Errata

Title & Document Type: 4278A 1 kHz/ 1MHz Capacitance Meter Service Guide

Manual Part Number: 04278-90500

Revision Date: July 1, 2000

HP References in this Manual

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

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

Support for Your Product

Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

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Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

Agilent 4278A
1 kHz/1 MHz Capacitance Meter

Service Manual

MANUAL IDENTIFICATION

Model Number: 4278A
Date Printed: July 2000
Part Number: 04278-90500

This supplement contains information for correcting manual errors and for adapting the manual to newer instruments that contains improvements or modifications not documented in the existing manual.

To use this supplement
1. Make all ERRATA corrections
2. Make all appropriate serial-number-related changes listed below

SERIAL PREFIX OR NUMBER CHANGES	MAKE MANUAL
2936J01770 and above	1
2830J01115 and above	2
2830J01160 and above	3

SERIAL PREFIX OR NUMBER CHANGES	MAKE MANUAL

◇**New Item**

ERRATA

Page 1-A30-5 in the pin out table for J1
Exchange the colum labels A30J1B and A30J1A

Page 1-A30-4, Table 1-46, A30 Handler Interface Replaceable Parts List:
See Parts Information Table at the end of this supplement.

NOTE

Manual change supplement are revised as often as necessary to keep manuals as current and accurate as possible. Agilent Technologies recommends that you periodically request the latest edition of this supplement. Free copies are available from all Agilent Technologies offices. When requesting copies, quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

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► CHANGE 1

Page 1-A30-4, Table 1-46, A30 Handler Interface Replaceable Parts List:

See the Parts Information Table at the end of this supplement.

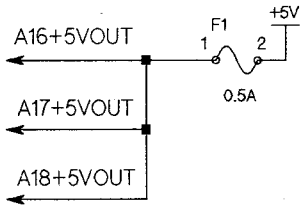
Page 1-A30-5, Figure 1-44, A30 Handler Interface Component Locations:

Replace the component locations with Figure 1

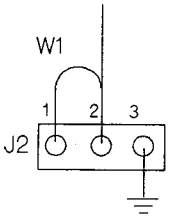
Page 1-A30-5, Figure 1-45, A30 Handler Interface Schematic Diagram:

Partially change the schematic diagram as described next.

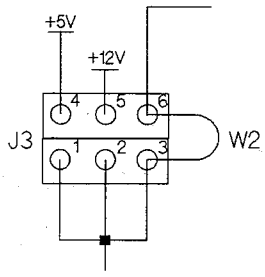
- Rename F1 to F2.
- Add F1 to the +5V line as shown next.



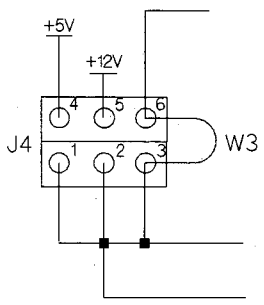
- Replace W1 with J2 and W1 as shown next.



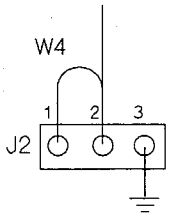
- Replace W2, W3, and W4 with J3 and W2 as shown next.



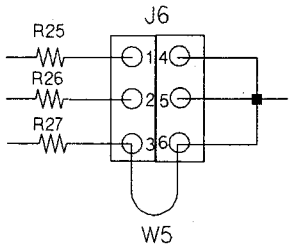
- Replace W5, W6, and W7 with J4 and W3 as shown next.



- Replace W8 with J5 and W4 as shown next.



- Replace W9, W10, and W11 with J6 and W5 as shown next.



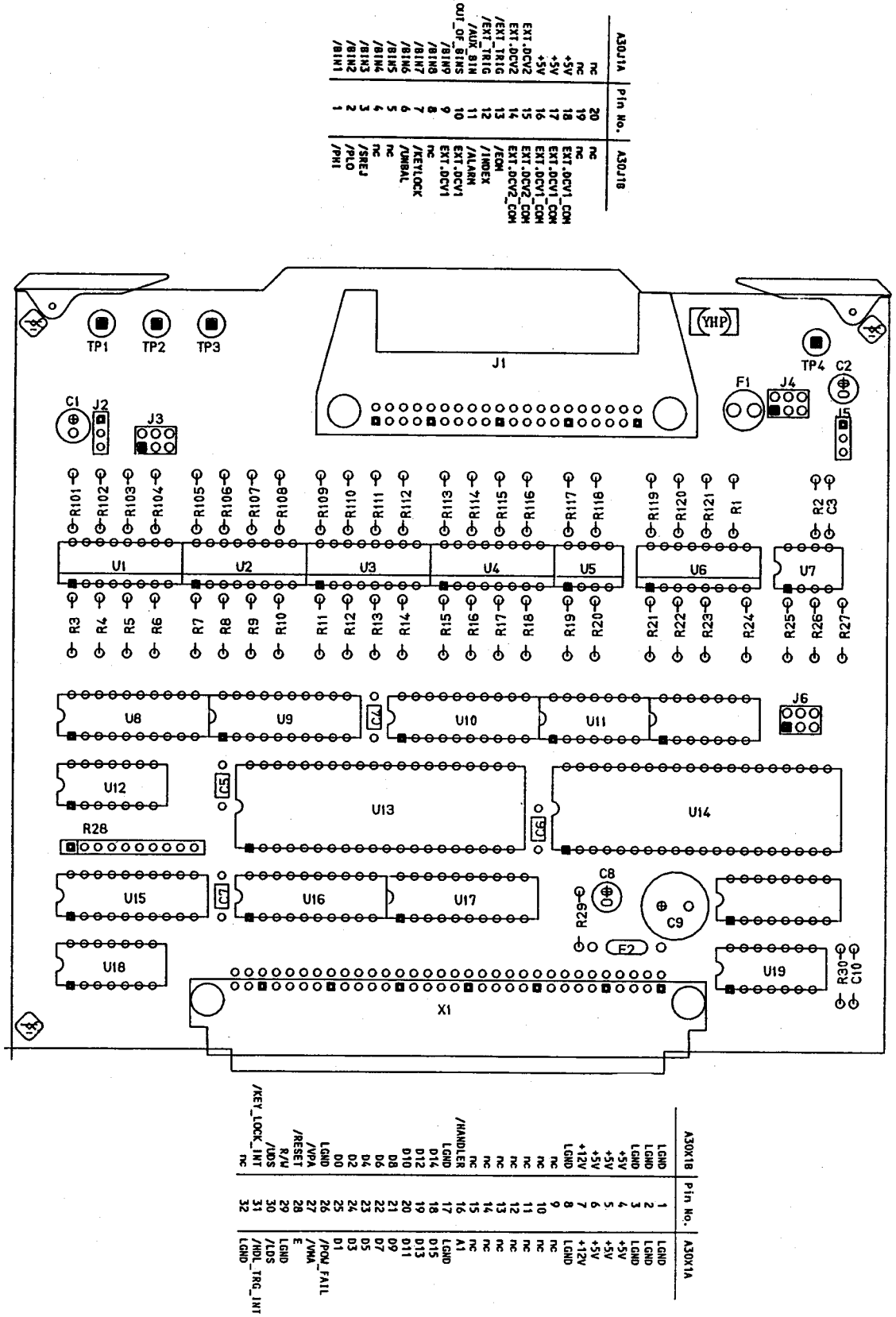


Figure 1. A30 Handler Interface Component Locations

Page 1-A31-4 and 1-A31-5, Table 1-48. A31 Handler Interface Replaceable Parts List:

See Parts Information Table at the end of this supplement.

Page 1-A31-7, Figure 1-46. A31 Handler Interface Component Locations:

Replace the component locations with Figure 2.

Page 1-A31-7, Figure 1-47. A31 Handler Interface Schematic Diagram:

Partially change the schematic diagram as shown Figure 3.

Page 1-A7-7, Table 1-35. A7 Digital Control Replaceable Parts List (4/4)

Change the version number to 3.10.

See Parts Information Table at the end of this supplement.

NOTE

ROM SET Ver. 3.10 (P/N 04278-86004) consists of four ROMs, from P/N 04278-85311 to P/N 04278-85314

► CHANGE 2

Page 1-A7-7, Table 1-35. A7 Digital Control Replaceable Parts List (4/4)

Change the version number to 3.01.

See Parts Information Table at the end of this supplement.

► CHANGE 3

Page 1-A7-7, Table 1-35. A7 Digital Control Replaceable Parts List (4/4)

Change the version number to 3.02.

See Parts Information Table at the end of this supplement.

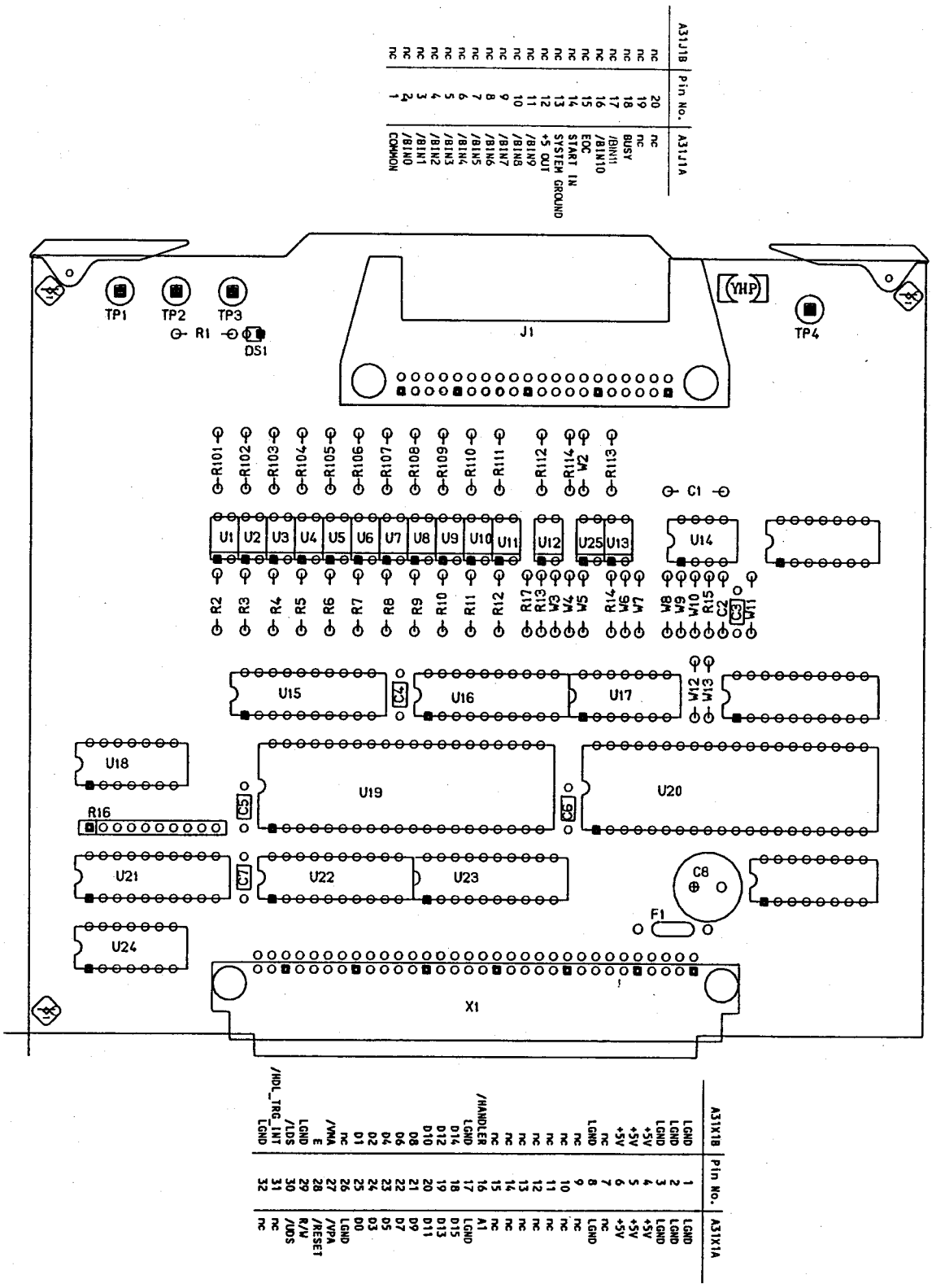


Figure 2. A31 Handler Interface Component Locations

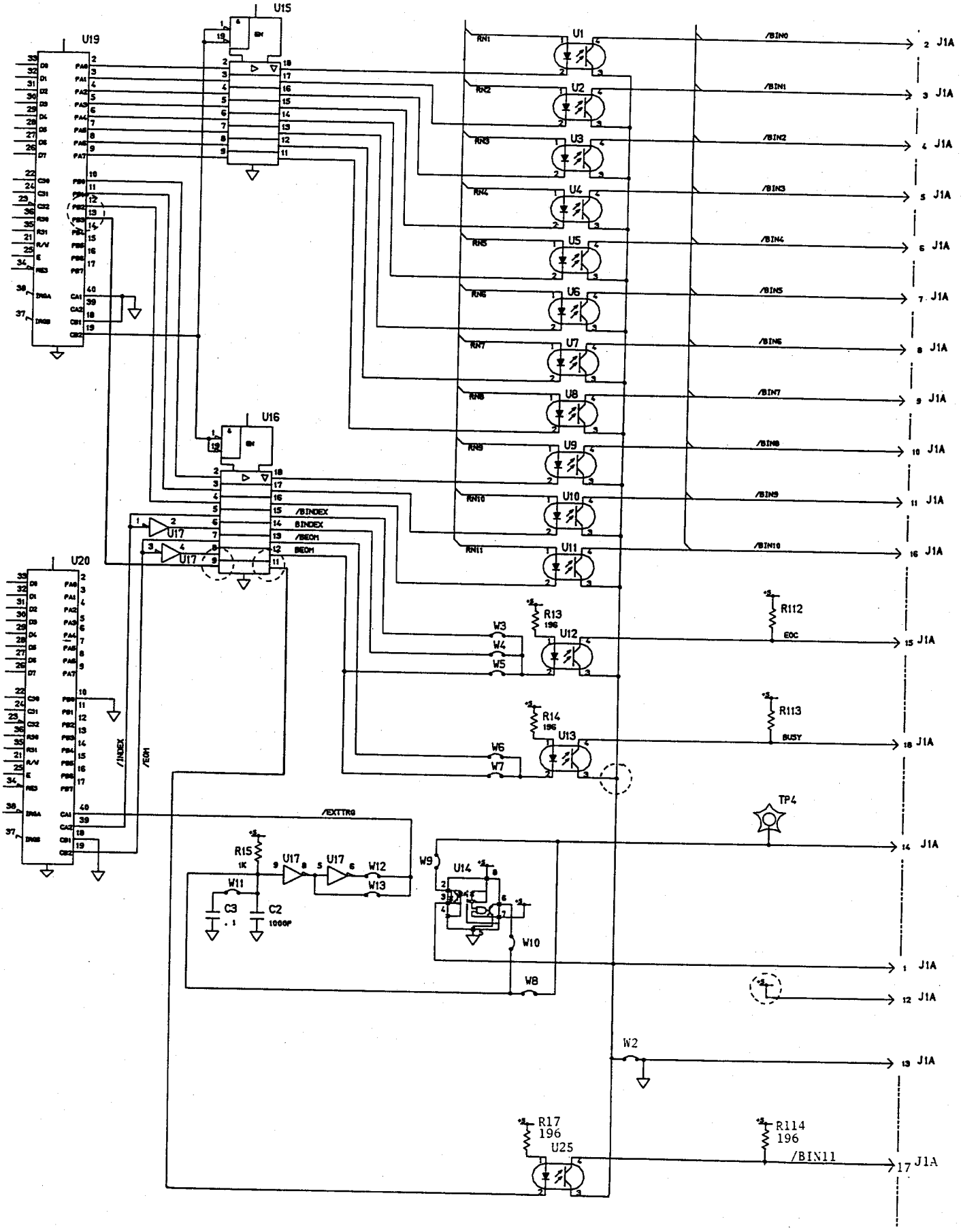


Figure 3. A31 Handler Interface Schematic Diagram

Table 1. Parts Information

CHANGE	PAGE	Note	Reference Designator	HP Part Number	Description
ERRATA	1-A30-4	►A	A30U12	1820-1199	IC INV TTL LS HEX
1	1-A40-4	►C	A30	04278-66532	#201 HANDLER IF
		►D	A30F1	2110-0741	FUSE 1A 125V
		►A	A30F1	2110-0046	FUSE 0.5A 125V
		►A	A30F2	2110-0741	FUSE 1A 125V
		►A	A30J2	1251-4822	CONN-POST-TP-HDR
		►A	A30J3	1251-8736	CONN-POST-TP-HDR
		►A	A30J4	1251-8736	CONN-POST-TP-HDR
		►A	A30J5	1251-4822	CONN-POST-TP-HDR
		►A	A30J6	1251-8736	CONN-POST-TP-HDR
		►D	A30W4	8159-0005	RESISTOR-ZERO OHMS
		►D	A30W7	8159-0005	RESISTOR-ZERO OHMS
		►D	A30W11	8159-0005	RESISTOR-ZERO OHMS
		►A	A30W1	1258-0141	JUMPER-REM
		►A	A30W2	1258-0141	JUMPER-REM
		►A	A30W3	1258-0141	JUMPER-REM
		►A	A30W4	1258-0141	JUMPER-REM
		►A	A30W5	1258-0141	JUMPER-REM
2	1-A31-4	►C	A31	04278-66533	#202 HANDLER IF
		►A	A31R17	0698-3440	RESISTOR 196 1% .125W
	1-A31-5	►A	A31U25	1990-1199	OPTO-ISOLATOR
	1-A7-7	►C	A7U9	04278-85311	ROM 0K BIT0
		►C	A7U10	04278-85313	ROM 20K BIT0
		►C	A7U33	04278-85312	ROM 0K BIT8
		►C	A7U34	04278-85314	ROM 20K BIT8
		►A		04278-86004	ROM SET Ver. 3.10
3	1-A7-7	►C	A7U9	04278-85111	ROM 0K BIT0
		►C	A7U10	04278-85113	ROM 20K BIT0
		►C	A7U33	04278-85112	ROM 0K BIT8
		►C	A7U34	04278-85114	ROM 20K BIT8
4	1-A7-7	►C	A7U9	04278-85211	ROM 0K BIT0
		►C	A7U10	04278-85213	ROM 20K BIT0
		►C	A7U33	04278-85212	ROM 0K BIT8
		►C	A7U34	04278-85214	ROM 20K BIT8

►: New Item C: Change D: Delete A: Add

HP 4278A
1kHz/1MHz Capacitance Meter

Service Manual

MANUAL IDENTIFICATION

Model Number: HP 4278A
Date Printed: April 1988
Part Number: 04278-90500

This supplement contains information for correcting manual errors and for adapting the manual to newer instruments that contains improvements or modifications not documented in the existing manual.

To use this supplement
1. Make all ERRATA corrections
2. Make all appropriate serial-number-related changes listed below

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
All	1

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

▸New Item

▸ERRATA

Front Pages, EXCLUSIVE REMEDIES

Replace the description as the following.

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

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Change	Page	Note	Reference Designator	HP Part Number	Description
1	1-A1-8	►C	A1C41	0180-4251	CAPACITOR-FXD 3300UF
	1-A1-10		T3	9100-4764	XFMR-POWER
			T4	9100-4765	XFMR-POWER
				2100-0726	FUSEHOLDER-CLIP TYPE.25D-FUSE
	1-A2-7		A2C31	0180-4402	CAPACITOR-FXD 220UF
	1-A4-6		A4CR1	1901-0880	DIODE-GEN PRP
			A4CR2	1901-0880	DIODE-GEN PRP
			A4CR3	1901-0880	DIODE-GEN PRP
			A4CR4	1901-0880	DIODE-GEN PRP
	1-A6-11		A6R20	0699-2690	RES 1.28M .1%
			A6R31	0699-2690	RES 1.28M .1%
			A6R43	0699-2690	RES 1.28M .1%
	1-A6-12		A6R54	0699-2690	RES 1.28M .1%
			A6U18	5080-3982	IC HD74LS74AP SE
			A6U22	5080-3982	IC HD74LS74AP SE
	1-A7-4		A7C23	0180-4403	CAPACITOR-FXD 470UF
			A7C24	0180-4403	CAPACITOR-FXD 470UF
	1-A7-6		A7U15	1818-5719	IC CMOS 64K EEPROM
			A7U39	1818-5719	IC CMOS 64K EEPROM
	1-A7-7		A7Y1	1813-0947	CLOCK-OSCILLATOR-XTAL
	1-A8-5		A8CR1 to CR10, CR15, CR16	1902-1250	DIO-PWR RECT
	1-A31-4		A31C8	0180-4403	CAPACITOR-FXD 470UF
	1-A40-5		A40C10	0180-4403	CAPACITOR-FXD 470UF

►: New Item C: Change D: Delete A: Add

Agilent 4278A 1 kHz/1 MHz CAPACITANCE METER (Including Option 001, 002, 003, 101, 201, 202 and 301)

Service Manual

SERIAL NUMBERS

This manual applies directly to instruments whose serial number prefix is 2740J and whose ROM-based firmware is version 3.0.
With the changes described in Section 2, this manual also applies to instruments whose serial number prefix is 2725J and below, and whose ROM-base firmware is version 2.0 and 2.1.
For additional important information about serial numbers, read "INSTRUMENT COVERED BY MANUAL" in Section 5 of the 4278A Operation Manual.

Agilent Technologies

Agilent Part No. 04278-90500
Printed in JAPAN July 2000

Notice

Hewlett-Packard to Agilent Technologies Transition

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. To reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product name/number was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648 is now model number Agilent 8648.

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(tel) 1 800 452 4844
(fax) 1 800 829 4433

Canada
(tel) +1 877 894 4414
(fax) +1 888 900 8921

Europe
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Latin America
(tel) (305) 269 7500
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Agilent Technologies

Printed in USA July 2004

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Agilent Technologies Japan, Ltd.
Component Test PGU-Kobe
1-3-2, Murotani, Nishi-ku, Kobe-shi,
Hyogo, 651-2241 Japan

Manual Printing History

The manual printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

April 1988 ..... First Edition (part number: 04278-90500)

July 2000 ..... Second Edition (part number: 04278-90500)

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific *WARNINGS* elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.
The Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

Ground The Instrument

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

DO NOT Operate In An Explosive Atmosphere

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

Keep Away From Live Circuits

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

DO NOT Service Or Adjust Alone

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

DO NOT Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

Dangerous Procedure Warnings

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

Warning

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

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility, or to the calibration facilities of other International Standards Organization members.

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of one year from the date of shipment, except that in the case of certain components listed in *General Information* of this manual, the warranty shall be for the specified period. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that prove to be defective.

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

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

Limitation Of Warranty

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

No other warranty is expressed or implied. Agilent Technologies specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

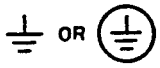
For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

SAFETY SYMBOLS

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

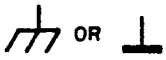
Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

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



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

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



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

Alternating current (power line).

Direct current (power line).

Alternating or direct current (power line).

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

A **CAUTION** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result damage to or destruction of part or all of the product.

NOTE

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

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SECTION 1 SERVICE

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SECTION 1

SERVICE

1-1. INTRODUCTION

This section provides information and instructions for servicing the HP 4278A 1kHz/1MHz Capacitance Meter.

1-2. SAFETY CONSIDERATIONS

This section contains **WARNINGS** and **CAUTIONS** that must be followed for your protection and to avoid damaging the equipment.

WARNING

THE 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 AWARE OF THE HAZARDS INVOLVED (FOR EXAMPLE, FIRE AND ELECTRICAL SHOCK). WHERE MAINTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED, THE POWER SHOULD BE REMOVED. BEFORE ANY REPAIR IS COMPLETED, ENSURE THAT ALL SAFETY FEATURES ARE INTACT AND FUNCTIONING AND THAT ALL NECESSARY PARTS ARE CONNECTED TO THEIR MEANS OF PROTECTIVE GROUNDING.

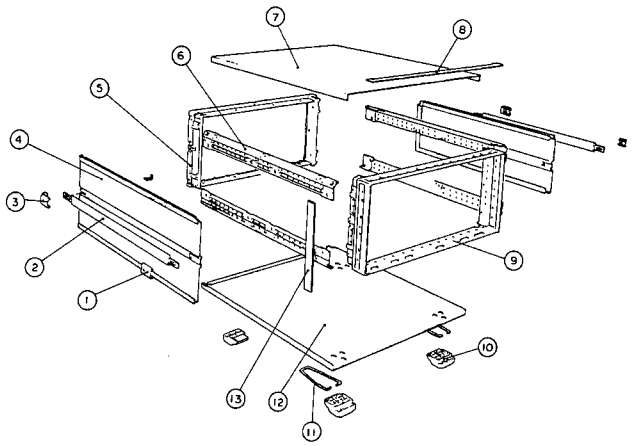
1-3. DISASSEMBLY

In order to repair or replace an assembly, the assembly must be removed from the instrument. The disassembly procedures are outlined in paragraph 4-7, DISASSEMBLY, in Section 4 of the **"HP 4278A MAINTENANCE MANUAL"** (PN 04278-90100).

1-4. REPLACEABLE MECHANICAL PARTS LIST

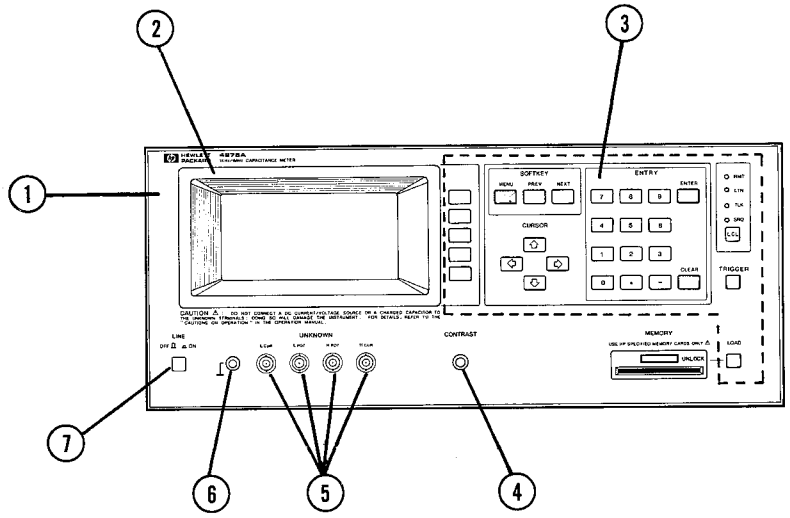
The replaceable mechanical parts are listed in Tables 1-1 to 1-6.

Table 1-1. Major Mechanical Parts (Exploded View)



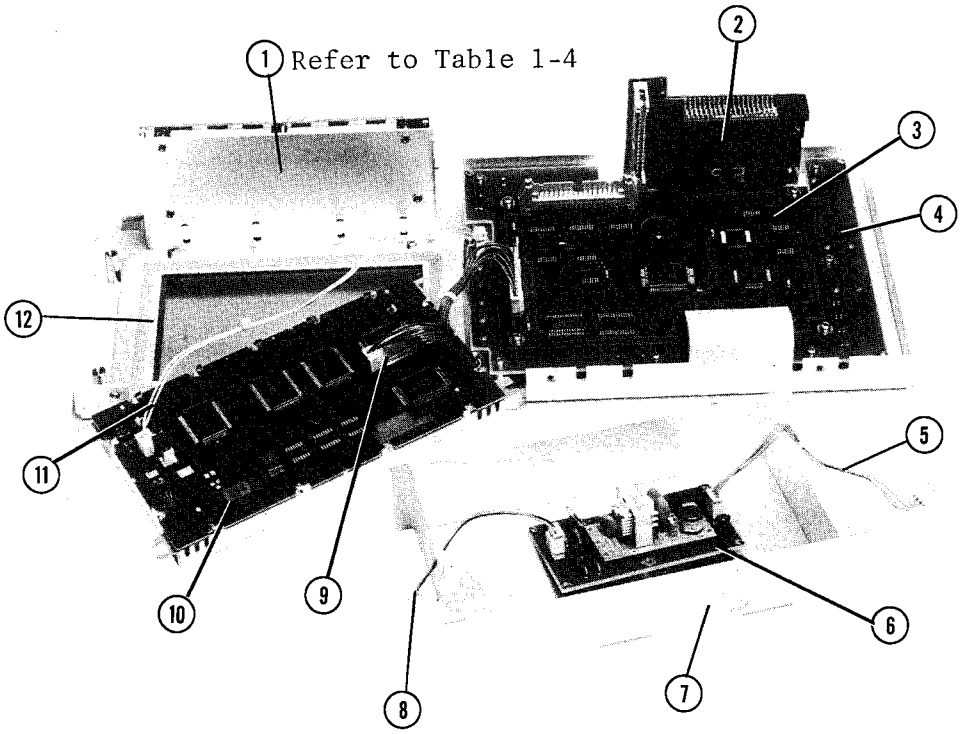
Reference Designator	Part Number	Qty.	Description
1	5041-6819	2	Front Cap
2	5060-9804	2	Strap Handle
3	5041-6820	2	Rear Cap
4	5060-9942	2	Side Cover
5	5021-5806	1	Rear Frame
6	5021-5837	4	Corner Strut
7	5061-9435	1	Top Cover
8	5040-7202	1	Top Trim
9	5021-5805	1	Front Frame
10	5040-7201	4	Foot
11	1460-1345	2	Tilt Stand
12	5061-9447	1	Bottom Cover
13	5001-0440	2	Side Bottom

Table 1-2. Front Panel Components



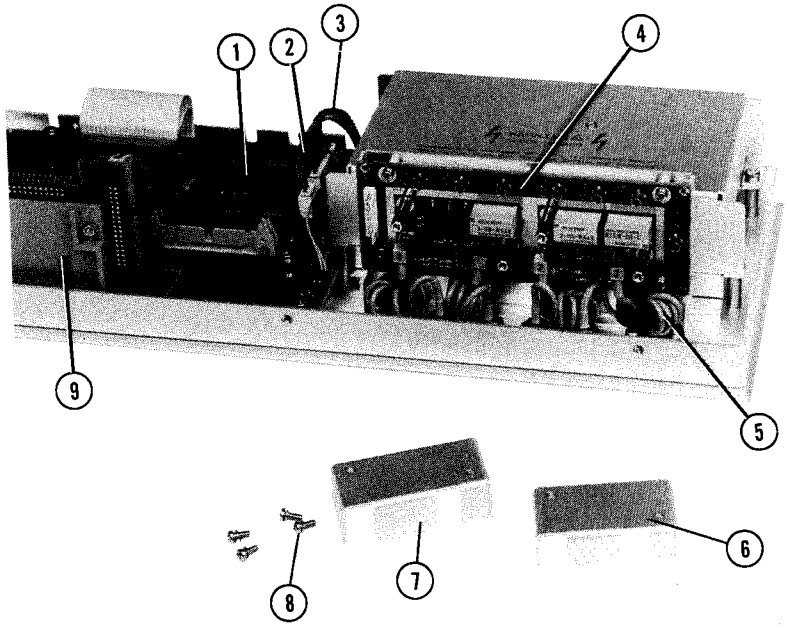
Reference Designator	Part Number	Qty.	Description
1	04278-00201	1	Panel, Front
2	04278-40001	1	Bezel
	3150-0541	1	Filter
	04278-00205	1	Plate
	04278-00203	1	Sub Panel
3	04278-25001	1	Rubber Key
	04278-40005	1	Bezel
4	0370-2446	1	Knob
5	1250-0252	4	BNC Connector
	5040-3324	4	Insulator
	5040-3325	4	Insulator
	2950-0035	4	Nut
6	1510-0130	1	Binding Post
	2190-0084	1	Washer
	2950-0006	1	Nut
7	5041-0564	1	Key Cap
	3101-2216	1	Power Switch
	04278-01203	1	Plate

Table 1-3. Front Panel Assembly Components



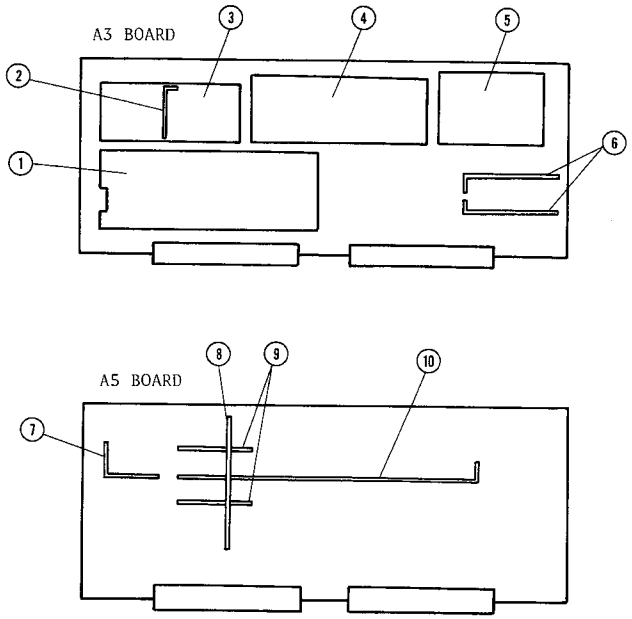
Reference Designator	Part Number	Qty	Description
1	04278-01202	1	Holder
	0535-0031	2	Nut
2	04278-40002	1	Bezel
	04278-08001	1	Spring
	0535-0031	2	Nut
	04278-40003	1	Knob
	04278-66510	1	A10 Memory Card Board
	0515-0920	2	Screw
	2190-0584	2	WSR-LK HLCL
	3050-0891	4	Washer(F)
	0535-0004	2	Nut(M3)
3	04278-66590	1	A90 KEY&DISP Control Unit
4	04278-66559	1	A9 Keyboard Unit
5	04278-61615	1	Cable Assembly(3-Pin)
6	04278-66513	1	A13 DC-AC CONVERTER Board
7	04278-00624	1	Shield Case
	1400-1048	1	Edge Saddle
8	04278-61630	1	Cable Assembly(3-Pin)
9	04278-61616	1	Cable Assembly(12-Pin)
10	04278-61102	1	A91 LCD module
11	04278-61631	1	Cable Assembly(2-Pin)
12	04278-00205	1	Plate
	3150-0541	1	Filter
	04278-40001	1	Bezel

Table 1-4. Input Switch Assembly



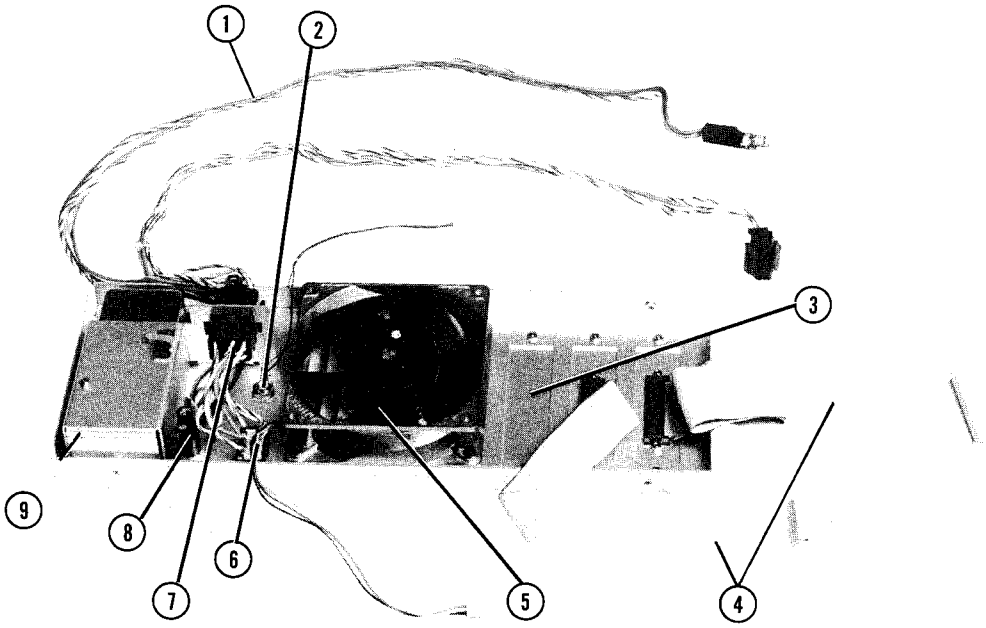
Reference Designator	Part Number	Qty.	Description
1	04278-66590	1	KEY&DISP Control Unit
2	04278-61631	1	Cable Assembly (2-Pin)
3	04278-61616	1	Cable Assembly (12-Pin)
4	04278-66508	1	A8 INPUT Switch Board
	04278-00621	1	Shield Box (Circuit Side)
	04278-00623	1	Shield Box (Circuit Side)
	0515-1005	4	Screw
5	04278-61608	4	Magnet Coil Assembly
6	04278-00620	1	Shield Box
7	04278-00622	1	Shield Box
8	0515-1550	4	Screw
9	04278-40002	1	Bezel

Table 1-5. Shield Case and Heat Sink



Board No.	Reference Designator	Part Number	Qty	Description
A1		04278-00601	1	Shield
		04278-00602	1	Shield on circuit side
		04278-01204	1	Heat Sink for CR28, CR29, and CR30
		0340-1126	1	Heat Sink for CR30
A2		1205-0095	4	Heat Sink for Q5, Q6, Q8 and Q9
A3	1	04278-00605	1	Shield
		04278-00606	1	Shield on circuit side
	2	04278-00611	1	Shield
	3	04278-00603	1	Shield
		04278-00604	1	Shield on circuit side
	4	04278-00607	1	Shield
		04278-00608	1	Shield
	5	04278-00609	1	Shield
		04278-00610	1	Shield on circuit side
	6	04278-00612	2	Shield
A4	--	1205-0095	4	Heat Sink for Q1, Q2, Q4, and Q5
	--	1205-0318	2	Heat Sink for U4 and U8
A5	7	04278-00619	1	Shield
	8	04278-00617	1	Shield
	9	04278-00618	2	Shield
	10	04278-00616	1	Shield

Table 1-6. Rear-Panel Components



Reference Designator	Part Number	Qty	Description
1	04278-61620	1	Cable Assembly (include the Power Switch PN 3101-2216)
2	1250-0083	1	Connector BNC
	0360-1190	1	Lug
	2190-0016	1	Washer
	2950-0001	1	Nut
	04278-61617	1	Cable Assembly(2-Pin)
3	04278-00212	1	Blank Panel
4			Option Assembly (refer to Maintenance Manual)
5	04278-61001	1	Fan Assembly
	0515-1598	4	Screw
	2190-0586	4	Washer
6	3101-2298	1	Switch
	0361-0010	2	Revet
7	04278-61619	1	Cable Assembly
8	2110-0565	1	Cap
	2110-0381	1	Fuse (3A slow) for 100/120V
	2110-0566	1	Fuse Holder
	2110-0569	1	Nut
9	04278-61002	1	Filter Assembly
	0515-0910	2	Screw
	2190-0586	2	Washer

1-5. THEORY OF OPERATION

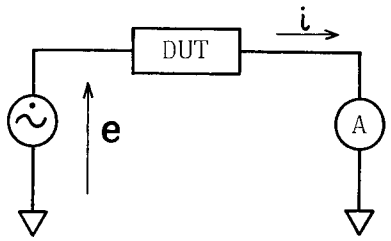
The theory of operation is organized into two sections: a discussion of basic theory, and a block diagram level discussion. The basic theory discussion explains the HP 4278A's principle of operation and how the HP 4278A's high measurement accuracy and its fully automated measurement performance are achieved. The block diagram discussion uses signal flow analysis to describe the HP 4278A's overall circuit operation.

1-5-1. BASIC THEORY

The following description explains the measurement principles of the HP 4278A 1kHz/1MHz Capacitance Meter. It is important to have a sound understanding of the basic concepts and operating principles before advancing to the circuit board description.

[Voltage-Current Ratio Measurement Method]

The 4278A's measurement function is based on the vector voltage-current ratio measurement principle in which the impedance or admittance of the Device Under Test (DUT) is determined by measuring the vector-ratio between the voltage across the DUT and the current through it. Refer to Figure 1-1.



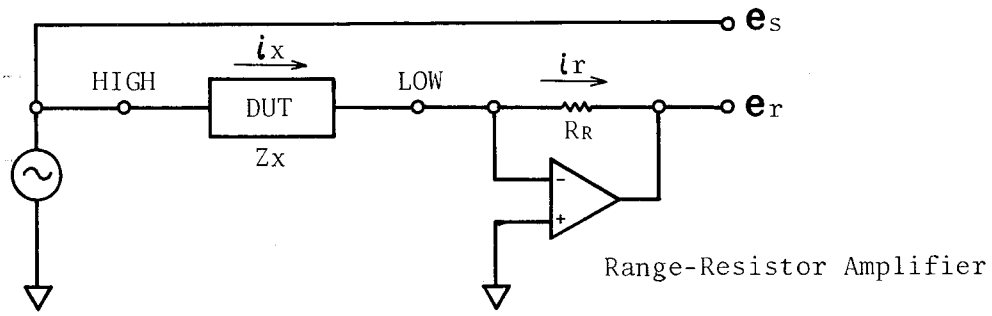
$$Z = v/i$$

Z is the impedance of the device under test, **v** is the amplitude of the signal voltage applied across the device, and **i** is the current through the device.

Figure 1-1. Voltage-Current Ratio Measurement Method.

[Transducer (I-V Converter)]

The current through the DUT is detected by a current-to-voltage (I-V) converter using a resistor (Range resistor, $\mathbf{R_R}$) in the feedback circuit. See Figure 1-2. The I-V converter generates a current flow through the range resistor equal to the current through the DUT. Therefore, the output voltage of the I-V converter is equal to the product of the current through the DUT and the range resistor value. Accordingly, the impedance is calculated using the voltage across the DUT, the output voltage of the I-V converter, and the value of the range resistor. The potential at the LOW terminal is approximately zero (the feedback node is at virtual ground), therefore, the range resistor value has no effect on the current through the DUT.



$$\therefore ix = \frac{\mathbf{e}s}{Zx} = \frac{\mathbf{e}r}{Rr} \quad \therefore Zx = Rr\frac{\mathbf{e}s}{\mathbf{e}r}$$

Figure 1-2. Voltage-Current Ratio Method Using the I-V Converter

[Vector Voltage Detector]

The Vector Voltage Detectors (abbreviated as VVD), detect all **Real** and **Imaginary** vector components of the test signal applied to the DUT, and the voltage across the range resistor, which is proportional to the current through the DUT. The VVD circuit performs analog-to-digital (A-D) conversion of the four vector components. Figure 1-3 shows a simplified block diagram of a VVD circuit consisting of a phase detector and an integrator. The phase detector is constructed using a synchronous switch which is controlled by a detecting pulse whose frequency is the same as that of the signal to be detected. The switched signal is integrated, and the output voltage of the integrator is proportional to the inphase component of the input vector voltage.

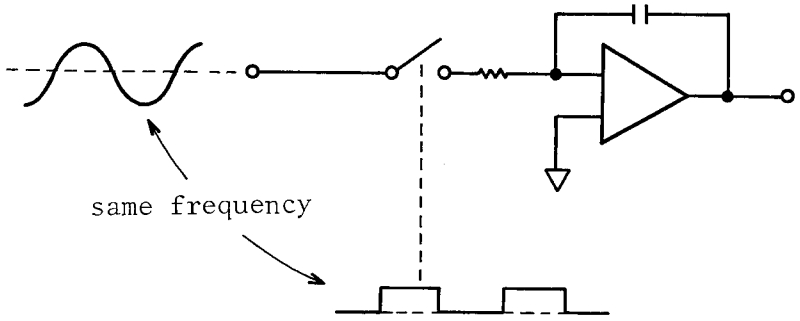


Figure 1-3. Vector Voltage Detector

To digitize the analog voltage, the analog voltage is integrated for a predetermined period of time (charging the capacitor), then the time required for a reference input to integrate "down" to zero (discharging the capacitor), is measured and this time is proportional to the analog voltage (Dual-slope integration). If the integration time is constant, the time required to discharge the capacitor is proportional to the unknown input voltage (in this case, the inphase component of the input signal), refer to Figure 1-4.

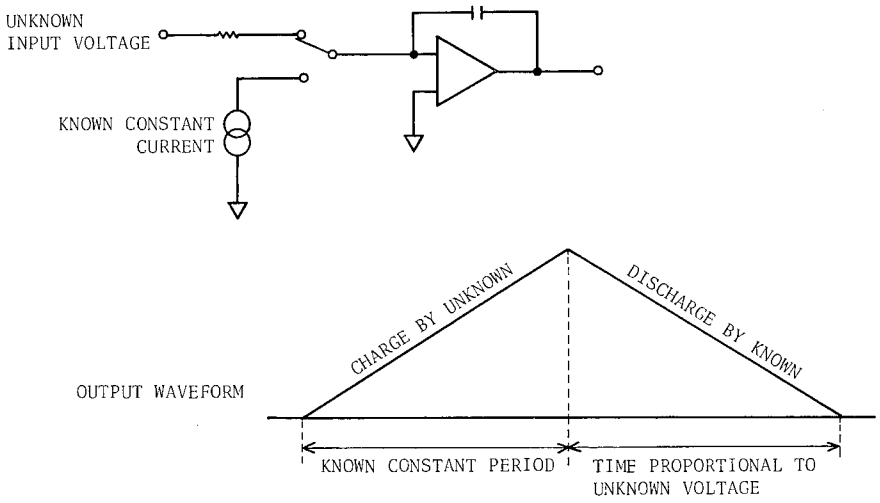
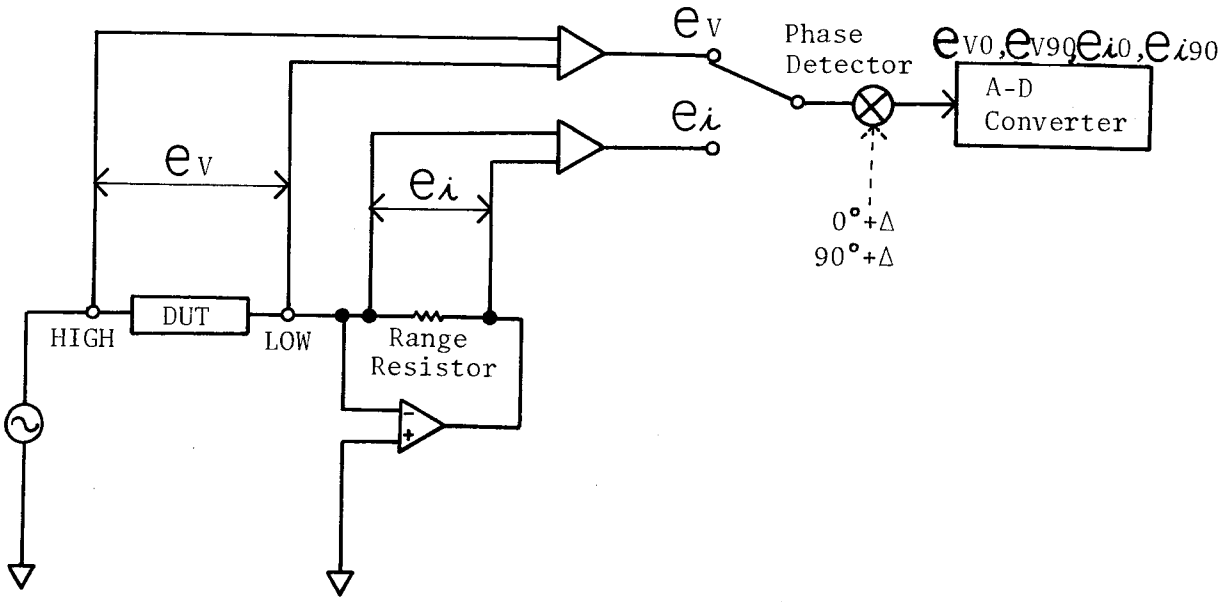
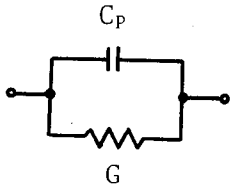


Figure 1-4. Dual-slope A-D Converter

[Vector Impedance Calculation]

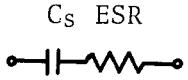
Figure 1-5 shows a simplified impedance measurement circuit. $\mathbf{e}_v$ is the voltage applied across the DUT, $\mathbf{e}_i$ is the voltage across the range resistor which is proportional to current flowing through the DUT. The **Real** and **Imaginary** components of each voltage are detected using a phase detector, and the detected voltages are converted using an A-D converter. The digital block calculates the impedance parameter using the digital values: $\mathbf{e}_i(0°)$, $\mathbf{e}_i(90°)$, $\mathbf{e}_v(0°)$, and $\mathbf{e}_v(90°)$.





$$\mathbf{Cp} = \frac{\mathbf{e}_i(90°) \times \mathbf{e}_v(0°) - \mathbf{e}_i(0°) \times \mathbf{e}_v(90°)}{\omega \times Rr \times (\mathbf{e}_v(0°)^2 + \mathbf{e}_v(90°)^2)}$$

$$\mathbf{G} = \frac{\mathbf{e}_i(0°) \times \mathbf{e}_v(0°) + \mathbf{e}_i(90°) \times \mathbf{e}_v(90°)}{Rr \times (\mathbf{e}_v(0°)^2 + \mathbf{e}_v(90°)^2)}$$



$$\mathbf{Cs} = \frac{\mathbf{e}_i(0°)^2 + \mathbf{e}_i(90°)^2}{\omega \times Rr \times (\mathbf{e}_v(90°) \times \mathbf{e}_i(0°) - \mathbf{e}_v(0°) \times \mathbf{e}_i(90°))}$$

$$\mathbf{ESR} = \frac{Rr \times (\mathbf{e}_i(0°) \times \mathbf{e}_v(0°) + \mathbf{e}_i(90°) \times \mathbf{e}_v(90°))}{\mathbf{e}_i(0°)^2 + \mathbf{e}_i(90°)^2}$$

Figure 1-5. Vector Impedance Calculation

ANALOG SECTION BLOCK DIAGRAM

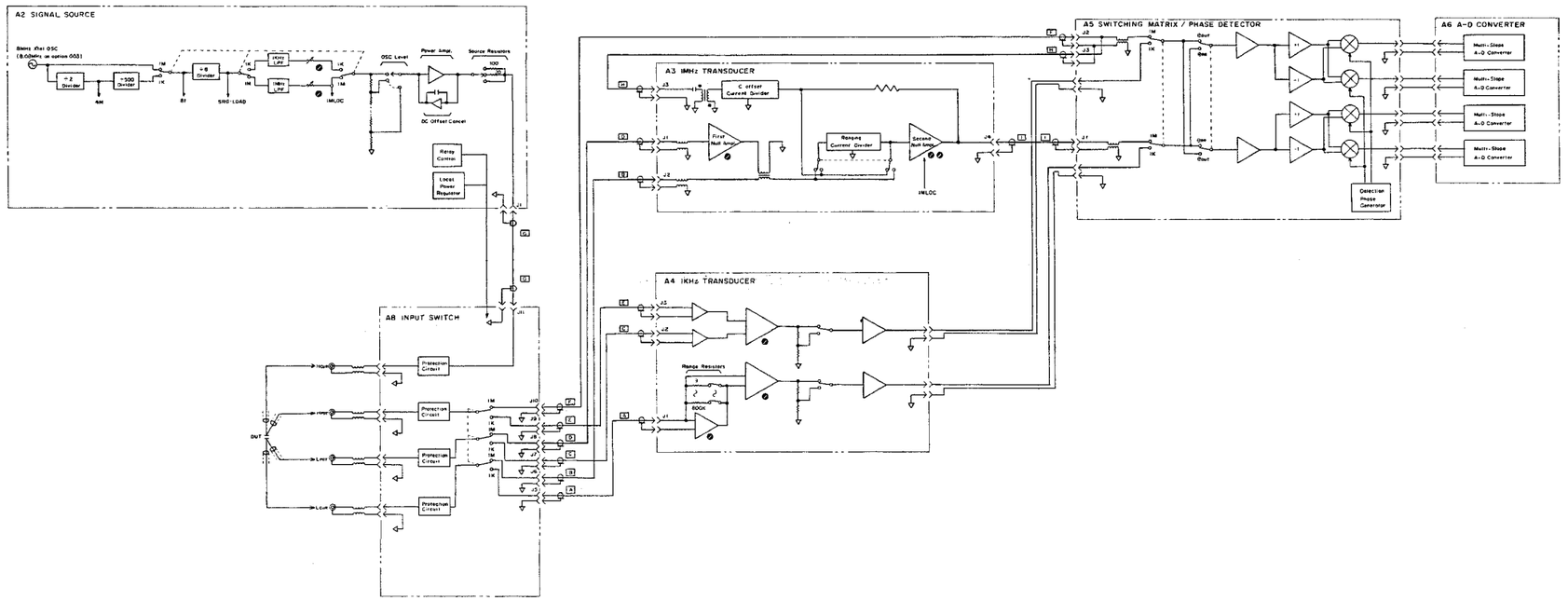


Figure 1-6. Analog Measurement Section Block Diagram

1-5-2. BLOCK DIAGRAM DISCUSSION

The following discussion describes the Analog Measurement and Digital Control sections.

[ANALOG MEASUREMENT SECTION]

A block diagram of the HP 4278A analog measurement section is shown in Figure 1-6. The analog measurement section consists of four subsections: (1) Signal Source, (2) 1 kHz Transducer, (3) 1 MHz Transducer, and (4) Vector Voltage Detector. An explanation for each subsection follows.

[Signal Source]

The test signal is either a 1 kHz or 1 MHz sine wave, derived from the 8 MHz crystal oscillator on the A2 board. In the case of the 1 kHz test signal, the output of the 8 MHz crystal oscillator is divided down by three dividers in series (divide by 2, 500, and 8), and is filtered with a 1 kHz LPF before being output. In the case of 1 MHz test signal, the output of the 8 MHz crystal oscillator is divided by 8, and is filtered using a 1 MHz LPF before being output. The OSC level is selected using a resistance voltage divider. The DC offset voltage of the OSC level is canceled by the DC offset-cancelling circuit.

The relay control and the local power regulator circuits are used to control the relays on the input switch (A8 board).

[1 kHz Transducer]

The 1 kHz transducer consists of two parts:

1. An I-V converter which converts the current through the DUT to a voltage.
2. The output of the differential amplifier is the voltage across the DUT.

In the 1kHz Transducer an I-V converter, as described in the Basic Operating Theory, is used. To achieve a wide dynamic measurement range (100 µF to 100 pF), six range resistors are used, one for each range.

A differential amplifier is used to detect the voltage applied to the DUT by subtracting the LPOT voltage from the HPOT voltage.

[1 MHz Transducer]

The 1 MHz transducer consists of the first null amplifier, I-V Converter, and C-Offset Circuit.

(1) **First Null Amplifier**

The 1 MHz Transducer I-V Converter is used as an ammeter. Even if the 1 MHz transducer is an ideal ammeter, some residual impedance of the connecting cables exists between the low lead of the DUT and the ideal ammeter which will result in an error voltage, and it will not completely nulled at the **LOW** terminal. So the voltmeter will measure the voltage which will is added the residual voltage to the voltage across the DUT. To cancel the residual voltage, a voltage is feedback from the LPOT Terminal to the first null amplifier and transformer. See Figure 1-7.

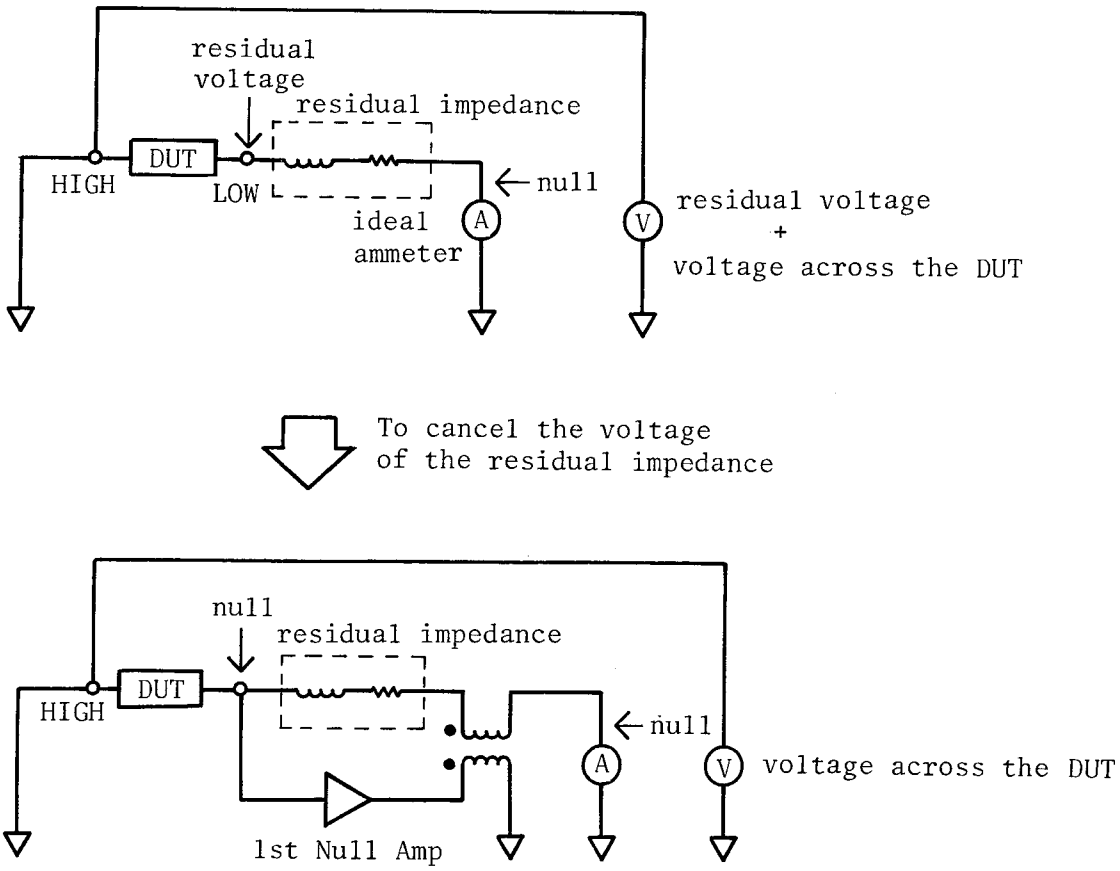


Figure 1-7. First Null Amplifier

(2) **I-V Converter**

The I-V Converter consists of three parts: the second null amplifier, a range resistor, and a ranging current divider. The basic block diagram of the 1 MHz I-V converter is shown in Figure 1-8. The I-V converter theory of operation is described in the Basic Operating Theory. The amplifier shown in Figure 1-8 is the second null amplifier. The resistor shown in Figure 1-8 is a fixed value range resistor. When the high accuracy mode is set to OFF (normal mode), the range resistor is approximately 5.7 kΩ. When the high accuracy mode is set to ON, the range resistor is set to approximately 20 kΩ. The range resistor sets the measurement range to the 16 pF range.

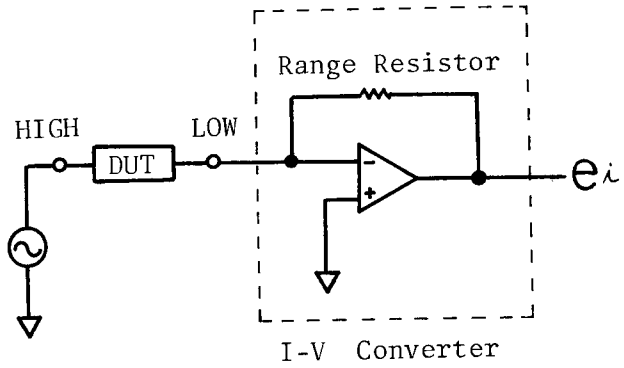


Figure 1-8. 1 MHz I-V converter.

The measurement range is determined by a single fixed value range resistor, so there is only one measurement range. So the measurement range can not be changed to adapt to the DUT. To get around this problem, a ranging current divider is used. The ranging current divider consists of the transformer current dividers and associated control switches. The simplified block diagram of the series-connected transformer ranging current dividers is shown in Figure 1-9. Each ranging current divider transformer divides the current input to it by two. This function of switching the connection of transformers is used to adapt to the fixed measurement range for measuring the current through the DUT by measuring known fractional parts of the current through the DUT (ratiometric measurement, if the total current is divided by 2, to bring the current to be measured within the fixed measurement range, then the actual current through the DUT is twice the value of the measured current, 2:1 ratio).

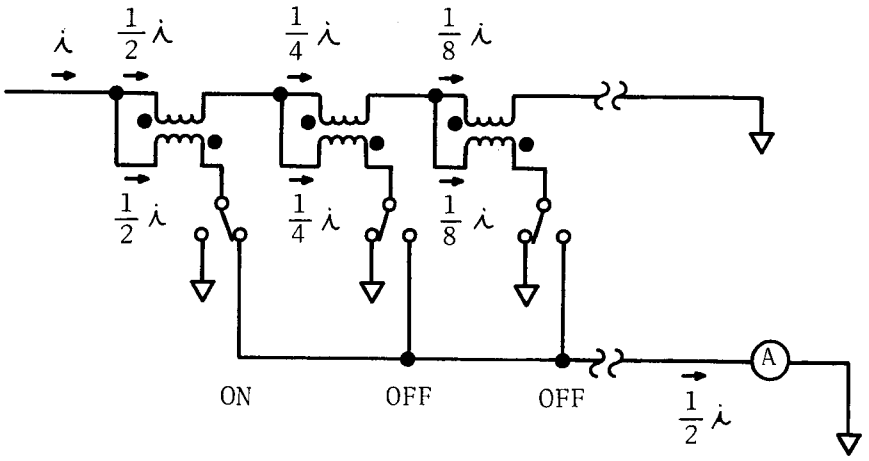


Figure 1-9. Ranging Current Divider

When the DUT is a capacitor, the current through the capacitor is proportional to the capacitance value when the voltage is constant. When a higher value capacitor (> 16 pF) is connected, the current through the capacitor is higher in proportion to its capacitance value. Refer to Figure 1-10. When the measurement range is set to greater than the 16 pF, the ranging current divider is connected between the LCUR Terminal and the I-V converter. The current through the **DUT** is divided by the ranging current divider so that the current through the range resistor will be appropriate for the 16 pF range.

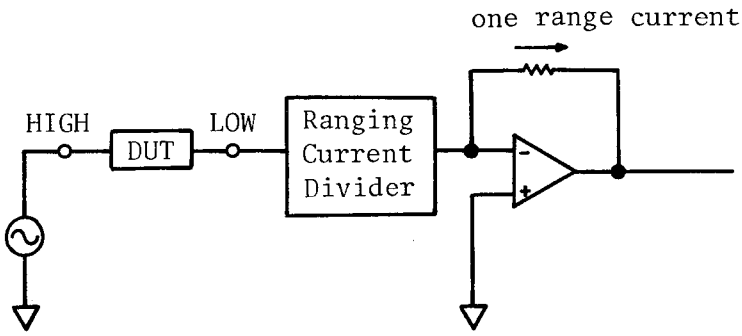


Figure 1-10. I-V Converter with the ranging current divider (1)

When a lower value capacitor (< 16 pF) is connected, the current through the capacitor is lower in proportion to the capacitor's value. Refer to Figure 1-11. When the measurement range is set to less than 16 pF, the ranging current divider is connected in the feedback circuit in series with the range resistor. The current through the **DUT** is multiplied by the ranging current divider which adjusts the current through the range resistor to be appropriate for the 16 pF measurement range.

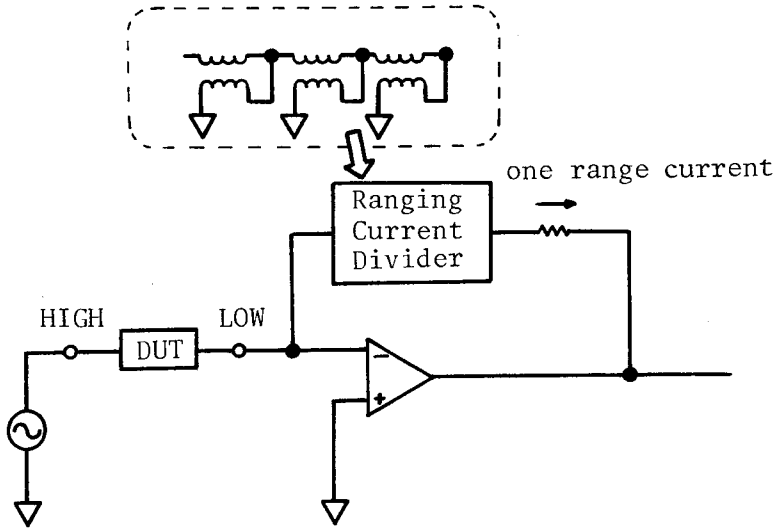


Figure 1-11. I-V Converter with the Ranging Current Divider (2)

(3) **C-Offset Circuit**

The C-Offset Circuit is used for accurately measuring low dissipation factors when the HP 4278A is set to the high accuracy mode. See Figure 1-12. The current through the capacitor under test is divided into two components: *Ir* and *Ic*. The value of the *Ic* component is much greater than the *Ir* component, so it is easy to accurately measure the *Ic* component, but it is difficult to accurately measure the *Ir* component, which is very small. In the case of the 1 MHz Transducer, since the C-offset circuit gives a minus value for the *Ic* component to *I* value, the *Ic* component value is almost canceled, so the *Ir* component value can be measured accurately by using the sensitive ammeter.

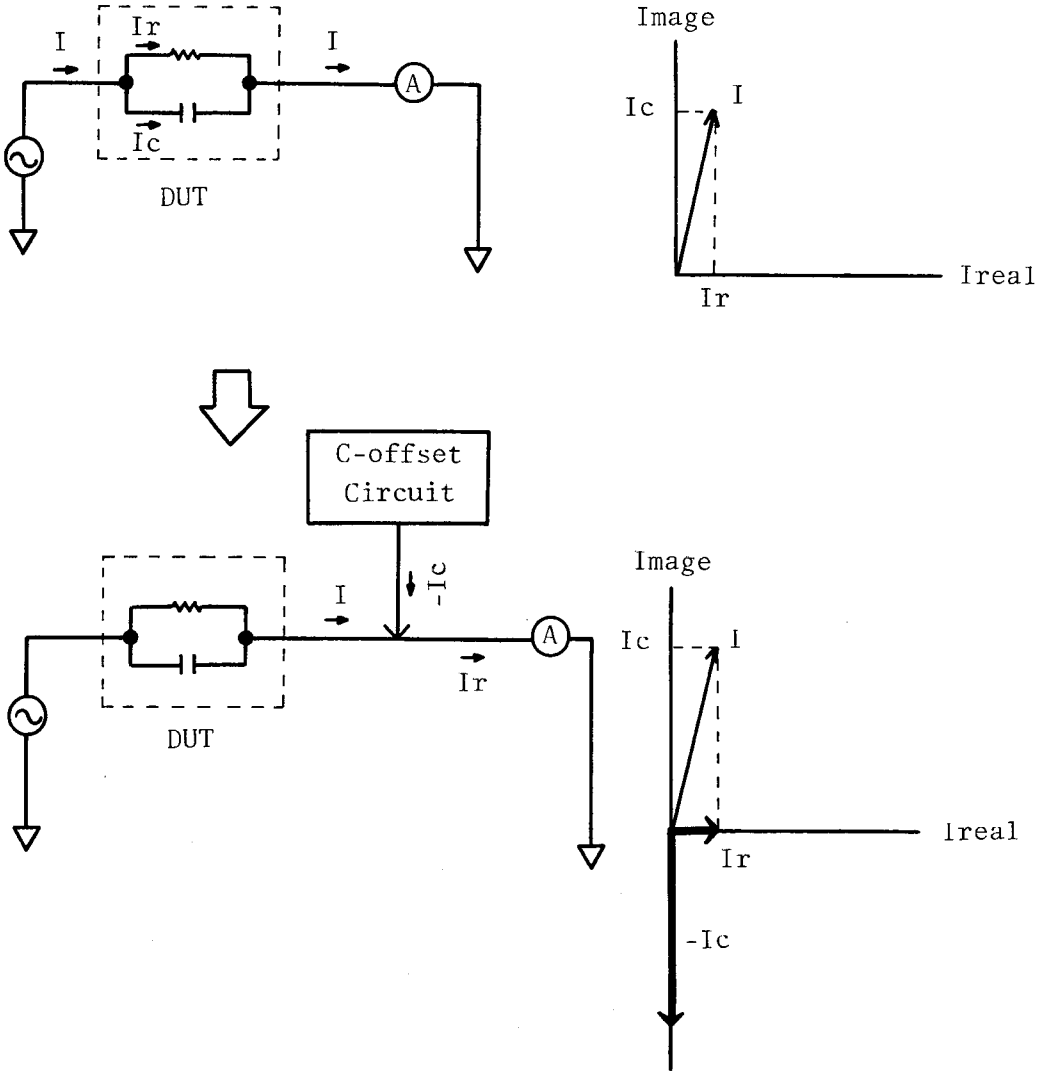


Figure 1-12. C-Offset Circuit Basic Theory

The C-offset circuit consists of three parts: a reference capacitor, a transformer, and a C-offset current divider. Refer to Figure 1-13.

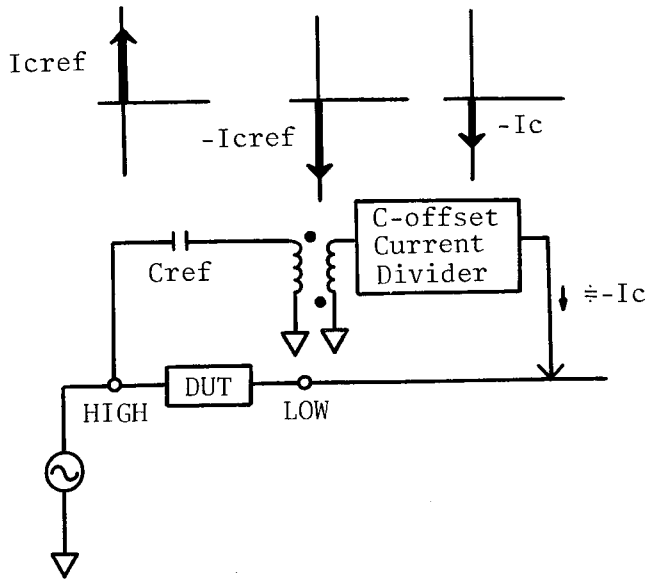


Figure 1-13. C-Offset Circuit

First part is the reference capacitor, which is used to shift the current phase by 90° from the signal voltage from the HPOT terminal, therefore the phase shifted current is almost inphase with the current (Ic component), through the capacitor under test.

The second part is the transformer, which is used to invert the phase of the above phase shifted current in order to cancel the Ic current component.

The third part is the C-offset current divider, which is used to set the above inverted current to almost the same magnitude as the Ic component of the current, so the output current through the C-offset current divider is almost same as Ic. The C-offset current divider's structure is as same as the Ranging current divider, refer to the above description ((2) I-V Converter).

[Vector Voltage Detector]

The HP 4278A uses four phase detectors, and four multi-slope A-D converters to simultaneously detect and measure all of the inphase and 90° phase shifted components of e_v and e_i (four components). Then the measurement error may be caused by any unbalance between the four phase detectors, and between the four multi-slope A-D converters. In order to minimize measurement errors caused by the unbalance and to achieve the high measurement accuracy, the HP 4278A detects the four unknown voltages more than once with different channel combination, and compensates errors each other. Refer to Figure 1-14.

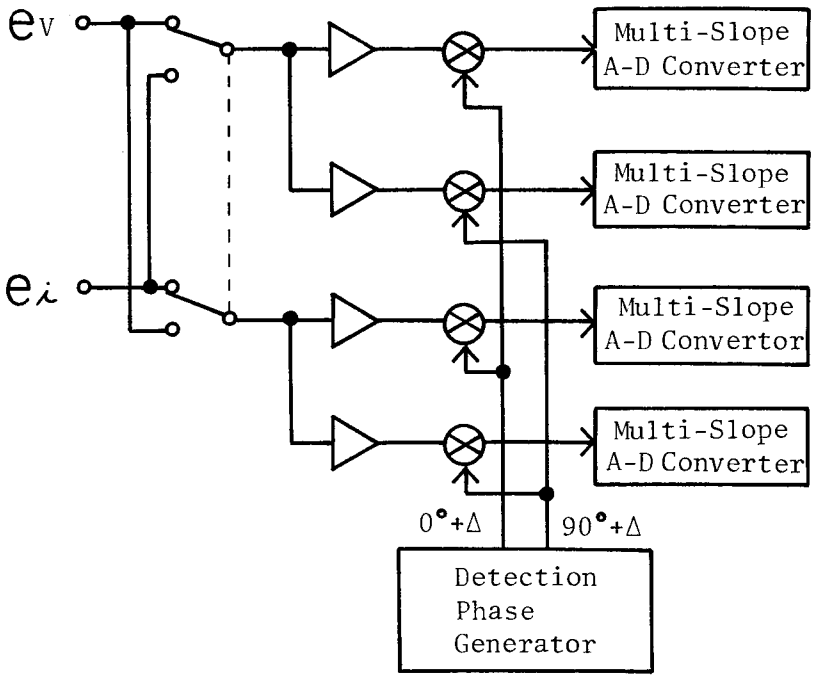


Figure 1-14. Vector ratio Detector

[DIGITAL CONTROL SECTION]

A simplified block diagram of the 4278A digital control section is shown in Figure 1-15. The digital control section of the 4278A is mainly included in the A7 board assembly, and the digital control circuit contains one 16-bit CPU for the data manipulation, the programmed ROMs, the RAMs, the optional interface, and the EEPROMs in which error calibration data, compensation data, and so on.

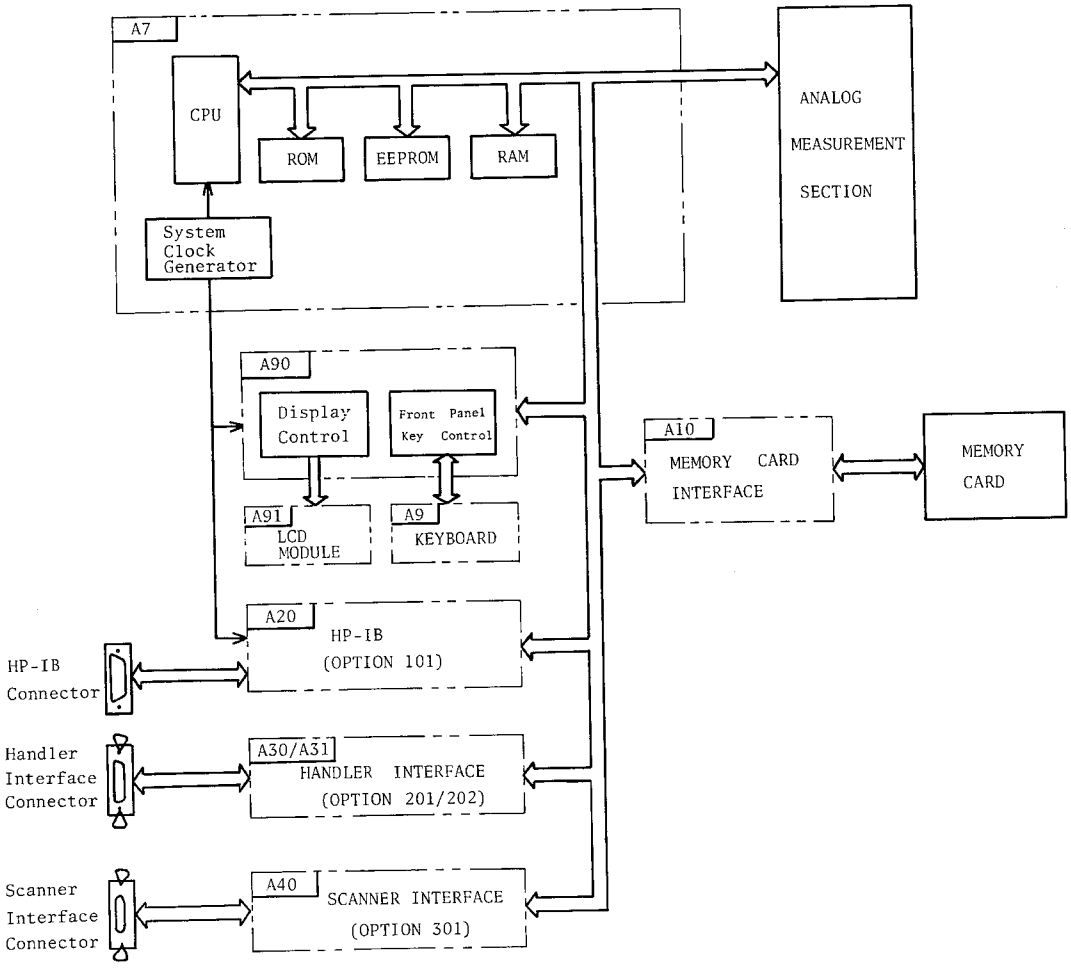


Figure 1-15. Digital Control Section Block Diagram

1-6. SERVICE SHEET

The service sheet for each board provides information about the board. Each service sheet is organized into six sections: Circuit Operation Theory, Troubleshooting Aids, Replaceable Parts List, Board Connector Pin Assignment, Component Locations, and Schematic Diagrams.

1-6-1. CIRCUIT DESCRIPTION

The circuit description provides a detailed description of the function of each board.

1-6-2. TROUBLESHOOTING AIDS

The troubleshooting aids provide to help you troubleshoot problems in the HP 4278A. Usually the troubleshooting aids consist of a list of jumpers, a list of test points, and the troubleshooting information. The jumper list shows the strapping configuration for each jumper. The test point list gives a description of the signal at each test point. The troubleshooting information includes waveforms for troubleshooting the board, and the measurement setup for viewing the waveform is listed next to the waveform figure. (Refer to Figure 1-16).

Setting up the oscilloscope:

(1) Set the oscilloscope inputs to DC coupled (1 MΩ).

(2) The settings (using a 1:1 probe) for channel A and B, and the time base setting are displayed with the waveform. (Refer to Figure 1- 16.) When a 10:1 probe is used, the channel A and B settings must be divided by 10.

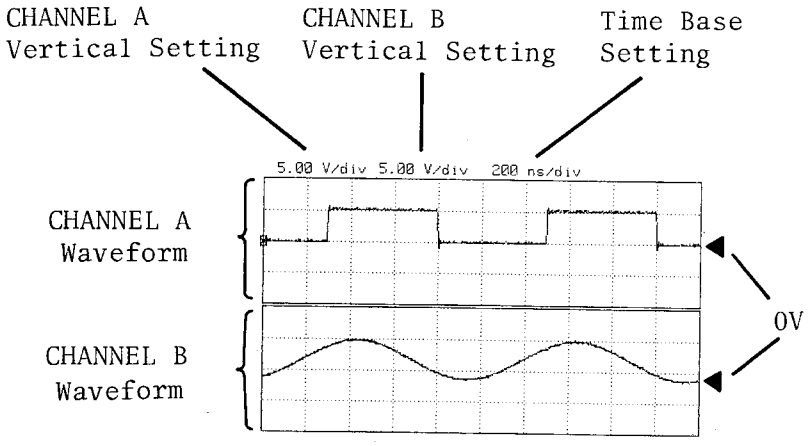


Figure 1-16. Oscilloscope Setup

1-6-3. REPLACEABLE PARTS LIST

The replaceable parts list provides information on the replaceable parts.

[Abbreviations]

Table 1-7 lists all abbreviations used throughout the manual. In some cases, three forms of the same abbreviation are used: all upper case, all lower case, and mixed upper and lower case. Abbreviations used in the parts lists are always upper case, and mixed upper- and lower-case letters.

Table 1-7. List of Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A	= assembly	E	= misc electronic part	P	= plug	U	= integrated circuit
B	= motor	F	= fuse	Q	= transistor	V	= vacuum, tube, neon bulb, photocell, etc.
BT	= battery	FL	= filter	R	= resistor	VR	= voltage regulator
C	= capacitor	J	= jack	RT	= thermistor	W	= cable
CP	= coupler	K	= relay	S	= switch	X	= socket
CR	= diode	L	= inductor	T	= transformer	Y	= crystal
DL	= delay line	M	= meter	TB	= terminal board		
DS	= device signaling (lamp)	MP	= mechanical part	TP	= test point		

ABBREVIATIONS

A	= amperes	H	= henries	NPN	= negative-positive-negative	RWV	= reverse working voltage
A. F. C.	= automatic frequency control	HEX	= hexagonal	NRFR	= not recommended for field replacement		
AMPL	= amplifier	HG	= mercury	NSR	= not separately replaceable	S-B	= slow-blow
B. F. O.	= beat frequency oscillator	HR	= hour(s)			SCR	= screw
BE CU	= beryllium copper	Hz	= hertz	OBD	= order by description	SE	= selenium
BH	= binder head	IF	= intermediate freq.	OH	= oval head	SECT	= section(s)
BP	= bandpass	IMPG	= impregnated	OX	= oxide	SEMICON	= semiconductor
BRS	= brass	INCD	= incandescent			SI	= silicon
BWO	= backward wave oscillator	INCL	= include(s)	P	= peak	SIL	= silver
CCW	= counter-clockwise	INS	= insulation(ed)	PC	= printed circuit	SL	= slide
CER	= ceramic	INT	= internal	p	= pico = 10^{-12}	SPG	= spring
CMO	= cabinet mount only	k	= kilo = 1000	PH BRZ	= phosphor bronze	SPL	= special
COEF	= coefficient	LH	= left hand	PHL	= Phillips	SST	= stainless steel
COM	= common	LIN	= linear taper	PIV	= peak inverse voltage	SR	= split ring
COMP	= composition	LK WASH	= lock washer	PNP	= positive-negative-positive	STL	= steel
COMPL	= complete	LOG	= logarithmic taper	P/O	= part of	TA	= tantalum
CONN	= connector	LPF	= low pass filter	POLY	= polystyrene	TD	= time delay
CP	= cadmium plate	m	= milli = 10^{-3}	PORC	= porcelain	TGL	= toggle
CRT	= cathode-ray tube	M	= meg = 10^{6}	POS	= position(s)	THD	= thread
CW	= clockwise	MET FLM	= metal film	POT	= potentiometer	TI	= titanium
DEPC	= deposited carbon	MET OX	= metallic oxide	PP	= peak-to-peak	TOL	= tolerance
DR	= drive	MFR	= manufacturer	PT	= point	TRIM	= trimmer
ELECT	= electrolytic	MINAT	= miniature	PWV	= peak working voltage	TWT	= traveling wave tube
ENCAP	= encapsulated	MOM	= momentary			μ	= micro = 10^{-6}
EXT	= external	MTG	= mounting	RECT	= rectifier	VAR	= variable
F	= farads	MY	= "mylar"	RF	= radio frequency	VDCW	= dc working volts
f	= femto = 10^{-15}	n	= nano = 10^{-9}	RH	= round head or right hand	W/	= with
FH	= flat head	N/C	= normally closed	RMO	= rack mount only	W	= watts
FIL H	= fillister head	NE	= neon	RMS	= root-mean square	WIV	= working inverse voltage
FXD	= fixed	NI PL	= nickel plate			WW	= wirewound
G	= giga = 10^{9}	N/O	= normally open			W/O	= without
GE	= germanium	NPO	= negative positive zero (zero temperature coefficient)				
GL	= glass						
GRD	= ground(ed)						

0001-9700

[Replaceable Parts Lists]

Table 1-8 lists the names and address of the manufacturers identified by the Manufacturer Code in the parts lists. In most cases the information given for each part includes the following:

1. Hewlett-Packard part number
2. Quantity used in the assembly--given only once, at the first appearance of the part
3. Five-digit code representing the manufacturer
4. Manufacture's part number

Table 1-8. Component Manufactures

Mfr Code	Manufacturer Name	Address	Zip Code
S0545	NEC ELECTRONICS LTD	MTN VIEW CA US	94043
S0562	TOSHIBA CORP	TOKYO JP	
S4013	HITACHI AMERICA LTD	SUNNYVALE CA US	94086
01121	ALLEN-BRADLEY CO INC	EL PASO TX US	79935
01295	TEXAS INSTRUMENTS INC	DALLAS TX US	75265
03888	K D I PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA INC SEMI-COND PROD	PHOENIX AZ US	85008
07263	FAIRCHILD CORP	MOUNTAIN VIEW CA US	94042
09922	BURNDY CORP	NORWALK CT US	06856
1B546	VARO SEMICONDUCTOR INC	GARLAND TX US	75046
11236	CTS CORP BERNE DIV	BERNE IN US	46711
13606	SPRAGUE ELECTRIC SEMICON DIV	CONCORD NH	03301
14433	ITT SEMICONDUCTORS DIV	TUSTIN CA US	92680
16299	CORNING ELECTRONICS	RALEIGH NC US	27604
19701	MEPCO/CENTRALAB INC	WEST PALM BEACH FL US	33407
24046	TRANSITRON ELECTRONIC CORP	WAKEFIELD MA	01880
24546	CORNING ELECTRONICS	SANTA CLARA CA US	95050
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA US	95052
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE NJ	
30161	AAVID ENGINEERING INC	LACONIA NH US	03247
32293	INTERSIL INC	CUPERTINO CA CA	95014
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE CA US	94086
34371	HARRIS CORP	MELBOURNE FL US	32901
55576	SYNERTEK	SANTA CLARA CA	95051
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
73138	BECKMAN INDUSTRIAL CORP	FULLERTON CA US	92632
73899	J F D ELECTRONICS CORP	BROOKLYN NY	11219
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA PA	19108
75915	LITTELFUSE INC	DES PLAINES IL US	60016
76381	3M CO	ST PAUL MN US	55144
9N171	UNITRODE CORP	LEXINGTON MA US	02173
91637	DALE ELECTRONICS INC	EL PASO TX US	79936

[Ordering Information]

When ordering a replacement part listed in the Replaceable Parts List, specify the Hewlett-Packard part number and the quantity required, and send the order to the nearest Hewlett-Packard office.

When ordering a part not listed in the Replaceable Parts List, state the full instrument model number and serial number, describe the function of the part, and give the quantity required. Send the order to the nearest Hewlett-Packard office.

[Direct Mailing Ordering]

Within the United States, Hewlett-Packard supplies parts through a direct mail order system. Advantages of using the system are:

-- Direct order and shipment from the HP Parts Center in Mountain View, California

-- No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through local HP offices when the order requires billing and invoicing)

-- Prepaid shipping (there is a small handling charge for each order)

-- No invoices, a check or money order must accompany each order

Mail order forms and specific ordering information are available through your local HP office. Addresses and telephone numbers are given in the back of this manual.

1-6-4. BOARD CONNECTOR PIN ASSIGNMENT

The board connector pin assignment provides the pin assignment information by using the signal names listed in Table 1-9. Then each pin assignment of each board is shown with each component locations.

Table 1-9. Signal Name Used In the Pin Assignment (1/2)

Signal Name	Description
/ACS0 to */ACS7*	Analog Board Select Signal
AD_GND1 to *AD_GND4*	Common ground for each phase detector and A-D Converter
AGND	Analog circuit ground
ANA1 to *ANA6*	Address bus lines for the analog boards
AND0 to *AND7*	Data bus lines for controlling the analog boards
/ANLDS	Analog Board Data Strobe Signal
ANR/W	Data Read/Write Signal
/AS	Address Strobe Signal
A1 to *A20*	Address bus lines
/CARD_LDS	Memory card lower data strobe
/CARD_R/W	Memory card read/write signal
/CLK16MHz	16 MHz Clock
CLK2MHz	2 MHz Clock
CLK8MHz	8 MHz Clock
/DTACK	Data acknowledge signal
D0 to *D15*	HP-IB DIO line
E	Handler interface access enable
Edut1k	Voltage signal across the DUT at 1 kHz
EOC_INT	Interrupt signal of the end of the A-D conversion
Err1k	Voltage signal across the range resistor at 1kHz
ETEST	Test signal for the self test
/HALT	Halt Signal
/HANDLER	Handler Interface Select Signal
/HDL_TRG_INT	Trigger Interrupt Signal from Handler Interface
/ID0 to */ID7*	Board Identification Signal
/INT_FRM_STD_IF	Interrupt from HP-IB Interface
/INT_TO_STD_IF	Interrupt to HP-IB Interface
/KBD_INT	Interrupt from the keyboard
/KEY_DSP_CTL	Keyboard and display control signal
/KEY_LOCK_INT	Keylock interrupt signal from the handler interface
/K1 to */K3*	Input switch board relay control signals
/LDS	Lower data strobe
LGND	Logic circuit ground line
/MEM_CARD	Memory Card access signal
PD_GND1 to *PD_GND2*	Ground lines for the phase detectors
/POW_FAIL	*/ALARM* signal to the handler interface
/REAR_TRG_INT	Trigger interrupt signal from the EXT.TRIGGER connector on the rear panel
/RESET	Reset signal
R/W	Read/write signal

Table 1-9. Signal Name Used In the Pin Assignment (2/2)

Signal Name	Description
/SCANNER	Scanner interface access signal
/SCANNER_INT	Interrupt signal from the scanner interface
/STD_IF	HP-IB interface access signal
/UDS	Upper data strobe
V_DC1 to V_DC4	A-D Counter signal
/VMA	Valid memory address signal
/VPA	Valid peripheral signal
1MLOC	1 MHz Local oscillator
4M	4 MHz
8F	8 MHz
+12VFAN	+12 V for the cooling fan
+5V_MEM_CARD	+5 V for the memory card
+5VRLY	+5 V for the input switch relay
-12VFAN	-12 V for the cooling fan

1-6-5. COMPONENT LOCATIONS

The component locations provides you with component position information.

1-6-6. SCHEMATIC DIAGRAMS

A schematic diagram provides circuit information for each board. Figure 1-17 shows the symbols used in the schematic diagrams.

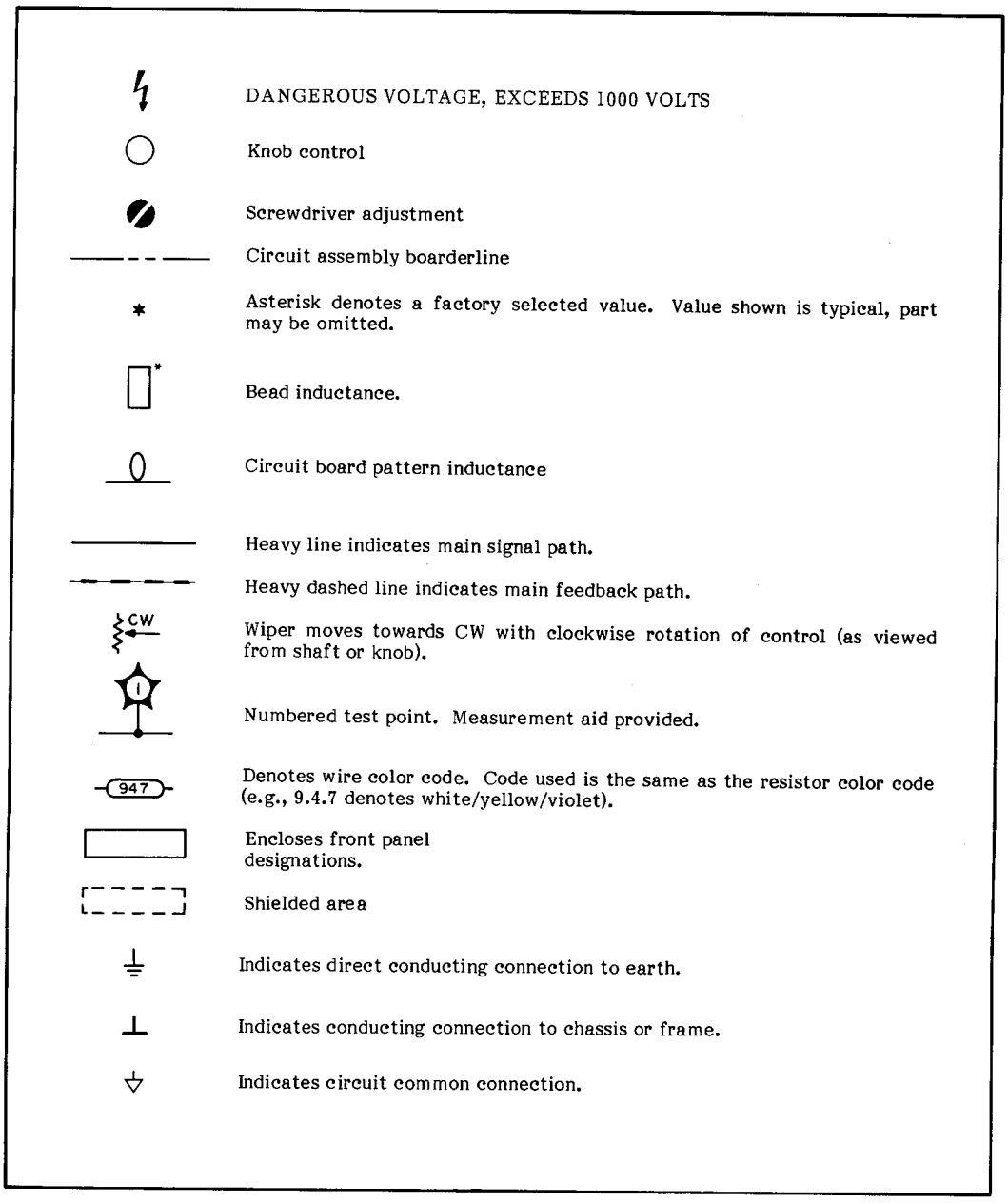


Figure 1-17. Schematic Diagram Symbols

A1 POWER SUPPLY BOARD SERVICE SHEET

NOTES

1-7. A1 BOARD SERVICE SHEET

1-7-1. A1 CIRCUIT DESCRIPTION

The A1 Power Supply board provides +5 V, +8 V, ±12 V, ±15 V, and -21 V to the A11 Motherboard. The A1 Power Supply board is divided into two sections at transformer A1T3: the primary circuit and the secondary circuit.

The primary circuit consists the following.

1. Primary rectifier
2. Turn-on surge current limiter
3. Slow start circuit
4. Supply voltage controller
5. Switching circuit
6. Shutdown circuit

The secondary circuit consists the following.

1. Secondary rectifier for each output voltage
2. Over voltage detector

An explanation for each circuit follows.

[Primary Rectifier]

The primary rectifier, composed of A1CR1, A1C2, A1C3, A1C4, and A1C5, rectifies the AC to supply the unregulated DC voltage. A1CR1 acts as a full wave rectifier when the line voltage selector is set to 220/240 V, and as a voltage doubler when the line voltage selector is set to 100/120 V.

[Surge Current Limiter]

The surge current limiter, composed of A1R1, A1K1, and A1FT1, limits the surge current when the instrument is turned on. A1K1 is activated by the slow start circuit about half a second after the power switch is turned on to by-pass A1R1 (surge current limit resistor), which protects the primary rectifier from the surge current at power up. If A1K1 does not activate, the heat produced by A1R1 will cause A1FT1 (thermal fuse), to open.

[Slow Start Circuit]

The slow start circuit consists of A1Q1, A1Q2, A1Q3, A1Q9, and A1Q10. This circuit lengthens the rise time of the supply voltage by limiting the maximum switching pulse width at power up. When the voltage from the primary rectifier becomes more than about 240 V, the slow start circuit is turned on.

[Supply Voltage Controller]

A1U2 (supply voltage controller), controls the switching circuit. The switching cycle is adjusted with A1R19 (FREQ-ADJ).

[Switching Circuit]

The switching circuit used to convert DC voltage to 40 KHz AC consists of A1Q11, and A1Q12. The duty cycle is varied to maintain constant output voltages, and it is controlled by A1U2 (supply voltage controller), by comparing the VREF 5 V (reference voltage) to the 9 V feedback voltage produced by A1CR21, A1CR22, A1L4, and A1C25.

[Shutdown Circuit]

The shutdown circuit consists of A1Q6, A1Q7, A1CR18, and A1CR19. It stops both the A1U2's oscillator and the switching circuit, and sends the */POW_FAIL* signal to A30 Handler Interface. The shutdown circuit works when one of the following situations occur.

1. The FAN STOP signal from A1U6 is received by the shutdown circuit.
2. The over voltage signal from the A1U5 comes to the shutdown circuit.

[Secondary Rectifier]

The secondary rectifier rectifies the output of the secondary windings of A1T3 and outputs +5 V, +8 V, ±12 V, ±15 V, and -21 V.

[Over Voltage Detector]

A1CR40, A1CR41, A1CR43, A1CR44, A1CR45, and A1CR47 make up the over voltage detector. If any voltage exceeds its limit, the over voltage detector will send the shutdown signal to A1U5 (photo coupler), which will turn on and send the shutdown signal to the shutdown circuit.

1-7-2. TROUBLESHOOTING AIDS

The troubleshooting aids provides the list of the dc output voltage at each test point, and the troubleshooting data. The list of the dc output voltage at each test point is shown in Table 1-10. The troubleshooting data is shown in Table 1-11.

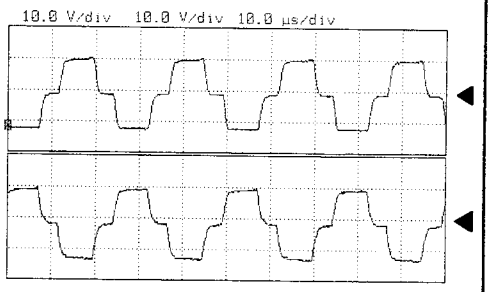
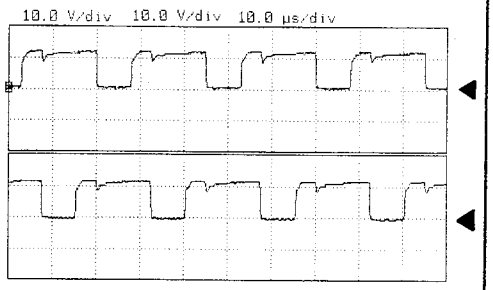
Table 1-10. DC Output Voltage and Test Point

Test Point	Name	Actual DC Voltage
A1TP13	- 15 V	- 16.5 V ± 0.7 V
A1TP14	+ 15 V	+ 16.5 V ± 0.7 V
A1TP15	- 12 V	- 12.5 V ± 0.5 V
A1TP16	+ 5 V	+ 5.2 V ± 0.2 V
A1TP17	+ 8 V	+ 8.7 V ± 0.4 V
A1TP18	+ 12 V	+ 12.5 V ± 0.5 V
	- 21 V	- 21.5 V ± 2V

WARNING

DISCONNECT THE POWER CABLE BEFORE WATCHING THE BELOW WAVEFORMS.

Table 3-11. Troubleshooting Data

HP 4278A Settings	Measurement Setup	Waveform
See Below	CHAN A: A1TP1 CHAN B: A1TP5 TRIG: CHAN A (Negative)	
See below	CHAN A: A1TP4 CHAN B: A1TP8 TRIG: CHAN A (Negative)	

HP 4278A Settings:

1. Disconnect the power cable.
2. Remove the A1 board.
3. Set A1W1 to the test position.
4. Tie A1TP3 to A1TP10.
5. Supply +12 V dc to A1TP2 referenced to A1TP3.

1-7-3. REPLACEABLE PARTS LISTS

The A1 Power Supply board is covered by the exchange assembly program. The A1 Power Supply replaceable parts are listed in Table 1-12. The part number for a rebuilt A1 exchange board is shown on the first page of the A1 replaceable parts list.

1-7-5. COMPONENT LOCATIONS

The component locations of the A1 Power Supply board with the board connect pin assignments are shown in Figure 1-18.

1-7-6. SCHEMATIC DIAGRAMS

The schematic diagram of the A1 Power Supply board is shown in Figure 1-19.

Table 1-12. A1 Power Supply Replaceable Parts List (1/3)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A1	04278-66501	2	1	POWER SUPPLY	28480	04278-66501
	04278-69501			POWER SUPPLY (RE-BUILT)	28480	04278-69501
C1	0160-3969	6	2	CAPACITOR-FXD .015UF +-20PF 250VAC(RMS)	28480	0160-3969
C2	0180-3253	3	4	CAPACITOR-FXD 470UF+-20% 250VDC AL	28480	0180-3253
C3	0180-3253	3		CAPACITOR-FXD 470UF+-20% 250VDC AL	28480	0180-3253
C4	0180-3253	3		CAPACITOR-FXD 470UF+-20% 250VDC AL	28480	0180-3253
C5	0180-3253	3		CAPACITOR-FXD 470UF+-20% 250VDC AL	28480	0180-3253
C6	0160-3969	6		CAPACITOR-FXD .015UF +-20PF 250VAC(RMS)	28480	0160-3969
C7	0180-3586	5	1	CAPACITOR-FXD 2200UF+-20% 35VDC AL	28480	0180-3586
C8	0160-4835	7	4	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C9	0180-3600	4	5	CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C10	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
C11	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C12	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C13	0160-4830	2	2	CAPACITOR-FXD 2200PF +-10% 100VDC CER	28480	0160-4830
C14	0160-4830	2		CAPACITOR-FXD 2200PF +-10% 100VDC CER	28480	0160-4830
C15	0160-6812	4	2	C-F 2.2UF 250V	28480	0160-6812
C16	0160-6812	4		C-F 2.2UF 250V	28480	0160-6812
C17	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C18	0160-4834	6	1	CAPACITOR-FXD .047UF +-10% 100VDC CER	28480	0160-4834
C19	0160-6561	0	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C20	0160-4822	2	1	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C21	0160-4833	5	2	CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
C22	0180-3583	2	1	CAPACITOR-FXD 10UF+-20% 50VDC AL	28480	0180-3583
C23	0160-4833	5		CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
C24	0160-3454	4	1	CAPACITOR-FXD 220PF +-10% 1KVDC CER	28480	0160-3454
C25	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C26	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C27	0180-3597	8	1	CAPACITOR-FXD 47UF+-20% 25VDC AL	28480	0180-3597
C28	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
C29	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C30	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C31	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C32	0180-3587	6	3	CAPACITOR-FXD 1000UF+-20% 50VDC AL	28480	0180-3587
C33	0180-3587	6		CAPACITOR-FXD 1000UF+-20% 50VDC AL	28480	0180-3587
C34	0180-3587	6		CAPACITOR-FXD 1000UF+-20% 50VDC AL	28480	0180-3587
C35	0180-1075	3	3	CAPACITOR-FXD 2200 UF 16VDC AL	28480	0180-1075
C36	0160-4808	4	1	CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C37	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C38	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C39	0180-1075	3		CAPACITOR-FXD 2200 UF 16VDC AL	28480	0180-1075
C40	0180-1075	3		CAPACITOR-FXD 2200 UF 16VDC AL	28480	0180-1075
C41	0180-3664	0	1	CAPACITOR-FXD 3300UF+-20% 10VDC AL	28480	0180-3664
CR1	1906-0313	1	1	BRIDGE 600V	28480	1906-0313
CR2	1906-0006	9	1	DIODE-FW BRDG 400V 1A	18546	VE48
CR3	1902-0969	5	1	DIODE-ZNR 30V 5% DO-35 PD=.4W TC=+.095%	28480	1902-0969
CR4	1901-0050	3	26	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR11	1902-3150	2	2	DIODE-ZNR 9.09V 2% DO-35 PD=.4W	28480	1902-3150
CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR13	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR14	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
CR15	1902-0943	5		DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR17	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR19	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR20	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR21	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR22	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR23	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR24	1902-3150	2		DIODE-ZNR 9.09V 2% DO-35 PD=.4W	28480	1902-3150
CR25	1902-0953	7	1	DIODE-ZNR 6.2V 5% DO-35 PD=.4W TC=+.053%	28480	1902-0953
CR26	1906-0317	5	2	DIODE-CT-RECT 200V 5A	28480	1906-0317
CR27	1906-0316	4	3	DIODE-CT-RECT 200V 5A	28480	1906-0316
CR28	1906-0317	5		DIODE-CT-RECT 200V 5A	28480	1906-0317
CR29	1906-0316	4		DIODE-CT-RECT 200V 5A	28480	1906-0316
CR30	1906-0316	4		DIODE-CT-RECT 200V 5A	28480	1906-0316
CR31	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR32	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR33	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR34	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR35	1901-0731	7	5	DIODE-PWR RECT 400V 1A	14433	1N4004G

Table 1-12. A1 Power Supply Replaceable Parts List (2/3)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
CR36	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
CR37	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
CR38	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
CR39	1906-0314	2	1	DIODE-CT-S-BARR 40V 15A	28480	1906-0314
CR40	1902-0964	0	2	DIODE-ZNR 18V 5% DO-35 PD=.4W TC=+.09%	28480	1902-0964
CR41	1902-3188	6	2	DIODE-ZNR 12.7V 2% DO-35 PD=.4W	28480	1902-3188
CR42	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR43	1902-0957	1	1	DIODE-ZNR 9.1V 5% DO-35 PD=.4W TC=+.069%	28480	1902-0957
CR44	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
CR45	1902-3188	6		DIODE-ZNR 12.7V 2% DO-35 PD=.4W	28480	1902-3188
CR46	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR47	1902-0964	0		DIODE-ZNR 18V 5% DO-35 PD=.4W TC=+.09%	28480	1902-0964
CR48	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR49	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR50	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR51	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
DS1	1990-0486	6	2	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
DS2	1990-0486	6		LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
E1	0837-0337	1	1	THERMISTOR-SURGE PTCTR BKDN V: DC 230V	28480	0837-0337
F1	2110-0014	3	1	FUSE 4A 250V TD 1.25X.25 UL	75915	313004
F2	2110-0746	8	2	FUSE 4A 125V NTD UL	28480	2110-0746
F3	2110-0746	8		FUSE 4A 125V NTD UL	28480	2110-0746
F4	2110-0741	3	2	FUSE 1A 125V NTD UL	28480	2110-0741
F5	2110-0741	3		FUSE 1A 125V NTD UL	28480	2110-0741
F6	2110-0743	5	3	FUSE 2A 125V UL	28480	2110-0743
F7	2110-0743	5		FUSE 2A 125V UL	28480	2110-0743
F8	2110-0743	5		FUSE 2A 125V UL	28480	2110-0743
FT1	2110-0663	8	1	FUSE-THERMAL 96 DEG C	28480	2110-0663
K1	0490-1312	8	1	RELAY IC 5VDC-COIL 10A 240VAC	28480	0490-1312
L2	9100-3139	5	2	INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
L3	9100-3139	5		INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
L4	9140-1136	2	1	INDUCTOR 27MH 35% .61W-INX.728LG-IN	28480	9140-1136
L5	9140-1135	1	1	INDUCTOR 76UH 15% 1.213W-INX1.161LG-IN	28480	9140-1135
Q1	1854-0810	2	11	TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q2	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q3	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q4	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q5	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q6	1853-0459	3	3	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
Q7	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q8	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q9	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q10	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
Q11	1855-0658	8	2	TRANSISTOR MOSFET N-CHAN E-MODE SI	S0562	2SK386
Q12	1855-0658	8		TRANSISTOR MOSFET N-CHAN E-MODE SI	S0562	2SK386
Q13	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q14	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q15	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q16	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
R1	0811-3621	8	1	RESISTOR 8 5% 6W PW TC=0+-50	28480	0811-3621
R2	0764-0031	7	4	RESISTOR 47K 5% 2W MO TC=0+-200	28480	0764-0031
R3	0764-0031	7		RESISTOR 47K 5% 2W MO TC=0+-200	28480	0764-0031
R4	0698-0085	0	4	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
R5	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
R6	0764-0031	7		RESISTOR 47K 5% 2W MO TC=0+-200	28480	0764-0031
R7	0764-0031	7		RESISTOR 47K 5% 2W MO TC=0+-200	28480	0764-0031
R8	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
R9	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3162-F
R10	0698-3455	4	1	RESISTOR 261K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2613-F
R11	0757-0280	3	8	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R12	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R15	0698-3457	6	2	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
R16	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
R17	0811-1668	9	1	RESISTOR 1.5 5% 2W PW TC=0+-400	75042	BWH2-1R5-J
R18	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	CT4-1/8-T0-121R-F
R19	2100-3207	1	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R21	0698-0084	9	8	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R23	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R24	0698-3155	1	7	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R25	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F

Table 1-12. A1 Power Supply Replaceable Parts List (3/3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R26	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R27	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R28	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
R29	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R30	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R31	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R32	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R33	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R34	0698-4037	0	2	RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
R35	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
R36	0698-3260	9	3	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
R37	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
R38	0764-0015	7	1	RESISTOR 560 5% 2W MO TC=0+-200	28480	0764-0015
R39	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R40	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R41	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
R42	0698-3454	3	1	RESISTOR 215K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2153-F
R43	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R46	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R47	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
R48	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R49	0698-0082	7	5	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R50	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R51	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	CT4-1/8-T0-681R-F
R52	2100-3350	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
R53	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
R54	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R55	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R56	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R57	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R58	0698-3628	3	2	RESISTOR 220 5% 2W MO TC=0+-200	28480	0698-3628
R59	0698-3628	3		RESISTOR 220 5% 2W MO TC=0+-200	28480	0698-3628
R62	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R63	0698-3435	0	1	RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
R64	0757-0274	5	2	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
R65	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R67	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
R68	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R69	0757-0984	4	1	RESISTOR 10 1% .5W F TC=0+-100	28480	0757-0984
R70	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
R71	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
R72	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
R73	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
R74	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R75	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R76	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R77	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R78	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R79	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R80	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
RV1	1901-1217	6	2	DIODE-VRTS 150V	28480	1901-1217
RV2	1901-1217	6		DIODE-VRTS 150V	28480	1901-1217
T1	9100-4618	7	1	XFMR-POWER	28480	9100-4618
T2	9100-4499	2	1	TRANSFORMER L(PINS 10 & 11): 5.3 MH+-30%	28480	9100-4499
T3	9100-4634	7	1	XFMR-POWER	28480	9100-4634
T4	9100-4635	8	1	XFMR-POWER	28480	9100-4635
U1	1826-0147	9	1	IC 7812 V RGLTR TO-220	04713	MC7812CP
U2	1826-1599	7	1	IC UPC494	28480	1826-1599
U3	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
U4	1990-1190	1	3	DOUBLE-COUPLER	28480	1990-1190
U5	1990-1190	1		DOUBLE-COUPLER	28480	1990-1190
U6	1990-1190	1		DOUBLE-COUPLER	28480	1990-1190
	1251-3819	9	1	CONN-UTIL MT-LK 6-CKT 6-CONT	28480	1251-3819
	1251-4822	6	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
	2110-0269	0	2	FUSEHOLDER-CLIP TYPE.25D-FUSE	28480	2110-0269
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-IN-BD-THKNS	28480	4040-0749
	04278-00601	5	1	BOX SHIELD	28480	04278-00601
	04278-00602	6	1	BOX SHIELD	28480	04278-00602
	04278-01204	6	1	HEAT SINK	28480	04278-01204

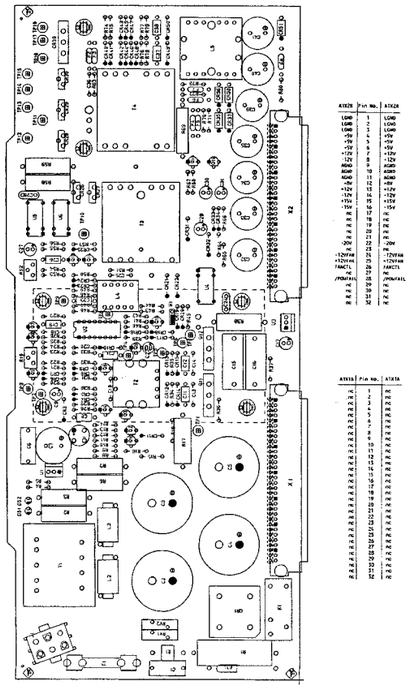
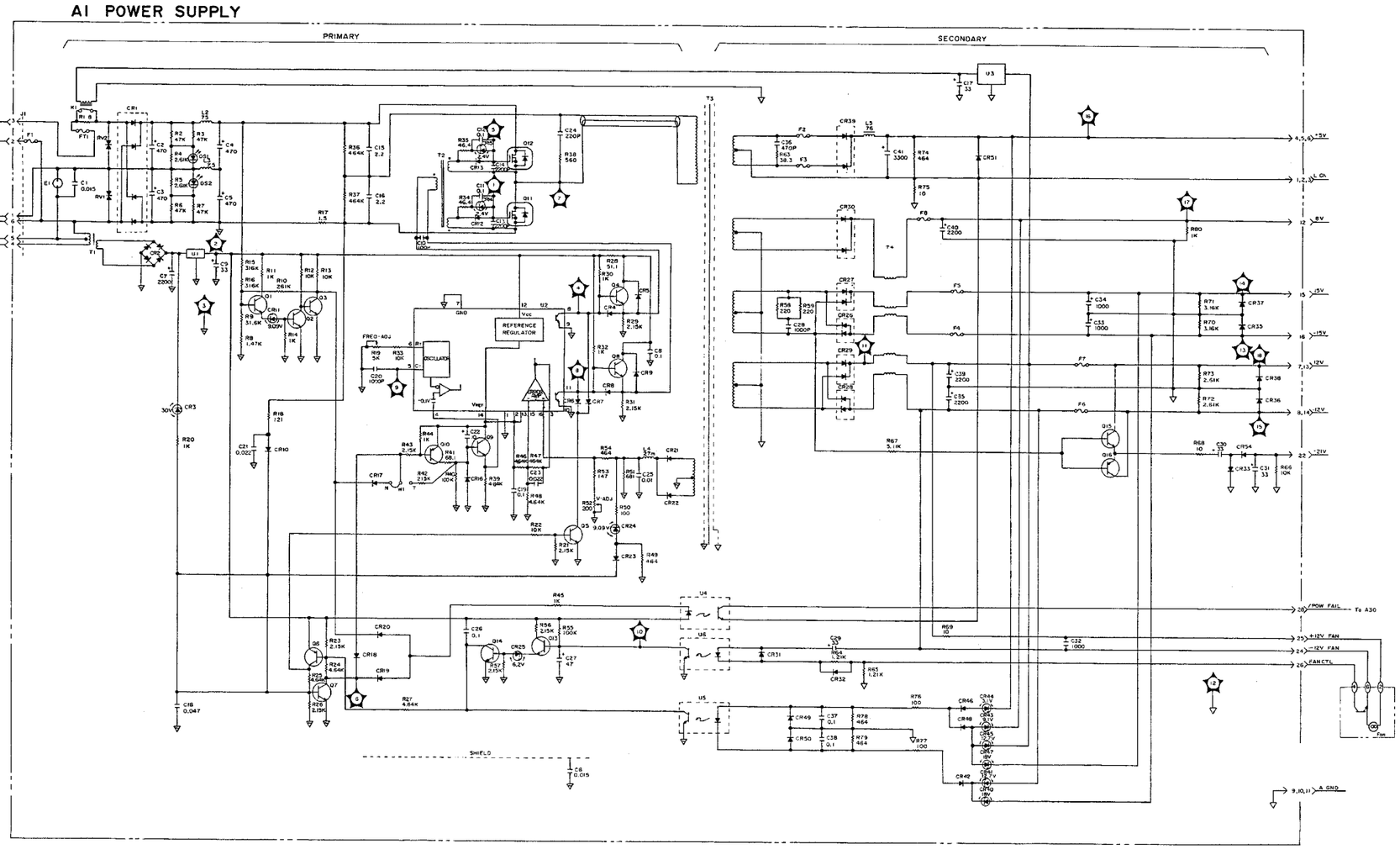


Figure 1-17. A1 Power Supply Component Locations



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μh)

Figure 1-19. A1 Power Supply Schematic Diagram

A2 SIGNAL SOURCE BOARD SERVICE SHEET

NOTES

1-8. A2 BOARD SERVICE SHEET

1-8-1. CIRCUIT DESCRIPTION

The A2 signal source board consists of the 1 kHz/1 MHz signal source and voltage regulators.

[1 kHz/1 MHz Signal Source]

The A2 signal source board generates the 1 kHz / 1 MHz test signals which is then selected using multiplexer A2U3. In the case of the 1 kHz test signal, the output of the 8 MHz crystal oscillator (A2U24) is counted down to 1 kHz by counters A2U1, A2U4, A2U5, A2U7, A2U8A, and A2U9. The 1 kHz frequency is filtered by a LPF (Low Pass Filter) to obtain the 1 kHz sine wave test frequency, and the filtered output is a fairly constant 2.8 Vrms signal. In the case of the 1 MHz test signal, the 8 MHz crystal oscillator (A2U24) output is counted down to 1 MHz by counter A2U1. The 1 MHz frequency is filtered by a LPF to obtain the 1 MHz sine wave test frequency, and the filtered output is fairly constant 1.6 Vrms signal. The sine wave output from the LPF which depends on the test frequency setting is attenuated by an attenuator made up of resistors (A2R16 to A2R25), the output of which is selected by A2U17 and A2U18. The output voltage is amplified a power amplifier, a feedback circuit (A2U20 used in an integrator configuration) is used to cancel the DC offset voltage due to the power amplifier. The source resistors A2R55, A2R56, and A2R57 which are switched by A2K1 and A2K2. When the test frequency is 1 kHz, the source resistor selection depends on the measurement range as shown below. When the test frequency is 1 MHz, the source resistor is approximately 20 Ω (A2R57).

Table 1-13. Source Resistor and Measurement Range

Measurement Range	Source Resistor
100 pF	approximately 100 Ω
1 nF	approximately 100 Ω
10 nF	approximately 100 Ω
100 nF	approximately 20 Ω
1 µF	Direct Connection (approximately 1 Ω)
10 µF	Direct Connection (approximately 1 Ω)
100 µF	approximately 20 Ω

[Voltage Regulator]

The voltage regulators, consisting of the A2U21, A2U22, and A2U23, regulate the unregulated voltages from the A1 power supply board to 5 V and ±8 V. A2U21 regulates the +8 V from the A1 board to 5 V, A2U22 regulates the + 12 V from the A1 board to +8 V, and A2U23 regulates the -12 V from the A1 board to -8 V.

1-8-2. TROUBLESHOOTING AIDS

The troubleshooting aids provides a list of test points and troubleshooting data. The test point list is shown in Table 1-14, and the troubleshooting data is shown in Table 1-15.

Table 1-14. Test Point List

Test Point	Signal Name	Description
A2TP1	*F*	1 kHz or 1 MHz (depends on the test frequency)
A2TP2	*GND*	Ground Line
A2TP3	*1K*	1 kHz sine wave
A2TP4	*GND*	Ground Line
A2TP5	*EOSC*	Output signal at Hcur Terminal
A2TP6	*GND*	Ground Line
A2TP7	*F*	Attenuated signal (1 kHz or 1 MHz)
A2TP8	*1M*	1 MHz sine wave
A2TP9	*4M*	4 MHz
A2TP10	*8F*	8 kHz when the test frequency is 1 kHz. 8 MHz when the test frequency is 1 MHz.
A2TP11	*+5V*	+ 5 V dc
A2TP12	*+8V*	+ 8 V dc
A2TP13	*-8V*	- 8 V dc
A2TP14	*8M*	8 MHz

Table 1-15. Troubleshooting Data (1/2)

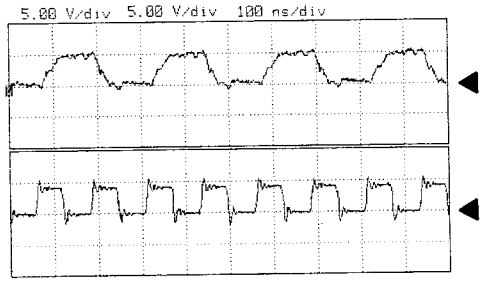
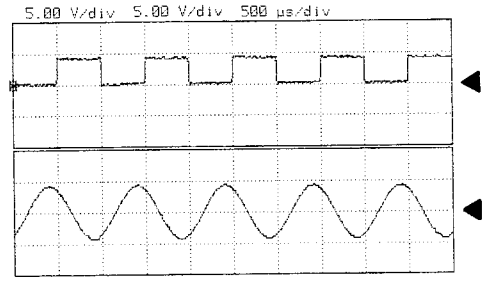
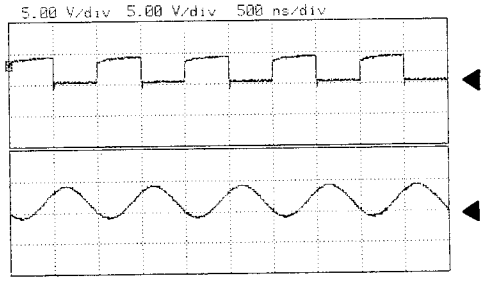
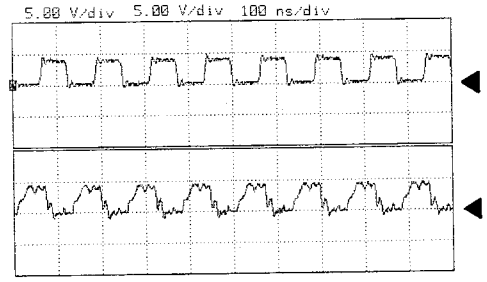
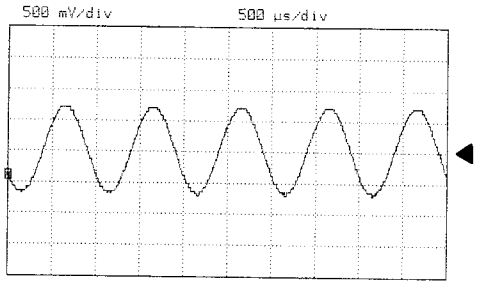
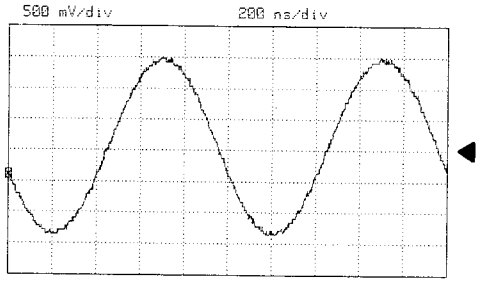
HP 4278A Settings	Measurement Setup	Waveform
Default Settings	CHAN A: A2TP9 CHAN B: A2TP14 TRIG: CHAN A (Negative)	
FREQ: 1 kHz	CHAN A: A2TP1 CHAN B: A2TP3 TRIG: CHAN A (Negative)	
FREQ: 1 MHz	CHAN A: A2TP1 CHAN B: A2TP8 TRIG: CHAN A (Negative)	
FREQ: 1 MHz	CHAN A: A2TP14 CHAN B: A2TP10 TRIG: CHAN A (Negative)	

Table 1-15. Troubleshooting Data (2/2)

HP 4278A Settings	Measurement setup	Waveform
FREQ: 1 kHz OSC LVL: 0.5V	CHAN A: A2TP7 TRIG: CHAN A (Negative)	
Selftest = 3	CHAN A: A2TP15 TRIG: CHAN A (Negative)	

1-8-3. REPLACEABLE PARTS LISTS

The A2 Signal Source board (standard board) is covered by the exchange assembly program. The A2 Signal Source replaceable parts are listed in Table 1-16. The part number for a rebuilt A2 exchange board is shown on the first page of the A2 signal source replaceable parts list.

1-8-4. COMPONENT LOCATIONS

The A2 signal source component locations with the board connector pin assignments is shown in Figure 1-20.

1-8-5. SCHEMATIC DIAGRAMS

The A2 signal source board schematic diagram is shown in Figure 1-21.

Table 1-16. A2 Signal Source Replaceable Parts list (1/3)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A2	04278-66502	3	1	SIGNAL SOURCE (STD ONLY)	28480	04278-66502
	04278-69502			SIGNAL SOURCE (RE-BUILT STD)	28480	04278-69502
	04278-66572	7	1	SIGNAL SOURCE (OPT 003 ONLY)	28480	04278-66572
C1	0160-6561	0	21	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C2	0180-3469	3	5	CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C3	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C4	0180-3363	6	21	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C5	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C6	0160-4822	2	6	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C7	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C8	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C9	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C10	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C11	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C12	0160-4904	1	3	CAPACITOR-FXD 6800PF +-5% 50VDC CER	28480	0160-4904
C13	0160-4904	1		CAPACITOR-FXD 6800PF +-5% 50VDC CER	28480	0160-4904
C14	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C15	0160-4904	1		CAPACITOR-FXD 6800PF +-5% 50VDC CER	28480	0160-4904
C16	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C17	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C18	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C19	0160-4808	4	2	CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C20	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C21	0160-4802	8	1	CAPACITOR-FXD 82PF +-5% 100VDC CER 0+-30	28480	0160-4802
C22	0160-4810	8	1	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C23	0160-4814	2	1	CAPACITOR-FXD 150PF +-5% 100VDC CER	28480	0160-4814
C24	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C25	0160-4835	7	2	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C27	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C28	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C29	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C30	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C31	0180-3470	6	2	CAPACITOR-FXD 220UF+-20% 25VDC AL	28480	0180-3470
C32	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C33	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C34	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C35	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C36	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C37	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C38	0180-3470	6		CAPACITOR-FXD 220UF+-20% 25VDC AL	28480	0180-3470
C39	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C40	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C41	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C42	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C43	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C44	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C45	0180-3600	4	2	CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C46	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C47	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C48	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C49	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C50	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C51	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C52	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C53	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C54	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C55	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C56	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C57	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C58	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C59	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C60	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C61	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C62	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C63	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C64	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C65	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C66	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C67	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C68	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C69	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C70	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
CR1	1902-0946	8	2	DIODE-ZNR 3.3V 5% DO-35 PD=.4W TC=-.039%	28480	1902-0946
CR2	1902-0946	8		DIODE-ZNR 3.3V 5% DO-35 PD=.4W TC=-.039%	28480	1902-0946
CR3	1901-0050	3	4	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR5	1901-1250	7	2	DIO-PWR RECT	28480	1901-1250

Table 1-16. A2 Signal Source Replaceable Parts list (2/3)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR8	1901-1250	7		DIO-PWR RECT	28480	1901-1250
J1	PPNR30576	6	1	CONN-RF F	28480	PPNR30576
K1	0490-1485	6	2	RELAY SW	28480	0490-1485
K2	0490-1485	6		RELAY SW	28480	0490-1485
L1	9100-1629	4	4	INDUCTOR RF-CH-MLD 47UH 5%	28480	9100-1629
L2	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5%	28480	9100-1629
L3	9100-3912	2	2	INDUCTOR RF-CH-MLD 15UH 5%	28480	9100-3912
L4	9140-0210	1	2	INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
L5	9100-0539	3	1	INDUCTOR (MISC ITEM)	28480	9100-0539
L6	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
L7	9100-3912	2		INDUCTOR RF-CH-MLD 15UH 5%	28480	9100-3912
L8	9100-3313	7	1	INDUCTOR RF-CH-MLD 22UH 5%	28480	9100-3313
L9	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5%	28480	9100-1629
L10	9140-0129	1	1	INDUCTOR RF-CH-MLD 220UH 5%	28480	9140-0129
L11	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5%	28480	9100-1629
L12	1250-2108	5	1	CONN-RF F	28480	1250-2108
L13	9100-3139	5	3	INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
L14	9100-3139	5		INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
L15	9100-3139	5		INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
Q1	1854-0810	2	5	TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q2	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q3	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q4	1853-0459	3	1	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
Q5	1854-0637	1	2	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
Q6	1854-0637	1		TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
Q7	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q8	1853-0314	9	2	TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
Q9	1853-0314	9		TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
Q10	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
R1	0757-0346	2	4	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R2	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R3	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R5	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
R6	0698-3161	9	6	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3832-F
R7	0698-3161	9		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3832-F
R8	2100-3350	5	2	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
R9	0698-3161	9		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3832-F
R10	0698-3161	9		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3832-F
R11	0698-3161	9		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3832-F
R12	0698-3161	9		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3832-F
R13	2100-3350	5		RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
R14	0757-0417	8	1	RESISTOR 562 1% .125W F TC=0+-100	24546	CT4-1/8-T0-562R-F
R15	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
R16	0757-0401	0	12	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R17	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R18	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R19	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R20	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R21	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R22	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R23	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R24	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R25	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R26	0757-0421	4	4	RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
R27	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
R28	0757-0277	8	2	RESISTOR 49.9 1% .125W F TC=0+-100	28480	0757-0277
R29	0764-0033	9	2	RESISTOR 33 5% 2W MO TC=0+-200	28480	0764-0033
R30	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R31	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R32	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R33	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R34	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R35	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R37	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R38	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R39	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R40	0683-0275	9	14	RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R41	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R42	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R43	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R44	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R45	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5

Table 1-16. A2 Signal Source Replaceable Parts list (3/3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R46	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R47	0698-3430	5	1	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
R48	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R49	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R50	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R51	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R52	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R53	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R55	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
R56	0757-0379	1	1	RESISTOR 12.1 1% .125W F TC=0+-100	19701	5033R-1/8-T0-12R1-F
R57	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R58	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
R59	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
R60	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	28480	0757-0277
R61	0764-0033	9		RESISTOR 33 5% 2W MO TC=0+-200	28480	0764-0033
R62	1810-0126	1	3	NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
R64	1810-0126	1		NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
R66	1810-0126	1		NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
R67	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
R68	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
R69	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
R70	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R71	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1782-F
R72	0683-0825	5	4	RESISTOR 8.2 5% .25W CF TC=0-400	01121	CB82G5
R73	0683-0825	5		RESISTOR 8.2 5% .25W CF TC=0-400	01121	CB82G5
R74	0683-0825	5		RESISTOR 8.2 5% .25W CF TC=0-400	01121	CB82G5
R75	0683-0825	5		RESISTOR 8.2 5% .25W CF TC=0-400	01121	CB82G5
R76	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R77	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
R78	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
TP1	0360-1653	5	15	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP2	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP3	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP4	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP5	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP6	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP7	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP8	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP9	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP10	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP11	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP12	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP13	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP14	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
TP15	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
U1	1820-1430	3	4	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
U2	1820-1144	6	3	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
U3	1820-1470	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
U4	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
U5	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
U6	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
U7	1820-1429	0	1	IC CNTR TTL LS DECD SYNCHRO	01295	SN74LS160AN
U8	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
U9	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
U10	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
U11	1826-0521	3	2	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	01295	TL072CP
U12	1826-0521	3		IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	01295	TL072CP
U13	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
U14	1820-2757	9	2	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
U15	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
U16	1820-1510	0	1	IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
U17	1820-1315	3	2	IC MULTIPLXR 8-CHAN-ANLG 16-DIP-P PKG	3L585	CD4051BE
U18	1820-1315	3		IC MULTIPLXR 8-CHAN-ANLG 16-DIP-P PKG	3L585	CD4051BE
U19	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
U20	1826-0519	9	1	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U21	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
U22	1826-0146	8	1	IC 7808 V RGLTR TO-220	04713	MC7808CP
U23	1826-0971	7	1	IC- UPC7908H	28480	1826-0971
U24	1813-0550	1	1	CLK OSC 8.00MHz (STD ONLY)	28480	1813-0550
	1813-0551	2	1	CLK OSC 8.08MHz (OPTION 003 ONLY)	28480	1813-0551
X1	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
X2	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	1205-0095	0	4	HEAT SINK SGL TO-5/TO-39-CS	30161	3225B
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	4040-0750	7	1	EXTR-PC BD RED POLYC .062-IN-BD-THKNS	28480	4040-0750
W1	8159-0005	0	2	RESISTOR ZERO OHMS (STD ONLY)	28480	8159-0005
W2	8159-0005	0		RESISTOR ZERO OHMS (OPTION 003 ONLY)	28480	8159-0005

NOTES

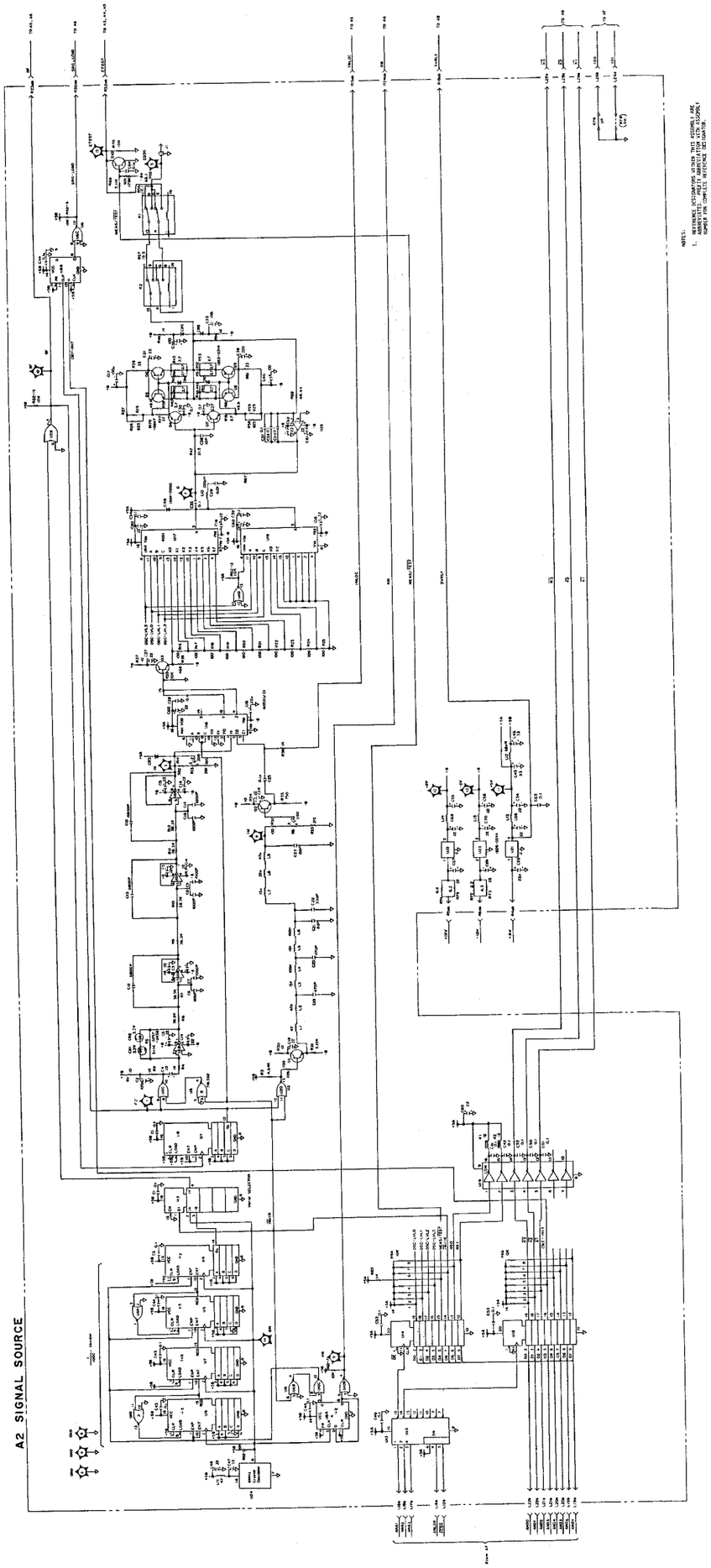


Figure 1-21. A2 Signal Source Schematic Diagram

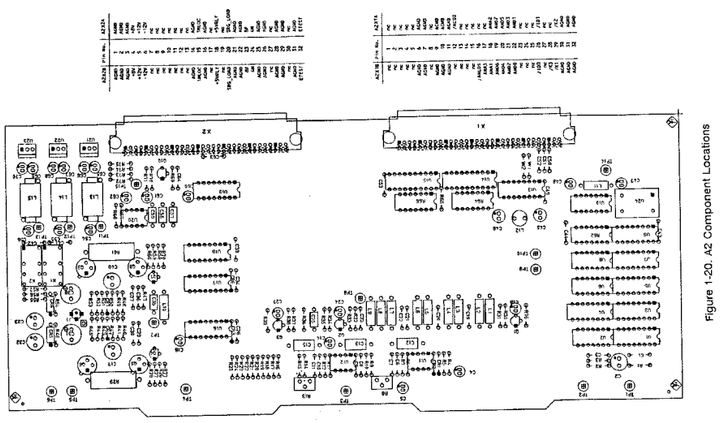


Figure 1-20. A2 Component Locations

A3 1 MHz TRANSDUCER BOARD SERVICE SHEET

NOTES

1-9. A3 BOARD SERVICE SHEET

1-9-1. CIRCUIT DESCRIPTION

The A3 1 MHz transducer board consists of the first null amplifier, the second null amplifier, the range resistor, the ranging current divider, the C offset circuit, and voltage regulators.

[First Null Amplifier]

The first null amplifier is described in the block diagram discussion in the paragraph 1-5-2 of this section. The first null amplifier includes the resonance circuit composed of A3L4, A3C11, A3C12, and A3C13. The output from the first null amplifier is feed into transformer A3T17.

[Second Null Amplifier]

The second null amplifier is described in the block diagram discussion in the paragraph 1-5-2 of this section. In the block diagram discussion, the current through the DUT is assumed to be the same as the current flow through the range resistor. If the current through the DUT is not equal to the current flow through the range resistor, the null detector (A3U4) in the second null amplifier detects and outputs the difference as a proportional error voltage. Multiplexer A3U10 is used to normalize the output error voltage which is then converted into a dc voltage proportional to the 0° vector component by the phase detector and the integrator in the hybrid IC (HIC) A3U21, and the normalized error voltage is converted into a dc voltage proportional to the 90° vector component by the phase detector and the integrator in HIC A3U20. A3Q7, A3L15, A3C83, A3R44, and A3Q8 feeds the 0° and 90° reference signals to HICs A3U20 and A3U21. The 0° component of the reference signal is amplitude modulated by the 0° component of the error voltage in HIC A3U21, and the 90° component of the reference signal is amplitude modulated using the 90° component of the error voltage in HIC A3U20. The output signals of A3U20 and A3U21 are summed, and the phase of the resultant vector signal is inverted and amplified by summing amplifier A3U16. The output voltage from the summing amplifier is fed back through the range resistor to cancel the error current, thereby making the current through the DUT equal to the current through the range resistor.

[Range Resistor]

The range resistor is one component of the I-V converter. When the high accuracy mode is set to OFF (normal mode), the range resistor is approximately 5.7 kΩ (A3R14 and A3R15 in parallel). When the high accuracy mode is set to ON, the range resistor is approximately 20 kΩ (A3R15). A3K9 is the switch used to select the value of the range resistor.

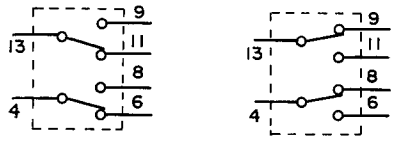
[Ranging Current Divider]

As described in the block diagram discussion in paragraph 1-5-2 of this section, the ranging current divider consists of transformers, binary output selection switches, and the ranging current divider's position control switches. The ranging current transformers are A3T3 through A3T8. The binary output selection switches are A3K2 through A3K7. The ranging current divider's position control switches are A3K1 through A3K8. The ON/OFF settings of all switches depends on the measurement range as listed below.

Table 1-17. Measurement Range and Control Switches

Measurement Range	A3K1	A3K2	A3K3	A3K4	A3K5	A3K6	A3K7	A3K8
1 pF	0	0	0	0	1	0	0	1
2 pF	0	0	0	1	0	0	0	1
4 pF	0	0	1	0	0	0	0	1
8 pF	0	1	0	0	0	0	0	1
16 pF	0	0	0	0	0	0	0	0
32 pF	1	1	0	0	0	0	0	0
64 pF	1	0	1	0	0	0	0	0
128 pF	1	0	0	1	0	0	0	0
256 pF	1	0	0	0	1	0	0	0
512 pF	1	0	0	0	0	1	0	0
1024 pF	1	0	0	0	0	0	1	0

0 setting: 1 setting:



[C Offset Circuit]

As described in the block diagram discussion in the paragraph 1-5-2 in this section, the C offset circuit consists of a reference capacitor, a transformer, and a C-offset current divider. The reference capacitor is 82 pF (A3C53). The transformer is A3T1. The C offset current divider consists of transformers A3T10 through A3T16, and the switches A3K10 through A3K15. A3U13 is the switching controller.

[Voltage Regulators]

The voltage regulators consists of A3U17 through A3U19. The voltage regulators regulate the unregulated voltage from the A1 Power Supply board to 5 V, and ± 8 V. A3U17 regulates the + 12 V from the A1 board to + 8 V. A3U18 regulates the - 12 V from the A1 board to - 8 V. A3U19 regulates the + 8 V from the A1 board to + 5 V.

1-9-2. TROUBLESHOOTING AIDS

The troubleshooting aids section contains troubleshooting procedures used when self test = 1, or self test = 2 fails. The troubleshooting aids section also contains a list of test points and troubleshooting data. The test points are listed in Table 1-18, and the troubleshooting data is listed in Table 1-19.

[Only self test = 1 (A3 1 MHz TRD C-offset div test) failed]

Perform the following steps.

1. Connect a 1 pF capacitor across the **UNKNOWN** Terminals.

2. Set up the 4278A as follows.

Test Frequency:	1 MHz
High Accuracy Mode:	ON
Measurement Range:	1.28 pF
Other Settings:	Initial Settings

3. Is the measurement value is within 1 pF ± 2%?

   YES: Go to step **4.**
   NO: Check A3T11 and A3K10.

4. Set the measurement range to 0.64 pF. Is the measurement value is within 1 pF ± 2%?

   YES: Go to step **5.**
   NO: Check A3T12 and A3K11.

5. Set the measurement range to 0.96 pF. Is the measurement value is within 1 pF ± 2%?

   YES: Go to step **6.**
   NO: Check A3T13 and A3K12.

6. Set the measurement range to 1.12 pF. Is the measurement value is within 1 pF ± 2%?

   YES: Go to step **7.**
   NO: Check A3T14 and A3K13.

7. Set the measurement range to 1.2 pF. Is the measurement value is within 1 pF ± 2%?

   YES: Go to step **8.**
   NO: Check A3T15 and A3K14.

6. Set the measurement range to 1.24 pF. Is the measurement value is within 1 pF ± 2%?

   YES: Check A3T10, and retry the above steps.
   NO: Check A3T10, A3T16, and A3K15.

[Only self test = 2 (A3 1 MHz TRD-Range div test) failed]

Perform the following steps.

1. Did **RESULT 1** pass?

   YES: Go to step **2.**
   NO: Check A3K1, A3K2, A3K8, and A3T3.

2. Did **RESULT 2** pass?

   YES: Go to step **3.**
   NO: Check A3K1, A3K2, A3K8, and A3T3.

3. Did **RESULT 3** pass?

   YES: Go to step **4.**
   NO: Check A3K1, A3K3, A3K8, and A3T4.

4. Did **RESULT 4** pass?

   YES: Go to step **5.**
   NO: Check A3K1, A3K4, A3K8, and A3T5.

5. Did **RESULT 5** pass?

   YES: Go to step **6.**
   NO: Check A3K1, A3K5, A3K8, and A3T6.

6. Did **RESULT 6** pass?

   YES: Go to step 7.
   NO: Check A3K1, A3K6, A3K8, and A3T7.

7. Did **RESULT 7** pass?

   YES: Check A3K1 and A3K8, and retry the above steps.
   NO: Check A3K1, A3K7, A3K8, and A3T8.

Table 1-18. Test Point List

Test Point	Signal Name	Description
A3TP1		Output signal from the 1st null amplifier
A3TP2		Ground Line
A3TP3		Output signal (1) from the pre amplifier in the 2nd null amplifier
A3TP4		Ground Line
A3TP5		Output signal from I-V converter
A3TP6		Ground Line
A3TP7	*+8V*	+ 8 V dc
A3TP8	*-8V*	- 8 V dc
A3TP9	*+5V*	+ 5 V dc
A3TP10		Ground Line
A3TP11		Output signal (2) from the pre amplifier in the 2nd null amplifier

Table 1-19. Troubleshooting Data (1/2)

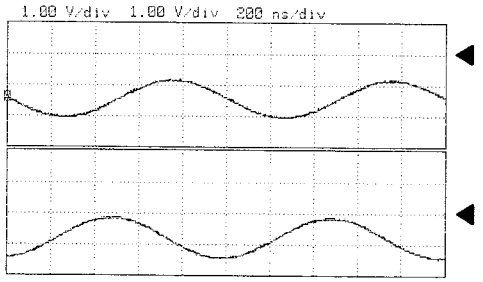
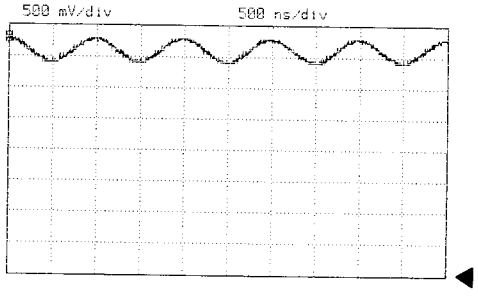
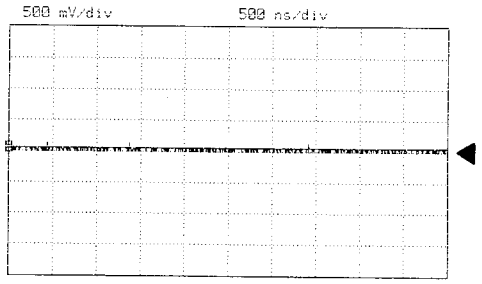
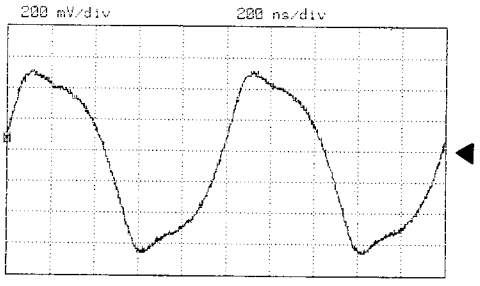
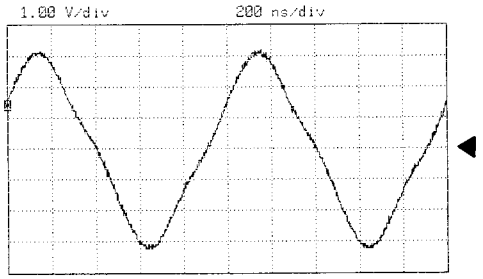
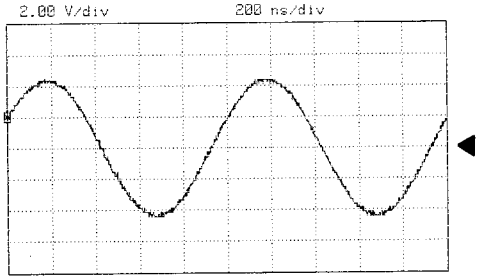
HP 4278A Settings	Measurement Setup	Waveform
FREQ: 1 MHz	CHAN A: A3TP12 CHAN B: A3TP13 TRIG: CHAN A (Negative)	
Selftest = 3	CHAN A: A3TP1 TRIG: CHAN A (Negative)	
Selftest = 4 DUT: OPEN	CHAN A: A3TP5 TRIG: CHAN A (Negative)	
DUT: 100 pF FREQ: 1 MHz Meas.Range: 16 pF Display: UNBAL	CHAN A: A3TP3 TRIG: CHAN A (Negative)	

Table 1-19. Troubleshooting Data (2/2)

HP 4278A Settings	Measurement Setup	Waveform
DUT: 100 pF FREQ: 1 MHz Meas.Range: 16 pF Display: UNBAL	CHAN A: A3TP4 TRIG: CHAN A (Negative)	
DUT: 100 pF FREQ: 1 MHz Meas.Range: 16 pF Display: UNBAL	CHAN A: A3TP5 TRIG: CHAN A (Negative)	

1-9-3. REPLACEABLE PARTS LISTS

The A3 1 MHz Transducer board is covered by the exchange assembly program. The A3 1 MHz transducer replaceable parts are listed in Table 1-20. The part number for a rebuilt A3 exchange board is shown on the first page of the A3 replaceable parts list.

1-9-4. COMPONENT LOCATIONS

The component locations of the A3 1 MHz Transducer with the board connector pin assignments are shown in Figure 1-22.

1-9-5. SCHEMATIC DIAGRAMS

The A3 board schematic diagram is shown in Figure 1-23.

Table 1-20. A3 1 MHz Transducer Replaceable Parts list (1/4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3	04278-66503	4	1	1MHz TRANSDUCER	28480	04278-66503
	04278-69503			1MHz TRANSDUCER (RE-BUILT)	28480	04278-69503
C1	0160-4799	2	5	CAPACITOR-FXD 2.2PF +-.25PF 100VDC CER	28480	0160-4799
C2	0160-4799	2		CAPACITOR-FXD 2.2PF +-.25PF 100VDC CER	28480	0160-4799
C3	0160-4799	2		CAPACITOR-FXD 2.2PF +-.25PF 100VDC CER	28480	0160-4799
C5	0160-4835	7	6	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C6	0160-2234	6	1	CAPACITOR-FXD .51PF +-.25PF 500VDC CER	28480	0160-2234
C7	0180-3600	4	13	CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C8	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C9	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C10	0160-4832	4	26	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C11	0160-3916	3	1	CAPACITOR-FXD 220PF +-2% 100VDC CER	28480	0160-3916
C12	0121-0105	4	1	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	73899	DV11PR35D
C13	0160-4787	8	4	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
C14	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C15	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C16	0160-4810	8	1	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C17	0160-4791	4	13	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C18	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C19	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C20	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C21	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C22	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C23	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C24	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C25	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C26	0160-4799	2		CAPACITOR-FXD 2.2PF +-.25PF 100VDC CER	28480	0160-4799
C27	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C28	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C29	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C30	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C31	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C32	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C33	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C34	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C35	0160-4801	7	3	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
C35	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C36	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C36	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C37	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C37	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C38	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
C39	0160-4822	2	3	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C40	0160-4789	0	1	CAPACITOR-FXD 15PF +-5% 100VDC CER 0+-30	28480	0160-4789
C41	0160-4795	8	1	CAPACITOR-FXD 4.7PF +-.5PF 100VDC CER	28480	0160-4795
C42	0160-4812	0	2	CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
C43	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
C44	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C45	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C46	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C47	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C48	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C49	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C50	0160-4830	2	1	CAPACITOR-FXD 2200PF +-10% 100VDC CER	28480	0160-4830
C51	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C52	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C53	0160-6828	4	1	C-F 82PF100VMICA	28480	0160-6828
C54	0160-4799	2		CAPACITOR-FXD 2.2PF +-.25PF 100VDC CER	28480	0160-4799
C55	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C56	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C57	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C58	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C59	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C60	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C61	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C62	0160-4805	1	1	CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30	28480	0160-4805
C63	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
C64	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C65	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C66	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C67	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C68	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832

Table 1-20. A3 1 MHz Transducer Replaceable Parts list (2/4)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
C69	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C70	0160-4808	4	4	CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C71	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C72	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C73	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C74	0160-6561	0	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C75	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C76	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C77	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C78	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
C79	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
C80	0160-4792	5	1	CAPACITOR-FXD 8.2PF +-.5PF 100VDC CER	28480	0160-4792
C81	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C82	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C83	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
C84	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C85	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
C86	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C87	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
C88	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
CR1	1901-0050	3	10	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR11	1902-3036	3	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
CR12	1902-3036	3		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	28480	1902-3036
CR13	1906-0257	2	2	DIODE-ARRAY 75V 350MA VF DIFF=15MV	28480	1906-0257
CR14	1906-0257	2		DIODE-ARRAY 75V 350MA VF DIFF=15MV	28480	1906-0257
J1	1250-2108	5	4	CONN-RF F	28480	1250-2108
J2	1250-2108	5		CONN-RF F	28480	1250-2108
J3	1250-2108	5		CONN-RF F	28480	1250-2108
J4	1250-2108	5		CONN-RF F	28480	1250-2108
J5	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
J6	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
K1	0490-1477	6	15	RELAY	28480	0490-1477
K2	0490-1477	6		RELAY	28480	0490-1477
K3	0490-1477	6		RELAY	28480	0490-1477
K4	0490-1477	6		RELAY	28480	0490-1477
K5	0490-1477	6		RELAY	28480	0490-1477
K6	0490-1477	6		RELAY	28480	0490-1477
K7	0490-1477	6		RELAY	28480	0490-1477
K8	0490-1477	6		RELAY	28480	0490-1477
K9	0490-1477	6		RELAY	28480	0490-1477
K10	0490-1477	6		RELAY	28480	0490-1477
K11	0490-1477	6		RELAY	28480	0490-1477
K12	0490-1477	6		RELAY	28480	0490-1477
K13	0490-1477	6		RELAY	28480	0490-1477
K14	0490-1477	6		RELAY	28480	0490-1477
K15	0490-1477	6		RELAY	28480	0490-1477
L1	9140-1263	6	3	INDUCTOR 120UH 10%	28480	9140-1263
L2	9140-1263	6		INDUCTOR 120UH 10%	28480	9140-1263
L3	9140-1263	6		INDUCTOR 120UH 10%	28480	9140-1263
L4	9140-0210	1	4	INDUCTOR 100UH 5%	28480	9140-0210
L5	9140-0210	1		INDUCTOR 100UH 5%	28480	9140-0210
L6	9140-0210	1		INDUCTOR 100UH 5%	28480	9140-0210
L7	9140-0761	7	2	INDUCTOR 220UH 10%	28480	9140-0761
L8	9140-1264	7	2	INDUCTOR 1MH 10%	28480	9140-1264
L9	9140-1262	5	1	INDUCTOR 100UH 10%	28480	9140-1262
L10	9140-0761	7		INDUCTOR 220UH 10%	28480	9140-0761
L11	9100-1629	4	2	INDUCTOR 47UH 5%	28480	9100-1629
L12	9100-1629	4		INDUCTOR 47UH 5%	28480	9100-1629
L13	9140-0137	1	2	INDUCTOR 1MH 5%	28480	9140-0137
L14	9140-0137	1		INDUCTOR 1MH 5%	28480	9140-0137
L15	9140-1264	7		INDUCTOR 1MH 10%		9140-1264
L16	9140-0210	1		INDUCTOR 100UH 5%	28480	9140-0210
L17	9140-1278	3	2	INDUCTOR 68UH 10%	28480	9140-1278
L18	9140-1278	3		INDUCTOR 68UH 10%	28480	9140-1278
Q1	1855-0570	3	2	TRANSISTOR J-FET D-MODE TO-92 SI	S0545	2SK523
Q2	1853-0459	3	2	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
Q3	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
Q4	1855-0570	3		TRANSISTOR J-FET D-MODE TO-92 SI	S0545	2SK523
Q5	1854-0810	2	4	TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810

Table 1-20. A3 1 MHz Transducer Replaceable Parts list (3/4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
Q6	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q7	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
Q8	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
R1	0757-0346	2	6	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R2	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R3	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
R4	0698-3447	4	2	RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
R5	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
R6	0698-3446	3	2	RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
R7	0757-0459	8	2	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5622-F
R8	0757-0459	8		RESISTOR 56.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5622-F
R9	0757-0442	9	8	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R10	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
R11	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R12	0757-0180	2	2	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
R13	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
R14	0699-2242	7	1	RES 8.06K 1/8W 0.1%	28480	0699-2242
R15	0699-2243	8	1	RES 20K 1/8W .1%	28480	0699-2243
R16	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
R17	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
R18	0698-0082	7	3	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R19	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R21	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R27	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R28	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R29	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
R30	2100-3161	6	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	73138	89PR20K
R31	2100-3161	6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	73138	89PR20K
R32	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R33	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R34	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
R35	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
R36	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
R37	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R38	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R39	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
R40	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R41	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
R42	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R43	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1782-F
R44	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
R45	0757-0274	5	2	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
R46	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
R47	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R48	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R49	0698-8827	4	2	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
R50	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R52	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
R53	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R54	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R55	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R56	0757-0439	4	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
T1	9100-0825	0	2	TRANSFORMER:PULSE (TDK 11385)	28480	9100-0825
T2	9100-0825	0		TRANSFORMER:PULSE (TDK 11385)	28480	9100-0825
T3	9100-4631	4	14	XFMR-PLS	28480	9100-4631
T4	9100-4631	4		XFMR-PLS	28480	9100-4631
T5	9100-4631	4		XFMR-PLS	28480	9100-4631
T6	9100-4631	4		XFMR-PLS	28480	9100-4631
T7	9100-4631	4		XFMR-PLS	28480	9100-4631
T8	9100-4631	4		XFMR-PLS	28480	9100-4631
T9	9100-4631	4		XFMR-PLS	28480	9100-4631
T10	9100-4631	4		XFMR-PLS	28480	9100-4631
T11	9100-4631	4		XFMR-PLS	28480	9100-4631
T12	9100-4631	4		XFMR-PLS	28480	9100-4631
T13	9100-4631	4		XFMR-PLS	28480	9100-4631
T14	9100-4631	4		XFMR-PLS	28480	9100-4631

Table 1-20. A3 1 MHz Transducer Replaceable Parts list (4/4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
T15	9100-4631	4		XFMR-PLS	28480	9100-4631
T16	9100-4631	4		XFMR-PLS	28480	9100-4631
T17	04278-61501	2	1	COIL ASSY	28480	04278-61501
U1	1820-0471	0	4	IC INV TTL HEX 1-INP	01295	SN7406N
U2	1826-0276	5	1	IC 78L05A V RGLTR TO-92	04713	MC78L05ACP
U3	1820-1510	0	2	IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
U4	1813-0300	9	4	IC OP AMP WB	28480	1813-0300
U5	1813-0300	9		IC OP AMP WB	28480	1813-0300
U6	1820-1510	0		IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
U7	1813-0300	9		IC OP AMP WB	28480	1813-0300
U8	1820-0471	0		IC INV TTL HEX 1-INP	01295	SN7406N
U9	1820-1730	6	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U10	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U11	1820-0471	0		IC INV TTL HEX 1-INP	01295	SN7406N
U12	1820-0471	0		IC INV TTL HEX 1-INP	01295	SN7406N
U13	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U14	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
U15	1820-1568	8	1	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
U16	1813-0300	9		IC OP AMP WB	28480	1813-0300
U17	1826-0146	8	1	IC 7808 V RGLTR TO-220	04713	MC7808CP
U18	1826-0971	7	1	IC- UPC7908H	28480	1826-0971
U19	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
U20	04278-81801	7	2	MODEM HIC	28480	04278-81801
U21	04278-81801	7		MODEM HIC	28480	04278-81801
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0751	8	1	EXTR-PC BD ORN POLYC .062-IN-BD-THKNS	28480	4040-0751
	04278-00603	7	1	BOX SHIELD	28480	04278-00603
	9140-0137	1	2	INDUCTOR RF-CH-MLD 1MH 5%	28480	9140-0137
	04278-00604	8	1	BOX SHIELD	28480	04278-00604
	04278-00605	9	1	BOX SHIELD	28480	04278-00605
	04278-00606	0	1	BOX SHIELD	28480	04278-00606
	04278-00607	1	1	BOX SHIELD	28480	04278-00607
	04278-00608	2	1	BOX SHIELD	28480	04278-00608
	04278-00609	3	1	BOX SHIELD	28480	04278-00609
	04278-00610	6	1	BOX SHIELD	28480	04278-00610
	04278-00611	7	1	SHIELD	28480	04278-00611
	04278-00612	8	2	SHIELD	28480	04278-00612

NOTES

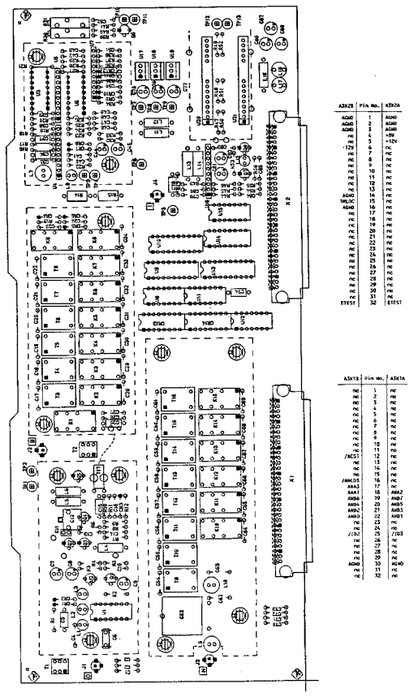
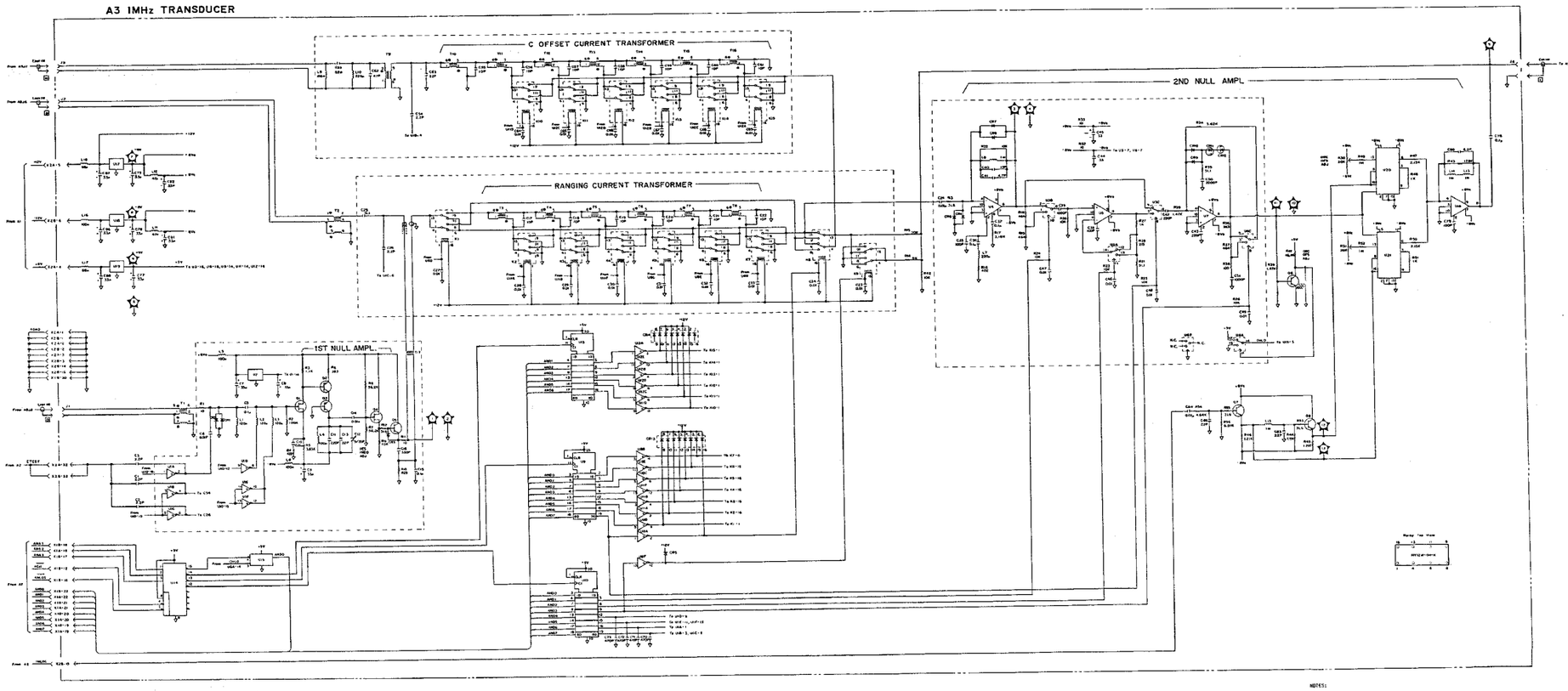


Figure 1-22. A3 Component Locations



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATION.
2. UNLESS OTHERWISE INDICATED:

   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

Figure 1-23. A3 1 MHz Transducer Schematic Diagram

A4 1 kHz TRANSDUCER BOARD SERVICE SHEET

NOTES

1-10. A4 BOARD SERVICE SHEET

1-10-1. CIRCUIT DESCRIPTION

The A4 1 kHz transducer board is divided into three sections: voltage channel circuit, current channel circuit, and voltage regulators.

[Voltage Channel Circuit]

The voltage channel circuit outputs the *EDUT* voltage, measured across the DUT, to the A5 board. The voltage difference between the Lpot Terminal and the Hpot Terminal are compared by differential amplifier A4U11, the output of which is output to the A5 board as *EDUT*.

When the oscillator level is set from 0.4 Vrms to 1.0 Vrms, the output of A4U11 is attenuated using by resistor A4R44 which is controlled by the A4U13.

[Current Channel Circuit]

The current channel circuit outputs the *ERR* voltage, which is proportional to the current through the DUT, to the A5 board. An I-V converter, as described in the block diagram discussion of this section, is used. The range resistors (one component of the I-V converter) are A4R11 to A4R17, one of which is selected by A4U6, A4U16, A4K1, and A4K2 in accordance with the measurement range selected. See Table 1-21.

Table 1-21. Measurement Range and Range Resistor

Measurement Range	Range Resistor
100 pF	800 kΩ (A4R17)
1 nF	80 kΩ (A4R16)
10 nF	8 kΩ (A4R15)
100 nF	800 Ω (A4R14)
1 µF	80 Ω (A4R13)
10 µF	8 Ω (A4R12)
100 µF	8 Ω (A4R12)

When the oscillator level is set from 0.4 Vrms to 1.0 Vrms, the signal output from the I-V converter is attenuated by resistor A4R6 which is selected by the A4U3.

[Voltage Regulators]

The voltage regulator consists of A4U4, A4U8, and A4U15. The voltage regulators regulate the unregulated voltages from the A1 Power Supply board to ± 5 V and ± 8 V. A4U4 regulates + 12 V from the A1 board + 5 V. A4U8 regulates the -12 V from the A1 board to - 5 V. A4U15 regulates the + 8 V from the A1 board to + 5 V. The ±12 V from the A1 board is also output through resistors and filtered, with a load applied the outputs are ±8 V.

1-10-2. TROUBLESHOOTING AIDS

The troubleshooting aids section provides a list of test points, and troubleshooting data. The test points are listed in Table 1-22, and the troubleshooting data is listed in Table 1-23.

1-10-3. REPLACEABLE PARTS LISTS

The A4 board is covered by the exchange assembly program. The A4 transducer replaceable parts list is shown in Table 1-24. The part number of the rebuilt exchange board is shown on the first page of the A4 replaceable parts list.

1-10-4. COMPONENT LOCATIONS

The component locations on the A4 board and pin assignments are shown in Figure 1-24.

1-10-5. SCHEMATIC DIAGRAMS

The schematic diagram of the A4 1 kHz transducer is shown in Figure 1-25.

Table 1-22. Test Points

Test Point	Signal Name	Description
A4TP1	*I/V OUT*	Output signal from the I-V converter
A4TP2	*FLT GND*	Floating ground for the I-V converter
A4TP3	*ICH*	Current channel output signal
A4TP4	*ERR*	Signal proportional to the current through the DUT
A4TP5	*VCH*	Voltage channel output signal
A4TP6	*EDUT*	Signal proportional to the voltage through the DUT
A4TP7	*GND*	Ground line

Table 1-23. Troubleshooting Data

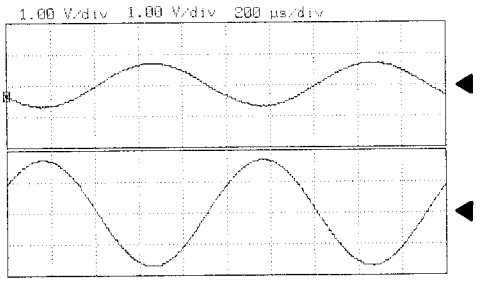
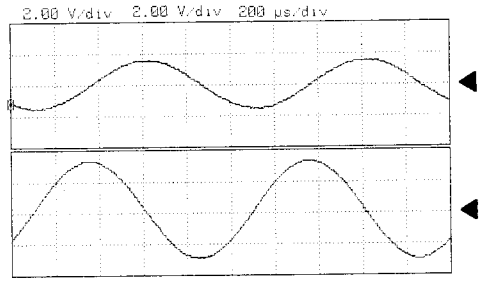
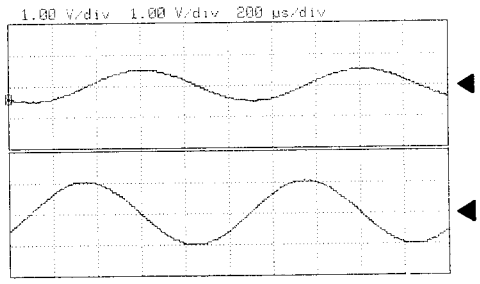
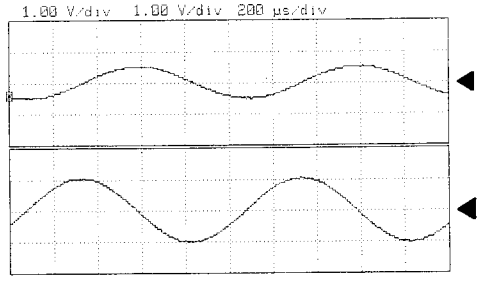
HP 4278A Settings	Measurement setup	Waveform
FREQ: 1 kHz Meas.Range: 100 pF OSC Level: 1 V DUT: 100 pF	CHAN A: A4TP1 (Connect the probe's GND to A4TP2) CHAN B: A4TP3 TRIG: CHAN A (Negative)	
FREQ: 1 kHz Meas.Range: 100 pF OSC Level: 0.9 V DUT: 100 pF	CHAN A: A4TP3 CHAN B: A4TP5 TRIG: CHAN A (Negative)	
FREQ: 1 kHz Meas.Range: 100 pF OSC Level: 0.3 V DUT: 100 pF	CHAN A: A4TP3 CHAN B: A4TP5 TRIG: CHAN A (Negative)	
FREQ: 1 kHz Meas.Range: 100 pF OSC Level: 0.3 V or 0.9 V DUT: 100 pF	CHAN A: A5TP4 CHAN B: A5TP6 TRIG: CHAN A (Negative)	

Table 1-24. A4 1 kHz Transducer Replaceable Parts List (1/2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	04278-66504	5	1	1KHz TRANSDUCER	28480	04278-66504
	04278-69504			1KHz TRANSDUCER (RE-BUILT)	28480	04278-69504
C1	0180-3363	6	12	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C2	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C3	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
C4	0160-6820	4	1	CAP 10PF 10% 50V	28480	0160-6820
C5	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C6	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C7	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C8	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C9	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C10	0180-3469	3	6	CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C11	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C12	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C13	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C14	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C15	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C16	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C17	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C18	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C19	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C20	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
CR1	1901-0376	6	4	DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
CR2	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
CR5	1902-0951	5	2	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
CR6	1901-0050	3	10	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR8	1902-0951	5		DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR13	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR14	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR15	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
J1	1250-2108	5	3	CONN-RF F	28480	1250-2108
J2	1250-2108	5		CONN-RF F	28480	1250-2108
J3	1250-2108	5		CONN-RF F	28480	1250-2108
K1	0490-1485	6	2	RELAY SW	28480	0490-1485
K2	0490-1485	6		RELAY SW	28480	0490-1485
Q1	1854-0637	1	2	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
Q2	1854-0637	1		TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
Q3	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
Q4	1853-0314	9	2	TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
Q5	1853-0314	9		TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
Q6	1854-0215	1	1	TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
R1	2100-3355	0	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	28480	2100-3355
R2	2100-3207	1	2	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
R3	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R5	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2612-F
R6	1810-1081	9	2	RES-NTWK 5K/10K	28480	1810-1081
R7	0698-8827	4	3	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
R8	2100-3207	1		RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
R9	0757-0401	0	10	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R10	0683-1065	7	1	RESISTOR 10M 5% .25W CC TC=-900/+1100	01121	CB1065
R11	0699-2210	9	1	RES 8 0.6W 0.1%	28480	0699-2210
R12	0699-2209	6	1	RES 80 0.6W .1%	28480	0699-2209
R13	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R14	0699-2208	5	1	RES 800 0.6W .1%	28480	0699-2208
R15	0699-2207	4	1	RES 8K 0.6W .1%	28480	0699-2207
R16	0699-2206	3	1	RES 80K 0.6W .1%	28480	0699-2206
R17	0699-2179	9	1	RES 800K 1/4W .1%	28480	0699-2179
R18	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R19	0698-3441	8	2	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R20	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R22	1810-1080	8	4	RES-NTWK 4K/10K	28480	1810-1080
R23	1810-1080	8		RES-NTWK 4K/10K	28480	1810-1080
R24	0757-0463	4	1	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8252-F
R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F

Table 1-24. A4 1 kHz Transducer Replaceable Parts List (2/2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R26	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R27	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R28	0698-3430	5	6	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
R29	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
R30	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
R31	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R32	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
R33	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
R34	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R36	0757-0397	3	4	RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
R37	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
R38	0683-0475	1	4	RESISTOR 4.7 5% .25W CF TC=0-400	01121	CB47G5
R39	0683-0475	1		RESISTOR 4.7 5% .25W CF TC=0-400	01121	CB47G5
R40	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R41	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
R42	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R43	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R44	PPNR11171	7		RES-NTWK 5K/10K	28480	PPNR11171
R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R46	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
R47	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R48	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2612-F
R49	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R50	1810-1080	6		RES-NTWK 4K/10K	28480	1810-1080
R51	0698-0082	7	2	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R52	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R53	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
R54	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
R55	0683-0475	1		RESISTOR 4.7 5% .25W CF TC=0-400	01121	CB47G5
R56	0683-0475	1		RESISTOR 4.7 5% .25W CF TC=0-400	01121	CB47G5
R57	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R58	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
R59	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R60	1810-0126	1	1	NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
R61	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R62	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
R63	1810-1080	6		RES-NTWK 4K/10K	28480	1810-1080
R64	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R65	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
R66	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
U1	1826-0519	9	3	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U3	1826-1282	5	2	ANALOG SWITCH 4 SPST 16 -DIP-P	34371	HI3-0201 B3053-047
U3	1826-1328	0	2	IC OP AMP LOW-NOISE DUAL 8-DIP-P PKG	28480	1826-1328
U4	1826-0146	8	1	IC 7808 V RGLTR TO-220	04713	MC7808CP
U5	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U6	1820-1546	2	2	ANALOG MULTIPLEXER 4 CHNL 16 -CERDIP	04713	MC14052BCL
U7	1826-0521	3	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	01295	TL072CP
U8	1826-0971	7	1	IC- UPC7908H	28480	1826-0971
U9	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
U10	1820-1997	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	34335	AM74LS374AP
U11	1826-1328	0		IC OP AMP LOW-NOISE DUAL 8-DIP-P PKG	28480	1826-1328
U12	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	34335	AM74LS374AP
U13	1826-1282	5		ANALOG SWITCH 4 SPST 16 -DIP-P	34371	HI3-0201 B3053-047
U14	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U15	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
U16	1820-1546	2		ANALOG MULTIPLEXER 4CHNL 16 -CERDIP	04713	MC14052BCL
	1205-0095	0	4	HEAT SINK SGL TO-5/TO-39-CS	30161	3225B
	1205-0318	0	2	HEAT SINK SGL TO-220-CS	28480	1205-0318
	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0752	9	1	EXTR-PC BD YEL POLYC .062-IN-BD-THKNS	28480	4040-0752

NOTES

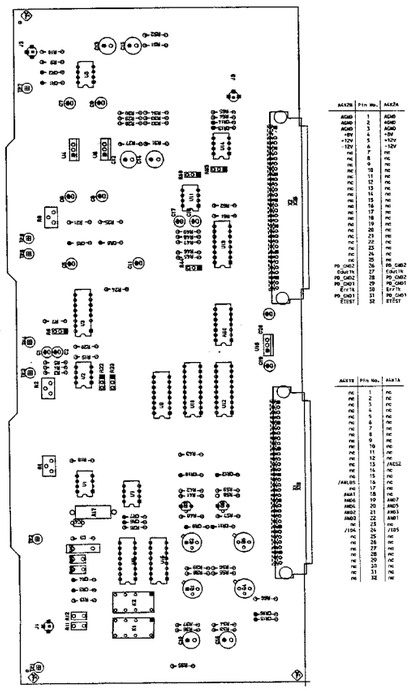
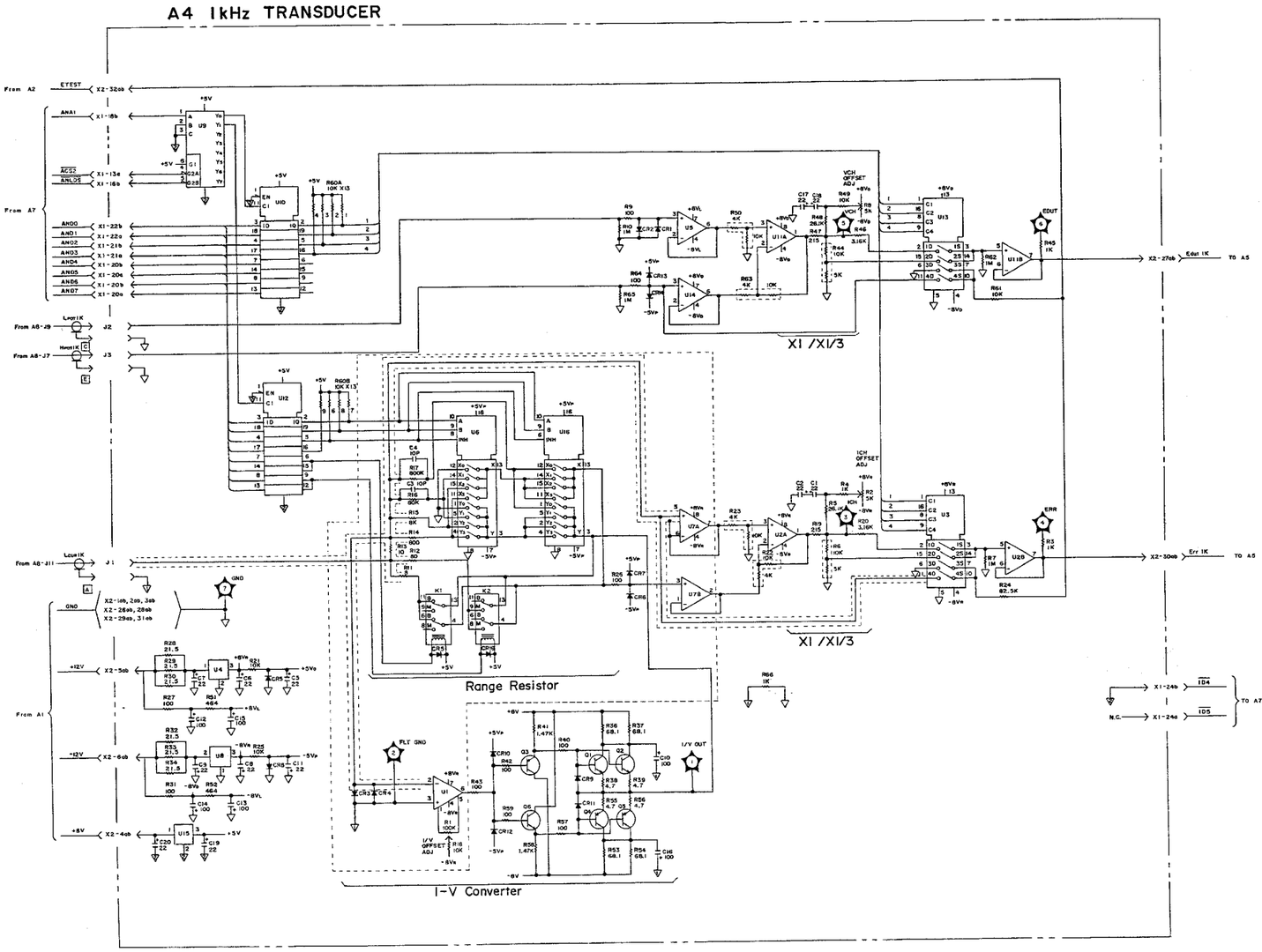


Figure 1-24. A4 1 kHz Transducer Component Locations



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:

   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (uF)
   INDUCTANCE IN MICROHENRIES (uH)

Figure 1-25. A4 1 kHz Transducer Schematic Diagram

A5 PHASE DETECTOR BOARD SERVICE SHEET

NOTES

1-11. A5 BOARD SERVICE SHEET

1-11-1. CIRCUIT DESCRIPTION

The A5 Switching Matrix/Phase Detector board consists of the phase detectors, the double wave detector circuits, the detection phase generator, the switching matrix circuit, and the voltage regulators.

[Phase Detectors]

The phase detectors consist of Hybrid ICs (HICs) A5U3 through A5U5, A5U11 through A5U13, A5U19 through A5U21, and A5U28 through A5U30. Each HIC contains one phase detector, and so there are twelve phase detectors. Three paralleled phase detectors are used to phase detect one of the four components (the inphase and 90° components of *Edut* and *Err*), and each phase detector is controlled by its own reference phase signal from the detection phase generator. See Figure 1-26.

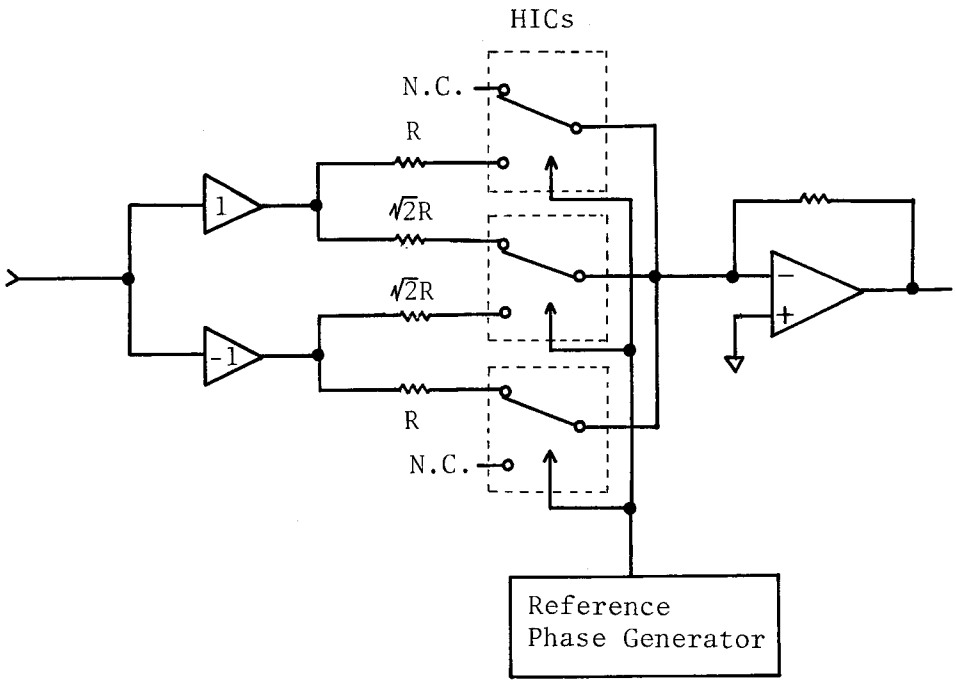


Figure 1-26. Three Paralleled Phase Detectors

[Double Wave Detector]

The double wave detector circuit consists of A5T2 and A5T4. The transformers receive the *Err* and *Edut* signals, and outputs the *0°* and *180°* signal to the phase detector (Refer to Figure 1-27).

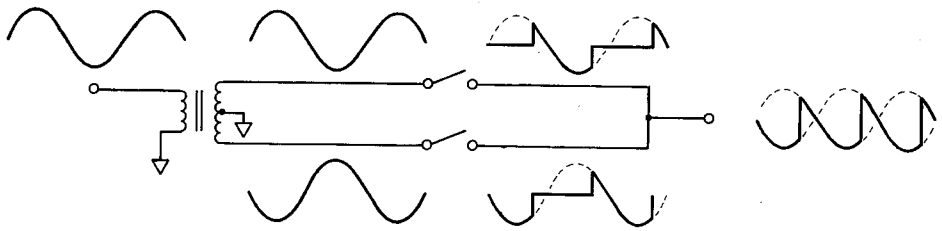
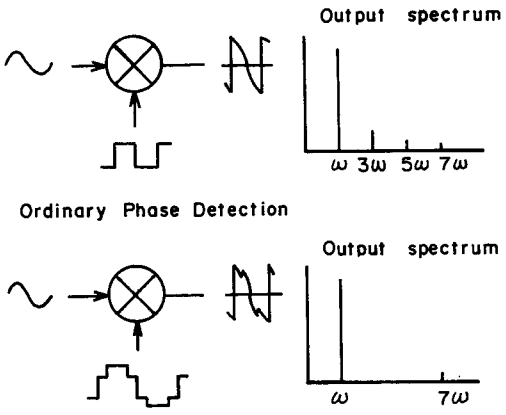


Figure 1-27. Double Wave Phase Detection Example

[Detection Phase Generator]

The detection phase generator consists of shift registers A5U6, A5U7, A5U14, A5U15, A5U22, and A5U23. The detection phase generator generates the reference signals used to phase detect the inphase and 90° components of the *Err* and *Edut* signals. The reference signals generated by the A5U6, A5U7, and A5U15 are the reference signals used to phase detect the inphase components of *Err* and *Edut*, and the reference signals generated by A5U14, A5U22, and A5U23 are the reference signals used to phase detect the 90° components of *Err* and *Edut*. These shift registers are clocked by the *SRG_CLK* signal from the A6 board. If each of the three phase detected signals are summed, a digital sine wave is produced, see Figure 1-28. Using such a phase detection signals significantly reduces the amplitude of the third and fifth harmonics in the output of the phase detector.



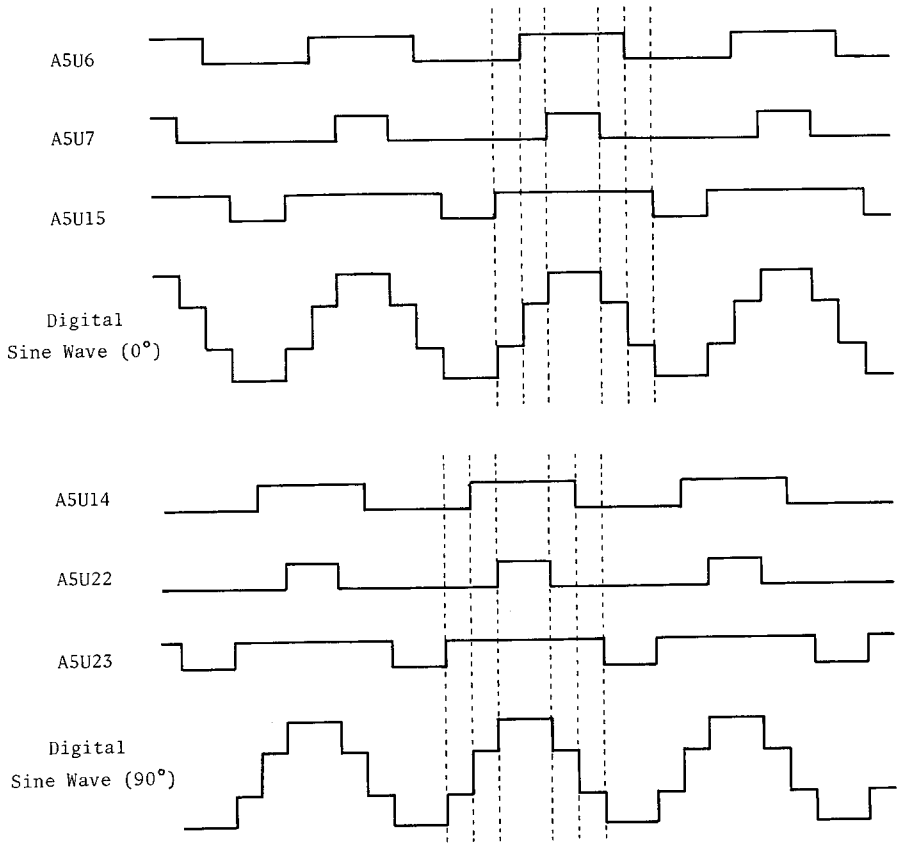


Figure 1-28. Reference Signals of the Detection Phase Generator

[Switching Matrix Circuit]

The switching matrix circuit consists of A5K1 through A5K4, and A5Q1 through A5Q12. The switching matrix circuit is used to connect the *Err* voltage line to one of the two double wave detectors, and to connect the *Edet* voltage line to the other double wave detector. The switching matrix is controlled by A5U32.

[Voltage Regulators]

The voltage regulators consist of A5U33, A5U34, and A5U35. The voltage regulators regulate the unregulated voltage from the A1 board to + 5 V and ± 15 V. A5U33 regulates + 8 V from the A1 board to + 5 V. A5U34 regulates + 15 V from the A1 board to + 12 V. A5U35 regulates - 15 V from the A1 board to - 12 V.

1-11-2. TROUBLESHOOTING AIDS

The troubleshooting aids section for the A5 board provides a list of jumpers, a list of test points, and troubleshooting data. The jumpers are listed in Table 1-25, the test points are listed in Table 1-26, and the troubleshooting data is listed in Table 1-27.

Table 1-25. Jumper List

Reference Designator	Description	Use
A5W1 A5W2	Phase Detector Input Signal	**Normal Position:** Connects the *Err* and *Edet* signals to the phase detector. **Test Position:** Connects the 12 V to the phase detector.
A5W3	Shift Register Clock	**Normal Position:** Connects the shift register clock (*SRG_CLK*) to the shift registers. **Test Position:** Connects the *8F* (8 MHz) signal to the shift registers.

Table 1-26. Test Point List

Test Point	Signal Name	Description
A5TP1	*ACH*	A channel output signal
A5TP2	*0A*	Phase detected signal (0A)
A5TP3	*90A*	Phase detected signal (90A)
A5TP4	*0B*	Phase detected signal (0B)
A5TP5	*90B*	Phase detected signal (90B)
A5TP6	*LOAD*	Shift register load signal
A5TP7	*GND*	Ground line
A5TP8	*GND*	Ground line
A5TP9	*BCH*	B channel output signal
A5TP10	*GND*	Ground line
A5TP11	*+ 5*	+ 5 V DC
A5TP12	*+12*	+ 12 V DC
A5TP13	*-12*	- 12 V DC
A5TP14	*GND*	Ground line

Table 1-27. Troubleshooting Data (1/2)

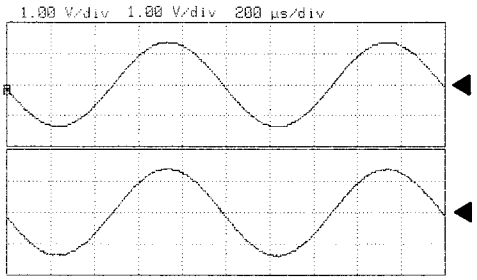
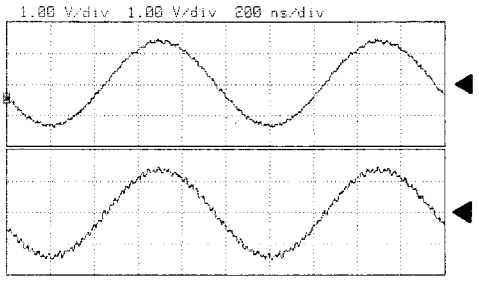
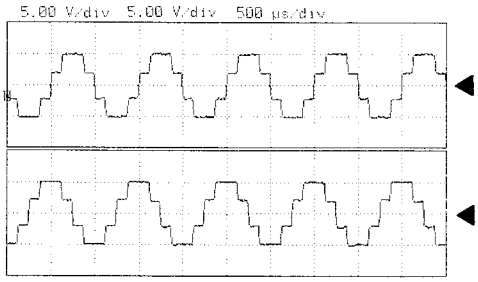
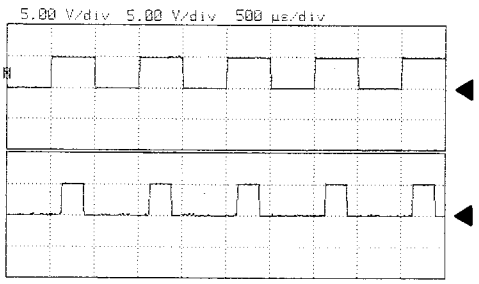
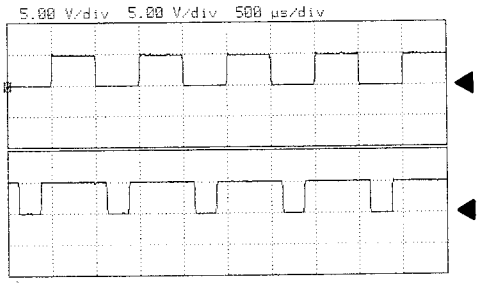
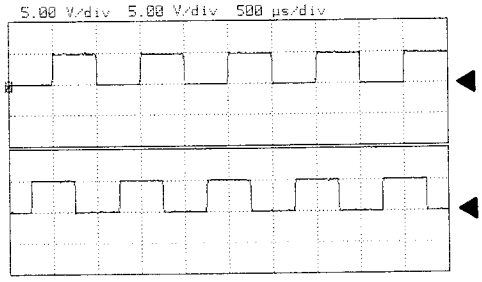
HP 4278A Settings	Measurement Setup	Waveform
Selftest = 6	CHAN A: A5TP1 CHAN B: A5TP9 TRIG: CHAN A (Negative)	
Selftest = 7	CHAN A: A5TP1 CHAN B: A5TP9 TRIG: CHAN A (Negative)	
A5W1: Test Position A5W2: Test Position Display: "ANALOG TEST(1kHz) FAILED"	CHAN A: A5TP2 or A5TP4 CHAN B: A5TP3 or A5TP5 TRIG: CHAN A (Negative)	
FREQ: 1 kHz TRIG: EXT.TRIG	CHAN A: A5U6 pin 9 or A5U14 pin 9 CHAN B: A5U7 pin 9 or A5U22 pin 9 TRIG: CHAN A (Negative)	

Table 1-27. Troubleshooting Data (2/2)

HP 4278A Settings	Measurement Setup	Waveform
FREQ: 1 kHz TRIG: EXT.TRIG	CHAN A: A5U6 pin 9 or A5U14 pin 9 CHAN B: A5U15 pin 9 or A5U23 pin 9 TRIG: CHAN A (Negative)	
FREQ: 1 kHz TRIG: EXT.TRIG	CHAN A: A5U6 pin 9 CHAN B: A5U14 pin 9 TRIG: CHAN A (Negative)	

1-11-3. REPLACEABLE PARTS LISTS

The A5 board is covered by the exchange assembly program. The replaceable parts of the A5 board are listed in Table 1-28. The part number for a rebuilt A5 exchange board is listed on the first page of the A5 board replaceable parts list.

1-11-4. COMPONENT LOCATIONS

The A5 board component locations and the board connector pin assignments are shown in Figure 1-29.

1-11-5. SCHEMATIC DIAGRAMS

The A5 board schematic diagram is shown in Figure 1-30.

Table 3-23. A5 Board Replaceable Parts List (1/4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	04278-66505	6	1	SW MTX/PHASE DET	28480	04278-66505
	04278-69505			SW MTX/PHASE DET (RE-BUILT)	28480	04278-69505
C1	0160-4830	2	1	CAPACITOR-FXD 2200PF +-10% 100VDC CER	28480	0160-4830
C3	0160-4805	1	2	CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30	28480	0160-4805
C4	0160-4810	8	4	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C5	0160-4810	8		CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C6	0160-4808	4	10	CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C7	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C8	0160-4833	5	4	CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
C9	0180-3363	6	21	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C10	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C11	0160-4822	2	4	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C12	0160-6561	0	8	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C13	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C14	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C16	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C17	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C18	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C19	0160-4812	0	2	CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
C20	0160-4833	5		CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
C21	0160-5139	6	2	CAPACITOR-FXD .033UF +-5% 100VDC POLYP	28480	0160-5139
C22	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C23	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C24	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C25	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C26	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C27	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C28	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C29	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C31	0160-4805	1		CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30	28480	0160-4805
C32	0160-4810	8		CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C33	0160-4810	8		CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C34	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C35	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C36	0160-4833	5		CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
C37	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C38	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C39	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C40	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C41	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C42	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C43	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C45	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C46	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C47	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C48	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
C49	0160-4833	5		CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
C50	0160-5139	6		CAPACITOR-FXD .033UF +-5% 100VDC POLYP	28480	0160-5139
C51	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
C52	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C53	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C54	0180-3469	3	3	CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C55	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C56	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
C57	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C58	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C59	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C60	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C61	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C62	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C63	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C64	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C65	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
CR1	1901-0040	1	8	DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
CR5	1902-0951	5	2	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
CR6	1902-0951	5		DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
CR9	1901-0050	3	2	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

Table 3-23. A5 Board Replaceable Parts List (2/4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
J1	1250-2108	5	3	CONN-RF F	28480	1250-2108
J2	1250-2108	5		CONN-RF F	28480	1250-2108
J3	1250-2108	5		CONN-RF F	28480	1250-2108
J7	1258-0141	8	3	JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
J8	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
J9	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
K1	0490-1477	6	4	RELAY	28480	0490-1477
K2	0490-1477	6		RELAY	28480	0490-1477
K3	0490-1477	6		RELAY	28480	0490-1477
K4	0490-1477	6		RELAY	28480	0490-1477
L1	9100-1629	4	4	INDUCTOR RF-CH-MLD 47UH 5%	28480	9100-1629
L2	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5%	28480	9100-1629
L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5%	28480	9100-1629
L4	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5%	28480	9100-1629
L5	9100-3139	5	3	INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
L6	9100-3139	5		INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
L7	9100-3139	5		INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
Q2	1853-0036	2	4	TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
Q5	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
Q8	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
Q11	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
R1	0757-0465	6	18	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R2	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R3	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	5033R-1/8-T0-9091-F
R4	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
R5	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R6	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R7	0698-3162	0	6	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
R8	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
R9	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
R10	0757-0442	9	14	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R11	0757-0346	2	18	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R12	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
R13	0698-6360	6	20	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R14	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R15	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R16	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R17	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R18	0698-6619	8	4	RESISTOR 15K .1% .125W F TC=0+-25	28480	0698-6619
R19	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R20	0699-2180	2	8	RES 14.14K 0.1%	28480	0699-2180
R21	0699-2180	2		RES 14.14K 0.1%	28480	0699-2180
R22	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R23	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R24	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R25	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R26	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R27	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R28	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R30	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R31	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R32	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R33	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R35	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R36	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R37	0698-6943	1	2	RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
R38	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R39	0698-6619	8		RESISTOR 15K .1% .125W F TC=0+-25	28480	0698-6619
R40	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R41	0699-2180	2		RES 14.14K 0.1%	28480	0699-2180
R42	0699-2180	2		RES 14.14K 0.1%	28480	0699-2180
R43	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R44	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R45	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R46	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R47	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R48	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R49	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R50	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F

Table 3-23. A5 Board Replaceable Parts List (3/4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R51	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R52	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R53	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R54	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
R55	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
R56	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
R57	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R58	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
R59	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R60	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R61	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R62	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R63	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R64	0698-6619	8		RESISTOR 15K .1% .125W F TC=0+-25	28480	0698-6619
R65	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R66	0699-2180	2		RES 14.14K 0.1%	28480	0699-2180
R67	0699-2180	2		RES 14.14K 0.1%	28480	0699-2180
R68	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R69	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R70	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R71	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R72	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R73	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R74	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R75	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
R76	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
R77	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R78	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R79	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R80	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R81	0698-6943	1		RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
R82	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R83	0698-6619	8		RESISTOR 15K .1% .125W F TC=0+-25	28480	0698-6619
R84	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R85	0699-2180	2		RES 14.14K 0.1%	28480	0699-2180
R86	0699-2180	2		RES 14.14K 0.1%	28480	0699-2180
R87	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R88	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R89	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R90	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R91	1810-0126	1	2	NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
R92	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R93	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R94	1810-0126	1		NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
R95	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
R96	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R98	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R99	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R100	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
T1	9100-0823	8	2	TRANSFORMER(TDK113B1) 1:1:1	28480	9100-0823
T2	9100-0820	5	2	TRANSFORMER:PULSE	28480	9100-0820
T3	9100-0823	8		TRANSFORMER(TDK113B1) 1:1:1	28480	9100-0823
T4	9100-0820	5		TRANSFORMER:PULSE	28480	9100-0820
U1	1813-0299	5	2	IC WIDEBAND AMPL H-SLEW-RATE	28480	1813-0299
U1	1855-0091	3	8	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
U2	1826-0519	9	6	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U3	04194-81804	9	12	HIC PHASE DET	28480	04194-81804
U3	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
U4	04194-81804	9		HIC PHASE DET	28480	04194-81804
U4	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
U5	04194-81804	9		HIC PHASE DET	28480	04194-81804
U6	1820-1975	1	6	IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165AN
U6	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
U7	1820-1975	1		IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165AN
U7	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
U8	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U9	1826-0521	3	2	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	01295	TL072CP
U9	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
U10	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U10	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
U11	04194-81804	9		HIC PHASE DET	28480	04194-81804
U12	04194-81804	9		HIC PHASE DET	28480	04194-81804
U12	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
U13	04194-81804	9		HIC PHASE DET	28480	04194-81804
U14	1820-1975	1		IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165AN
U15	1820-1975	1		IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165AN
U16	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
U17	1813-0299	5		IC WIDEBAND AMPL H-SLEW-RATE	28480	1813-0299

Table 3-23. A5 Board Replaceable Parts List (4/4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
U18	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U19	04194-81804	9		HIC PHASE DET	28480	04194-81804
U20	04194-81804	9		HIC PHASE DET	28480	04194-81804
U21	04194-81804	9		HIC PHASE DET	28480	04194-81804
U22	1820-1975	1		IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165AN
U23	1820-1975	1		IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165AN
U24	1826-0138	8	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
U25	1826-0521	3		IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	01295	TL072CP
U26	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U27	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
U28	04194-81804	9		HIC PHASE DET	28480	04194-81804
U29	04194-81804	9		HIC PHASE DET	28480	04194-81804
U30	04194-81804	9		HIC PHASE DET	28480	04194-81804
U31	1820-2657	8	1	IC GATE TTL ALS OR QUAD 2-INP	01295	SN74ALS32N
U32	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U33	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
U34	1826-0147	9	1	IC 7812 V RGLTR TO-220	04713	MC7812CP
U35	1826-0221	0	1	IC V RGLTR TO-220	04713	MC7912CT
W1	1251-4822	6	3	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
W2	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
W3	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
X1	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
X2	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	1400-1334	6	2	CLAMP-CABLE STL	28480	1400-1334
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS	28480	4040-0753
	04278-00616	2	1	SHIELD	28480	04278-00616
	04278-00617	3	1	SHIELD	28480	04278-00617
	04278-00618	4	2	SHIELD	28480	04278-00618
	04278-00619	5	1	SHIELD	28480	04278-00619
	04278-61625	1	2	RF CBL ASSY (SHORT)	28480	04278-61625
	04278-61627	3	1	RF CBL ASSY (MID)	28480	04278-61627
	04278-61628	4	1	RF CBL ASSY (LONG)	28480	04278-61628

NOTES

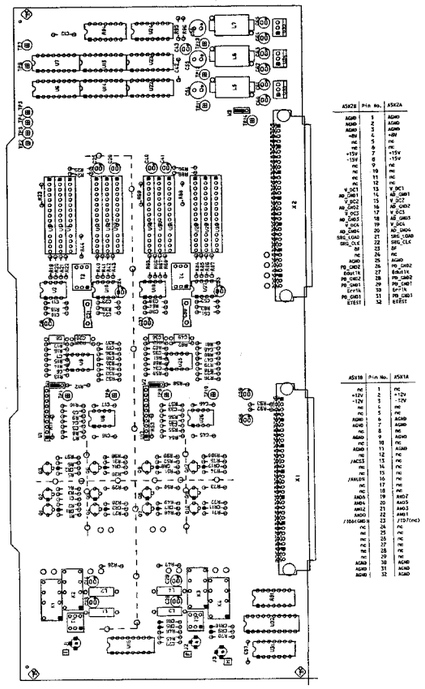
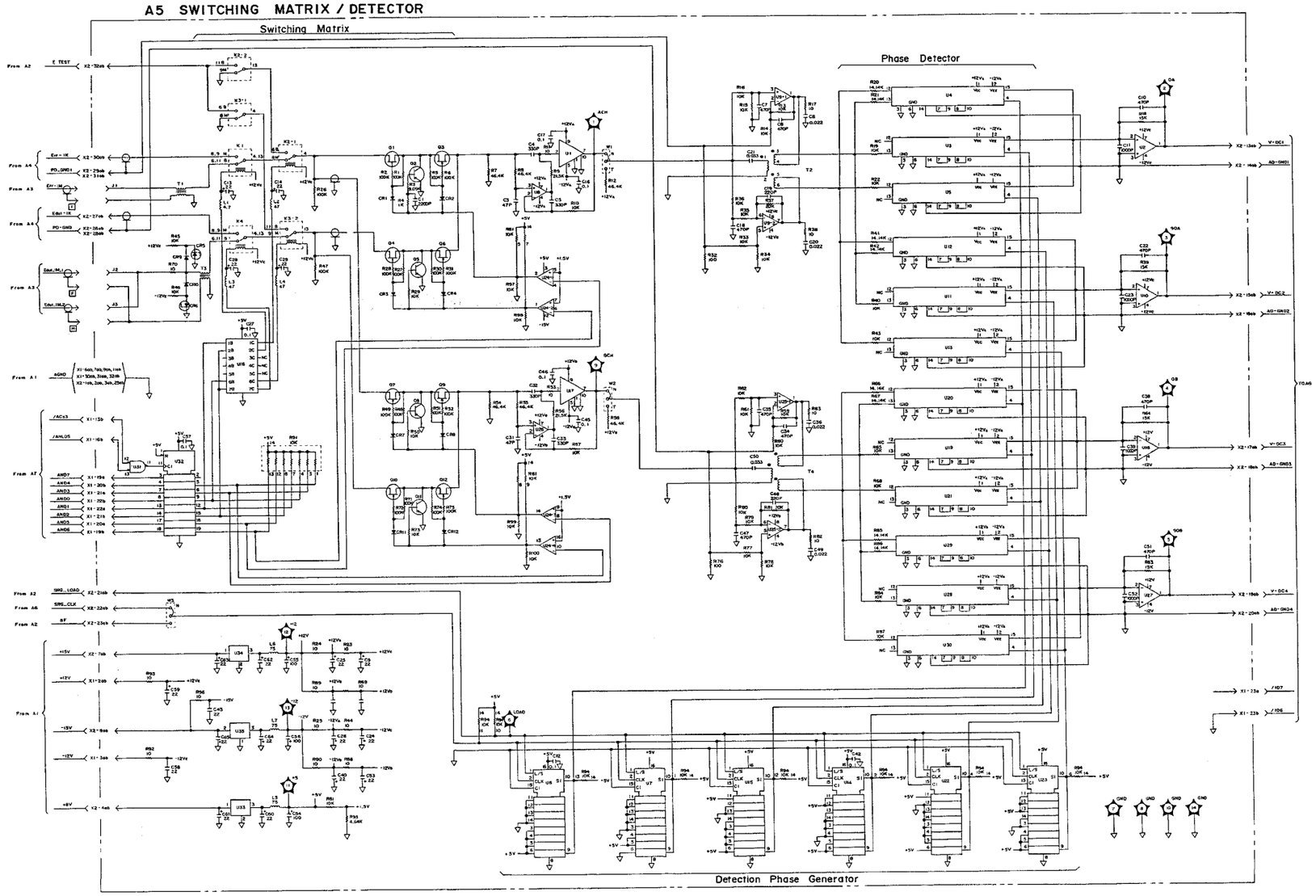


Figure 3-15. A5 Switching Matrix/Phase Detector Component Locations



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

Figure 1-30. A5 Switching Matrix / Phase Detector Schematic Diagram

A6 A-D CONVERTER BOARD SERVICE SHEET

NOTES

1-12. A6 BOARD SERVICE SHEET

1-12-1. CIRCUIT DESCRIPTION

The A6 A-D Converter board consists of the A-D converter, the A-D counter, the phase shifter, and the voltage regulators.

[A-D Converter]

The simplified circuit diagram of a multi-slope A-D converter is shown in Figure 1-31. The multi-slope A-D converter contains an offset current source, an integrator and three comparators, a coarse gate and current source, a fine gate and current source.

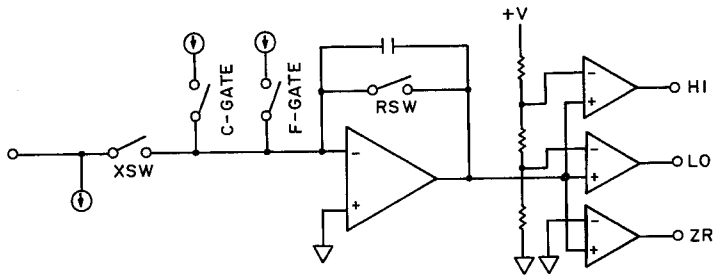


Figure 1-31. Multi-Slope A-D Converter

The offset current source offsets the A5's phase detected output signal by one-half of the full-scale range. This make it always possible to maintain one polarity, even though the input signal is bipolar. The offset current is approximately -450 µA. Then the formula used to determine the offset current is:

$$\text{Offset Current} = -V_R / \text{Roc}$$

Where,

V_R: - 9 V

Roc: 20 kΩ (A6R7, A6R12, A6R61, and A6R66)

The integrator integrates the A5's phase detected signal. Three comparators (HI, LO, ZR) are used to detect the level of the integrated DC voltage. The HI comparator's limit is set to determine if the integrator output is 1.2 V or greater. The LO comparator's limit is set to determine if the integrator output is less than 0.1 V. The ZR comparator is set to determine if the integrator output voltage is positive.

There are four hybrid ICs (HICs) in the 4278A (A6U19, A6U20, A6U29, and A6U30). Each HIC contains one integrator and three comparators.

The coarse current source discharges the integrator capacitor till LO comparator detects that it has discharged to the LO limit ($\leq$ 0.1 V) level. The coarse current is approximate 900 µA. The formula used to determine the coarse current is:

$$\text{Coarse Current} = +V_R / Rcc$$

Where,

V_R: 9 V

Rcc: 10 kΩ (A6R21, A6R30, A6R44, and A6R53)

The coarse gate synchronizes the turning ON and OFF of the coarse counter to coincide with switching of the coarse current input to the integrator. Then each coarse gate works using the coarse gate signals (*CGT0A*, *CGT90A*, *CGT0B*, and *CGT90B*).

The fine current source discharges the integrator capacitor to 0V from the time the LO comparator detects that the integrator's output has reached $\leq$ 0.1 V at the end of the unknown integration. The fine current is approximate 7 µA. The formula to determine the fine current is:

$$\text{Fine Current} = + V_R / Rfc$$

where,

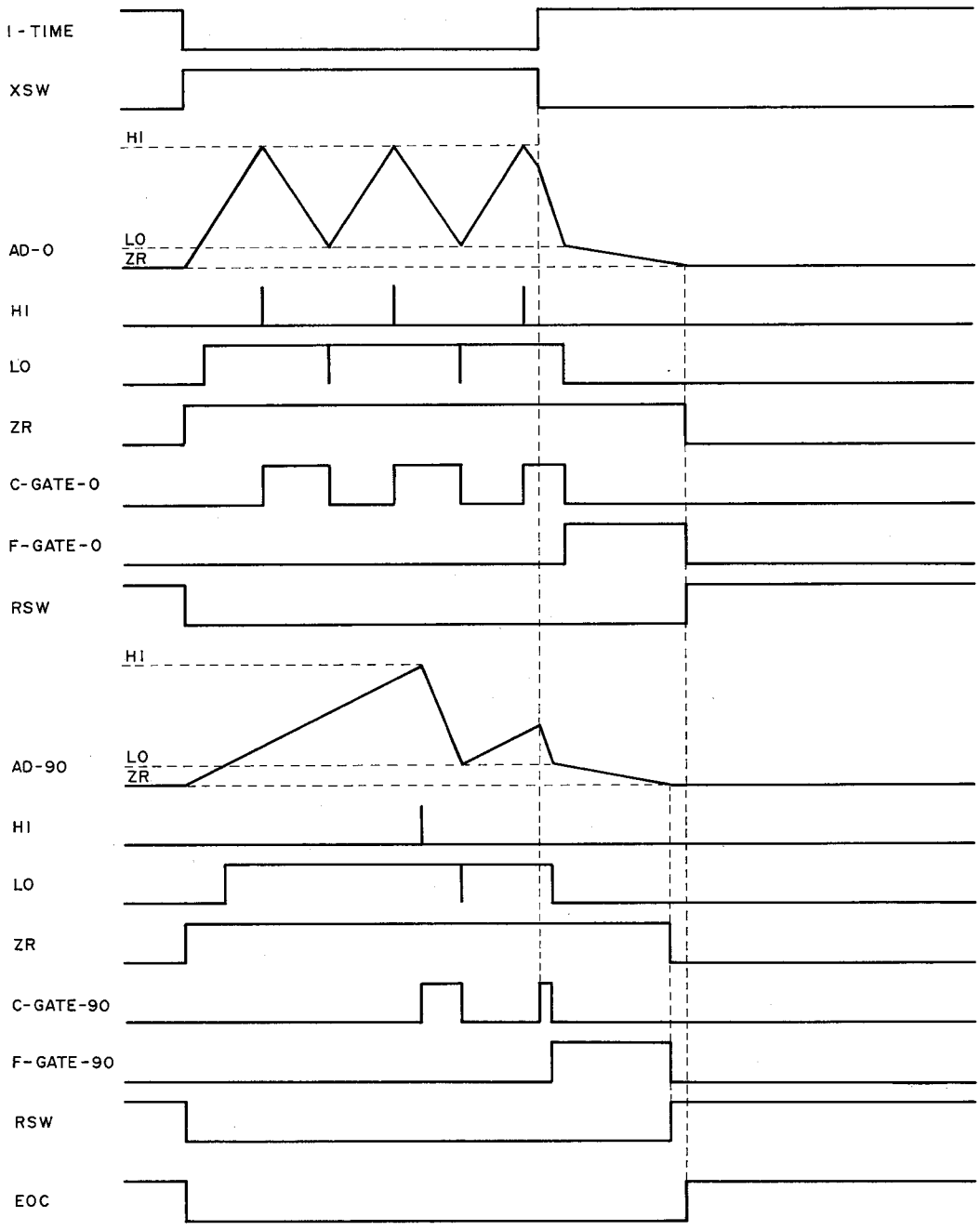
V_R: 9 V

Rfc: 1.28 MΩ (A6R20, A6R31, A6R43, and A6R54)

The ratio of the coarse current source output and the fine current source output is 128:1, so one coarse count is 128 fine counts. The fine gate synchronizes the turning ON and OFF of the fine counter to coincide with switching of the fine current input to the integrator. The fine gates are controlled by fine gate signals (*FGT0A*, *FGT90A*, *FGT0B*, and *FGT90B*).

The A-D Converter Timing Diagram is shown in Figure 1-32.

When switch XSW is turned ON, the integrator's output starts ramping up to +1.2 V. When the integrator's output reaches the HI comparator's limit, the coarse gate is turned ON to start the integrator ramping down until the integrator's output reaches LO comparator's limit. The coarse counter is enabled while the coarse gate is ON. When the integrator's output reaches the LO comparator's limit, the coarse gate is turned OFF to start the integrator ramping back up to +1.2 V. This action is repeated for the duration of the integration. At the end of the integration of the unknown value, switch XSW switch is turned OFF, and the coarse gate is turned ON until the integrator's output reaches the LO comparator's limit. Once the integrator reaches the LO limit, the coarse gate is turned OFF and the fine gate is turned ON (the fine counter counts while the fine gate is ON) to bring the integrator's output to 0 V. The sum of the coarse and fine counts constitutes the measured value. After the A-D conversion, switch RSW is turned ON because the integrator's output voltage is held at 0 V.



Critical timing is shown below.

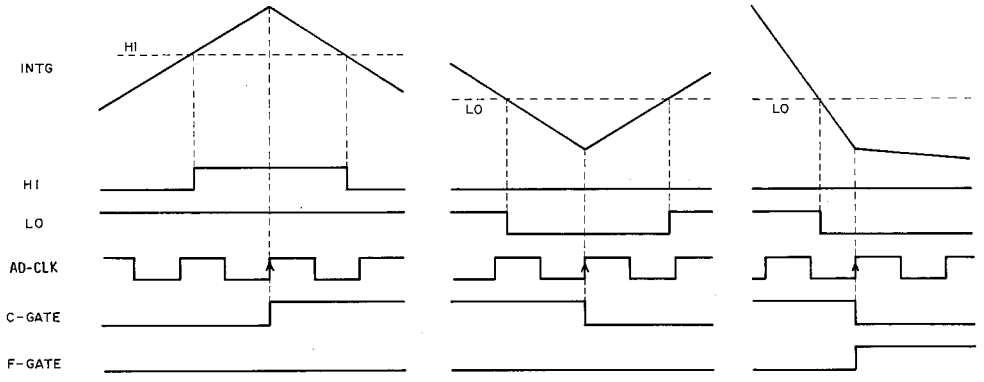


Figure 1-32. A-D Converter Timing Chart

The relationship between the **INTEG.TIME** (in the HP 4278A softkey) and the multi-slope A-D converter operation in Table 1-29.

Table 1-29. INTEG.TIME and A-D Converter Operation

INTEG.TIME	A-D Conversion Operation		
	A-D Converter	Integration Time	Number of Integrations
SHORT	A6U30(0A) A6U20(90A) A6U19(0B) A6U29(90B)	1 ms 1 ms 1 ms 1 ms	1 1 1 1
MEDIUM	A6U30(0A) A6U20(90A) A6U19(0B) A6U29(90B)	2 ms 2 ms 2 ms 2 ms	2 2 2 2
LONG	A6U30(0A) A6U20(90A) A6U19(0B) A6U29(90B)	1 ms 1 ms 1 ms 1 ms	8 8 8 8

[A-D Counter]

The A-D counter consists of A6U14, A6U15, and A6U16. The A-D counter receives the coarse gate signal and the fine gate signal, and the AD_CLK signal (the original signal name is $4M$) as the counter clock. The A-D counter counts the discharge time which is the total time in which the coarse gate and fine gate signals are set to HIGH. Then the A6U14 A-D counter outputs the $I\text{-}TIME$ signal, and during the integration period, the $I\text{-}TIME$ signal goes LOW.

[Phase Shifter]

The phase shifter consisting of A6U4 through A6U10 creates the shift register clock signal (*SRG_CLK*) for the detection phase generators on the A5 board. The detection phase is shifted using *SRG_CLK*, so the detection phase generators still maintain a 90 ° phase difference. The *SRG_CLK* signal is generated from the *8F* signal by hexadecimal counter A6U26.

[Voltage Regulator]

The voltage regulators consist of A6U11, A6U12, A6U32, and A6U33. The voltage regulator regulates the unregulated voltages from the A1 Power Supply board to + 5 V and ± 12 V. A6U11 and A6U12 regulates + 8 V from the A1 board to + 5 V. A6U32 regulates - 15 V from the A1 board to - 12 V. A6U33 regulates + 15 V from the A1 board to + 12 V.

1-12-2. TROUBLESHOOTING AIDS

The troubleshooting aids section for the A6 board provides a list of jumpers, a list of test points, and troubleshooting data. The jumpers are listed in Table 1-30, the test points are listed in Table 1-31, and the troubleshooting data is listed in Table 1-32.

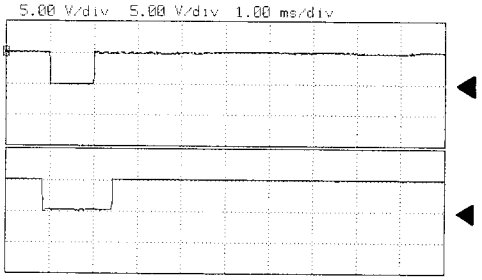
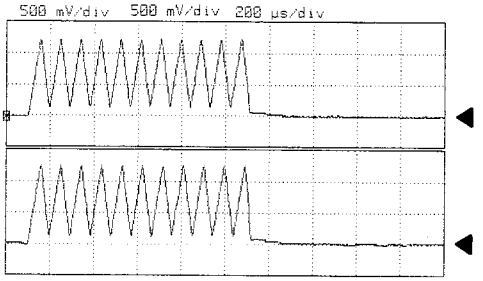
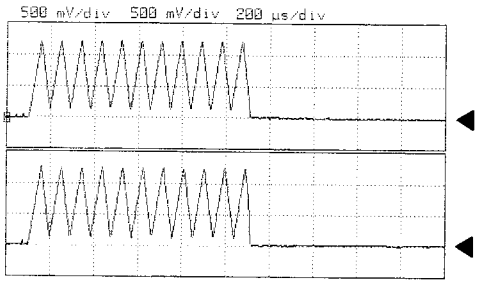
Table 1-30. Jumper List

Reference Designator	Description	Use
A6W1 A6W2 A6W3 A6W4	Zero Comparator Signal	**Normal Position:** Connects the zero comparator's output signal to the PAL. **Test Position:** Connects 0 V to the PAL. This is used when the zero comparator is not functional.

Table 1-31. Test Point List

Test Point	Signal Name	Description
A6TP1	*GND*	Ground line
A6TP2	*MEAS*	Measurement Start Signal
A6TP3	*90B*	A-D converter output signal (90B)
A6TP4	*0B*	A-D converter output signal (0B)
A6TP5	*90A*	A-D converter output signal (90A)
A6TP6	*0A*	A-D converter output signal (0A)
A6TP7	*IT*	Integration Time signal
A6TP8	*+ 5*	+ 5 V (b)
A6TP9	*+ 5*	+ 5 V dc (a)
A6TP10	*- 12*	- 12 V dc
A6TP11	*+ 12*	+ 12 V dc

Table 1-32. Troubleshooting Data

HP 4278A Settings	Measurement Setup	Waveform
Selftest = 8	CHAN A: A6TP7 CHAN B: A6TP2 TRIG: CHAN A (Negative)	
Selftest = 8	CHAN A: A6TP3 or A6TP5 CHAN B: A6TP4 or A6TP6 TRIG: A6TP7 (Negative)	
Selftest = 8 A6W1: Test Position A6W2: Test Position A6W3: Test Position A6W4: Test Position	CHAN A: A6TP3 or A6TP5 CHAN B: A6TP4 or A6TP6 TRIG: A6TP7 (Negative)	

1-13-3. REPLACEABLE PARTS LISTS

The A6 board is covered by the exchange assembly program. The A6 board replaceable parts are listed in Table 1-33. The part number of the A6 rebuilt exchange board is listed on the first page of the A6 board replaceable parts list.

1-13-4. COMPONENT LOCATIONS

The component locations and the board connector pin assignments are shown in Figure 1-33.

1-13-5. SCHEMATIC DIAGRAMS

The A6 board schematic diagram is shown in Figure 1-34.

Table 1-33. A6 A-D Converter Replaceable Parts List (1/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A6						
A6	04278-66506	7	1	A-D CONVERTER	28480	04278-66506
	04278-69506			A-D CONVERTER (RE-BUILT)	28480	04278-69506
A6C1	0160-6561	0	15	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C2	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C3	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C4	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C5	0180-3469	3	4	CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
A6C6	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C7	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C8	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C9	0180-3363	6	7	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A6C10	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A6C11	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A6C12	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C13	0160-6341	4	4	CAPACITOR-FXD 0.018U 100V	28480	0160-6341
A6C14	0160-6341	4		CAPACITOR-FXD 0.018U 100V	28480	0160-6341
A6C15	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C16	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C17	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C18	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
A6C19	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C20	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C21	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C22	0160-6341	4		CAPACITOR-FXD 0.018U 100V	28480	0160-6341
A6C23	0160-6341	4		CAPACITOR-FXD 0.018U 100V	28480	0160-6341
A6C24	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A6C25	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
A6C26	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
A6C27	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A6C28	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A6C29	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A6C30	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A6CR1	1901-0040	1	6	DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A6CR2	1901-1011	8	4	DIODE-ARRAY 25MA VF DIFF=5MV	28480	1901-1011
A6CR3	1901-1040	3	2	DIODE-PWR RECT 100V 30A 1US DO-5	28480	1901-1040
A6CR4	1901-1040	3		DIODE-PWR RECT 100V 30A 1US DO-5	28480	1901-1040
A6CR5	1901-1011	8		DIODE-ARRAY 25MA VF DIFF=5MV	28480	1901-1011
A6CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A6CR7	1902-0786	4	1	DIODE-ZNR 1N937 9V 5% DO-7 PD=.5W	24046	1N937
A6CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A6CR9	1901-1011	8		DIODE-ARRAY 25MA VF DIFF=5MV	28480	1901-1011
A6CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A6CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A6CR12	1901-1011	8		DIODE-ARRAY 25MA VF DIFF=5MV	28480	1901-1011
A6CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A6J1	1251-4822	6	4	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A6J2	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A6J3	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A6J4	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822

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

Table 1-33. A6 A-D Converter Replaceable Parts List (2/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A6L5	9100-3139	5	3	INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
A6L6	9100-3139	5		INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
A6L7	9100-3139	5		INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
A6Q1	1855-0406	4	4	TRANSISTOR J-FET P-CHAN D-MODE SI	32293	IT110
A6Q2	1855-0406	4		TRANSISTOR J-FET P-CHAN D-MODE SI	32293	IT110
A6Q3	1855-0406	4		TRANSISTOR J-FET P-CHAN D-MODE SI	32293	IT110
A6Q4	1855-0406	4		TRANSISTOR J-FET P-CHAN D-MODE SI	32293	IT110
A6R1	1810-0126	1	4	NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
A6R2	0757-0280	3	17	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R3	0698-6360	6	10	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R4	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360 1
A6R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R7	0698-6943	1	4	RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
A6R9	0757-0416	7	4	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A6R10	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A6R12	0698-6943	1		RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
A6R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R14	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R15	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R16	0698-3155	1	16	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R18	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R19	0698-3243	8	4	RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A6R20	0698-8649	8	4	RESISTOR 1.28M .1% .25W F TC=0+-25	28480	0698-8649
A6R21	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R22	0757-0274	5	4	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A6R23	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R24	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R25	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A6R26	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R27	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R29	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R30	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R31	0698-8649	8		RESISTOR 1.28M .1% .25W F TC=0+-25	28480	0698-8649
A6R32	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A6R33	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R35	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R37	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A6R38	1810-0126	1		NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
A6R39	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R40	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R41	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R42	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A6R43	0698-8649	8		RESISTOR 1.28M .1% .25W F TC=0+-25	28480	0698-8649
A6R44	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R45	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R46	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R47	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R48	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F

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

Table 1-33. A6 A-D Converter Replaceable Parts List (3/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A6R49	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A6R50	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R51	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R52	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A6R53	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R54	0698-8649	8		RESISTOR 1.28M .1% .25W F TC=0+-25	28480	0698-8649
A6R55	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A6R56	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R57	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R58	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A6R59	1810-0126	1		NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
A6R60	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R61	0698-6943	1		RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
A6R63	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A6R64	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A6R66	0698-6943	1		RESISTOR 20K .1% .125W F TC=0+-50	28480	0698-6943
A6R67	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R68	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R69	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R70	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A6R71	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R72	1810-0126	1		NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
A6U1	1820-1208	3	2	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A6U2	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A6U3	1820-1112	8	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U4	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U5	1820-1201	6	2	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A6U6	1820-1470	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
A6U7	1820-1278	7	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS191N
A6U8	1820-1208	3		IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A6U9	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U10	1820-2634	1	1	IC INV TTL ALS HEX	01295	SN74ALS04BN
A6U11	1826-0122	0	2	IC 7805 V RGLTR TO-220	07263	7805UC
A6U12	1826-0122	0		IC 7805 V RGLTR TO-220	07263	7805UC
A6U13	1820-1201	6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A6U14	1820-4927	9	3	CMOS-COUNTER 16B	28480	1820-4927
A6U15	1820-4927	9		CMOS-COUNTER 16B	28480	1820-4927
A6U16	1820-4927	9		CMOS-COUNTER 16B	28480	1820-4927
A6U17	04194-80001	6	4	PAL 16L8A-2	28480	04194-80001
A6U18	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U19	04194-81803	8	4	HIC AD	28480	04194-81803
A6U20	04194-81803	8		HIC AD	28480	04194-81803
A6U21	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U22	04194-80001	6		PAL 16L8A-2	28480	04194-80001
A6U23	1826-0521	3	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	01295	TL072CP
A6U24	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A6U25	1820-1730	6	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U26	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U27	1820-2075	4	1	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
A6U28	04194-80001	6		PAL 16L8A-2	28480	04194-80001
A6U29	04194-81803	8		HIC AD	28480	04194-81803
A6U30	04194-81803	8		HIC AD	28480	04194-81803

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

Table 1-33. A6 A-D Converter Replaceable Parts List (4/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A6U31	04194-80001	6		PAL 16L8A-2	28480	04194-80001
A6U32	1826-0221	0	1	IC V RGLTR TO-220	04713	MC7912CT
A6U33	1826-0147	9	1	IC 7812 V RGLTR TO-220	04713	MC7812CP
A6W1	1258-0141	8	4	JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
A6W2	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
A6W3	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
A6W4	1258-0141	8		JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
A6W5	8159-0005	0	8	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W6	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W7	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W8	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W9	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W10	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W11	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W12	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6X1	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A6X2	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	0340-0092	2	20	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	28480	0340-0092
	0360-1653	5	12	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0754	1	1	EXTR-PC BD BLU POLYC .062-IN-BD-THKNS	28480	4040-0754

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

NOTES

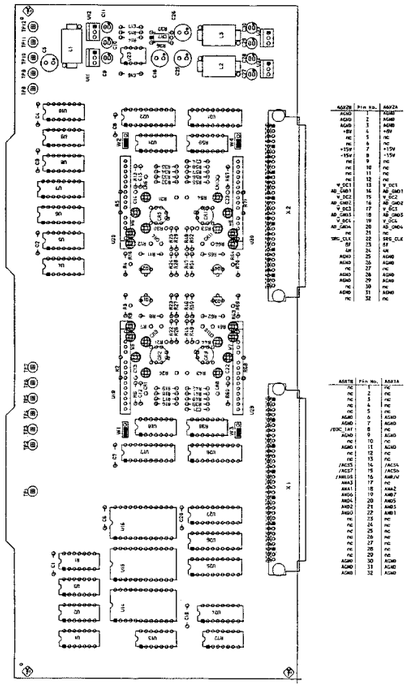
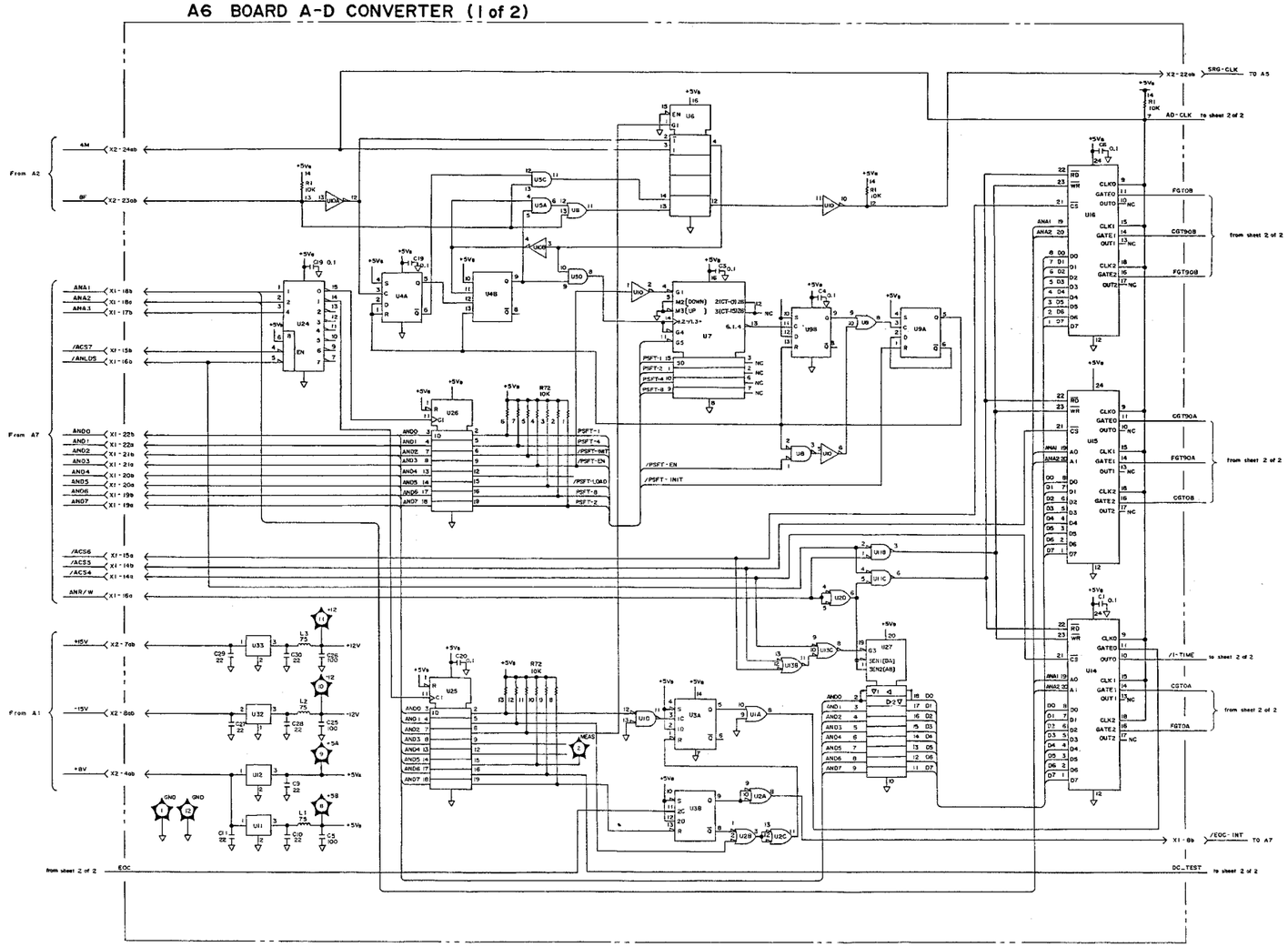


Figure 1-33. A6 A-D Converter Component Locations



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

Figure 1-34. A6 A-D Converter Schematic Diagram (1/2)

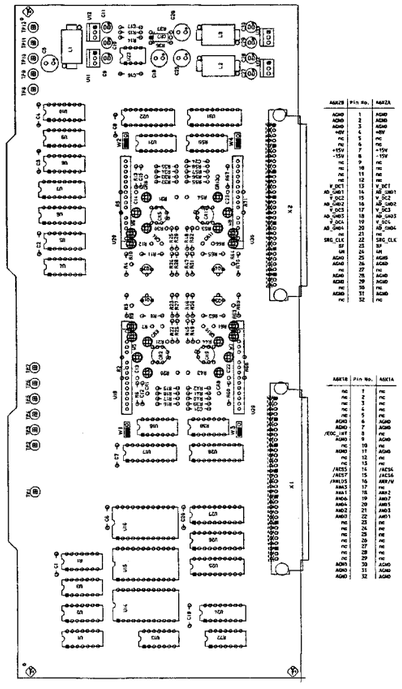


Figure 1-33. A6 A-D Converter Component Locations

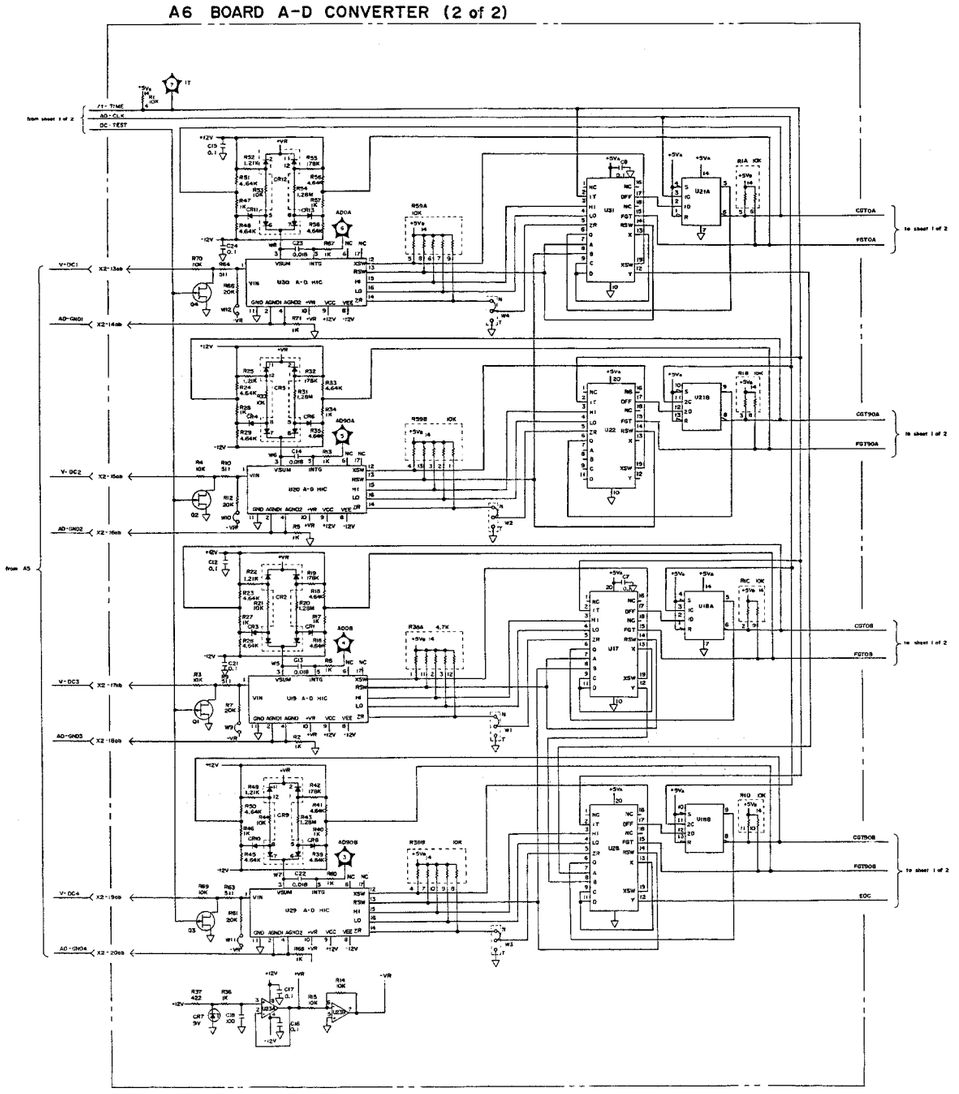


Figure 1-34. A6 A-D Converter Schematic Diagram (2/2)

A7 DIGITAL CONTROL BOARD SERVICE SHEET

NOTES

1-13. A7 BOARD SERVICE SHEET

1-13-1. CIRCUIT DESCRIPTION

The A7 digital control board's MPU is A7U5 (16-bit micro processor). A7U9, A7U10, A7U33, and A7U34 are programmed ROMs. If a ROM or ROMs fail the check sum test during the power-on self test, the message "ROM CHECK SUM ERROR NO=xx" will be displayed. The ROM numbers with the message are listed below.

Table 1-34. ROM Number

ROM Number	Reference Designator
0	A7U9
1	A7U33
2	A7U10
3	A7U34

1-13-2. TROUBLESHOOTING AIDS

Since the A7 board has been set up under the exchange program, when the A7 board is defective, you replace the A7 board. The board isolation procedure is given in SECTION 4, HP 4278A MAINTENANCE MANUAL (PN 04278-90100).

1-13-3. REPLACEABLE PARTS LISTS

The replaceable parts for the A7 board are divided into two groups: a ROMless A7 board and the programmed ROMs. This protects against the mismatching of ROM versions between the replaced CPU board and the defective CPU board. Only the ROMless A7 board has been set up under the exchange assembly program. If the A7 board is defective except for the ROMs, order a ROMless A7 board. Then install the ROMs from the defective A7 board on the replacement A7 board. If both the A7 board and the ROMs are defective, order a ROMless A7 board and four ROMs.

The A7 board's replaceable parts are listed in Table 1-35. The part number for a rebuilt exchange board is listed on the first page of the A7 board's of the A7 board's replaceable parts list.

1-13-4. COMPONENT LOCATIONS

The component locations of the A7 board Digital Control board are shown in Figure 1-35.

1-13-5. SCHEMATIC DIAGRAMS

The A7 Digital Control Board's schematic diagram is not supplied since of the ROMless A7 board has been set up on the exchange assembly program.

Table 1-35. A7 Digital Control Replaceable Parts List (1/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7						
A7	04278-66657	9	1	DIGITAL CONTROL W/O ROMs	28480	04278-66657
	04278-69657		1	DIGITAL CONTROL W/O ROMs (RE-BUILT)	28480	04278-69657
A7C1	0160-4822	2	10	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C2	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C3	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C4	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C5	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C6	0160-6561	0	9	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C7	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C8	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C9	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A7C10	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C11	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C12	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C13	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C14	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C15	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C16	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C17	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C18	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C19	0160-4806	2	1	CAPACITOR-FXD 39PF +-5% 100VDC CER0+-30	28480	0160-4806
A7C21	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C22	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C23	0180-3590	1	2	CAPACITOR-FXD 470UF+-20% 10VDC AL	28480	0180-3590
A7C24	0180-3590	1		CAPACITOR-FXD 470UF+-20% 10VDC AL	28480	0180-3590
A7CR3	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
A7DS1	1990-0665	3	2	LED-LAMP LUM-INT=1MCD IF=30MA-MAX BVR=5V	28480	1990-0665
A7DS2	1990-0665	3		LED-LAMP LUM-INT=1MCD IF=30MA-MAX BVR=5V	28480	1990-0665
A7DS3	1990-0652	8	2	LED-LAMP ARRAY LUM-INT=200UCD IF=5MA-MAX	28480	1990-0652
A7DS4	1990-0652	8		LED-LAMP ARRAY LUM-INT=200UCD IF=5MA-MAX	28480	1990-0652
A7F1	2110-0743	5	1	FUSE 2A 125V UL	28480	2110-0743
A7FL1	9135-0329	2	1	FILTER-LINE LEADS-TERMS	28480	9135-0329
A7FL2	9170-1397	0	1	BEAD INDUCTOR	28480	9170-1397
A7J1	1251-4822	6	7	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J2	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J3	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J4	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J5	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J6	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J7	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J11	1200-0567	1	4	SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J12	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J13	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J14	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J25	1200-0639	8	3	SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639
A7J26	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639
A7J27	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639
A7L1	9140-1272	7	1	L SF-C27	28480	9140-1272

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

Table 1-35. A7 Digital Control Replaceable Parts List (2/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7Q3	1853-0459	3	1	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A7R1	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A7R2	0689-1055	7		RESISTOR 1M 5% 1W CC TC=0+1000	01121	GB1055
A7R3	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A7R4	1810-0279	5	16	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R5	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A7R6	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R8	0698-3155	1	4	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A7R9	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A7R10	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A7R11	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A7R12	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A7R16	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A7R17	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R20	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R21	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R24	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R25	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R26	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R27	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R28	1810-0275	1	1	NETWORK-RES 10-SIP 1.0K OHM X 9	91637	
A7R29	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R30	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R31	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R32	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R33	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R34	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R35	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A7R36	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	1810-0279
A7R37	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A7R38	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A7S1	3101-2831	8	3	SWITCH 8P	28480	3101-2831
A7S2	3101-2831	8		SWITCH 8P	28480	3101-2831
A7S3	3101-2831	8		SWITCH 8P	28480	3101-2831
A7TP1	0360-1653	5	19	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP2	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP3	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP4	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP5	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP6	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP7	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP8	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP9	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP10	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP11	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP12	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP13	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP14	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP15	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP16	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP17	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP18	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP19	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653

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

Table 1-35. A7 Digital Control Replaceable Parts List (3/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7U1	1820-2696	5	1	IC FF TTL F D-TYPE POS-EDGE-TRIG COM CLK	07263	74F175PC
A7U2	1820-2690	9	1	IC GATE TTL F OR QUAD 2-INP	07263	74F32PC
A7U3	1820-2774	0	1	IC GATE TTL ALS NAND DUAL 4-INP	01295	SN74ALS20AN
A7U4	1820-2635	2	1	IC GATE TTL ALS AND QUAD 2-INP	01295	SN74ALS08N
A7U5	1820-4952	0	1	PROC MC68000	28480	1820-4952
A7U6	1820-2711	5	8	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U7	1820-3100	8	7	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U8	1820-3121	3	2	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN74ALS245AN
A7U13	1818-3981	8	2	IC CMOS 262144 (256K) STAT RAM 120-NS	S4013	HM62256LP-12
A7U15	1818-3801	1	2	IC NMOS 65536 (64K) ELEC-ER-PROM 300-NS	S4013	HN58064P-30
A7U16	1820-2922	0	1	IC GATE CMOS/74HC NAND QUAD 2-INP	04713	MC74HC00N
A7U19	1820-3348	6	1	IC CNTR TTL F BIN SYNCHRO POS-EDGE-TRIG	07263	74F163APC
A7U20	1820-2634	1	3	IC INV TTL ALS HEX	01295	SN74ALS04BN
A7U21	1820-2777	3	1	IC CNTR TTL ALS BIN SYNCHRO	01295	SN74ALS161BN
A7U22	1820-3376	0	1	IC INV TTL ALS HEX	01295	SN74ALS05AN
A7U23	1820-2861	6	1	IC DCDR TTL F 3-TO-8-LINE	07263	74F138PC
A7U25	1820-2488	3	6	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U26	1820-2634	1		IC INV TTL ALS HEX	01295	SN74ALS04BN
A7U27	1820-2657	8	3	IC GATE TTL ALS OR QUAD 2-INP	01295	SN74ALS32N
A7U28	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U29	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U30	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U31	1820-3220	3	1	IC DCDR TTL F BIN 2-TO-4-LINE DUAL	07263	74F139PC
A7U32	1820-3121	3		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN74ALS245AN
A7U37	1818-3981	8		IC CMOS 262144 (256K) STAT RAM 120-NS	S4013	HM62256LP-12
A7U39	1818-3801	1		IC NMOS 65536 (64K) ELEC-ER-PROM 300-NS	S4013	HN58064P-30
A7U40	1826-1648	7	1		28480	1826-1648
A7U42	1820-4927	9	1	CMOS-COUNTER 16B	28480	1820-4927
A7U43	04278-80003	9	1	PAL	28480	04278-80003
A7U44	04278-80002	8	1	PAL	28480	04278-80002
A7U45	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U46	04278-80005	1	1	PAL	28480	04278-80005
A7U47	1820-2686	3	1	IC GATE TTL F AND QUAD 2-INP	07263	74F08PC
A7U48	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U49	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U50	1820-2757	9	3	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
A7U51	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A7U52	1820-2657	8		IC GATE TTL ALS OR QUAD 2-INP	01295	SN74ALS32N
A7U53	1820-2657	8		IC GATE TTL ALS OR QUAD 2-INP	01295	SN74ALS32N
A7U54	1820-3298	5	1	IC GATE CMOS/74HC OR QUAD 2-INP	27014	MM74HC32N
A7U55	1820-2634	1		IC INV TTL ALS HEX	01295	SN74ALS04BN
A7U56	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U57	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U58	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
A7U59	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U60	1820-2075	4	3	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
A7U61	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U62	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U63	1820-3145	1	1	IC DRVR TTL ALS BUS OCTL	01295	SN74ALS244AN
A7U64	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
A7U65	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U66	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U67	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN

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

Table 1-35. A7 Digital Control Replaceable Parts List (4/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7U68	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U69	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
A7U70	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
A7U71	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U72	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U73	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7V1	2140-0127	2	1	LAMP-NEON 90V	28480	2140-0127
A7W1	1258-0141	8	7	JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W2	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W3	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W4	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W5	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W6	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W7	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7X1	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A7X2	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A7Y1	1813-0545	4	1	CLOCK-OSCILLATOR-XTAL 31.680-MHZ0.005%	28480	1813-0545
	0403-0026	6	1	PLUG-HOLE BDR-HD FOR .187-D-HOLE NYL	02768	207-120241-03-0101
	1200-0638	7	1	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0755	2	1	EXTR-PC BD VIO POLYC .062-IN-BD-THKNS	28480	4040-0755
				ROM		
				Version 3.0		
A7U9	04278-85011	9	1	ROM 0K BIT0 (ROM Version 3.0)	28480	04278-85001
A7U10	04278-85013	1	1	ROM 20K BIT0 (ROM Version 3.0)	28480	04278-85003
A7U33	04278-85012	0	1	ROM 0K BIT8 (ROM Version 3.0)	28480	04278-85002
A7U34	04278-85014	2	1	ROM 20K BIT8 (ROM Version 3.0)	28480	04278-85004

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

NOTES

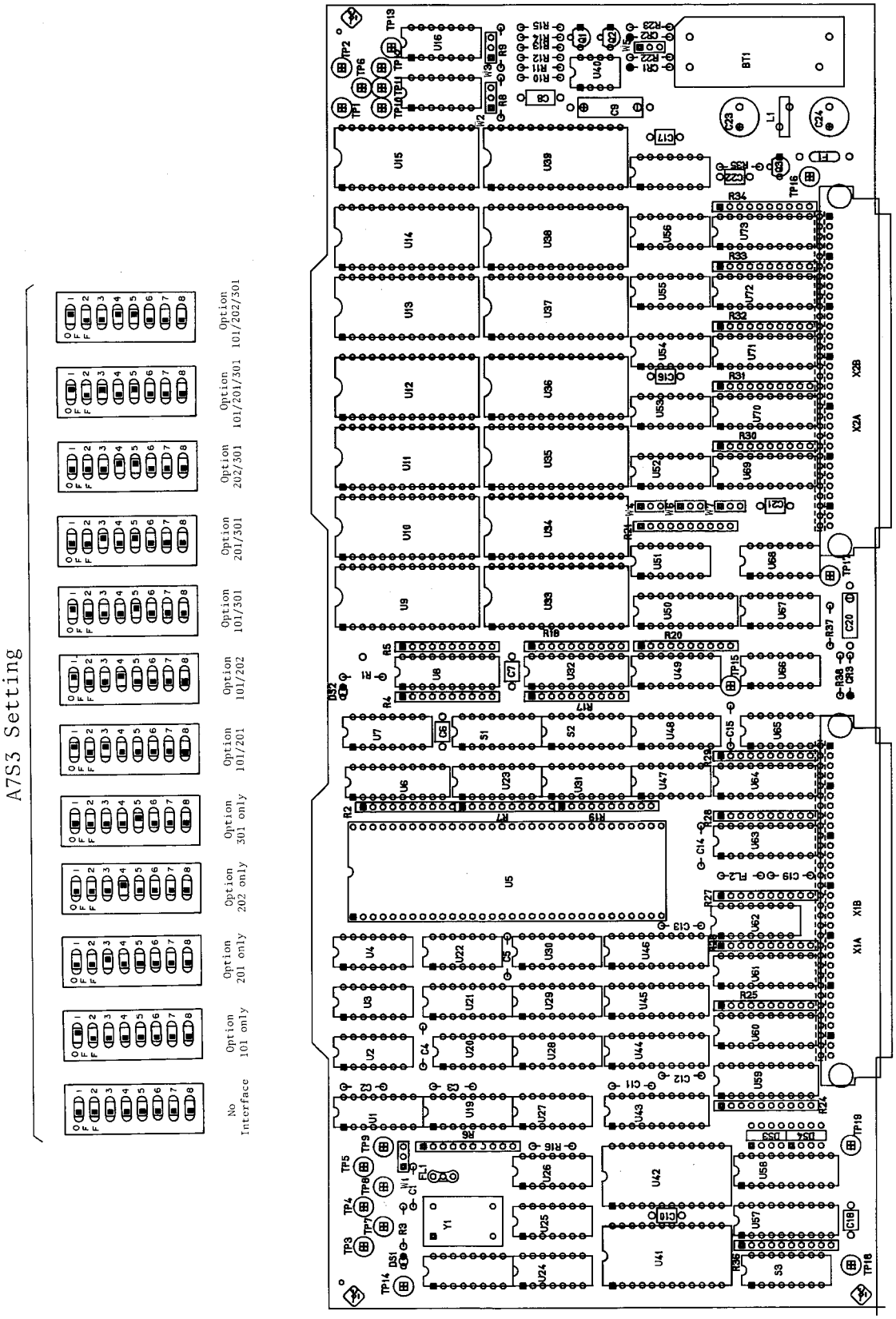


Figure 1-35. A7 Digital Control Component Locations

A8 INPUT SWITCH BOARD SERVICE SHEET

NOTES

1-14. A8 BOARD SERVICE SHEET

1-14-1. CIRCUIT DESCRIPTION

The A8 input switch board distributes the measurement signals to either the 1 kHz or 1 MHz circuits by switching A8K1 through A8K3. These switches are controlled by the switching control signals *K1* through *K3* from the A2 board. Protection circuitry for the main circuit board to protect against any external dc bias is included on the A8 board.

1-14-2. TROUBLESHOOTING AIDS

The troubleshooting aids section provides the troubleshooting data in Table 1-36.

1-14-3. REPLACEABLE PARTS LISTS

The A8 Input Switch board replaceable parts are listed in Table 1-37.

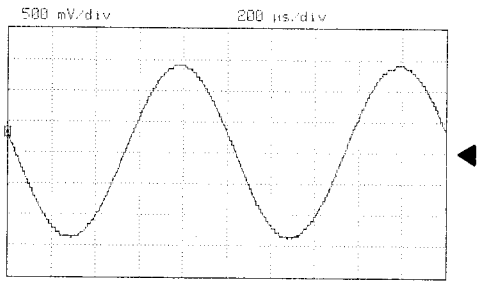
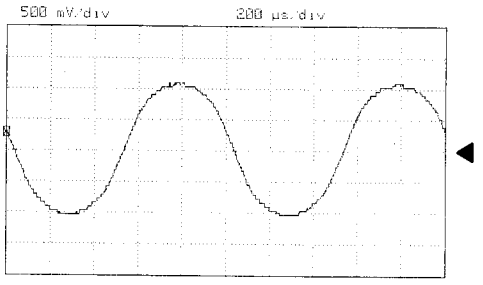
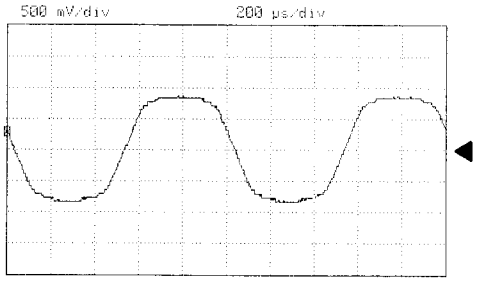
1-14-4. COMPONENT LOCATIONS

The component locations of the A8 Input Switch board are shown in Figure 1-36.

1-14-5. SCHEMATIC DIAGRAMS

The schematic diagram of the A8 Input Switch board is shown in Figure 1-37.

Table 1-36. Troubleshooting Data

HP 4278A Settings	Measurement Setup	Waveform
FREQ: 1 kHz Meas.Range: 100 pF OSC level: 1 Vrms	CHAN A: Hcur Term. and Hpot Term. (See below) TRIG: CHAN A (Negative)	
FREQ: 1 kHz Meas.Range: 100 pF OSC level: 1 Vrms	CHAN A: Hcur Term. and Lpot Term. (See below) TRIG: CHAN A (Negative)	
FREQ: 1 kHz Meas.Range: 100 pF OSC level: 1 Vrms	CHAN A: Hcur Term. and Lcur Term. (See below) TRIG: CHAN A (Negative)	

Connections between the HP 4278A and the oscilloscope:

1. Connect the Tee adaptor (PN 1250-0781) to the Hcur Terminal.

2. Connect the Tee adaptor to both the Hpot Terminal (Lpot Terminal, or Lcur Terminal) and CHAN A of the oscilloscope, using two BNC (m) to BNC (m) cables.

Table 1-37. A8 Replaceable Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8						
	04278-66508	9	1	INPUT SWITCH	28480	04278-66508
C1	0160-6561	0	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C2	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C3	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C4	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C5	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
CR1	PPNR50536	0	12	DIO-PWR RECT	28480	PPNR50536
CR2	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR3	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR4	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR5	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR6	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR7	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR8	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR9	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR10	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR11	1902-1525	1	4	DIODE ZENER	28480	1902-1525
CR12	1902-1525	1		DIODE ZENER	28480	1902-1525
CR13	1902-1525	1		DIODE ZENER	28480	1902-1525
CR14	1902-1525	1		DIODE ZENER	28480	1902-1525
CR15	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
CR16	PPNR50536	0		DIO-PWR RECT	28480	PPNR50536
J1	1250-0257	1	4	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
J2	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
J3	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
J4	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
J5	1250-2108	5	7	CONN-RF F	28480	1250-2108
J6	1250-2108	5		CONN-RF F	28480	1250-2108
J7	1250-2108	5		CONN-RF F	28480	1250-2108
J8	1250-2108	5		CONN-RF F	28480	1250-2108
J9	1250-2108	5		CONN-RF F	28480	1250-2108
J10	1250-2108	5		CONN-RF F	28480	1250-2108
J11	1250-2108	5		CONN-RF F	28480	1250-2108
J12	1251-7406	8	1	CONNECTOR 10-PIN M METRIC POST TYPE	28480	1251-7406
K1	0490-1485	6	3	RELAY SW	28480	0490-1485
K2	0490-1485	6		RELAY SW	28480	0490-1485
K3	0490-1485	6		RELAY SW	28480	0490-1485
L1	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
R1	0757-0442	9	4	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R2	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R3	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
	0380-1796	9	4	STANDOFF	28480	0380-1796

NOTES

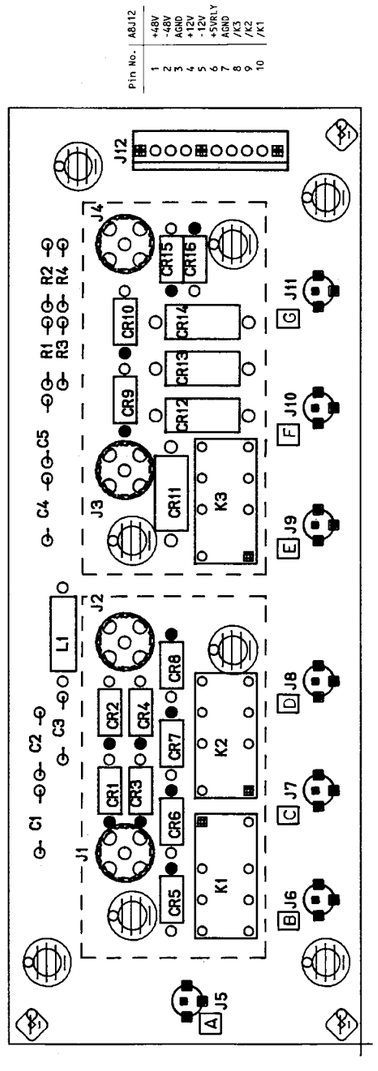
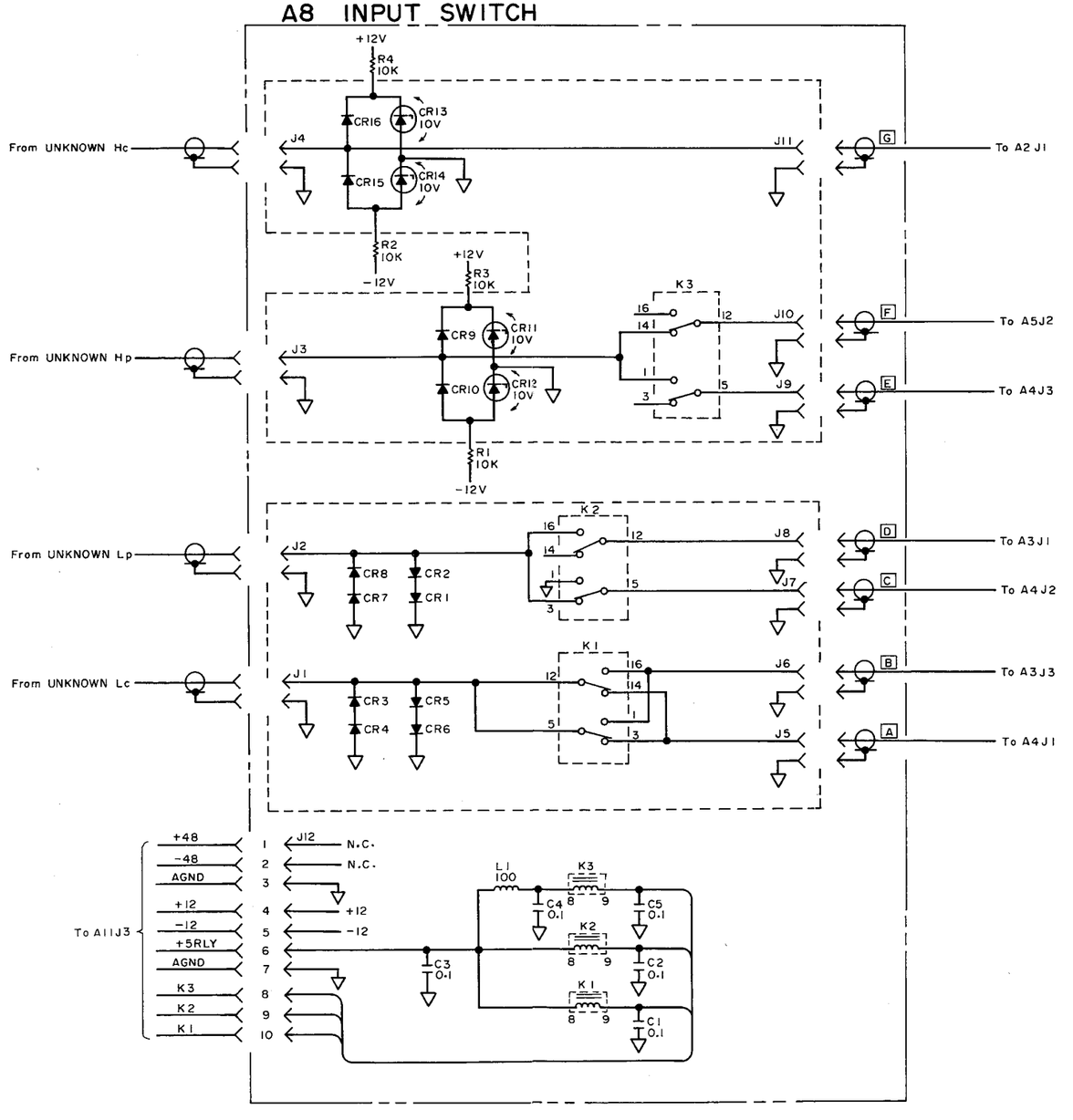


Figure 1-37. A8 Input Switch Component Locations



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:

   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

Figure 1-37. A8 Input Switch Schematic Diagram

A9, A13, A90, A91 BOARDS SERVICE SHEET

NOTES

1-15. A9, A13, A90, A91 BOARDS SERVICE SHEET

1-15-1. CIRCUIT DESCRIPTION

A9 Keyboard consists of Key switches, LED indicators, and the LCD contrast potentiometer. A13 DC-AC Converter Board converts ±12V DC into 600V AC to supply the 600V AC to the A91 LCD Module board for backlighting the LCD. A90 Keyboard/Display Control Module board interfaces A7 CPU board to both A90 Keyboard board and A91 LCD Module board. The A91 LCD Module is used as the HP 4278A's display screen.

1-15-2. TROUBLESHOOTING AIDS

Fuse A9F1 on the A9 keyboard is the fuse for the A90 board. If the 4278A's display screen isn't active, check fuse A9F1 first.

The A90 and A91 board assemblies aren't repaired at the component level because the components on each board are surface mounted, and are difficult to be replace. Thus if the A90 or A91 board is faulty, it must be repaired at the assembly level only.

1-15-3. REPLACEABLE PARTS LISTS

The A9 Keyboard replaceable parts are listed in Table 1-38. The A13 DC-AC Converter replaceable parts are listed in Table 1-39. The A90 Keyboard/Display Control and the A91 LCD module replaceable parts are listed in Table 1-40. The A90 and A91 boards are repaired at the assembly level only, because the components on each board are surface mounted, and are difficult to replace. So, only the complete assembly part numbers are listed in Table 1-40.

1-15-5. COMPONENT LOCATIONS

The component locations for the A9 Keyboard and the A13 DC-AC Converter board are shown in Figure 1-38. Component locations for the A90 and A91 boards are not shown, these board assemblies are repaired at the assembly level only.

1-15-6. SCHEMATIC DIAGRAMS

A9 Keyboard, A13 DC-AC Converter, A90 Keyboard/Display Control Module, and A91 LCD Module schematic diagrams are shown in Figure 1-39.

Table 1-38. A9 Keyboard Replaceable Parts List

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A9						
A9	04278-66559	1	1	KEY BOARD	28480	04278-66559
A9DS1	1990-0487	7	4	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A9DS2	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A9DS3	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A9DS4	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A9F1	2110-0741	3	1	FUSE 1A 125V NTD UL	28480	2110-0741
A9J1	1251-4959	0	1	CONNECTOR 2-PIN M METRIC POST TYPE	28480	1251-4959
A9R4	0698-0082	7	4	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4640-F
A9R5	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4640-F
A9R6	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4640-F
A9R7	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4640-F
A9R8	2100-4174	3	1	RESISTOR-VAR CONTROL CF 20K 10% LIN	28480	2100-4174
A9W1	8120-4904	5	1	FLEX JUMPER WIRE	28480	8120-4904
A9W2	8120-4910	3	1	FLEX JUMPER WIRE	28480	8120-4910

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

Table 1-39. A13 DC-AC Converter Replaceable Parts List

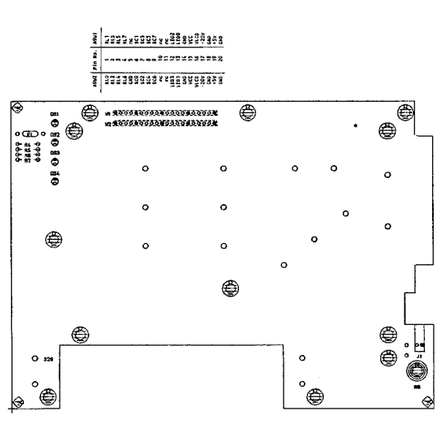
Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A13						
A13	04278-66513	6	1	DC-AC CONVERTER	28480	04278-66513
A13C1	0180-3602	6	1	CAPACITOR-FXD 22UF+-20% 50VDC AL	28480	0180-3602
A13DS1	2140-0127	2	1	LAMP-NEON 90V	28480	2140-0127
A13E1	04278-61101	8	1	CONVERTER DCIAC	28480	04278-61101
A13J1	1251-4938	5	2	CONNECTOR 3-PIN M METRIC POST TYPE	28480	1251-4938
A13J2	1251-4938	5		CONNECTOR 3-PIN M METRIC POST TYPE	28480	1251-4938
A13L1	9140-1278	3	1	INDUCTOR 68UH 10% 7.5D-MM Q=60	28480	9140-1278
A13R1	0689-1055	7	2	RESISTOR 1M 5% 1W CC TO=0+1000	01121	GB1055
A13R2	0689-1055	7		RESISTOR 1M 5% 1W CC TO=0+1000	01121	GB1055
A13R3	0698-3454	3	1	RESISTOR 215K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-2153-F
A13R4	0698-3455	4	1	RESISTOR 261K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-2613-F

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

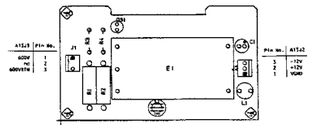
Table 1-40. A90 and A91 Replaceable Parts List

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A90						
A90	04278-66590	9	1	KEYBOARD/DISPLAY CONTROL	28480	04278-66590
A91						
A91	04278-61102	9	1	LCD MODULE	28480	04278-61102

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

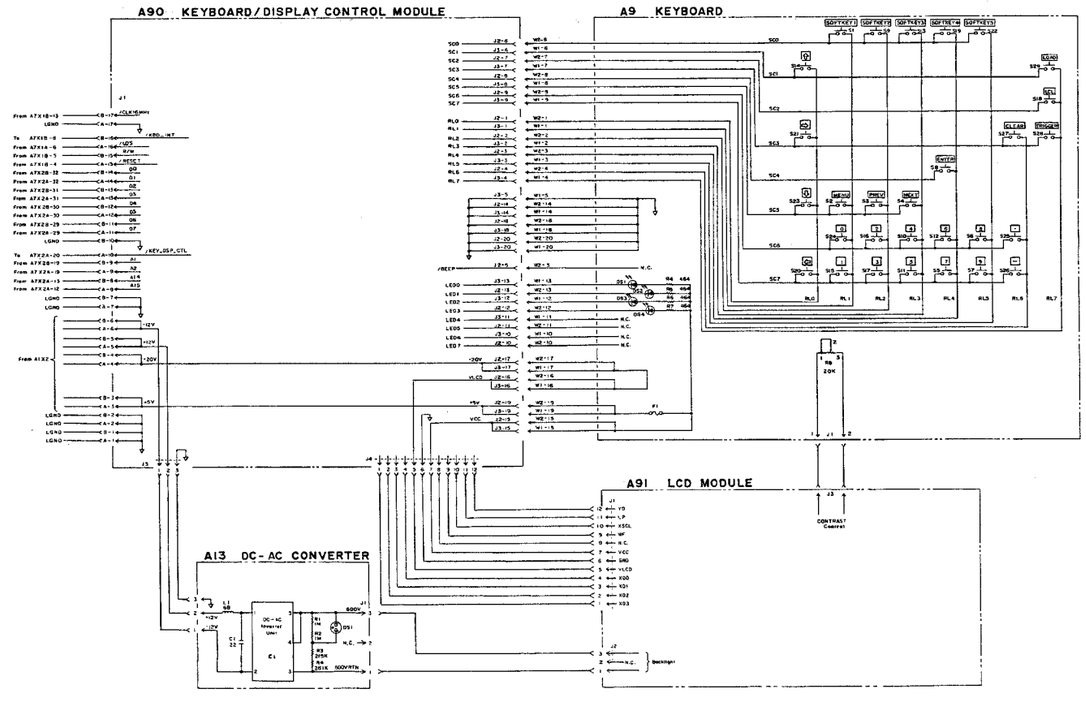


A9 Component Locations



A13 Component Locations

Figure 1-38. A9 Keyboard and A13 DC-AC Converter Component Locations



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

Figure 1-39. A9, A13, A90, and A91 Schematic Diagrams

A10 MEMORY CARD BOARD SERVICE SHEET

NOTES

1-16. A10 BOARD SERVICE SHEET

1-16-1. CIRCUIT DESCRIPTION

The A10 Memory Card board contains only the connector for the A7 CPU board and the Memory Card.

1-16-2. TROUBLESHOOTING AIDS

Troubleshooting aids for the A10 Memory Card board are not given, the pin assignment list gives the only information needed for troubleshooting.

1-16-3. REPLACEABLE PARTS LISTS

The replaceable parts for the A10 Memory Card board are listed in Table 1-41.

1-16-4. COMPONENT LOCATIONS

The A10 Memory Card board component locations are shown in Figure 1-40.

1-16-5. SCHEMATIC DIAGRAMS

A schematic diagram for the A10 Memory Card board is not supplied, the pin assignment list gives the information needed for troubleshooting.

Table 1-41. A10 Memory Card board replaceable parts list

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10						
	04278-66510	3	1	MEM CARD SOCKET	28480	04278-66510
C1	0160-6561	0	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
X1	1251-3025	9	1	CONN-POST TYPE .100-PIN-SPCG 34-CONT	28480	1251-3025
X2	1252-1951	3	1	CONN 38PIN	28480	1252-1951

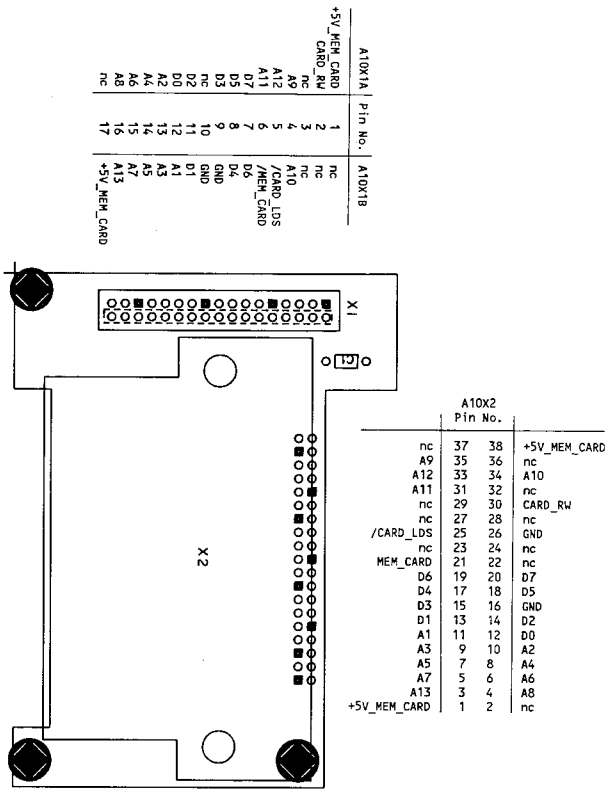


Figure 1-40. A10 Memory Card Component Locations

A11 MOTHERBOARD SERVICE SHEET

NOTES

1-17. A11 BOARD SERVICE SHEET

1-17-1. CIRCUIT DESCRIPTION

THe A11 Motherboard is the common bus for all other boards.

1-17-2. TROUBLESHOOTING AIDS

No troubleshooting aids for the A11 Motherboard are given, the pin assignment for each board gives the only information needed for troubleshooting.

1-17-3. REPLACEABLE PARTS LISTS

The replaceable parts are listed in Table 1-42.

1-17-4. COMPONENT LOCATIONS

The component locations of the A11 motherboard are shown in Figure 1-41.

1-17-5. SCHEMATIC DIAGRAMS

A schematic diagram for the A11 Motherboard is not supplied, the pin assignments give the information needed for troubleshooting.

Table 1-42. A11 Motherboard Replaceable Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11						
	04278-66511	4	1	MOTHERBOARD	28480	04278-66511
J1	1251-4938	5	1	CONNECTOR 3-PIN M METRIC POST TYPE	28480	1251-4938
J2	1251-5066	2	1	CONN-POST TYPE 2.5-PIN-SPCG 2-CONT	28480	1251-5066
J3	1251-7406	8	1	CONNECTOR 10-PIN M METRIC POST TYPE	28480	1251-7406
J4	1252-1404	6	2	CONN-POST TYPE 2.54-PIN-SPCG 34-CONT	76381	7834-0000T
J5	1252-1404	6		CONN-POST TYPE 2.54-PIN-SPCG 34-CONT	76381	7834-0000T
X1	1252-1745	8	18	CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X2	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X3	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X4	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X5	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X6	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X7	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X8	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X9	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X10	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X11	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X12	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X13	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X14	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X15	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X16	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X17	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
X18	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
	04278-61624	0	1	FL CBL ASSY 34P	28480	04278-61624
	04278-61629	5	1	FL CBL ASSY 34P	28480	04278-61629

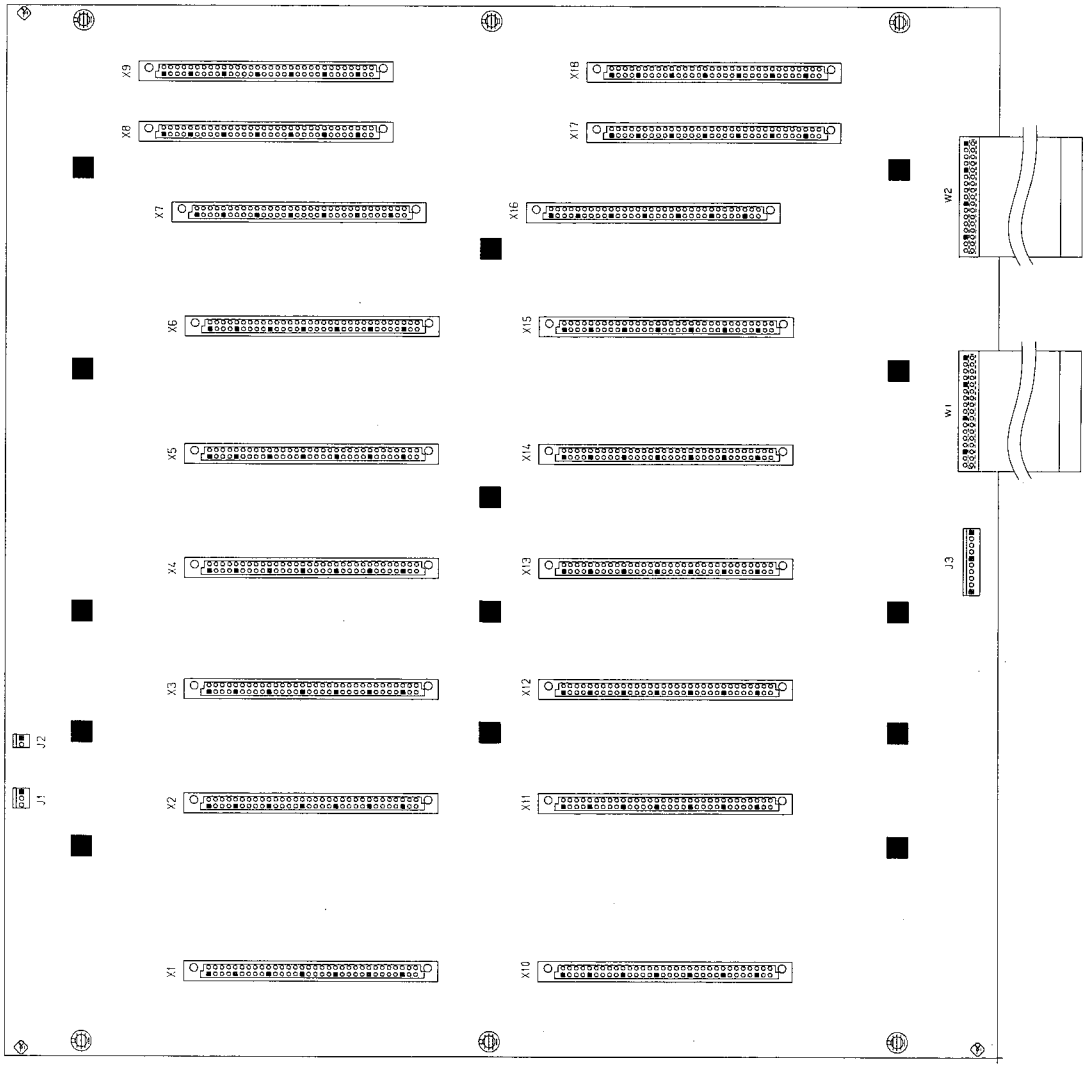


Figure 1-41. A11 Motherboard Component Locations

A20 HP-IB INTERFACE BOARD SERVICE SHEET

NOTES

1-18. A20 BOARD SERVICE SHEET

1-18-1. CIRCUIT DESCRIPTION

The A20 HP-IB interface board handles all HP-IB interface functions. The HP-IB interface board controls the "handshake" between the Microprocessor and external HP-IB controlled equipment. The main chip is A20U8.

1-18-2. TROUBLESHOOTING AIDS

The test points are listed in Table 1-43.

Table 1-43. Test Point List

Test Point	Signal Name	Description
A20TP1	*GND*	Ground line
A20TP2	*+5V*	+ 5 V dc
A20TP3	*LDS*	Lower data strobe signal
A20TP4	*4MHz*	4 MHz is counted down from the A7 / *CLK16MHz* signal

1-18-3. REPLACEABLE PARTS LISTS

The replaceable parts list of the A20 HP-IB interface board is shown in Table 1-44.

1-18-4. COMPONENT LOCATIONS

The component location of the A20 HP-IB interface board is shown in Figure 1-42.

1-18-5. SCHEMATIC DIAGRAMS

The schematic diagram of the A20 HP-IB interface board is shown in Figure 1-43.

Table 1-41. A20 HP-IB Interface Replaceable Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20						
	04278-66520	5	1	#101 HP-IB	28480	04278-66520
C1	0160-6561	0	6	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C2	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C3	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C4	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C5	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C6	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C7	0180-3590	1	1	CAPACITOR-FXD 470UF+-20% 10VDC AL	28480	0180-3590
F1	2110-0742	4	1	FUSE 1.5A 125V NTD UL	28480	2110-0742
J1	1251-5650	0	1	CONNECTOR 26-PIN M POST TYPE	28480	1251-5650
R1	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
U1	1820-1208	3	1	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
U2	1820-2058	3	4	IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	04713	MC3448AL
U3	1820-2058	3		IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	04713	MC3448AL
U4	1820-2058	3		IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	04713	MC3448AL
U5	1820-1433	6	1	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
U6	1820-1430	3	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
U7	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
U8	1820-2549	7	1	IC-8291A P HPIB	28480	1820-2549
U9	1820-2058	3		IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	04713	MC3448AL
U10	1820-1200	5	1	IC INV TTL LS HEX	01295	SN74LS05N
U11	1820-2711	5	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
U12	1820-2075	4	1	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
W1	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
X1	1252-1598	9	1	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0750	7	1	EXTR-PC BD RED POLYC .062-IN-BD-THKNS	28480	4040-0750

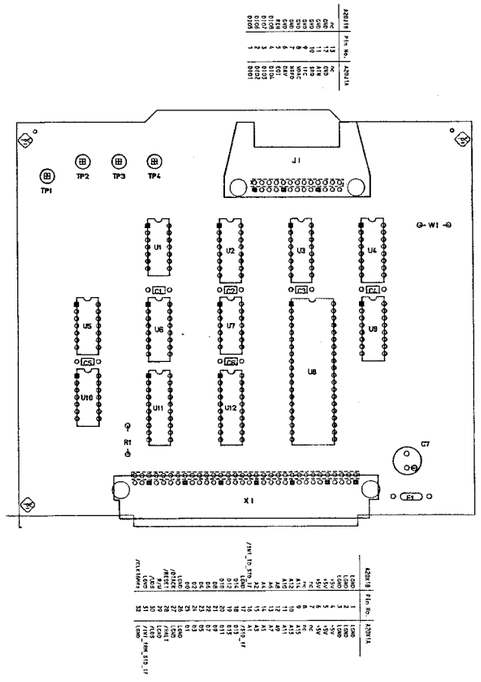


Figure 1-42. A20 HP-IB Interface Component Locations

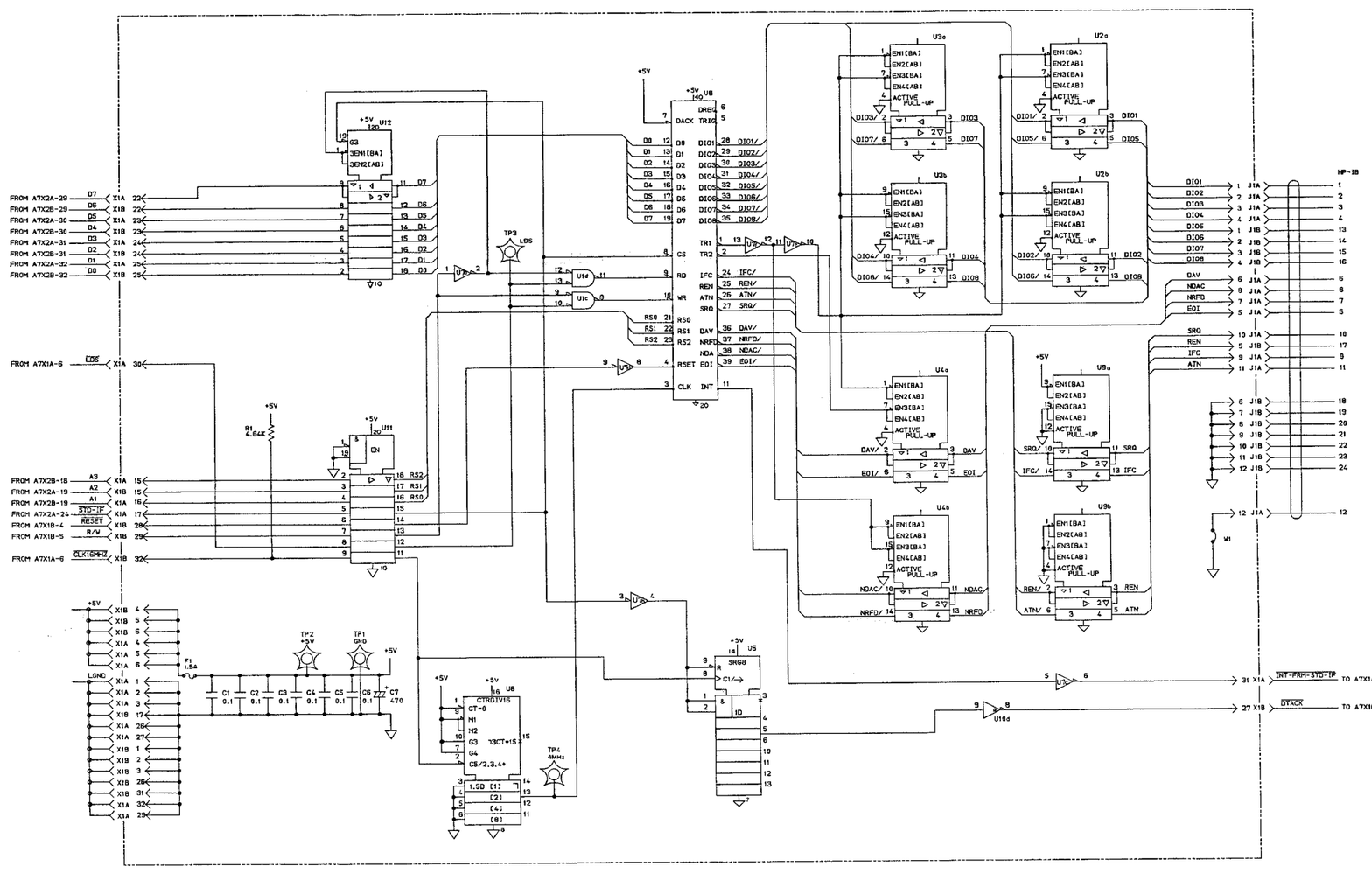


Figure 1-43. A20 HP-IB Interface (Option 101) Schematic Diagram

A30 HANDLER INTERFACE BOARD SERVICE SHEET

NOTES

1-19. A30 BOARD SERVICE SHEET

1-19-1. CIRCUIT DESCRIPTION

The A30 handler interface board consists of photo couplers, and the peripheral interface adapters.

[Photo Couplers]

Photo couplers A30U1 through A30U7 opto-isolate the input and output signals. Jumpers (A30W1 through A30W11) are set according to the pull up voltages used. For more detail information about the input/output signals and jumpers, refer to the paragraph 4-3. option 201. handler interface in the HP 4278A operation manual.

[Peripheral Interface Adapters]

A30U13 and A30U14 are peripheral interface adapters (PIAs) which interface between the A7 CPU board and the A30 board.

1-19-2. TROUBLESHOOTING AIDS

The test points are listed in Table 1-45.

Table 1-45. Test Point List

Test Point	Signal Name	Description
A30TP1	*GND*	Ground line
A30TP2	*+5V*	+ 5 V DC
A30TP3	*BE*	792 kHz Clock signal
A30TP4		EXT.TRIG signal

1-19-3. REPLACEABLE PARTS LISTS

The replaceable parts of the A30 handler interface board are listed in Table 1-46.

1-19-4. COMPONENT LOCATIONS

The component locations of the A30 handler interface board and the board connector pin assignments are shown in Figure 1-44.

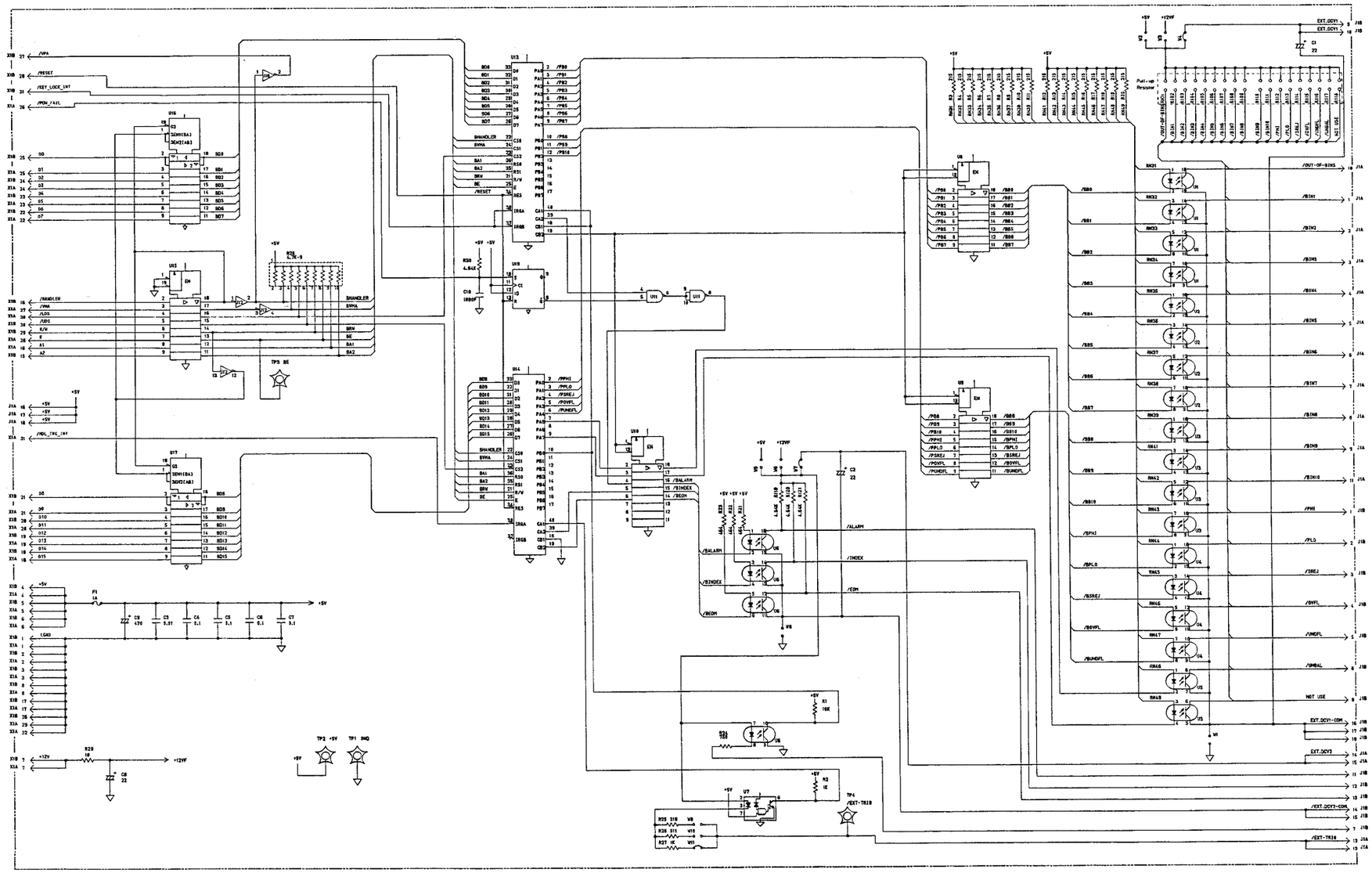
1-19-5. SCHEMATIC DIAGRAMS

The schematic diagram of the A30 handler interface board is shown in Figure 1-45.

Table 1-46. A30 Handler Interface Replaceable Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A30						
	04278-66530	7	1	#201 HANDLER IF	28480	04278-66530
C1	0180-3602	6	1	CAPACITOR-FXD 22UF+-20% 50VDC AL	28480	0180-3602
C2	0180-3363	6	2	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C3	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C4	0160-6561	0	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C5	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C6	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C7	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
C8	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C9	0180-3217	9	1	CAPACITOR-FXD 470UF+-20% 6.3VDC AL	28480	0180-3217
C10	0160-4822	2	1	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
F1	2110-0741	3	1	FUSE 1A 125V NTD UL	28480	2110-0741
J1	1251-5652	2	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	28480	1251-5652
R1	0698-6360	6	1	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
R2	0698-6362	8	2	RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
R3	0698-3441	8	18	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R4	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R5	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R6	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R7	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R8	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R9	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R10	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R11	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R12	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R13	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R14	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R15	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R16	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R17	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R18	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R19	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R20	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
R21	0698-0082	7	3	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R22	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R23	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R24	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
R25	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
R26	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
R27	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	28480	0698-6362
R28	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-
R29	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
R30	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
U1	1990-1179	6	5	PHOTO COUPLER	28480	1990-1179
U2	1990-1179	6		PHOTO COUPLER	28480	1990-1179
U3	1990-1179	6		PHOTO COUPLER	28480	1990-1179
U4	1990-1179	6		PHOTO COUPLER	28480	1990-1179
U5	1990-1180	9	1	PHOTO COUPLER	28480	1990-1180
U6	1990-1179	6		PHOTO COUPLER	28480	1990-1179
U7	1990-0602	8	1	OPTO-ISOLATOR LED-IC GATE IF=20MA-MAX	28480	5082-4361
U8	1820-2711	5	4	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
U9	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
U10	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
U11	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
U13	1820-4888	1	2	CMOS 6321P	28480	1820-4888
U14	1820-4888	1		CMOS 6321P	28480	1820-4888
U15	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
U16	1820-2075	4	2	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
U17	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
U18	1820-1200	5	1	IC INV TTL LS HEX	01295	SN74LS05N
U19	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
W4	8159-0005	0	3	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
W7	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
W11	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
X1	1252-1598	9	1	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0751	8	1	EXTR-PC BD ORN POLYC .062-IN-BD-THKNS	28480	4040-0751

A30 #201 HANDLER INTERFACE



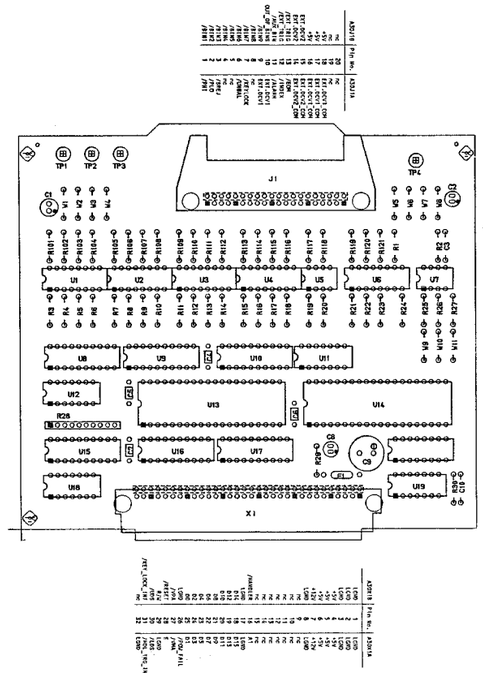


Figure 1-44. A30 Handler Interface Component Locations

NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:

   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (uF)
   INDUCTANCE IN MICROHENRIES (uH)

Figure 1-45. A30 Handler Interface (Option 201) Schematic Diagram

A31 HANDLER INTERFACE BOARD SERVICE SHEET

NOTES

1-20. A31 BOARD SERVICE SHEET

1-20-1. CIRCUIT DESCRIPTION

The A31 handler interface board consists of photo couplers, and peripheral interface adapters.

[Photo Couplers]

Photo couplers A31U1 through A31U14 opto-isolate the input and output signals. Then timing of the input/output signals is determined by the setting jumpers (A31W3 through A31W13). For more detail information about the input/output signals and jumpers, refer to paragraph 4-4. option 202, Handler Interface in the HP 4278A Operation Manual.

[Peripheral Interface Adapters]

Peripheral interface adapters (PIAs) A31U19 and A31U20 interface between the A7 CPU board and the A31 board.

1-20-2. TROUBLESHOOTING AIDS

The test point list is shown in Table 1-47.

Table 1-47. Test Point List

Test Point	Signal Name	Description
A31TP1	*GND*	Ground line
A31TP2	*+5V*	+ 5 V dc
A31TP3	*BE*	792 kHz Clock signal
A31TP4		START IN signal

1-20-3. REPLACEABLE PARTS LISTS

The replaceable parts of the A31 Handler Interface board are listed in Table 1-48.

1-20-4. COMPONENT LOCATIONS

The component locations on the A31 Handler Interface board and the board connector pin assignments are shown in Figure 1-46.

1-20-5. SCHEMATIC DIAGRAMS

The schematic diagram of the A31 handler interface board is shown in Figure 1-47.

Table 1-48. A31 Handler Interface Replaceable Parts List (1/2)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A31						
A31	04278-66531	2	1	HANDLER IF (OPTION 202)	28480	04278-66531
C1	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
C2	0160-4822	2	1	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C3	0160-6561	0	5	CAPACITOR-FXD 0.1UF +-20% 50VDC CER	16299	CACO2Z5U104M050A
C4	0160-6561	0		CAPACITOR-FXD 0.1UF +-20% 50VDC CER	16299	CACO2Z5U104M050A
C5	0160-6561	0		CAPACITOR-FXD 0.1UF +-20% 50VDC CER	16299	CACO2Z5U104M050A
C6	0160-6561	0		CAPACITOR-FXD 0.1UF +-20% 50VDC CER	16299	CACO2Z5U104M050A
C7	0160-6561	0		CAPACITOR-FXD 0.1UF +-20% 50VDC CER	16299	CACO2Z5U104M050A
C8	0180-3217	0	1	CAPACITOR-FXD 470UF +-20% 6.3VDC AL	16299	CACO2Z5U104M050A
DS1	0990-0665	6	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
F1	2110-0741	3	1	FUSE 1A 125V NTD VL	28480	2110-0741
J1	1251-5652	2	1	CONN-POST TYPE .100-PIN-SPCG 40-CONT	28480	1251-5652
R1	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
R2	0698-3440	7	13	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R3	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R4	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R5	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R6	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R7	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R8	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R9	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R10	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R11	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R12	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R13	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R14	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8/TO-196R-F
R15	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
R16	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP
U1	1990-1199	0	13	OPTO-ISOLATOR	28480	1990-1199
U2	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U3	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U4	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U5	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U6	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U7	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U8	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U9	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U10	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U11	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U12	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U13	1990-1199	0		OPTO-ISOLATOR	28480	1990-1199
U14	1990-0655	1	1	OPTO-ISOLATOR	28480	1990-0655
U15	1820-2711	5	3	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
U16	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
U17	1820-1416	5	1	IC SCHMITT TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
U18	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
U19	1820-4888	1	2	CMOS 6321P	28480	1820-4888
U20	1820-4888	1		CMOS 6321P	28480	1820-4888

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

Table 1-48. A31 Handler Interface Replaceable Parts List (2/2)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
U21	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
U22	1820-2075	4	2	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS00N
U23	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS00N
U24	1820-1200	5	1	IC INV TTL LS HEX	01295	SN74LS05N
W6	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
W9	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
W10	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
W13	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
X1	1252-1589	9	1	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-BD-THKNS	28480	4040-0749
	4040-0751	8	1	EXTR-PC BD ORN POLYC .062-BD-THNKS	28480	4040-0751

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

NOTES

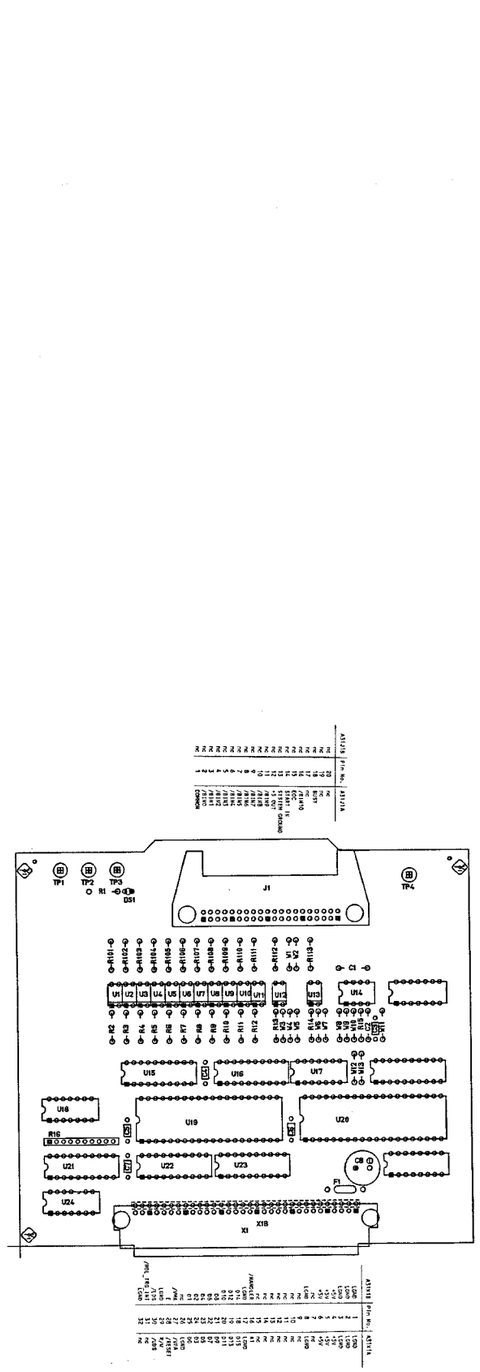
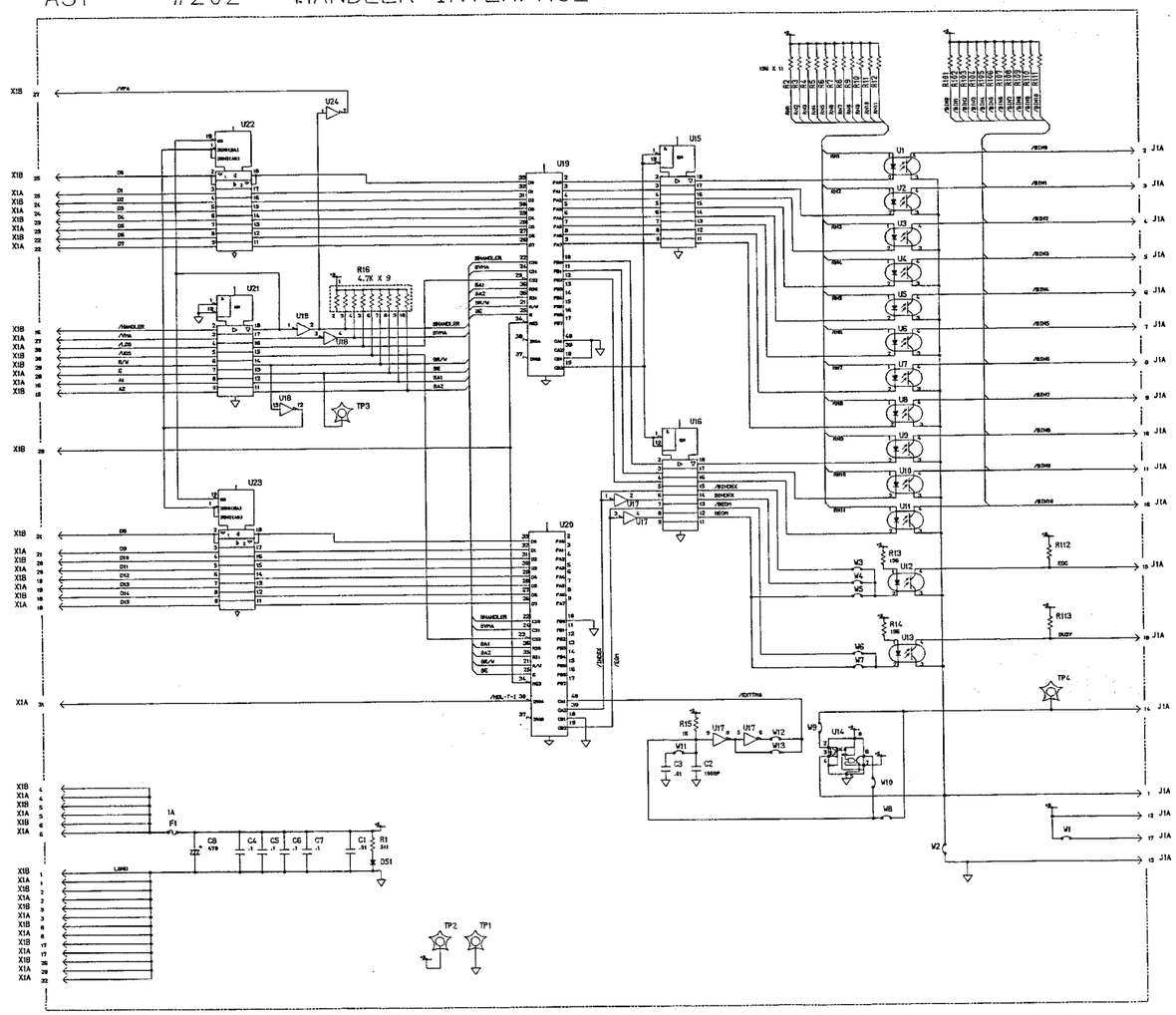


Figure 1-46. A31 Handler Interface Component Locations

A31 #202 HANDLER INTERFACE



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:

   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

Figure 1-47. A31 Handler Interface (Option 202) Schematic Diagram

A40 SCANNER INTERFACE BOARD SERVICE SHEET

NOTES

1-21. A40 BOARD SERVICE SHEET

1-21-1. CIRCUIT DESCRIPTION

The A40 scanner interface board consists of photo couplers, EEPROMs, Static RAMs, and the peripheral interface adapter (PIA).

[Photo Couplers]

When the scanner interface connector on the rear panel is used to synchronize an external scanner, the input/output signals are opto-isolated by A40U3, A40U4, A40U5, and A40U6 photo-couplers. The pull-up resistors for the input signals are selected with A40SW1 and A40SW2.

[EEPROMs]

EEPROMs A40U7 and A40U12 (64 KBytes) are used to store compensation data for 256 channels.

[Static RAMs]

SRAMs A40U1 and A40U2 (256 Kbytes) are used to store five hundred sets of measurement data when a block data transfer via HP-IB is performed. They are also used to calculate the compensation data factor.

[Peripheral Interface Adapter]

Peripheral interface adapter (A40U9) interfaces between the A7 CPU board and the 40 board.

1-21-2. TROUBLESHOOTING AIDS

The test points are listed in Table 1-49.

Table 1-49. Test Point List

Test Point	Signal Name	Description
A40TP1	*EXT_TRIG*	External trigger signal
A40TP2	*EXT_DCV*	External dc voltage
A40TP3	*COMMON*	Common line
A40TP4	*VCC*	+ 5 V dc
A40TP5	*GND*	Ground line

1-21-3. REPLACEABLE PARTS LISTS

The replaceable parts of the A40 Scanner Interface Board are listed in Table 1-50.

1-21-4. COMPONENT LOCATIONS

The component locations on the A40 scanner interface board and the board connector pin assignments are shown in Figure 1-48.

1-21-5. SCHEMATIC DIAGRAMS

The schematic diagram of the A40 Scanner Interface board is shown in Figure 1-49.

Table 1-50. A40 Scanner Interface Replaceable Parts list (1/2)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A40						
A40	04278-66540	2	1	SCANNER INTERFACE (OPTION 301)	28480	04278-66540
C1	0180-3363	6	1	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
C2	0160-6561	0	6	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M
C3	0160-4832	4	1	CAPACITOR-FXD .01F +-10% 100VDC CER	28480	0160-4832
C4	0160-4822	2	1	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
C5	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M
C6	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M
C7	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M
C8	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M
C9	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M
C10	0180-3217	9	1	CAPACITOR-FXD 470UF +-20% 6.3VDC AL	28480	0160-4822
F1	2110-0742	4	1	FUSE 1.5A 125V NTD VL	28480	2110-0742
R1	0757-0421	4	18	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R2	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R3	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R4	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R5	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R6	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R7	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R8	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R9	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R10	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R11	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R12	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R13	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R14	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R15	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R16	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R17	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R18	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
R19	0757-0280	3	2	RESISTOR 1K 1% .125W F TC =0+-100	24546	C4-1/8-T0-1001-F
R20	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
R21	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
R22	0698-0082	7	2	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R23	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R24	0757-0280	3		RESISTOR 1K 1% .125W F TC =0+-100	24546	C4-1/8-T0-1001-F
R25	1810-0273	9	1	NETWORK-RES 10-SIP470.0 OHM X 9	01121	210A471
R26	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8/T0-4641-F
S1	3101-2831	8	2	SWITCH 8P	28480	3101-2831
S2	3101-2831	8		SWITCH 8P	28480	3101-2831
U1	1818-3918	8	2	IC CMOS 262144 (256K) STAT RAM 120-NS	S4013	HM62256LP-12
U2	1818-3918	8		IC CMOS 262144 (256K) STAT RAM 120-NS	S4013	HM62256LP-12
U3	1990-1179	6	3	PHOTO-COUPLER	28480	1990-1179
U4	1990-1179	6		PHOTO-COUPLER	28480	1990-1179
U5	1990-1179	6		PHOTO-COUPLER	28480	1990-1179
U6	1990-0602	8	1	OPTO-ISOLATOR LED-IC GATE IF=20MA-MAX	28480	5082-4316
U7	1818-3801	1	2	IC NMOS 65536 (64K) ELEC-ER-PROM 300-NS	S4013	HN58064P-30
U8	1820-1208	3	2	IC GATE TTL LS OR QUAD 2-PIN	01295	SN74LS32N
U9	1820-4888	1	1	CMOS 6321P	28480	1820-4888
U10	1820-1208	3		IC GATE TTL LS OR QUAD 2-PIN	01295	SN74LS32N

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

Table 1-50. A40 Scanner Interface Replaceable Parts list (2/2)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
U11	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
U12	1818-3801	1	2	IC NMOS 65536 (64K) ELEC-ER-PROM 300-NS	S4013	HN58064P-30
U13	1820-1200	5	1	IC INV TTL LS HEX	01295	SN74LS05N
U14	1820-2075	4	5	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
U15	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
U16	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
U17	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
U18	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
U19	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
U20	04278-80004	0	1	PAL	28480	04278-80004
X1	1252-1598	9	1	CONN-POST TYPE 2.54-PIN-SPCG 96 CONT	09922	PI96B30P00F50N9
	4040-0748	3	1	EXTR-PC BD BLK POLYC .62-BD-THKNS	28480	4040-0748
	4040-0752	9	1	EXTR-PC BD YEL POLYC .062-IN-BD-THKNS	28480	4040-0752

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

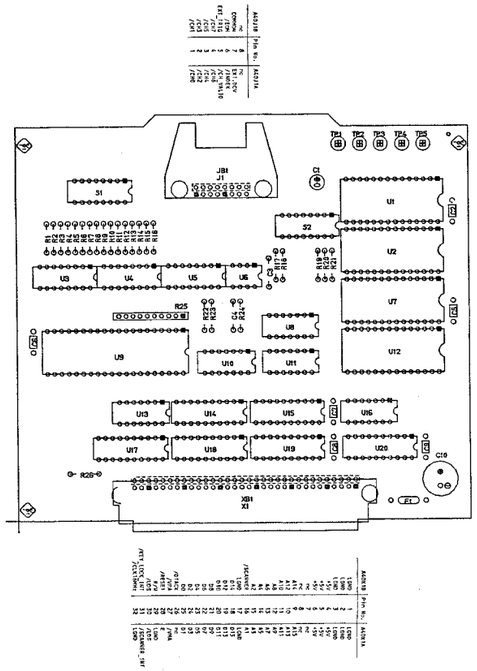
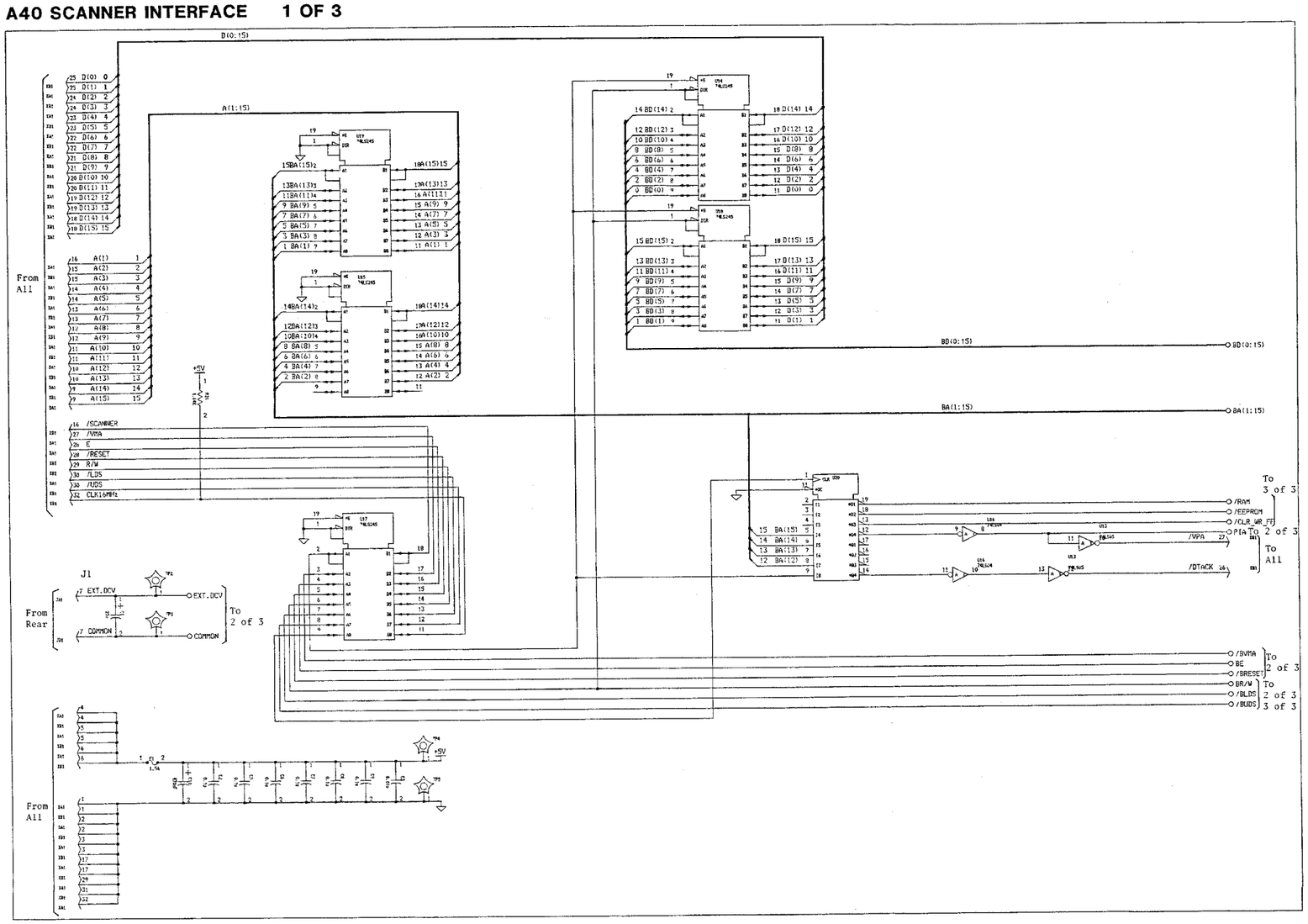


Figure 1-47. A40 Scanner Interface Component Locations

A40 SCANNER INTERFACE 1 OF 3



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (uF)
   INDUCTANCE IN MICROHENRIES (uH)

Figure 1-49. A40 Scanner Interface (Option 301) Schematic Diagram (1/3)

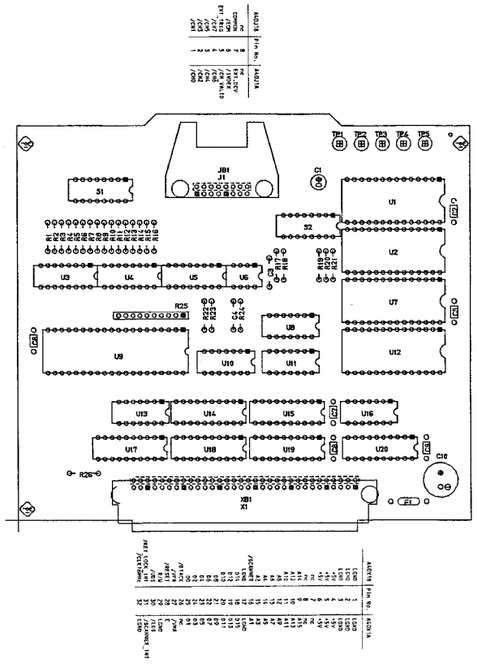
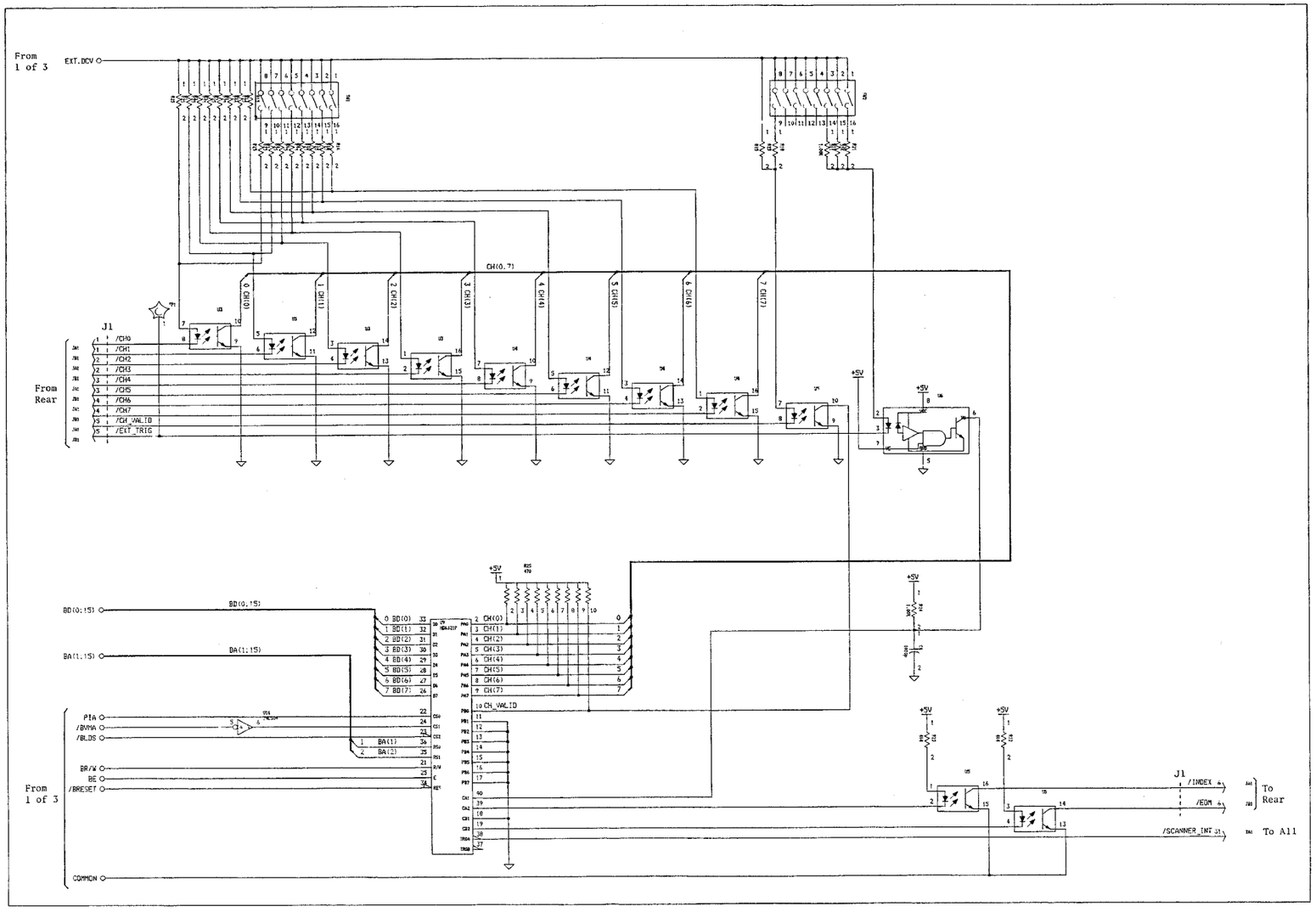


Figure 1-47. A40 Scanner Interface Component Locations

A40 SCANNER INTERFACE 2 OF 3



NOTES:

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2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (uF)
   INDUCTANCE IN MICROHENRIES (uH)

Figure 1-49. A40 Scanner Interface (Option 301) Schematic Diagram (2/3)

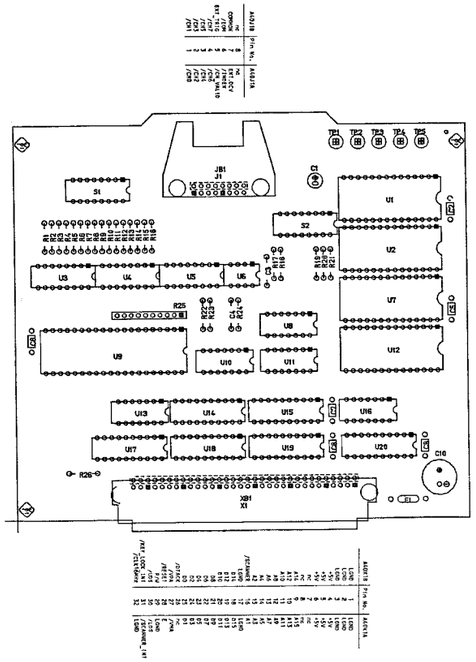
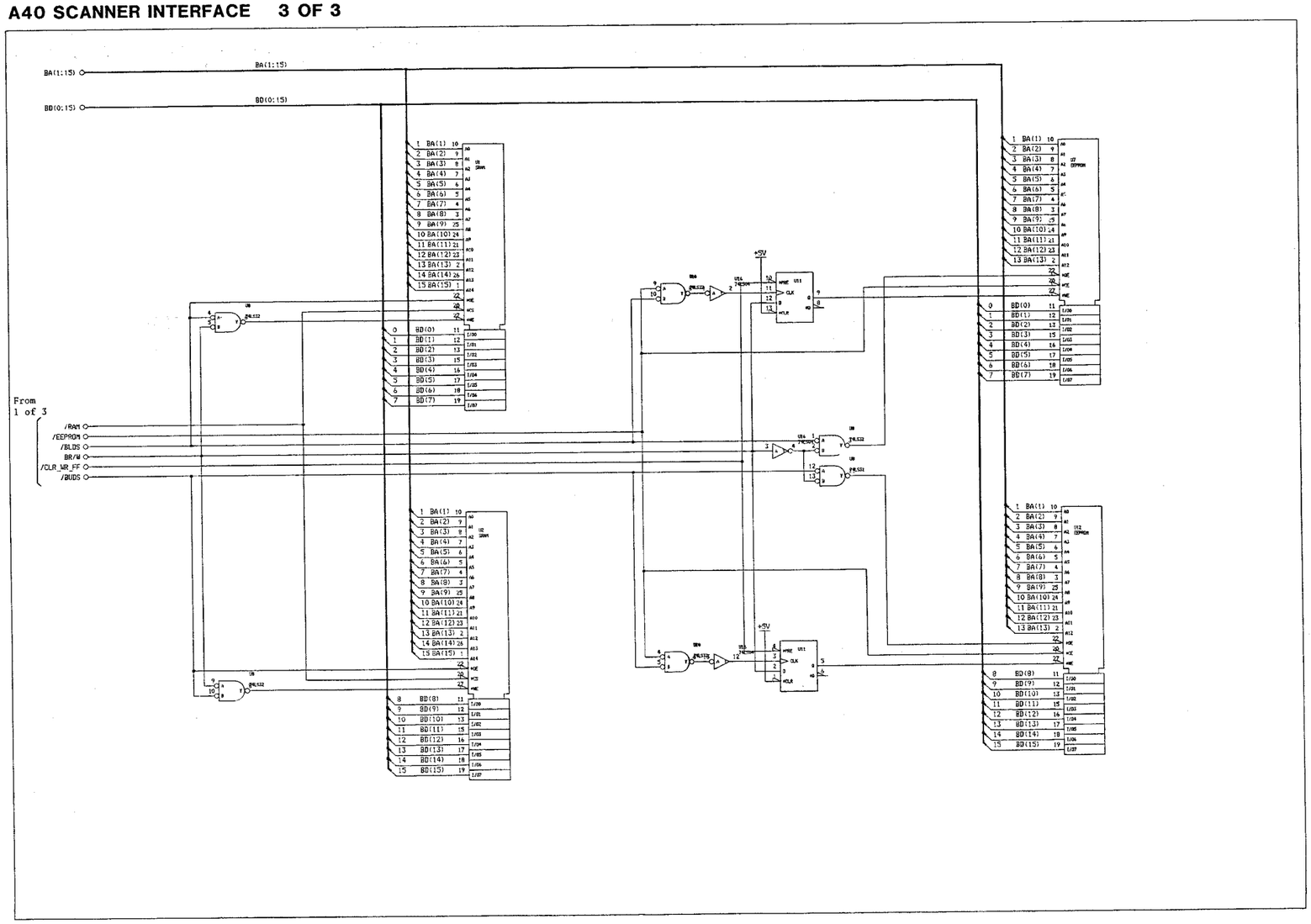


Figure 1-47. A40 Scanner Interface Component Locations

A40 SCANNER INTERFACE 3 OF 3



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. PREFIX ABBREVIATION WITH ASSEMBLY NUMBER FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω)
   CAPACITANCE IN MICROFARADS (μF)
   INDUCTANCE IN MICROHENRIES (μH)

Figure 1-49. A40 Scanner Interface (Option 301) Schematic Diagram (3/3)

SECTION 2

MANUAL CHANGES

2-1. INTRODUCTION

This section contains information for adapting this manual to HP 4278A's to which the content of this manual does not directly apply. The following paragraphs explains how to adapt this manual to apply to instruments who's serial number prefix/number or ROM version number is lower than that given on the title page.

2-2. MANUAL CHANGES

To adapt this manual to your instrument, refer to Table 2-1 and make all of the manual changes listed opposite your instrument's serial number. Perform these changes in the sequence listed.

If your instrument serial number is not listed on the title page of this manual or in Table 2-1, it may be documented in a yellow MANUAL CHANGES supplement. For additional information on serial number coverage, refer to **INSTRUMENTS COVERED BY MANUAL** in **SECTION 5** of the 4278A's Operation Manual.

Table 2-1. Manual Changes By Serial Number

Serial Number Prefix or Number	Make Manual Changes
2713J00375 and below	1, 2
2725J00376 through 2740J00564	2

If ROM-based firmware is version 2.1 and below, disregard the changes listed under CHANGE 2.

CHANGE 1

Page 1-3, Table 1-2. Front Panel Components,

Change Table 1-2 to the Table 7-2.

Page 1-4, Table 1-3. Front Panel Assembly Components,

Change the part number of number 4 (reference designator) to PN 04278-66509.

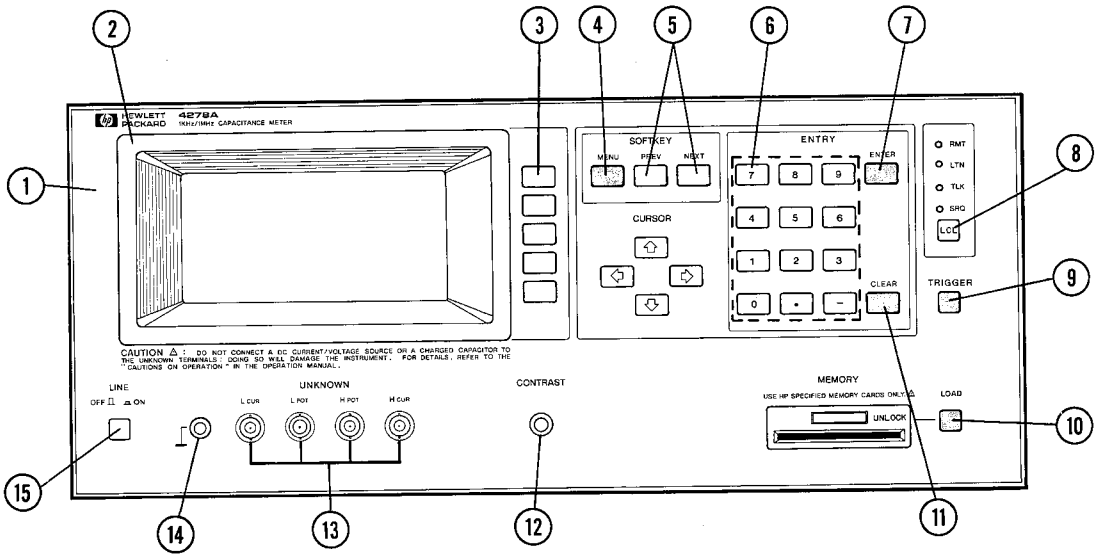
Page 1-A9/A13/A90/A91-4, Table 1-38. A9 Keyboard Replaceable Parts Lists,

Change Table 1-38 to Table 7-3.

Page 1-A9/A13/A90/A91-7, Figure 1-37. A9 Keyboard and A13 DC-AC Converter Component Locations,

Change the A9 keyboard Component Locations to the Figure 7-1.

Table 7-2. Front Panel Components



Reference Designator	Part Number	Qty	Description
1	04278-00201	1	Panel, Front (HP)
2	04278-40001	1	Bezel
	3150-0541	1	Filter
	04278-00205	1	Plate
	04278-00203	1	Sub Panel
3	5041-0310	5	Key Cap, Half Pearl
4	5041-0376	1	Key Cap, Half Gray
5	5041-0310	2	Key Cap, Half Pearl
6	5041-0758	1	Key Cap, Half (-)
	5041-0808	1	Key Cap, Half (.)
	5041-0819	1	Key Cap, Half (0)
	5041-0811	1	Key Cap, Half (1)
	5041-0812	1	Key Cap, Half (2)
	5041-0813	1	Key Cap, Half (3)
	5041-0814	1	Key Cap, Half (4)
	5041-0815	1	Key Cap, Half (5)
	5041-0816	1	Key Cap, Half (6)
	5041-0817	1	Key Cap, Half (7)
	5041-0818	1	Key Cap, Half (8)
	5041-0816	1	Key Cap, Half (9)
7	5041-0376	1	Key Cap, Half Gray
8	5041-0758	1	Key Cap, Quarter LCL
9	5041-0309	1	Key Cap, Quarter Gray
10	5041-0375	1	Key Cap, Quarter Smoke Gray
11	5041-0310	1	Key Cap, Half, Gray
12	0370-2446	1	Knob
13	1250-0252	4	BNC Connector
	5040-3324	4	Insulator
	5040-3325	4	Insulator
	2950-0035	4	Nut
14	1510-0130	1	Binding Post
	2190-0084	1	Washer
	2950-0006	1	Nut
15	5041-0564	1	Key Cap
	3101-2216	1	Power Switch
	04278-01203	1	Plate

Table 7-3. A9 Keyboard Replaceable Parts Lists (1/2)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A9						
	04278-66509	0	1	KEYBOARD	28480	04278-66509
DS1	1990-0487	7	4	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
DS2	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
DS3	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
DS4	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
F1	2110-0741	3	1	FUSE 1A 125V NTD UL	28480	2110-0741
J1	1251-4959	0	1	CONNECTOR 2-PIN M METRIC POST TYPE	28480	1251-4959
KC1	5041-0310	8	8	HALF KEY CAP	28480	5041-0310
KC2	5041-0376	6	2	HALF KEY CAP	28480	5041-0376
KC3	5041-0310	8		HALF KEY CAP	28480	5041-0310
KC4	5041-0310	8		HALF KEY CAP	28480	5041-0310
KC5	5041-0817	0	1	HAF-SMK-SMST	28480	5041-0817
KC6	5041-0818	1	1	HAF-SMK-SMST	28480	5041-0818
KC7	5041-0816	9	2	HAF-SMK-SMST	28480	5041-0816
KC8	5041-0376	6		HALF KEY CAP	28480	5041-0376
KC9	5041-0310	8		HALF KEY CAP	28480	5041-0310
KC10	5041-0814	7	1	HAF-SMK-SMST	28480	5041-0814
KC11	5041-0815	8	1	HAF-SMK-SMST	28480	5041-0815
KC12	5041-0816	9		HAF-SMK-SMST	28480	5041-0816
KC13	5041-0310	8		HALF KEY CAP	28480	5041-0310
KC14	5041-0994	4	2	HALF KEY CAP	28480	5041-0994
KC15	5041-0811	4	1	HAF-SMK-SMST	28480	5041-0811
KC16	5041-0812	5	1	HAF-SMK-SMST	28480	5041-0812
KC17	5041-0813	6	1	HAF-SMK-SMST	28480	5041-0813
KC18	5041-0726	0	1	KEY Q-LCL	28480	5041-0726
KC19	5041-0310	8		HALF KEY CAP	28480	5041-0310
KC20	5041-1000	5	2	HAF-SMST-SMK	28480	5041-1000
KC21	5041-1000	5		HAF-SMST-SMK	28480	5041-1000
KC22	5041-0310	8		HALF KEY CAP	28480	5041-0310
KC23	5041-0994	4		HALF KEY CAP	28480	5041-0994
KC24	5041-0819	2	1	KEY CAP	28480	5041-0819
KC25	5041-0808	9	1	HAF-SMK-SMST	28480	5041-0808
KC26	5041-0758	8	1	HAF-SMK-SMST	28480	5041-0758
KC27	5041-0310	8		HALF KEY CAP	28480	5041-0310
KC28	5041-0309	5	1	KEY CAP	28480	5041-0309
KC29	5041-0375	5	1	QTR-SMK	28480	5041-0375
R4	0698-0082	7	4	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R5	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R6	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R7	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
R8	2100-4162	9	1	VOLUME	28480	2100-4162
S1	5060-9436	7	29	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S6	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S7	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S8	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S9	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S10	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S11	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S12	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S13	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S14	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S15	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S16	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S17	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S18	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S19	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S20	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S21	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S22	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S23	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S24	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S25	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S26	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S27	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S28	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S29	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436

Table 7-3. A9 Keyboard Replaceable Parts Lists (2/2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W1	8120-4910	3	1	FLEX JUMPER WIRE	28480	8120-4910
W2	8120-4904	5	1	FLEX JUMPER WIRE	28480	8120-4904
	0380-1779	8	4	STANDOFF	28480	0380-1779
	04262-40001	5	1	INSULATOR	28480	04262-40001

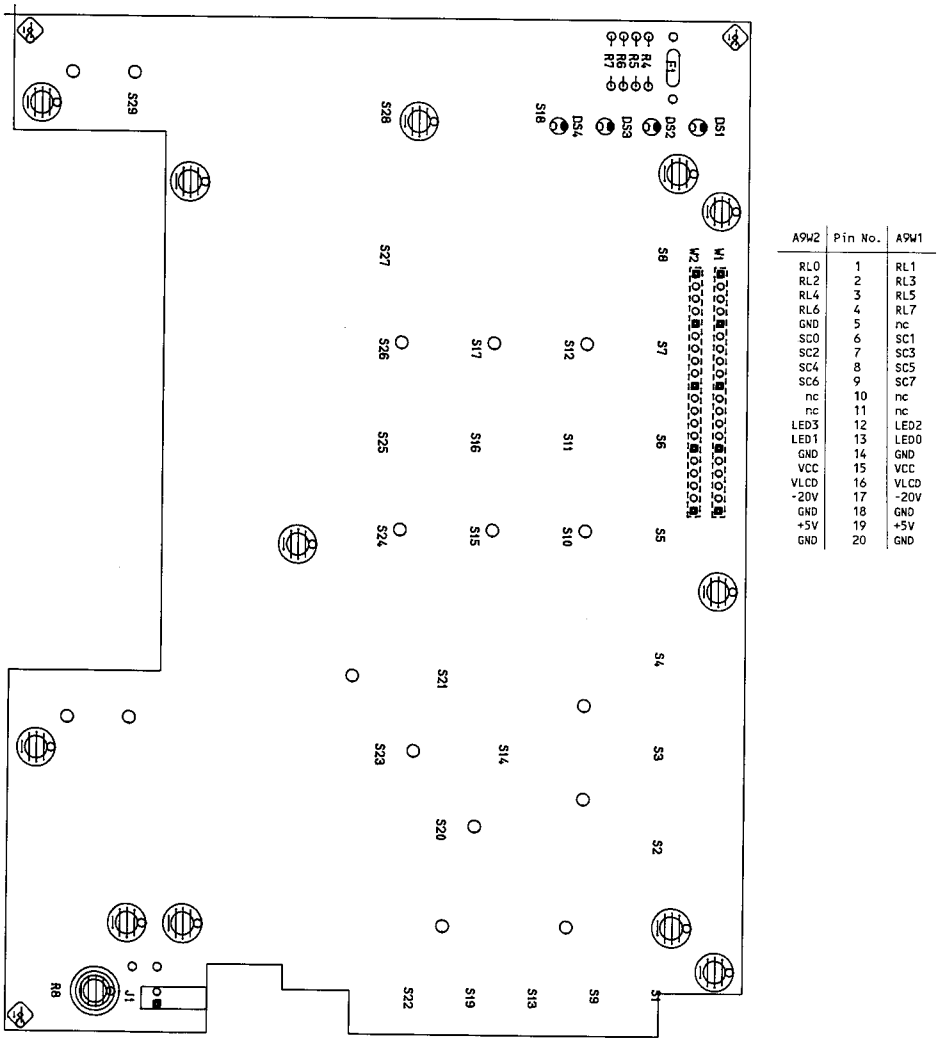


Figure 7-1. A9 Keyboard Component Locations

CHANGE 2

Page 1-A7-4, Table 1-35. A7 Board Replaceable Parts Lists,

Change the Table 1-35 to the Table 7-4.

Table 7-4. A7 Board Replaceable Parts List (1/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7						
A7	04278-66607	8	1	DIGITAL CONTROL W/O ROMs (For Ver 2.0/2.1)	28480	04278-66607
	04278-69607		1	DIGITAL CONTROL W/O ROMs (RE-BUILT)	28480	04278-69607
A7C1	0160-4822	2	10	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C2	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C3	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C4	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C5	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C6	0160-6561	0	9	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C7	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C8	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C9	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A7C10	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C11	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C12	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C13	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C14	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C15	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A7C16	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C17	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C18	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C19	0160-4806	2	1	CAPACITOR-FXD 39PF +-5% 100VDC CER0+-30	28480	0160-4806
A7C21	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C22	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A7C23	0180-3590	1	2	CAPACITOR-FXD 470UF+-20% 10VDC AL	28480	0180-3590
A7C24	0180-3590	1		CAPACITOR-FXD 470UF+-20% 10VDC AL	28480	0180-3590
A7CR3	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
A7DS1	1990-0665	3	2	LED-LAMP LUM-INT=1MCD IF=30MA-MAX BVR=5V	28480	1990-0665
A7DS2	1990-0665	3		LED-LAMP LUM-INT=1MCD IF=30MA-MAX BVR=5V	28480	1990-0665
A7DS3	1990-0652	8	2	LED-LAMP ARRAY LUM-INT=200UCD IF=5MA-MAX	28480	1990-0652
A7DS4	1990-0652	8		LED-LAMP ARRAY LUM-INT=200UCD IF=5MA-MAX	28480	1990-0652
A7F1	2110-0743	5	1	FUSE 2A 125V UL	28480	2110-0743
A7FL1	9135-0329	2	1	FILTER-LINE LEADS-TERMS	28480	9135-0329
A7FL2	9170-1397	0	1	BEAD INDUCTOR	28480	9170-1397
A7J1	1251-4822	6	7	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J2	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J3	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J4	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J5	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J6	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J7	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A7J11	1200-0567	1	12	SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J12	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J13	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J14	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J15	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J16	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J17	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J18	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7L1	9140-1272	7	1	L SF-C27	28480	9140-1272

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

Table 7-4. A7 Board Replaceable Parts List (2/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7Q3	1853-0459	3	1	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A7R1	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A7R2	0689-1055	7		RESISTOR 1M 5% 1W CC TC=0+1000	01121	GB1055
A7R3	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A7R4	1810-0279	5	16	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R5	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A7R6	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R8	0698-3155	1	4	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A7R9	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A7R10	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A7R11	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A7R12	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A7R16	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A7R17	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R20	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R21	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R24	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R25	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R26	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R27	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R28	1810-0275	1	1	NETWORK-RES 10-SIP 1.0K OHM X 9	91637	
A7R29	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R30	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R31	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R32	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R33	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R34	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A7R35	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A7R36	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	1810-0279
A7R37	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A7R38	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A7S1	3101-2831	8	3	SWITCH 8P	28480	3101-2831
A7S2	3101-2831	8		SWITCH 8P	28480	3101-2831
A7S3	3101-2831	8		SWITCH 8P	28480	3101-2831
A7TP1	0360-1653	5	19	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP2	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP3	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP4	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP5	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP6	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP7	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP8	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP9	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP10	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP11	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP12	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP13	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP14	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP15	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP16	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP17	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP18	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP19	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653

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

Table 7-4. A7 Board Replaceable Parts List (3/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7U1	1820-2696	5	1	IC FF TTL F D-TYPE POS-EDGE-TRIG COM CLK	07263	74F175PC
A7U2	1820-2690	9	1	IC GATE TTL F OR QUAD 2-INP	07263	74F32PC
A7U3	1820-2774	0	1	IC GATE TTL ALS NAND DUAL 4-INP	01295	SN74ALS20AN
A7U4	1820-2635	2	1	IC GATE TTL ALS AND QUAD 2-INP	01295	SN74ALS08N
A7U5	1820-4952	0	1	PROC MC68000	28480	1820-4952
A7U6	1820-2711	5	8	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U7	1820-3100	8	7	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U8	1820-3121	3	2	IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN74ALS245AN
A7U13	1818-3183	2	4	IC CMOS 65536 (64K) STAT RAM 150-NS	S4013	HM6264LP-15
A7U14	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS	S4013	HM6264LP-15
A7U15	1818-3801	1	2	IC NMOS 65536 (64K) ELEC-ER-PROM 300-NS	S4013	HN58064P-30
A7U16	1820-2922	0	1	IC GATE CMOS/74HC NAND QUAD 2-INP	04713	MC74HC00N
A7U19	1820-3348	6	1	IC CNTR TTL F BIN SYNCHRO POS-EDGE-TRIG	07263	74F163APC
A7U20	1820-2634	1	3	IC INV TTL ALS HEX	01295	SN74ALS04BN
A7U21	1820-2777	3	1	IC CNTR TTL ALS BIN SYNCHRO	01295	SN74ALS161BN
A7U22	1820-3376	0	1	IC INV TTL ALS HEX	01295	SN74ALS05AN
A7U23	1820-2861	6	1	IC DCDR TTL F 3-TO-8-LINE	07263	74F138PC
A7U25	1820-2488	3	6	IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U26	1820-2634	1		IC INV TTL ALS HEX	01295	SN74ALS04BN
A7U27	1820-2657	8	3	IC GATE TTL ALS OR QUAD 2-INP	01295	SN74ALS32N
A7U28	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U29	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U30	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U31	1820-3220	3	1	IC DCDR TTL F BIN 2-TO-4-LINE DUAL	07263	74F139PC
A7U32	1820-3121	3		IC TRANSCEIVER TTL ALS BUS OCTL	01295	SN74ALS245AN
A7U37	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS	S4013	HM6264LP-15
A7U38	1818-3183	2		IC CMOS 65536 (64K) STAT RAM 150-NS	S4013	HM6264LP-15
A7U39	1818-3801	1		IC NMOS 65536 (64K) ELEC-ER-PROM 300-NS	S4013	HN58064P-30
A7U40	1826-1648	7	1		28480	1826-1648
A7U42	1820-4927	9	1	CMOS-COUNTER 16B	28480	1820-4927
A7U43	04278-80003	9	1	PAL	28480	04278-80003
A7U44	04278-80002	8	1	PAL	28480	04278-80002
A7U45	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U46	04278-80001	1	1	PAL	28480	04278-80001
A7U47	1820-2686	3	1	IC GATE TTL F AND QUAD 2-INP	07263	74F08PC
A7U48	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U49	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U50	1820-2757	9	3	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
A7U51	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A7U52	1820-2657	8		IC GATE TTL ALS OR QUAD 2-INP	01295	SN74ALS32N
A7U53	1820-2657	8		IC GATE TTL ALS OR QUAD 2-INP	01295	SN74ALS32N
A7U54	1820-3298	5	1	IC GATE CMOS/74HC OR QUAD 2-INP	27014	MM74HC32N
A7U55	1820-2634	1		IC INV TTL ALS HEX	01295	SN74ALS04BN
A7U56	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U57	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U58	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
A7U59	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U60	1820-2075	4	3	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
A7U61	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U62	1820-3100	8		IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A7U63	1820-3145	1	1	IC DRVR TTL ALS BUS OCTL	01295	SN74ALS244AN
A7U64	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS574AN
A7U65	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN

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

Table 7-4. A7 Board Replaceable Parts List (4/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7U66	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U67	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U68	1820-2488	3		IC FF TTL ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74AN
A7U69	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
A7U70	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
A7U71	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U72	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7U73	1820-2711	5		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A7V1	2140-0127	2	1	LAMP-NEON 90V	28480	2140-0127
A7W1	1258-0141	8	7	JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W2	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W3	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W4	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W5	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W6	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7W7	1258-0141	8		JUMPER-REMOVABLE FOR0.025 IN SQ PINS	28480	1258-0141
A7X1	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A7X2	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A7Y1	1813-0545	4	1	CLOCK-OSCILLATOR-XTAL 31.680-MHZ0.005%	28480	1813-0545
	0403-0026	6	1	PLUG-HOLE BDR-HD FOR .187-D-HOLE NYL	02768	207-120241-03-0101
	1200-0638	7	1	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	4040-0748
	4040-0755	2	1	EXTR-PC BD VIO POLYC .062-IN-BD-THKNS	28480	4040-0755
				ROM		
				Version 2.0		
A7U9	04278-85501	2	1	ROM 0K BIT0 (ROM Version 2.0)	28480	04278-85501
A7U10	04278-85503	3	1	ROM 10K BIT0 (ROM Version 2.0)	28480	04278-85503
A7U11	04278-85505	4	1	ROM 20K BIT0 (ROM Version 2.0)	28480	04278-85505
A7U12	04278-85507	5	1	ROM 30K BIT0 (ROM Version 2.0)	28480	04278-85507
A7U33	04278-85502	6	1	ROM 0K BIT8 (ROM Version 2.0)	28480	04278-85502
A7U34	04278-85504	7	1	ROM 10K BIT8 (ROM Version 2.0)	28480	04278-85504
A7U35	04278-85506	8	1	ROM 20K BIT8 (ROM Version 2.0)	28480	04278-85506
A7U36	04278-85508	9	1	ROM 30K BIT8 (ROM Version 2.0)	28480	04278-85508
				Version 2.1		
A7U9	04278-85601	3	1	ROM 0K BIT0 (ROM Version 2.1)	28480	04278-85601
A7U10	04278-85603	4	1	ROM 10K BIT0 (ROM Version 2.1)	28480	04278-85603
A7U11	04278-85605	5	1	ROM 20K BIT0 (ROM Version 2.1)	28480	04278-85605
A7U12	04278-85607	6	1	ROM 30K BIT0 (ROM Version 2.1)	28480	04278-85607
A7U33	04278-85602	7	1	ROM 0K BIT8 (ROM Version 2.1)	28480	04278-85602
A7U34	04278-85604	8	1	ROM 10K BIT8 (ROM Version 2.1)	28480	04278-85604
A7U35	04278-85606	9	1	ROM 20K BIT8 (ROM Version 2.1)	28480	04278-85606
A7U36	04278-85608	0	1	ROM 30K BIT8 (ROM Version 2.1)	28480	04278-85608

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*** Indicates factory selected value.**

NOTES

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