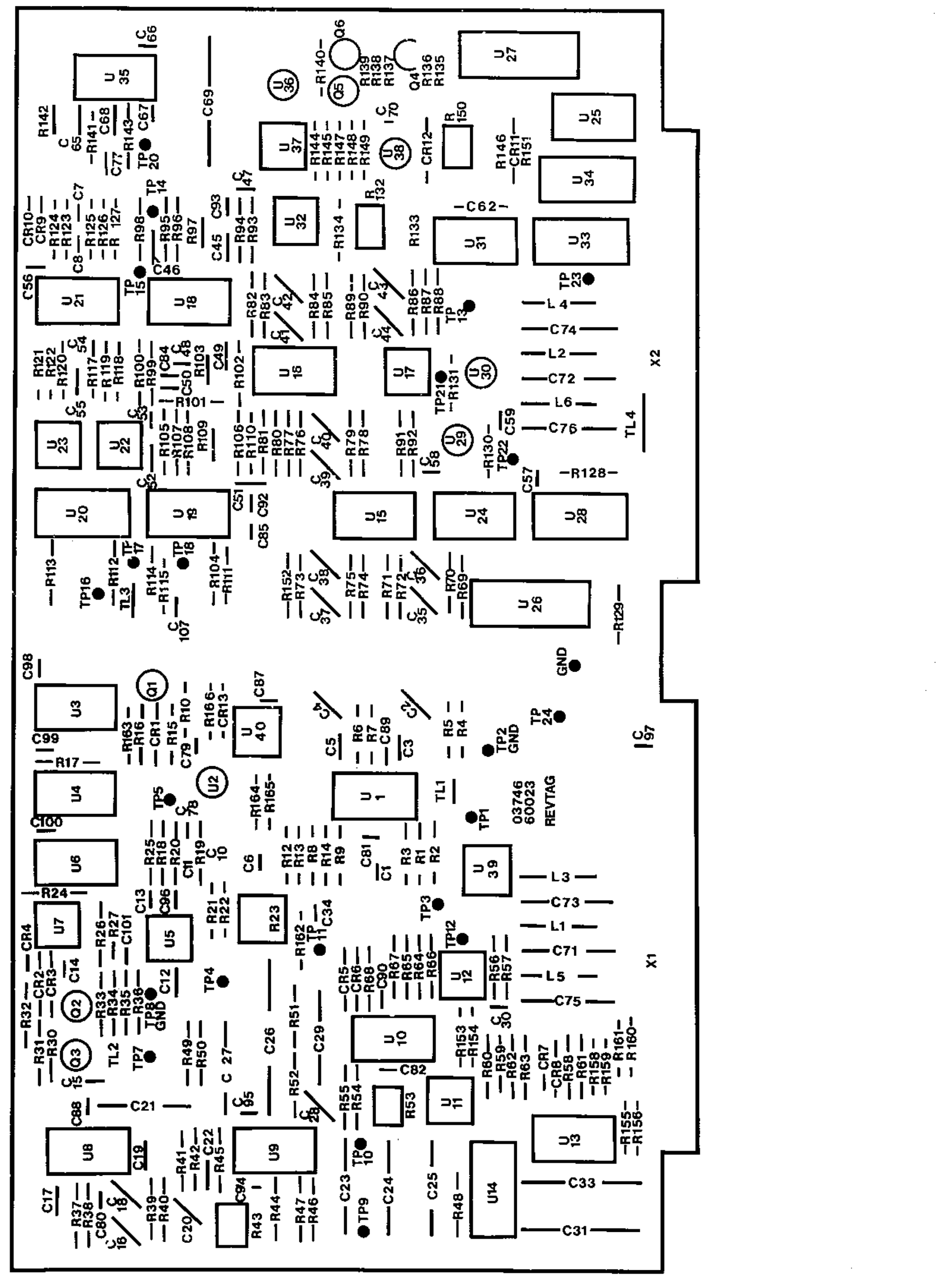
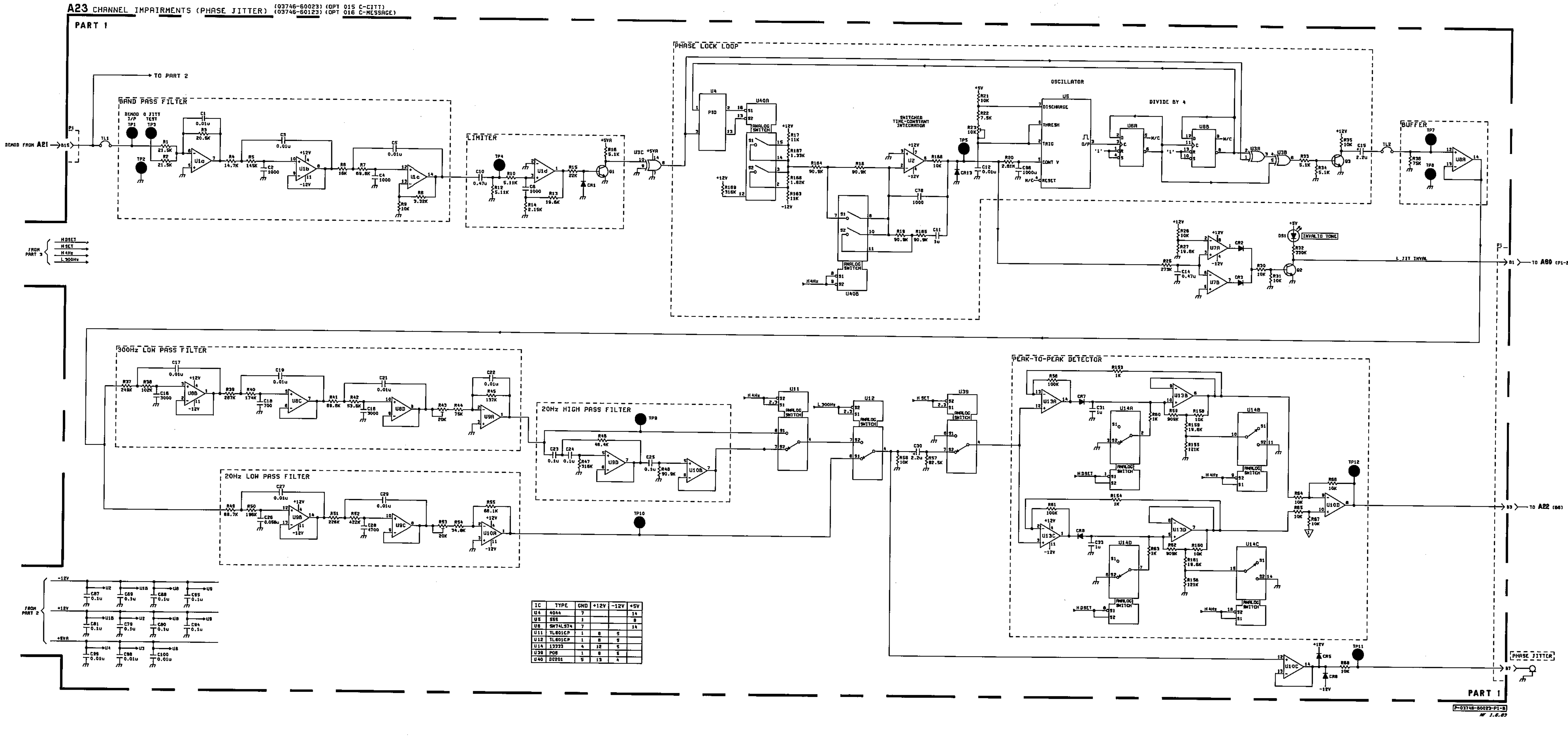


Figure A23-1 A23 Component Location

A22 Schematic Diagram



IC	TYPE	GND	+12V	-12V	+5V
U4	4044	7			14
U5	555	1			8
U6	SN74LS74	7			14
U11	TL601CP	1	8	5	
U12	TL601CP	1	8	5	
U14	13333	4	12	5	
U39	P08	1	8	5	
U40	DG201	5	13	4	

Figure A23-2 A23 Schematic Diagram Part 1

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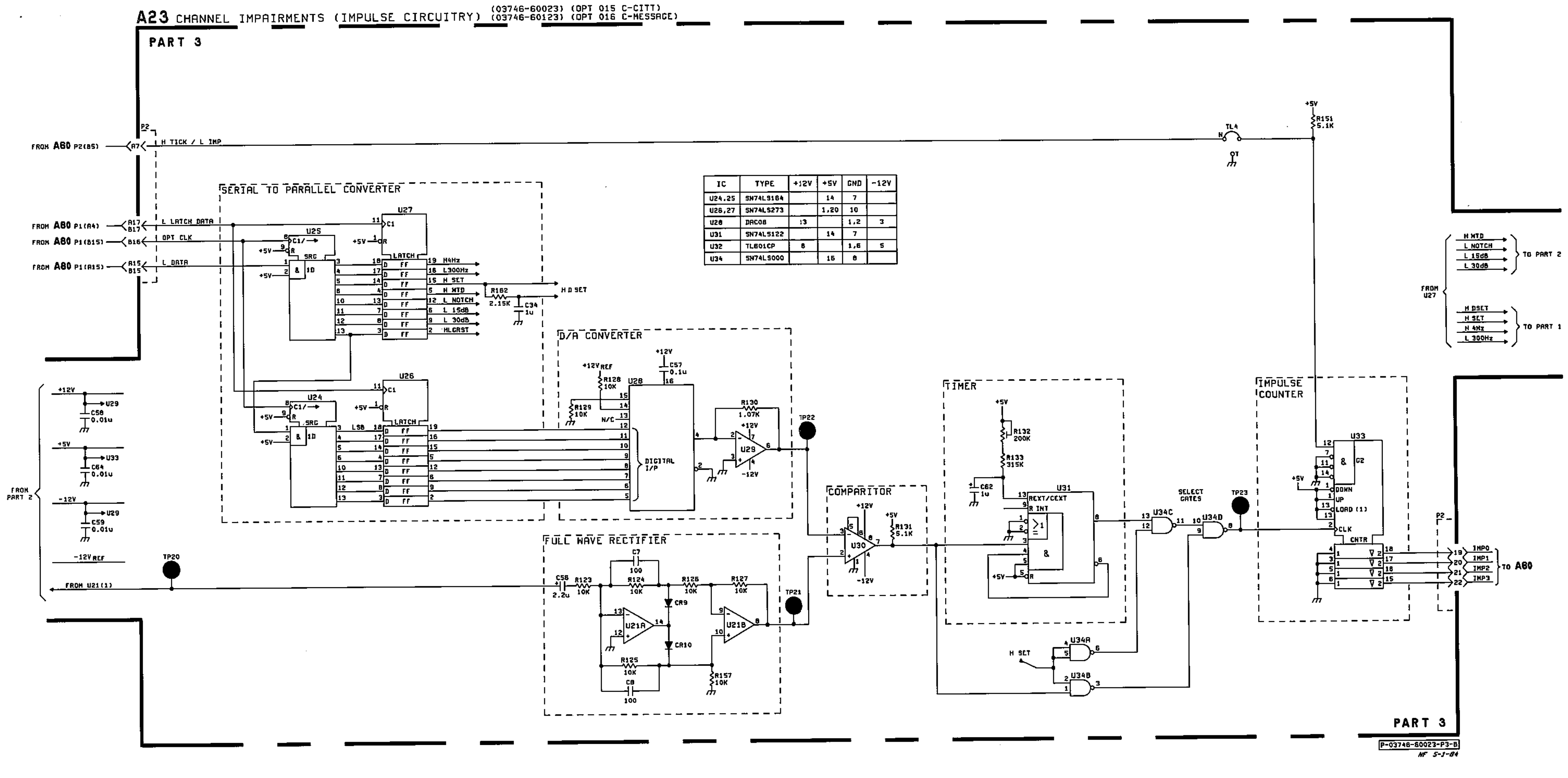
IC	TYPE	+12V	GND	-12V
U20	13333	12	4	5
U22	TL601CP	8	1	5
U23	TL601CP	8	1	5
U35	AD536AJ	14	9,10	3
U37	TL601CP	8	1	5
U41	TL601CP	8	1	5

A23 Schematic Diagram Part 1

Figure A23-3 A23 Schematic Diagram Part 2



IC	TYPE	+12V	+5V	GND	-12V
U24,25	SN74LS164		14	7	
U26,27	SN74LS273		1,20	10	
U28	DAC08	13		1,2	3
U31	SN74LS122		14	7	
U32	TL601CP	8		1,6	5
U34	SN74LS000		16	8	

Figure A23-4 A23 Schematic Diagram Part 3

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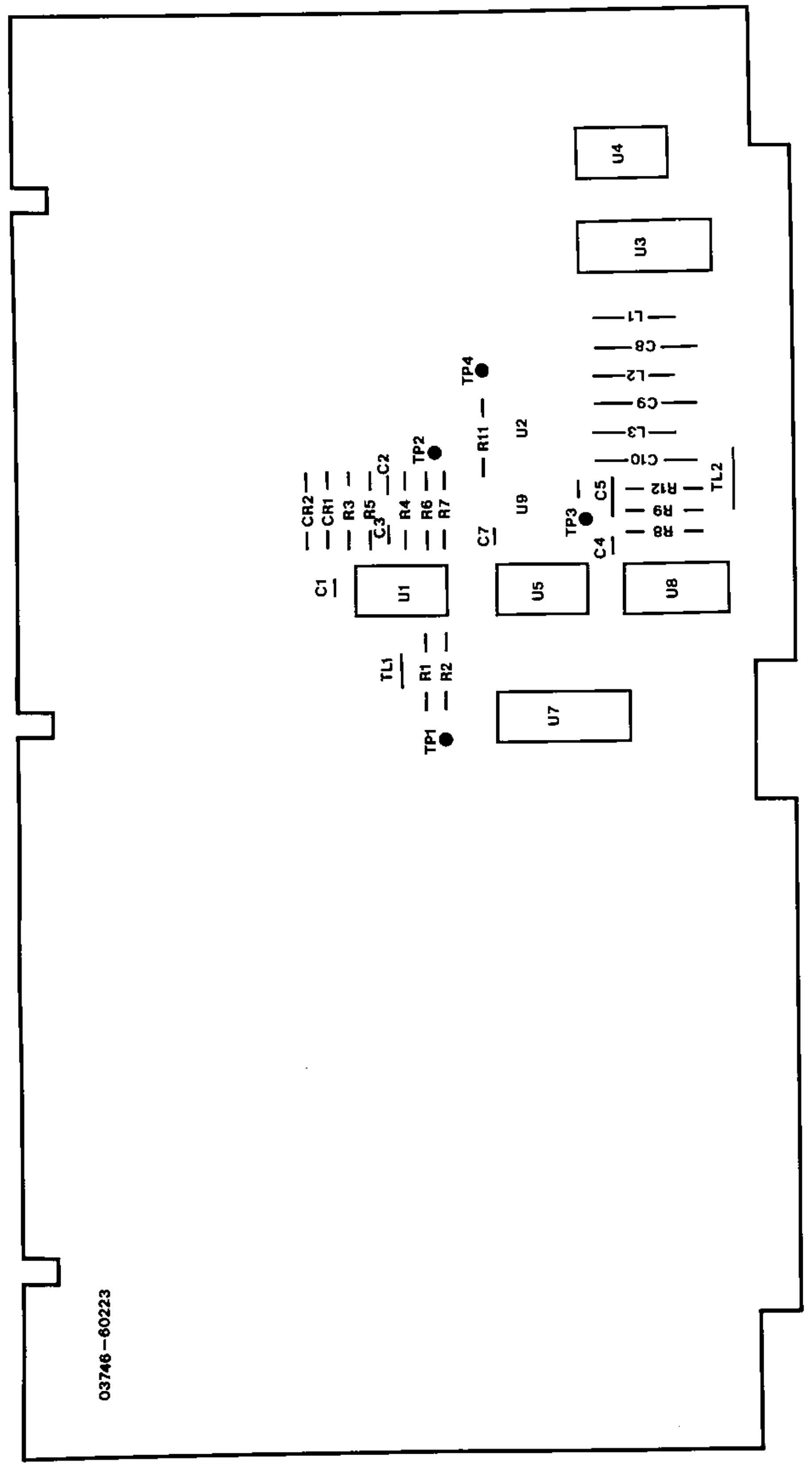


Figure A23-5 A23 Component Location

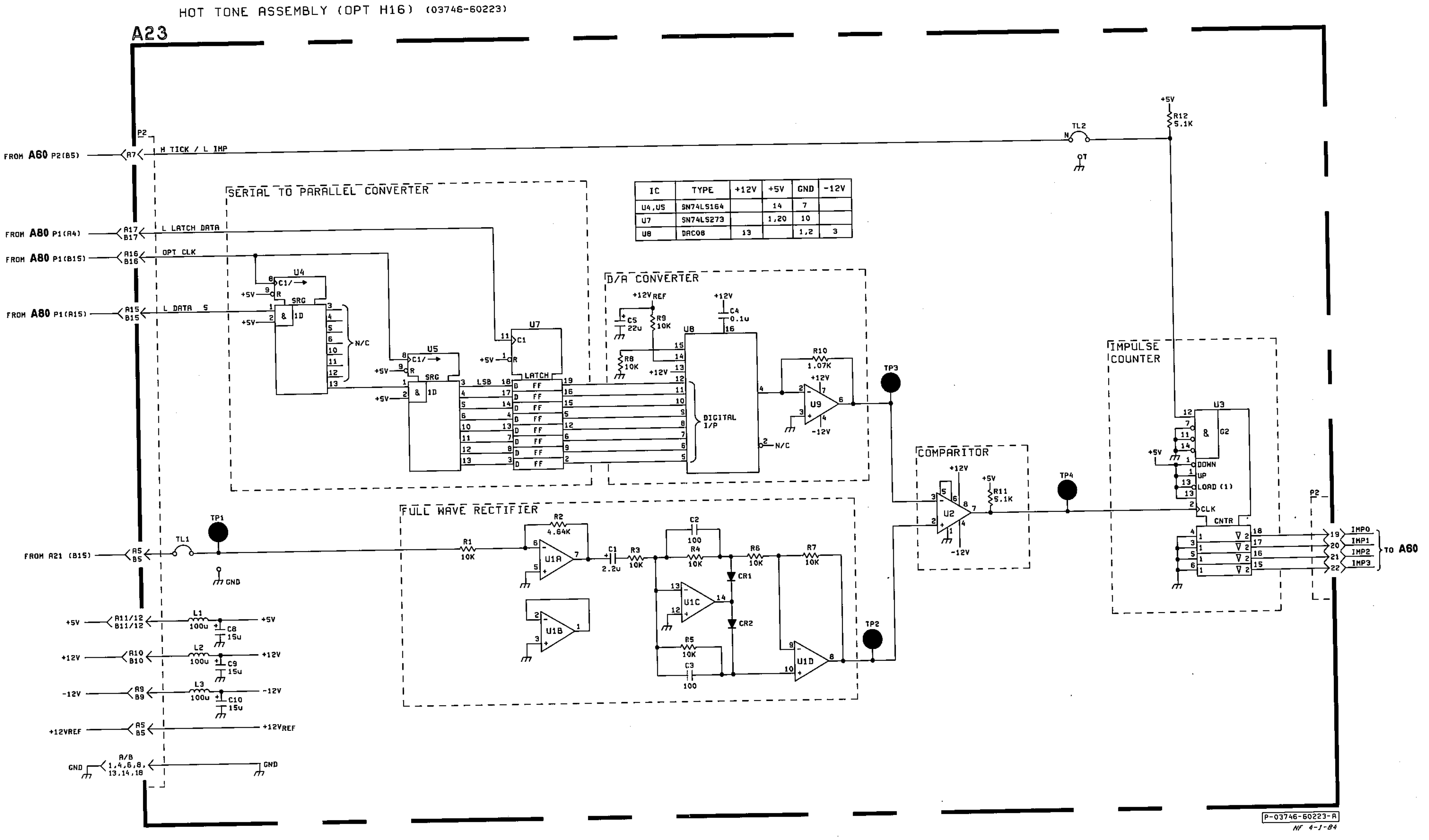
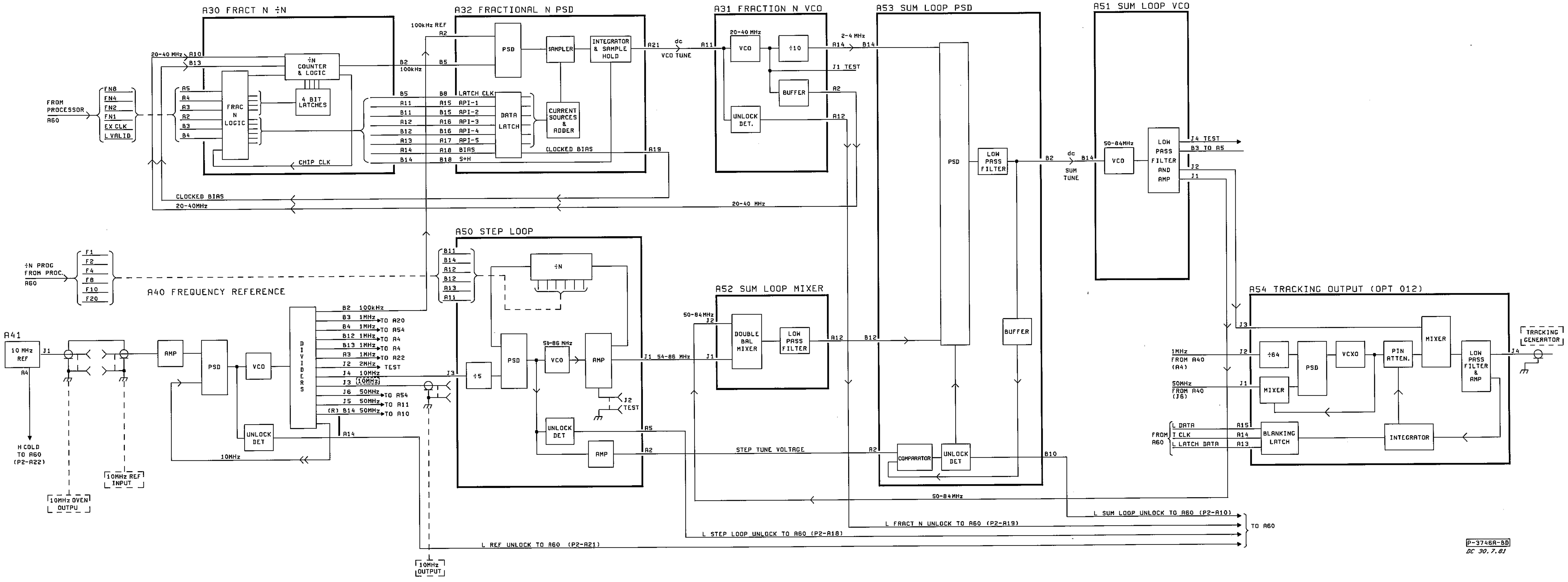


Figure A23-6 A23 Schematic Diagram

◀ A23 Component Location



Synthesizer Block Diagram

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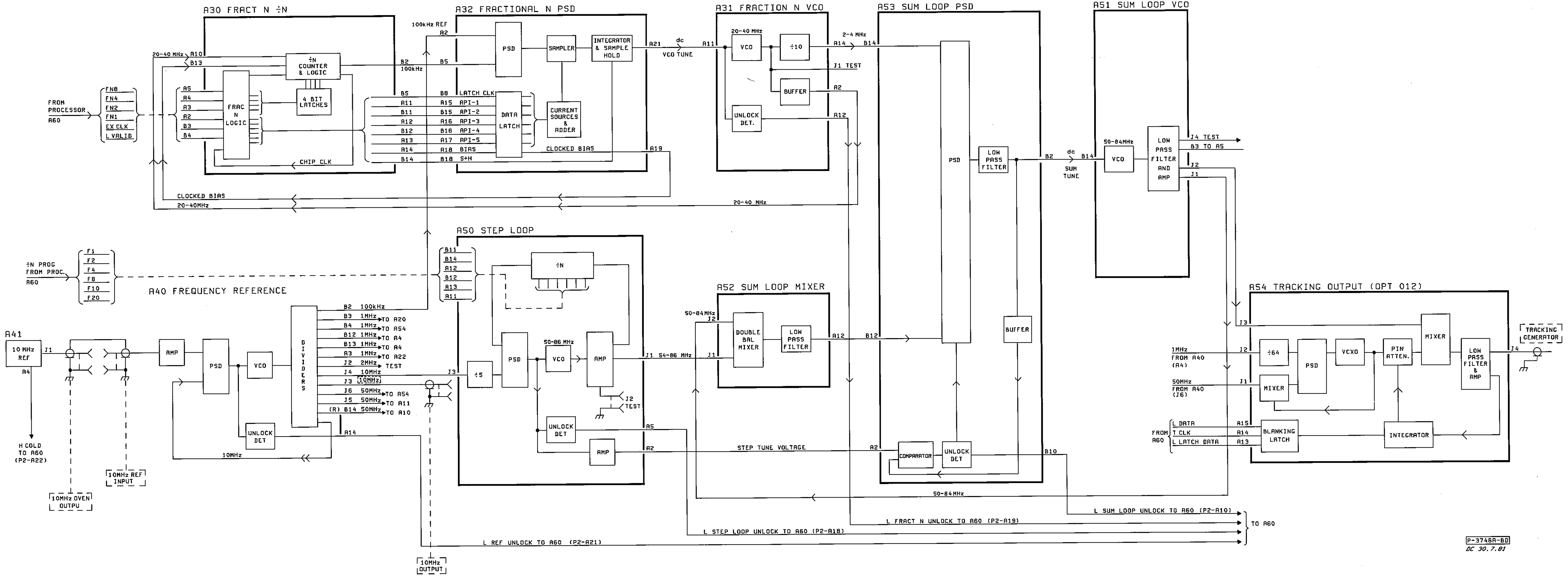


Synthesizer Block Diagram

SYNTHESIZER SECTION

SIMPLIFIED BLOCK DIAGRAM

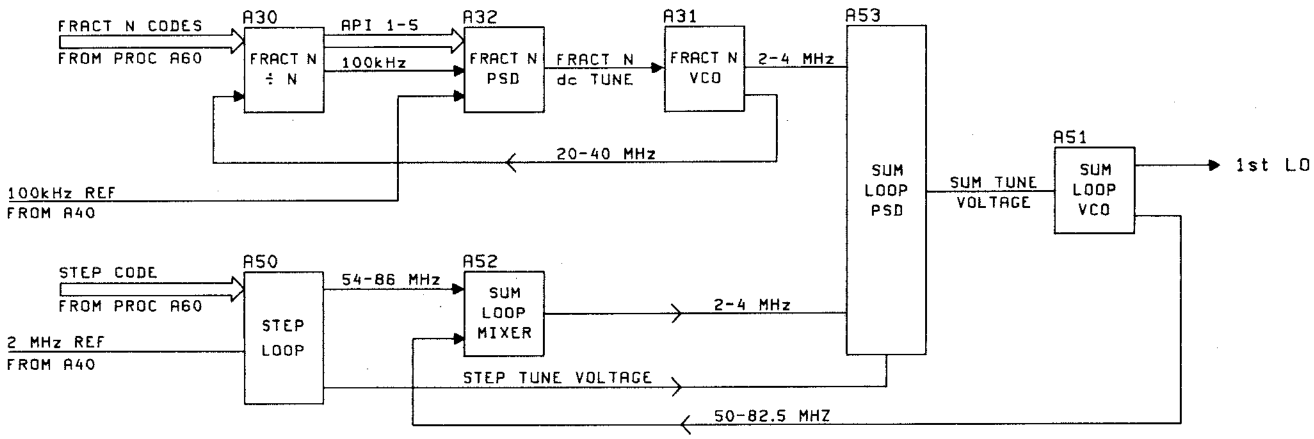


Figure 8S-1 Simplified Block Diagram

8S-1 INTRODUCTION

8S-2 This section of the manual contains information which describes the Synthesizer Section of the 3746A.

8S-3 GENERAL DESCRIPTION

8S-4 The Synthesizer General Description, aided by a Detailed and Simplified Block Diagram, describes the action of the Synthesizer.

8S-5 ASSEMBLY SERVICE SHEETS

8S-6 The Assembly Service Sheets are listed below. They contain component layout and schematic diagrams of the individual assemblies.

A30 Fractional N divide by N

A31 Fractional N VCO

A32 Fractional N PSD

A40 Frequency Reference

A41 10MHz Reference

A50 Step Loop

A51 Sum Loop VCO

A52 Sum Loop Mixer

A53 Sum Loop PSD

A54 Tracking Generator (Option 012)

8S-7 TROUBLESHOOTING

8S-8 When a Synthesizer fault has been diagnosed the information in the Synthesizer Troubleshooting should be used to isolate the fault.

8S-9 SYNTHESIZER GENERAL DESCRIPTION

8S-10 The main function of the Synthesizer is to provide a highly accurate and stable tuneable frequency which is used as the 1st Local Oscillator (LO) input to the 3746A Receiver. A Frequency Reference Assembly (A40) provides additional LO signals for successive stages of signal mixing in the Receiver. The Simplified Block Diagram shows how the 1st LO output is synthesized from the three loops.

1. Step 2. Fractional N 3. Sum

8S-11 The Step Loop (A50) is controlled by the processor and tunes to frequencies in the range 54 to 86MHz in multiples of 2MHz.

8S-12 The Fractional N Loop (A30, A31 and A32) is also controlled by the processor and tunes to a frequency between 20 and 40MHz. This loop can be tuned precisely, with a resolution of 10Hz. The output of the Fractional N Loop (A31) is divided by 10 to give a 2 to 4MHz reference input with a resolution of 1Hz at the Sum Loop PSD (A53).

8S-13 The Sum Loop (A51, A52 and A53) produces an output frequency equal to the difference between Step Loop and Fractional N Loop frequencies. The 2-4MHz reference signal from the Fractional N Loop is phase Locked to the 2 - 4MHz signal from the Sum Loop Mixer. The Sum Loop PSD produces a resultant dc SUM TUNE VOLTAGE to tune the SUM LOOP VCO. The STEP TUNE VOLTAGE ensures that the Sum Loop VCO tracks close to the Step Loop VCO and is always greater than the Step Loop VCO frequency.

8S-14 Thus the Step Loop can be regarded as providing the coarse frequency stepping of the Sum Loop VCO while the Fractional N Loop provides the fine frequency control. The Sum Loop VCO output 50 - 82.5MHz has a 1Hz resolution.

8S-15 FRACTIONAL N LOOP OVERVIEW

8S-16 The Fractional-N Loop circuits on assemblies A30, A31 and A32 form a phase-locked loop which operates over the frequency range 20MHz to 40MHz. The output is divided by 10 to provide a 2MHz - 4MHz signal with a 1Hz resolution as an input to the SUM LOOP (see Figure 8S-2).

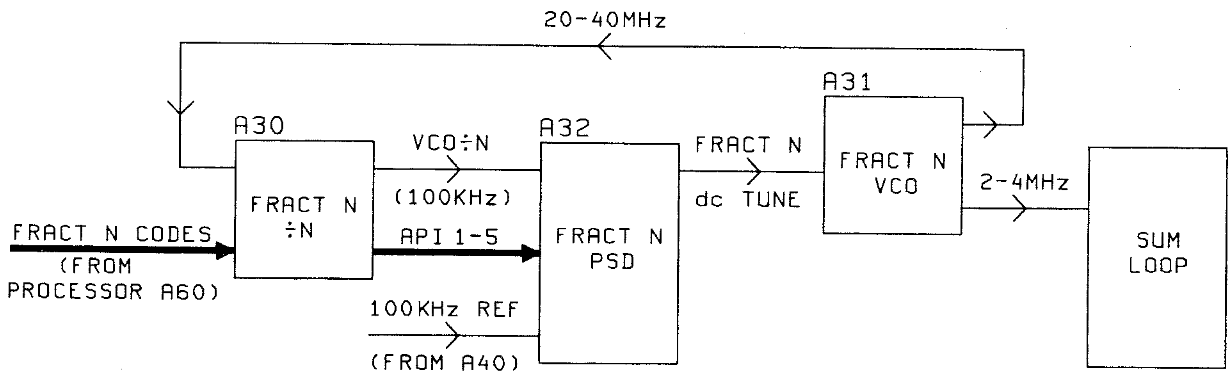


Figure 8S-2

8S-17 In a conventional synthesizer divider loop the VCO frequency is NxF ref. (where N is the division number and F ref is the reference frequency. In the example shown in Figure 8S-3 the VCO Frequency is 20MHz = 200 (divide by N) x 100kHz [F ref], and will always be an integer multiple of the F ref frequency.

8S-18 Consider the conventional loop in Figure 8S-3 with the output from the PSD interrupted, and a precise voltage used to tune the VCO, as shown in Figure 8S-4.

8S-19 The Voltage reference is adjusted to tune the VCO frequency to precisely 20.01MHz. The output from the divide by N now 100.05kHz, would result in a considerable error voltage at the output of the PSD. If the switch S1 was closed this error voltage would tend to override the Voltage reference, and try to pull the VCO frequency back to 20MHz (an exact multiple of F ref).

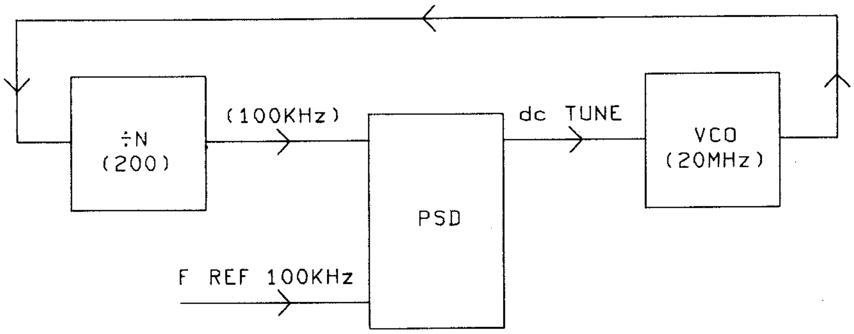


Figure 8S-3

8S-20 In the example shown in Figure 8S-4 for every 10 cycles of F ref the VCO goes through 2001 cycles. If we therefore remove a single pulse every 2000 cycles, the output of the N would be in sync with the F ref frequency. The circuit is modified as shown in Figure 8S-5.

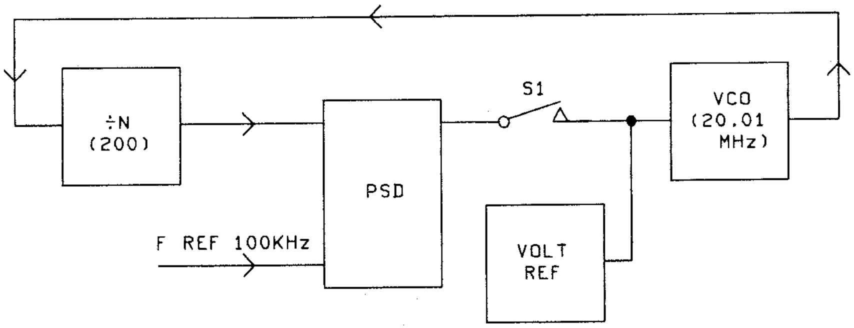


Figure 8S-4

8S-21 Referring to Figure 8S-5, the Pulse Swallow circuit is synchronised to remove a single pulse each time the VCO frequency is at a multiple of 2000Hz, making a total of 10,000 pulse swallows every second. This keeps the input to the divide by N divider circuit at 20MHz (20,010,000Hz - 10,000Hz) and the input to the PSD at 100kHz.

8S-22 A simplified block of a Fractional N loop is shown in Figure 8S-6. The VCO tuning is now a function of the PSD output and the Switched Bias/API Current sources. An Integrator and a Sample hold circuit reduce the complex waveform to a steady dc voltage which determines the tuning point of the VCO.

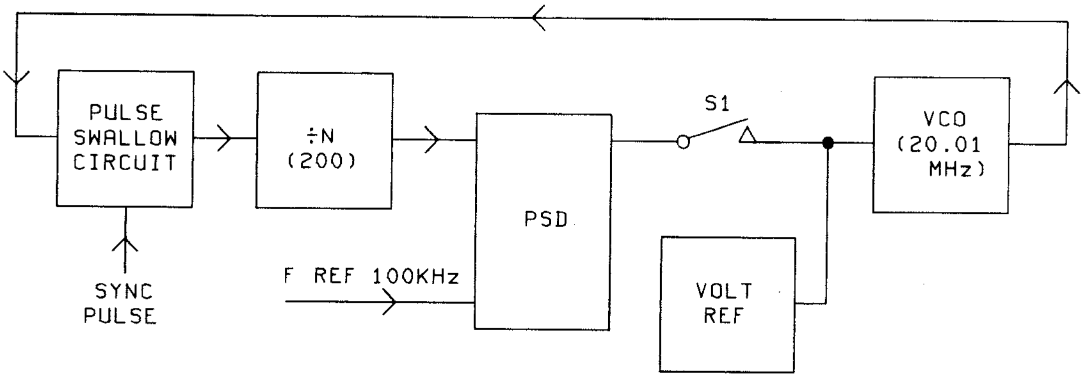


Figure 8S-5

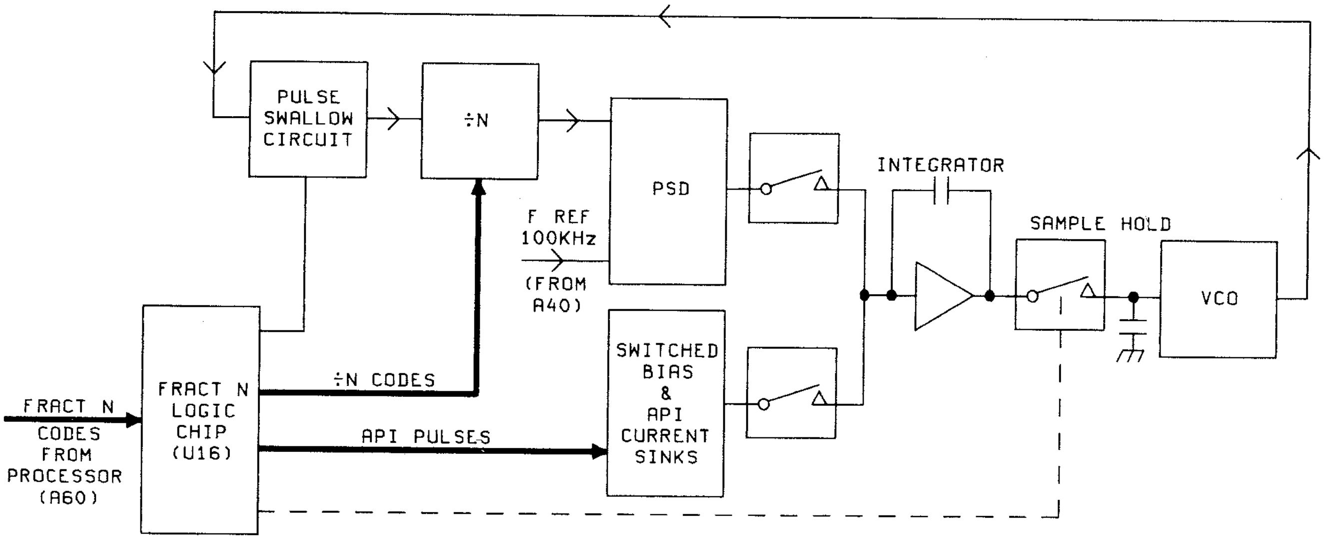


Figure 8S-6

8S-23 In Figure 8S-6 the PSD output is a negative going pulse whose width is proportional to the phase relationship between the leading edges of the input signals. The pulse width controls the ramp-up time of the integrator. The ramp-down time of the integrator is controlled by five current sources known as the Analogue Phase Interpretation (API) current sources. These five current sources enable the VCO to be tuned to a resolution of 1Hz.

8S-24 Control of the intricate tuning, division, and sampling is performed by a special function LSI device known as the Fractional N-chip which determines when to sample the Integrator Output, when to pulse swallow, and when to switch-in the API current sources. Figure 8S-7 shows a typical waveform at the integrator output.

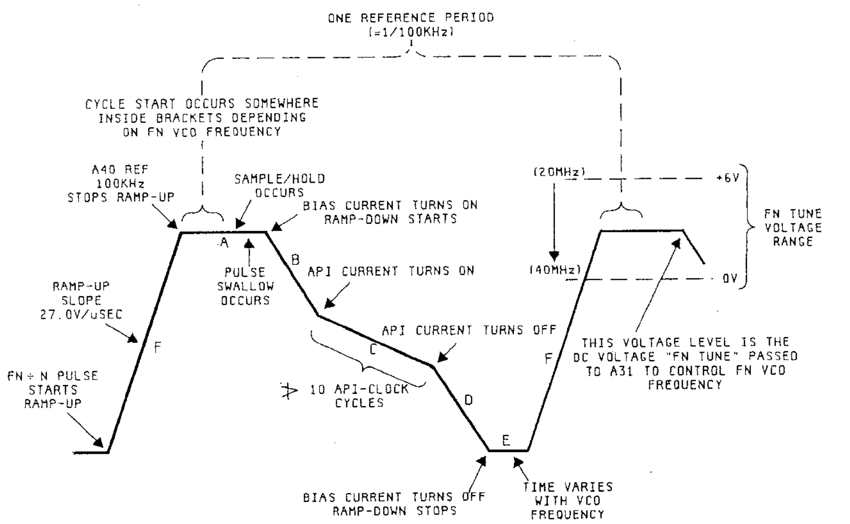


Figure 8S-7

8S-25 To tune the Synthesizer the Processor sends a number to the Fractional N chip. From this the Fractional N chip determines the divide by N number, and the number of pulse swallows to take place, see Table 8S-1.

Table 8S-1

Synthesizer Frequency kHz	divide by N	No. of Pulses Swallows/sec
26.666660	266	66660
10.012570	100	12570

8S-26 SYNTHESIZER TROUBLESHOOTING

8S-27 INTRODUCTION

8S-28 Most catastrophic failures in the Synthesizer cause one of the loops to go out of lock. When a loop goes out of lock an Error Code is displayed in the TEST-POINT display. Should more than one loop go out of lock the Processor selects, on a priority basis, the loop most likely to be faulty. The Error Codes are shown in Table 8S-2.

Note: To ensure accuracy of measurement either gate the counter from the 3746A rear panel 10MHz OUTPUT, or sync the 3746A to the counter by connecting the counter output (which must be a submultiple of 10MHz) to the 3746A 10MHz REF INPUT.

8S-29 Frequency/Tuning errors may sometimes occur if the Synthesizer drifts out of adjustment due to ageing or component failure. Faults of this kind are best checked by monitoring the synthesizer output at selected tuning points to cover lower, middle, and upper tuning points of each loop. Table 8S-3 gives front panel tuning to select the appropriate points in each loop. If the

Table 8S-2 Error Codes

Error Code	Loop Out of Lock	Troubleshooting
E01	FREQUENCY REFERENCE (Assembly A40)	Paragraph 8S-35
E02	STEP LOOP (Assembly A50)	Paragraph 8S-36
E03	FRACTIONAL N LOOP (Assemblies A30 to A32)	Paragraph 8S-37
E04	SUM LOOP (Assemblies A51 to A53)	Paragraph 8S-38
E05	STEP LOOP AND FRACTIONAL N LOOP	
E06	STEP LOOP and SUM LOOP	
E07	FRACTIONAL N LOOP and SUM LOOP	
E09	STEP LOOP, FRACTIONAL N LOOP, and SUM LOOP	

synthesizer output frequency is correct then the STEP LOOP and FRACTIONAL N LOOP frequencies must be correct.

Note: Frequencies in Table 8S-3 are only valid when the 3.1kHz on 38Hz Filters are selected.

If the FRACTIONAL N frequency is incorrect refer to Paragraph 8S-37. If the STEP LOOP frequency is incorrect refer to Paragraph 8S-36. If the Synthesizer frequency is incorrect and both FRACTIONAL and STEP LOOP are correct refer to Paragraph 8S-38.

8S-30 Steps (a) to (c) show how to calculate LOOP FREQUENCIES from a given front panel tuning frequency.

(a) Synthesizer Output Frequency
The synthesizer output frequency (1st L.O.) can be calculated as follows:

Front Panel Input Frequency + 50.015625MHz for 38Hz and 3.1kHz Filter Modes
or Front Panel Input Frequency + 50.05MHz for 48kHz Filter Mode.

Table 8S-3 Front Panel Tuning

Front Panel Tuned Frequency	Synthesizer Frequency A51 J2	Step Loop Frequency A50 J2	Fractional N Frequency A31 J2
31,984.375kHz	82,000,000Hz	86,000,000Hz	40,000,000Hz
31,984.374kHz	81,999,999Hz	84,000,000Hz	20,000,010Hz
16,984.375kHz	67,000,000Hz	70,000,000Hz	30,000,000Hz
00,000.000kHz	50,015,625Hz	54,000,000Hz	39,843,750Hz
1,984.374kHz	51,999,999Hz	54,000,000Hz	20,000,010Hz

(b) Step Loop Output Frequency

The STEP LOOP output frequency will always be the first even numbered integer below the synthesizer output frequency plus 4MHz.

3746A tuned to 1MHz
Synthesizer output is 50.015625MHz
STEP LOOP output is even integer
<50.015625 + 4 = 54MHz

(c) Fractional N Loop Frequency

The FRACTIONAL N LOOP frequency is equal to the STEP LOOP frequency minus the synthesizer output frequency e.g.

3746A tuned to 1MHz
Synthesizer Output is 51.015625MHz
STEP LOOP output is 54MHz
FRACTIONAL N LOOP output is
54 - 51.105625 = 2.984375MHz

8S-31 Processor Test Programs are available to allow each loop to be tested in isolation. These test programs are accessed by pressing the TR key followed by a number.

Fractional N Loop	TR 30	↑	Tunes the FRACTION N LOOP to spot frequency of 40MHz or 20MHz
	TR 32	↑	Tunes the FRACTIONAL N LOOP 20,010.000 through to 20,000.001 by decades
	TR 33	↑	Tunes the FRACTIONAL N LOOP 30,010.000 through to 30,000.001 by decades
	TR 34	↑	Tunes the FRACTIONAL N LOOP 40,010.000 through to 40,000.001 by decades
Step Loop	TR 50	↑	Step Tunes the STEP LOOP to spot frequencies from 52 to 86MHz in 2MHz steps
	TR 51		Continuously sweeps the STEP LOOP in 2MHz steps from 52 to 86MHz
Sum Loop	Press TR 30	↑	to tune the FRACTIONAL N LOOP to 20MHz.
	Press TR 50	↑	to step the SUM LOOP (A51 J4) by 2MHz steps from 50MHz to 84MHz.
	Press TR 51		will continuously sweep the STEP LOOP in 2MHz steps from 50MHz to 84MHz.

8S-32 TROUBLESHOOTING HINTS

8S-33 The easiest method of troubleshooting is by loop isolation, and then by Assembly isolation. The first few steps in each loop check verifies that the loop is working correctly. The remaining steps isolate a fault to Assembly level.

(a) Check for an Error Code (see Table 8S-2) shown in the TEST POINT display.

(b) As well as an Error Code being displayed LEDs on the A31, A40, A50, and A53 show which loop is out of lock. Sometimes more than one UNLOCK LED will be on, when this condition occurs the error indicated on the TEST POINT display shows which loop is most likely to be faulty (see Table 8S-2).

Note: When both the STEP and FRACTIONAL N loops show an out of lock condition check all the reference frequencies at the A40 Assembly.

8S-34 Sometimes there may be no "out-of-lock" indication but the Synthesizer is suspected of being faulty. In such cases the various loop outputs can be checked as in Paragraphs 8S-35, 8S-36, 8S-37 and 8S-38 to verify the synthesizer tuning.

8S-35 Frequency Reference A40

This can be monitored at the rear panel 10MHz OUTPUT. The frequency reading should be 10MHz ± 500Hz; if the Precision Frequency Reference (OPT 014) is fitted the frequency accuracy should be 10MHz ±3Hz.

Note: The following frequency measurements should be made with either the counter gated from the 3746A (use the 10MHz OUTPUT) or with the 3746A gated from the counter (use the 10MHz REF INPUT). In cases where the 3746A is gated from a counter, the counter reference must be 10MHz or an exact submultiple of 10MHz.

8S-36 STEP LOOP Check and Troubleshooting Hints

(a) Monitor the frequency at A50J2.

(b) Press the TR key followed by keys 50.

(c) Repeatedly press the ↑ key and check the frequency changes from 52,000,000Hz to 86,000,000Hz in exact steps of 2,000,000Hz.

(d) If this is not the case refer to Assembly Service Sheet A50 Troubleshooting.

8S-37 FRACTIONAL N LOOP Check and Troubleshooting Hints

(a) Monitor the frequency at A31J1 (TP1) with an electronic counter.

(b) Press the TR key followed by keys 30.

(c) Press the ↑ key several times and check the frequency on the electronic counter changes from 20,000,000Hz to 40,000,000Hz and back for each key press. If the frequency is incorrect proceed to step (g), otherwise continue.

(d) Press key 3, the diagnostic mode should now change to d33 and the frequency on the counter should read 30,010,000Hz.

(e) Repeatedly press the ↑ key. The frequency should change to 30,001,000Hz, 30,000,100Hz, 30,000,010Hz, 30,000,001Hz and 30,111,111Hz.

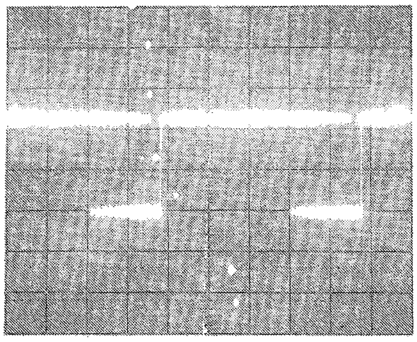
(f) If a fault is indicated proceed from step (g), if no fault is indicated and the Synthesizer is suspect check the remaining loops (8S-35, 8S-36, 8S-38).

(g) A quick check on the VCO, Assembly A31, can be carried out by shorting A31TP3 to ground. The frequency at A31J1 should change to approximately 40MHz when A31TP3 is grounded. If the frequency does not change refer to Assembly A31 Troubleshooting and check the VCO across the range.

(h) To check the Fractional N divide by N Assembly A30, short A31TP3 to ground. Note the frequency at A31J1. Press key 0 (to return the instrument to diagnostic d30 mode), and press the key. The frequency at A30TP3 should be 1/400th of the frequency at A31J1 when the SLMS indicates 40 000 000 and 1/200th of the frequency at A31J1 when the SLMS indicates 20 000 000.

Note: The pulses at A31TP3 are very narrow, and some other spikes may be in evidence making the counter triggering critical. If necessary use an oscilloscope to check for pulses.

(i) Press key 3 (to set the instrument to diagnostic mode d33), and press the ↑ key several times until the 3746A display indicates 30.000 001. Monitor the following:



U16 pin 2 (API-1) this should be a pulse train with the pulse width modulated at 1Hz.

U16 pin 3 (API-2) this should be a pulse train with the pulse width modulated at 10Hz.

U16 pin 4 (API-3) this should be a pulse train with the pulse width modulated at 100Hz.

U16 pin 5 (API-4) this should be a pulse train with the pulse width modulated at 1kHz.

U16 pin 6 (API-5) this should be a pulse train with the pulse width modulated at 10kHz.

This step checks out the Frational N Logic Chip U16 and associated circuitry.

(j) If either step (h) or (i) is wrong refer to Assembly A30 Troubleshooting.

(k) If both steps (h) and (i) appear to be correct then refer to Assembly Service Sheet A32 Troubleshooting. If the FRACTIONAL N LOOP goes out of lock at certain frequencies only, refer to the troubleshooting on Assemblies A30/A31 first, then if necessary to Assembly A32 Troubleshooting.

8S-38 SUM LOOP Check and Troubleshooting Hints

(a) Monitor the frequency at A51J4.

(b) Press the TR key followed by keys 30.

(c) Press the ↑ key to give 20 000 000 on the 3746A displays. This tunes the FRACTIONAL N LOOP to 20MHz (2MHz to the SUM LOOP).

(d) Press the TR key followed by keys 50.

(e) Press the ↑ key and check the frequency at A51J4 changes in 2MHz steps each time the key is pressed. The frequency range is from 52 to 84MHz. (The key changes the STEP LOOP frequency as indicated on the 3746A display, which in turn causes the SUM LOOP frequency to change).

(f) If the SUM LOOP frequency is incorrect check the VCO output by switching A51S1 to test. The output frequency should change to 52MHz. If the frequency does not change or is not within 0.5MHz of 52MHz refer to the A51 Assembly Troubleshooting.

(g) To check the Sum Loop Mixer refer to A52 Troubleshooting.

(h) If steps (f) and (g) are functioning correctly and the SUM LOOP is still suspect refer to A53 Troubleshooting.

ASSEMBLY SERVICE SHEET A30
FRACTIONAL N DIVIDE BY N ASSEMBLY

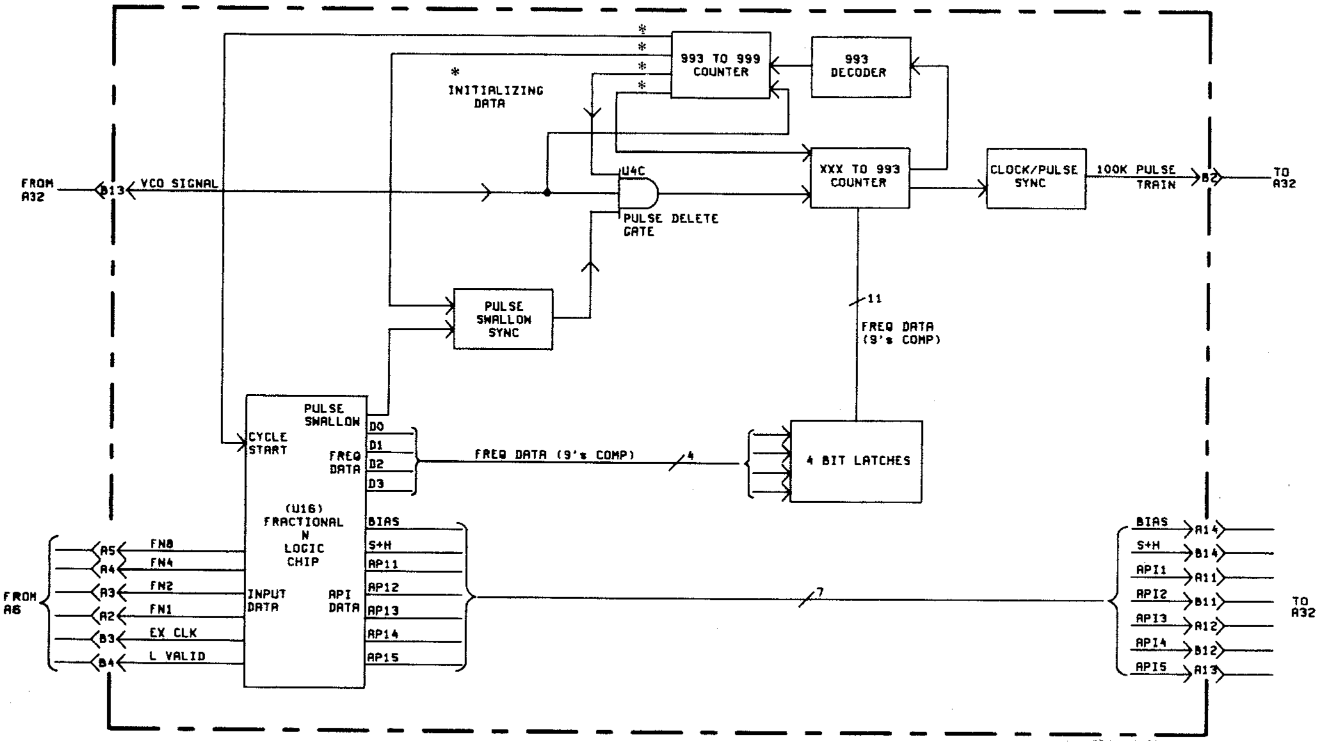


Figure A30-1 A30 Block Diagram

A30-1 INTRODUCTION

A30-2 The Fractional N divide by N assembly provides the divide by N function of the Fractional N Phase Lock Loop. At the heart of the operation is a Fractional N Logic chip U16 which receives instructions and data from the Processor (assembly A60) and controls the logic on the board.

A30-3 FRACTIONAL N CHIP U16

A30-4 The Fractional N Logic chip is an LSI device specifically designed to operate in a Fractional N Phase Lock Loop. It stores data and performs the logic operations which enables the loop to function correctly. Frequency information from the Processor (Assembly A60) is entered in bit parallel, byte serial format on the C0, C1, C2 and C3 input lines. Data from D0, D1, D2 and D3 lines to set the XXX-993 counter, is clocked into 3 x 4 Bit Latches in bit parallel byte serial format. These operations are independent of the control action carried out by the Fractional N Chip.

A30-5 The Fractional N chip acts on data received from the Processor (Assembly A60) and carries out a complex operation to provide timing and control signals essential for the operation of the loop ensuring the VCO is tuned to the desired frequency. The chip controls:

(a) The Sample/Hold timing at the Integrator.

(b) When to Pulse Swallow.

(c) Bias and API switching.

A30-6 An important part of the operation of this chip is in determining when to pulse swallow. If there were no pulse swallow action, to achieve phase lock, the VCO would have to run at an integer multiple of the reference frequency input to the Phase Detector. In the fractional N loop the VCO does not necessarily run at an integer multiple of the F reference frequency. By arranging to swallow a requisite number of pulses the input to the XXX-993 COUNTER can be set on average to an integer multiple of the F reference frequency.

A30-7 Consider the action when the Fractional N loop is required to tune to 23.572MHz (The introduction to this section shows how to calculate the Fractional N Loop frequency from a given front panel tuning setting.) The Processor loads the number 23,572,000 (Hz) serially into the internal registers of the Fractional N chip. The Fractional N chip splits this number into two components, 235 and 72000. The 235 determines the counter divide by N number whilst 72000 sets the number of pulse swallows per second, and A30-8 In order to divide 23572000Hz down to 100kHz the XXX-999 Counter must divide an input frequency of 23,500,000 by 235. This means 72000 pulses/second are swallowed, or prevented from reaching the counter by the Pulse Delete Gate U4C thus ensuring an input frequency to the XXX-993 Counter of 23,500,000. The Fractional N chip converts the number 235 into 9's compliment form and loads this number through the 4 Bit Latches to increment the counter. The Counter increments from 764 to 999 (999 - 235 = 764, 764 is the 9's compliment of 235).

A30-9 As well as determining the number of pulses to be swallowed the 72,000 also determines the number of times the API1-API5 lines are turned on. In this case API1 is turned on for 7 out of 10 API clock pulses, API2 for 2 out of 10, and the remaining API lines are each on for a fixed length of time each reference cycle. This pulsing of the API lines controls precisely the return slope of the Integrator ramp (on Assembly A32) to maintain the "Fine Tuning" of the VCO. Details of the main chip functions are given in the text accompanying the Timing Figure A30-2.

A30-10 CIRCUIT ACTION

A30-11 The circuit action of the Fractional N divide by N assembly repeats each time the divide by N counter reaches 999. The counter is split into two parts, an XXX-999 Counter and a 993-999 Counter. The 993-999 high speed counter counts the final 6 pulses and allows the main counter to be preloaded prior to starting the next cycle, allowing uninterrupted counting (division) of the VCO signal.

A30-12 The sequence of events over each 10usec period [1/Fref (input at PSD) = 1/100kHz] is controlled by the Fractional N Logic chip U16. During this period the integrator (on Assembly A32) completes one cycle. At the end of each reference period the 993-999 Counter sets the START/STOP CYCLE flip flop U11A(4) low to begin a new cycle of operation as follows:

1. The START/STOP CYCLE flip flop output U11A(5) goes high making U16 (28) cycle start line high. As 993-999 counter reaches the final count of the previous cycle, U6B(7) goes high. This removes the inhibit at the Pulse Delete Gate U4(10) and the XXX-993 Counter starts counting up to provide a FVCO divide by 10 output from U3(2) which is used as the Fractional N Logic Chip, Chip Clk. This same clock is used as the LATCH CLOCK for Assembly A32. The Latch Clock Enable Logic provides a LATCH CLOCK to Assembly A32 when the Bias line from the Fractional N Logic chip U16(10) goes high.

2. The Fractional N chip calculates when the Integrater (on the A32 Assembly) ramp-up period ends and sets the Sample Hold S+H U16(11) high for 2 cycles of the CHIP CLK. The Integrator output (on A32) is sampled to provide a dc Tune Voltage for the VCO (on Assembly A31).

3. The Fractional N Logic chip determines if a Pulse Swallow is required, and if this is the case, sets the PS U16(12) line high. The Clock/Pulse Swallow Sync logic now changes state. U7A(6) goes low to inhibit the Pulse Delete Gate U4C for 1 cycle of VCO. The Logic State Machine formed by U7A, U7B ensures only a single pulse is swallowed.

4. The Fractional N Logic chip Bias line U16(10) goes high and causes the Integrator output (on

Assembly A32) to ramp-down. Also, the output at U14C(10) goes low to reset the Clock/Pulse Swallow Sync logic U15A(15) and the Start/Stop Cycle flip flop U11A(15). The reset at the Start/Stop Cycle flip-flop sends the Fractional N Logic chip CS line U16(28) low. The Latch Clock Enable Logic is enabled when the BIAS line goes high to provide a Latch CLK to assembly A32.

5. During the ramp-down period of the Integrator (on A32) the Fractional N Logic chip pulses the API lines U16(2, 3, 4, 5 and 6) to modify the ramp-down slope of the Integrator.

6. The Fractional N Logic chip BIAS line goes low U16(10) the Latch Clock Enable Logic remains enabled since the Clocked Bias line holds U14C (10) low until the new state of the BIAS line is latched on Assembly A32, causing the Clocked Bias line to go low. U14C(10) now goes high to disable the Latch CLK. The Clock/Pulse Sync logic produces a single pulse at TP3 as a result if the clocked Bias line going low.

7. When the XXX-993 Counter reaches 993 the Decoder sets TP5 high and the 993-999 Counter starts counting. The 993-999 Counter controls the action as follows:

a. At 996 U6A(6) goes low to LOAD the XXX-993 Counter with the number held at the 4 BIT Latches. The Start/Stop Cycle flip-flop U11A(4) goes low to set the Fractional N Logic chip CS line U16(28) high and begin a new cycle. U5A/U5B S inputs on the 993-999 Counter are pulled low to ensure U6A does not change state until the counter reaches 998.

b. At 997 the output of the 993-999 Counter U6B(7) goes low to inhibit the Pulse Delete gate U4C and prevent any VCO clock pulses reaching the XXX-993 Counter. This ensures the XXX-993 does not start counting when the LOAD input U3(1) returns high at 998.

c. At 998 U6A(6) goes high to enable the XXX-993 Counter.

d. At 999 the output of the 993-999 Counter U6B(7) goes high, and removes the inhibit at the Pulse Delete Gate U4C. The XXX-993 Counter will start counting on the arrival of the next pulse.

8. The cycle repeats.

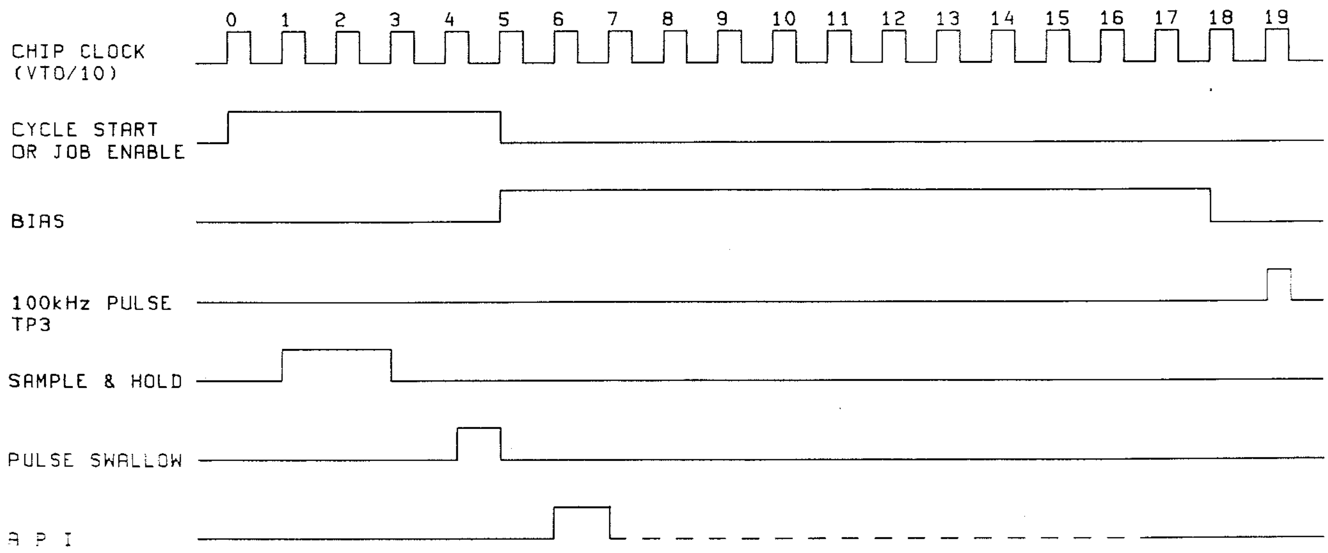


Figure A30-2 Timing Diagram

A30-13 Fractional N Logic Chip - Input/Output

CHIP CLK U16(7) This is derived from U3, and runs at the VCO frequency divided by 10.

CS CYCLE START U16(28) This is a positive going sync pulse occuring at 10 usec intervals.

C0, C1, C2, C3 U16(23, 22, 21, 20) Data and Instruction input lines. Data is entered with EXT CLK (26),instructions with INV (24) and EXT clock.

EXT CLK U16(26) This line is used to clock data on the C0-C3 lines into the chip.

INV U16(24) Distinguishes between data and instruction.

S+H U16(11) The Sample and Hold line is pulsed high for 2 cycles of the CHIP CLK.

BIAS U16(10 This line goes high for approximately 14 cycles of the CHIP CLK.

API1-API5 U16(2, 3, 4, 5, 6) These lines are pulsed during the BIAS period.

PS U16(12) Pulses after the S+H line when a Pulse Swallow is required.

D0, D1, D2, D3 U16(16, 15, 14, 13) These are the Data Output lines used to set the XXX-993 Counter start point.

Divide by N CLK U16(17) This line clocks the data on the D0-D3 lines into the 4 bit latches.

A30-14 TROUBLESHOOTING

1.

(a) Failure of any of the Counters U1, U2 and U3 will prevent the Fractional N divide by N Assembly A30 from working correctly. IF THERE IS NO CYCLE START PULSE FROM U11a PIN 5 THE A30 ASSEMBLY WILL BE INOPERATIVE. The cycle start pulse is used to synchronise and start the Fractional N Logic Chip U16. This positive going pulse occurs at the end of each divide cycle, and must be present before checks 2, 3 or 4 can be carried out. If the cycle start pulse is missing proceed as follows:

(b) Remove Assembly A31 and connect A31TP3 to ground. Re-insert Assembly A31. This opens the FRACTIONAL N LOOP and makes the VCO run at approximately 40MHz.

(c) Check the outputs of U1, U2 and U3, FF5 and FF6. [The numbers present on the Counters (U1 through U3) pre-set load inputs, from the 4 Bit Latches, will be arbitary when the cycle start pulse is missing. This number can be checked using a scope or logic probe to find out the 9's compliment code present on the data inputs. Table A30-2 shows (by example) how the divide N number is derived from the code present on the counter data inputs].

(d) Grounding U11a pin 4 should force a high at U11a pin 5.

Note: Momentarily grounding U11a pin 4 does not ensure a start up of the Fractional N Chip U16.

2. Fractional N Logic Chip U16 Checks

(a) Remove Assembly A31 and connect A31TP3 to ground. Re-insert assembly A31. This opens the Fractional N loop and makes the VCO run at approximately 40MHz.

(b) Press the SLMS TR key followed by 34.

(c) Press the ↑ key continuously and monitor U16 pins 20 through 24 and pin 26 with a suitable logic probe. The probe should flash, though not always in exact sequence with the change in frequency in the SLMS display. This checks that the data is arriving from the Processor (Assembly A60). The pulses may be difficult to see on an oscilloscope because they are <0.1usec wide and are spaced milliseconds apart.

(d) Press the ↑ key to tune the SLMS to 40,000.001kHz and monitor the API lines at U16 pins 2, 3, 4, 5 and 6.

API-1 should be a pulse train with the pulse width modulated at 1Hz
API-2 should be a pulse train with the pulse width modulated at 10Hz
API-3 should be a pulse train with the pulse width modulated at 100Hz
API-4 should be a pulse train with the pulse width modulated at 1kHz
API-5 should be a pulse train with the pulse width modulated at 10kHz

This check does not fully check out U16 but indicates that the Fractional N Logic Chip U16 is probably working correctly.

3. 4 Bit Latches and XXX to 993 Counter Checks

(a) Remove Assembly A31 and connect A31TP3 to ground. Re-insert assembly A31. This opens the Fractional N Loop and makes the VCO run at approximately 40MHz.

(b) Connect an electronic counter to A31J1 and note the frequency.

(c) Press the keys TR and 30.

(d) The SLMS frequency display should indicate 40,000.000 or 20,000.000. Pressing the ↑ key alternates between these two display readings. Monitor A30TP5 with an oscilloscope and press the ↑ key. Check the waveform changes frequency and is typically as shown in the Figure A30-3 and Figure A30-4

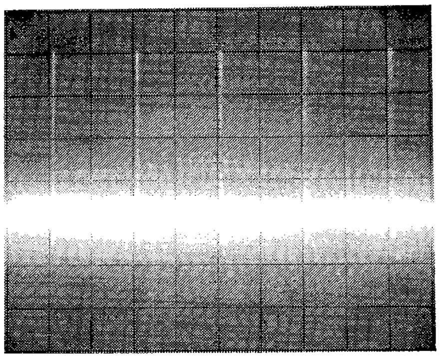


Figure A30-3
SLMS freq. 40,000.000

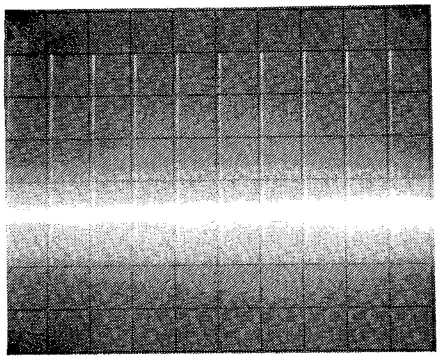


Figure A30-4
SLMS freq. 20,000.000

The waveforms will change frequency because the VCO frequency is unchanged [step 3 (a)] and the XXX-993 program data is changed by pressing the ↑ key.]

(e) With the SLMS at 40,000.000kHz the divide N circuit should divide the incoming frequency by 400. Check that at A30TP3 the frequency is 1/400th of that noted in step (b).

(f) With the SLMS at 20,000.000kHz the divide N circuit should divide by 200.

Table A30-1 Fractional N Codes

SLMS Frequency Display	÷N Code	9's Complement	U1 Pins				U2 Pins				U3 Pins			
			11 GND	3 L	10 K	4 J	11 H	3 G	10 F	4 E	11 D	3 C	10 B	4 A
20,000.000	200	799	0	1	1	1	1	0	0	1	1	0	0	1
30,000.001	300	699	0	1	1	0	1	0	0	1	1	0	0	1
40,000.000	400	599	0	1	0	1	1	0	0	1	1	0	0	1

Note: 30,000.001kHz can be accessed by pressing TR followed by keys 33 and ↑ until 30,000.001 is displayed.

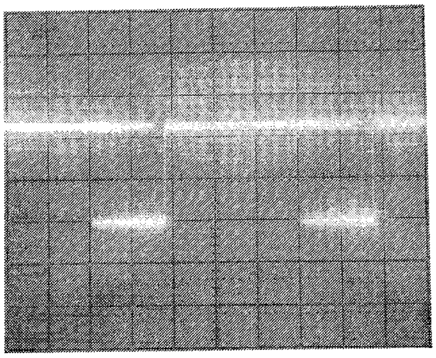
(g) If the division is incorrect check that the data from the Fractional N Logic Chip U16 is being latched correctly at the XXX to 993 Counter load inputs (shown on Table A30-1).

(h) Table A30-2 gives a more comprehensive list of frequencies which the VCO should tune to when the shorting link on A31TP3 is removed and the FRACTIONAL N LOOP is working correctly. If the FRACTIONAL N LOOP is not working correctly Table A30-2 may also be used to check the data on the Counters U1 to U3. If the data is correct this gives another good indication that the Fractional N Chip U16 is working correctly.

Table A30-2 Fractional N Codes and Frequency

Front Panel Tuned Frequency	Fractional N VCO Frequency at A31TP1	Fractional N VCO ÷ 10 at A31 (A14)	Code	Decimal Preset Code (9's Complement)	Counter Preset Code (÷N 9's Complement)											
					U1 Pins (MSD)				U2 Pins				U3 Pins (LSD)			
					11	3	10	4	11	3	10	4	11	3	10	4
984.375kHz	30,000,000Hz	3,000,000Hz	300	699	0	1	1	0	1	0	0	1	1	0	0	1
984.376kHz	29,999,990Hz	2,999,999Hz	299	700	0	1	1	1	0	0	0	0	0	0	0	0
1,095.487kHz	28,888,880Hz	2,888,888Hz	288	711	0	1	1	1	0	0	0	1	0	0	0	1
1,206,598kHz	27,777,770Hz	2,777,777Hz	277	722	0	1	1	1	0	0	1	0	0	0	1	0
1,317.709kHz	26,666,660Hz	2,666,666Hz	266	733	0	1	1	1	0	0	1	1	0	0	1	1
1,428.820kHz	25,555,550Hz	2,555,555Hz	255	744	0	1	1	1	0	1	0	0	0	1	0	0
1,539.931kHz	24,444,440Hz	2,444,444Hz	244	755	0	1	1	1	0	1	0	1	0	1	0	1
1,651.042kHz	23,333,330Hz	2,333,333Hz	233	766	0	1	1	1	0	1	1	0	0	1	1	0
1,762.153kHz	22,222,220Hz	2,222,222Hz	222	777	0	1	1	1	0	1	1	1	0	1	1	1
1,873.264kHz	21,111,110Hz	2.111,111Hz	211	788	0	1	1	1	1	0	0	0	1	0	0	0
1,984.375kHz	40,000,000Hz	4,000,000Hz	400	599	0	1	0	1	1	0	0	1	1	0	0	1

4. The waveforms shown are with the instrument under normal working conditions. Figures A30-6, 8 and 9 can be reproduced by carrying out the procedure in step 3. Note however that the frequencies of the displayed waveforms may differ.



U16 pin 2

Press TR33 keys
Press ↑ key to tune to 30,000.100kHz

Figure A30-5

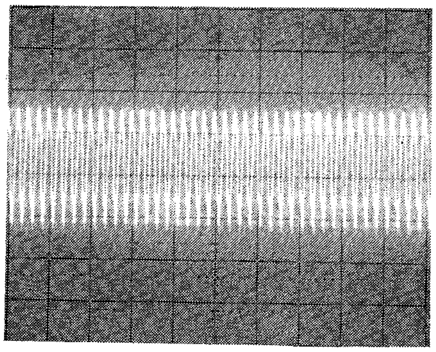


Figure A30-6

TP1 and TP4

Press TR30 keys
Press ↑ key to tune to 40,000.000kHz

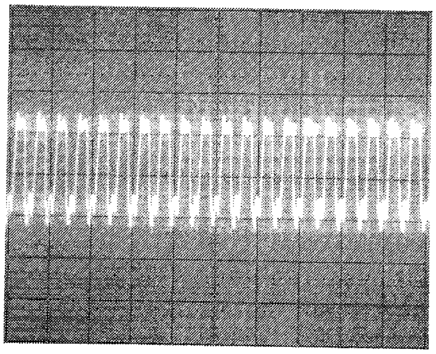


Figure A30-7

TP1 and TP4

As for 2 with tuned to 20,000.000kHz

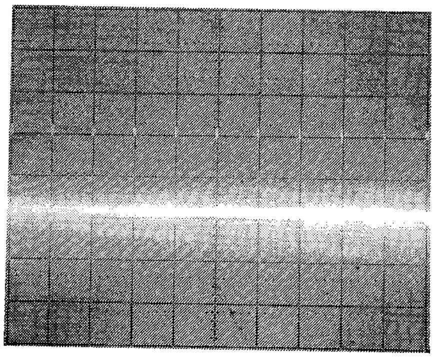
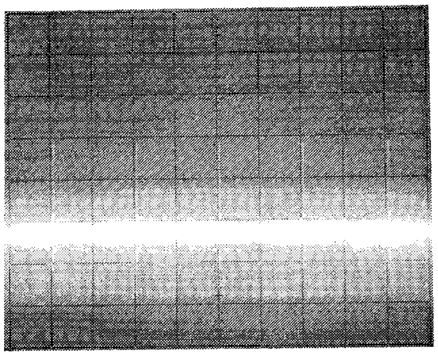


Figure A30-8

TP2

Press TR33 keys
Press ↑ key to tune to 30,010.000kHz



TP3

Press TR30 keys
Press ↑ key to tune to
40,000.000kHz

Figure A30-9

5. The 933-999 COUNTER, CLOCK PULSE SYNC, and CLOCK PULSE SWALLOW SYNC logic can be checked by monitoring/tracing the pulse through the logic chain.

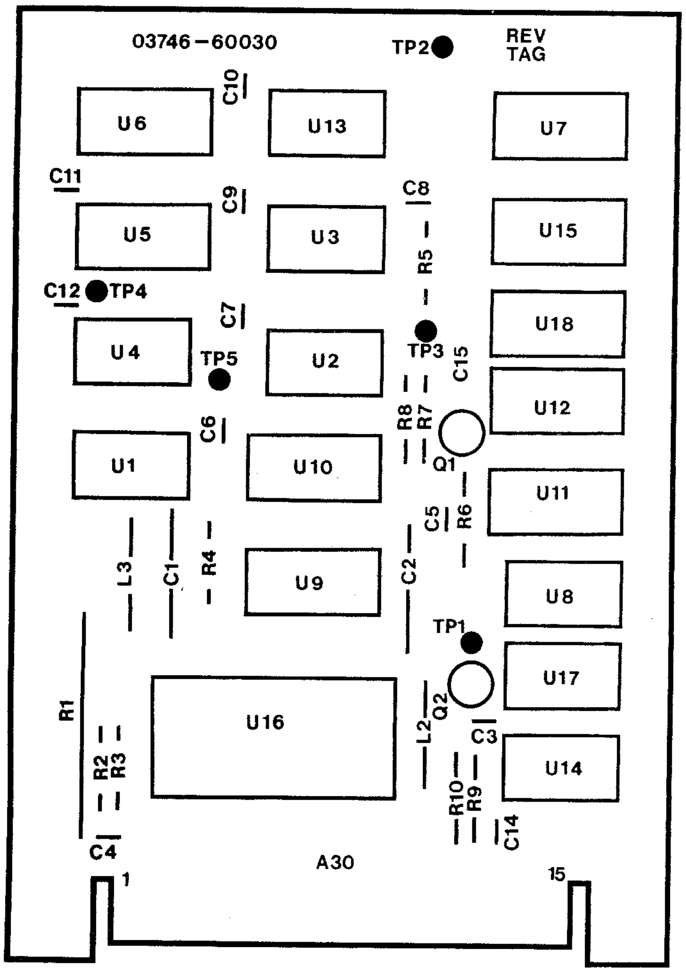


Figure A30-10 A30 Component Location

Figure A30-11 A30 Schematic Diagram

8-99
8-100

ASSEMBLY SERVICE SHEET A31
FRACTIONAL N VCO

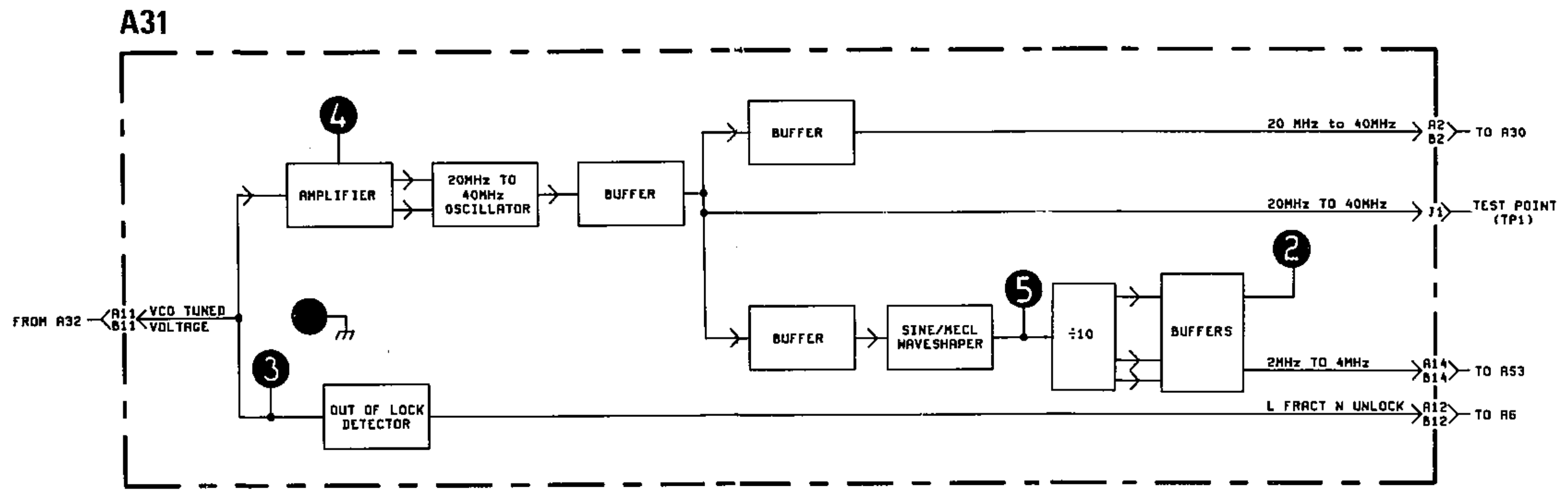


Figure A31-1 A31 Block Diagram

A31-1 INTRODUCTION

A31-2 This assembly forms part of the Fractional N phase lock loop, providing outputs in the range 20MHz to 40MHz for use within the Fractional N loop and in the range 2MHz to 4MHz as one of the inputs to the Sum Loop PSD (Assembly A53).

A31-3 CIRCUIT DESCRIPTION

A31-4 The voltage controlled oscillator (VCO) employs three varactor diodes CR4, CR5 and CR6 connected in parallel to acheive a frequency swing from 20MHz to 40MHz. The VCO is tuned to a spot frequency by a VCO tune voltage derived from the integrator output on the Fractional N Phase Detector (assembly A32).

A31-5 A non-inverting buffer U1B provides a stablised +6.7V reference supply to the cathodes of CR4, CR5 and CR6 via L4. The dynamic range of the VCO Tune voltage, typically 0V at 40MHz and +6V at 20MHz, is expanded to approximately +6V at 20MHz and -9V at 40MHz by amplifier UIA.

A31-6 The settling time of the loop, when the frequency changes, is largely determined by the time constant R15/R16/C17 (for small changes) and by R15/C17 (for large changes). Large voltage changes, required to produce the large frequency changes, switch on one of the "speed up" diodes CR15/CR16 (shorting R16) to improve the reaction time of the loop. Diode CR3 "clamps" the tuning voltage at just above +6.7V ensuring the tuning diodes CR4 through CR6 do not become foward biased.

A31-7 Three stages of buffering provide the necessary amount of isolation and signal drive level between the oscillator and adjacent circuits. (Buffers Q5/Q6 and Q7/Q8 are identical.)

A31-8 The 20 to 40MHz VCO output is divided by 10 at U3 and buffered at U4 to give a suitable ECL drive level to the SUM LOOP Phase Detector (Assembly A53). The buffered output at TP2 is at the VCO frequency divided by 10.

A31-9 When an out of lock condition exists, the VCO Tune Voltage (at TP3) usually goes to either the upper or lower voltage limit and violates the threshold limit (of ± 8.6V) set at the input of the OUT OF LOCK DETECTOR. Transistor Q9 is turned on to pull L FRACT N UNLOCK low and inform the processor (on Assembly A60) that the Fractional N Loop is out of lock. A LED, DS1 mounted at the top of A31 assembly gives a visual indication of this condition.

A31-10 TROUBLESHOOTING

1. The fractional N VCO (A31) Assembly will not operate correctly if there is a fault in the other assemblies A30 or A32 which together with A31 make up the FRACTIONAL N LOOP. A failure of the 100kHz frequency reference from the A40 assembly will also cause a failure in the loop.

2. An error code E03 on the SLMS TEST-POINT display and a red "UNLOCK" LED A31 DS1 indicate when the FRACTIONAL N LOOP goes out-of-lock. (A fault in the FRACTIONAL N LOOP may however exist, without an out-of-lock condition being displayed - see Paragraph 8S-32).

3. The VCO can be checked out in isolation as follows:

   (a) Remove the A32 assembly.

   (b) Mount A31 on an appropriate extender card.

   (c) Ground TP3, the VCO should oscillate at approximately 40MHz ±5MHz (monitor at A30J1).

   (d) Connect a low voltage power source to A31TP3 and check the VCO at spot frequencies across the range.

0V	40MHz	±6MHz
+3V	30MHz	
+6V	20MHz	

   (e) The threshold limits of the OUT-OF-LOCK DETECTOR can be checked by increasing the voltage above and below +9V and -9V respectively.

4. Voltages and waveforms on the schematic diagram were measured with TP3 grounded (A32 assembly removed).

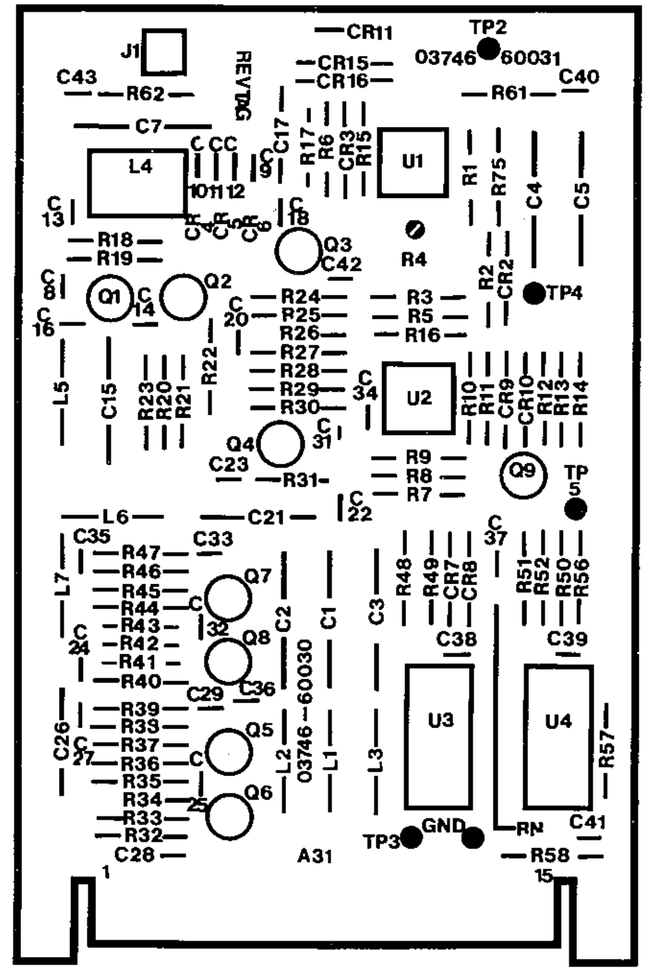
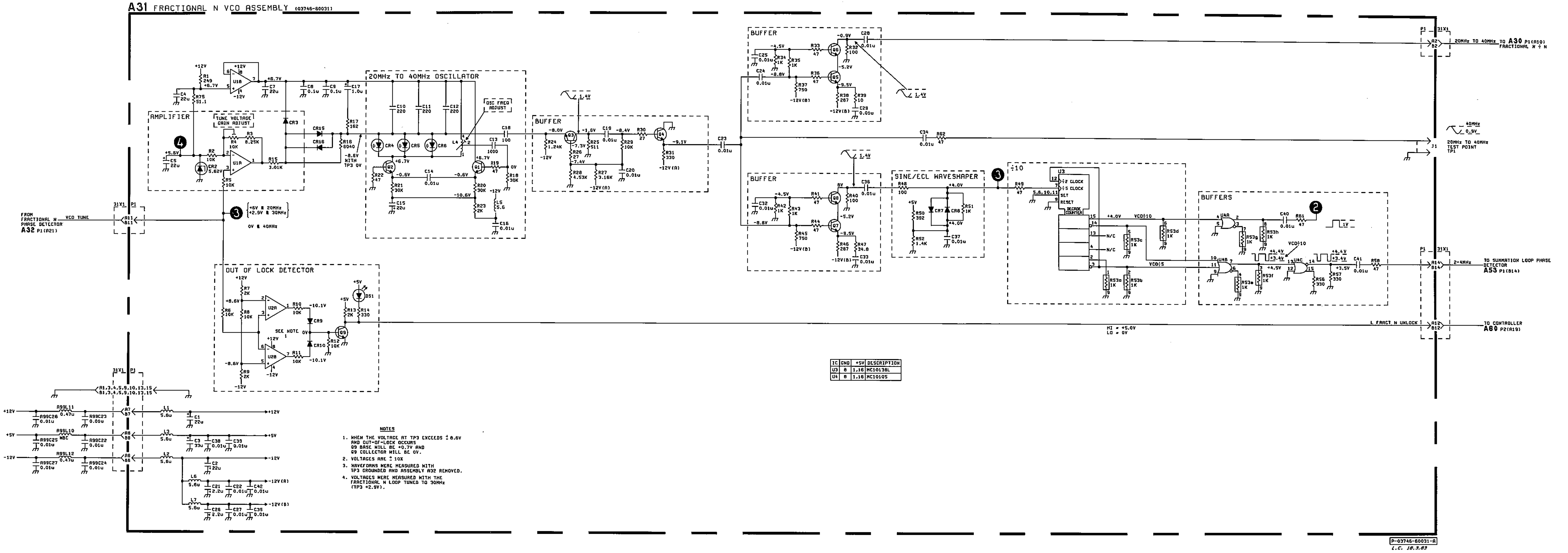


Figure A31-2 A31 Component Location

A30 Schematic Diagram



IC	GND	+5V	DESCRIPTION
U3	8	1,16	MC10138L
U4	8	1,16	MC10105

Figure A31-3 A31 Schematic Diagram

8-101
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ASSEMBLY SERVICE SHEET A32
FRACTIONAL N PHASE DETECTOR

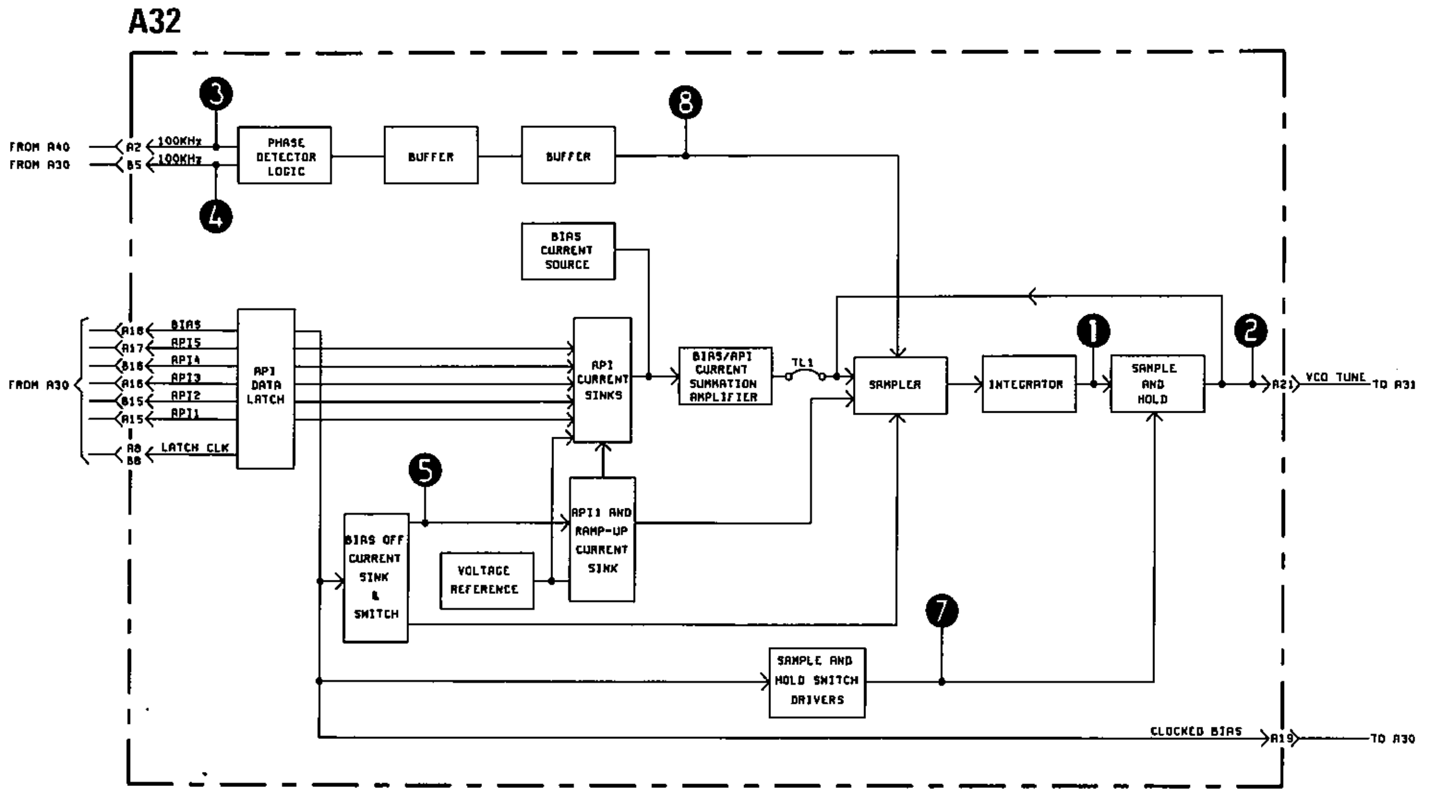

Figure A32-1 A32 Block Diagram

A32-1 INTRODUCTION

A32-2 The Fractional N Phase Detector assembly produces a dc control voltage to tune the VCO on assembly A31. This control voltage is proportional to the phase difference between a 100kHz signal derived within the Fractional N loop and a 100kHz reference signal (F ref) from the Frequency Reference Assembly (A40).

A32-3 In a conventional Phase Lock Loop, the inputs to the Phase Detector would be exactly 100kHz and have a fixed phase difference which would only change as the VCO or F. ref frequency changed. In this type of loop a programmable divider divides the VCO frequency such that VCO divide by N = F ref.

A32-4 In a Fractional N loop the VCO frequency is not necessarily harmonically related to the F ref frequency. A "pulse swallow" circuit precedes the divided by N divider as shown in Figure A32-1.

A32-5 By arranging to pulse swallow each time the VCO advances 1 cycle on N x F ref, both inputs to the PSD are kept at a 100kHz. Although the frequencies are the same, the phase shift at the input to the PSD is not constant since the VCO frequency is advancing up to the point when a pulse swallow occurs. This means that there is a small incrementing phase change (=360 degrees [1 cycle of VCO Freq] divide by N) superimposed on the existing "fixed" phase difference at the input to the PSD.

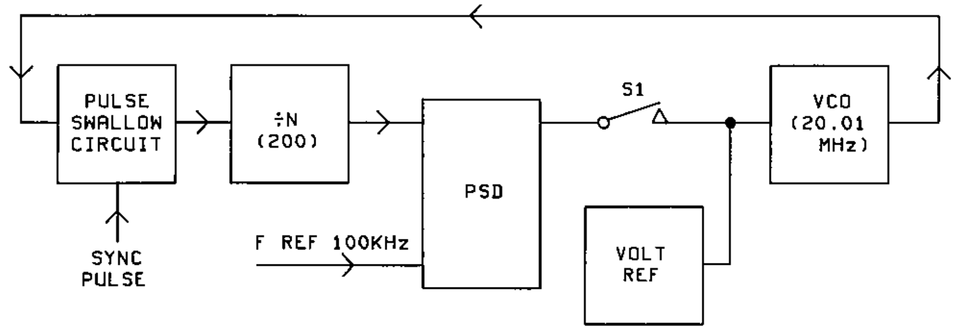

Figure A32-2 Simplified Fractional N Loop

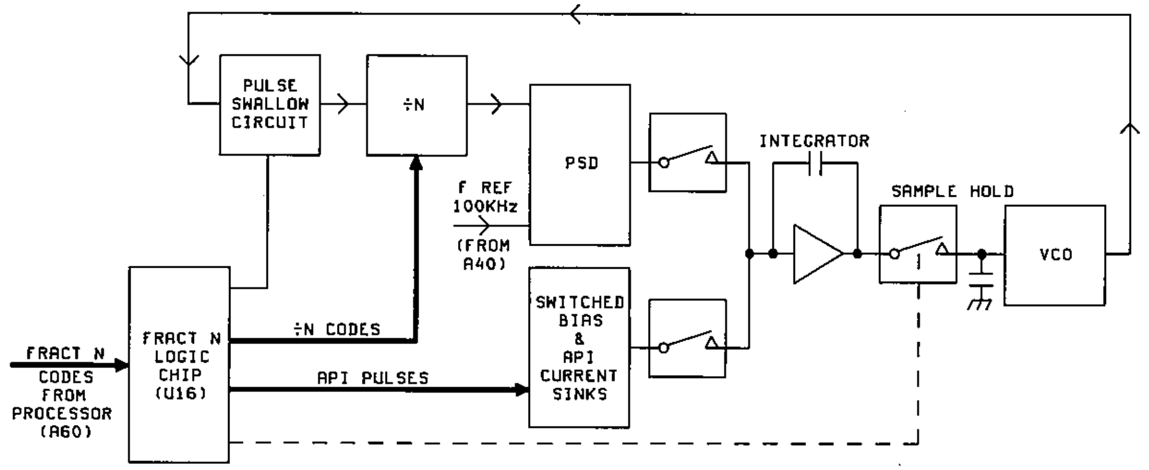

Figure A32-3 Fractional N Phase Detector & Integrator

A32-6 Refering to Figure A32-3, the output from the PSD is a negative going pulse whose width is the time between the leading edges of the two 100kHz input signals. This pulse controls the ramp-up of the integrator, the ramp-down is controlled by the turn-on of a fixed bias current which is modified by switching in 5 API current sinks. These currents known as the Analogue Phase Interpolation currents are switched in to modify the down ramp if the integrator and nullify the effect of any offset at the Integrator output caused by the small incrementing phase change at the input to the PSD. The on/off signals controlling Bias and API current switching comes from a Fractional N Logic chip on assembly A30. Control of the five API currents enables precise tuning of the Fractional N VCO within 1Hz. A sample/hold circuit at the integrator output keeps the changing Integrator output from modulating the VCO Tune voltage. When the ramp-up is complete, the

voltage at the Integrator output is sampled and passed to the Fractional N VCO. Figure A32-4 shows a graphic representation of the output from the integrator.

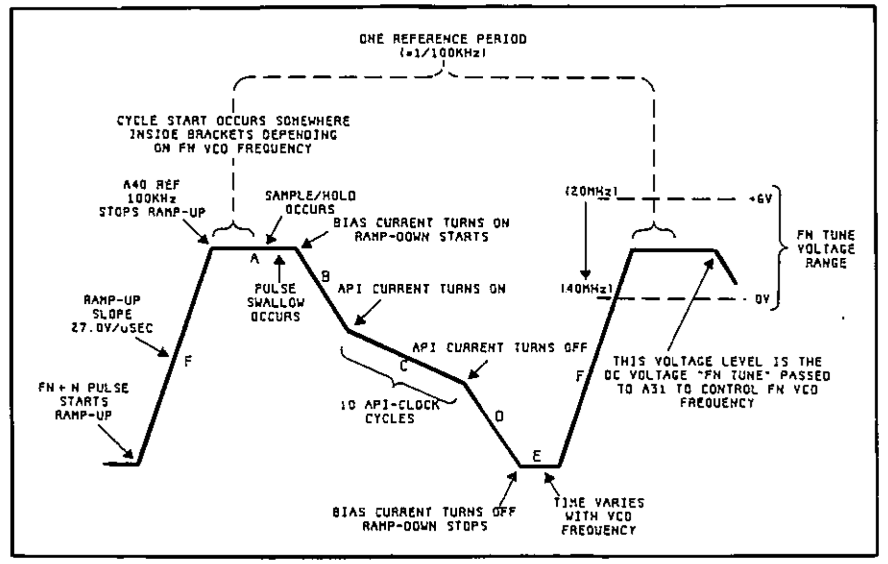

Figure A32-4 Fractional-N Integrator Output (A32TP1)

A32-7 CIRCUIT DESCRIPTION

A32-8 The 100kHz pulse from the Fractional N divide by N assembly (A30) normally arrives at U1B before the F ref input pulse from assembly A40. The outputs of U1A switch Q1 and Q2 to turn Q3 off and Q4 on. TP8 goes low and CR3 is switched off. The API-1 and Ramp-up current sink "pulls" current from the Integrator input via CR4 causing the Integrator output to ramp-up. During the ramp-up period current from the Bias Current Source is diverted away from the Integrator input via CR5 and R25; CR6, CR4 and Q16 to the -12V supply line.

A32-9 When the F ref 100kHz pulse arrives U1A switches Q1 and Q2 to turn Q3 on and Q4 off. TP8 goes high CR3 turns on, and the ramp-up stops. No current flows in or out of the integrator. The integrator now has a constant output, shown by the flat portion A in Figure A32-4.

A32-10 During the flat portion of the Integrator output, at a time determined by the Fractional N logic chip on assembly A30, the sample hold line, S + H, is pulsed high. The sample and Hold Switch Drivers turn-on Q32 and Q33 allowing C11 to charge up to the dc level at the Integrator output (TP1). At the end of the S + H pulse, Q32 and Q33 are switched off and C11 "holds" the charge "sampled".

A32-11 The "ramp-down" period is initiated by the Bias line at U3(14) going high, immediately followed by the arrival of Latch clock pulses at U2/U3. The high on the Bias line is clocked through to U3 (15). Q17 is switched on to bias off CR3/CR4; CR5 is also biased off. The current from the Bias Current Source is then diverted into the Integrator and the "ramp-down" period begins.

A32-12 The five API lines are switched by the Fractional N logic chip on assembly A30, at a pre-determined rate dependent on the VCO tuning frequency. This modifies the down-ramp of the integrator. The API Data Latch clock (LATCH CLK) is at the same rate as the Fractional N Logic chip clock (on assembly A30). The API lines 1 to 5 at the output of the API Data Latch are switched on and off as programmed, to change the current at the input of the BIAS/API Current Summation Amplifier thus reducing the down slope of the Integrator. Each API Current Sink absorbs 10 times more current than the next, with API-1 absorbing the most, and API-5 the least. The current cycle can last for up to 10 pulses of the API clock (Latch Clock). Each current-sink may be on for 0-9 of the 10 clock pulses giving a combination of 0-99,999 current variations.

A32-13 When the API current cycle ends the Integrator ramp down returns to its initial gradient determined by the Bias Current Source. The ramp down continues until the BIAS line U3(14) goes low, removing the reverse bias from CR5, CR3 and CR4. The Integrator is momentarily in a quiescent state "E" shown in Figure A32-4 where it remains until the receipt of the next pulse from the Fractional N Divide by N assembly and the cycle repeats.

A32-14 In the Integrator circuit, Q22 provides a high impedance input with unity gain to an operational amplifier formed by Q24, Q25, Q26 and Q27. With Q22b gate at ground Q22a gate sits at 0V dc. The amplifier is high gain and high speed to satisfy the ramp-up, ramp down speed requirements of the integrator. The output driver formed by Q28, Q29, Q30 and Q31 provides a low impedance output with low distortion which is required for the ramp-up current. TL1 Through TL3 allows the Integrator to be re-configured as an amplifier for ease of Troubleshooting.

A32-15 TROUBLESHOOTING

Component failures in the PHASE DETECTOR and INTEGRATOR will directly affect the Fractional N VCO frequency on the A31 Assembly. Component failures associated with the API circuitry (Q17 through Q20 etc.) will have a minimal affect on the VCO tuning. However spurious levels around the Loop maybe affected.

The A32 board is more sensitive than the average board to surface contamination because of the precision currents used to control the Fractional N VCO frequency. Corrosion buildup due to long periods of high humidity, dirt, etc. can cause unusual spurs and unstable operation of the Fractional N Loop. After washing boards to remove dirt, inspect A32 for particles knocked loose which might wedge between IC pins, etc.

Phase Detector and Buffer Troubleshooting Hints

1. Remove the A40 and A30 Assemblies. Switch the power off and then on. The Flip-Flops Ula and Ulb "power on" in an arbitary state. Connect Ul pin 1 to pin 5 to set Ula pin 2 (+4.3V). Check the voltages at Ql through Q4.
2. Short A31TP3 to GND to make the A31 VCO run at approximately 40MHz.
3. Re-insert A31, A30, and A40.
4. Press the TR 30 keys.
5. Press the ↑ key to give a SLMS frequency display of 40,000.000MHz. This should now program the divider on the A30 Assembly to divide the VCO frequency (from A31) by 400 to give approximately 100kHz at A30TP3.
6. A modulated squarewave should now be present at A32TP8. (Set oscilloscope on 5us/div,1V/div). Pressing the ↑ key should change the period. With the LOOP connected up for normal operation and with a correctly functioning LOOP, a steady waveform should be present at A32TP8.

The INTEGRATOR can be checked as follows.

1. Remove TL1 and insert it in position TL2.
2. Insert TL3 in the test position (T).
3. Connect a d.c. coupled oscilloscope or DVM to A32TP1.
4. The d.c. voltage should be approximately -0V. The voltages around Q24 through Q31 are now valid.

5. Connect A32TP9 to the +5V supply, A32TP1 should now go negative to approximately -5V.

6. Connect A32TP9 to the +12V supply, A32TP1 should now go negative to approximately -9V.

7. Now connect A32TP9 to the -12V supply A32TP1 should now go positive to approximately +9V.

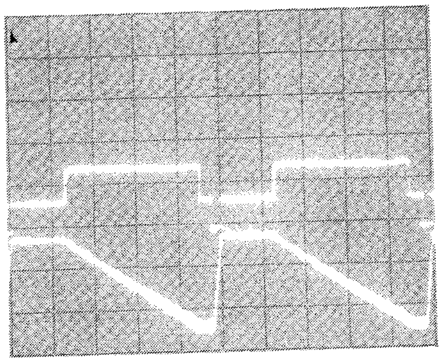

Figure A32-5

Typical Integrator Waveform

API Circuitry

The pulse widths of the waveforms measured around Q17 through Q20 do not follow a definite pattern. The voltages limits of the pulses should be the same.

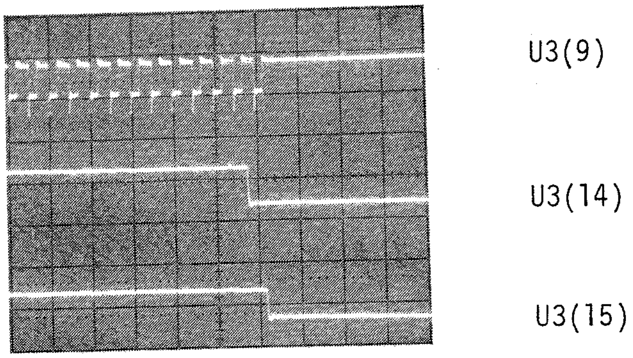

Figure A32-6

API Waveforms

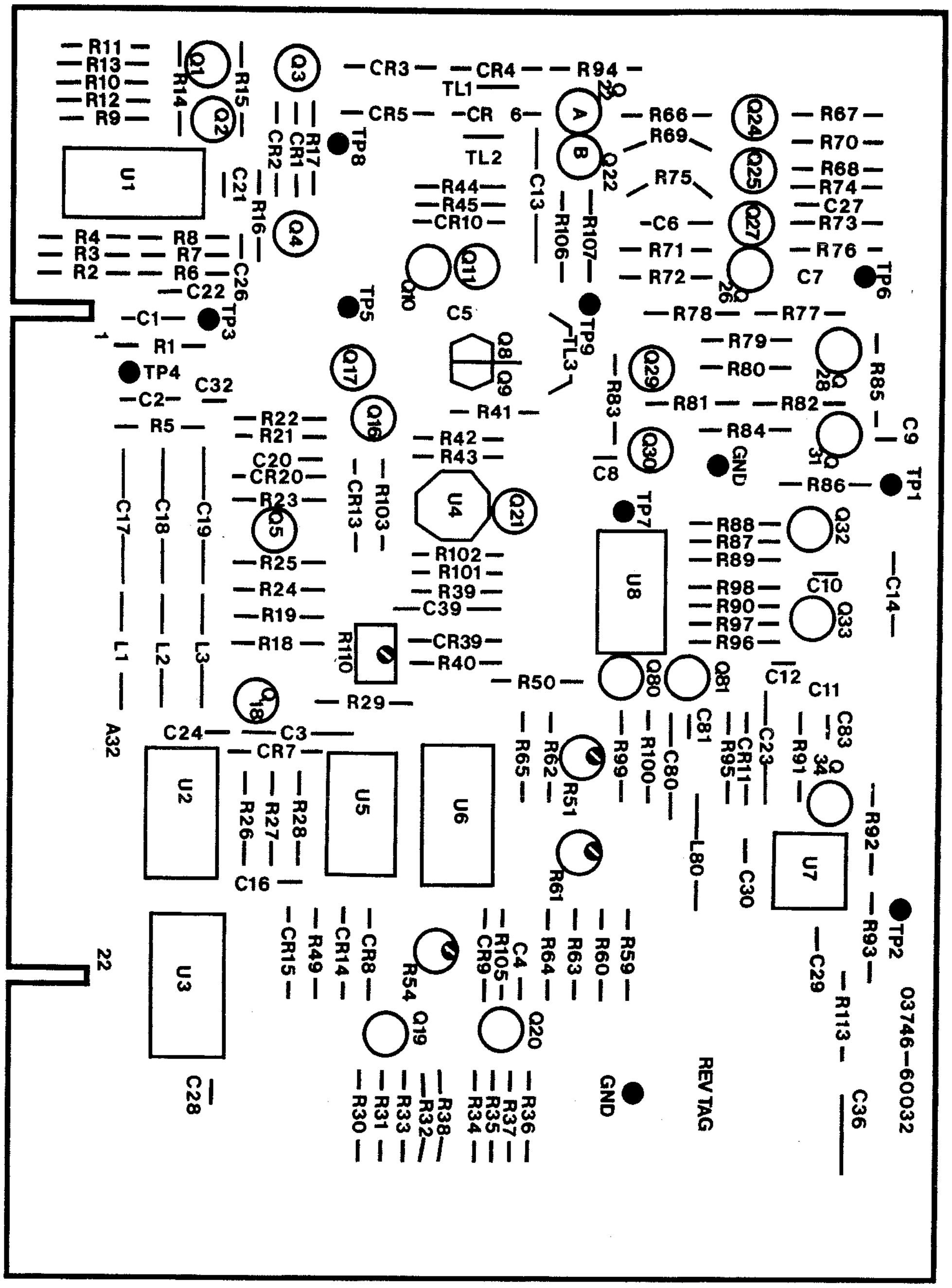

Figure A32-7 A32 Component Location

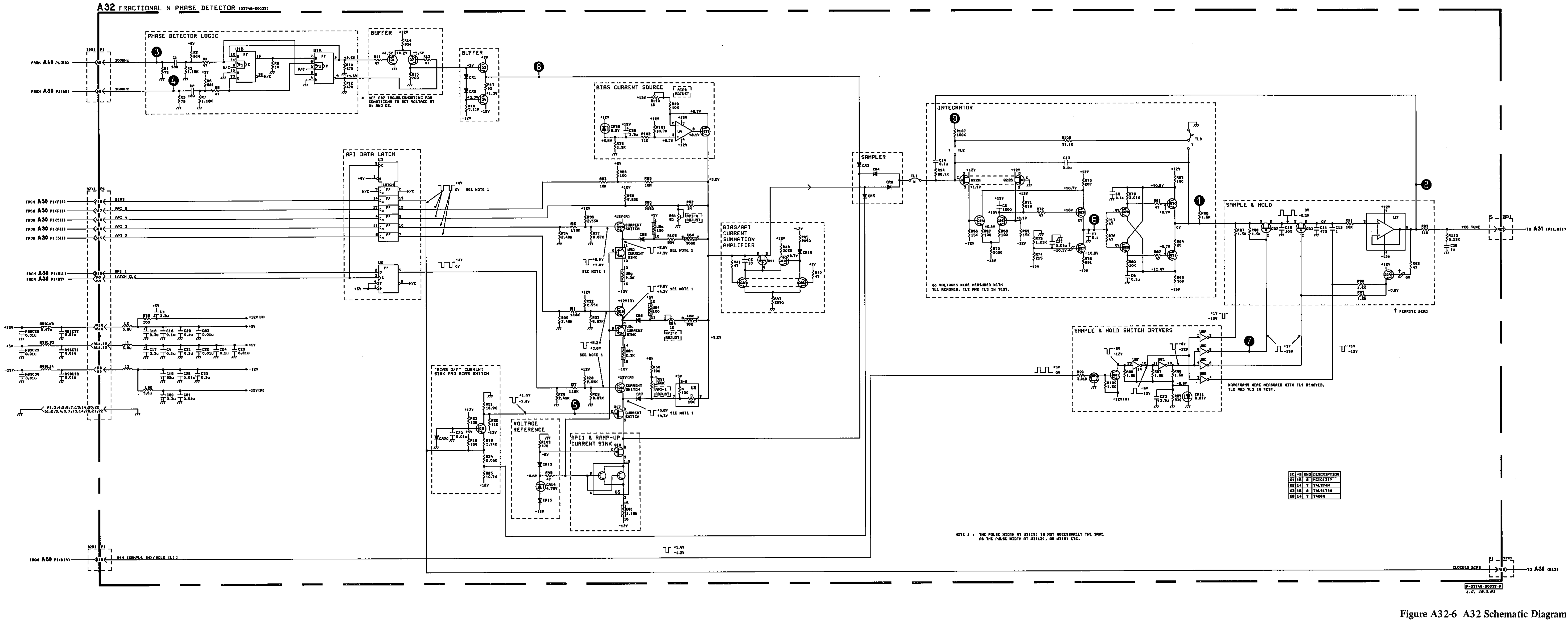

Figure A32-6 A32 Schematic Diagram

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ASSEMBLY SERVICE SHEET A40
FREQUENCY REFERENCE

A40

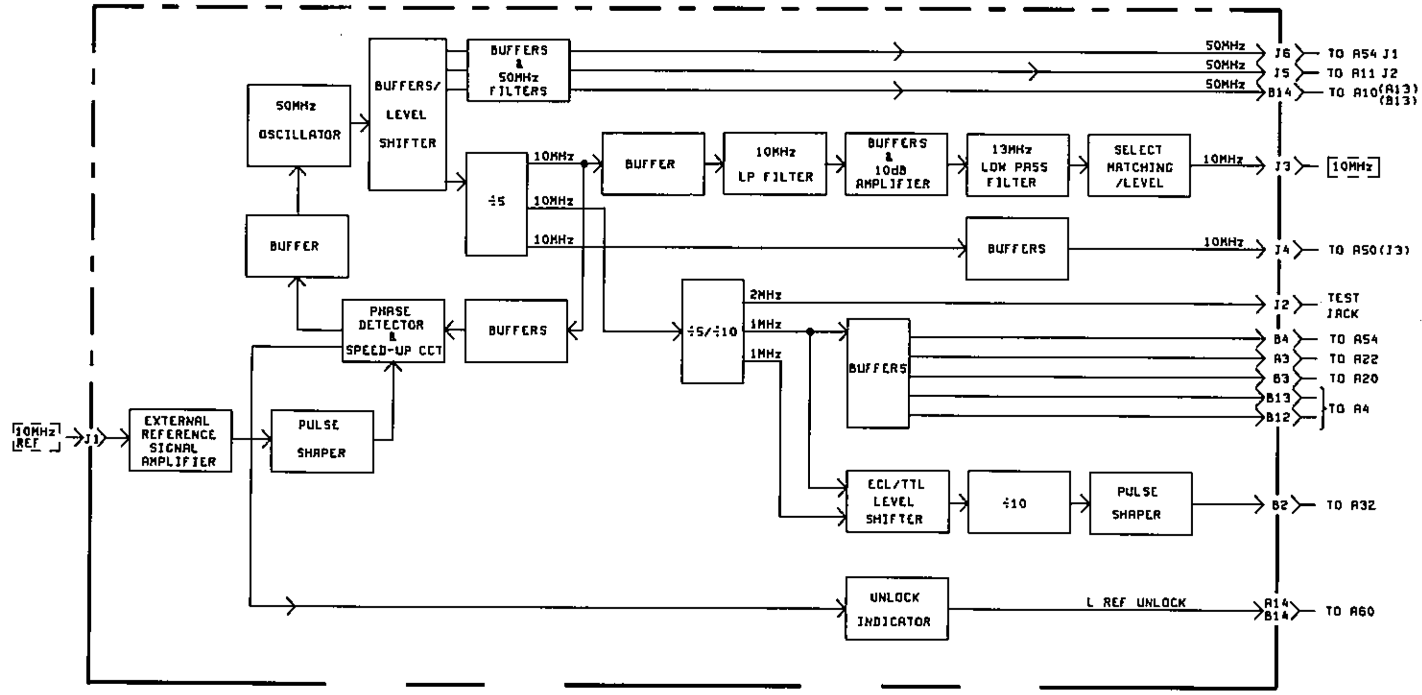

Figure A40-1 A40 Block Diagram

A40-1 INTRODUCTION

A40-2 The Frequency Reference board provides most of the frequencies used throughout the instrument as references. A 50MHz oscillator is used as the base frequency and all other frequencies are obtained by dividing 50MHz in successive stages until each desired frequency is obtained. Available frequencies are: 50MHz, 10MHz, 2MHz, 1MHz and 100kHz.

A40-3 CIRCUIT DESCRIPTION

A40-4 The 50MHz reference is obtained from a voltage-controlled crystal oscillator (VCXO) made up from Q90 and Q91 with Y90 (50MHz) and varicap CR91 providing a positive feedback path. A dc control voltage from U55 is used to change the capacitance of CR91 and thereby maintain the 50MHz reference accurately.

A40-4 The 50MHz Oscillator output feeds a Buffer/Level Shifter circuit which raises the sinewave to an ECL level signal. Other ECL level buffers (U90, U91, U93) then drive three 50MHz outputs to the A10, A11 (OPT 012), assemblies.

A40-6 A further 50MHz output is to a divide by 5 chip (U53) where three outputs of 10MHz are obtained. One of these goes to a rear panel BNC labelled "10MHz OUTPUT" for phase-locking other instruments to the 3746A frequency reference. One 10MHz path from U53 (pin 4) is buffered by U52b and passed through a low-pass filter to obtain a clean sinewave. The signal is then squared by buffers (U3a and U3b) to drive a +10 dB amplifier to produce the desired amplitude level. The output of T1 has some harmonic distortion remaining which is reduced by another low-pass filter and then passed to a Matching pad which can be set to give a +6dBm level with a 50 ohms output impedance or -30dBm level with a 75 ohms output impedance.

A40-7 The 10MHz signal from U53 (pin 2) is buffered and then passed to the A50 STEP LOOP board. C15 blocks the DC.

A40-8 The 10MHz output of U53 (pin 3) goes to a divide by 5/divide by 10 chip (U31) where two outputs of 1 MHz and one of 2MHz are obtained. The 1MHz outputs, being out-of-phase, are used to drive and ECL/TTL level shifter (Q31 and Q30). The resulting TTL signal at 1MHz is again divided by 10 in U30 to obtain 100KHz, which is passed through a Pulse Shaper to obtain a very narrow pulse (about 30 nanoseconds wide). This pulse is used in the Fractional-N Phase Detector as the reference input.

A40-9 A 1MHz output from U31 (pin 14) is also used to provide a 1MHz reference three other boards. It is first buffered by U32 and then shifted in level. From ECL to CMOS by U33b. Three buffered outputs go to A20, A22 and A54 (OPT 012) assemblies.

A40-10 The 10MHz at U53(4) is also fed through some buffers to a Phase Detector stage. The other input to the Phase Detector may come from an external source. Provision is made by 3746A Option 013 for a temperature stabilized (oven controlled) precision 10MHz crystal oscillator (A41) with stability of 1Hz/year. Any other stable external source may be used which is exactly 10MHz or a sub-multiple thereof (e.g. 5MHz, 3.333333MHz, 2.5MHz, 2MHz, or 1MHz).

A40-11 The external source is connected through the rear panel BNC connector labelled "10MHz input" to a signal amplifier (U1) with input diode protection (CR1 and CR2). The signal level is shifted from 0 volt reference at the BNC input to a +3.5v (VBB) reference at the input to U1a. It is then amplified by U1b and out-of-phase signals at U1b pins 6 and 7 are passed to U2a. U1B pin 6 output is delayed slightly behind the pin 7 output so that U2a is turned on for only a short period. The pulses from the U2a out-of-phase outputs are applied to a differential amplifier (Q50 and Q51) in the Phase Detector stage where they are amplified and used to switch a bridge made up of diodes CR50-CR53.

A40-12 When external source is being used, the action of the phase detector bridge is to switch the 10MHz signal from U53 into U54. C56 and R59 filter the signal so that only a dc level is seen as the input and output of U54. This dc level is buffered by U55 and used to control the frequency of the 50MHz OSCILLATOR, locking it in phase to the external source. U54 has a voltage gain of 11 to pull up the low level Sampling Bridge Output to an amplitude that will control the VCXO.

A40-13 If the loop does not lock up and the signal at the Phase Detector output is not within the loop bandwidth, the output of U54 will swing positive and negative trying to lock on. The negative peaks will turn on CR55, charging C75 and turning off Q55. R88 (5.1 M ohm) now dominates the input impedance to ground instead of R83 (12.4 k ohms), widening the bandwidth momentarily so the loop can "speed-up" the lock onto the external source. When lock-on is achieved, the output of U54 will stop swinging, Q55 will again turn-on and the desired narrow bandwidth is achieved.

A40-14 Whenever the loop is not locked but trying to lock-up (as described above) the charge on C75 will also bias off Q56. This will allow Q54 to turn on and the loop unlock indicator DS1 will glow. At the same time, a LOW signal on the (L) REF UNLOCKED line to the processor will cause an error code E01 to be displayed on the front panel.

A40-15 If an external source is not used, the diode bridge is never turned on and U54(3) is essentially at ground potential. R78 is now used to set the Oscillator frequency to exactly 50MHz while manually shorting TP4 to TP5 to speed-up the normally very slow loop response time. Q55 is normally on, providing a very narrow bandwidth to the loop.

A32 Schematic Diagram

A40-16 TROUBLESHOOTING

1. 50MHz OSCILLATOR CHECK

   (a) Short A40TP6 to ground. The VCO should now run at approximately 50MHz.

2. An out-of-lock condition may sometimes exist on the A40 Assembly with no out-of-lock condition indicated. This is particularly true when the external reference source is at a submultiple of 10MHz. In almost all cases when the reference source is at 10MHz, any drift between the 50MHz Oscillator and the 10MHz reference source will be indicated by an error code E01 and DS1 being on. The long time constant of the Reference Frequency Loop (A40) can be reduced during troubleshooting and adjustments by shorting A40TP4 to A40TP5.

Note: Most of the circuitry on the A40 Assembly uses ECL logic with a logic 0(+3.5V and a logic 1>+4V +/-0.1V.

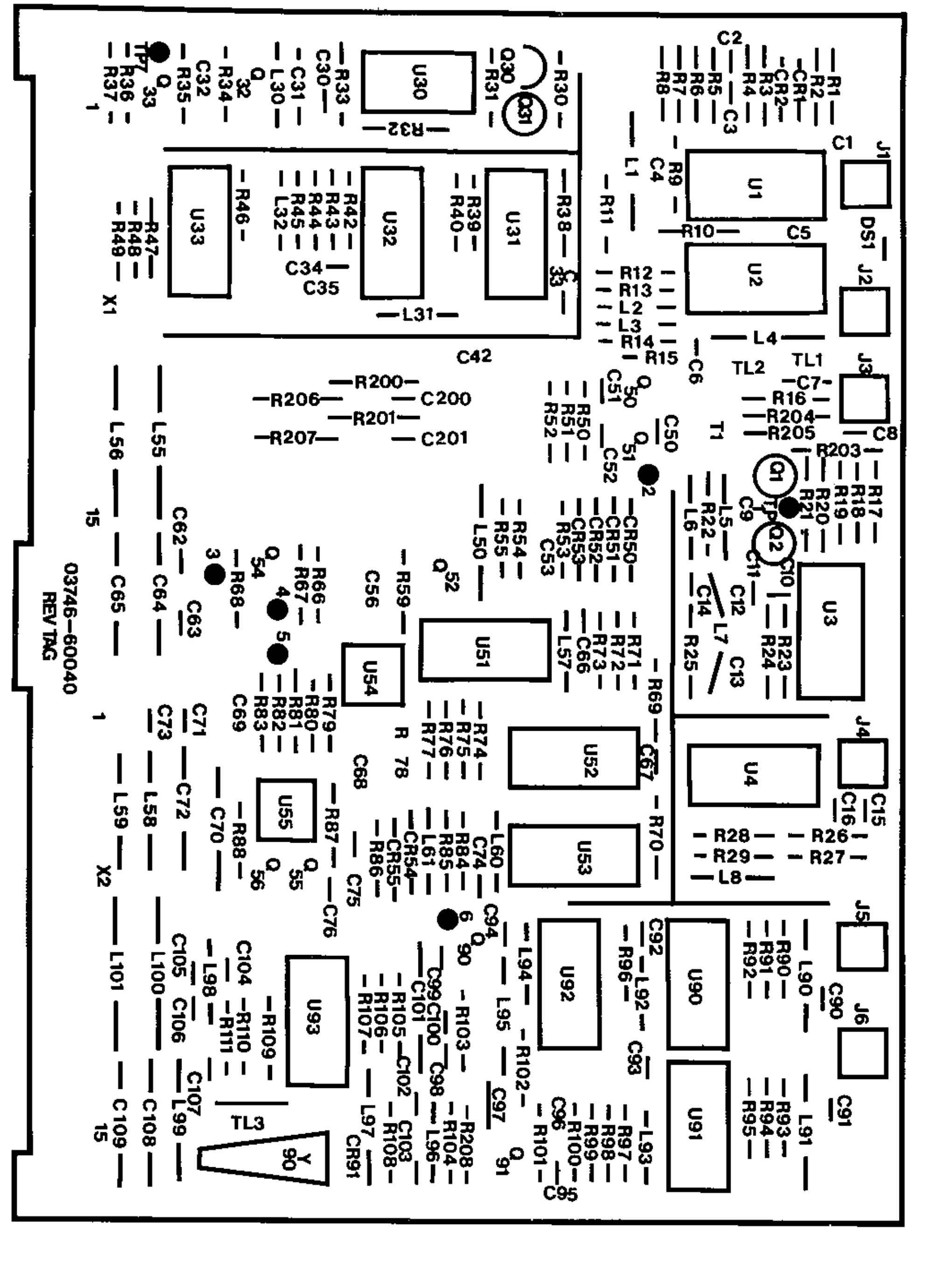

Figure A40-2 A40 Component Location

IC	GND	+5V	DESCRIPTION
U1	8	1,16	MC10116
U2	8	1,16	MC10109
U3	8	1,16	MC10109
U4	8	1,16	MC10109
U30	7	14	SN74LS196N
U31	8	1,16	MC10138L
U32	8	1,16	MC10105
U33	8	1,16	MC14049UCB
U51	8	1,16	MC10109
U52	8	1,16	MC10105
U53	8	1,16	MC10138L
U90	8	1,16	MC10109
U91	8	1,16	MC10109
U92	8	1,16	MC10116
U93	8	1,16	MC10109

Figure A40-3 A40 Schematic Diagram

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8-110

ASSEMBLY SERVICE SHEET A41
10MHz PRECISION REFERENCE (OPT 013 ONLY)

A41-1 INTRODUCTION

A41-2 Assembly A41 is fitted as an option (013) to provide a highly accurate and stable 10MHz FREQUENCY reference (with a drift of less than 1Hz per year) for use in instruments where no alternative stable reference is available. The Frequency Reference Assembly (A40) which provides most of the reference frequencies throughout the instrument is phase locked to the output of the A41 board. The frequency references in the instrument now have the same accuracy and stability as the 10MHz Precision Reference.

NOTE: If the Reference Frequencies are not precise, this could give apparent measurement inaccuracies.

A41-3 CIRCUIT DESCRIPTION

A41-4 The 10MHz signal from the Oven Reference Oscillator is amplified and buffered by Q4 and Q6 and passed to the rear panel 10MHz OVEN output. Connecting the rear panel 10MHz OVEN output to the rear panel 10MHz INPUT phase locks the Frequency Reference Assembly (A40) to the 10MHz Oven Reference Oscillator. Diodes CR3, CR4 and fuse F1 are fitted as a safeguard to protect the circuitry against any high voltages accidentally applied to the rear panel 10MHz OVEN output.

A41-5 The Oven Monitor output gives a high/low status indication of the temperature of the Oscillator oven. Consider the case when the Oven is cold and the power cord is connected to the instrument:

Q1 switches off, Q2 switches on switching DS1 on.

Q3 turns off and Q5 switches on, to ground the 10MHz signal.

The H COLD line goes high to inform the Processor (A60) that the oven has not yet reached normal operating point.

The Processor (A60) flags the Display and Keyboard (A63) to turn on the Front Panel OVEN annunicator.

A41-6 In the condition when the OVEN is warming-up the short term stability of the Frequency Reference Assembly (A40) is better than the 10MHz Oven Reference Oscillator. The Frequency Reference Assembly (A40) is thus allowed to run in its "non locked" mode.

A41-7 When the oven reaches normal operating temperature Q1 and Q3 switch on Q2 and Q5 are switched off and the 10MHz Reference Signal is switched on, allowing the Frequency Reference Assembly to phase lock to the 10MHz Oven Reference.

A41-8 When the POWER switch is set to STBY, the ±15V supplies to A41 remain on, maintaining the oven at its normal operating temeprature.

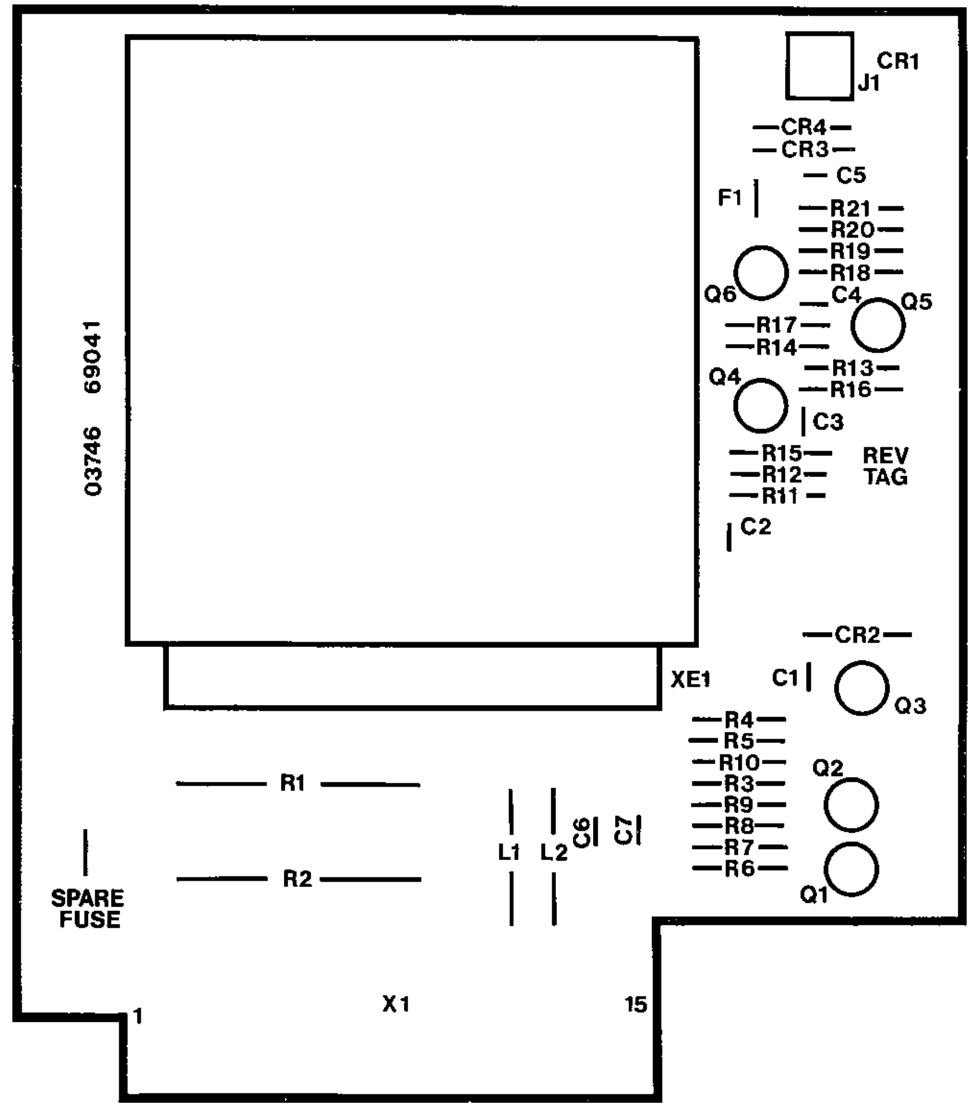

Figure A41-1 A41 Component Location

A40 Schematic Diagram

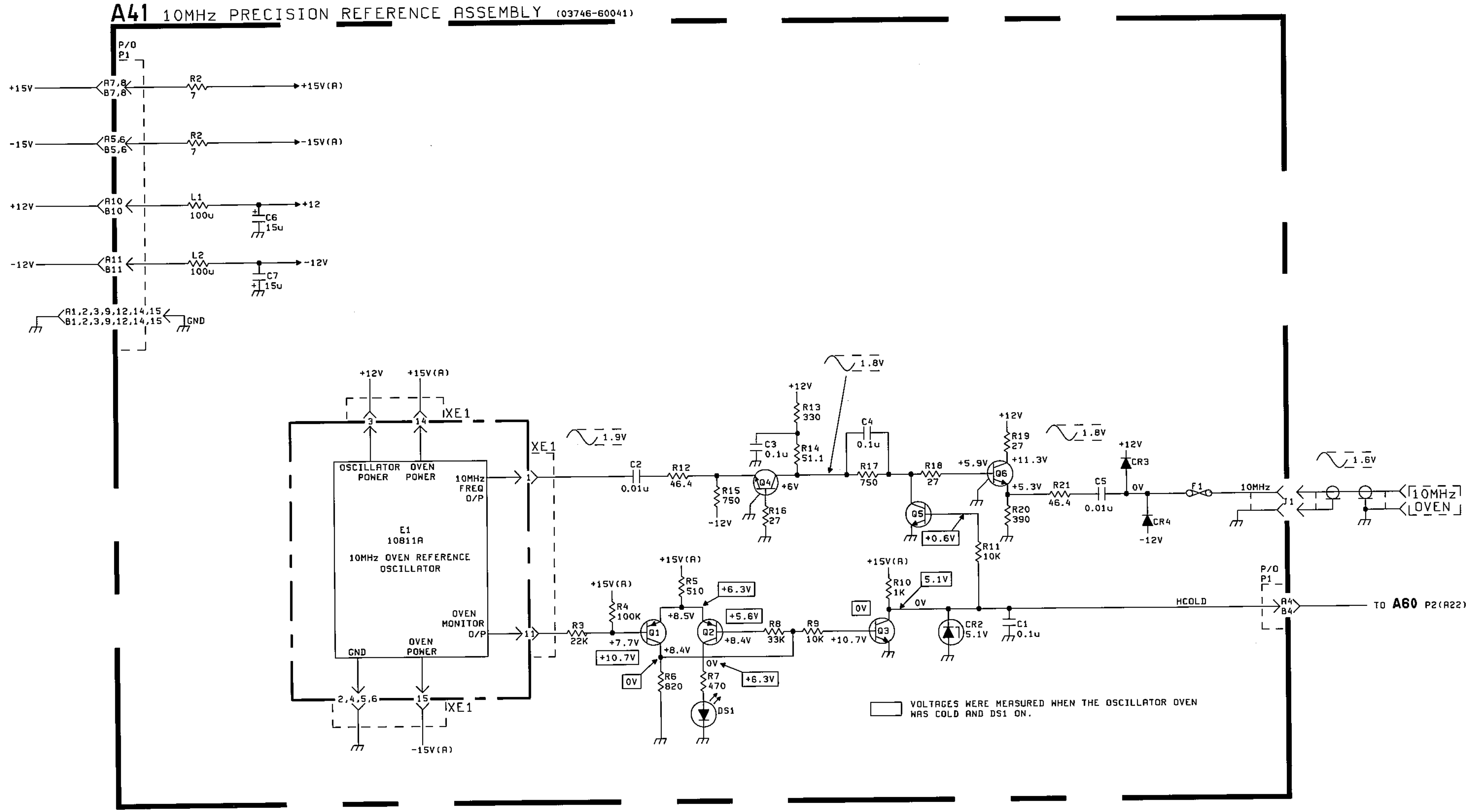

Figure A41-2 A41 Schematic Diagram

9-111
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ASSEMBLY SERVICE SHEET A43
10MHz PRECISION REFERENCE (OPT 014 ONLY)

A43-1 INTRODUCTION

A43-2 Assembly A43 is fitted as an option (014) to provide a highly accurate and stable 10MHz FREQUENCY reference (with a drift of less than 1Hz per year) for use in instruments where no alternative stable reference is available. The Frequency Reference Assembly (A40) which provides most of the reference frequencies throughout the instrument, is phase locked to the output of the A43 Assembly. The frequency references in the instrument now have the same accuracy and stability as the 10MHz Precision Reference.

NOTE: If the Reference Frequencies are not precise, this could give apparent measurement inaccuracies.

A43-3 CIRCUIT DESCRIPTION

A43-4 The 10MHz Oscillator E1 produces a 10MHz TTL waveform which is amplified by common base transistor Q3 and buffered by Q4.

A43-5 In order to blank the 10MHz OUTPUT while the oven is heating, the current drawn by the oven is sensed by a 1ohm power resistor R1. U1 is a dual comparator, one of which drives the blanking, the other comparator drives the TEST LED to set up the blanking threshold level. The threshold is set by adjusting R6 until DS1 is just on the point of switching. The threshold is defined by the divider chain R3, R4, R5 and R6 and is slightly different for each comparator so that when the TEST LED is just switching the blanking will be at the correct level to allow it to switch off when the oven does.

A43-6 As mentioned above the oscillator output is at TTL levels. When schottky diode CR3 is on it draws current from Q3. To blank the output, Q2 is switched on, which switches Q1 on, grounding the anode of CR3. When Q2 is on, a LED, DS2 indicates that the oven is cold. This fact is signalled to the processor by the HCOLD line so the front panel OVEN lamp can be turned on.

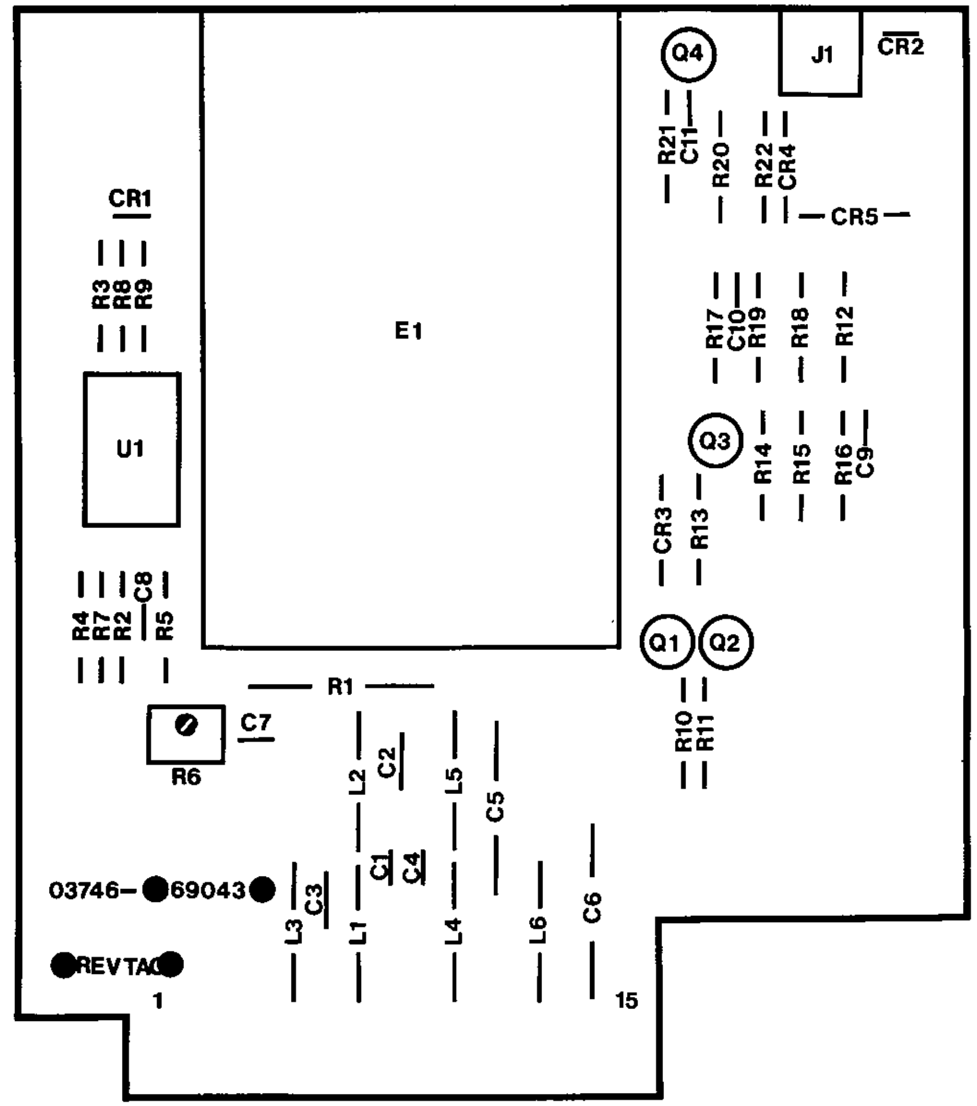


Figure A43-1 A43 Component Location

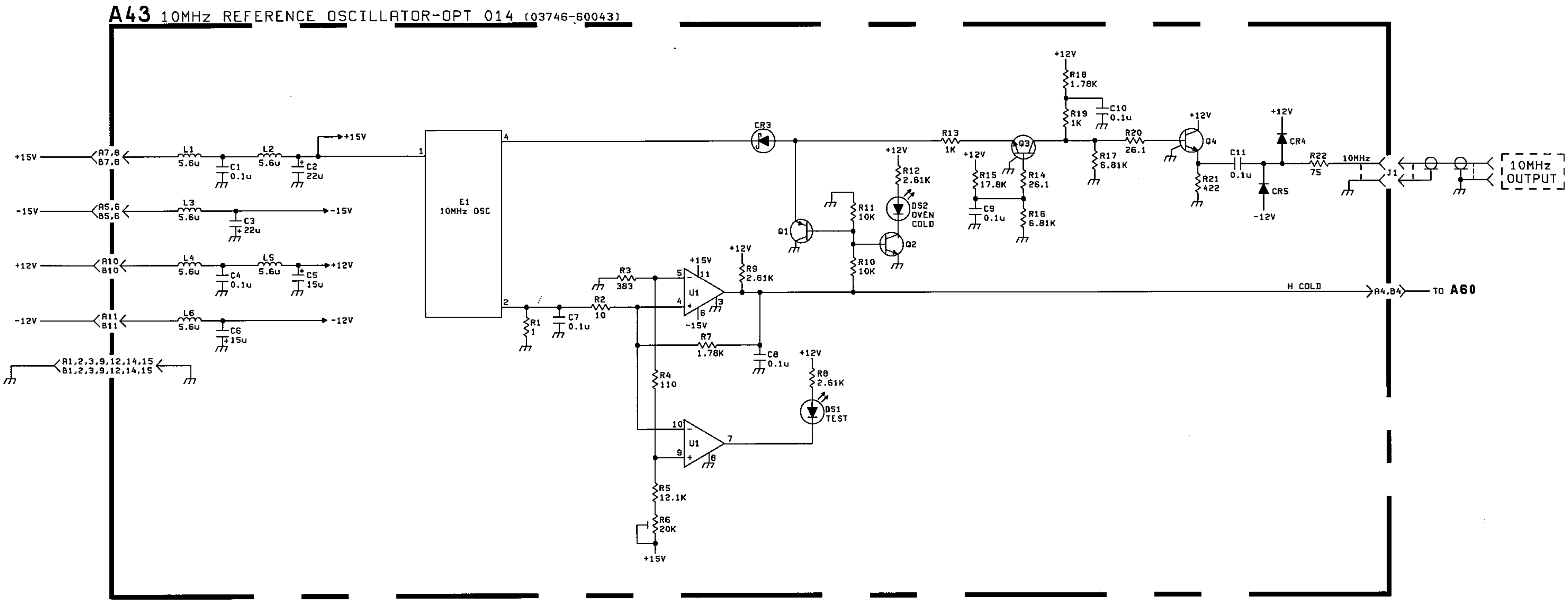


Figure A43-2 A43 Schematic Diagram

8-113
8-114

ASSEMBLY SERVICE SHEET A50
STEP LOOP

A50

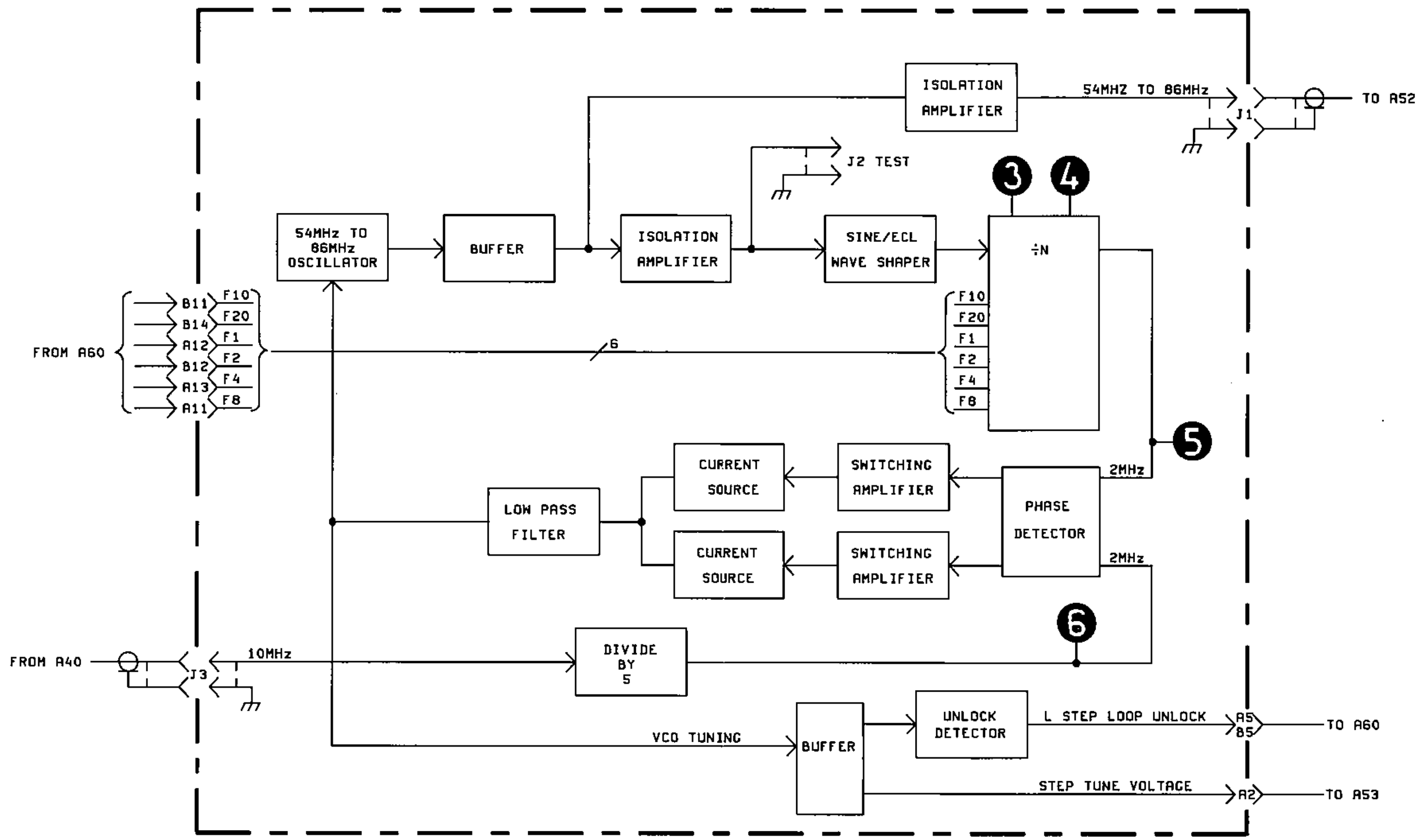


Figure A50-1 A50 Block Diagram

A50-1 INTRODUCTION

A50-2 The Step Loop is fully contained on the A50 board and consists of the four basic elements of a phase-locked-loop (PLL): a voltage-controlled oscillator (VCO), a divide-by-N circuit (divide by N, a phase detector, and a low-pass filter (LPF).

A50-3 CIRCUIT DESCRIPTION

A50-4 Step Loop VCO

A50-5 The VCO operates in the range of 54-86MHz in 2 MHz steps. The actual frequency is controlled by the STEP TUNE VOLTAGE across the voltage-variable-capacitance (VARICAP) diodes CR1 and CR2. The STEP TUNE voltage can vary from +9 VDC to -9 VDC, changing the capacitance of the VARICAPS and thus changing the frequency of the oscillator.

A50-6 The VCO output is buffered by Q7 and Q8 and then goes to two isolation amplifiers. One provides a test jack capability for monitoring the step VCO frequency (J2 TEST) and drive to an ECL Waveshaper which converts the sine wave to a square wave output to drive the divide by N circuit. The other provides the output (J1) to the SUM LOOP MIXER (assembly A52).

A50-7 Divide by N Counter

A50-8 The divide by N Counter is programmed via the Processor (A60) to divide the VCO frequency down to 2MHz. The VCO frequency is always at a muliple of 2MHz in the range 54MHz to 86MHz. This means the divide by N Counter division range is 27 to 43 (see Table A50-1. The divide by N Counter is configuired in such a way that U71 counts continuously and U72 increments each time U71 reaches a count of 16 {=0000 at U71-FF(1), FF(2), FF(3) and DD(4)}. The 15 + 1 outputs of U71(4) and U72(4) are "wired or" and go low only when both outputs are low.

A50-9 If a Step Loop Frequency of 78MHz is selected the divide by N Counter is programmed to divide by 39. The code on the respetive lines F20-F1 is 011001 (see Table A50-1). The two most significant bits (01) are added to the hard wire inputs to program U72 to 1101 (=13), and the four least significant bits program U71 to 1001 (=9). The Counting sequence is as follows:

1. U71 counts from 9 to 16 (making a total of 7 pulses). When the count of 16 is reached U72 increments by 1 (to 1110).

2. U71 counts from 1-16 and (making a total of 7 + 16 pulses). U72 increments again by 1 (to 1111). U72 tries to pull its 15 + 1 output low but cannot since U71 count has advanced to 0001, at the same time as U72 increments, to maintain U71(4) high.

3. U71. counts to 15 + 1 and pulls U71(4) low (after a total count of 7 + 16 + 16 = 39). Both

U71(4) and U72(4) are low. TP5 is pulled low. The Counter loads the number present on the F20-F1 inputs into the counter. The sequence repeats.

A50-10 Step Phase Detector

A50-11 The phase detector has two inputs. The first input comes into A50 as a 10MHz reference from the Q40 board. A divide by 5/Waveshaper converts this 10MHz pulse which is the precision reference input to the Phase Detector. The second input from the divide N circuit at 2MHz is the VCO frequency divided by N.

A50-12 The phase detector compares the 2MHz input from the divide N to the fixed 2MHz precision reference. If the rising edges of the pulses are at the proper phase, the VCO has the correct frequency ordered by the processor, the loop is phase-locked and the STEP TUNE DC voltage across main-loop charging capacitor C48 is constant, holding the VCO frequency constant. The positive and Negative Current Sources are now exactly in phase, and no current flows through S1 and R50 into C48.

A50-13 If the VCO frequency is too low (Example: operator changes frequency upwards, processor increases N, divide by N output is less than 2MHz), the input pulse from the divider now lags the reference input pulse. The Negative Current Source (Q71) is turned on for longer than the Positive Current Source (Q72) and the voltage across C48 decreases as current flows through R50 and S1 into Q71. As the voltage across C48 goes more negative, the VCO increases in frequency until the variable input is again in phase with the reference. Now the Negative and Positive Current sources will again turn on and off together at the 2MHz rate set by the reference input, no more current flows and the loop is again locked. For a VCO frequency too high the circuit action is reversed. The Positive Source is on longer than the Negative, current flows out of Q72 into C48 and the VCO frequency decreases until the loop is again locked.

A50-14 The Switching Amplifiers are driven differentially to ensure quick turn-on and turn-off of the two current sources. The TEST position of S1 provides a pre-set tuning voltage of +7.4V which should tune the VCO to 54MHz.

A50-15 Step Loop Low Pass Filter

A50-16 The LPF keeps the 2MHz pulses of current flow from adding 2MHz sidebands to the VCO output. The output of the LPF also goes to a unity gain Buffer stage (U1) to provide the dc STEP TUNE VOLTAGE to the Sum Loop PSD (A53).

A50-17 The Unlock Detector circuit (U73) compares the STEP TUNE voltage to ± 9V. If the loop is not locked, the STEP TUNE voltage will exceed the UNLOCK thresholds, DS70 will turn on and the processor will be notified via a LOW on (L) STEP UNLOCK to present error code E02 (Step Loop unlocked).

A50-18 TROUBLESHOOTING

1. If the STEP LOOP goes out-of-lock a front panel Error Code E02 will be displayed and a red LED A50 DS70 (located at the top of the A50 Assembly) will illuminate.

2. Most failures in the STEP LOOP cause an out-of-lock condition. The following points however should be noted.

   (a) Failure of the Reference Frequency 10MHz signal from A40J4 automatically causes the STEP LOOP to go out-of-lock.

   (b) There is a slight possibility that the loop could drift so far out of adjustment, that an out-of-lock condition would be indicated, and the loop remains in lock. Confirmation that the loop is still in lock is given by checking the output frequency in step 4(a). The threshold limits of the unlock detector are pre-set at +9V and -9V. The normal range of the STEP LOOP (54 - 86MHz) typically produces a tuning voltage of -3V at 86MHz. The VCO coil L5 is tuned to a frequency of 54MHz when the tuning voltage is pre-set to +7.4V. If the condition exists, whereby the loop remains in lock with an out-of-lock condition indicated, check the threshold detector limits on U73 pin 2 and pin 7 before refering to the appropriate paragraph in the adjustments (Section V).

3. If a test cable is unavailable, disconnect the orange cable from A40J3 to the rear panel 10MHz OUTPUT and use this as the test cable.

4. The following built-in troubleshooting facilities are available to help check out the A50 Assembly and assist in fault isolation.

   (a) A manual overide facility to control the loop tuning via the Processor. This facility is enabled by pressing the TR key followed by the number 50. By pressing the ↑ keys the loop can now be tuned from 52 to 86MHz in 2MHz steps. The frequency can be monitored at A50J1 or A50J2.

   (b) A test switch S1 breaks the STEP LOOP and pre-sets the VCO tuning voltage to 7.4V - the VCO frequency should now tune to approximately 54MHz.

5. VCO Check

   (a) Set A50S1 to test (T).

   (b) The STEP LOOP frequency at A50J2 (TEST) and A50J1 should be 54MHz +/-0.5MHz. If the VCO frequency is out by more than 5MHz suspect a failure. If the frequency is out by less than 5MHz refer to the adjustment procedure (Section V).

(c) The VCO open loop tuning range can be checked by driving A50TP1 from a d.c. voltage source and varying the voltage from +8V to -8V. The VCO frequency should change from 52MHz to 86MHz.

CAUTION

Do not let the current from the d.c. source get too high while driving the VCO otherwise component damage may occur.

Table A50-1 Step Loop divide-by-N Codes

Step VCO Frequency	Divide by N Number	F20	F10	F8	F4	F2	F1
54MHz	27	1	0	0	1	0	1
56MHz	28	1	0	0	1	0	0
58MHz	29	1	0	0	0	1	1
60MHz	30	1	0	0	0	1	0
62MHz	31	1	0	0	0	0	1
64MHz	32	0	0	0	0	0	0
66MHz	33	0	1	1	1	1	1
68MHz	34	0	1	1	1	1	0
70MHz	35	0	1	1	1	0	1
72MHz	36	0	1	1	1	0	0
74MHz	37	0	1	1	0	1	1
76MHz	38	0	1	1	0	1	0
78MHz	39	0	1	1	0	0	1
80MHz	40	0	1	1	0	0	0
82MHz	41	0	1	0	1	1	1
84MHz	42	0	1	0	1	1	0
86MHz	43	0	1	0	1	0	1

6. Divide by N Troubleshooting Hints

(a) Set the SLMS to diagnostic mode d50 by pressing the keys TR and 50.

(b) With A50S1 set to the normal (N) position 2MHz pulses should be present at U74 pin 6.

(c) If the frequency is incorrect reset A50S1 to test (T). Note the frequency at A50J2. Press the ↑ key until the SLMS display shows n LOOP = (the nearest frequency to that noted at A50J2). Check that the frequency at U74 pin 6 is 2MHz. Note: if the codes from the Processor A60 are incorrect divide by N will not operate correctly.

CAUTION

When removing or replacing the Processor Assembly A60 always switch off the power to the 3746A.

(d) If the divide by N codes are wrong remove the Processor Assembly A60. Then check that the divide by N code is 011111. Replace the Processor A60. Press TR and 50 keys, step the VCO frequency to 66MHz by means of the ↑ key. If the divide by N code is now incorrect refer to the Processor Troubleshooting.

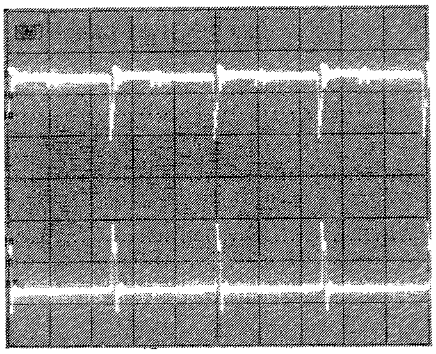
(e) If pulses are NOT present at U74 pin 6 check for pulses at U71 pin 3, 2, 14 or 15 (at R70). If pulses are present then check, A72 pins 3, 2, 1 or 15. If outputs are present at U72 pins 3, and U71 pins 3, suspect U74(a). Pulses present at U71 pin 3 and NOT at U72 pin 3, suspect U72.

(f) Set A50S1 to the test position (T). Press keys TR and 50. Monitor U74 pin 6 and keep the ↑ key pressed continuously. The 2MHz output should now change in frequency as the divide by N code to the divide by N circuit changes. (The VCO is held at a constant frequency by A50S1 being in the test position).

(g) Linking the pins at A50TP2 inhibits the CLK to the divide by N Counter.

7. Phase Detector (Switching Amplifiers and Current Source)

(a) Flip Flops U74a and U74b should have a 2MHz input signal as shown in Figure A50-2.



U74(6)

U74(11)

0.2usec/cm 1V/div

Figure A50-2

If either input is missing the Q outputs of the flip-flops will not toggle.

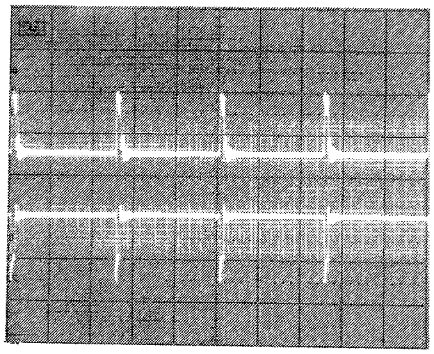


Figure A50-3

(b) Set A50S1 to the N position. Short the two pins at A50TP2 to inhibit the input to the divide by N Counter. The VCO output at A50J1 should go to one end, near 100MHz.

(c) Remove the short at A50TP2 and disconnect the coax from A50J3, the 10MHz reference input. The VCO output at A50J1 should go to the low end, near 50MHz.

(d) If correct, steps (b) and (c) give some indication that the Phase Detector, Switching Amplifiers and Current Sources are working correctly. Steps (e) through (f) however give some other troubleshooting hints.

(e) Repeat step (b). The flip-flops U74a and U74b should now hang-up as follows.

U74a pin 2 should be low (approx. +3.4V)
U74b pin 15 should be high (approx. +4.2V)

The 2MHz signal should switch U75d and Q75, Q76 at 2MHz rate. Q74 should be off with Q73 on.

(f) Repeat step (c). The flip-flops U74a and U74b should now hang-up as follows.

U74(a) pin 2 should be high (approx. +4.2V)
U74(b) pin 15 should be low (approx. +34V)
Q75 should be on, Q76 off, and Q72 on.
Q73 should be off, Q74 on, and Q71 off.

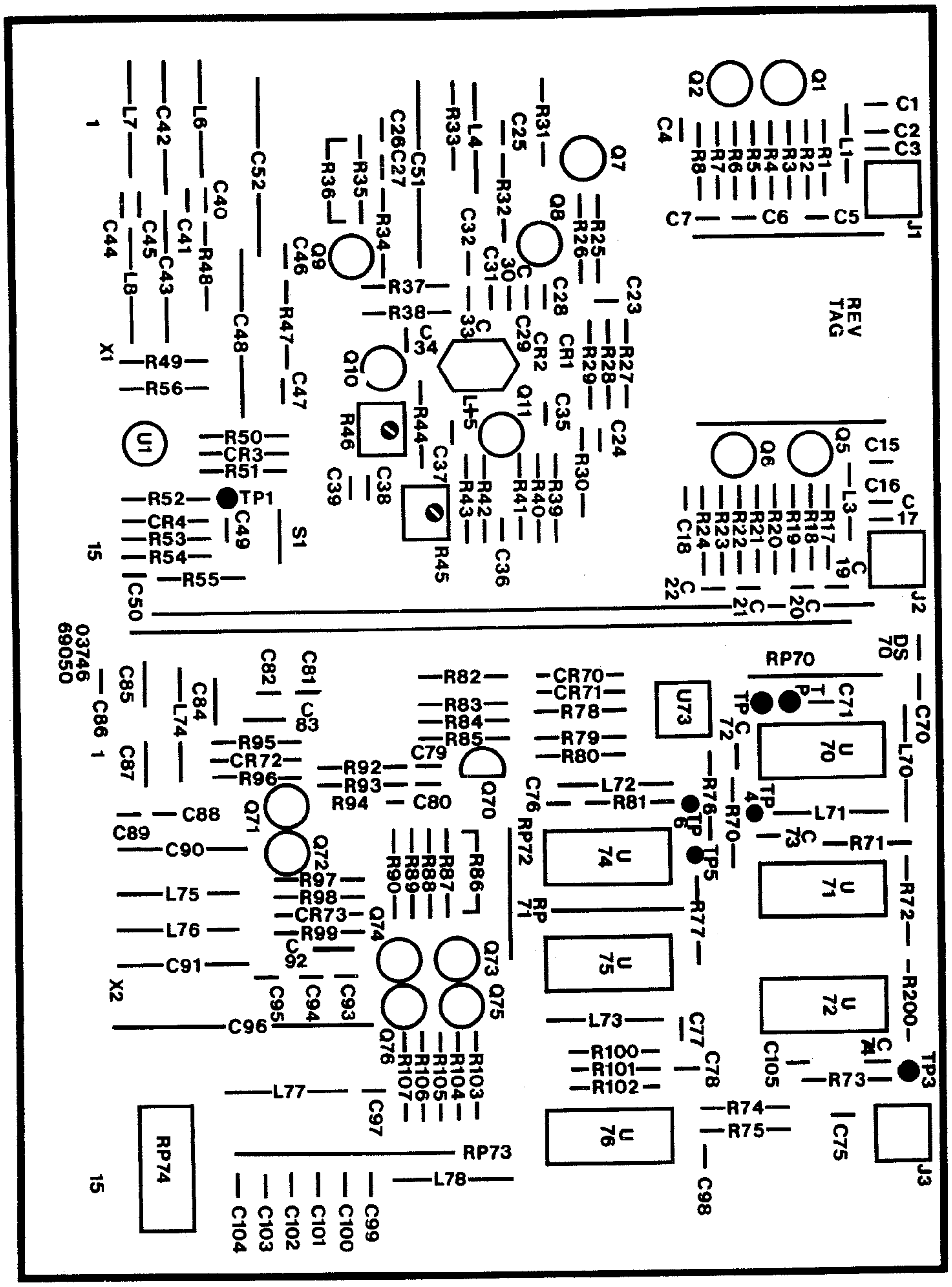


Figure A50-4 A50 Component Location

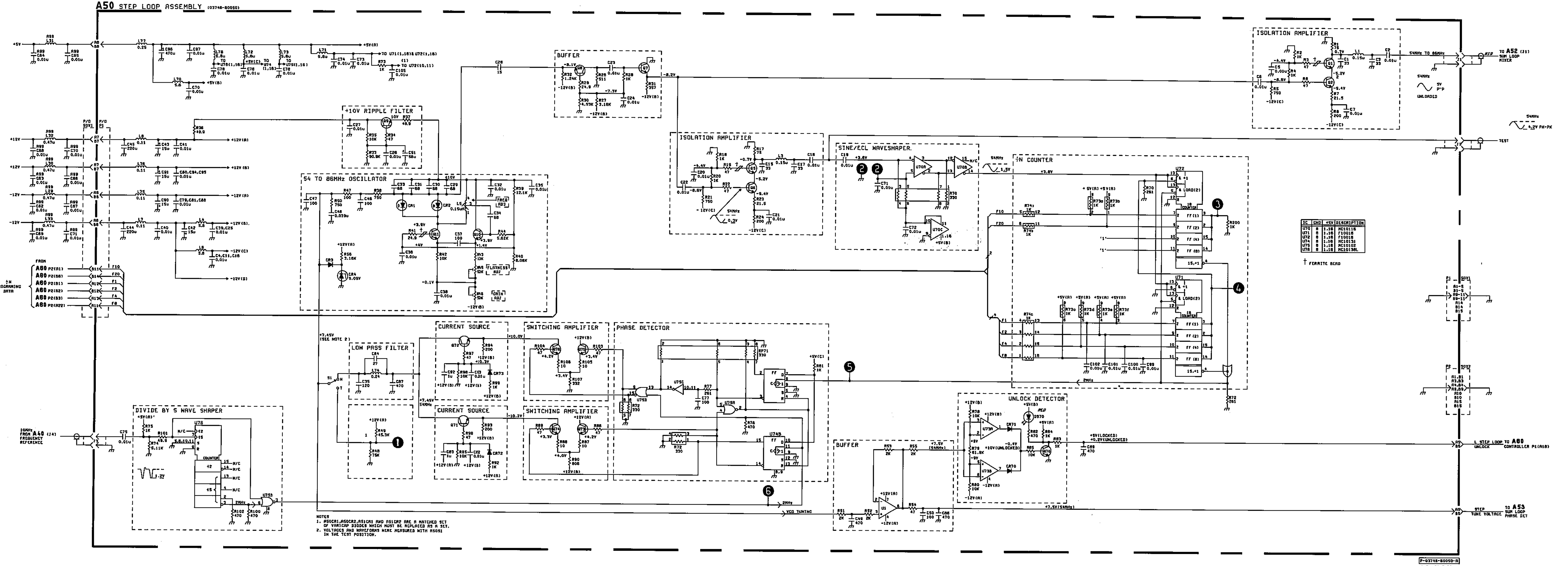


Figure A50-5 A50 Schematic Diagram

8-121
8-122

ASSEMBLY SERVICE SHEET A51
SUM LOOP VCO

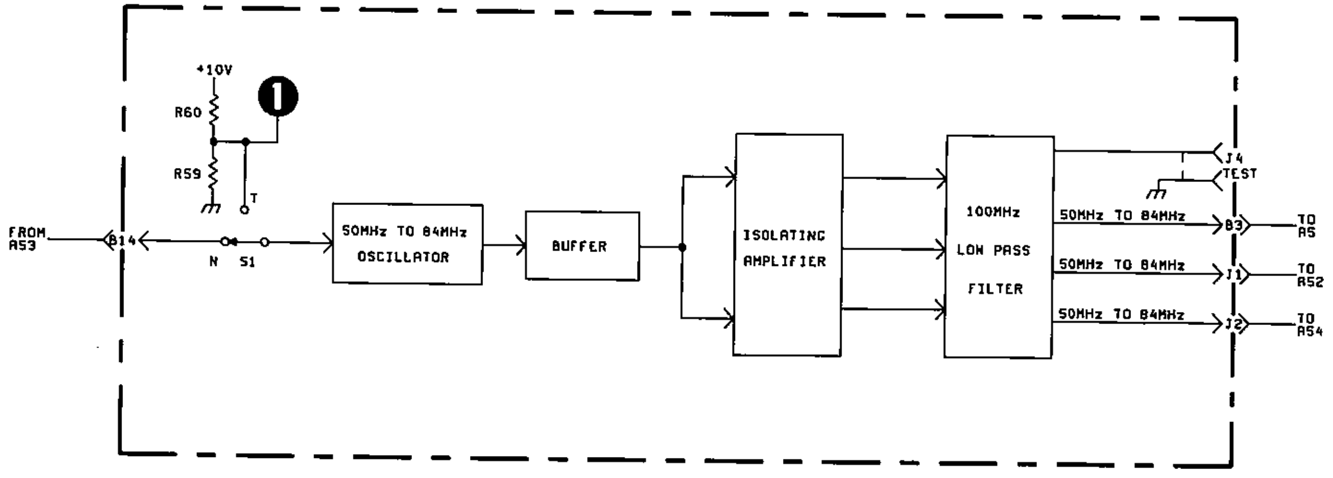


Figure A51-1 A51 Block Diagram

A51-1 INTRODUCTION

A51-2 This assembly provides a tunable 1st Lo Signal which is applied to the instrument Receiver section.

A51-3 CIRCUIT DESCRIPTION

A51-4 50-84MHz Oscillater (VCO)

A51-5 The voltage controlled oscillater (VCO) operates in the frequency range of 50-84MHz. The actual frequency is controlled by the SUM TUNE voltage which is applied to varicap diodes CR1 and CR2. Switch S1 provides a fixed voltage in the TEST position for SUM LOOP VCO frequency adjustments and test.

NOTE: Since both the Step and Sum Loops track together very closely, varicap diodes A50CR1/CR2 and A51CR1/CR2 are a four component matched set. Therefore, if a diode is to be replaced all four must be replaced.

A51-6 Buffer and Isolating Amplifiers.

A51-7 The output of the VCO is applied to the Isolating Amplifier via Buffer Q11 and emitter followers Q9 and Q10. The 100MHz Low Pass Filter rejects oscillator harmonics.

A51-8 TROUBLESHOOTING

1. The SUM LOOP VCO can be checked out in isolation to the remainder of the Sythesizer by carrying out the following procedure.

   (a) Place the A51 Assembly on an extender card and set A51S1 to the test (T) position.

   (b) The SUM LOOP VCO should now run at approximately 52MHz. (Monitor the frequency at A51J2).

   (c) Short A51TP1 to ground. The VCO frequency should now change to approximately 72MHz.

   (d) Steps (a) through (c) give a good indication of whether the VCO is operating correctly or not. If the VCO is suspected of NOT operating over the full range, connect a dc power supply to A50TP1. Vary the power supply voltage from +8V to -8V and check the frequency varies from at least 50MHz to 82MHz (probably nearer 100MHz).

CAUTION

Avoid driving A50TP1 with too much current from the dc source as this could possibly destroy circuit components.

2. The voltage and waveforms on the A51 schematic were measured with A51S1 set to the test (T) position.

   (a) To measure waveforms at Q8, Q1 and Q3 collectors terminate the oscilloscope in 75 ohm and remove assembly A5. The outputs at J1, J2 and the Test Jack J4 should now be 200mV +/-50mV. The variation in signal levels is due to return loss mismatch caused by cabling, track length etc. The output at J4 is usually slightly lower than the outputs at J1 and J2.

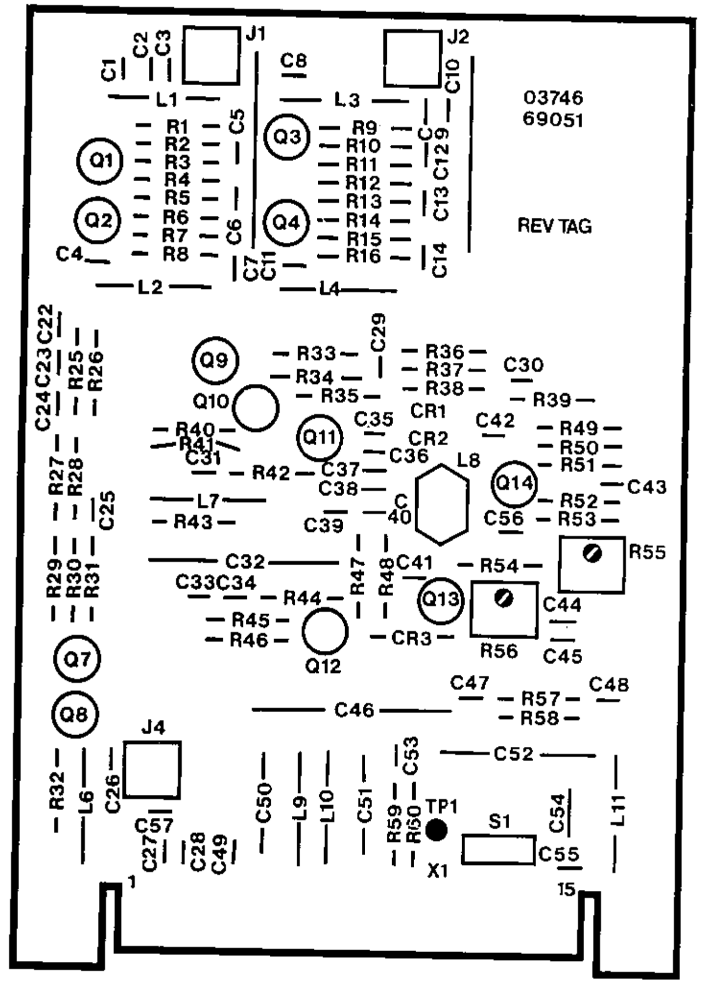


Figure A51-2 A51 Component Location

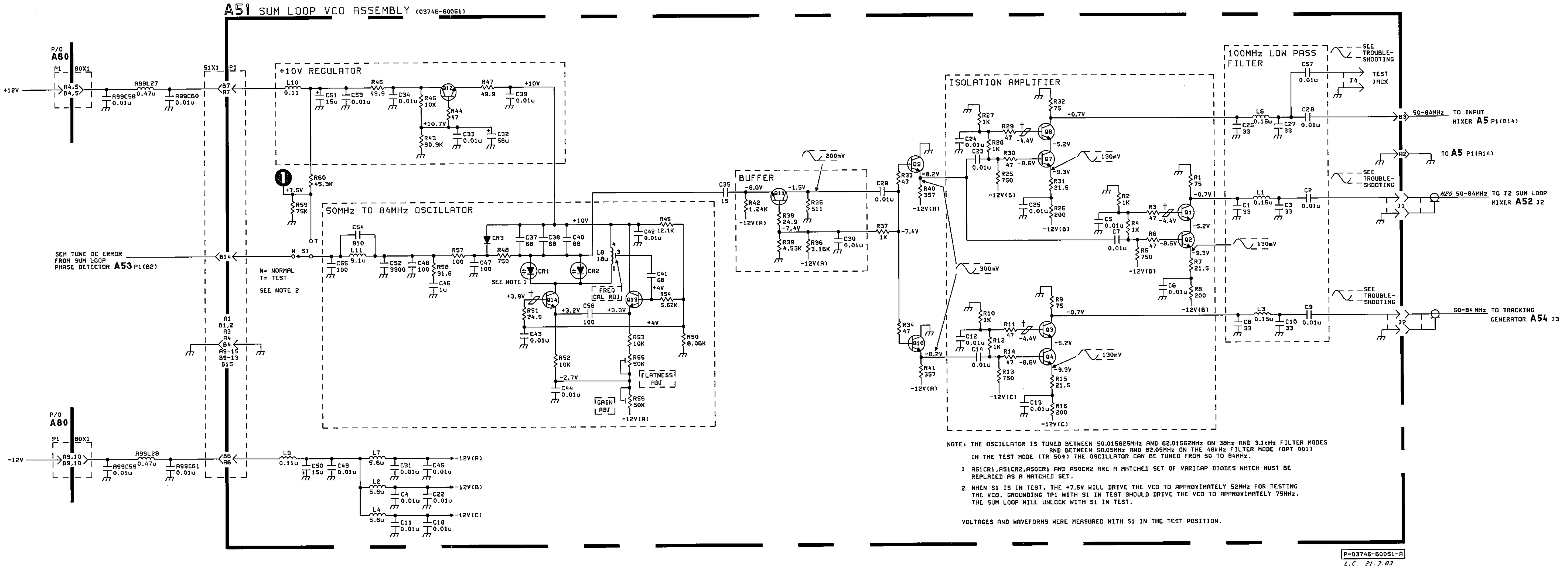


Figure A51-3 A51 Schematic Diagram

8-123
8-124

ASSEMBLY SERVICE SHEET A52
SUM LOOP MIXER

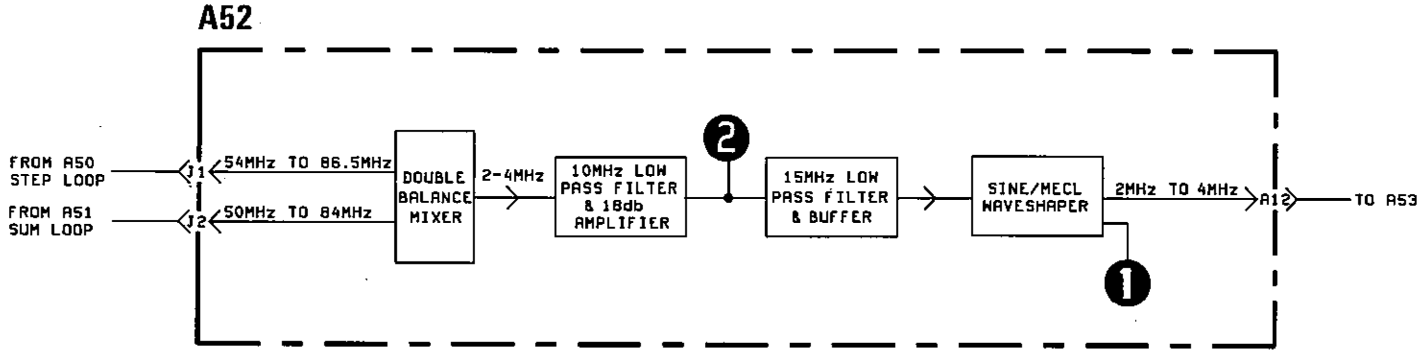


Figure A52-1 A52 Block Diagram

A52-1 INTRODUCTION

A52-2 This assembly mixes the output of the Step Loop VCO and the output of the Sum Loop VCO to produce an IF signal between 2 and 4MHz for the Sum Loop Phase Detector.

A52-3 CIRCUIT DESCRIPTION

A52-4 Mixer

A52-5 Double-balanced Mixer U1 mixes the 54-86MHz signal from the Step Loop VCO and the 50-84MHz signal from the Sum Loop VCO.

The output of the Mixer is filtered by a 10MHz and 15MHz Low Pass Filter to remove high frequency components (upper sideband and input signals).

A52-6 18dB Amplifier

A52-7 Amplifier Q1 boosts the level of the 2-4MHz IF signal by 18dB.

A52-8 Sine/ECL Waveshaper

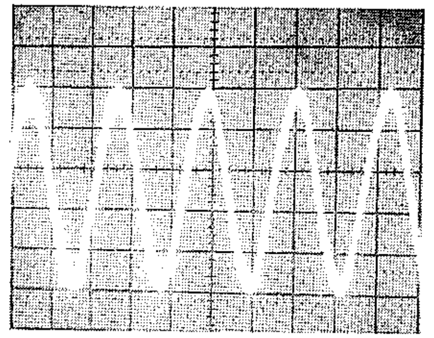
A52-9 Waveshaper U2a/U2d converts the sine wave signal at the output of Q2 to a ECL level which drives the Sum Loop PSD on Assembly A53.

A52-10 TROUBLESHOOTING

1. The waveforms on Figure A52-2 and Figure A52-3 were measured under the following conditions.

   (a) Connect A52J2 to the 50MHz output at A40J5. This eliminates all other parts of the SUM LOOP when checking out the Mixer (A52). A52J1 remains connected to the STEP LOOP A50J1. (It is assumed that the STEP LOOP is not faulty, otherwise fault finding should be carried out on Assembly A50 first).

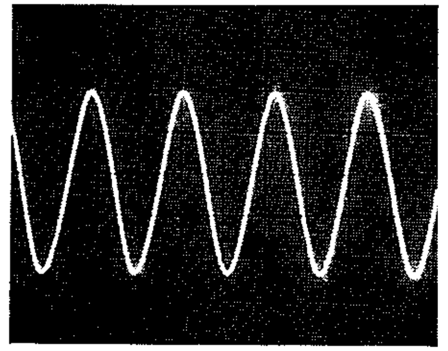
   (b) Press the keys TR and 50, if necessary also press the ↑ keys to obtain an LOOP = 52 reading on the SLMS display. (The frequency changes as the ↑ key is stepped.)



0.2usec/div 0.1V/div

U1 pin 12

Figure A52-2



0.2ns/div 0.1V/div

Q1 base

Figure A52-3

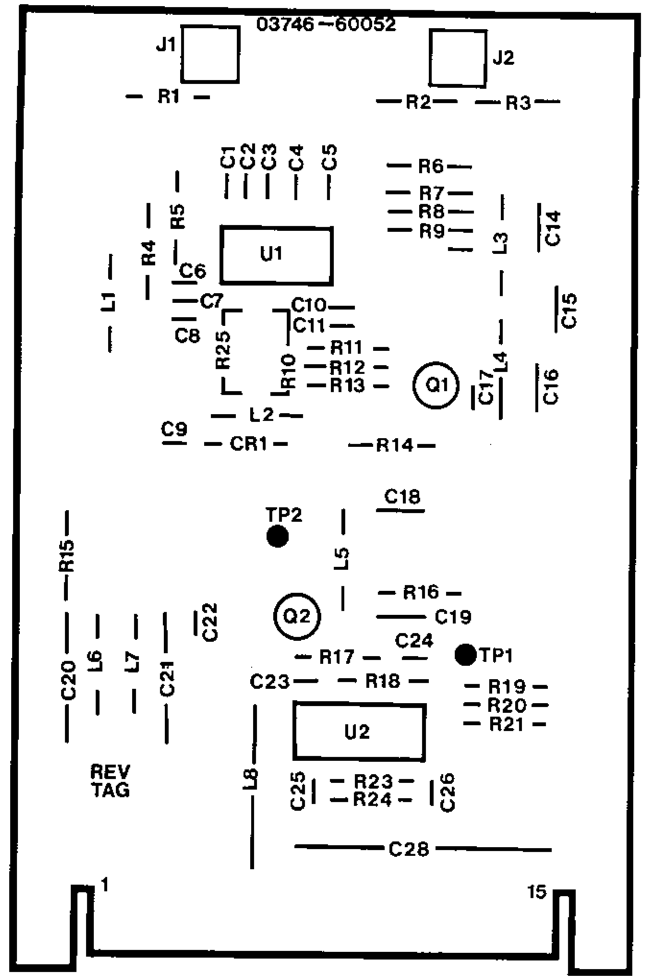
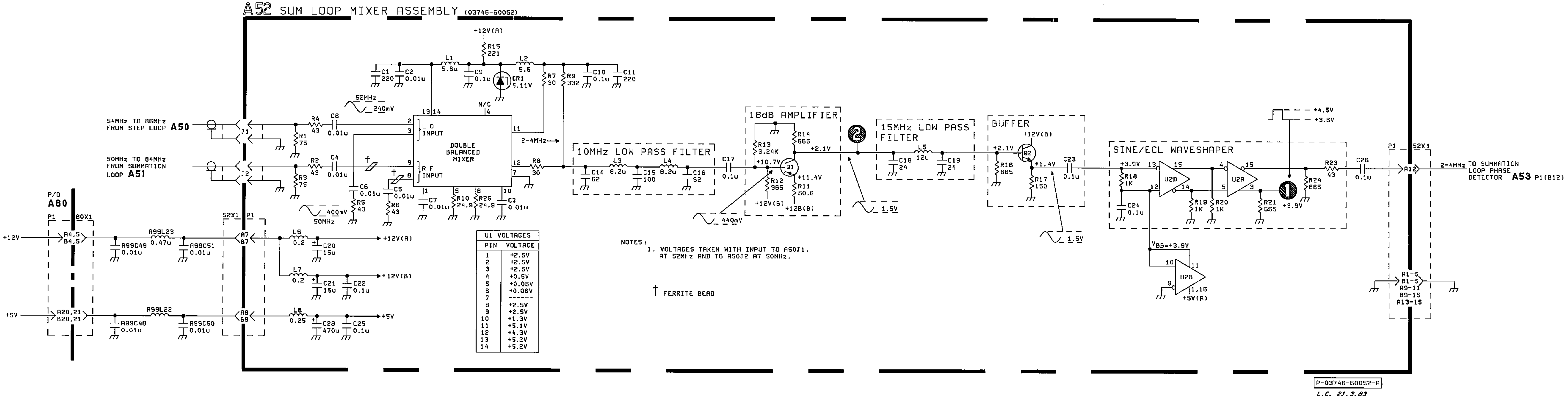


Figure A52-4 A52 Component Location



U1 VOLTAGES	
PIN	VOLTAGE
1	+2.5V
2	+2.5V
3	+2.5V
4	+0.5V
5	+0.06V
6	+0.06V
7	------
8	+2.5V
9	+2.5V
10	+1.3V
11	+5.1V
12	+4.3V
13	+5.2V
14	+5.2V

NOTES:
1. VOLTAGES TAKEN WITH INPUT TO A50J1. AT 52MHz AND TO A50J2 AT 50MHz.

† FERRITE BEAD

Figure A52-5 A52 Schematic Diagram

8-125

8-125
8-126

ASSEMBLY SERVICE SHEET A53
SUM LOOP PHASE DETECTOR

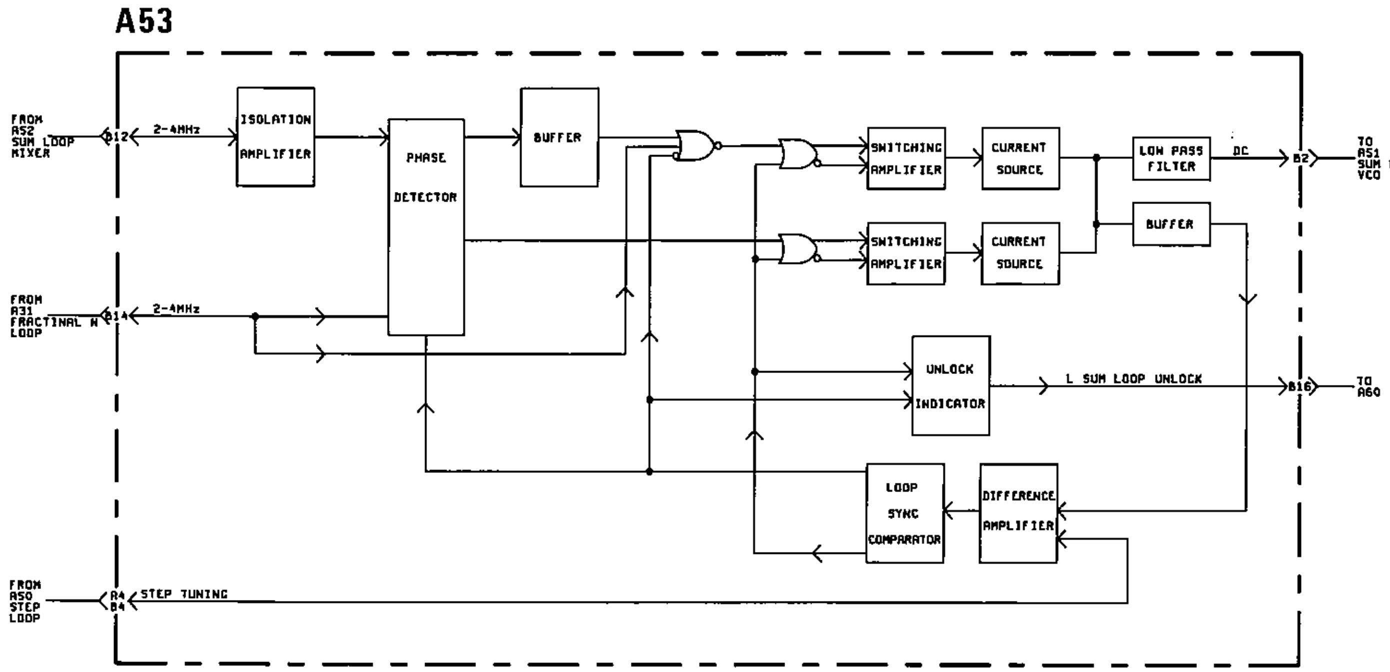


Figure A53-1 A53 Block Diagram

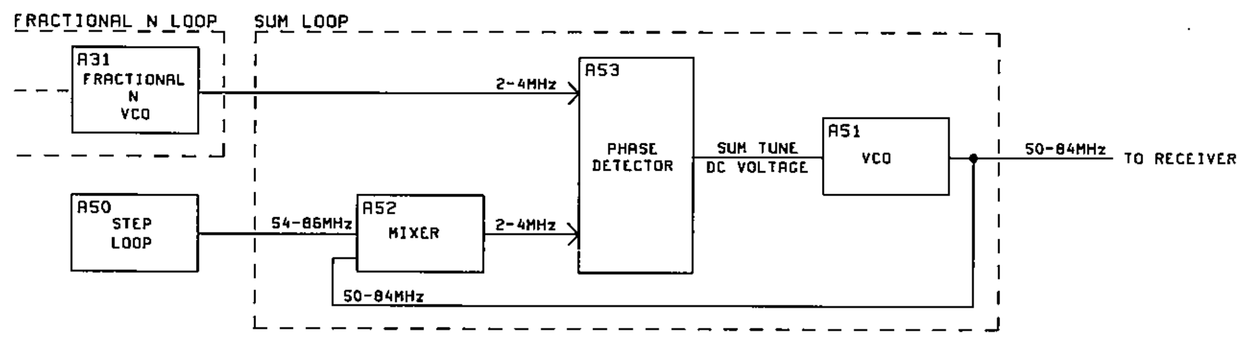


Figure A53-2 Simplified Sum Loop Block Diagram

A53-1 INTRODUCTION

A53-2 Phase Detector Assembly A53 compares the 2-4MHz signals from the Fractional N VCO (A31) and the Sum Loop Mixer (A52) to produce a dc tuning voltage proportional to the phase difference between the two signals. This SUM TUNE DC VOLTAGE defines the frequency of the Sum Loop VCO (A51). A simplified diagram of the Sum Loop is illustrated in Figure A53-2.

A53-3 CIRCUIT DESCRIPTION

A53-4 When the Sum Loop is phase-locked to the Fractional N reference, the outputs of the current sources (Q4 and Q5) are exactly in sync, so no current flows through the Low Pass Filter either to or from the Sum Loop VCO and the Sum Loop VCO frequency is stable. If the operator makes a front panel frequency change so that only the Fractional N frequency is changed, the loop momentarily unlocks. The phase detector adjusts the on/off time duration of the appropriate current source to raise or lower the SUM TUNING DC VOLTAGE. The SUM TUNING DC VOLTAGE is sent to the Sum Loop VCO (A51). The Sum Loop VCO frequency changes accordingly, the A52 mixer output follows the VCO change and, when it equals the Fractional N reference, the loop stabilizes.

A53-5 If a frequency change is made from the front panel the processor reprograms the Fractional N loop and if necessary changes the Step Loop frequency. If the Step Loop VCO frequency change causes the A52 Mixer output to be greater than approximately 10MHz, the A52 Low Pass Filter will not pass the signal, the Sum Loop Mixer input to the phase detector dies and the Sum TUNE DC VOLTAGE tries to drive to one end as commanded by the Phase Detector. However, the STEP TUNE VOLTAGE change is applied to Differential Amplifier A53U1 to switch in the Loop Synchronization Comparator circuit to handle these "loop-out-of-limit" conditions. The output of either U3a or U3b changes state to over-ride the Phase Detector and drive the Sum Loop VCO up or down in frequency until the Loop is back within limits. At this time, the Fractional N reference again assumes control of the loop until phase-lock occurs.

A53-6 In normal (locked loop) operation, the output of U1 is approximately 0 volts, the output of U3a is HIGH and the output of U3b is LOW. If the loop unlocks with the Sum Loop VCO too low and out of limits, the STEP TUNE voltage goes instantaneously more negative than the dc voltage at TP1. U1 output now goes positive causing U3a output to go LOW. This state change of U3a turns the Negative Current Source on. It also freezes the Phase Detector flip-flops by putting a LOW on the D inputs of U6a and U6b. This turns the Positive Current Source off to pull the Sum Loop VCO frequency up to within 2MHz of the STEP VCO. When the SUM TUNE VOLTAGE lowers the input of U1 sufficiently to return U1 output to 0 volts, U3a reverses state, the loop returns within operating limits and the Phase Detector again assumes control and locks up the loop. During this sequence, the output of U3b remains constant.

A53-7 If the loop unlocks with the Sum Loop VCO too high and out of limits, the process is similar but the Negative Current Source turns off (U3b changes state) and the Positive source turns on until the Sum Loop VCO comes down to within 2MHz of the Step VCO. When the Phase Detector assumes control, it again locks up the Sum Loop to agree with the Fractional N loop.

A53-8 Anytime the Sum Loop goes to an "out-of-limit" condition, one of the two inputs to U4a will go HIGH turning Q1 on to light the unlock indicator DS1. At the same time, this LOW at pin 2 of U4a is sent to the processopr via the SUM UNLOCK (L) line to cause the E04 error code (Sum loop unlocked) to be displayed.

A53-9 TROUBLESHOOTING

This assembly will normally be one of the last assemblies checked when the Synthesizer is faulty.

The following procedure troubleshoots the A53 Assembly and makes use of the built-in diagnostic facilities to tune the FRACTIONAL N and STEP LOOPS. The SUM LOOP is opened by disconnecting the coax at A52J2. A 50MHz reference from A40J5 is then applied to A52J2. (It is assumed that the FRACTIONAL N and STEP LOOPS are both working correctly – see Synthesizer Troubleshooting, Paragraph 8S-27 and Table 8S-3).

The following steps check out the PSD and most of the circuitry on A53.

1. Connect A50J2 to A40J5.

2. Connect A53TP2 to GND.

3. The unlock LED A53DS1 should now extinguish and A53TP4 should be at +1.5V +/-0.5V. If this is not the case U3b is faulty.

4. Press TR followed by keys 30.

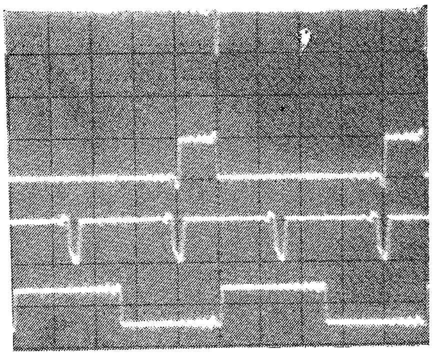
5. If necessary press the ↑ key to tune the FRACTIONAL N LOOP to 40MHz (giving 4MHz at test point A53J1) indicated by 40,000.000 on the SLMS display.

6. Press TR followed by keys 50. The SLMS display should now indicate n LOOP = 52. (This makes the inputs to the A52 Assembly 50MHz at A52J2 and 52MHz at A52J1 - this gives an output frequency of 2MHz at A52J2 and at the input to the Sum Loop PSD at A53B12).

7. Connect a dc coupled oscilloscoe to A53TP1. The dc level should be at +11V +/-1V.

8. Press the ↑ key to shift the n LOOP = 52 (on the display) through 54MHz to 56MHz. The dc level should switch to -11V +/-1V (this change usually takes place when the FRACTIONAL N LOOP frequency is at 54MHz). If this check works, most of the A53 assembly, except U1, seems to be working.

9. If there is no change in level at A52TP1 check that the Flip-Flops U6b and U6a are toggling - see Figures A53-3 through A53-7.

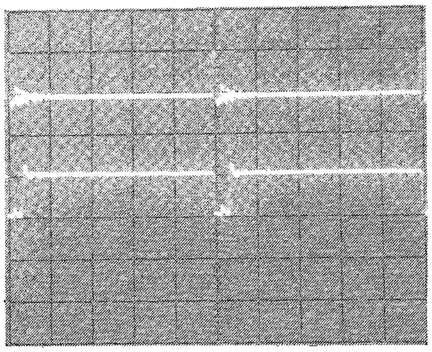


0.1usec 1V per div

Figure A53-3

U6b pin 11 n Loop = 52MHz
U53J1 FRACTIONAL N LOOP =
40MHz 4MHz at U53J1
U6a pin 2
U6b pin 15
TP1 +11V

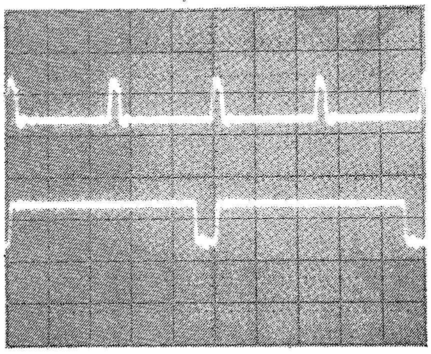
FRACTIONAL N LOOP frequency set to 40MHz (4MHz at U53J1), see step 4. STEP LOOP frequency at 52MHz, see step 5.



0.1usec 1V per div

Figure A53-4

U6 pin 4 FRACTIONAL N LOOP 4MHz
U6 pin 2 STEP LOOP at 52MHz



0.1usec/cm   1V div

Figure A53-5

A53J1 FRACTIONAL N LOOP 4MHz
U6 pin 2 STEP LOOP at 52MHz

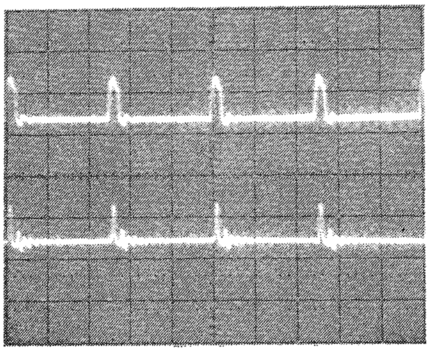


Figure A53-6

A53J1 FRACTIONAL N LOOP 4MHz
U6 pin 2 STEP LOOP at 54MHz

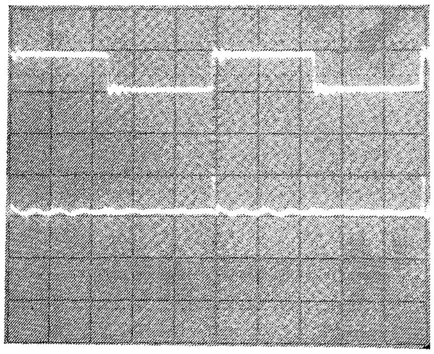


Figure A53-7

U6 pin 11 FRACTIONAL N LOOP 4MHz
U6 pin 15 STEP LOOP at 52MHz

10. If the PHASE DETECTOR appears to be working correctly in step 9 and, step 8 is faulty, the remaining circuitry can be checked out by using the following procedure:

    (a) Ensure there is a signal between 2 and 4MHz at the clock inputs of U6a and U6b (pins 11 and 6).

    (b) Connect A53TP2 to GND.

    (c) Short together test pins at A53TP3. This sets the D inputs at U6a and U6b low (approximately +3.3V). The following conditions should now exist:

        U6 pins 14 and 3 HIGH (approximately 4.3V)
        Q7 ON, Q6 OFF, Q5 ON, A53TP1 -9.9V
        Q2 OFF, Q3 ON, Q4 OFF

        The voltages on the schematic diagram around the SWITCHING AMPLIFIERS show the dc conditions for the ON/OFF states, the voltages in brackets being for the OFF state.

    (d) Remove the short from A53TP3 and short together test pins at A53TP4. This sets U5 pins 4 and 13 high and the following conditions now exist.

        Q2 ON, Q3 OFF, Q4 ON TP1 +11V
        Q7 OFF, Q6 ON, Q5 OFF

    (e) The unlock indicator should be OFF at step 2, and ON at step 3 and 4.

To check U1

1. Short the test pins at A53TP3.

2. Short the test pins at A53TP4.

3. This should set A53TP1 to +11V.

4. Press the TR followed by 50 keys.

5. Press the ↑ key to change the SLMS display n Loop = from 52 to 86 MHz.

6. Check the voltage at A53TP5 changes from +8V through to -4V. This should cause a change in voltage at A53TP2. The voltage variation at A53TP2 depends on the settings of A53R13 and A53R12. If no change is evident U1 is probably faulty.

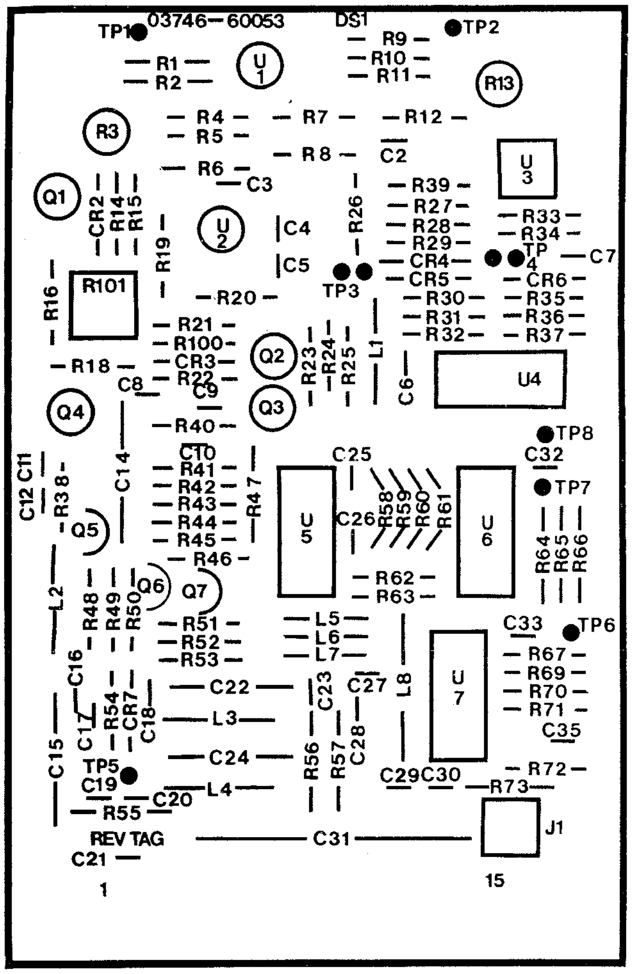
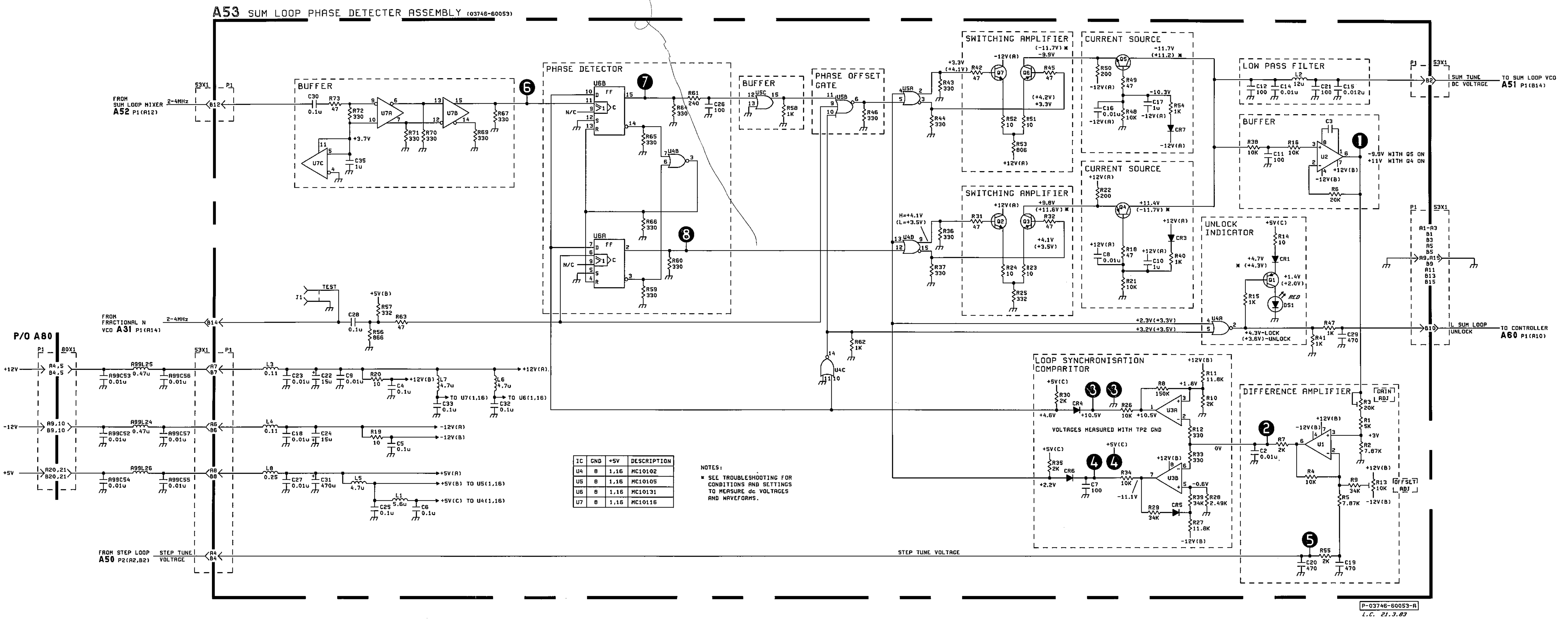


Figure A53-8 A53 Component Location



IC	GND	+5V	DESCRIPTION
U4	8	1,16	MC10102
U5	8	1,16	MC10105
U6	8	1,16	MC10131
U7	8	1,16	MC10116

NOTES:

* SEE TROUBLESHOOTING FOR CONDITIONS AND SETTINGS TO MEASURE dc VOLTAGES AND WAVEFORMS.

L.C. 21.3.83

Figure A53-9 A53 Schematic Diagram

8-131 8-132

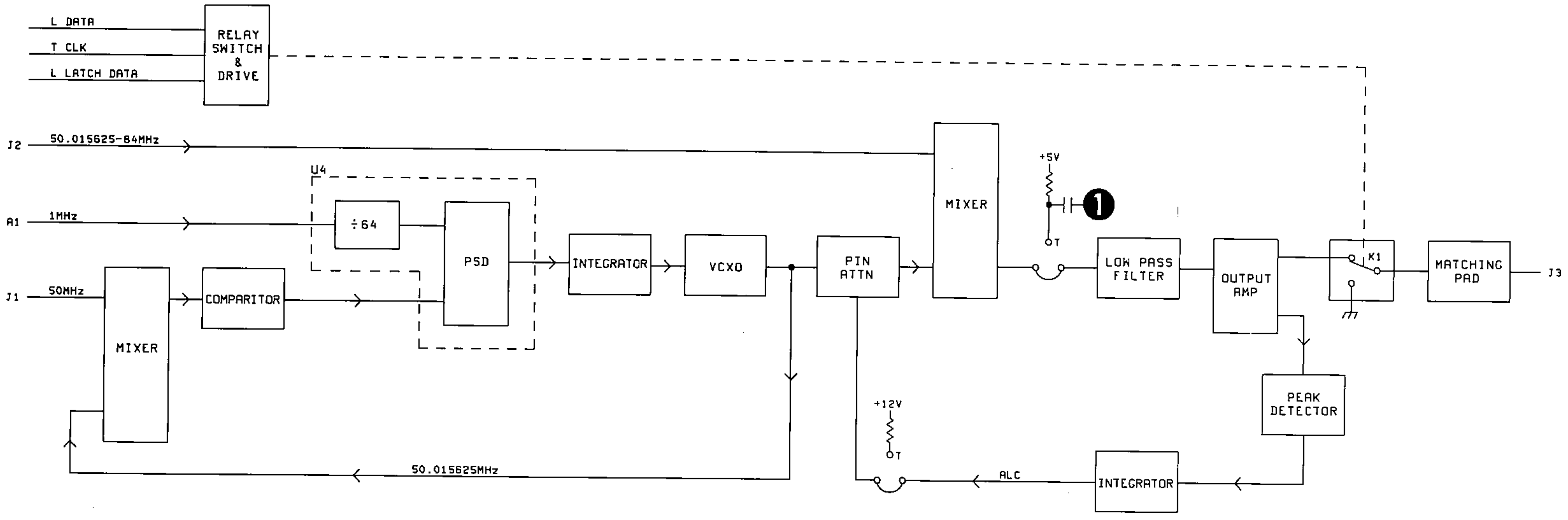


Figure A54-1 A54 Block Diagram

ASSEMBLY SERVICE SHEET A54
TRACKING GENERATOR (OPTION 012)

A54-1 INTRODUCTION

A54-2 This assembly synthesises the frequency to which the SLMS is tuned and makes it available at a rear panel output. The method used to synthesise the tuned frequency is to mix the first L.O. output with the IF (50.015625MHz) and take the difference.

A54-3 The IF signal itself can not be used and so must first be synthesised. Available within the instrument is a 50MHz signal, and a 1MHz signal. 15625Hz can be obtained from the 1MHz signal by dividing by 64.

A54-4 CIRCUIT DESCRIPTION

A54-5 The 50.015625MHz IF is synthesised in a phase lock loop as follows:

A54-6 A Voltage Controlled Xtal Oscillator generates a 50.015MHz signal which is mixed with the 50MHz signal in the Double Balanced Mixer U1 which produces an error signal at 15625Hz. This signal is converted to TTL levels by U2.

A54-7 U3 performs two functions the first of which is to divide the 1MHz signal from A40 by 64 to produce 15625Hz. There are now two 15625Hz signals, one from the mixer, and one divided from the 1MHz reference. These two signals can now be compared by the Phase Detector which is the second function of U3. The phase detector output drives the Integrator U4 which in turn tunes the VC0 to maintain the lock condition. The network R9, R10 and C11 ensures that the integrator output goes negative and the VCO varactor (CR2) is set to its maximum capacitance state at switch on to start the oscillator.

A54-8 Having synthesised the first IF at 50.015625MHz, this is now used to synthesise the original tuned frequency. This is accomplished by mixing the first L.O. frequency (which can range from 50.015625MHz to 84MHz) with the synthesised IF in another Double Balanced Mixer U6. The difference frequency (between 0 and 32MHz) is the frequency to which the SLMS is toned. This signal, from U6(12) is then applied to the 35MHz Low Pass Filter to remove mixing products or any other breakthrough from previous stages.

A54-9 The Output Amplifier comprises a video amplifier U7 driving transistor pair Q2 and Q3. Q2 and Q3 are a quasi push-pull pair the transistors being driven in anti-phase to produce a 75ohm output.

A54-10 A levelling loop, comprising a peak-peak detector and an integrator driving a PIN diode keep the output level constant.

A54-11 The Peak to Peak Detector, comprising four matched diodes CR4 to CR7 senses the Amplifier output level. CR4 and CR5 are biased on via R43 which also biases CR6 and CR7 to be just conducting. The dc level on C46 reflects the peak-to-peak level of the amplifier output as sensed by C5.

A54-12 An Integrator (U8) is driven by the peak-to-peak detector output. The integrator has a small offset set by the divider chain R46, R21 and R22. R46 adjusts the output level from the Tracking Generator (normally -10dBm).

A54-13 A Pin Diode Attenuator CR3, is driven by the integrator output to maintain the Tracking Generator Output at -10dBm over the required frequency range. The input level to the Double Balanced Mixer and the 35MHz Low Pass Filter will therefore change as the loop characteristics change according to frequency.

A54-14 In order to check the filters without the levelling loop, a test link TL2 is provided which allows the Pin Diode Attenuator to be biased on.

A54-15 After the levelling loop, a relay K1 is provided to blank the output during calibration cycles and for group filter measurements.

A54-16 The 6dB Pad on the output of the assembly ensures that a 75ohm source with a good return loss is provided.

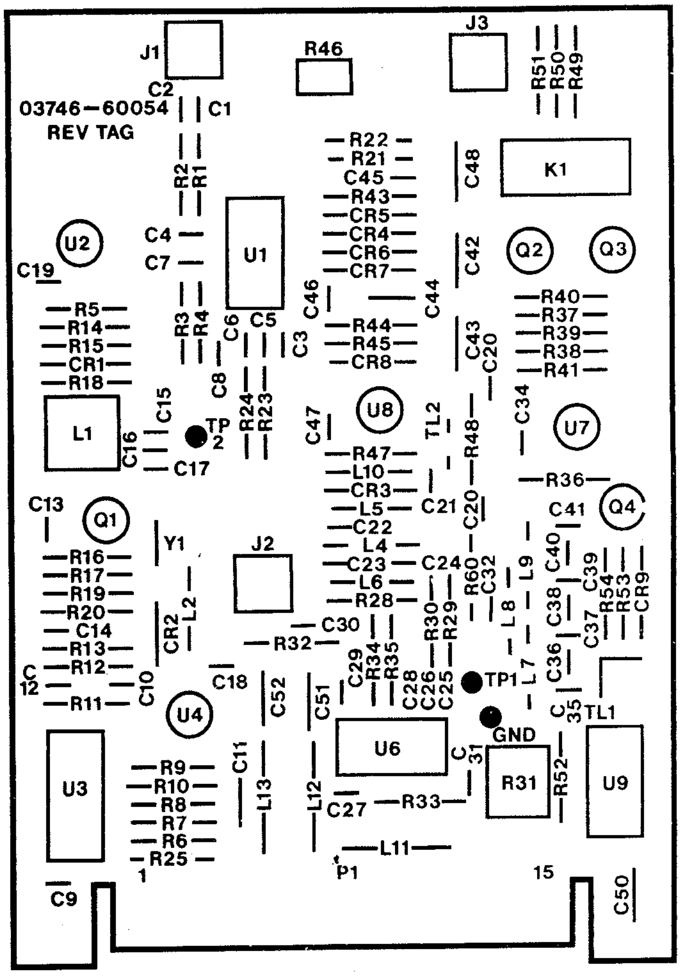


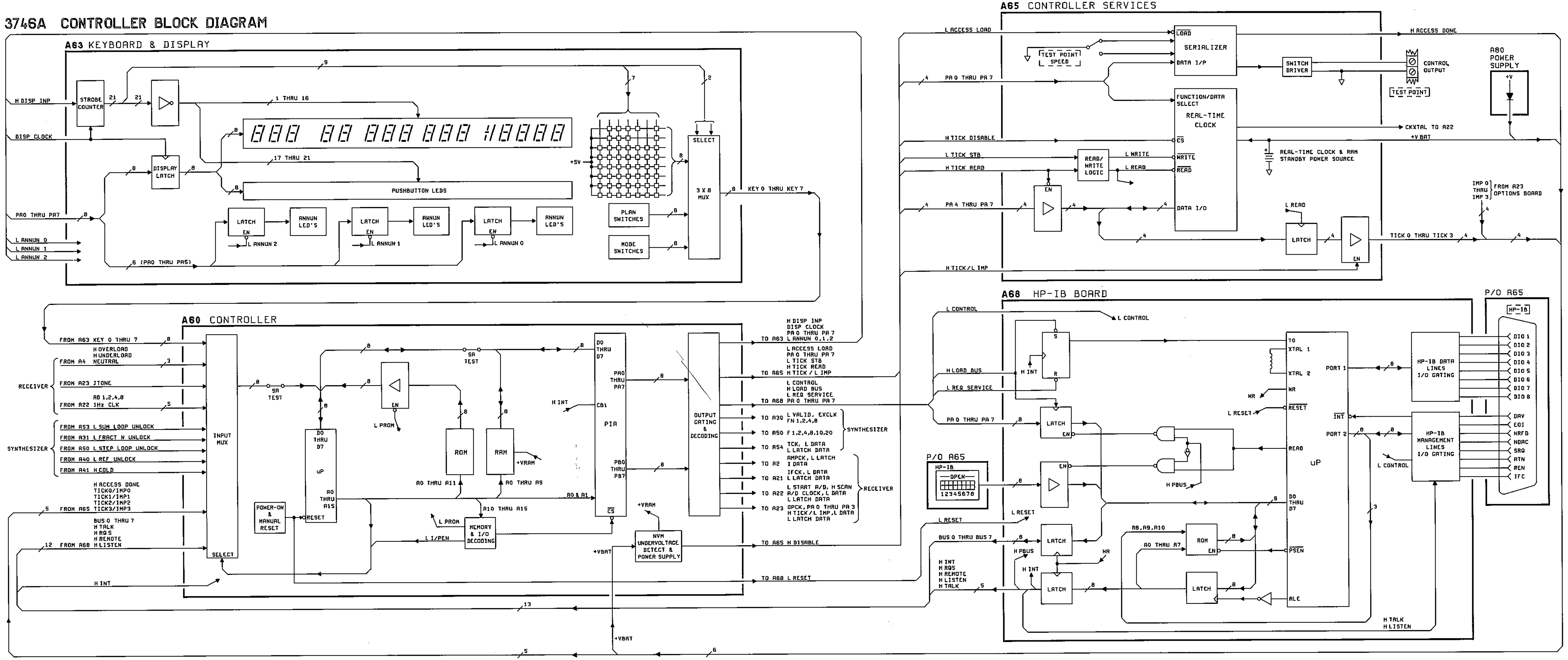
Figure A54-2 A54 Component Location

Figure A54-3 A54 Schematic Diagram

8-135
8-136

A54 Schematic Diagram

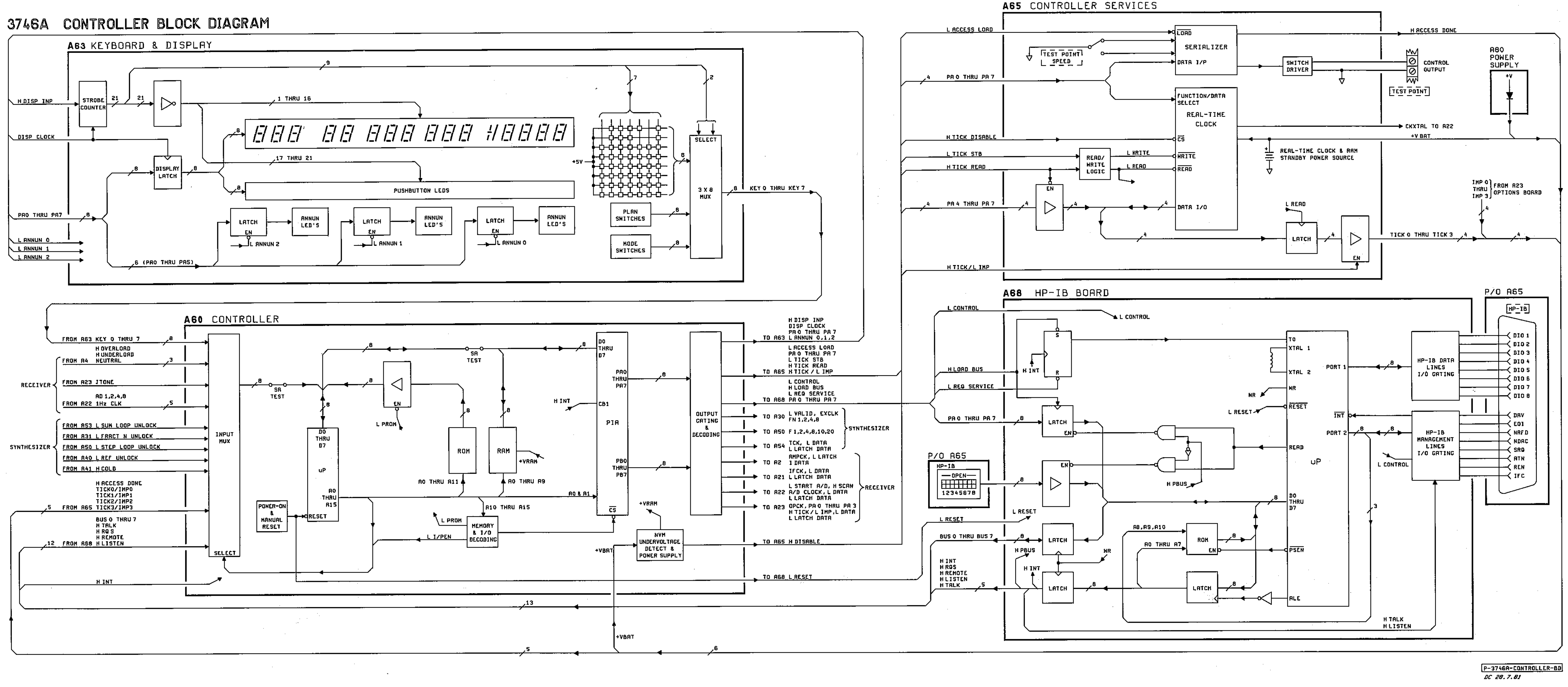
3746A CONTROLLER BLOCK DIAGRAM



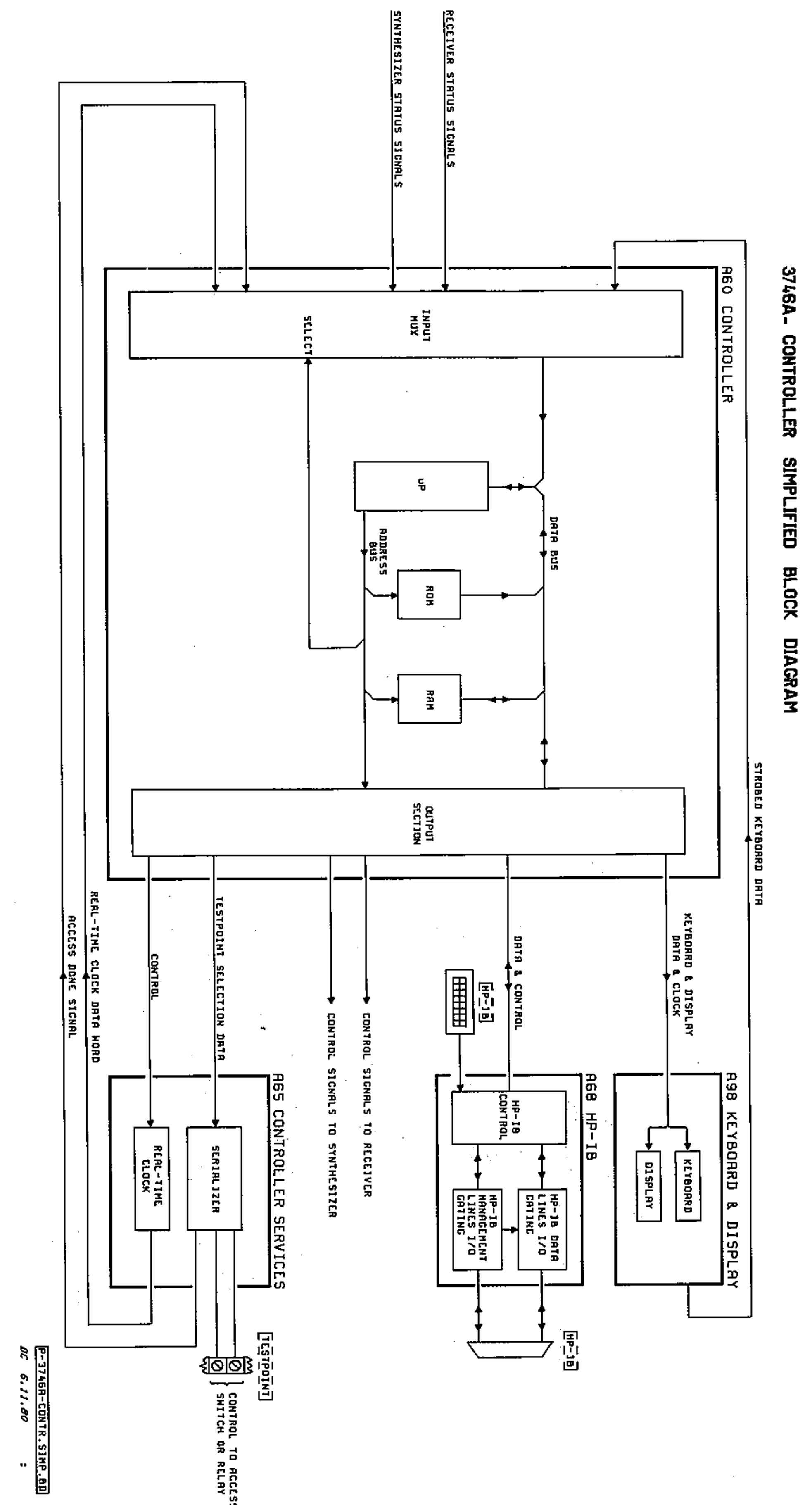
P-3746A-CONTROLLER-BD

Controller Block Diagram

3746A Controller Block Diagram



3746A Controller Block Diagram



Controller Simplified Block Diagram

PROCESSOR, KEYBOARD & DISPLAY SECTION

8P-1 THE RELATIONSHIP BETWEEN A60 AND THE REST OF THE 3746

8P-2 The Controller Simplified Block Diagram gives a hardware-level representation of the functions of the A60 controller. The diagram shows its relationship with other control boards and with the receiver & synthesizer.

8P-3 Receiver & Synthesizer

8P-4 Both the receiver & synthesizer operate under the direct control of the A60 controller board. Both present status signals to the A60 INPUT MULTIPLEXER and these are constantly monitored.

8P-5 Receiver & Synthesizer commands are transmitted from the A60 OUTPUT SECTION.

8P-6 A68 HP-IB Board

The function of the A68 board is to provide an interface between the A60 controller and the HP-IB. This interface has its own microprocessor and so is able to play an extremely active role in HP-IB operations. This reduces the load on the controller.

8P-7 A65 Controller Services Board

8P-8 The A65 board performs four functions:

i. On receipt of a 4-bit data word from the controller, it generates the serial pulse train required to drive an access switch.

ii. It has a real-time clock which can be set and read by the controller.

iii. It provides a mechanical mounting for the HP-IB address/function switch and the HP-IB connector.

iv. It provides the A60 board RAM with a standby battery supply.

8P-9 A63 Keyboard & Display

8P-10 The controller constantly scans the keyboard to detect the operation of any key.

8P-11 All 7-segment, bar, & pushbutton LED's are under processor control, with the exception of the STBY LED which is controlled by the STBY/ON switch.

ASSEMBLY SERVICE SHEET A60
CONTROLLER BOARD

A60-1 INTRODUCTION

A60-2 The A60 board has four main components:

Input Multiplexer
Microprocessor
Memory
Output Section

A60-3 INPUT MULTIPLEXER

A60-4 The input multiplexer picks an 8-bit word from the inputs to A60 and puts this word on the microprocessor data bus. All A60 input signals other than the HP-IB interrupt (HINT) are routed through the input multiplexer.

A60-5 When LI/PEN (low input enable) is high, the input multiplexer presents a high-impedance output to the processor bus D0-D7.

A60-6 When LI/PEN is low, an 8-bit output is offered to the processor bus. This output is selected by the address lines A0, A1, A2.

A60-7 Switches S2-1 thru S2-8 must be set to generate an input word which tells the processor what optional hardware is fitted to the instrument. This is displayed to inform the user what options are fitted, each time TR 27 is pressed.

A60-8 MICROPROCESSOR

A60-9 The microprocessor performs a series of operations in accordance with an operating program which is stored in the ROM (read-only memory).

A60-10 After switch-on the processor is reset by the POWER-ON CIRCUITRY and reads an instruction from a pre-defined start address. It then continues with the stored operating program.

The processor signal lines are:

A0-A15

A 16-bit address bus.

D0-D7

An 8-bit bi-directional data bus with 3-state outputs.

$\overline{\text{HALT}}$

Stops the processor when low.

MR

Memory Read input. Allows normal operation when held high.

R/$\overline{\text{W}}$

Read/Write output. High for processor read, low for processor write.

VMA

Valid Memory Access. An output which is high when there is a valid address on the address bus.

BA

Bus Available. Output which is not used in this instrument.

$\overline{\text{IRQ}}$

Interrupt Request. When low this input triggers an interrupt sequence.

$\overline{\text{RESET}}$

When low this input resets the processor. When it goes high a restart sequence is initiated. The restart sequence is determined by the program stored in ROM.

NMI

Non-Maskable Interrupt. An input which is held high for normal operation. A low-going edge on this input will in this case call up an SA test program.

RE

RAM Enable. When high, this input enables its own built-in RAM to operate. Permanently tied low on this assembly.

XTAL & EXTAL

Crystal connections for the internal oscillator.

E

Enable. A single-phase TTL-compatible clock output.

A60-11 MEMORY

A60-12 The organisation of the processor ROM and RAM memory is conventional, with minor variations which are expanded upon in the following description.

A60-13 Read-Only Memory (ROM)

A60-14 The read-only memory shown in sheet 2 of the A60 schematic is fitted with 4kX8 PROMS which may be either Intel 2732 or Texas Instruments TMS 2532. However, these devices have slightly different addressing, and in order to be able to use either the board is provided with the PROM TYPE SELECT LINKS. For Texas Instruments devices the links must all be set to "T", and for Intel devices to "I".

A60-15 In the interests of economy the PCB for this assembly has been designed to accomodate 8kX8 PROMS at some future date. When these are fitted the ROM SIZE SELECT LINKS will be set to "64".

A60-16 Random Access Memory (RAM)

A60-17 The A60 RAM devices are provided with a battery power source +VBAT which takes over whenever the instrument +5V supply is not present. This effectively makes the RAM an NVM (non-volatile memory) for a period dependent on the state of charge of the battery.The nickelcadmium battery is sited on the A65 controller services board.

A60-18 If the +5V supply falls below about +4.7V this is detected by the NVM UNDERVOLTAGE DETECT. Transistor Q1 turns off and HTICK DISABLE goes high. This signal is used on the A65 board to switch a real-time clock chip into a low-power mode. (The real-time clock is also powered by +VBAT, and so switching it to low-power mode maximises the period of RAM non-volatility.) During a power failure H Disable at U26, holds the RAM memory permanently in the read state.

A60-19 OUTPUT SECTION (A60 Part 1)

A60-20 The output section consists of a peripheral interface adaptor (PIA) which feeds assorted latches, decoders, gates, & bus systems. The three 8-bit I/O ports of the PIA have bi-directional capability, but ports A & B are in this case used only for output.

The PIA signal lines are:

D0-D7, PA0-PA7, PB0-PB7

Bi-directional 8-bit I/O ports.

CLK

Timing reference input.

$\overline{\text{R}}$/W

Input which is high to write data to the processor, low when reading data from the processor.

$\overline{\text{RESET}}$

Resets the PIA when low.

CS0, CS1 & $\overline{\text{CS2}}$

Chip select inputs.

RS0 & RS1

Register select inputs.

$\overline{\text{IRQA}}$ & $\overline{\text{IRQB}}$

Low-true interrupt request inputs.

CA1 & CB1

Interrupt inputs.

CA2 & CB2

Dual function lines: may be programmed to act as interrupt inputs or (as on this board) as peripheral control outputs.

A60-21 The processor writes into the output section by putting data on the data bus and then addressing the PIA so that the data is stored in an internal register. The stored data is then output from the PIA under processor control as a data bit or word from port A (PA0-PA7) and an associated clocking signal from port B (PB0-PB7).

A60-22 INTERRUPTS

A60-23 Neglecting the SA TEST switch, there are two sources from which an interrupt can occur. In both cases the interrupt is routed through the PIA. The sources are:

(1) 600us TIMER. The output of this timer is connected to the PIA CA1 input. When the timer output goes low then IRQA follows, driving LIRQ true (low). This interrupt is used to "remind" the processor that the display should be refreshed.

(2) HINT. This input from the A68 HP-IB board is connected to the PIA CB1 input. When HINT goes high then IRQB goes low, driving LIRQ low. This interrupt lets the A60 processor know that the A68 processor has HP-IB data to pass over.

The data is read as an 8-bit data word (BUS 0 thru BUS 7) which is selected by the INPUT MULTIPLEXER. Further information about this is given with the A68 board description.

A60-24 The active transitions of both CA1 & CB1 are programmable by the processor via the data bus. The action of activating either CA1 or CB1 sets one of two interrupt flags within the PIA, and these are read by the processor to determine the source of the interrupt.

A60-25 SWITCH S2

A60-26 The processor interrogates a switch bank of 10 switches (S2), to find the current status of the instrument and act according. Table A50-1 shows the function of switches S2-1 through S2-10.

Table A60-1 S2 Switch Functions

SWITCH POSITION	FUNCTION
S2-1	CHART RECORDER (CURRENT/VOLTAGE)
S2-2	GROUP FILTER OPTION FITTED
S2-3	TRACKING GENERATOR FITTED
S2-4	PRECISION OSCILLATOR FITTED
S2-5	IMPAIRMENTS BOARD OPT 015
S2-6	IMPAIRMENTS BOARD OPT 016
S2-7	FDM EXTENSION, CCITT 17MHz
S2-8	HIGH IMPEDANCE WAKE UP
S2-9	NOT USED
S2-10	SIGNATURE ANALYSIS TEST (EDGE-TRIGGERED)

A60-27 TROUBLESHOOTING– For Instruments with rev 3 and rev 4 software. (For Instruments below Serial Number 2250U-00332 refer to Section 7 of this Manual)

A60-28 KERNEL SIGNATURES

To run the Kernel Signature program:

1. Switch the SLMS POWER switch to STBY.
2. Remove XP4, XP3 and U19. XP4 disconnects the Input data from the micro-processor data bus, XP3 disconnects the RAM data bus, and U19 disconnects the ROM data bus. The no OP code is now forced by the hard-wire resistor pack R3.
3. Set the signature Analyzer controls as follows:

   START ⌐ STOP ⌐ CLOCK ⌐

4. Connect the START STOP probes to TP2 and the CLOCK probe to TP1.
5. Set the POWER switch to ON.

Check the +5V signature is 0003

The following signatures are independent of any software changes.

U6 Address bus

9	UUUU	(A0)	17	7791	(A8)
10	FFFF	(A1)	18	6321	(A9)
11	8484	(A2)	19	37C5	(A10)
12	P763	(A3)	20	6U28	(A11)
13	1U5P	(A4)	22	4FCA	(A12)
14	0356	(A5)	23	4868	(A13)
15	U759	(A6)	24	9UPI	(A14)
16	6F9A	(A7)	25	0001	(A15)

NOTE: U6 pin 1 is located at the bottom right hand-side of the IC.

U18		U7	
11	UUUU	7	7791
9	FFFF	13	6321
13	8484	9	37C5
7	P763	11	6U28
15	1U5P	3	4FCA
5	0356	17	4868
17	U759	5	9UP1
3	6F9A	15	0001

U8

1	4868	9	64HF
2	9UP1	10	29A4
3	0001	11	5FUA
4	GND	12	2302
5	GND	13	F9CF
6	HIGH	14	534H
7	1183	15	C9U1
8	GND	17	HIGH

Kernal Signatures

U30		U5			
1	37C5	1	37C5	9	44PU
2	6U28	2	6U28		
3	4FCA	3	4FCA	12	CF30
4	C9U1	4	C9U1	13	5050
5	C9U1	5	C9U1	14	05AP
6	HIGH	6	0003	15	75H9
		7	4H16		

TP3 1F9F
TP4 3080

U38, U40 through U44

Check the signatures at pin 5 on U41 through U44, signature should register. This signature should change when the appropriate S2- switch (at pin 4 of the IC) is switched. Ensure the switch is returned to its original setting. On IC38 and IC40 the signature at the output pins (9 and 7) should change when the appropriate S2- switch setting is altered.

Note: Sometimes the signature may register as unstable or give 2 signatures. The important part of the check is to ensure the signature changes when the switch S2- is altered. This check does not ensure that the INPUT MULTIPLEXER circuits is functioning 100% correctly, but it does give an indication that the circuitry is working.

A60-29 PROGRAM SIGNATURES

To run the program signatures - switch the SLMS POWER to STBY;

1. Test links XP4 and XP3 should be removed, and U19 connected in circuit.

2. Connect the Signature Analyzer START to TP3, the STOP to TP4, and the CLK to TP1. 3. Set the Signature Analyzer controls to

   START ⏋_ STOP ⏋_ CLOCK ⏋_

4. Switch the POWER switch to ON.

5. Switch S2-10 ON and then OFF. This forces an edge at the microprocessor NMI (non maskable interrupt) input and sends the processor to the NMI address location which is the start point for the signature analysis program.

The +5V signature should be HA9P. If this signature is incorrect go to the KERNEL TEST signatures/or replace U19.

6. Set the POWER switch to STBY.

7. Replace XP3.

8. Remove Assembly A2 (or disconnect) this is to prevent all relays being exercised.

9. Switch S2-10 ON and then OFF to re-start the SA program.

The +5V signature should now be 503H. An incorrect signature indicates there is a fault associated with the RAM or ROM area; see RAM/ROM faults.

Program Signatures

(PIA) U14

1	GND		21	3AC4	(R/W)
2	4638		22	HIGH	
3	14U6		23	F297	(CS2)
4	651U		24	HIGH	
5	4433	PA0-PA7	25	503H	(Pulsing)
6	63F3		26	PC98	
7	CF52		27	CA73	
8	32PC		28	P2UP	
9	U762		29	U9F9	D7-D0
10	37A1		30	4PPH	
11	6F66		31	8UFF	
12	141U		32	H83A	
13	A7P6	PB0-PB7	33	UCPC	
14	8FC5		34	HIGH	
15	6HP8		35	FHH4	RS1
16	191U		36	F009	RS0
17	C43H		37	LOW	IRQB
18	GND		38	LOW	IRQA
19	046U	(CB2)	39	HIGH	
20	HIGH		40	CLOCK from TIMER U25	

U1
Signatures are
the same as
PA0-PA7
on I/p and O/p
pins

U37				U27	
11	F94C			11	82UC
12	P874	13	4638	12	3H5A
15	CP2U	14	14U6	15	0472
16	A5HH	17	651U	16	56P4
19	4383	18	4433	19	U892
2	FUA4	3	63F3	2	H835
5	4CP2	4	CF52	5	A670
6	6U0U	7	32PC	6	7F74
9	8U59	8	U762	9	C0HH

U36		U33		U34		U35	
3	2HHP	12	7U2P	3	86A5	3	A844
6	HH4A	10	AHOU	6	9047	6	PH21
8	4361	8	6335	8	46P7	8	5391
11	5P70	6	P400	11	P7F0	11	C9U4
		4	503H				
		2	PU1P				

U32			
1	37A1	15	P2U1
2	6F66	14	F94C
3	141U	13	220P
4	A7P6	12	2U13
5	046U	11	UH32
6	HIGH	10	3308
		9	60C1
		7	82UC

U31			
1	37A1	15	6PF7
2	6F66	14	A55A
3	141U	13	CU23
4	GND	12	0500
5	046U	11	1737
6	A7P6	10	7255
		9	C9H9
		7	U380

Note: The signature analysis programs do not check the timer IC, U25. If this IC is faulty the PIA will not generate timed interrupts and at switch-on the instrument does not initialise properly. It is also worthwhile checking the presence of the 1Hz CLK at U40 pin 2. Absence of this clock signal can produce a faulty measurement sequence.

A60-30 ROM and RAM FAULTS

Failures of these devices tend to fall into two main categories.

(a) Bus type faults, whereby the device fails in such a way that one of the address or data lines is held low or high or adjacent lines are shorted together.

(b) Data type faults which corrupt the data, due to either program erasure (in the case of ROM only) or internal failures within the ROm or RAM chip.

The first type of fault is difficult to isolate to a particular device and the second type of fault can usually be readily isolated to one or two devices.

A60-31 BUS FAULTS

A60-32 The ROM data bus can be readily checked by removing U19, XP2 and XP3 and running the KERNEL signature test. All the signatures on the ROM data bus should be stable and each signature should be unique. The actual signature value is not significant when checking for lines stuck high or low, it is however, important that each signature is unique and no signature is the same as the +5V signature. In the kernel mode of operation the RAM data signatures are random, hence the RAM data bus can only be checked in the program mode of operation - described in the next paragraphs. The ROM and RAM address bus can be checked for incorrect signatures in the kernel mode.

A60-33 DATA FAULTS

A60-34 Continuing from step 9 in the PROGRAM SIGNATURES, press the reset switch (located at the top of the A60 assembly) immediately followed by switching A60 S2-10 ON and then OFF. It is important that these steps are carried out in quick succession. If the 5V signature is correct the fault is unlikely to be associated with the RAM or ROM area. An incorrect signature will usually indicate the area of failure.

503H................correct 5V signature

HA9P	indicates	RAM	U15 or U2	faulty
A7CU	indicates	RAM	U16 or U3	faulty
9PUP	indicates	RAM	U17 or U4	faulty
57A9	indicates	ROM	U9	faulty
7A70 (8P54)	indicates	ROM	U20	faulty *
C616	indicates	ROM	U21	faulty
U473	indicates	ROM	U22	faulty
AH7F	indicates	ROM	U23	faulty
8P54	indicates	ROM	U24	faulty

Roms U20 and U24 contain the program to run the signature analysis.

* The signature 8P54 refers to rev 3 software (00332-00372). For instruments below Serial Number 2250U-00332 refer to Section 7 of this Manual.

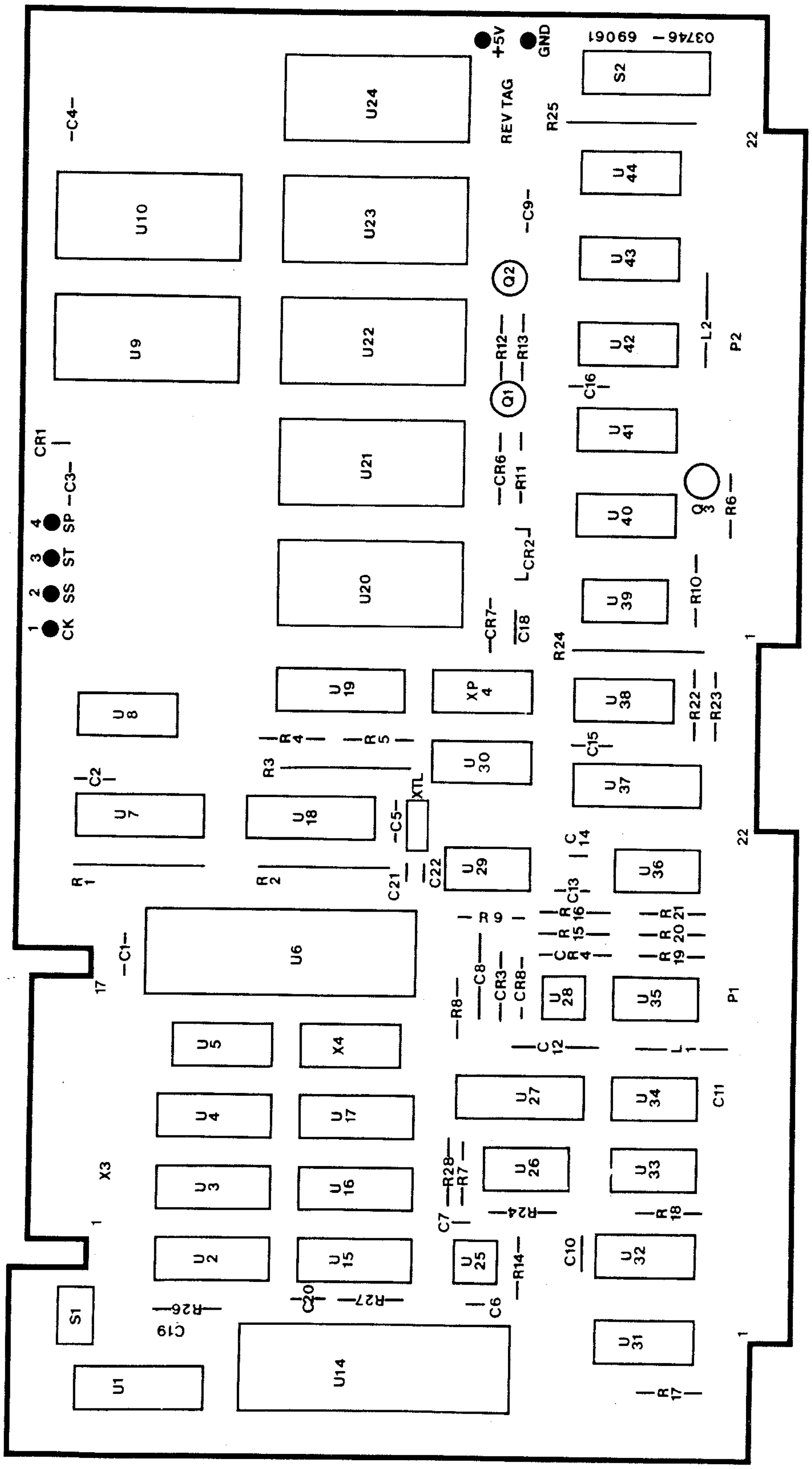


Figure A60-1 A60 Component Location

8-149
8-150

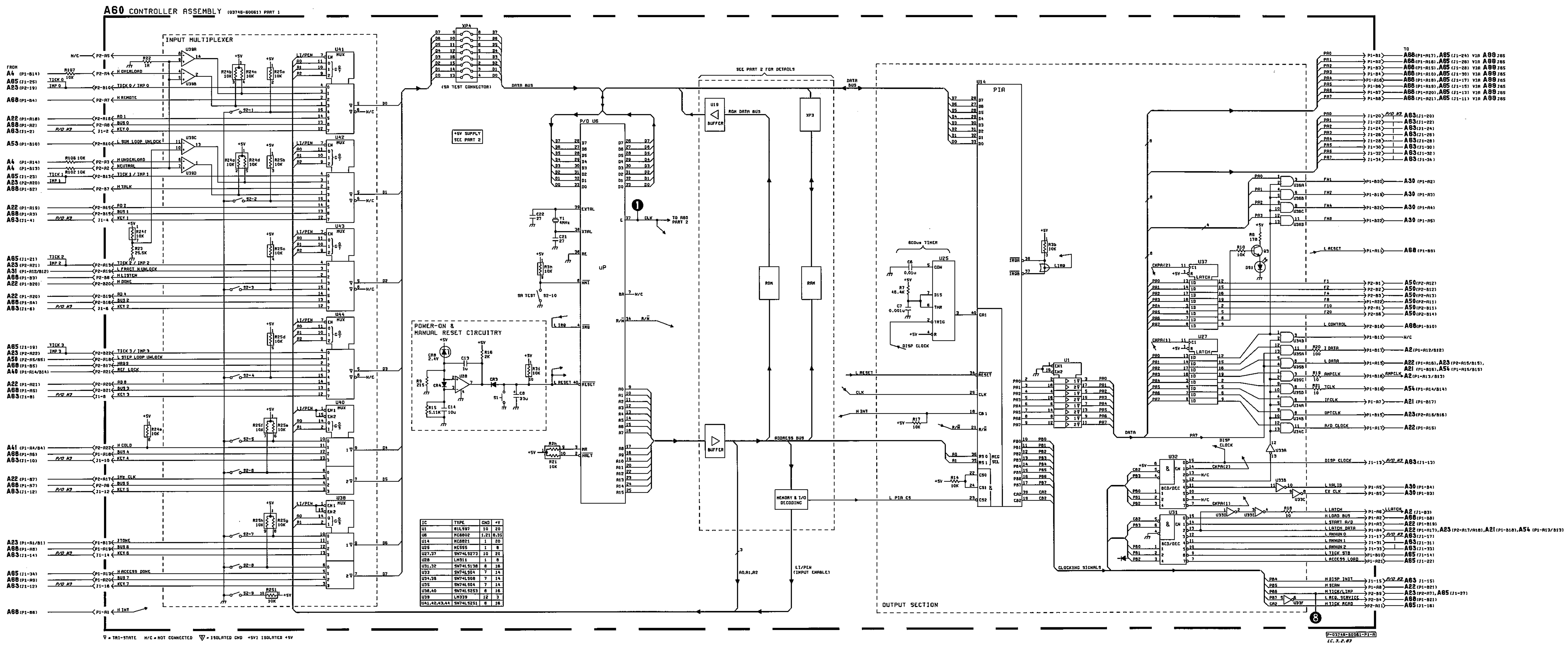


Figure A60-2 A60 Schematic Diagram Part 1

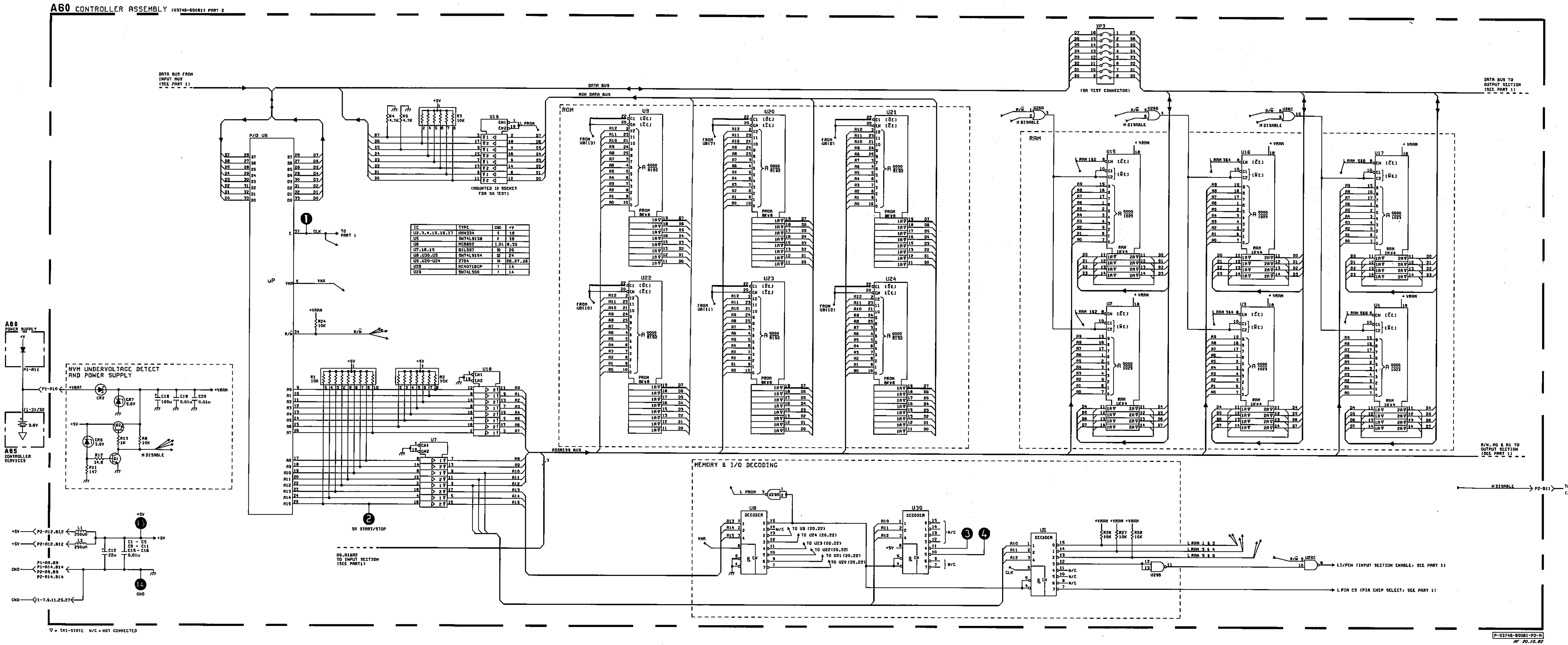


Figure A60-2 A60 Schematic Diagram Part 1

Figure A60-3 A60 Schematic Diagram Part 2

ASSEMBLY SERVICE SHEET A63
KEYBOARD & DISPLAY

A63-1 STROBE GENERATOR

A63-2 The strobe generator is a 24-stage shift register, but as the outputs of the last three stages are not connected to anything it is more convenient to think of it as a 21-stage shift register. The register is used to strobe both the keyboard and the display.

A63-3 To start the strobe the A60 processor writes an initializing "1" into stage 1 of the register by pulsing HDISP INIT high. The DISP CLOCK occuring at intervals of about 600us, clocks this single "1" through the register. The processor keeps count of where the "1" is, and after 21 clock periods writes a new "1" into stage 1. This produces the effect of a single logic "1" circulating around the register, reappearing in stage 1 immediately after exiting stage 21.

A63-4 DISPLAY

A63-5 Annunciators

A63-6 The annunciator LED's are not strobed but are instead latched on or off by U2, U11 & U15. On these devices Iout is an analog input which sets the level of the LED drive current.

A63-7 Numeric & Pushbutton LED's

A63-8 The 7-segment and pushbutton LED's are each strobed once per cycle of the strobe generator. To turn on an LED, the processor waits until the LED is about to be strobed and then puts on bus PA0-PA7 a bit-pattern which will turn on the required segments (for 7-segment LED's) or individual pushbutton LED. This bit-pattern is clocked into latch U1 at the same time as the strobe advances to the LED of interest. The LED will then be illuminated for the duration of the strobe (about 600us).

A63-9 The strobing gives the illusion of continuous illumination of one LED. Th strobe rate is ie once every 600X21ns or about every 12ms.

A63-10 KEYBOARD

A63-11 The keyboard contains the pushbuttons shown in the A63 schematic as a 7X8 matrix, and also the PLAN and MODE switches. In the schematic the switches have been drawn to correspond with their physical locations on the front panel, but for descriptive purposes it is more convenient to consider them as two further matrix elements. So from a black-box point of view the keyboard is a 9X8 matrix, and this is strobed by outputs 1 thru 9 of the strobe generator.

A63-12 Strobes 1 thru 7 strobe the pushbutton matrix. The matrix outputs are normally high, but when a pushbutton is both strobed and depressed the matrix output which it is associated with goes low. Strobes 8 & 9 must be both low for the matrix output to be gated through U6 and be read by the processor.

A63-13 When strobe 8 is present U6 is disabled and U14 is enabled, and the processor can then read the positions of the MODE switches.

A63-14 Similarly, when strobe 9 is present the proccessor can read the positions of the PLAN switches.

A63-15 TROUBLESHOOTING

Note: A faulty Controller Assembly (A60) will automatically affect the operation of the Keyboard and Display Assembly.

INTRODUCTION

There are two built-in test facilities. These facilities in conjuction with the power-on-reset display check, allow the Keyboard and Display Assembly (A63) to be verified.

DISPLAY CHECK

Switch the SLMS Power switch to STBY and then to ON. This forces a power-on-reset of the processor on the CONTROL Assembly (A60). All the segments in the seven segment displays, including the decimal point, should be on, and all the remaining LEDs should be on for a period of about 2 seconds. Failure of a single segment of a single LED, normally indicates a failure of that particular component. Failure of more than one LED suggests the failure may be due to an IC or some other component.

KEYBOARD SWITCH CHECK

To enter the keyboard switch check press keys TR and 00. The SLMS TEST POINT display should now indicate d00. The FREQ/FDM display should show code = XX where XX is the key code. The following are the key codes for the switches listed:

CLEAR/SET	=11	IMP NOISE	=66	AUTO	=03
FREQ/FDM	=73	TIME ϕ JITTER	=63	48KHz	=06
SMG	=76	THRESH NWT	=61	3.1KHz	=01
HG/MG	=71	AVE	=64	22Hz	=04
SG	=74	dB/dBm	=65	WTD	=02
G	=72	GAIN	=62	75 OHMS	=13
CH	=75	LOCAL	=60	150 OHMS	=16
COUNTER	=70			600 OHMS	=12

REF	=53	FREQ	=56	7	=51	8	=54	9	=52
UPPER	=43	START	=46	4	=41	5	=44	6	=42
LOWER	=33	STOP	=36	1	=31	2	=34	3	=32
WS PILOT	=23	STEP	=26	0	=21	.	=24	↑	=22

SG/GP POWER	=55	1/P POWER	=50
SCAN	=45	SPECT	=40
TR	=35	MEAS	=30
↓	=25	HALT	=20

To exit from the keyboard switch check set the POWER switch to STBY and then ON.

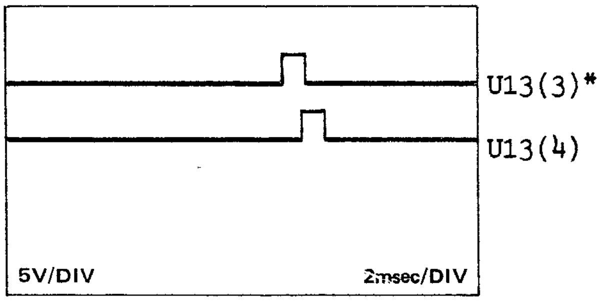
SLIDE SWITCH CHECK

Set the slide switches to their left-most position. Press keys TR and 01. The SLMS TEST POINT display should now show d01. The FREQ/FDM display should read 11111 and the LEVEL display 1111.

The PLAN switches should increment one of the LEVEL seven segment displays, and the MODE switches increment one of FREQ/FDM seven segment displays.

STROBE GENERATOR & BUFFERS CHECK

The Strobe Generator is essentially a 21 stage shift registar. The outputs of the STROBE GENERATOR and its associated buffers should have a narrow pulse, which is one pulse-width advanced on the previous output, as shown in figure A63-1.



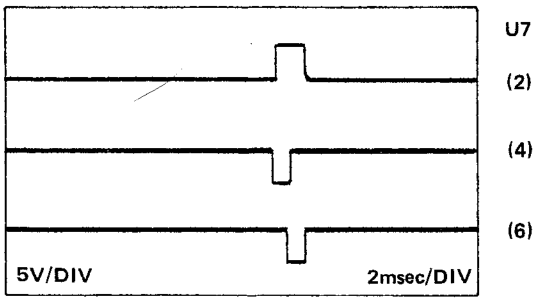
*The outputs could also be U13(4), U13(5), or U9(3), U9(4) etc. The appropriate buffers will invert the pulse.

Figure A63-1 STROBE GENERATOR Outputs

KEYBOARD, SLIDE SWITCH and OUTPUT BUFFERS (U5,U6,U14) CHECK

This check gives some indication that banks of Key switches or Slide switches are operating. It also checks the output buffers U5, U6, and U14. Prior to carrying out this check set the POWER switch to STBY and then to ON.

Figure A63-2 shows the enable pulses at U6, U5 and U14.



Note the enable pulse at U7(2) is exactly twice the width of the pulse at U7(6) and U7(4).

Figure A63-2

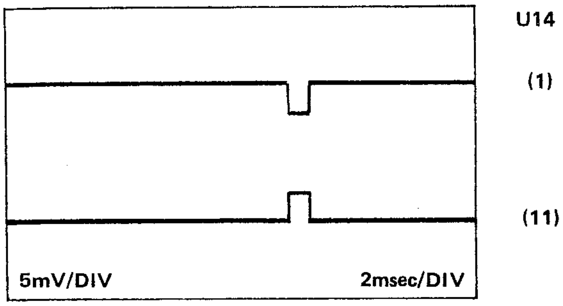


Figure A63-3

Set all slide switches to their left-most position. A pulse appears at U14 pin 11 when the limits switch is moved to the LO or BOTH positions; i.e. grounding U14 pin 12. Grounding any other line H, either at U5 pin 2 by moving the Pilot slide switch, or by pressing keys CNTR, HG/MG, G, FREQ/FDM, SG, CH, or SMG, causes a pulse to appear at U14(11). (Since U14(11) is the same bus line as U5(3) and U6(3) connected in a wired-or configuration).

The outputs of each buffer can thus be checked by monitoring each output at U14 and pressing or moving the appropriate switch on the input side.

The remaining parts of the A63 assembly can be checked by utilising the signature analysis program on the A60 assembly to toggle the inputs to the A63 assembly.

SIGNATURE ANALYSIS PROCEDURE (for instruments below Serial Number 2250U-00332)

1. Switch the SLMS POWER Switch to STBY.
2. Mount the A60 (Controller Assembly) on a suitable extender card. (After removing the A60 assembly, ensure the extender cards are inserted in the A60 slot and not the A23 option slot).
3. Set the SLMS POWER Switch to ON.
4. Switch A60 S2-10 ON-OFF-ON to force the microprocessor to jump to the signature analysis program mode.
5. The SLMS Display (A63) should now indicate

```
TEST POINT              FREQ/FDM                      LEVEL
 *  _|  *        _|  *  _|  *  _|  *  _|  *     _|  *  _|  *  _|
   DS15         DS13   DS11    DS9    DS7      DS5    DS3    DS1
```

* Seven Segment not on

The following switch LEDS are also ON:

AUTO, 48kHz, SG, G, IMP NOISE, TIME O JITTER, AVE, GAIN, UPPER, START, LOWER, STEP.

The following LED annunciators are also ON:

TIME and PILOT (DS56), FREQ (p/o DS57), KHz (DS52A), UL1M and LL1M (DS51), OVEN and EQLZD (DS55), Op-p and dB (DS53), dBm (DS60), REMOTE (DS59A), TALK and SRQ (DS58).

The Display will flicker every 5 seconds. If the display does not flicker, this indicates the SA program is not running.

An indication of the probable area of failure can be ascertained by noting which LEDS are on and off. All LEDS are in sockets and may be checked by substitution.

U1 outputs should be as follows:

2	LOW	19	HIGH *
5	"	16	" *
9	"	15	" *
6	"	12	" *

U9/U4/U3 is configured as follows:

3	ON *	10	ON *
4	OFF *	11	OFF *
5	ON *	12	ON *
6	OFF *	13	OFF *

*These outputs pulse once every 5 seconds. The pulse width is less than 1msec (Use a logic probe to check for the pulse).

FOR INSTRUMENTS ON AND ABOVE 2250U-00332

Carry out steps 1 through 5. The signature analysis program should now strobe all the lines on the keyboard and display assembly. If a fault is present, remove A2 Assembly to avoid excessive relay wear during the S.A. program.

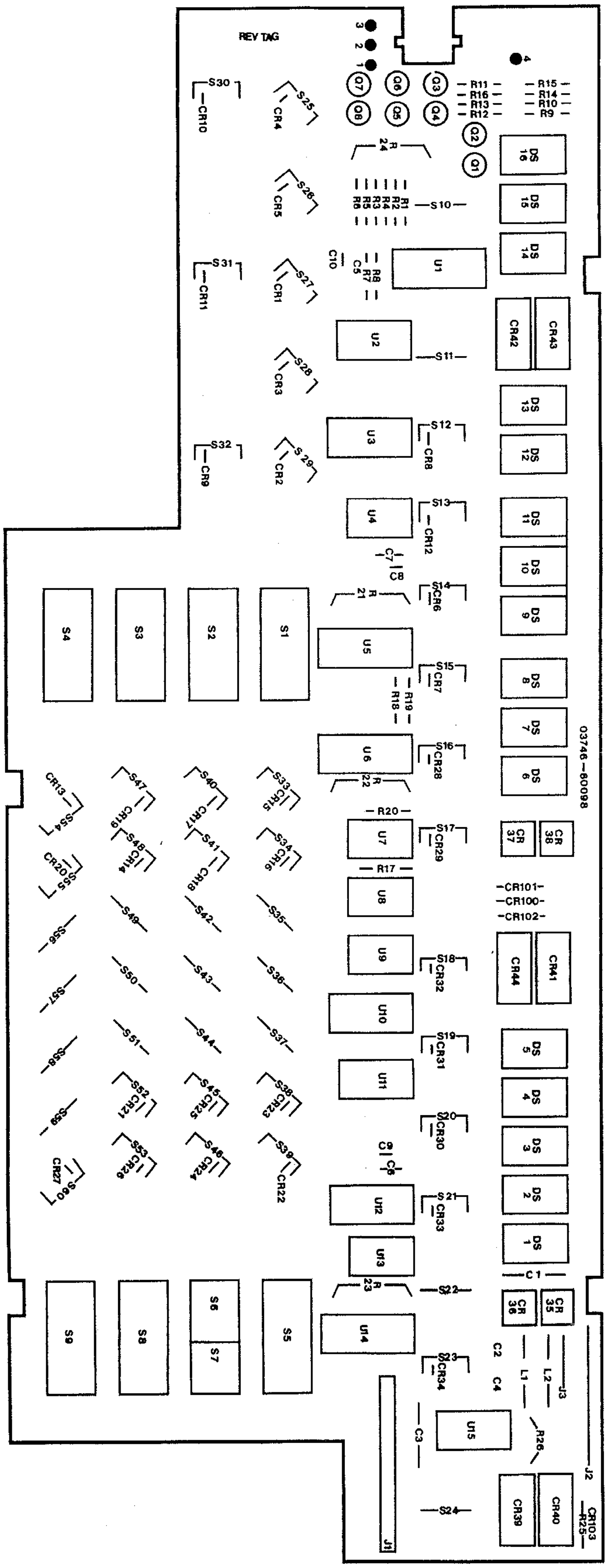


Figure A63-4 A63 Component Location

Figure A63-5 A63 Schematic Diagram

8-157
8-158

A63 Schematic Diagram

ASSEMBLY SERVICE SHEET A65
CONTROLLER SERVICES BOARD

A65-1 INTRODUCTION

A65-2 The A65 Assembly performs several functions which are related to the operations of the A60 controller board.

A65-3 SERIALIZER & SWITCH DRIVER

A65-4 The serializer and switch driver together produce a control signal used to select test points in Access Switches. There are three modes of operation:

A65-5 The "WAIT" State

A65-6 When waiting for instructions the counter U5 is "empty" and the output of U7B is low. The switch driver then presents a high impedance to an access switch connected across the control output.

A65-6 Controlling an Access Switch

A65-7 To control an access switch the A60 controller loads a number from 0 to 14 inclusive into counter U5. (This range of numbers covers all the valid addresses & commands for Access Switches.) The act of loading the number causes the counter MAX/MIN output to leave its high "waiting" state and go low. When MAX/MIN goes low Q3 turns off and the astable U6 is enabled. The period of U6 depends on the setting of the TESTPOINT SPEED switch. Each cycle of U6 clocks down the contents of U5, until the counter is empty and its MAX/MIN output once more disables the astable. During this process each negative pulse of the astable output disables U7B and allows the switch driver transistors Q4 & Q2 to sink current. The symmetrical design allows the combination Q4/Q2 to sink current from either a positive or a negative source.

A65-8 Controlling a Relay

A65-9 In "B-A" mode the switch driver is required to hold on a relay, rather than operate an access switch. To do this the A60 controller loads decimal 15 into counter U5. This sends the output of the B-A MODE DETECT GATE U7A low, disabling U7B. The output of U7B will therefore be high, enabling the switch driver to sink current. This condition will be maintained until the count of 15 in U5 is over-written by the processor. (During this period the astable will be running, but to no effect. This is because U7B will be disabled, and U5 will be trying to count up when it is already full).

A65-10 REAL-TIME CLOCK

A65-11 The real-time clock U1 has its own internal oscillator, controlled by the crystal Y1. The clock chip has internal registers in which it keeps a series of BCD words which give time as follows:

1/10 second
seconds
tens of seconds
minutes
tens of minutes
hours
tens of hours
days
tens of days
months
tens of months
day of week

A65-12 The contents of each register can be read by the A60 Controller, and the resultant real-time data can be printed out by the controller when logging measurement results. Register selection is by the lines address lines A0-A3.

A65-13 The A60 Controller can also write in data to initially set the clock on the D_0-D_3 DATA I/O lines.

A65-14 When the 3746A is switched off the real-time clock draws power from battery BT1. This avoids having to reset the clock after every switch-off. When operating on battery power the signal HTICK DISABLE switches the clock chip into a low-power mode of operation.

A65-15 BATTERY POWER

A65-16 Battery BT1 has two nickel-cadmium cells which charge from the +VBAT line when the instrument is connected to line power and is switched on.

A65-17 When the 3746A is not on-power the battery provides power to the real-time clock on this board and the RAM on the A60 board.

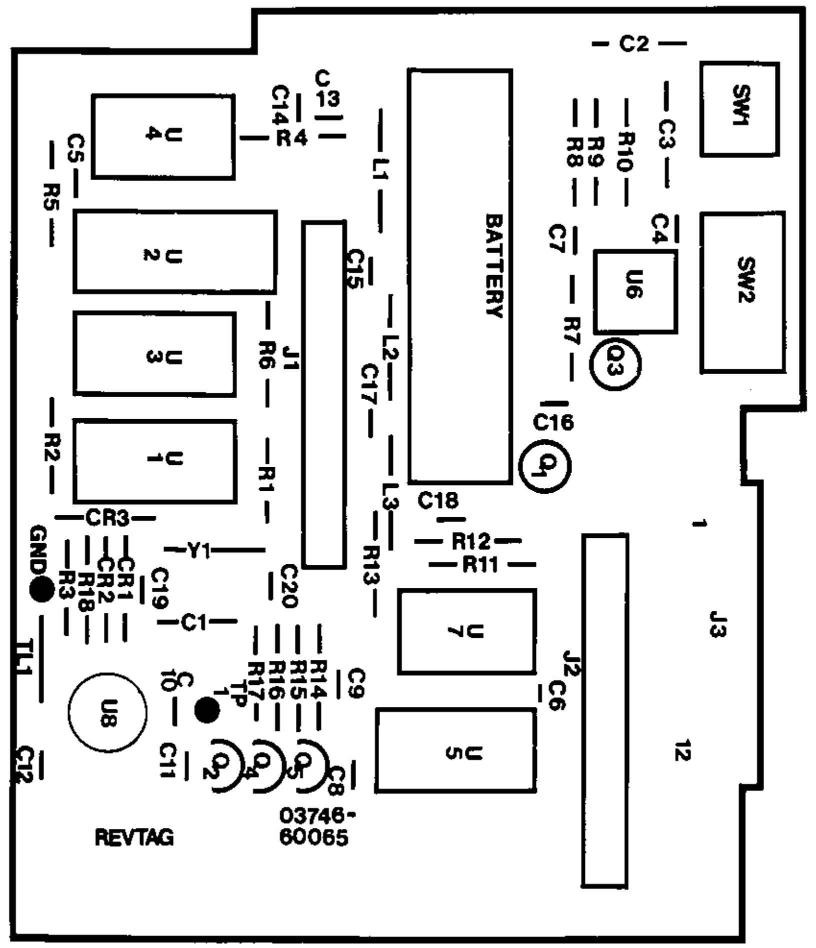


Figure A65-1 A65 Component Location

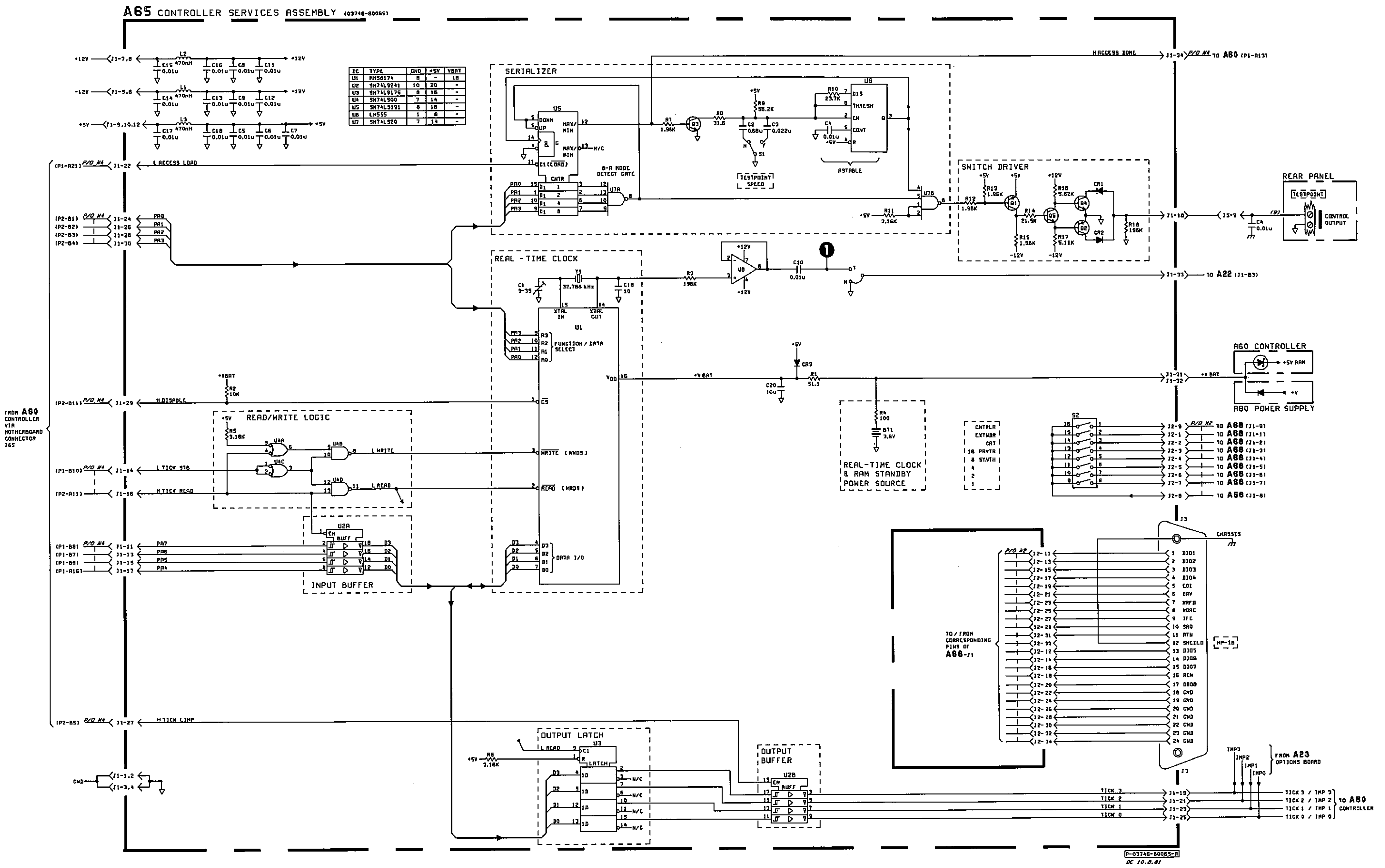


Figure A65-2 A65 Schematic Diagram

A65 Component Location

8-159
8-160

ASSEMBLY SERVICE SHEET A68
HP-IB ASSEMBLY

A68-1 INTRODUCTION

A68-2 The A68 HP-IB board functions as an interface between an external HP-IB system and the A60 controller. One way of looking at its function is to say that:

(1) It makes life easier for the A60 controller by functioning as a "translator" between codes used for HP-IB communication and the codes used by the A60 processor for input/output.

(2) It takes care of HP-IB protocol and bus management.

A68-3 These tasks are carried out partly by an operating program stored in ROM and partly by hard-wired logic circuitry.

A68-4 MICROPROCESSOR

A68-5 The processor has three ports:

(1) Port 0 (DB0-DB7 / A0-A7) is both a data I/O port and an address port, and is used for:

i. Bi-directional communication with A60.

ii. Reading from & addressing the ROM.

iii. Writing commands into the STATUS/ CONTROL LATCH.

iv. Reading the settings of the HP-IB address/function switch.

(2) Port 1 (P10-P17) is a data I/O port and is used for bi-directional transmission of HP-IB data.

(3) Port 2 (P20-P27) is both a data I/O port and an address port and is used for:

i. Bi-directional transmission of HP-IB management signals.

ii. Output of the ROM address bits A8, A9, A10.

Other processor signal lines are as follows:

T0

Test Input 0. An input which the processor can look at when so instructed by the operating program.

T1

Test Input 1. An input which in this case functions as a processor interrupt.

$\overline{\text{INT}}$

Low-true interrupt input.

$\overline{\text{RD}}$

An output which is low when the processor reads via port 0.

$\overline{\text{RESET}}$

Low-true reset input.

$\overline{\text{WR}}$

An output which has a low-to-high transition when output data is present on PORT 0.

ALE

Address Latch Enable. An output which has a high-to-low transition when the processor outputs an address, and a low-to-high transition when port 2 outputs data.

$\overline{\text{PSEN}}$

Program Store Enable. This output is used to enable external memory for a read operation.

$\overline{\text{SS}}$

Single Step input. Not used in this instrument.

EA

External Access input. Not used in this instrument.

XTAL1 & XTAL2

Crystal connections for internal oscillator. (An LC circuit may be used instead of a crystal.)

A68-6 HP-IB DATA LINES I/O GATING

A68-7 The data I/O gating is straightforward: LENOUT (low enable data out) enables data to be transmitted to the external HP-IB, and LENIN (low enable data in) enables data to be received from HP-IB. The HP-IB DAV and EOI management lines are similarly controlled.

A68-8 HP-IB MANAGEMENT LINES I/O GATING

A68-9 This block of circuitry has two modes of operation, depending on whether the 3746A is operating as a controlled instrument or as a controller. Selection between the two is made by the signal LCONTROL (low for operation as a controller) from A60. When the 3746A is a bus controller, the outgoing SRQ line is disabled and the ATN, REN & IFC lines are controlled by the 3746A. When the 3746A is a controlled instrument the converse applies.

A68-10 The ATN Bistable

A68-11 When the 3746A is operating as an HP-IB controlled instrument the bus specification demands a response within 200ns by the NRFD (Not Ready For Data) line when the ATN (attention) line goes true. The ATN BISTABLE is provided to meet this requirement. It consists of two J-K flip-flops U2A & U2B. These are connected together to form an edge-triggered bistable.

A68-12 The "waiting" condition of the bistable is both J-K's reset and LATNINT (low for attention interrupt) high. When ATN goes true U2B will be clocked and LATNINT will go low, sending NRFD true. This will occur within 200ns, without any action by the processor. At the same time LATN INTERRUPT will go low and this condition will eventually be clocked into the proccessor T1 input by ALE (address latch enable). The function of the T1 input is internally programmable and is, in this instance, to function as an interrupt.

A68-13 The proccessor will eventually reset the bistable by setting LATN BISTABLE RESET low.

A48-14 Latched Management Lines

A68-15 The SRQ, ATN, REN & IFC lines from the processor are latched by the D-types U8A/B/C/D. This is because these processor I/O lines are multiplexed and serve also as high-order address bits.

A68-16 COMMUNICATION WITH THE A60 PROCESSOR

A68-17 The A60 & A68 processors exchange data by a handshake sequence. They have equal status in that neither processor can be considered to consistently operate in either a master or a slave role.

A68-18 When the A68 proccessor has data to communicate to the A60 processor it will act as follows:

(1) Output (at U25 PORT 0) a status/control word with the interrupt bit DB4 set.

(2) Latch the status/control word into U29.

(3) Output (at U25 PORT 0) the data word to be communicated.

(4) Simultaneously latch the data word in U27 and the status/control word in U28.

A68-19 This sequence will put the data word on BUS0-BUS7 at U27 and set the interrupt signal HINT at U28. Having done this, the A68 processor sit back and wait for a response.

A68-20 In due course the A60 processor will read the data word on BUS0-BUS7 and will respond as follows:

(1) It will place a data word on PA0-PA7.

(2) It will then set HLOAD BUS true. (This will send the output of U31A high, and will cause an interrupt via the A68 processor T0 test input. It will also clock the data on PA0-PA7 into U30, although the output of U30 will not at this instant be enabled.)

A68-21 After this the A60 processor returns to internal program operations until further action by the A68 processor. The A68 processor will read and act upon the data word in U30. The interrupt on the A68 proccessor T0 input will remain until it is reset by the next occurrence of HINT.

A68-22 If the A60 processor has something more to say before the A68 proccessor gets around to resetting U31A the A60 processor gets the attention of the A68 processor by setting LREQ SERVICE low. This action resets U31, and the A68 processor interprets the disappearance of the T0 input as a request for service by the A60 processor.

A68-23 TROUBLESHOOTING

A68-24 KERNEL SIGNATURES

To run the Kernel signature program

1. Switch the SLMS POWER switch to STBY.
2. Disconnect the 34 way multi-coloured cable at the top of the HP-IB Assembly (A68) and remove the assembly.
3. Remove TL2 (this ensures there is no interraction on the SRQ line to the microprocessor U25).
4. Remove the ROM U26. (The pull down resistor pack R10 on microprocessor PORT 0 forces the NO OP code for the microprocessor).
5. Mount the A68 assembly on an extender board.
6. Connect the Signature Analyzer as follows:

GND	START	STOP	CLOCK
GNDA	TP11	TP11	TP2

7. Set the POWER switch to ON and check the +5V signature is 7A7O.

Check the following signatures

TP1 High	TP4 High
TP2 Pulsing	TP10 High
TP3 Pulsing	

U25

12	0000 (with logic probe pulsing)	
13	0000 (with logic probe pulsing)	
14	0000 (with logic probe pulsing)	
15	0000 (with logic probe pulsing)	PORT 0
16	0000 (with logic probe pulsing)	
17	0000 (with logic probe pulsing)	
18	0000 (with logic probe pulsing)	
19	0000 (with logic probe pulsing)	
21	9635	
22	1734	PORT 2
23	8P54	

The remaining outputs at Ports 2 and 3 of the microprocessor (U25) are set to the high impedance state. These outputs will however registar as either High or Low depending on the state of the adjacent circuitry - see HP-IB DATA LINES I/O GATING and HP-IB MANAGEMENT LINES I/O GATING in the Kernel Signature Section.

U29

2	H62U
5	C21A
6	HA07
9	H0AA
12	P030
15	4442
16	4U2A
19	0772

A68-25 PROGRAM SIGNATURES

To run the program signatures

1. Set the Power switch to STBY.

2. Re-connect the 34-way multi-coloured cable.

3. Re-insert ROM U26 (This contains the program to run the signatures).

4. Set TL1 to +5V (TL2 should be removed also).

5. Set the rear panel switches to 10011111 (The address switches are set to 11111).

6. Switch the POWER switch to ON.

7. Connect the Signature Analyzer as follows:

START	STOP	CLOCK	GND
TP9	TP9	TP3	GNDA

8. In most cases the SLMS TEST POINT display will indicate an error code E89. This indicates the SA program is running. Failure to display this code is not necessarily indicative that the program is not running. If the program is running, indicated by correct signatures, and there is no error E89 indication, the buffer U27 could be faulty.

9. The +5V signature should be U2A2.

A68-26 PROGRAM SIGNATURES

Note: (1) Signatures remain the same with TL2 in GND position except for signatures marked*.

(2) (P) indicates probe pulsing (H) indicates high (L) indicates low.

(3) If an incorrect signature occurs, switch the POWER to STBY and then ON to activate a reset. Check the signature again. Sometimes accidental shorting of certain pins can cause the microprocessor to JUMP and give false signatures.

TP1	U2A2 (Pulsing)		TP7	High		H77P*
TP2	U2A2 (Pulsing)		TP8	8721		
TP3	U2A2 (Pulsing)		TP9	4CCF		
TP4	U2A2 (Pulsing)		TP10	High		LOW*
TP5	0000 (Pulsing)	HIGH*	TP11	U2A2	(Pulsing)	93CU*
TP6	PC07					

U25 Microprocessor

Pin 2	U2A2 (P)			
3	U2A2 (H)			
4	HIGH			
5	HIGH			
6	FP9H 2487*			
7	HIGH			
8	U2A2 (P)			
9	U2A2 (P)			
10	U2A2 (P)			
11	0000 (P)			
12	65U7........	0		
13	6H4H........	1		
14	167U........	2	PORT 0	
15	430F........	3	DATA/ADDSS	
16	A740........	4		
17	H6P4........	5		
18	FU36........	6		
19	1063........	7		
20	0000 (L)			
21	U2A2 (P).................		(IFC)	
22	U2A2 (P) 4FC6*........		(REN)	PORT 2
23	U2A2 (P) 93CU*........		(ATN)	
24	4CCF.....................		(SRQ)	
25	HIGH			
26	HIGH			

(P) indicates pulsing

U25 Microprocessor (cont.)

27	A400 0			PORT 1 HP-IB DATA
28	13P5 1			
29	P37P 2			
30	5418 3			
31	F62A 4			
32	3844 5			
33	88U3 6			
34	5729 7			
35	71PA		.... (DAV)	PORT2
36	5P0F		.... (EOI)	
37	37U2	122P*	.... (NRFD)	
38	CAC4	9U68*	.... (NDAC)	
39	HIGH	604F*		
40	HIGH			

A68-27 HP-IB DATA LINES I/O GATING Signatures

The signatures on the microprocessor DATA BUS U25 pins 27 to 34 are duplicated at each point in the I/O gating.

U21 (11)	A400	U4 (3)	A400	U12 (5)	A400
U21 (13)	A400	U4 (2)	A400	U12 (2)	A400
		U4 (1)	A400	U4 (4)	TP8 8721

A68-28 HP-IB MANAGEMENT LINES I/O GATING Signatures

DAV (Data Valid)

U23	(5)	71PA
U23	(2)	71PA
U6	(11)	71PA
U6	(10)	71PA
U6	(9)	71PA
U14	(9)	71PA

EOI (End Or Identify)

U23	(7)	5P0F
U23	(1)	5P0F
U6	(13)	5P0F
U6	(14)	5P0F
U6	(15)	5P0F

NRFD (Not Ready for Data)

U19	(8)	37U2	122P*
U19	(9)	PC07	
U19	(10)	F550	
U21	(6)	F550	
U21	(1)	37U2	
U3	(13)	37U2	
U3	(12)	HIGH	H77P*
U3	(11)	37U2	122P*
U4	(13)	37U2	122P*
U4	(14)	37U2	122P*
U4	(15)	37U2	122P*

NDAC (Not Data Accepted)

U19	(5)	CAC4	9U68*
U19	(6)	PC07	
U19	(4)	4816	
U22	(6)	4816	
U22	(1)	CAC4	
U3	(9)	CAC4	
U3	(100	HIGH	H77P*
U3	(8)	CAC4	9U68*
U5	(13)	CAC4	9U68*
U5	(14)	CAC4	9U68*
U5	(15)	CAC4	9U68*

U12 (11)	37U2	122P*		U13 (11)	CAC4	9U68*	
U12 (13)	37U2	122P*		U13 (13)	CAC4	9U68*	

SRQ (Service ReQuest)

U8 (13)	4CCF	LOW
U8 (9)	0000 (P)	
U8 (9)	U2A2 (P)	
U8 (15)	2P2H	
U24 (7)	2P2H	
U24 (1)	2P2H	
U7 (13)	2P2H	
U7 (12)	LOW	HIGH*
U7 (14)	2P2H	HIGH*
U7 (15)	2P2H	HIGH*
U15 (10)	2P2H	HIGH*
U15 (13)	HF8U	LOW*

REN (Remote ENable)

U8 (12)	U2A2 (P)	4FC6*
U8 (9)	0000 (P)	
U8 (10)	HIGH	AHA8*
U24 (11)	HIGH	AHA8*
U24 (13)	HIGH	AHA8*
U7 (3)	HIGH	AHA8*
U7 (4)	HIGH	LOW
U7 (2)	HIGH	AHA8*
U7 (1)	HIGH	AHA8*
U15 (4)	HIGH	AHA8*
U15 (2)	LOW	5U0A*

ATN (Attention)

U8 (5)	U2A2 (P)	93CU*
U8 (9)	0000 (P)	
U8 (7)	HIGH	422F*
U24 (5)	HIGH	422F*
U24 (2)	HIGH	422F*
U7 (11)	HIGH	422F*
U7 (10)	HIGH	422F*
U7 (9)	HIGH	422F*
U15 (8)	HIGH	422F*
U15 (14)	LOW	
U1 (7)	9FUU	
U1 (1)	FP7U	
U2 (13)	FP7U	
U2 (14)	LOW	25HF*
U2 (7)	HIGH	
U2 (15)	HIGH	
U2 (1)	HIGH	
U2 (5)	LOW	422F*
U2 (6)	HIGH	H77P*
U14 (11)	HIGH	H77P*
U14 (13)	HIGH	H77P*

Critical Timing on U1 results in different Signatures for input and output. Changing the clock edge should make all codes identical.

IFC (Interface Clear)

U8 (4)	U2A2 (P)
U8 (9)	0000 (P)
U8 (2)	HIGH
U1 (11)	U2A2
U1 (13)	U2A2
U7 (5)	U2A2
U7 (6)	U2A2
U7 (7)	U2A2
U15 (6)	U2A2
U15 (1)	0000

OTHERS

U18 (9)	LOW	5U0A*		U31 (2)	HIGH	H77P*
U18 (8)	HIGH	AHA8*		U31 (3)	U2A2	
U20 (1)	HIGH			U31 (5)	HIGH	604F*
U20 (2)	3F3U					

```
U20 (3)  3F3U  H625*
U19 (11) 3F3U  H625*
U19 (12) LOW
U19 (13) FP9H  2487*
```

A68-29 BUFFERS AND LATCHES CHECK (U9, U27, U28 and U29)

Normally a failure of any of the Latches or Buffers (U9, U27, U28 or U29) will prevent the transfer of information to and from the microprocessor on the A60 assembly. The signature analysis program does not check these components. If the HP-IB Program Signatures test paragraph A68-25 can be run, U9 may be assumed to be working (since the microprocessor U25 reads the rear panel switches via U9 prior to initiating the program). The following procedure is included to assist in isolating the faulty component.

NOTE U30 AND U31 REMAIN UNCHECKED.

A68-30 PROCEDURE TO CHECK U9,U27,U28 and U29.

1. Remove the ROM (U26) and the Microprocessor U25.
2. Connect TP1 and U28 pin 2 to GND A or B (this enables U9).
3. Ensure the multiway connector (which interfaces the rear panel switches to the HP-IB assembly) is connected.
4. Set all the rear panel switches to the '1' position.
5. Short U25 pin 11 (U25 is removed) momentarily to GND twice, to latch the output from U9 at U29.
6. The output pins at U29 should all be at logic '1' level. (If the output pins are not at logic 1, ensure the input pins at U29 are at logic 1, then if necessary replace U29).
7. Short TP4 momentarily to GND twice.
8. The output pins at U28 and U27 should now be at logic 1 level.
9. Set all the rear panel switches to the '0' position.
10. Short U25 pin 11 momentarily to GND twice.
11. The outputs at U29 should now be at a logic 0.
12. Short TP4 momentarily to GND twice.
13. The outputs of U28 and U27 should now be at a logic 0 level.

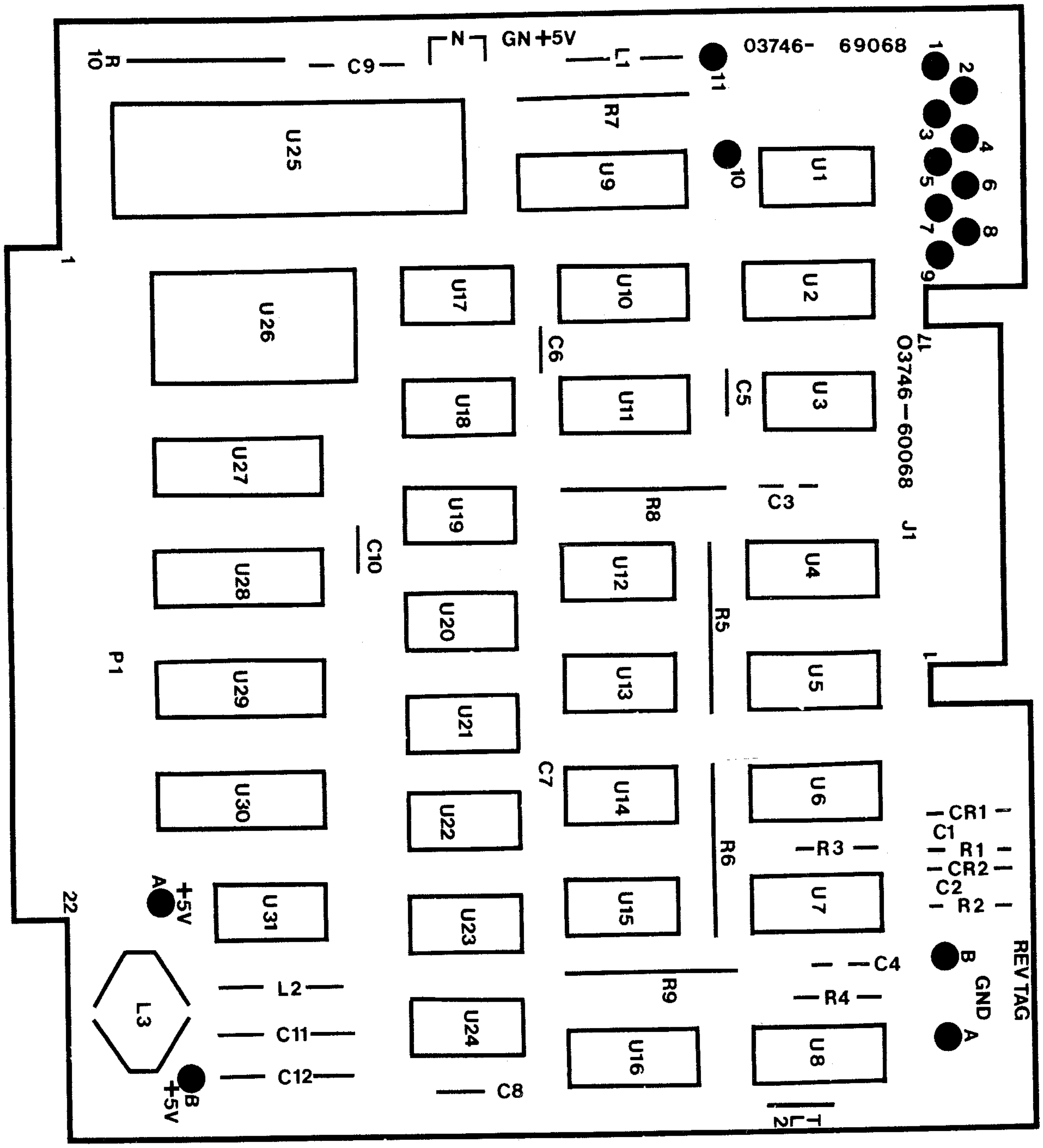
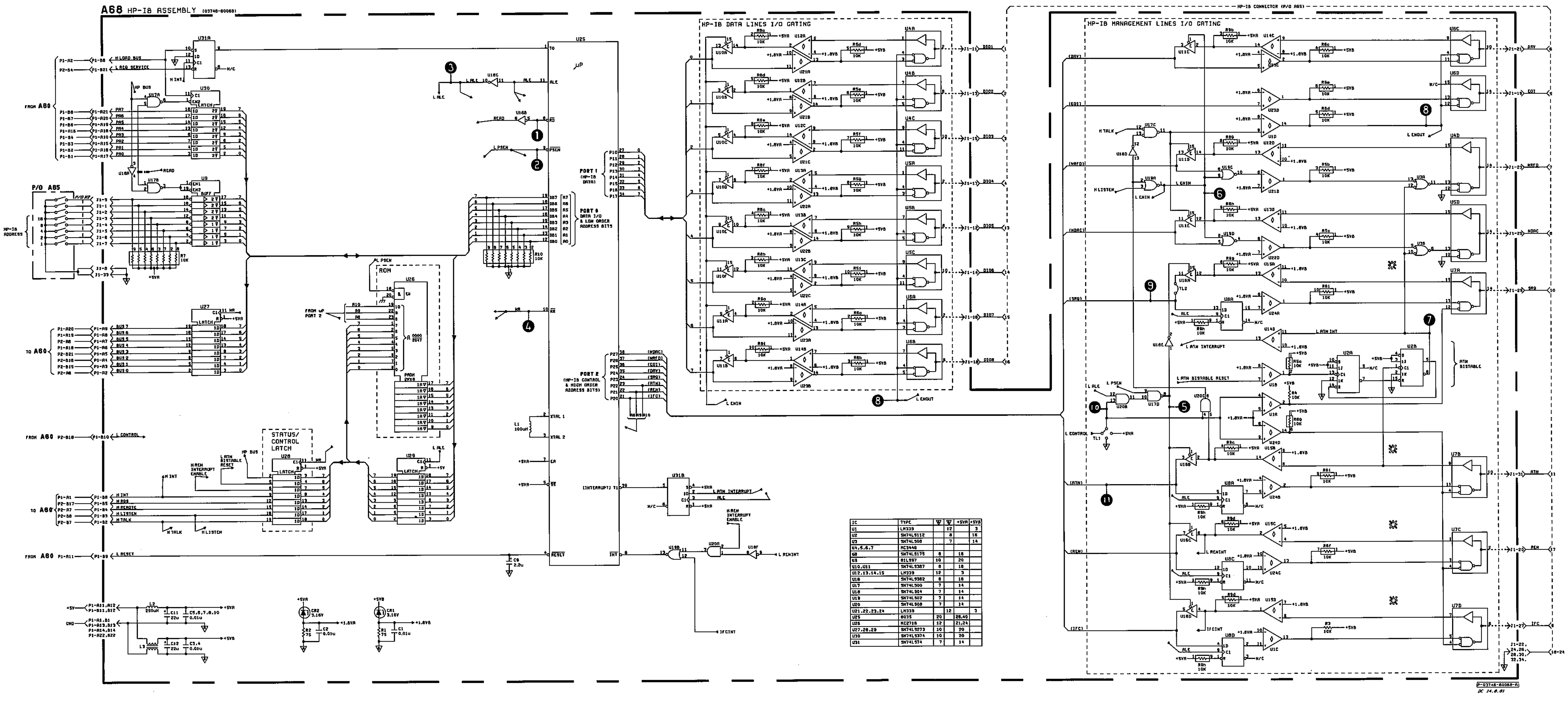


Figure A68-1 A68 Component Location



IC	TYPE	▽	▽	+5VA	+5VB
U1	LM339		12		3
U2	SN74LS112		8		16
U3	SN74LS08		7		14
U4,5,6,7	MC3448				
U8	SN74LS175	8		16	
U9	81LS97	10		20	
U10,U11	SN74LS367	8		16	
U12,13,14,15	LM339	12		3	
U16	SN74LS362	8		16	
U17	SN74LS00	7		14	
U18	SN74LS04	7		14	
U19	SN74LS02	7		14	
U20	SN74LS08	7		14	
U21,22,23,24	LM339		12		3
U25	8035	20		26,40	
U26	MC2716	12		21,24	
U27,28,29	SN74LS273	10		20	
U30	SN74LS374	10		20	
U31	SN74LS74	7		14	

Figure A68-2 A68 Schematic Diagram

8-169
8-170

ASSEMBLY SERVICE SHEET A80
POWER SUPPLY

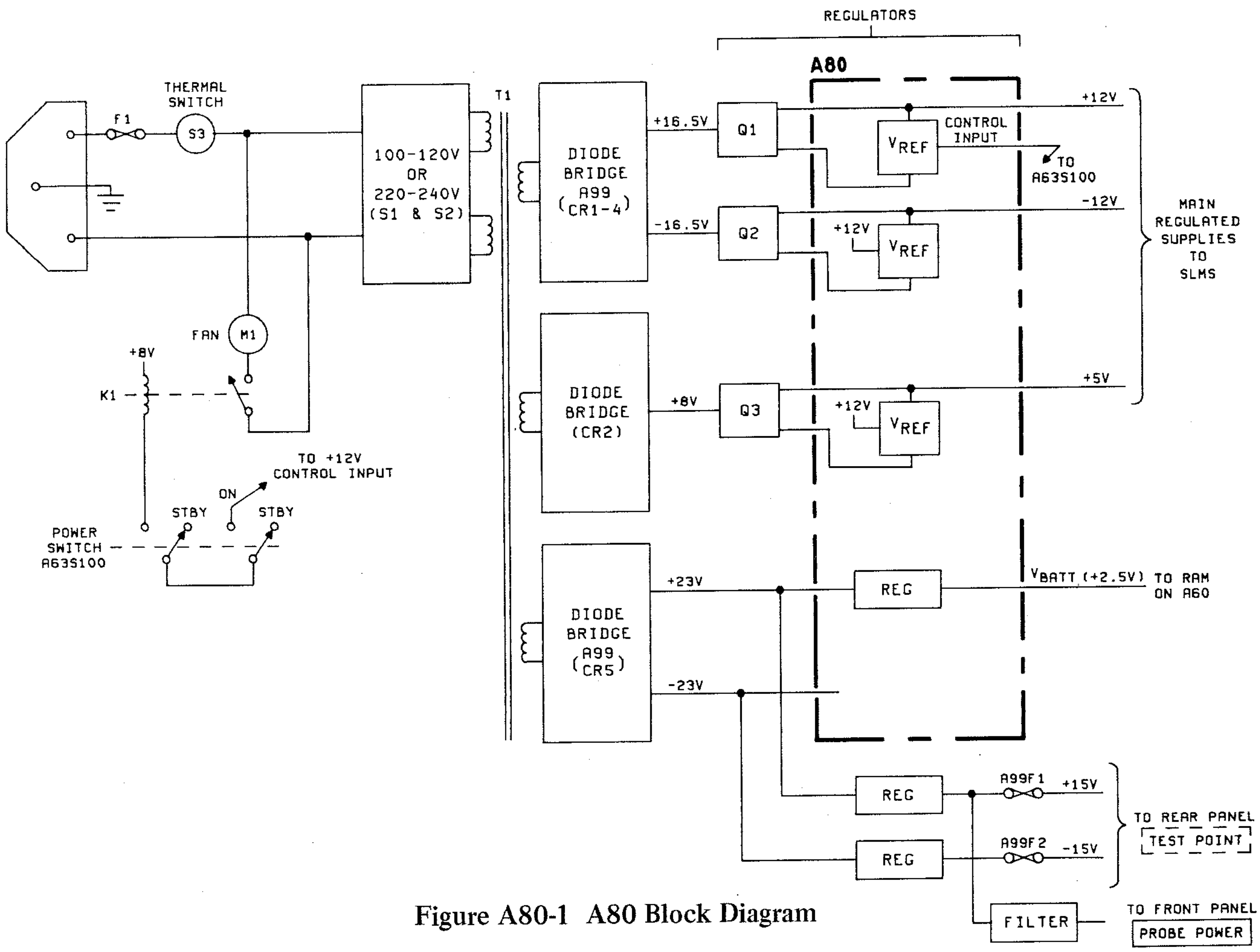


Figure A80-1 A80 Block Diagram

A80-1 INTRODUCTION

A80-2 This assembly, with Q1, Q2 and Q3 produce the three main regulated power lines for the SLMS (+12V, -12V and +5V). These volteages are derived from the unregulated dc voltages at the diode bridges. Two of these bridges (A99CR1-CR4 and A99CR5) are located on the Motheroard A99, the third is chassis mounted, as are Q1, Q2 and Q3.

A80-3 The ac power input is selectable, from 110, 120, 220 or 240Vac at 48 to 66Hz. Two switches, S1 and S2, mounted on the rear panel allow one of the four voltages to be selected. S3 provides thermal cut out protection if the ambient temperature exceeds 105°C. A fan (M1) is on whenever the instrument POWER switch (A63S100) is in the ON position (via the energised relay K1). The secondary windings of T1 drive the diode bridges.

A80-4 When the POWER switch is in the STBY position and the ac power is connected, the following lines are live:

a. All the unregulated supplies.

b. Regulated +15V and -15V to rear panel TEST POINT terminal.

c. V_{BATT} (+2.5V) to RAM devices on Assembly A60.

d. Regulated +15V to front panel PROBE POWER.

A80-5 When the POWER switch is set to ON, the three main regulated power lines are live. The

+12V line supplies the reference voltage for the -12V and +5V lines and so must be first to power up. It is enabled by shortng its control input to ground via the POWER switch, see Figure A80-1.

A80-6 The +23V and -15V unregulated dc voltages from CR2 are applied to two regulators on the Motherboard (A99U2 and A99U3). These produce the fused +15V and -15V supplies at the rear panel TEST POINT and the filtered +15V PROBE POWER on the front panel.

A80-7 CIRCUIT DESCRIPTION

A80-8 A80CR8 is the reference zener diode for the +12V supply. Overload protection for the amplifiers A80U1A and U1B is provided by A80CR9 and A80 CR3 provides -5.11V for A80U1. When the instrument POWER switch is in the STBY position, pin A22 of A80P1 is "open" and A80Q1 is biased on through A80R17 and R18. This brings A80U1(5) down to approximately 0V and A80U1(6) follows, cutting off the +12V supply. Since the +12V supply is used as the reference input for the -12V and +5V regulators, all three supplies are therefore off. The voltage at the junction A80R17 and R18 is applid via A80P1(A22) to the A63 Assembly to turn on the STBY annunciator (A63DS52B) on the front panel.

A80-9 When the POWER switch is switched from STBY to ON, the junction of A80R17 and R18 is grounded through the POWER switch, turning the STBY annunciator off, switching A80Q1 off and allowing the inputs of A80U1B to come up to the reference voltage across A80CR8. The voltage at A80TP1 now goes to +12V as set by A80R15 and all three main supplies are turned on.

A80-10 A80U1B is the voltage regulator for the +12V supply, and U1A provides current limiting. If the +12V supply were to become shorted, U1(1) would go low, turning on red LED DS4 and biasing Darlington transistor Q1 off to limit the current into the regulator. During normal supply operation, green LED A80DS1 is turned on and CR6 provides reverse bias protection for U1 in case the positive and negative supplies were to accidently short to each other.

A80-11 The -12V regulator operates in the same way as the +12V regulator, except that the reference for the regulator A80U2B is the +12V supply through A80R38.

A80-12 The +5V regulator operates in the same way as the +12V regulator, except that the reference for the regulator A80U3B is the +12V supply through A80R58. Zener CR3 (near Darlington transistor Q3) provides over-voltage protection at +5.6V for the +5V supply.

A80-13 The +23V input to A80 is also used to charge A65BT1, a 100mA NICAD battery which furnishes +2.5V of standby power to the CMOS RAMs on the A60 Assembly. When all input ac power is removed from the SLMS, the RAMs draw approximately 100uA from A65BT1. With ac power connected, even in STBY, a charging current of approximately 7uA maintains A65BT1 at full charge to provide about 30 days of battery life at the designed load current when power is removed.

A80-14 MOTHERBOARD - A99

A80-15 The A99 Motherboard provides a common point of contact for all of the plug-in printed circuit cards in the SLMS and eliminates unnecessary wiring and cabling between circuits. The Motherboard also provides connection points for chassis mounted components such as the power transformer T1.

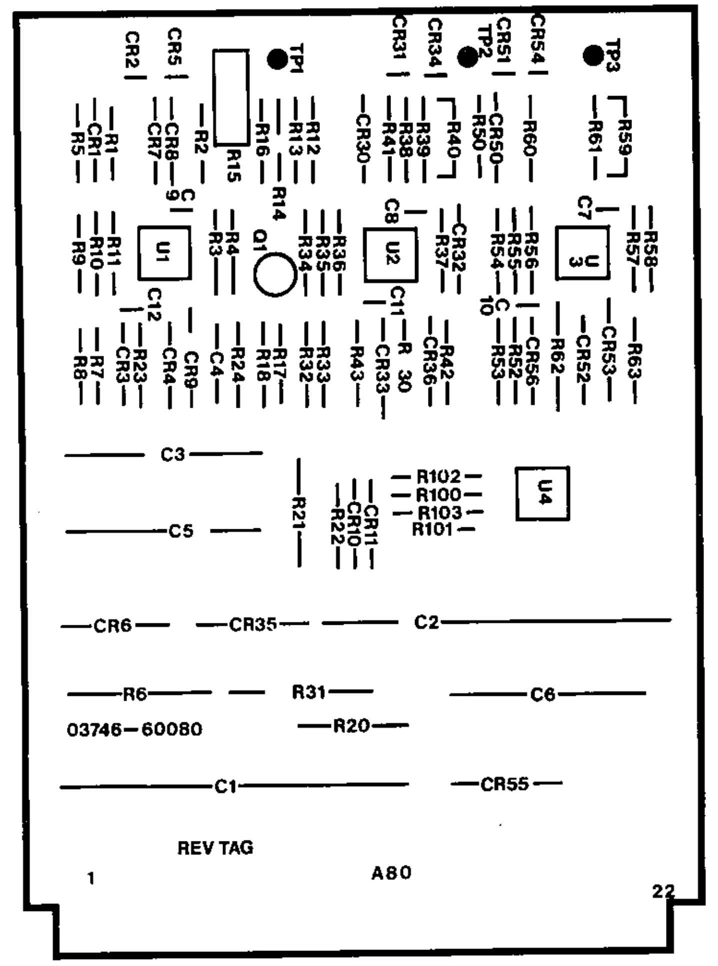


Figure A80-2 A80 Component Location

8-173
8-174

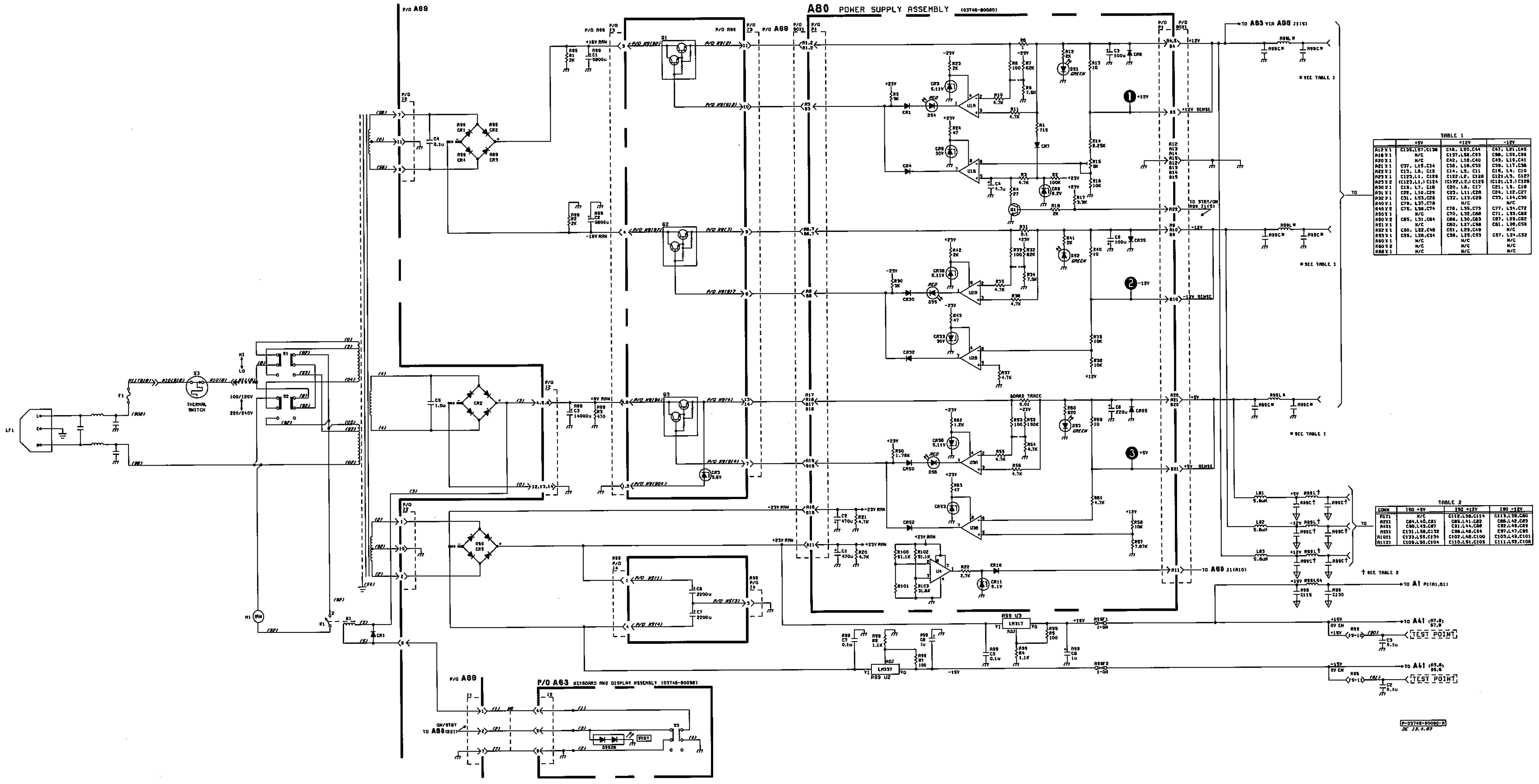


Figure A80-3 A80 Schematic Diagram

A80 Component Location
A80 Schematic Diagram

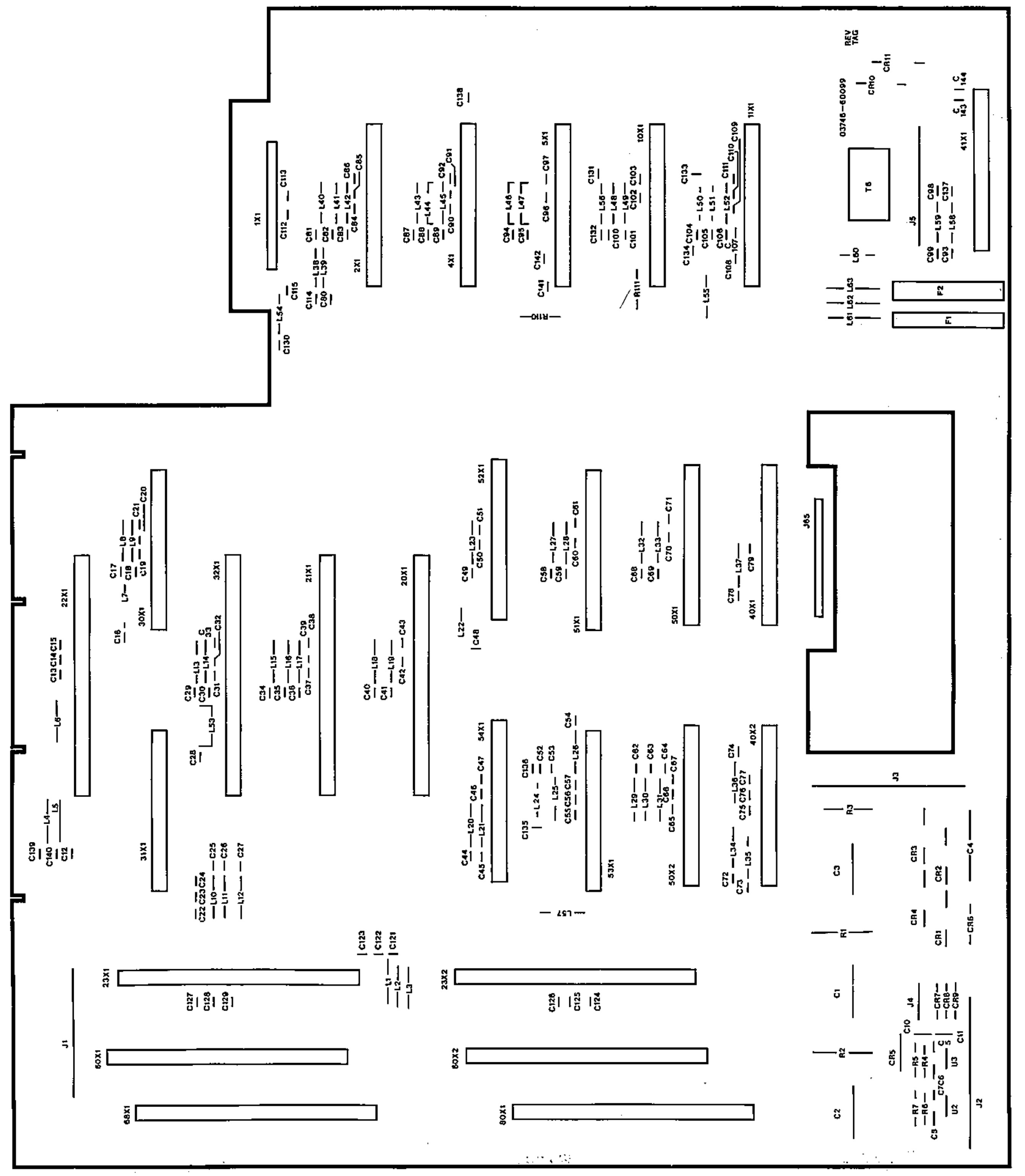


Figure A99-1 A99 Component Location

APPENDIX A

List of Error Codes

NUMBER	MEANING
E01	REF, FREQ, LOOP UNLOCKED
E02	STEP LOOP UNLOCKED
E03	FRAC N LOOP UNLOCKED
E04	SUM LOOP UNLOCKED
E05	STEP AND FRAC N LOOPS UNLOCKED
E06	STEP AND SUM LOOPS UNLOCKED
E07	FRAC N AND SUM LOOPS UNLOCKED
E09	STEP, FRAC N AND SUM LOOPS UNLOCKED
E11	FREQUENCY ENTRY IS TOO HIGH
E12	START FREQUENCY ENTRY IS TOO HIGH
E13	STOP FREQUENCY ENTRY IS TOO HIGH
E14	STEP FREQUENCY ENTRY IS TOO HIGH
E15	NON-STANDARD PILOT FREQUENCY IS TOO HIGH
E16	ATTEMPT TO TUNE SYNTHESIZER TO A FREQUENCY WHICH IS TOO HIGH
E17	STOP FREQUENCY IS LESS THAN START FREQUENCY
E24	ATTEMPT TO MEASURE RANDOM FREQUENCIES WITH AN EMPTY ARRAY
E31	REFERENCE LEVEL ENTRY IS TOO HIGH OR TOO LOW
E32	UPPER LIMIT ENTRY IS TOO HIGH OR TOO LOW
E33	LOWER LIMIT ENTRY IS TOO HIGH OR TOO LOW
E35	ATTEMPT TO SELECT OPTION NOT FITTED
E36	IMPULSE LEVEL THRESHOLD IS TOO HIGH
E37	IMPULSE LEVEL THRESHOLD IS TOO LOW
E39	UNDEFINED TEST FUNCTION SELECTED
E41	CHANNEL ENTRY IS TOO LOW
E42	GROUP ENTRY IS TOO LOW
E43	SUPER-GROUP ENTRY IS TOO LOW
E44	MASTER-GROUP ENTRY IS TOO LOW
E45	SUPER-MASTER-GROUP ENTRY IS TOO LOW
E51	CHANNEL ENTRY IS INCONSISTENT WITH PLAN
E52	GROUP ENTRY IS INCONSISTENT WITH PLAN
E53	SUPER-GROUP ENTRY IS INCONSISTENT WITH PLAN
E54	MASTER-GROUP ENTRY IS INCONSISTENT WITH PLAN
E55	SUPER-MASTER-GROUP ENTRY IS INCONSISTENT WITH PLAN
E61	CHANNEL ENTRY IS TOO HIGH
E62	GROUP ENTRY IS TOO HIGH
E63	SUPER-GROUP ENTRY IS TOO HIGH
E64	MASTER-GROUP ENTRY IS TOO HIGH
E65	SUPER-MASTER-GROUP ENTRY IS TOO HIGH
E70	FDM ARRAY IS ALL ZERO
E71	MIXED DASHES AND NUMBERS IN FDM ENTRY
E72	DASH PRESENT IN FDM ENTRY DURING SCAN
E73	ZERO IN GROUP POSITION DURING GROUP POWER MEASUREMENTS
E74	NUMBERS INTERSPERSED WITH ZEROS IN FDM ENTRY
E75	CHANNEL NOT ZERO DURING GROUP POWER MEASUREMENT
E77	DASH IN FDM QUALIFIER FDM START OR FDM STOP ENTRIES
E78	IMBALANCE IN START AND STOP FDM DESCRIPTIONS

E79	FDM SLIDE SWITCHES CHANGED SINCE INITIAL SCAN CYCLE
E80	PILOT STORE OVERFLOW, MORE THAN 1024 POINTS
E81	UNIDENTIFIED SRQ DURING SERIAL POLL OF EXTENDER
E82	HP-IB CABLE NOT CONNECTED OR ALL SWITCHES SET TO 1
E83	CONTROLLER CONTENTION, ON POWER-UP REM LINE HELD LOW
E84	HP-IB ROM CHECK-SUM IS INCORRECT
E85	ILLEGAL ASCII STRING
E86	HP-IB BOARD RUNNING TEST 00
E87	HP-IB BOARD RUNNING TEST 1
E88	HP-IB BOARD RUNNING TEST 2
E89	HP-IB BOARD RUNNING TEST 4 (SIGNATURE ANALYSIS)
E90	A/D FAILS TO BE READY WITHIN SPECIFIED MAXIMUM TIME (LEVEL)
E91	A/D FAILS TO BE READY WITHIN SPECIFIED MAXIMUM TIME (COUNTER)
E92	PHASE-JITTER, TONE NOT PRESENT AFTER 5 SECONDS
E94	OVERLOAD, SIGNAL ABOVE 20dB (75ohm) OR 0dB (OTHER I P)
E95	A/D DATA IS NON-BCD OR BOARD IS NOT PLUGGED
E96	UNABLE TO AUTO-RANGE AFTER 20 ATTEMPTS
E97	CALIBRATION SIGNAL IS OUT OF RANGE
E98	OVERLOAD DETECTED WITH NO I.F. GAIN

APPENDIX B

Diagnostic Test Key Codes

TR	0	0		SELF-TEST, DISPLAY KEY-CODE (NO EXIT)
TR	0	1		SELF-TEST, DISPLAY SLIDE SWITCHES
TR	0	2		DISPLAY NUMBER OF INTERRUPTS PER SECOND
TR	0	9		DISPLAY PROM REV. NO. AND CRC TEST
TR	1	0		DISPLAY FDM SKIPS
TR	1	1		DISPLAY STORED FREQUENCIES
TR	1	9		DISPLAY THE TIME
TR	2	0		DISPLAY IF-GAIN STATE
TR	2	0	+/-	INCREMENT/DECREMENT IF-GAIN
TR	2	1		DISPLAY RF-ATTENUATION STATE
TR	2	1	+/-	INCREMENT/DECREMENT RF-ATTENUATION
TR	2	2		DISPLAY A/D INPUT SETTING
TR	2	2	+/-	INCREMENT/DECREMENT A/D I/P SETTING
TR	2	3		DISPLAY A/D COUNT
TR	2	4		SETS THE SLMS TO A COUNT ONLY MODE AND DISPLAYS IF FREQUENCY
TR	2	5	+/-	CHART RECORDER D/A CONTROL
TR	2	7	+/-	DISPLAY OPTION GAIN STATE
TR	2	8	+/-	DISPLAY IMP. THRESHOLD D/A
TR	2	9		MEASURE/DISPLAY & PRINT CAL. VALUE
TR	3	0		N-LOOP TOGGLED BETWEEN 20 AND 40MHz
TR	3	2		FRAC-N PROGRAMMED FROM 20.01 TO 20.01111MHz
TR	3	3		AS ABOVE BUT 30.01 TO 30.01111MHz
TR	3	4		AS ABOVE BUT 40.01 TO 40.01111MHz
TR	5	0		N-LOOP PROGRAMMED TO 52, 54,..., 84,86 (FRAC-N LEFT ALONE)
TR	5	1		N-LOOP AUTO-SCAN (AS ABOVE)
TR	5	3		N-LOOP GAIN AND OFFSET ADJUST
TR	6	0		DISABLE CRT OUTPUT
TR	6	1		ENABLE CRT OUTPUT
TR	7	0		DISPLAY OPTIONS FITTED
TR	9	0		DIAGNOSTIC TUNES
TR	LOCAL			DISPLAY HP-IB ADDRESS

APPENDIX C

Additional TR Key Sequences

TR 10				DISPLAY FDM SKIPS
Following TR 10				
			+	STEP UP THROUGH LIST OF SKIPS
			-	STEP DOWN THROUGH LIST OF SKIPS
	SMG (NUM)			ENTER SUPERMASTERGROUP FOR THIS SKIP
	MG/HG (NUM)			ENTER MASTERGROUP FOR THIS SKIP
	SG (NUM) (NUM)			ENTER SUPERGROUP FOR THIS SKIP
	CLEAR/SET			ENTER TERMINATE CODE AT THIS SKIP
TR 11				DISPLAY STORED FREQUENCIES
Following TR 11				
			+	STEP UP THROUGH LIST OF FREQUENCIES
			-	STEP DOWN THROUGH LIST OF FREQUENCIES
	(NUM)			ENTER NUMBER AT CURRENT POSITION
				ENTER DECIMAL POINT
	CLEAR/SET			ENTER TERMINATOR AT CURRENT POSITION
TR 19				DISPLAY TIME
Following TR 19				
	FREQ/FDM			TOGGLE TIME/DATE
	STOP			STOP THE CLOCK
	START			START THE CLOCK
	SMGT			ENTER HOUR/DAY
	SG			ENTER MINUTE/MONTH
	CH			CLEAR SECONDS/ENTER YEAR

NOT ON HP-IB (applies to the TR 19 sequences above)

TR	COUNTER MEAS		-	MEASURE INCOMING FREQ. RETUNE TO IT
TR	TR		-	TOGGLE TRANSFER
TR	CLEAR/SET			RESET SLMS, CLEAR ALL RAM
TR	+	DB/DBM		TURN ON EQUALISER
TR	-	DB/DBM		TURN OFF EQUALISER
TR	DB/DBM			OUTPUT "REF" TO HP-IB SYNTHESIZER
TR	DB/DBM	MEAS		PERFORM EQUALISATION CYCLE
TR	SPECT	MEAS		CONTINUE SPECTRUM FROM CURRENT FREQ
TR	SPECT	+	MEAS	AS ABOVE BUT SET TO SPECTRUM UP
TR	SPECT	-	MEAS	AS ABOVE BUT SET TO SPECTRUM DOWN
TR	SCAN	MEAS		SCAN MEAS FROM LIMIT FDM
TR	SCAN	+	MEAS	SCAN UP FROM LOWER FDM LIMIT
TR	SCAN	-	MEAS	SCAN DOWN FROM UPPER FDM LIMIT
TR	MEAS			GPO CHART RECORDER
TR	REF			TRANSFER CURRENT LEVEL TO REF LEVEL
TR	STEP	(FREQ)		DISPLAY/ENTER FDM OFFSET FREQUENCY
TR	FDM			DISPLAY/ENTER QUALIFIER FDM PLAN
TR	FREQ/FDM			PLANLOAD MAX START FDM AND MIN STOP FDM
TR	LOWER			SET LOWER SIDEBAND
TR	UPPER			SET UPPER SIDEBAND
TR	LOCAL			DISPLAY HP-IB ADDRESS

F46AC - Additional TR Key Sequences (Appendix C)

APPENDIX D

HP-IB Serial Poll Responses and Codes

LIST OF HP-IB SERIAL POLL RESPONSES

HEX	DEC	OCT	MEANING	
2	2	002	TALK ADDRESS 1 (MESSAGES) STILL REQUIRED	
3	3	003	TALK ADDRESS 2 (SYNTHESIZER) STILL REQUIRED	
6	6	006	IDLE (HALTED)	
7	7	007	BUSY (MEASURING)	
8	8	010	TALK ADDRESS 3 (DISPLAY) STILL REQUIRED	
1	65	101	END OF SINGLE MEASUREMENT	(SRQ)
2	66	102	TALK ADDRESS 1 (MESSAGES) REQUIRED	(SRQ)
3	67	103	TALK ADDRESS 2 (SYNTHESIZER) REQUIRED	(SRQ)
4	68	104	SLMS ERROR (SEE ERROR NUMBERS LIST)	(SRQ)
6	70	106	GONE LOCAL (FRONT-PANEL ONLY)	(SRQ)
6	86	126	LOCAL KEY PRESSED BUT LOCAL LOCKOUT	(SRQ)
8	72	110	TALK ADDRESS 3 (DISPLAY) REQUIRED	(SRQ)
6	102	146	ILLEGAL ASCII STRING	(SRQ)

LIST OF HP-IB ASCII STRINGS FOR INTERNAL AND EXTERNAL KEYCODE

ASCII	KEY	
+	PLUS/UP	
-	MINUS/DOWN	
AC	CLEAR/SET (ACCESS SWITCH)	
AF	AUTO FILTER SET	
AU0	AUTO UNTALK (TURN OFF)	**HP-IB ONLY**
AU1	AUTO UNTALK (TURN ON)	**HP-IB ONLY**
AV (0,1,2)	AVERAGE	
BD	BINARY DUMP	**HP-IB ONLY**
BL	BINARY LOAD	**HP-IB ONLY**
BS	BRANCH TO SUBROUTINE	**HP-IB ONLY**
CF	CHANNEL FILTER	
CH	FDM CHANNEL (DISPLAY AND LOAD WHEN HP-IB)	
CL	CALIBRATE (NOT SAME AS TRF 2 9)	**HP-IB ONLY**
CN	COUNTER	
CR0	CRT REMOTE DISABLE	**HP-IB ONLY**
CR1	CRT REMOTE ENABLE	**HP-IB ONLY**
DB	DISPLAY DB	**HP-IB ONLY**
DF	DISPLAY FDM	**HP-IB ONLY**
DM	DISPLAY DBM	**HP-IB ONLY**
DQ	DISPLAY FREQUENCY	**HP-IB ONLY**
DY	SET DAYS REGISTER (CLOCK)	**HP-IB ONLY**
EQ	EQUALISATION COEFF. LOAD	**HP-IB ONLY**
FM	FREQ. REGISTER-FDM REGISTER (=CH IN FRONT-PANEL)	
FP	FDM POWER	
FR	FREQUENCY	

GF	GROUP FILTER	
GN	GAIN DB	
GR	FDM GROUP (HP-IB ONLY: DISPLAY & LOAD)	
HA	HALT	
HR	SET HOURS REGISTER	**HP-IB ONLY**
HG	FDM HYPERGROUP (HP-IB ONLY: DISPLAY & LOAD)	
IM	IMPULSE COUNT MODE	
IP	INPUT POWER	
IS	INTERNAL SWITCH	**HP-IB ONLY**
JG	FDM JUMBO GROUP (HP-IB ONLY: DISPLAY & LOAD)	
KH	TERMINATOR (RANDOM FREQ.)	**HP-IB ONLY**
LO	LOCAL	
LL	LOWER LIMIT	
ME	MEASURE	
MG	FDM MASTERGROUP (HP-IB ONLY: DISPLAY & LOAD)	
MH	SET MONTHS REGISTER	**HP-IB ONLY**
MN	SET MINUTES REGISTER	**HP-IB ONLY**
NF	NOTCH FILTER ON	
PF	PILOT FILTER	
PJ	PHASE JITTER	
PR	PRINT	**HP-IB ONLY**
RF	RANDOM FREQUENCY	**HP-IB ONLY**
RL	REFERENCE LEVEL	
SC	SCAN	
SE	STEP	
SG	FDM SUPERGROUP (HP-IB ONLY: DISPLAY & LOAD)	
SK	SKIP FDM DESCRIPTIONS	**HP-IB ONLY**
SM	FDM SUPERMASTERGROUP (HP-IB ONLY: DISPLAY & LOAD)	
SP	SPECTRUM	
SR	START	
ST	STOP	
SW	SLIDE SWITCH CONTROL	**HP-IB ONLY**
T1	TERMINATION 1 (75ohm)	
T2	TERMINATION 2 (124/135/150ohm)	
T3	TERMINATION 3 (600ohm)	
TR	TRANSFER	
UL	UPPER LIMIT	
WF	WEIGHTED FILTER ON	
YR	SET YEARS	**HP-IB ONLY**
H20	TURN OFF BRIDGED INPUTS (HIGH Z)	**HP–IB ONLY**
H21	TURN ON BRIDGED INPUTS (HIGH Z)	**HP–IB ONLY**

LIST OF HP-IB INTERNAL AND EXTERNAL SWITCH CODES

INTERNAL SWITCH CODES FOR HP-IB

SELECTED BY HP-IB CODES: IS (DIGIT 1) (DIGIT 2)
FIRST DIGIT DEFINES WHICH SWITCH (1 TO 9)
SECOND DIGIT DEFINES POSITION (1 TO 9)

SWITCH	POSITION	FUNCTION
1	1	5150A THERMAL PRINTER MESSAGE SELECTED
1	2	FDM, FREQ, LEVEL, LIMIT CONDITION MESSAGE
1	3	FREQ, LEVEL, LIMIT CONDITION
1	4	LEVEL, LIMIT CONDITION
1	5	ERROR CODE
[...ABOVE MESSAGE FORMATS ARE SIMILAR (BUT NOT IDENTICAL) TO 3745...]		
1	6	++ UNDEFINED (CR,LF)
1	7	80-COL, PRINTER FORMAT
1	8	DATE/TIME DUMP: DD/MM/YY HH:MM:SS
1	9	++ UNDEFINED (CR,LF)
2	1	3330 SYNTHESIZER FORMAT SELECTED
2	2	3335
2	3	3336
2	4...9	UNDEFINED (DEFAULTS TO 3336)
3	1	FDM PLAN LOADED FROM SLMS PROM
3	2	FDM PLAN LOADED FROM SLMS RAM (0600H TO 07FFH)
3	3...9	*DEFAULTS TO 1*
4	1	CLEAR LIMITS COMPARISON STORE BEFORE NEXT MEASUREMENT
4	2...9	PRESERVE CURRENT CONTENTS OF LIMITS COMPARISON STORE
5.9	ALL	UNDEFINED (NO ACTION IMPLEMENTED)

EXTERNAL SLIDE SWITCH CODES FOR HP-IB

SELECTED BY CODES: SW <DIGIT 1> >DIGIT 2>
FIRST DIGIT DEFINES WHICH SWITCH (1 TO 9)
SECOND DIGIT DEFINES POSITION (1 TO 4)
FRONT-PANEL CORRELATION AS FOLLOWS:

SWITCH		POSITION			
CODE	FUNCTION	1	2	3	4
1	FDM PLAN				
2	FDM PLAN				
3	BANDWIDTH				
4	FDM PILOT				
5	GEN TRACK	OFF	STABILITY	LIMITS	OPEN LOOP

6	MEAS MODE	CONT	SINGLE		
7	LIMIT HALT	OFF	ON		
8	LIMITS	OFF	LOWER	UPPER	BOTH
9	PRINTER	OFF	LIMITS	CONT	

(WHERE A FRONT-PANEL SWITCH HAS LESS THAN 4 POSITIONS, THE DEFAULT VALUE IS SHOWN IN THE TABLE ENTRY FOR ILLEGAL POSITION CODES.)
(FOR ALL SWITCHES, IF DIGIT 2 >4, THEN POSITION 4 IS FORCED INTERNALLY.)

DEVICE CLEAR COMMANDS

GENERAL DEVICE CLEAR FORCES A POWER-ON RESET
AND CLEAR ALL WORKING MEMORY, NON-VOLATILE MEMORY
WILL BE PRESERVED IF IT HAS NOT BEEN CORRUPTED.
SLIDE SWITCHES WILL BE SET TO FRONT-PANEL STATE, SRQ
CLEARED, REMOTE/LISTEN/TALK PRESERVED AVERAGE 1,
AUTO-FILTER SELECTED NOT LOCAL LOCKOUT, NOT AUTO-UNTALK.

SELECTED DEVICE CLEAR
ALL DISPLAYS ARE CLEARED (TEST-POINT PRESERVED)
REMOTE AND LISTENER STATUS IS PRESERVED
PENDING HP-IB MESSAGES ARE DITCHED
IDLE STATE IS ENTERED (SRQ STATUS=6)
CRT OUTPUT IS DISABLED (CR0)
AVERAGE 1, AUTO-FILTER SELECTED
ALL FRONT-PANNEL SLIDE SWITCHES SET TO LEFT
PRINTER FORMAT IS FREQ, LEVEL, OVLD (IS13)
SYNTHESIZER FORMAT IS 3336 (IS23)
AUTO-UNTALK IS DISABLED (AU0)
FDM TABLE FROM PROM (IS31)
PILOT STORE ENABLE INITIAL RESET (IS41)

REAL-TIME CLOCK, SET BY A CONTROLLER OVER HP-IB

5 SPECIAL KEY-CODES ARE PROVIDED TO ALLOW SETTING THE SLMS CLOCK:

YR <DIGITS> - TO LOAD YEAR REGISTER
MH <DIGITS> - TO LOAD MONTHS REGISTER
HR <DIGITS> - TO LOAD HOURS REGISTER
DY <DIGITS> - TO LOAD DAYS REGISTER
MN <DIGITS> - TO LOAD MINUTES REGISTER

UPON RECEIPT OF ANY TIME-SET CODES, THE CLOCK IS STOPPED AND THE SECONDS REGISTER CLEARED TO ZERO. THE SLMS THEN ENTERS THE CLOCK DISPLAY/LOAD MODE, WHICH IS ALSO ACCESSIBLE FROM THE KEYBOARD BY THE SEQUENCE <TRANSFER><1><9>. WHILE IN THIS MODE, THE FOLLOWING KEYS ARE RE-DEFINED:
<SR> (NORMALLY START FREQUENCY) STARTS THE CLOCK
<ST> (NORMALLY STOP FREQUENCY) STOPS THE CLOCK

ANY OTHER KEYCODE WILL START THE CLOCK AND EXIT CLOCK MODE.

EXAMPLE SEQUENCES:

```
YR 81 MH 2 DY 27 HR 14 MN 36 HA ...SETS DATE= 27/FEB/81
                                          TIME= 14:36:00
                                     STARTS CLOCK AND LEAVES ENTRY MODE
                                  ...SETS TIME=   :36:00
                                          (HOURS NOT CHANGED)
                                     STARTS CLOCK AND REMAINS IN ENTRY MODE
```

APPENDIX E

Operating

OPERATIONAL KEY SEQUENCES

1ST KEY	2ND KEY	3RD KEY	4TH KEY	ACTION
75ohm	-	-	-	SELECT 75ohm TERMINATION
150ohm	-	-	-	SELECT 150ohm TERMINATION
600ohm	-	-	-	SELECT 600ohm TERMINATION
22Hz	-	-	-	SELECT PILOT FILTER (AUTO-FILTER OFF)
3.1kHz	-	-	-	SELECT CHANNEL FILTER (AUTO-FILTER OFF)
48kHz	-	-	-	SELECT GROUP FILTER (AUTO-FILTER OFF)
AUTO	-	-	-	SELECT/DESELECT AUTO-FILTER (TOGGLE)
AVE	(NUMBER)	-	-	SELECT MEASUREMENT ACCURACY (0,1,2)
CLEAR/SET	(NUMBER)	(NUMBER)	(NUMBER)	ACCESS SWITCH CONTROL(See Operating Manual)
COUNTER	MEAS	-	-	START FREQUENCY COUNTER, NO RETUNING
dB/dBm	-	-	-	DISPLAY dB OR dBm (TOGGLE)
FREQ/FDM	-	-	-	TOGGLE FREQUENCY/FDM DESCRIPTION DISPLAY
(FDM)	-	-	-	DISPLAY CURRENT FDM REGISTER:
"	CH	(NUMBER)		LOAD CHANNEL DESCRIPTION
"	G	(NUMBER)		LOAD GROUP DESCRIPTION
"	HG/MG	(NUMBER)		LOAD HYPER/MASTER GROUP
"	SG	(NUMBER)		LOAD SUPERGROUP DESCRIPTION
"	SMG	(NUMBER)		LOAD SUPERMASTERGROUP DESCRIPTION
FREQ	(	NUMBER, kHz	)	DISPLAY/ENTER CURRENT FREQUENCY
GAIN	-	-	-	DISPLAY TOTAL GAIN (ONLY VALID DURING A MEASUREMENT)
GP PWR	-	-	-	SELECT/DESELECT, GROUP/SUPERGROUP POWER
"	MEAS	-	-	START GROUP/SUPERGROUP POWER MEASUREMENT
"	SCAN	-	-	INITIALISE GRP/SGP POWER SCAN
"	"	UP	-	(DITTO, FROM LOWER END FDM DESCRIPTION)
"	"	DOWN	-	(DITTO, FROM HIGHER END)
"	"	"	MEAS	START GRP/SGP POWER SCAN MEASUREMENT
HALT	-	-	-	STOP MEASUREMENT (RE-START WITH MEAS)
IMP NOISE	-	-	-	ENTER IMPULSE COUNT MODE:
"	TIME	-	-	DISPLAY/LOAD TIME THRESHOLD
"	THRESH	-	-	DISPLAY/LOAD LEVEL THRESHOLD
"	IMP NOISE	-	-	DISPLAY RUN-TIME, COUNT, LEVEL
"	MEAS	-	-	MEASURE IMPULSE COUNTS
"	"	TIME	-	DISPLAY TIME THRESHOLD WHILE COUNTING
"	"	THRESH	-	DISPLAY LEVEL THRESHOLD WHILE COUNTING
"	"	IMP NOISE	-	DISPLAY RUN-TIME, COUNT LEVEL (COUNTING)
INP PWR				INPUT POWER INITIALISE (TOGGLE)
"	MEAS			START INPUT POWER MEASUREMENT
LOCAL	-	-	-	GO LOCAL IF REMOTE, AND NOT LOCAL LOCKOUT
LOWER		(NUMBER)		DISPLAY/LOAD LOWER LIMIT (dBm)
MEAS	-	-	-	MEASURE LEVEL AT CURRENT FREQUENCY
NS PILOT	(	NUMBER, kHz	)	DISPLAY/LOAD NON-STANDARD PILOT
NWT	-	-	-	SELECT NOTCH FILTER (CHANNEL)
JITTER	-	-	-	PHASE JITTER MEASUREMENT

				(3-WAY TOGGLE, SELECT 20-300HZ):
"	JITTER	-	-	SELECT 4-300HZ RANGE
"	"	JITTER	-	SELECT 4020HZ RANGE
"	(NUMBER)	-	-	(SELECT RANGE: 0=20-300
				1= 4-300
				2= 4-20
"	MEAS	-	-	START PHASE-JITTER MEASUREMENT
REF	(NUMBER, dBm)			DISPLAY/LOAD REFERENCE LEVEL
START	FREQ	(NUMBER, kHz).		DISPLAY/ENTER START FREQUENCY
START	<FDM>	-	-	DISPLAY START FDM PLAN
"	"	(FDM)	(NUMBER)	ENTER START FDM PLAN (SEE FDM ENTRY)
STOP	FREQ	<NUMBER, kHz>		DISPLAY/ENTER STOP FREQUENCY
STOP	(FDM)			DISPLAY/ENTER STOP FDM PLAN
				(SEE FDM ENTRY)
STEP	(NUMBER, kHz)			DISPLAY/ENTER STEP FREQUENCY
SPECT	+	MEAS		SPECTRUM UPWARDS FROM START FREQUENCY
SPECT	-	MEAS		SPECTRUM DOWNWARDS FROM STOP FREQUENCY
SPECT	MEAS			SPECTRUM FROM START/STOP FREQUENCY
SPECT	NS PILOT	MEAS		SPECTRUM THROUGH STORED FREQUENCIES
SCAN	+	MEAS		SCAN UPWARDS FROM CURRENT FDM DESCRIPTION
SCAN	-	MEAS		SCAN DOWNWARDS FROM CURRENT FDM DESCRIPTION
SCAN	MEAS			SCAN FROM CURRENT FDM DESCRIPTION

EUQALISATION PROCEDURES

<u>TO MEASURE A GIVEN NETWORK RESPONSE</u>:

SET TO SINGLE-SWEEP, BUS TRACKING ON, THEN THE KEY-SEQUENCE:

(TR) (dB/dBm)	WILL SEND TO THE TRACKING GENERATOR THE LEVEL VALUE STORED AS A REFERENCE LEVEL.
(MEASURE)	INITIATES AN EQUALISATION SPECTRUM WITH READINGS TAKEN AT 500kHz, 1.5MHz, 2.5MHz,..., 31.5MHz. THE RESULTS ARE STORED AS: (MEASURED LEVEL-REF, LEVEL) FOR EACH OF THE ABOVE FREQUENCIES.

<u>TO SEND A KNOWN CIRCUIT RESPONSE</u>

USE THE HP-IB SEQUENCE:

EQ (RESPONSE AT 500kHz) DB (RESPONSE AT 1.5MHz) DB.....

FDM SKIP FACILITY

UP TO 30 ELEMENTS CAN BE DEFINED IN NON-VOLATILE RAM. THE SCAN ALGORITHM WILL SKIP ROUND ALL ELEMENTS DEFINED IN THE ARRAY, STARTING WITH FIRST ENTRY AND ENDING WHEN A TERMINATOR HAS BEEN FOUND (A TERMINATOR IS ALWAYS PRESENT AFTER 30TH ELEMENT). THUS, THE FIRST TERMINATOR FOUND, EFFECTIVELY DEFINES THE END OF THE ACTIVE ARRAY, EVEN IF ADDITIONAL DATA FOLLOWS IT.

<u>DATA ENTRY</u>:

THE ARRAY CAN BE LOADED MANUALLY, BY USING THE SEQUENCE:

(TR) (1) (0) , AND THEN:

-THE UP/DOWN KEYS TO "ROLL" THE ARRAY
-NORMAL FDM DATA ENTRY KEYS TO LOAD SKIP DESCRIPTIONS
-THE SET/CLEAR KEY (TEST-POINT) TO LOAD A TERMINATOR AT THE CURRENT DESCRIPTION.
-ANY OTHER KEY TO EXIT SKIP MODE (NO TERMINATOR)

FROM HP-IB, THE ABOVE SEQUENCE CAN BE DUPLICATED, OR THE SPECIAL CODE "SK" CAN BE USED AS FOLLOWS:

SK (SMG1) (MG1) (SG1) (SMG2) (MG2) (SG2)....

WHERE SMG AND MG MUST BE 1 DIGIT ONLY, AND SG1 MUST BE 2 DIGITS (INCLUDING LEADING ZEROES).
A "MOVING" TERMINATOR IS USED SO THAT ANY NON-NUMERIC DATA RECEIVED TERMINATES THE ARRAY AFTER LAST COMPLETE DESCRIPTION.
(CODE SK WITH NO NUMBERS, EFFECTIVELY CLEARS THE ARRAY, AS A TERMINATOR IS LOADED ON 1ST ELEMENT)
IF MORE THAN 30 DESCRIPTIONS ARE SENT, THE ARRAY "ROLLS" AND DESCRIPTION 31 WILL OVERWRITE DESCRIPTION 1.

RANDOM FREQUENCY SCAN FACILITY

AN ARRAY CONTAINING UP TO 145 FREQUENCIES IN NON-VOLATILE MEMORY IS PROVIDED.

DATA ENTRY:

FROM THE KEYBOARD, THE ARRAY CAN BE ACCESSED BY:

<TRANSF> <1> <1>, THEN:

-THE UP/DOWN KEYS TO "ROLL" THE ARRAY ELEMENTS
-STANDARD FREQUENCY DATA ENTRY TO LOAD ELEMENTS
-THE SET/CLEAR KEY (TEST-POINT) TO LOAD A TERMINATOR AT THE CURRENT ELEMENT IF LESS THAN 145 TO BE USED.
-ANY OTHER KEY TO LEAVE THIS MODE. (NO TERMINATOR)

FROM HP-IB, THE ABOVE SEQUENCE CAN BE DUPLICATED, OR THE SPECIAL CODE "RF" CAN BE USED AS FOLLOWS:

(RF) (FREQ1) + (FREQ2) + ... (FREQN) (KH)

3748A - SLMS BLOCK DIAGRAM

SLMS Block Diagram