Agilent 4279A
1MHz C-V Meter
(Including Options 003)

Service Manual

MANUAL IDENTIFICATION

Model Number: 4279A
Date Printed: July 2000
Part Number: 04279-90100

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
All	1

SERIAL PREFIX OR NUMBER CHANGES	MAKE MANUAL

◆ New Item

ERRATA

CHANGES 1

Change	Page	Note	Reference Designator	HP Part Number	Description
1	3-A1-7	►C	A1C41	0180-4251	CAPACITOR-FXD 3300UF
	3-A1-11		A1T3	9100-4764	TRANSFORMER
			A1T4	9100-4765	TRANSFORMER
				2110-0726	FUSEHOLDER-CLIP TYPE.25D-FUSE
	3-A2-9		A2CR1	1901-0880	DIODE-GEN PRP
			A2CR2	1901-0880	DIODE-GEN PRP
			A2CR3	1901-0880	DIODE-GEN PRP
			A2CR4	1901-0880	DIODE-GEN PRP
	3-A2-10		A2Q2	1853-0336	TRANSISTOR PNP
			A2Q3	1854-0523	TRANSISTOR NPN
			A2Q5	1853-0336	TRANSISTOR PNP
	3-A7-5		A7C23	0180-4403	CAPACITOR-FXD 470UF
			A7C24	0180-4403	CAPACITOR-FXD 470UF
	3-A7-7		A7U15	1818-5719	IC CMOS 64K EEPROM
			A7U39	1818-5719	IC CMOS 64K EEPROM

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

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.

PRINTED IN JAPAN

Agilent Technologies

Agilent 4279A 1MHz C-V Meter (Including Option 003)

Service Manual

SERIAL NUMBERS

This manual applies directly to instruments whose serial number prefix is 2737J-, and whose ROM-based firmware is version 1.0 and 2.0.
For additional important information about serial numbers, read INSTRUMENTS COVERED BY MANUAL in Section 8 of the 4279A Operation Manual.

Agilent Technologies

Agilent Part No. 04279-90100
Printed in JAPAN July 2000

Notice

The information contained in this document is subject to change without notice.

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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: 04279-90100)

July 2000 ..... Second Edition (part number: 04279-90100)

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.

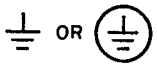
For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

SAFETY SYMBOLS

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

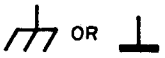
Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

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

ADJUSTMENTS

1-1. INTRODUCTION

This section describes the adjustments required to ensure the HP 4279A 1 MHz C-V Meter is within its published specifications after it has been repaired. These adjustments should be performed along with periodic maintenance to keep the 4279A in optimum operating condition. The recommended calibration cycle is six months. If proper performance cannot be achieved after calibration refer to the troubleshooting procedures in this service manual.

NOTE

To ensure proper results and correct instrument operation, Hewlett-Packard suggests a 30-minute warm-up and stabilization period before performing any of the following adjustments.

1-2. SAFETY CONSIDERATIONS

This manual contains **NOTE**s, **CAUTION**s, and **WARNING**s which must be followed to ensure the safety of the operator and to keep the instrument in a safe and serviceable condition. The adjustments covered in this section must be performed by qualified service personnel.

WARNING

ANY INTERRUPTION OF THE PROTECTIVE GROUND CONDUCTOR (INSIDE OR OUTSIDE THE INSTRUMENT) OR DISCONNECTION OF THE PROTECTIVE GROUND TERMINAL CAN MAKE THE INSTRUMENT DANGEROUS. INTENTIONAL INTERRUPTION OF THE PROTECTIVE GROUND SYSTEM FOR ANY REASON IS PROHIBITED.

The removal or opening of covers for adjustment, or removal of parts other than those which are accessible by hand will expose circuits containing dangerous voltage levels.

Remember that even though you have turned the 4279A off, and unplugged it, the capacitors in the 4279A can remained charged for a few minutes.

WARNING

THE ADJUSTMENTS DESCRIBED IN THIS SECTION ARE PERFORMED WITH POWER APPLIED AND THE PROTECTIVE COVERS REMOVED. DANGEROUS VOLTAGE LEVELS EXIST AT MANY POINTS AND CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH IF YOU COME INTO CONTACT WITH THEM.

1-3. TEST EQUIPMENT

Table 1-1 lists the test equipment required to perform the adjustments described in this section. Use only calibrated test equipment when adjusting the 4279A. If the recommended test equipment is not available, equipment whose specifications are equal to, or surpass those of the recommended test equipment may be used.

1-4. ADJUSTABLE COMPONENTS

Table 1-2 lists the 4279A's adjustable components, the name of the adjustment related to each component, and gives a brief description of each adjustment.

1-5. ADJUSTMENT INTERACTION

Some of the 4279A adjustments are interactive. If you repair or replace an 4279A assembly, be sure to perform the related adjustment(s) in the sequence given. Table 1-3 lists the adjustments required for each assembly repaired or replaced. Ignoring or changing the adjustment sequence will make it impossible to obtain optimum performance.

1-6. ADJUSTMENT LOCATIONS

Figure 1-1 will help you to locate the adjustment points. Each adjustment procedure contains a figure to help you locate the test points, and to identify the required connectors and other related equipment.

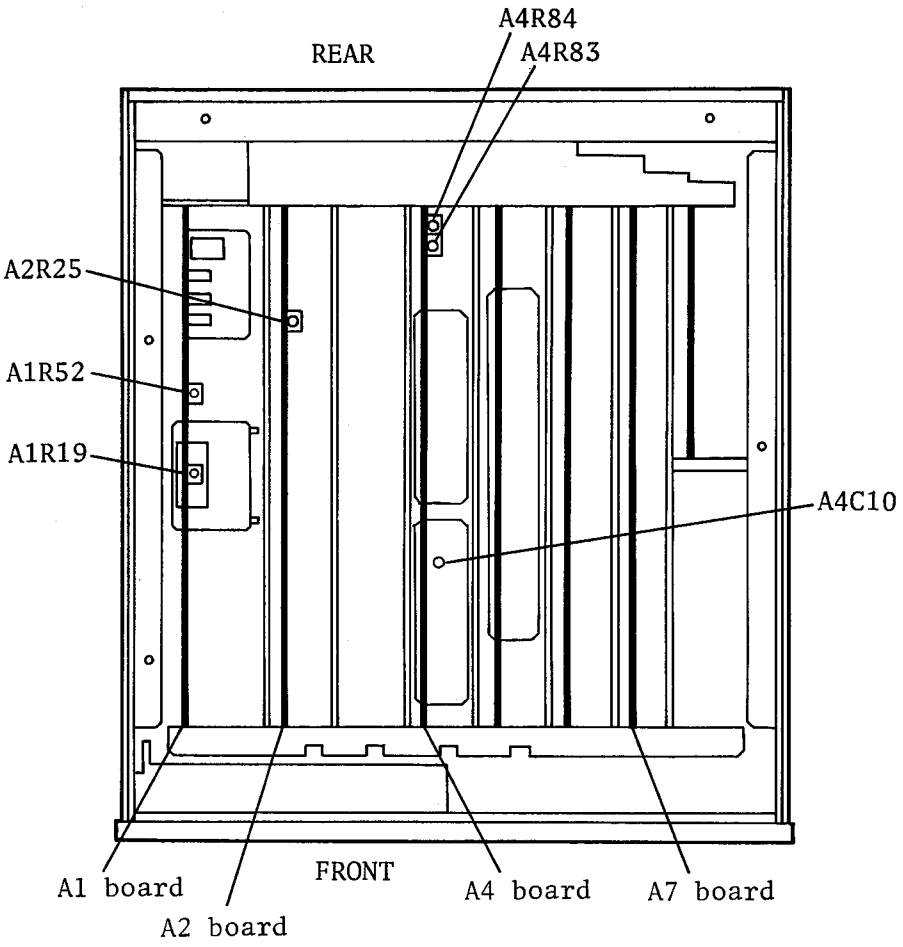


Figure 1-1. Adjustment Locations

1-7. INITIAL OPERATING PROCEDURE

Before you start, perform the BASIC OPERATING CHECK and the DISASSEMBLY procedures given in the following paragraphs to prepare the 4279A for adjustment. The 4279A must be initialized (set to its initial control settings), before each adjustment as described in Appendix C of the Operation Manual. Exceptions to these settings will be noted as they occur. After you complete an adjustment reinitialize the 4279A.

NOTE

The 4279A is initialized when it is turned on and when it receives an HP-IB ***RST** command.

OPERATIONAL VERIFICATION

Check that the line voltage selector switch on the rear panel of the 4279A is set properly. Turn the 4279A on and let it warm-up for at least 30 minutes. After the warm-up period, initialize the instrument. If the 4279A fails its self test or if you can't initialize it, refer to the troubleshooting procedures in this service manual.

DISASSEMBLY, TOP COVER REMOVAL

To gain access to the adjustment points, perform the following procedure.

1. Remove the two plastic instrument-feet located at the upper corners of the rear panel.
2. Fully loosen the top cover retaining screw located at the back of the top cover.
3. Slide the top cover towards the rear and lift it off.
4. Loosen the five screws that secure the right hand side top shield plate. You don't have to remove the screw.

WARNING

DO NOT REMOVE THE LEFT HAND SIDE TOP SHIELD PLATE ON WHICH WARNING MESSAGE IS PRINTED EXCEPT FOR THE POWER SUPPLY ADJUSTMENT.

5. Slide the top shield plate towards the front and lift it off.

WARNING

TO PROTECT AGAINST POSSIBLE ELECTRICAL SHOCK, USE INSULATED TOOLS TO MAKE ALL ADJUSTMENTS.

Table 1-1. Recommended Test equipment

Equipment	Critical Specification	Qty.	Recommended Model	Use
Oscilloscope	Band Width: 10 MHz Range: 10 mV/div min Voltage Accuracy: 3%	1	HP 1740A	A,T
Divider Probe	10:1, 1 MΩ	1	HP 10040A	A,T
RMS Voltmeter	Frequency: 1 MHz Accuracy: 1%	1	HP 3400A	A
Test Cable	BNC(m) to BNC(m), 30 cm	1	PN 8120-1838	A
Digital Voltmeter	Range: DC 0.1 to 38 V Sensitivity: 0.1 mV min.	1	HP 3478A	A,T
Test Lead	Dual Banana Plug to Alligator Clip	1	HP 11002A	A
Adapter	BNC(f)-to-Dual Banana	1	PN 1251-2277	A
Standard Capacitor	C: 1 pF, 10 pF, 100 pF 1000 pF Four Terminal Pair	1	HP 16380A	A
OPEN/SHORT Reference	Four Terminal Pair	1	P/O HP 16074A	A
Test Leads	Length 1 m and 2 m Four Terminal Pair	1 1	HP 16048A HP 16048D	A A
Program Disc	Service Program	1	PN 04279-65002	A,T
Controller	HP Technical Computer	1	HP 9000 Series 200 Model 226	A,T
HP-IB Cable	HP-IB Cable, 1 m	2	HP 10833A	A,T
Extender Board	For Half Board For Digital Board For Analog Board	1 1 1	PN 04278-66596 PN 04278-66597 PN 04278-66598	T T T

A: Adjustments T: Troubleshooting

Table 1-2. Adjustable Components

Adjustable Component	Adjustment Name	Description
A1R19	FREQ-ADJ	Power Supply Switching Frequency Adjustment
A1R52	V-ADJ	Power Supply Output Voltage Adjustment
A2R25	OSC LVL	Test Signal Voltage Adjustment
A4R84 A4R85	OFS ADJ	Transducer Second Null Amplifier Offset Voltage Adjustment
A4C10	RES FREQ ADJ	Transducer First Null Amplifier Resonance Frequency Adjustment

Table 1-3. Required Adjustments

Assembly Replaced or Repaired		Adjustments Required (Paragraph Number)
A1	Power Supply	1-8
A2	Signal Source	1-9, 1-10, 1-11
A4	Transducer	1-10, 1-11
A5	Phase Detector	1-11
A6	A-D converter	1-11
A7	Digital Control	1-11
A9	Keyboard	None
A11	Mother Board	None
A13	DC-AC Converter	None
A20	HP-IB Interface	None
A90	Keyboard/Display Control	None
A91	LCD Module	None

1-8. POWER SUPPLY ADJUSTMENTS

The following two part procedure adjusts the switching frequency and the output voltage of the switching power supply.

1-8-1. POWER SUPPLY SWITCHING FREQUENCY ADJUSTMENT

Adjusts the switching frequency of the power supply.

EQUIPMENT:

Oscilloscope	HP 1740A
10:1 Divider Probe, 1 MΩ	HP 10040A

PROCEDURE:

1. Make sure that the 4279A is turned off.
2. Loosen the two screws holding the left hand side top shield plate (the shield plate on which the **WARNING** message is printed), and remove it.

WARNING

DANGEROUS VOLTAGES ARE PRESENT ON THE BOARD UNDER THE SHIELD PLATE. DON'T TOUCH ANYPLACE EXCEPT WHERE INSTRUCTED TO.

3. Connect the 10040A to the **CHAN A INPUT** of the 1740A. Figure 1-2 shows the setup for this adjustment.

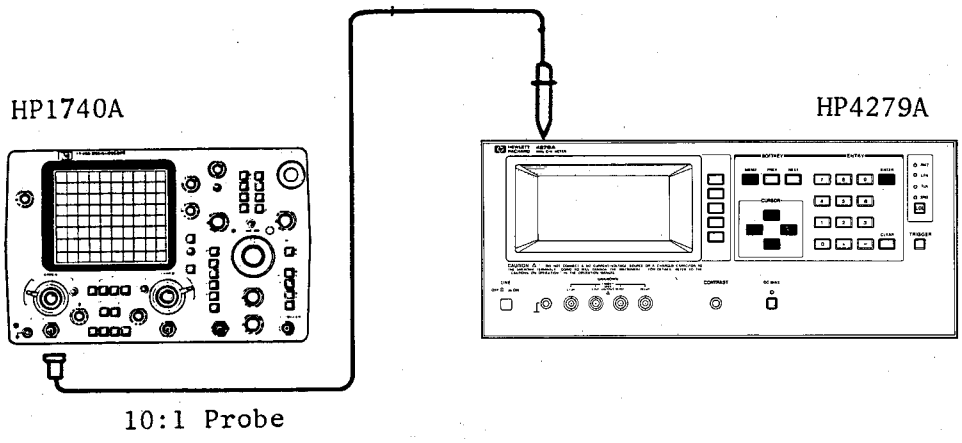


Figure 1-2. Power Supply Frequency Adjustment Setup

4. Set the 1740A's controls as follows:

INPUT A:	DC, 1 MΩ
CHAN A Vertical:	1 V/DIV
TIME BASE:	2 µsec

5. Connect the probe's ground lead to A1TP12. Connect the probe tip to A1TP11. Figure 1-3 shows the access and adjustment locations.

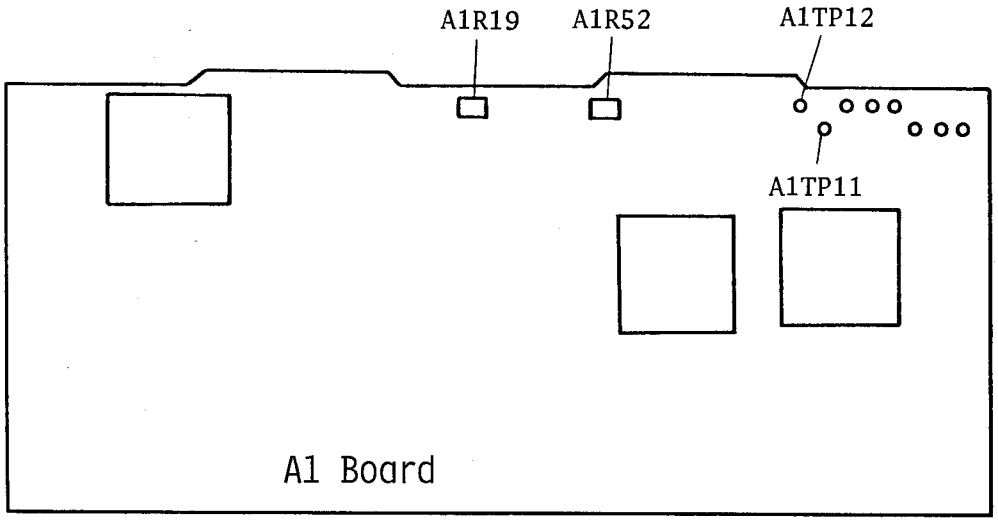


Figure 1-3. Power Supply Adjustment Locations

6. Turn on the 4279A.

7. Adjust A1R19 (FREQ-ADJ) until the period (T), of the waveform, is 12.5 µs ± 0.5 µs, as shown in Figure 1-4.

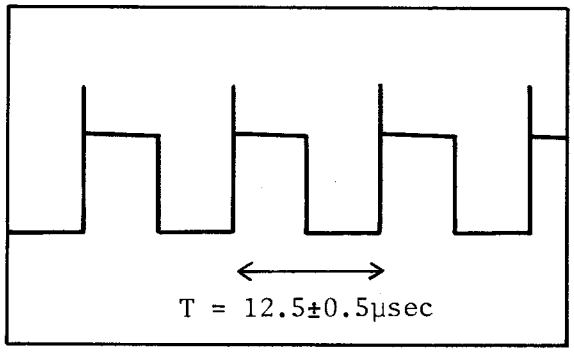


Figure 1-4. Switching Waveform

8. Disconnect the probe from the 4279A.

1-8-2. POWER SUPPLY OUTPUT VOLTAGE ADJUSTMENT

This adjustment sets the output voltage of the power supply.

EQUIPMENT:

Digital Voltmeter	HP 3478A
Dual Banana Plug to Alligator Clip Cable	HP 11002A

PROCEDURE:

1. Connect the 11002A to the 3478A's INPUT. Figure 1-5 shows the equipment setup.

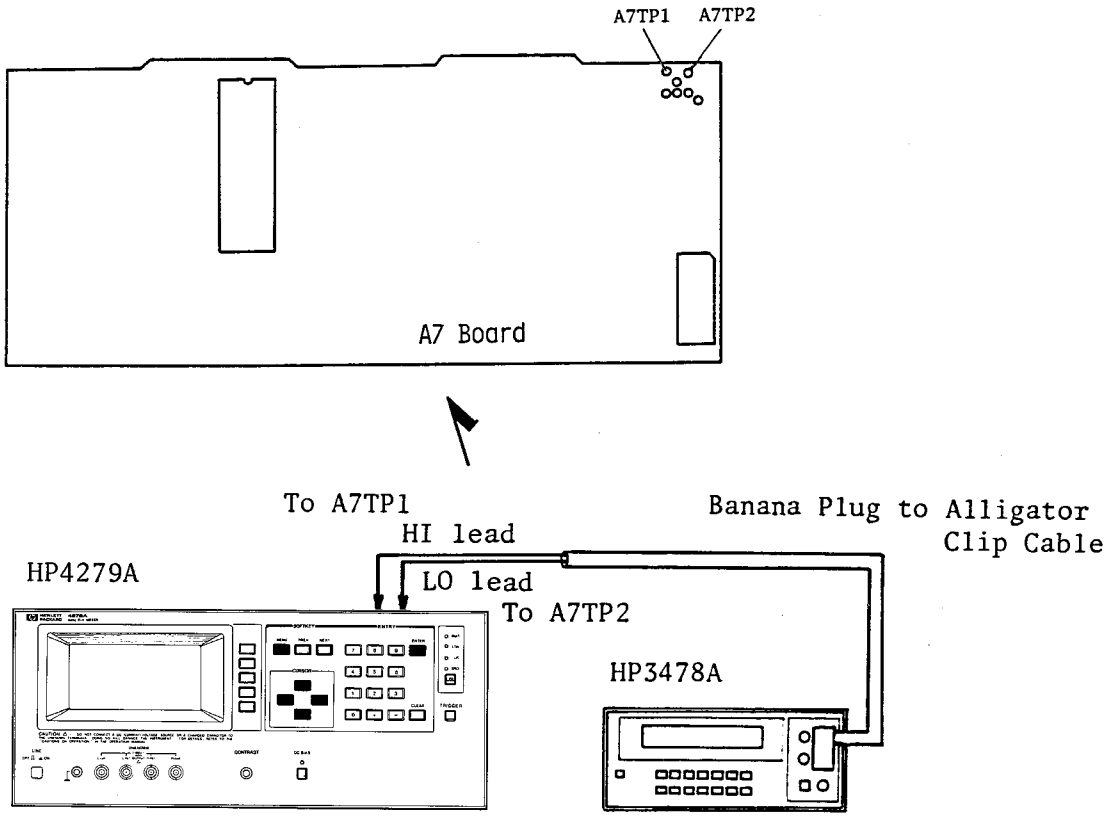


Figure 1-5. Power Supply Voltage Adjustment Setup

2. Set the 3478A's controls as follows:

FUNCTION:	DCV
RANGE:	AUTO

3. Connect the LO lead of the 3478A to A7TP2 and the HI lead to A7TP1 as shown in Figure 1-5.

4. Turn A1R52 (**V-ADJ**) fully **CCW** (Counter Clock-Wise).

5. Adjust A1R52 until the voltage reading of the 3478A is 5 V ± 0.05 V.

6. Remove the test leads and turn off the 4279A.

7. Reinstall the left hand side top shield plate on the A1 board.

1-9. SIGNAL SOURCE ADJUSTMENTS

This adjustment sets the test signal voltage.

EQUIPMENT:

RMS Voltmeter	HP 3400A
BNC (m)- to - BNC (m) Cable (30cm)	HP PN 8120-1838

PROCEDURE:

1. Set the voltage range on the 3400A to 3 V.
2. Connect INPUT of the 3400A and the **UNKNOWN Hcur** Terminal of the 4279A using the BNC cable as shown in Figure 1-6.

NOTE

The length of the BNC cable used in this adjustment must be less than 50 cm.

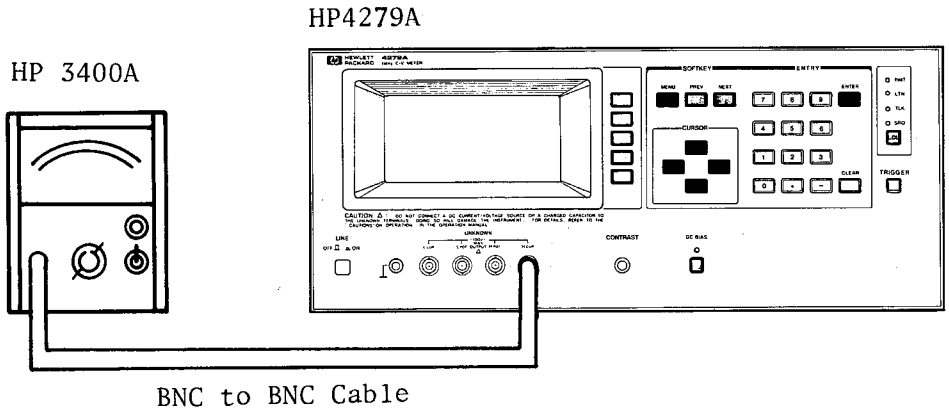


Figure 1-6. Signal Source Adjustments Setup

3. Set the 4279A's oscillator level to 1000 mV.
4. Adjust A2R25 (OSC LVL), until the voltage reading of the 3400A is 1 V ± 0.01 V.
5. Disconnect the 3400A from the 4279A.

1-10. TRANSDUCER ADJUSTMENTS

The following two part procedure adjusts the the offset voltage of the second null amplifier, and the resonant frequency of the first null amplifier.

1-10-1. SECOND NULL AMPLIFIER OFFSET ADJUSTMENT

The following adjustment minimizes the offset voltage of the integrator in the second null amplifier circuit. This adjustment is performed using the 4279A's self test function.

PROCEDURE:

1. Press the **MENU** and **PREV** keys in sequence.
2. Press the **'SVC FNCTN'**, **'SELF TEST'**, and **'TEST No.='** softkeys in sequence.
3. Press the **2** and **ENTER** keys in sequence.
4. Press the **'TEST START'** softkey.
5. Adjust A4R84 and A4R85 (**OFS ADJ**), alternately so that the displayed result on the LCD is less than 0.00003 and minimized.
6. Press the **'TEST ABORT'** and **'TEST MENU'** softkeys in sequence, to return to the test menu.

NOTE

Continue on to the next adjustment without resetting the 4279A.

1-10-2. FIRST NULL AMPLIFIER RESONANT FREQUENCY ADJUSTMENT

Adjusts the resonant frequency of the first null amplifier. This adjustment is performed using the self test.

PROCEDURE:

1. Press the **'TEST No.='** softkey.
2. Press **1** and **ENTER** keys in sequence.
3. Press the **'TEST START'** softkey.
4. Adjust A4C10 (**RES FREQ ADJ**), for a maximum readout on the LCD.

NOTE

Confirm that the maximum value in step 4 is between 0.2 and 0.8. If the value is out of range, troubleshoot the A4 board.

1-11. UPDATING CALIBRATION DATA

NOTE

All adjustments previously described must have been completed before performing the following calibration.

The 4279A's DC bias voltage output calibration data and capacitance measurement calibration data is stored in its EEPROM and must be updated whenever the 4279A is adjusted. First, the procedure given in paragraph 1-11-1, CALIBRATION SETUP must be performed, and second, when you want to calibrate the DC bias voltage output, the the procedure given in paragraph 1-11-2, DC BIAS VOLTAGE OUTPUT CALIBRATION must be performed. Also when you want to calibrate capacitance measurement, the procedure given in paragraph 1-11-3, CAPACITANCE MEASUREMENT CALIBRATION must be performed. The procedure given in paragraph 1-11-4, REPOSITIONING THE EEPROM WRITE PROTECT JUMPER, must be performed after calibrating the 4279A.

NOTE

The Calibration operation can only be done by controlling the 4279A using an HP 9000 series 200 computer and running the service utilities provided on the program disc (PN 04279-65002).

1-11-1. CALIBRATION SETUP

This paragraph gives the procedure to perform before calibrating the 4279A.

EQUIPMENT:

Service Program Disc	PN 04279-65002
HP-IB Controller	HP 9000 Series 200 Model 226
HP-IB Interconnection Cable	HP 10833A

PROCEDURE:

1. Turn the 4279A off and remove the A7 board assembly.
2. Set the 4279A's EEPROM write protect jumper (A7W2) from the normal position (**N**) to the test position.
3. Install the A7 board assembly into the 4279A, and replace the shield plate and the top cover.
4. Connect the HP-IB cable between the HP-IB connectors on the 4279A's rear panel and on the controller's rear panel (select code is 7). Figure 1-7 shows the setup.

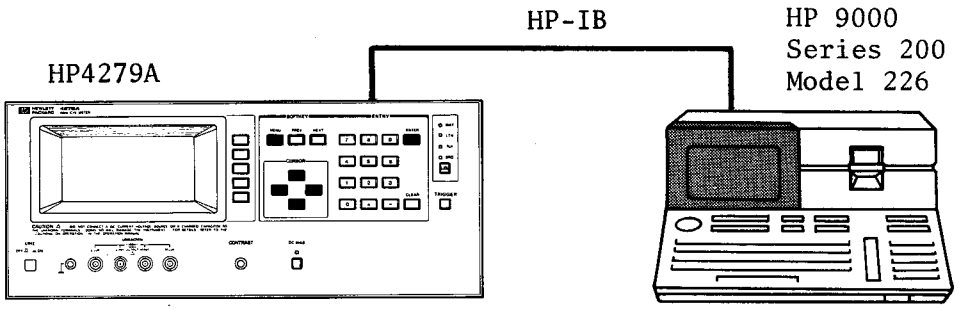


Figure 1-7. EEPROM Calibration Data Update Setup

5. Turn the 4279A and controller on.

6. Set the 4279A to the Addressable mode and the HP-IB address to 17.

7. Boot up BASIC and load the necessary binary files in the controller. The necessary **BASIC BIN**aries for version 3.0/4.0/5.0 are as follows.

HPIB, IO, MAT, ERR

8. Load the calibration program in the controller, the file name is **"SVC_4279A"**.

9. Press the controllers **RUN** key and wait until the main menu is displayed.

10. Press the **1** and **ENTER** keys to perform the calibration, the calibration menu will be displayed.

1-11-2. DC BIAS VOLTAGE OUTPUT CALIBRATION

This paragraph provides the procedure for DC bias voltage output calibration.

NOTE

The procedure given in paragraph **1-11-1, CALIBRATION SETUP** must be performed before performing the DC bias voltage output calibration.

EQUIPMENT:

Digital Multimeter	HP 3456A or HP 3478A
BNC(m)-to-BNC(m) Cable 30cm	PN 8120-1838
BNC(f)-to-Dual Banana Adapter	PN 1251-2277
HP-IB Cable	HP 10833A

PROCEDURE:

1. The calibration menu and **"Select and enter a number."** are displayed. Press the controller's **1** and **ENTER** keys to select the DC bias voltage output calibration.

2. The message, **"Select and enter a number."**, will be displayed. Press the controller's **1** and **ENTER** keys to perform the DC bias voltage output calibration.

3. The message, **"Enter the DMM you are using."** will be displayed on the controller's screen. Then when you use the 3456A, press the controller's **1** and **ENTER** keys in sequence. When you use the 3478A, press the controller's **2** and **ENTER** keys in sequence.

4. Your selection information and the message, **"Is your selection correct?(Y or N)"** will be displayed. If your selection for the DMM is correct, press the controller's **Y** and **ENTER** keys in sequence. Otherwise press the controllers **N** and **ENTER** keys in sequence, and the same information will be displayed as in step 3. Then, enter your DMM selection again.

5. Connect the Digital multimeter to the 4279A's **Hcur** Terminal as shown in Figure 1-8.

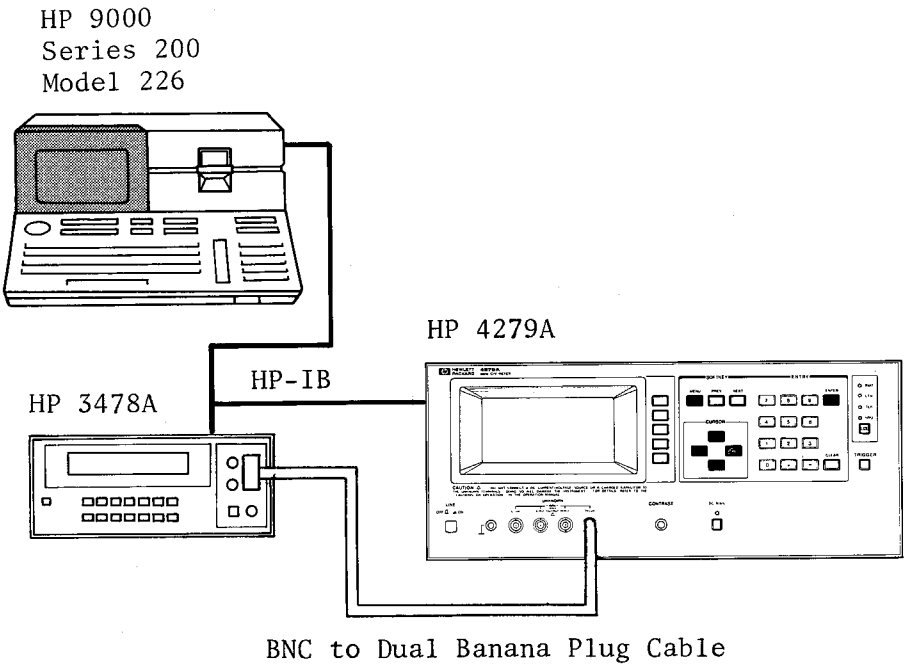


Figure 1-8. DC BIAS Voltage Output Calibration Setup

6. Set the HP-IB address of the Digital multimeter to 23.

7. Press the **CONTINUE** key to perform the DC bias voltage output calibration.

NOTE

After the calibration measurements, the controller calculates the calibration factor, and sends the calibration factors to the 4279A via HP-IB. Don't disturb the controller and the 4279A.

8. Wait until the message, "**Calibration is complete.**", is displayed.

9. Press the **CONTINUE** key to return to the calibration menu.

1-11-3. CAPACITANCE MEASUREMENT CALIBRATION

This paragraph gives the procedure for capacitance measurement calibration.

NOTE

The procedure given in paragraph **1-11-1, CALIBRATION SETUP** must be performed before performing the capacitance measurement calibration.

EQUIPMENT:

Standard Capacitor 1 pF	P/O HP 16380A
Standard Capacitor 10 pF	P/O HP 16380A
Standard Capacitor 100 pF	P/O HP 16380A
Standard Capacitor 1000 pF	P/O HP 16380A
SHORT Reference	P/O HP 16074A
OPEN Reference	P/O HP 16074A
Four-Terminal Pair Test Leads (1m)	HP 16048A
Four-Terminal Pair Test Leads (2m)	HP 16048D

PROCEDURE:

1. The calibration menu and the message, **"Select and enter a number"**, will be displayed on the controller's screen. Press the controller's **2** and **ENTER** keys in sequence to select capacitance measurement calibration.

2. The message, **"Select and enter a number."**, will be displayed on the controller's screen. Press the controller's **1** and **ENTER** keys in sequence to perform capacitance measurement calibration.

3. The necessary equipment for this capacitance measurement calibration will be listed on the controller's screen. Press the controller's **CONTINUE** key to proceed.

4. The previously recorded calibration data for the standard capacitors, and the message, **"Are you upgrading the C.V.? (Y or N)"**, will be displayed on the controller's screen. Press the **Y** and **ENTER** keys, if the displayed calibration values do not match your standards' calibration data. If the displayed value matches your standards' calibration data, press the **N** and **ENTER** keys.

NOTE

If you have selected **N**, skip to the step 10.

5. The message, **"Enter the 1 pF C.V. (Serial No., C[pF])."**, will be displayed on the controller's screen. Enter your 1 pF standard's serial number and its calibrated capacitance value in pico-farads, separated by comma(,). Note that the calibration value must be valid at 1 kHz. An input example is:

2411J00417,1.00014[ENTER]

NOTE

If you don't want to change the 1 pF standard's serial number and the calibration value, just press **ENTER** or **CONTINUE** key.

6. The message, **"Enter the 10 pF C.V. (Serial No., C[pF])."** will be displayed on the controller's screen. Enter your 10 pF standard's serial number and its calibration value in a similar manner.

7. The message, **"Enter the 100 pF C.V. (Serial No., C[pF])."** will be displayed on the controller's screen. Enter your 100 pF standard's serial number and its calibration value.

8. The message, **"Enter the 1000 pF C.V. (Serial No., C[pF])."** will be displayed on the controller's screen. Enter your 1000 pF standard's serial number and its calibration value.

9. The updated calibration data and the message, **"Are the entered Calibration Values correct? (Y/N)"**, will be displayed. Press the controller's **Y** and **ENTER** keys if the displayed information is correct. If you made any mistakes when you entered the calibration data, and want to correct them, press the **N** and **ENTER** keys.

10. The message, **"Allow the 4279A to warm up, then press [Continue]"** will be displayed. After the warm-up time press the **CONTINUE** key.

11. The message, **"Temperature compensation in progress."**, will be displayed. Wait until instructions are displayed on the controller's screen.

12. Follow the instructions displayed on the controller's screen.

NOTE

After the calibration measurements, the controller calculates the calibration factor, and sends the calibration factors to the 4279A via the HP-IB bus. Don't disturb the controller and the 4279A.

13. Wait until the message, **"All data were written to EEPROM, and Capacitance measurement cal. is complete."** is displayed.

14. Press the **CONTINUE** key to return to the calibration menu.

1-11-4. REPOSITIONING THE EEPROM WRITE PROTECT JUMPER

This paragraph provides the information for returning the EEPROM WRITE PROTECT JUMPER (A7W2), which you set in the paragraph 1-11-1, to its proper position.

1. The calibration menu is displayed on the controller's screen. Press the **4** and **ENTER** keys to exit the calibration program.

4. Turn off the 4279A.

5. Replace the 4279A's EEPROM write protect jumper (A7W2) to its Normal position (**N**).

6. Replace the shield plate and the top cover.

SECTION 2

ASSEMBLY SERVICE INFORMATION

2-1. INTRODUCTION

This section provides service information for the HP 4279A 1 MHz C-V Meter's assemblies.

2-2. SAFETY CONSIDERATIONS

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

WARNING

THE MAINTENANCE PROCEDURES DESCRIBED HEREIN ARE PERFORMED WHEN POWER IS SUPPLIED TO THE INSTRUMENT AND ITS PROTECTIVE COVERS ARE REMOVED. THIS TYPE OF MAINTENANCE MUST BE PERFORMED ONLY BY SERVICE-TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED (FOR EXAMPLE, FIRE AND ELECTRICAL SHOCK). WHEN MAINTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED TO THE INSTRUMENT, REMOVE POWER FROM THE INSTRUMENT. BEFORE ANY REPAIR IS COMPLETED, ENSURE THAT ALL SAFETY FEATURES ARE INTACT AND FUNCTIONING, AND THAT ALL NECESSARY PARTS ARE PROPERLY CONNECTED TO THE PROTECTIVE GROUNDING SYSTEM.

2-3. RECOMMENDED TEST EQUIPMENT

The required troubleshooting test equipment is listed in Table 1-1, Section 1. The table lists the type of instrument required, the critical specifications, and the model numbers of the equipment recommended. If the recommended models are not available, equipment which meets or exceeds all of the critical specifications may be substituted.

2-4. AFTER SERVICE PRODUCT SAFETY CHECKS

WARNING

WHENEVER IT APPEARS LIKELY THAT PROTECTIVE SAFETY PROVISIONS HAVE BEEN IMPAIRED, THE APPARATUS SHALL BE MARKED AS INOPERATIVE AND SHOULD BE SECURED AGAINST ANY UNINTENDED OPERATION. THE PROTECTION PROVISIONS WILL HAVE LIKELY BEEN COMPROMISED IF, FOR EXAMPLE:

-- **INSTRUMENT SHOWS VISIBLE DAMAGE.**

-- **THE INSTRUMENT FAILS TO PERFORM THE INTENDED MEASUREMENT.**

-- **THE UNIT HAS UNDERGONE PROLONGED STORAGE UNDER UNFAVORABLE CONDITIONS**

-- **THE INSTRUMENT WAS SEVERELY STRESSED IN TRANSPORT.**

Perform the following five checks to verify the 4279A's safety (these checks may also be used for safety checks after troubleshooting and repair).

1. Visually inspect the interior of the instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards and components, damaged insulation, or evidence of arcing. Determine the cause and repair.

2. Use an ohmmeter which can accurately measure 0.5 Ω to check the resistance from the instrument enclosure to the power cord's ground pin. The resistance must be less than 0.5 Ω. Flex the power cord while making this measurement to determine if any intermittent discontinuities exist.

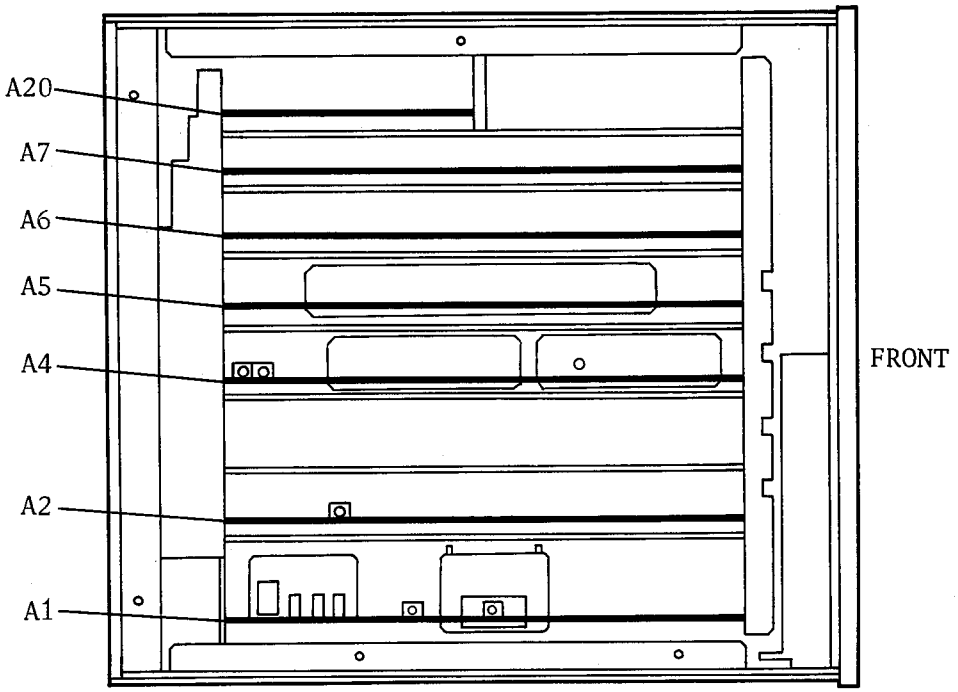
3. Check the **GUARD** terminal on the front panel using the procedure outlined in step 2.

4. Unplug the 4279A's power plug from the power source. Set the power switch to **ON**. Tie the line and neutral pins of the power connector together and check the resistance between them and the instrument's enclosure. The minimum acceptable resistance is 2 MΩ. Find and replace any component which causes the instrument to fail this test.

5. Verify that the correct fuse is installed.

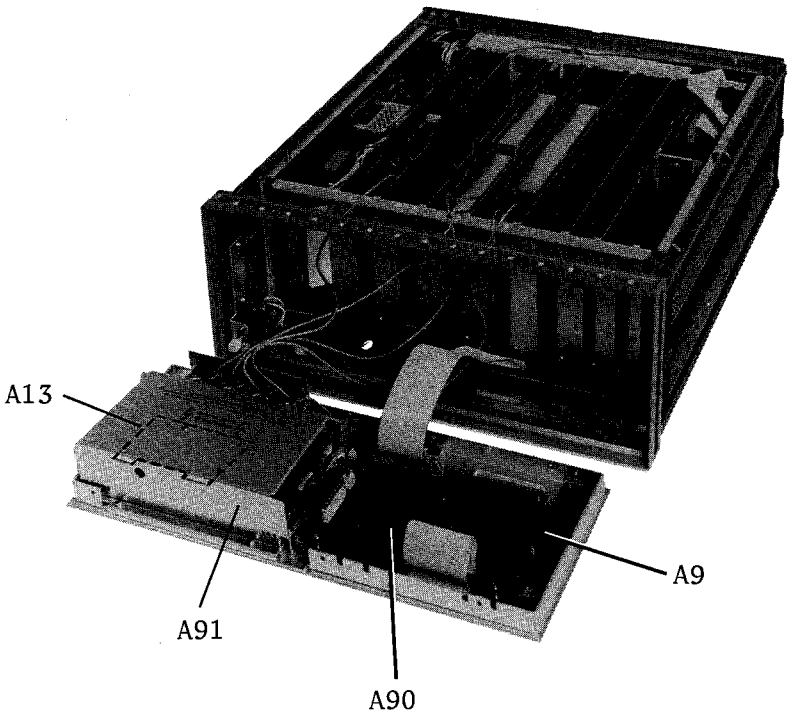
2-5. ASSEMBLY DESIGNATIONS AND LOCATIONS

Assemblies, such as printed circuit boards, are assigned sequential numbers, A1, A2 etc., as shown in Figure 2-1. Figure 2-1 also gives the location of the assemblies.



Assembly No.	Assembly Name
A1	Power Supply Board Assembly
A2	Signal Source Board Assembly
A4	Transducer Board Assembly
A5	Phase Detector Board Assembly
A6	A-D Converter Board Assembly
A7	Digital Control Board Assembly
A11	Motherboard Assembly
A20	HP-IB Interface Board Assembly

Figure 2-1. Assembly Identification (1/2)



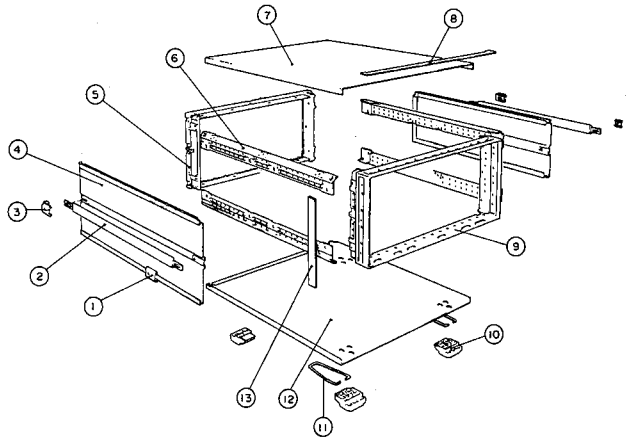
Assembly No.	Assembly Name
A9	Keyboard Assembly
A13	DC-AC Converter Board Assembly
A90	Keyboard/Display Control Board Assembly
A91	LCD Module Assembly

Figure 2-1. Assembly Identification (2/2)

2-6. REPLACEABLE MECHANICAL PARTS LIST

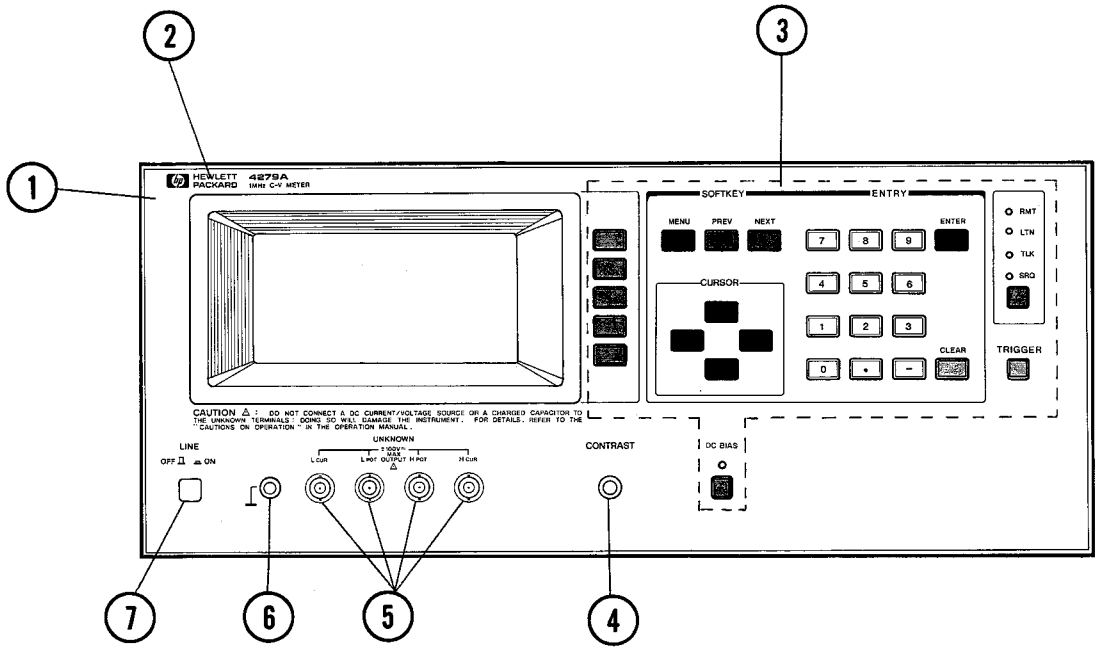
The replaceable mechanical parts are listed in Tables 2-1 to 2-6.

Table 2-1. Major Mechanical Parts (Exploded View)



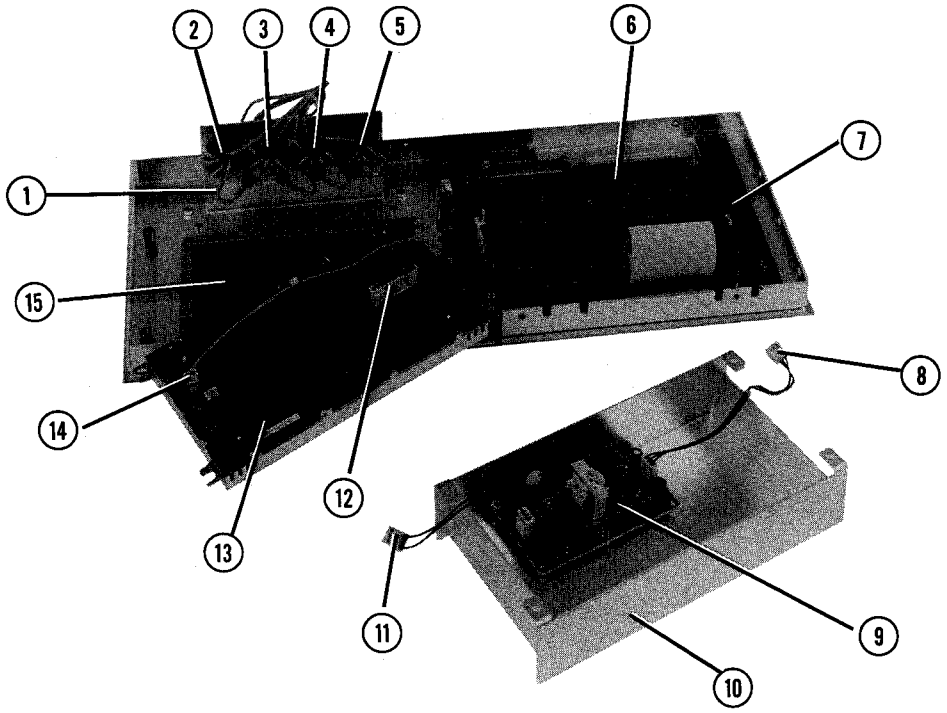
Reference Designator	Part Number	Qty.	Description
1	5041-6819	2	Front Cap
2	5060-9804	2	Strap Handle
3	5041-6820	2	Rear Cap
4	5060-9942	2	Side Cover
5	5021-5806	1	Rear Frame
6	5021-5837	4	Corner Strut
7	5061-9435	1	Top Cover
8	5040-7202	1	Top Trim
9	5021-5805	1	Front Frame
10	5040-7201	4	Foot
11	1460-1345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

Table 2-2. Front Panel Components



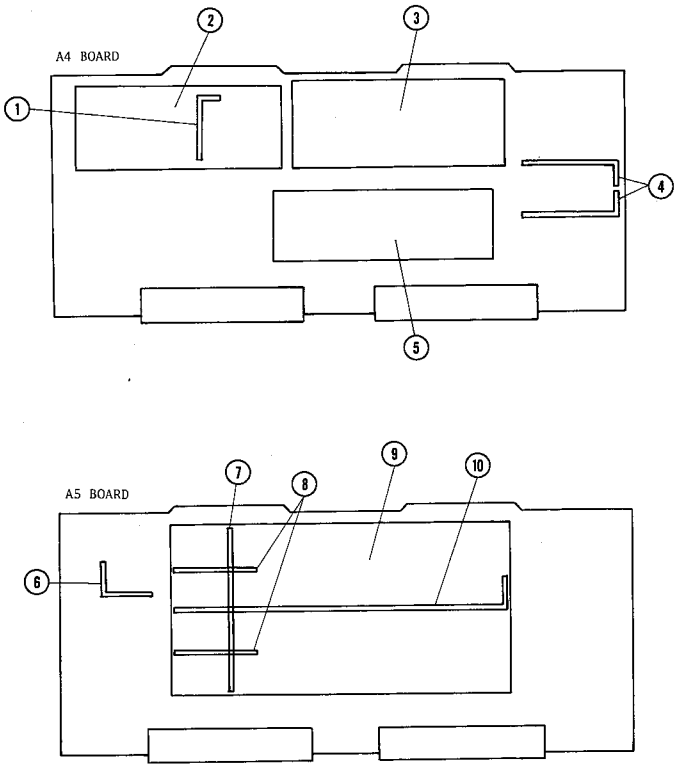
Reference Designator	Part Number	Qty.	Description
1	04279-00201	1	Panel, Front
2	04278-40001	1	Bezel (Display)
	3150-0541	1	Filter
	04278-00205	1	Plate
	04278-00206	1	Sub Panel
3	04278-25001	1	Rubber Key
	04278-40005	1	Bezel (Key)
4	0370-2446	1	Knob
5	1250-0252	4	BNC Connector
	04278-61608	4	Magnet Coil Assembly
	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 (included in PN 04278-61620)
	04278-01203	1	Plate

Table 2-3. Front Panel Assembly Components



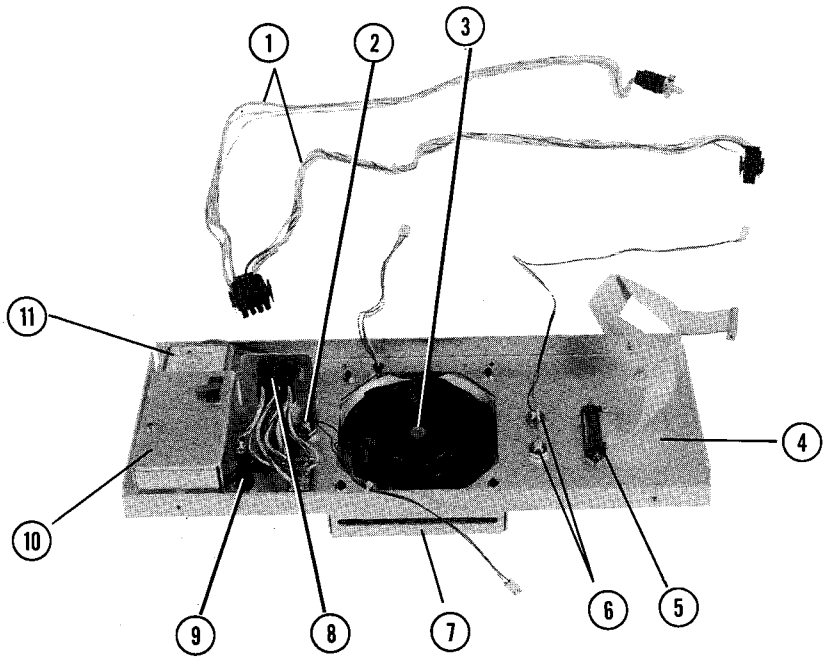
Reference Designator	Part Number	Qty.	Description
1	04279-01201	1	Holder
	0535-0031	2	Nut
2	04279-61604	1	Magnet Coil Assembly (D)
3	04279-61603	1	Magnet Coil Assembly (C)
4	04279-61602	1	Magnet Coil Assembly (B)
5	04279-61601	1	Magnet Coil Assembly (A)
6	04278-66590	1	KEY&DISP Control Unit
7	04279-66559	1	Keyboard Unit
8	04278-61615	1	Cable Assembly
9	04278-66513	1	DC-AC Converter Board
10	04278-00624	1	Shield Case
	1400-1048	1	Edge Saddle
11	04278-61630	1	Cable Assembly
12	04278-61616	1	Cable Assembly
13	04278-61102	1	LCD Unit
14	04278-61631	1	Cable Assembly
15	04278-00205	1	Plate
	3150-0514	1	Filter
	04278-40001	1	Bezel

Table 2-4. 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, CR30, and CR39
A4	1	04278-00611	1	Shield (Plate)
	2	04279-00600	1	Shield
		04279-00601	1	Shield on circuit side
	3	04279-00602	1	Shield
		04279-00603	1	Shield on circuit side
	4	04279-00608	2	Shield (Plate)
	5	04279-00604	1	Shield
		04279-00605	1	Shield on circuit side
A5	6	04278-00619	1	Shield (Plate)
	7	04278-00617	2	Shield (Plate)
	8	04278-00618	1	Shield (Plate)
	9	04279-00606	1	Shield
		04279-00607	1	Shield on circuit side
	10	04278-00612	1	Shield (Plate)

Table 2-5. Rear Panel Components



Reference Designator	Part Number	Qty	Description
1	04278-61620	1	Cable Assembly
	3101-2216	1	Power Switch (included in PN 4278-61620)
2	1250-0083	1	Connector BNC
	0360-1190	1	Lug
	2190-0016	1	Washer
	2950-0001	1	Nut
	04278-61617	1	Cable Assembly
3	04278-61001	1	Fan Assembly
	0515-1598	4	Screw
	2190-0586	4	Washer
4	04278-00212	1	Blank Panel
5	04278-61621	1	Flat Cable Assembly
	2190-0577	2	Washer
6	1250-0083	2	Connector BNC
	2190-0016	2	Washer
	2950-0001	2	Nut
	04279-61605	1	Cable Assembly
7	04279-04001	1	Fan Cover
	0515-1550	4	Screw
8	04278-61619	1	Cable Assembly
9	2110-0565	1	Cap
	2110-0381	1	Fuse
	2110-0566	1	Fuse Holder
	2110-0569	1	Nut
10	04278-00634	1	Shield
	1400-1334	1	Cable Clamp
	0515-1550	3	Screw
11	04278-61002	1	Filter Assembly
	0515-0910	2	Screw
	2190-0586	2	Washer

Table 2-6. Coaxial Cable Assembly

Marker	Part Number	Qty.	Description
A	04279-61601	1	A2J2 to **Hcur** Terminal (Magnet Coil Assembly)
B	04279-61602	1	A5J2 to **Hpot** Terminal (Magnet Coil Assembly)
C	04279-61603	1	A4J1 to **Lpot** Terminal (Magnet Coil Assembly)
D	04279-61604	1	A4J2 to **Lcur** Terminal (Magnet Coil Assembly)
E	04279-61606	1	A4J3 to A5J1

2-7. TOOLS AND FASTENERS

The 4279A's mechanical components are secured using metric threaded screws. Many screws in the 4279A may appear to be Phillips type, but they are in fact, Pozidrive type. To avoid damaging them, use only Pozidrive screwdrivers to remove or tighten Pozidrive screws.

2-8. DISASSEMBLY

Disassembly procedures are given in the following paragraphs. The top cover removal procedure is given first, and then the following paragraphs tell you how to remove each assembly from the instrument.

2-8-1. TOP COVER REMOVAL

The following procedures are common for gaining access to any of the assemblies.

1. Remove the two plastic instrument-feet located in the upper corners of the rear panel.

2. Fully loosen the top cover retaining screw located at the rear of the top cover.

3. Slide the top cover towards the rear and lift it off.

2-8-2. A1 ASSEMBLY REMOVAL

1. Loosen the two screws which secure the left hand side top shield plate. Don't completely remove them.

NOTE

There are two top shield plates. To gain access to the A1 assembly, remove the top shield plate which has the **WARNING** message printed on it.

WARNING

CAPACITOR ON THE A1 BOARD REMAIN CHARGED WITH HAZARDOUS VOLTAGES FOR A PERIOD OF TIME AFTER THE INSTRUMENT IS TURNED OFF, OR AFTER THE POWER CABLE IS DISCONNECTED. ALLOW AT LEAST ONE MINUTE FOR THE CAPACITORS TO DISCHARGE AFTER THE INSTRUMENT IS TURNED OFF OR THE POWER CABLE IS DISCONNECTED.

2. Slide the top shield plate towards the front and lift it off.

3. Lift the black and the brown board extractors at the top corners of the A1 assembly.

4. Disconnect the cable that connects between the A1 board assembly and the rear panel.

2-8-3. REMOVING THE A2, A4, A5, A6, A7, OR A20 ASSEMBLIES

1. Loosen the five screws that secure the right hand side plate. Don't remove the screws completely.

NOTE

There are two top shield plates. In order to access A2, A4, A5, A6, A7, or A20 assemblies, remove the top shield plate on which the **WARNING** message label is **NOT** printed.

2. Slide the top shield plate towards the front and lift it off.

3. Lift the extractors at top corners of the board assembly that you want to remove.

2-8-4. FRONT PANEL DISASSEMBLY

This paragraph describes how to remove the front panel assembly from the 4279A. In order to remove the A9, A13, A90, or A91 assembly which are shown in Figure 2-2, first disassemble the front panel assembly.

1. Remove the top trim from the front frame.
2. Remove the two front feet from the bottom cover.
3. Remove the three screws from the bottom of the front frame.
4. Remove the three screws from the top of the front frame.
5. Carefully remove the 4279A's front panel assembly.

2-8-5. A9 OR A90 ASSEMBLY REMOVAL

First remove the front panel assembly from the 4279A as described in paragraph 2-8-4.

1. Loosen the two hex set screws on the **CONTRAST** knob and remove it.
2. Disconnect the flat cable assembly that interconnects the motherboard to the A90 assembly.
3. Disconnect the 3 and 12-pin cables from the A90 assembly.
4. Remove the seven nuts that secure the A9 assembly.
5. Remove the four screws that secure the A90 assembly to the A9 assembly, and slide the A90 assembly out.
6. Disconnect the 2-pin cable from the A9 assembly.
7. Disconnect the wires that connect the A90 and A9 assemblies.

2-8-6. A13 ASSEMBLY REMOVAL

First remove the front panel assembly from the 4279A as described in paragraph 2-8-4.

1. Remove four screws that secure the shield case on which the **WARNING** is printed.
2. Remove the screw that secure the A13 assembly to the back of the shield case.
3. Disconnect the 3-pin cable from the A90 assembly.
4. Disconnect the 3-pin cable from the A91 assembly, and remove the A13 board assembly.

2-8-7. A91 (LCD MODULE) ASSEMBLY REMOVAL

Remove the 4279A's front panel assembly as described in the paragraph 2-8-4.

1. Remove the four screws that secure the shield case on which the **WARNING** label is printed.
2. Remove the 3-pin cable that connects between the A13 assembly and the A91 assembly.
3. Remove the 12-pin cable from the A91 assembly.
4. Remove the 2-pin cable from the A91 assembly, and remove the A91 LCD module assembly.

NOTE

The A91 LCD module assembly consists of its LCD panel and the control circuit. Do not disassemble the LCD module, the LCD panel and the circuit board must remain together as a unit.

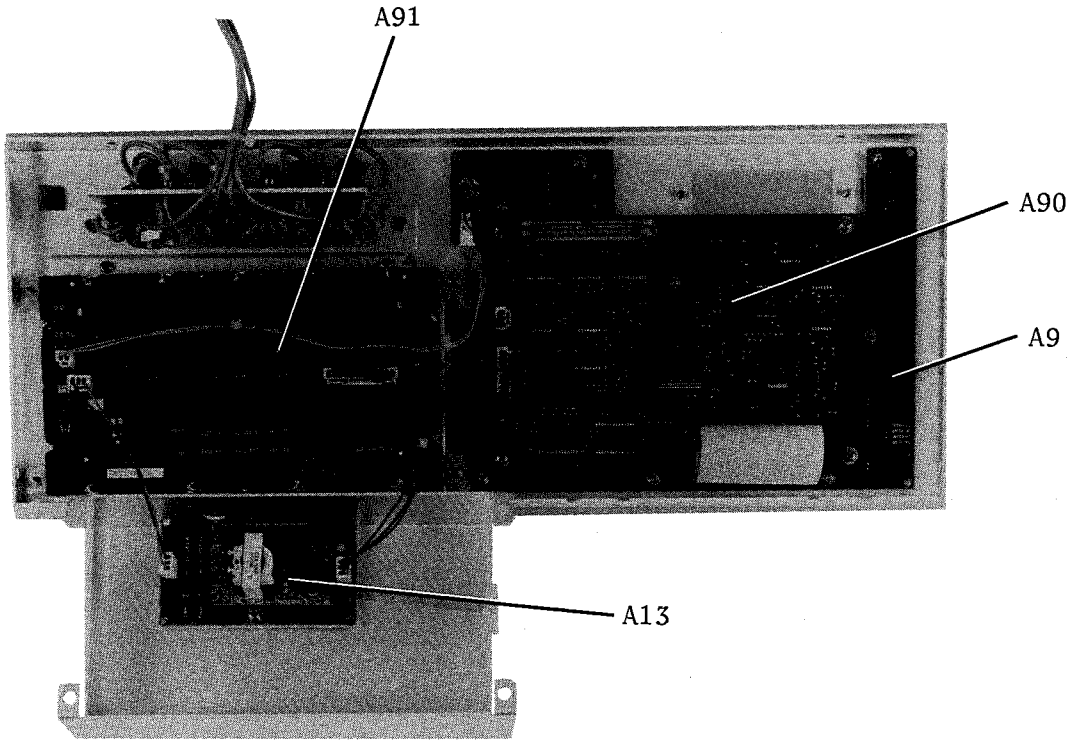


Figure 2-2. A9, A13, A90, or A91 Assembly Removal

2-9. THEORY OF OPERATION

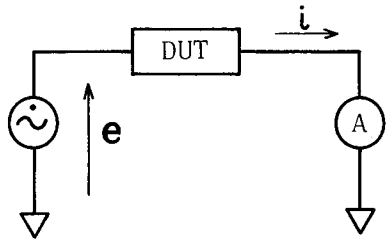
The theory of operation is organized into two sections: a discussion of basic theory, and a block diagram level discussion. The discussion of basic theory explains the 4279A's principle of operation, and how the 4279A's high measurement accuracy and its fully automated measurement performance are achieved. The block diagram discussion describes the overall circuit operation of the 4279A with signal flow analysis.

2-9-1. BASIC THEORY

The following description explains the measurement principles of the 4279A 1 MHz C-V Meter. It is important to have a sound understanding of the basic concepts and operating principles before advancing to the circuit board descriptions.

[Voltage-Current Ratio Measurement Method]

The 4279A's measurement function is based on the vector voltage-current ratio measurement principle in which 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 2-3.



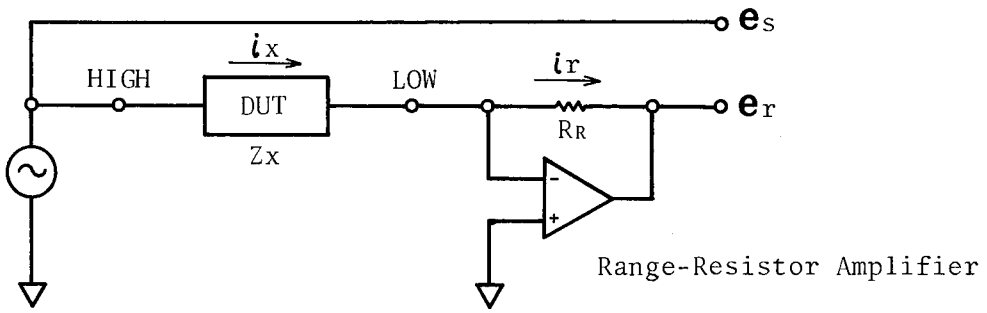
$$Z=v/i$$

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

Figure 2-3. Voltage-Current Ratio Measurement Method

[Transducer (I-V Converter)]

The current through the DUT is detected with a current-to-voltage (I-V) converter using a resistor (Range resistor, R) in the feed back circuit. See Figure 2-4. 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 resistance of the range resistor. 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 (a feedback node that is held at virtual ground), therefore, the range resistor value has no effect on the current through the DUT.



$$\therefore ix = \frac{es}{Zx} = \frac{er}{Rr} \quad \therefore Zx = Rr\frac{es}{er}$$

Figure 2-4. Voltage-Current Ratio Method Using the I-V Converter

[Vector Voltage Detector]

The Vector Voltage Detectors (VVD) detect all Real and Imaginary vector components of the two signals, 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 2-5 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.

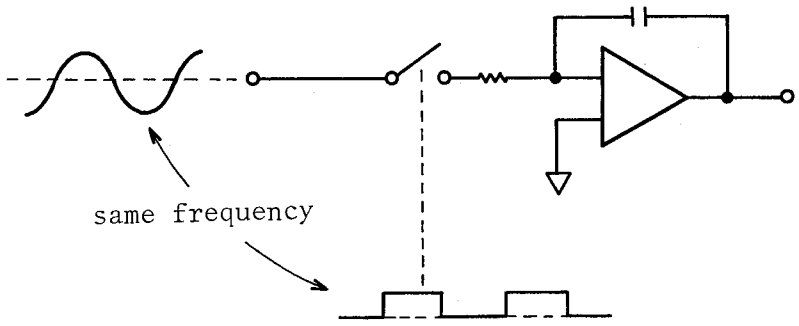


Figure 2-5. Vector Voltage Detector

To digitize the analog voltage, the analog voltage is first integrated for a predetermined period of time (Charging a capacitor), then the time required for a reference input to integrate "down" to zero (discharging a capacitor to zero) is measured, 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), See Figure 2-6.

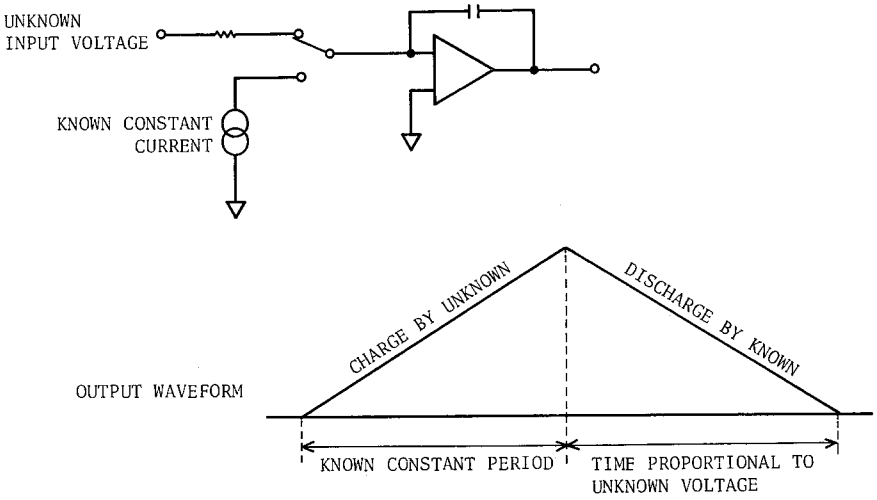
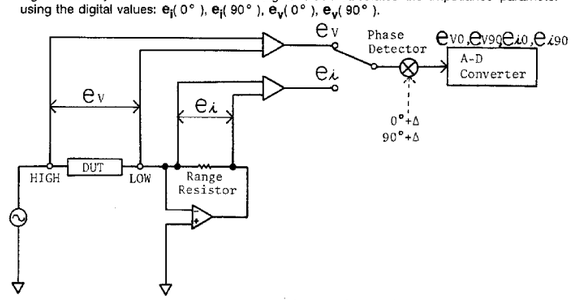


Figure 2-6. Dual Slope Integration

[Vector Impedance Calculation]

Figure 2-7 shows a simplified impedance measurement circuit. e_v is the voltage applied across the DUT, and 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 from analog to digital form by an A-D converter. The digital block calculates the impedance parameter using the digital values: $e_i(0°)$, $e_i(90°)$, $e_v(0°)$, $e_v(90°)$.



Cp
G

$$Cp = \frac{e_i(90°) \times e_v(0°) - e_i(0°) \times e_v(90°)}{\omega \times Rr \times (e_v(0°)^2 + e_v(90°)^2)}$$

$$G = \frac{e_i(0°) \times e_v(0°) + e_i(90°) \times e_v(90°)}{Rr \times (e_v(0°)^2 + e_v(90°)^2)}$$

Cs ESR

$$Cs = \frac{e_i(0°)^2 + e_i(90°)^2}{\omega \times Rr \times (e_v(90°) \times e_i(0°) - e_v(0°) \times e_i(90°))}$$

$$ESR = \frac{Rr \times (e_i(0°) \times e_v(0°) + e_i(90°) \times e_v(90°))}{e_i(0°)^2 + e_i(90°)^2}$$

Figure 2-7. Vector Impedance Calculation

ANALOG SECTION BLOCK DIAGRAM

SEE INSIDE

ANALOG SECTION BLOCK DIAGRAM

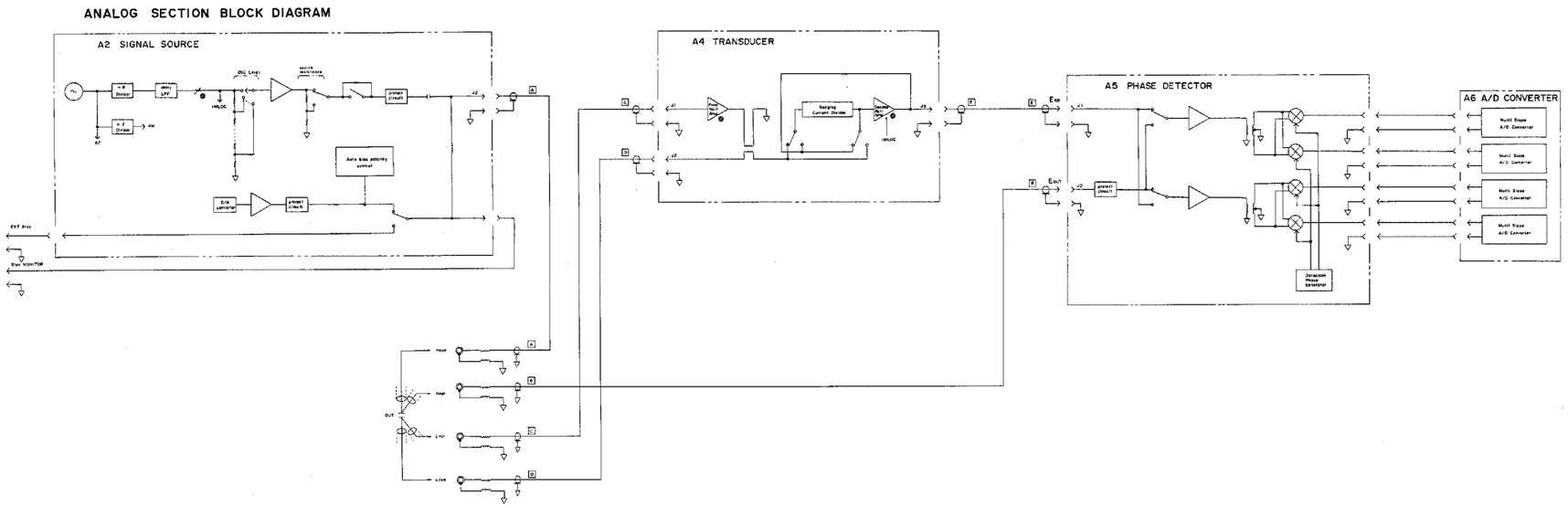


Figure 2-8. Analog Section Block Diagram

2-9-2. BLOCK DIAGRAM DISCUSSION

The following discussion describes the 4279A's Analog Measurement and digital Control sections.

[ANALOG MEASUREMENT SECTION]

A block diagram of the 4279A analog measurement section is shown in Figure 2-8. The analog measurement section consists of three sections: (1) Signal Source, (2) Transducer, and (3) Vector Voltage Detector. An explanation for each subsection follows.

[Signal Source]

The test signal is a 1 MHz sine wave, derived from the 8 MHz crystal oscillator on the A2 board. The output of the 8 MHz crystal oscillator is divided by 8, and is filtered by a LPF before being output. The OSC level is selected using a resistive voltage divider. When the internal DC bias voltage is applied to the DUT, the DC bias voltage is set using a Digital-to-Analog Converter (DAC).

[Transducer]

The transducer consists of the first null amplifier, and the I-V converter.

(1) First Null Amplifier

The I-V Converter is used as an ammeter. Even if the I-V converter were an ideal ammeter, there is still the residual impedance of the connecting cables which exists between the low lead of the DUT and the ammeter, which will result in an error voltage which will be not be nulled out at the LOW Terminal. So the voltmeter will measure the voltage which is added the voltage across the DUT to the residual voltage. To cancel the residual voltage, a feedback voltage from the Lpot Terminal is used by the first null amplifier and transformer to negate the residual voltage. See Figure 2-9.

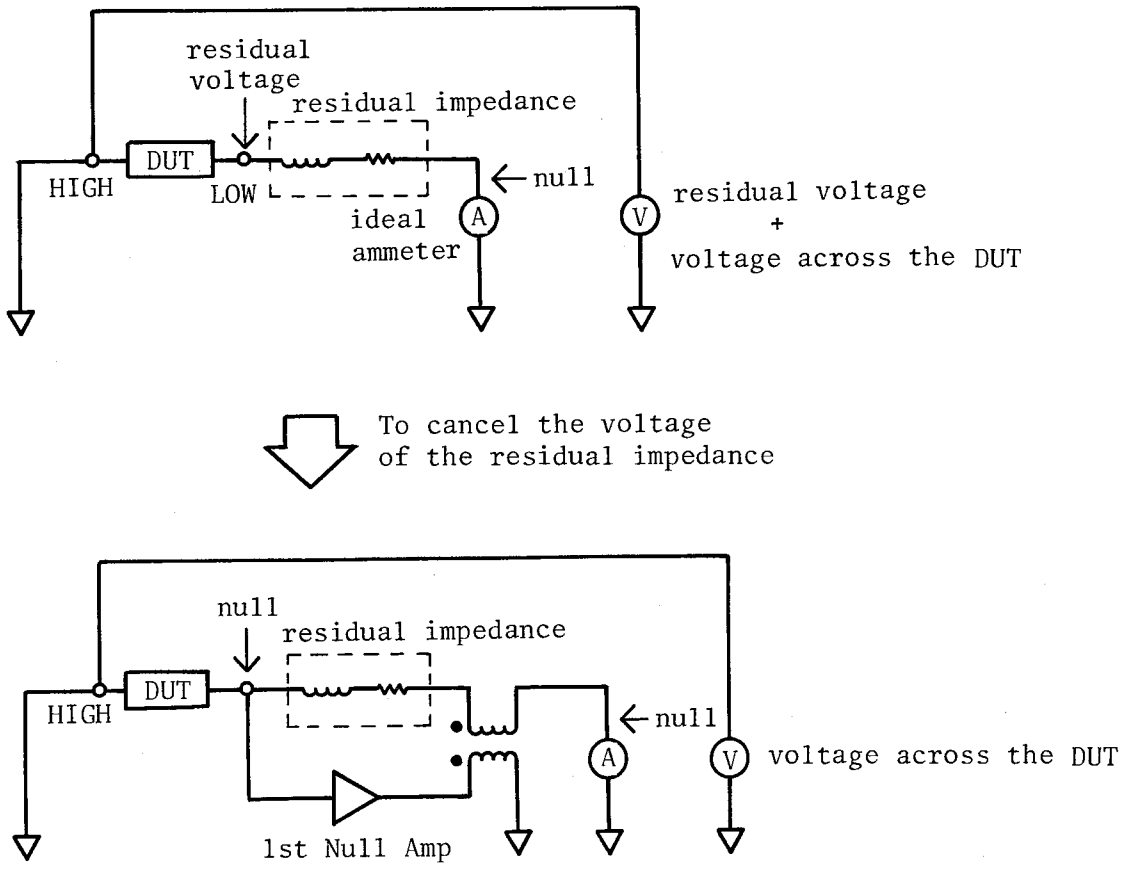


Figure 2-9. First Null Amplifier

(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 an I-V converter is shown in Figure 2-10. The I-V convertor's theory of operation is described in the Basic Theory discussion. Figure 2-10 shows the circuit for the second null amplifier. The resistor shown in Figure 2-10 is a fixed value range resistor (8.06 kΩ).

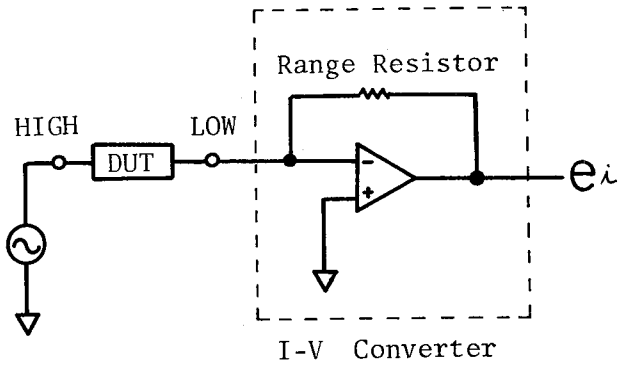


Figure 2-10. I-V Converter

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 ranging current divider are connected in series as shown in Figure 2-11. 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).

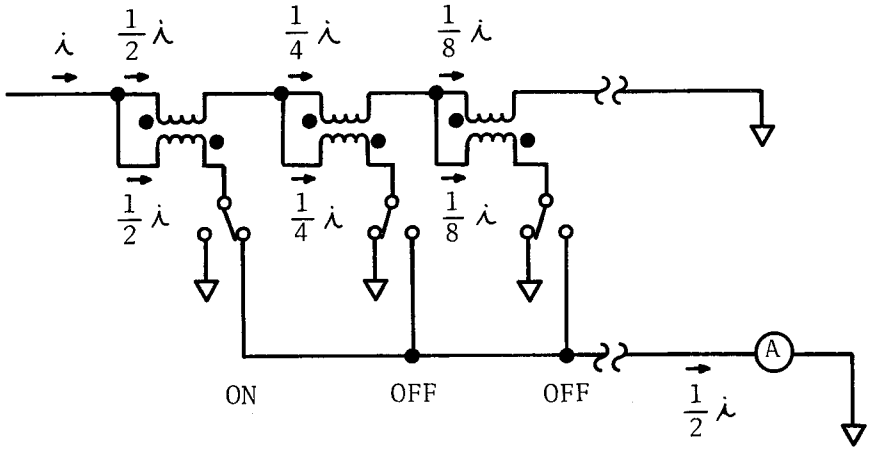


Figure 2-11. Ranging Current Divider

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. Then the ranging current divider is connected between the Lcur Terminal and the I-V converter as shown in Figure 2-12, and the current through the capacitor is divided by the ranging current divider. So the current through the range resistor will be optimum for the fixed measurement range.

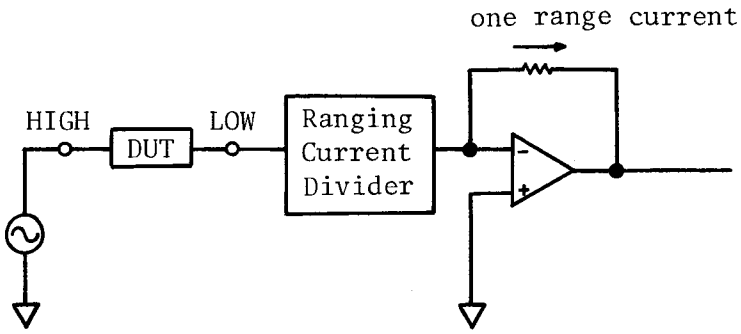


Figure 2-12. I-V Converter with the Ranging Current Divider (1)

When a lower value capacitor (< 16 pF) is connected, the current through the capacitor is lower in proportion to the capacitor's value. The ranging current divider will now be connected in the feedback circuit in series with the range resistor as shown in Figure 2-13, and the current through the capacitor is multiplied by the ranging current divider. So the current through the range resistor will be optimum for the fixed one measurement range.

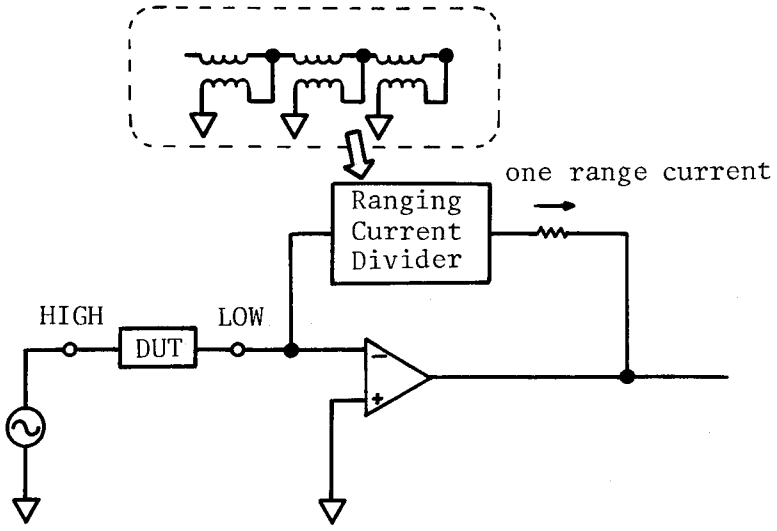


Figure 2-13. I-V Converter with the Ranging Current Divider (2)

[Vector Voltage Detector]

The 4279A 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 $\mathbf{e_i}$ and $\mathbf{e_v}$ (four components). Measurement error can 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 these unbalances, and to achieve the high measurement accuracy, the 4279A detects the four unknown voltages more than once using different measurement configurations, so the errors compensate for each other. Refer to Figure 2-14.

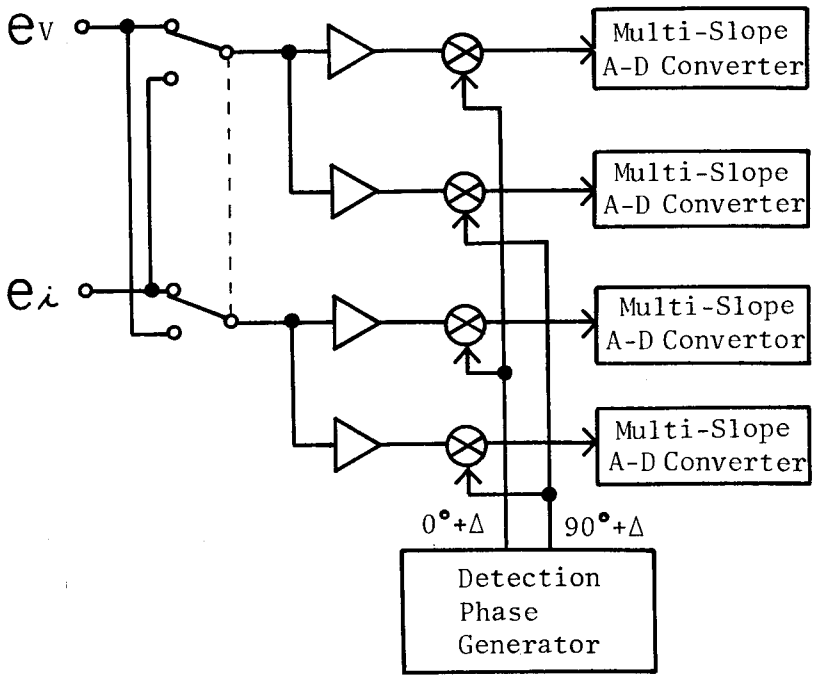


Figure 2-14. Vector Voltage Detector

[DIGITAL CONTROL SECTION]

A simplified block diagram of the 4279A's digital control section is shown in Figure 2-15. The digital control section of the 4279A is contained mainly on the A7 board. The digital control circuit contains one 16-bit CPU for data manipulation, programmed ROMs, RAMs, HP-IB interface, and EEPROMs where the calibration factor, compensation data, etc., are stored.

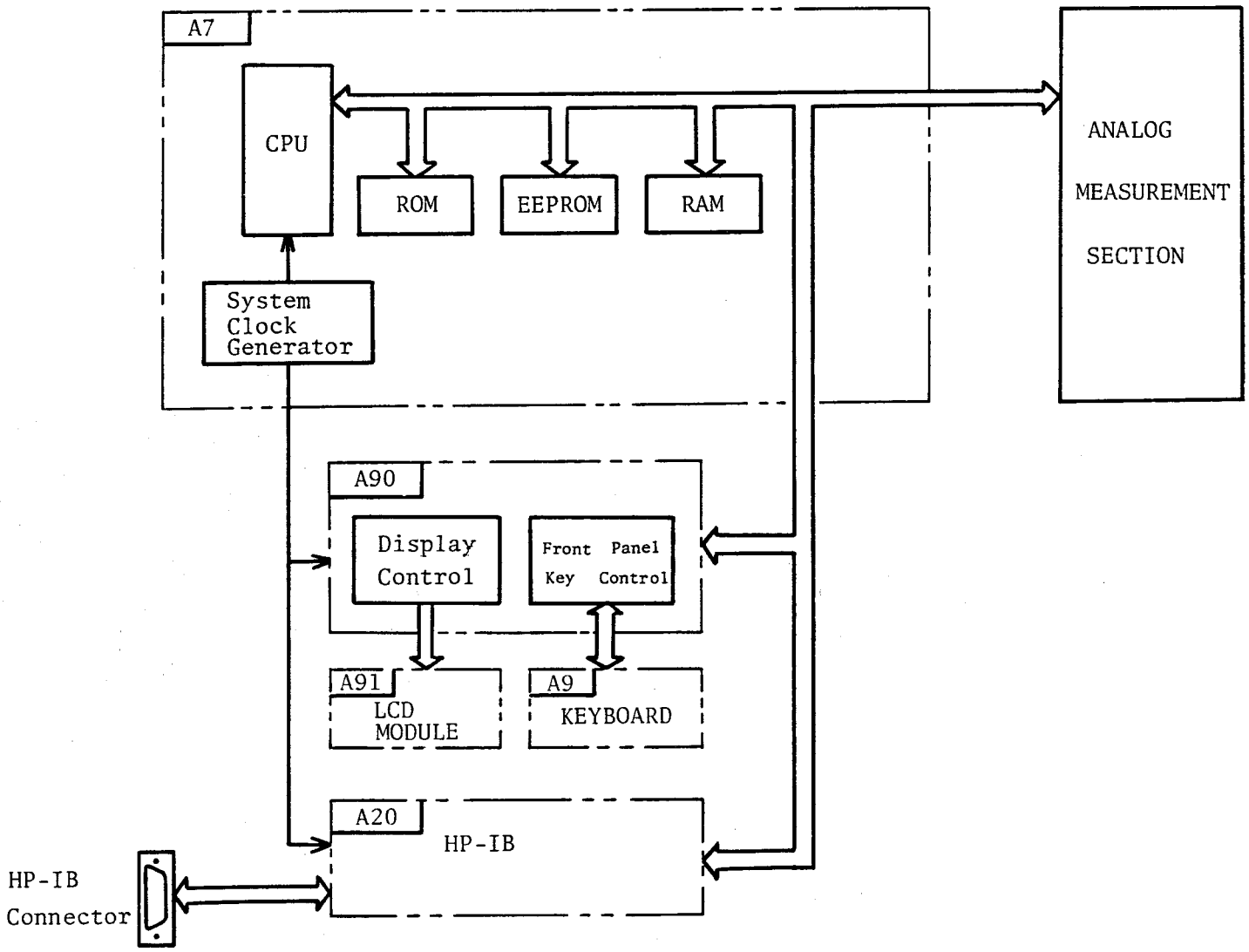


Figure 2-15. Digital Control Section Block Diagram

2-10. SELF TEST

Self tests are the 4279A's special functions used for making adjustments, troubleshooting, and ROM/RAM tests. The 4279A's self tests can be categorized into three types, power-on self test, self test selected with softkeys, and self test selected by a bit switch.

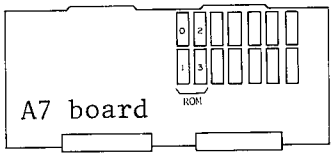
2-10-1. POWER ON SELF TEST

Every time the 4279A is turned on it performs a power-on self test as part of the power on sequence. The 4279A performs the following self tests at power-on.

- ROM check sum test
- RAM R/W test
- EEPROM check sum test

If the power-on self test fails, one of the error messages listed in Table 2-7 will be displayed.

Table 2-7. Error Message

Error Message	Description
RAM TEST ERROR	The RAM R/W test failed.
ROM CHECK SUM ERROR NO=XX	The check sum of one of the programmed ROMs on the A7 board is incorrect. The ROM number with this message is shown below. 
EEPROM CSUM ERROR NO=0	The check sum of EEPROM (0) is incorrect.
EEPROM CSUM ERROR NO=1	The check sum of EEPROM (1) is incorrect.
A6 B'd is not working	The end of conversion signal from the A-D converter was not output.

2-10-2. SELF TESTS SELECTED BY SOFTKEYS

Softkey selected self tests are as follows.

[Self Test No. = 1: A4 TRD 1st Null Amp Adjust]

This self test is used to adjust the first null amplifier on the A4 board. Refer to SECTION 1.

[Self Test No. = 2: A4 TRD 2nd Null Amp Adjust]

This self test is used to adjust the second null amplifier on the A4 board. Refer to SECTION 1.

[Self Test No. = 3: A6 ADC Test]

This self test checks the analog-to-digital converters on the A6 board. If this test fails, the A6 board is faulty.

The 4279A's setup for this test is different from the typical measurement setup, in order to check the 4279A's A-D converters. The 4279A has four A-D converters, and each A-D converter has its own offset circuit and associated offset value. When this test is performed, the offset value for each A-D converter is counted by each A-D converter. The A-D converter test values are displayed as ADC1, ADC2, ADC3, and ADC4.

This test will pass when the test values of the four multislope A-D converters are within the following limits.

$$197000 \leq \text{ADC1} \leq 240000$$
$$197000 \leq \text{ADC2} \leq 240000$$
$$197000 \leq \text{ADC3} \leq 240000$$
$$197000 \leq \text{ADC4} \leq 240000$$

[Self Test No. = 4: ROM check sum display]

This self test is used to display the ROM check sum values on the LCD. If any of the ROM check sum values are incorrect, the 4279A will fail the power on self test, so normally you won't need to run this self test.

[Self Test No. = 5: LED display test]

This self test is used to test the front panel indicators by repeatedly turning them ON and OFF.

[Self Test No. = 6: LCD display test]

This self test is used to test the LCD display by repeatedly reversing all pixels on the LCD, with the exception of the pixels used for the lines that partition the softkey labels, these remain on.

To perform softkey selected self tests, press the following keys in sequence.

1. Press the **MENU** and **PREV** keys in sequence.
2. Press the **'SVC FNCTN'** and the **'SELF TEST'** softkeys in sequence to display the self test menu.
3. Press the **'TEST No.='** softkey.
4. Enter the desired self test number using the numeric keys and press the **ENTER** key.

Some of the softkey selected self test are described as follows.

'TEST START' This softkey is used to start a self test.

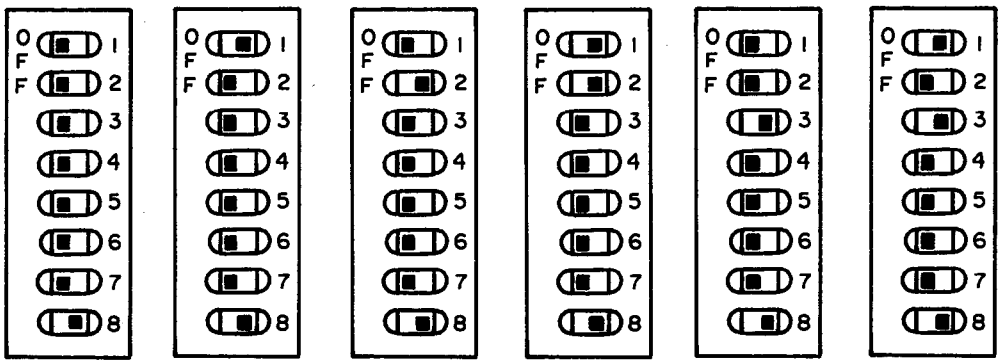
'TEST ABORT' This softkey is used to stop a self test.

'TEST MENU' This softkey is used to display the self test menu. This softkey is valid only when a test is not in progress.

'exit TEST' This softkey is used to exit the self test function. The 4279A's control settings will be set to the default settings.

2-10-3. SELF TESTS SELECTED BY THE BIT SWITCH

The following self tests can be performed by setting the A7S3 bit switch.



No.0 No.1 No.2 No.3 No.4 No.5

[No.0 Setting's Self Test]

This self test displays the ROM check sum on the LCD display.

[No.1 Setting's Self Test]

This self test performs the RAM read/write test.

[No.2 Setting's Self Test]

This self test performs the EEPROM read/write test.

[No.3 Setting's Self Test]

This self test perform the front panel keyboard test. Pressed key code and its abbreviated name will be displayed.

[No.4 Setting's Self Test]

This self test initializes the EEPROM. Only perform this self test when the EEPROM is being replaced.

[No.5 Setting's Self Test]

This self test initiates the LCD self test. All pixels on the LCD are repeatedly turned ON and OFF.

2-11. ASSEMBLY LEVEL TROUBLESHOOTING

This paragraph provides procedures or assembly level problem isolation. When you troubleshoot the 4279A, select from the phenomenon listed in Table 2-8 which best describes your problem, and perform the isolation procedures in the paragraph listed for the chosen phenomenon.

Table 2-8. Assembly Level Troubleshooting List

Phenomenon	Paragraph No.
The 4279A will not turn on	2-11-1
The 4279A fails its power-on self test	2-11-2
The analog circuit is defective	2-11-3
The digital circuit is defective	2-11-4
The display backlight will not light	2-11-5

2-11-1. WHEN THE 4279A WILL NOT TURNED ON

If the 4279A will not start operation, perform the following procedure.

1. Check the cooling fan on the rear panel. Is it running?

   YES: Go to step 2.
   NO: Go to step 3.

2. Check the DC output voltages (+5 V, +8 V, ±12 V, ±15 V, -21 V, and ±48 V) on the A1 board. Are the DC output voltages correct?

   YES: Go to paragraph 4-11-4. DIGITAL CIRCUIT TROUBLESHOOTING.
   NO: Troubleshoot the A1 board.

3. Check A1DS1 and A1DS2 (LEDs) on the A1 board. Are they lit?

   YES: Troubleshoot the A1 board.
   NO: Go to step 4.

4. Check the power line fuse on the rear panel. Is the fuse blown?

   YES: Replace the blown fuse.
   NO: Go to step 5.

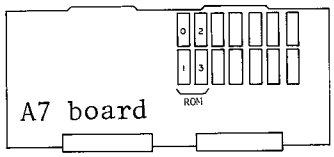
5. Check the **LINE VOLTAGE SELECTOR** switch. Is it proper set?

   YES: Troubleshoot the A1 board.
   NO: Set the switch properly.

2-11-2. WHEN THE 4279A FAILS ITS POWER-ON SELF TEST

When the 4279A can be turned on, but will not start measurement, one of the following message will be displayed on the LCD display. Perform the method which is mentioned with the error message.

Table 2-9. Error Message and the Troubleshooting Method

Error Message	Method
RAM TEST ERROR	1. Troubleshoot the A7 board.
ROM CHECK SUM ERROR NO=xx	1. Replace the faulty ROM. The ROM number associated with this message and its location are shown below. If the same message is redisplayed, troubleshoot the A7 board. 
EEPROM CSUM ERROR NO=0	1. Calibrate the 4279A. 2. Does the same error occurs? **YES:** Troubleshoot the A7 board. **NO:** No Trouble found.
EEPROM CSUM ERROR NO=1	1. Turn on the 4279A and wait until the 4279A starts making measurements. 2. Cycle the 4279A's power off and on. 3. Does the same error reoccur? **YES:** troubleshoot the A7 board. **NO:** No Trouble found.
A6 B'd is not working	1. Check the output voltages from the A1 board are the correct output voltages. Are they proper outputs? **YES:** Go to the step 2. **NO:** Troubleshoot the A1 board. 2. Is the 4 MHz clock (TTL level) present at A2TP9 on the A2 board? **YES:** Troubleshoot the A6 board. **NO:** Troubleshoot the A2 board.
Another message (a meaningless message)	1. Go to paragraph 4-11-4. DIGITAL CIRCUIT TROUBLESHOOTING.

2-11-3. ANALOG CIRCUIT TROUBLESHOOTING

When the 4279A passes the power-on self test, and seems to be operating properly, but does not measure accurately, perform the following procedure using the service program on the 5.25" service program disc (PN 04279-65002).

1. Check the DC output voltages on the A1 board. Are they correct?

   YES: Go to step 2.
   NO: Troubleshoot the A1 board.

2. Check the signal at A2TP9 on the A2 board. Is the 4 MHz TTL level clock present?

   YES: Go to step 3.
   NO: Troubleshoot the A2 board.

3. Set the oscillator level to 1 Vrms. Is the test signal's amplitude at A2TP5 1 Vrms?

   YES: Go to step 4.
   NO: Troubleshoot the A2 board.

4. Set the spot DC bias to 1 V, and set the DC BIAS switch to ON. Is the DC bias output voltage at A2TP5 1 V?

   YES: Go to step 5.
   NO: Troubleshoot the A2 board.

5. Prepare the following equipment.

HP-IB Controller	HP 9000 Series 200 model 226
HP-IB Cable	HP 10833A
Service Program Disc	PN 04279-65002

6. Connect the HP-IB cable between the HP-IB connectors on the HP 4279A's rear panel and on the controller's rear panel (select code 7) as shown below.

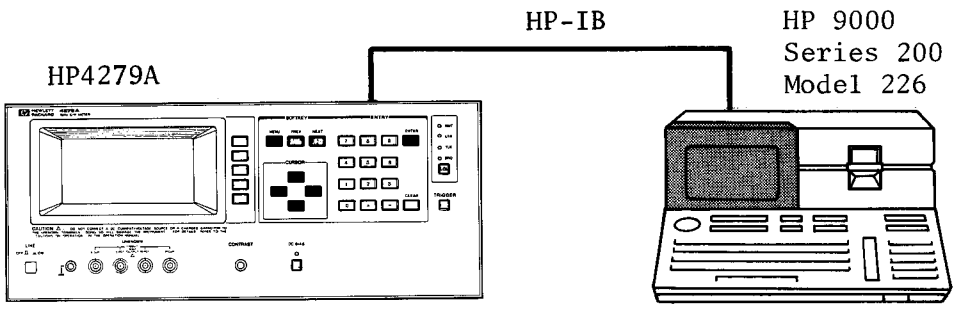


Figure 2-16. Analog Circuit Board Isolation Setup

7. Turn the 4279A and the controller on.

8. Set the 4279A to the Addressable mode, and the HP-IB address to 17.

9. Boot up **BASIC** and load the necessary binary files in the controller. The necessary **BIN**aries for **BASIC** version 3.0/4.0/5.0 are as follows.

HPIB, IO, MAT, ERR

10. Load the service program in the controller, the file name is **"SVC_4279A"**.

11. Press the **RUN** key on the controller and wait. The main menu and the message, **"Select and enter a number."**, will be displayed.

12. Press the **2** and **ENTER** keys to perform the diagnostics.

13. The diagnostics menu and the message **"Select and enter a number."** is displayed. Press the **1** and **ENTER** keys to select AUTO TEST.

14. Press the **1** and **ENTER** keys to perform AUTO TEST.

15. After a short time the A6 A-D Converter test, the A5 Phase detector test, and the A4 transducer test will be automatically performed in sequence, and the test results will be displayed. If the test fails, troubleshoot the test failed board. Then the error message on the controller's screen are shown in Table 2-10. If the test passes, perform the all adjustments (Refer to SECTION 1).

Table 2-10. AUTO TEST Error Messages

Message	Description
ADC (1) is defective.	The A6 A-D converter test failed. Check A6U30, A6U31 and their peripheral circuitry.
ADC (2) is defective.	The A6 A-D converter test failed. Check A6U20, A6U22 and their peripheral circuitry.
ADC (3) is defective.	The A6 A-D converter test failed. Check A6U17, A6U19 and their peripheral circuitry.
ADC (4) is defective.	The A6 A-D converter test failed. Check A6U28, A6U29 and their peripheral circuitry.
A-CH PSD (IC or Amp) is defective.	The A5 Phase Detector test failed. Check A5U1, A5U2, A5U6, A5U8, and their peripheral circuitry.
PSD (IC or Amp) is defective.	The A5 Phase Detector test failed. Check A5U12, A5U13, A5U18, and their peripheral circuitry. Also check A5U1, A5U2, A5U6, A5U8, and their peripheral circuitry.
A-CH x10 Gain Amp is defective.	The A5 Phase Detector test failed. Check A5T3, A5U5 and their peripheral circuitry.
PSD x10 Gain Amp is defective.	The A5 Phase Detector test failed. Check A5T6, A5U15, and their peripheral circuitry. Also check A5T3, A5U5 and their peripheral circuits.
1st Null Amp is defective.	The A4 Transducer test failed. Check the A4Q5 to A4Q9 and their peripheral circuits.
2nd Null Amp is defective.	The A4 Transducer test failed. Check the second null amplifier circuit.

2-11-4. DIGITAL CIRCUIT TROUBLESHOOTING

If the 4279A's digital circuit seems to be defective, perform the following procedure.

1. Turn off the 4279A and remove the A20 board (HP-IB Interface).

2. Set all bits of A7S3 to OFF.

3. Turn on the 4279A. Is the problem resolved?

   YES: Troubleshoot the A20 board.
   NO: Go to the step 4.

4. Perform self test number 5 selected by the bit switch for the LCD test. Does the LCD repeatedly turned on and off?

   YES: Troubleshoot the A7 board.
   NO: Troubleshoot the A90 and A91 boards.

2-11-5. THE BACK LIGHT ON THE DISPLAY DOES NOT LIGHT

When the 4279A can be turned on, but the LCD display back light does not light, perform the following procedure.

1. Check the DC output voltages on the A1 board. Are they correct?

   YES: Go to the step 2.
   NO: Troubleshoot the A1 board.

2. Check the neon lamp (A13DS1) on the A13 board. Is it lit?

   YES: Troubleshooting the A91 board.
   NO: Troubleshooting the A13 board.

SECTION 3

SERVICE SHEETS

3-1. INTRODUCTION

This section contains a service sheet for each of the 4279A's boards. Each service sheet is organized into six parts: Circuit Description, Troubleshooting Aids, Board Connector Pin Assignments, Replaceable Parts List, Component Location Drawing, and Schematic Diagrams.

3-2. CIRCUIT DESCRIPTION

The circuit description gives a detailed functional description of each board.

3-3. TROUBLESHOOTING AIDS

The troubleshooting aids provide information to help you troubleshoot problems in the HP 4279A. Usually the troubleshooting aids consists of a list of jumpers, a list of test points, and 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 3-1).

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 3-1). When a 10:1 divider probe is used, the channel A and B settings must be divided by 10.

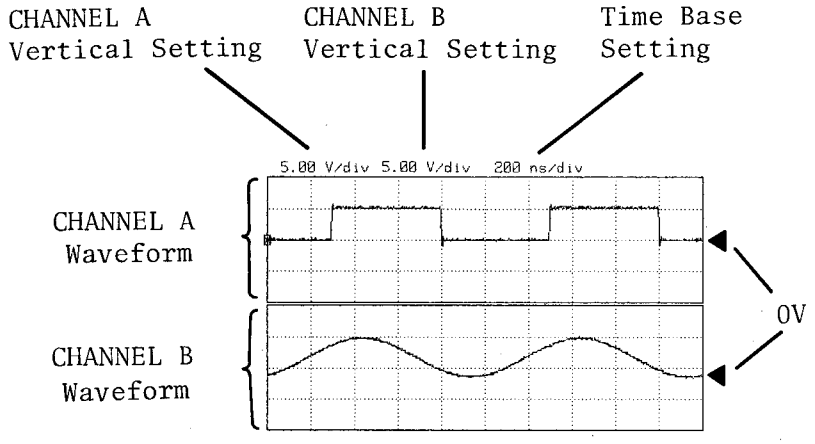


Figure 3-1. Oscilloscope Setup

3-4. BOARD CONNECTOR PIN ASSIGNMENT

The pin assignments for each board are provided with the component locations using the names listed in Table 3-1.

Table 3-1. Signal Name Used for Pin Assignments

Name	Description
AGND	Analog circuit ground
A1 to *A20*	Address bus lines
/ACS0 to */ACS7*	Analog board (card) select signal
AD_GND1 to *AD_GND4*	Common ground for phase detectors and A-D converter
ANA1 to *ANA6*	Address bus lines for the analog boards
AND0 to *AND7*	Data bus line for controlling the analog boards
/ANLDS	Analog Board Data Strobe Signal
ANR/W	Data Read/Write Signal
/AS	Address strobe signal
CLK8MHz	8 MHz Clock
/CLK16MHz	16 MHz Clock
D0 to *D15*	Data Bus Line for the digital boards
/DTAC	Data acknowledge signal
/EOC_INT	Interrupt signal for A-D End Of Conversion
ETEST	Test signal for self test
/HALT	Halt signal
/ID0 to */ID7*	Board identification signal
/INT_FRM_STD_IF	Interrupt from the HP-IB interface
/INT_TO_STD_IF	Interrupt to the HP-IB interface
KBD_INT	Interrupt from the keyboard
/KEY_DSP_CTL	Keyboard and display control signal
/LDS	Lower data strobe
/LGND	Logic circuits ground line
/REAR_TRG_INT	Trigger interrupt signal from the external trigger connector on the rear panel
/RESET	Reset signal
R/W	Read/Write signal
SRG_LOAD	Shift register load signal
SRG_CLK	Shift register clock
/STD_IF	HP-IB access signal
/UDS	Upper data strobe
V_DC1 to *V_DC4*	A-D counter signal
/VMA	Valid memory access signal for CPU
/VPA	Valid peripheral signal
1MLOC	1 MHz Local oscillator
4M	4 MHz
8F	8 MHz
+12VFAN	+12 V for the cooling fan
-12VFAN	-12 V for the cooling fan

3-5. REPLACEABLE PARTS LIST

The replaceable parts list provides information about replaceable parts.

3-5-1. ABBREVIATIONS

Table 3-2 lists the abbreviations used throughout this 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 3-2. 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		
C	= capacitor	J	= jack	RT	= thermistor	VR	= voltage regulator
CP	= coupler	K	= relay	S	= switch	W	= cable
CR	= diode	L	= inductor	T	= transformer	X	= socket
DL	= delay line	M	= meter	TB	= terminal board	Y	= crystal
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			SE	= selenium
BH	= binder head	IF	= intermediate freq.			SECT	= section(s)
BP	= bandpass	IMPG	= impregnated			SEMICON	= semiconductor
BRS	= brass	INCD	= incandescent	OBD	= order by description	SI	= silicon
BWO	= backward wave oscillator	INCL	= include(s)	OH	= oval head	SIL	= silver
		INS	= insulation(ed)	OX	= oxide	SL	= slide
CCW	= counter-clockwise	INT	= internal			SPG	= spring
CER	= ceramic			P	= peak	SPL	= special
CMO	= cabinet mount only	k	= kilo = 1000	PC	= printed circuit	SST	= stainless steel
COEF	= coefficient	LH	= left hand	p	= pico = 10^{-12}	SR	= split ring
COM	= common	LIN	= linear taper	PH BRZ	= phosphor bronze	STL	= steel
COMP	= composition	LK WASH	= lock washer	PHL	= Phillips		
COMPL	= complete	LOG	= logarithmic taper	PIV	= peak inverse voltage	TA	= tantalum
CONN	= connector	LPF	= low pass filter	PNP	= positive-negative-positive	TD	= time delay
CP	= cadmium plate			P/O	= part of	TGL	= toggle
CRT	= cathode-ray tube	m	= milli = 10^{-3}	POLY	= polystyrene	THD	= thread
CW	= clockwise	M	= meg = 10^{6}	PORC	= porcelain	TI	= titanium
		MET FLM	= metal film	POS	= position(s)	TOL	= tolerance
DEPC	= deposited carbon	MET OX	= metallic oxide	POT	= potentiometer	TRIM	= trimmer
DR	= drive	MFR	= manufacturer	PP	= peak-to-peak	TWT	= traveling wave tube
		MINAT	= miniature	PT	= point		
ELECT	= electrolytic	MOM	= momentary	PWV	= peak working voltage	μ	= micro = 10^{-6}
ENCAP	= encapsulated	MTG	= mounting			VAR	= variable
EXT	= external	MY	= "mylar"			VDCW	= dc working volts
						W/	= with
F	= farads	n	= nano = 10^{-9}	RECT	= rectifier	W	= watts
f	= femto = 10^{-15}	N/C	= normally closed	RF	= radio frequency	WIV	= working inverse voltage
FH	= flat head	NE	= neon	RH	= round head or right hand		
FIL H	= fillister head	NI PL	= nickel plate	RMO	= rack mount only	WW	= wirewound
FXD	= fixed	N/O	= normally open	RMS	= root-mean square	W/O	= without
G	= giga = 10^{9}	NPO	= negative positive zero (zero temperature coefficient)				
GE	= germanium						
GL	= glass						
GRD	= ground(ed)						

0001-9700

3-5-2. REPLACEABLE PARTS LISTS

Table 3-3 lists the names and addresses of the manufacturers identified by Mfr. Code in the parts lists. In most cases the information given for each part includes the following:

1. HP part number.
2. Quantity used in the assembly -- given once -- at the first occurrence of the part number.
3. Five-digit code representing the typical manufacturer.
4. Manufacture's part number.

Table 3-3. 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
02768	ITW FASTEX	DES PLAINES IL US	60016
03888	K D I PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA INC SEMI-COND PROD	PHOENIX AZ US	85008
06665	PRECISION MONOLITHICS INC.	SANTA CLARA CA	95050
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
24355	ANALOG DEVICES INC	NORWOOD MA US	02062
24546	CORNING ELECTRONICS	SANTA CLARA CA US	95050
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA US	95052
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON NC	28401
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE NJ	
32293	INTERSIL INC	CUPERTINO CA CA	95014
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
98291	SEALECTRO CORP	MAMARONECK NY	10544

3-5-3. 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 on 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.

3-5-4. DIRECT MAILING ORDERING

Within the United States, Hewlett-Packard supplies parts through a direct mail order system. The advantages of using this 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 the order.

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

3-6. COMPONENT LOCATIONS

The component locations provide you with component position information.

3-7. SCHEMATIC DIAGRAMS

The schematic diagram for each board provides you with circuit information. Figure 3-2 shows the symbols used in the schematic diagrams.

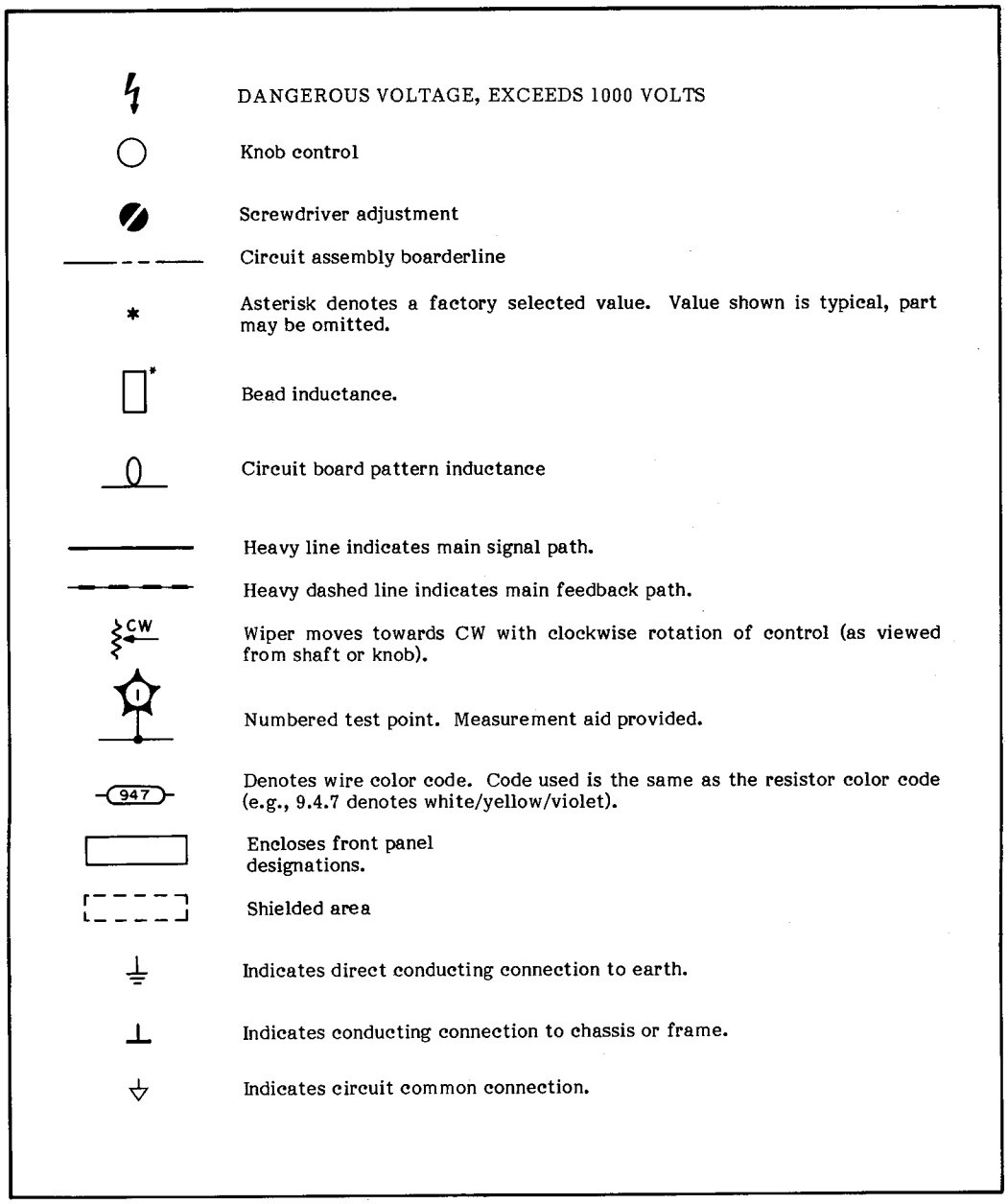


Figure 3-2. Schematic Diagram Symbols

A1 POWER SUPPLY BOARD SERVICE SHEET

NOTES

3-8. A1 BOARD SERVICE SHEET

3-8-1. CIRCUIT DESCRIPTION

The A1 Power Supply board provides +5 V, +8 V, ±12 V, ±15 V, -21 V, and ±48 V to the A11 Mother Board. 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. Overvoltage detector

An explanation for each circuit follows.

[Primary Rectifier]

The primary rectifier, composed of A1CR1, A1C2, A1C3, A1C4, and A1C5, rectifies the AC source voltage to supply the unregulated DC voltages. 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 current surges at power up. If A1K1 does not activate, the heat produced by A1R1 will cause thermal fuse A1FT1 to open up.

[Slow Start Circuit]

The slow start circuit, composed of A1Q1, A1Q2, A1Q3, A1Q9, and A1Q10, 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 greater than about 240 V, the slow start circuit is enabled.

[Supply Voltage Controller]

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

[Switching Circuit]

The switching circuit used to convert the DC primary voltage to a 40 kHz AC voltage consists of A1Q11, and A1Q12. The duty cycle is the parameter varied to regulate the output voltage, and it is controlled by A1U2 (supply voltage controller), by comparing the 5 V Vref (reference voltage) to the 9 V feedback voltage produced by A1CR21, A1CR22, A1L4, and A1C25.

[Shutdown Circuit]

The shutdown circuit, consisting of A1Q6, A1Q7, A1CR18, and A1CR19, stops both the A1U2's oscillator and the switching circuit if one of the following situations occur.

1. The FAN STOP signal form A1U6 is received by the shutdown circuit.

2. The over voltage signal from A1U5 is received by 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, -21 V, and ±48 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 a shutdown signal to A1U5 (opto-coupler) which will transfer the signal to the shutdown circuit.

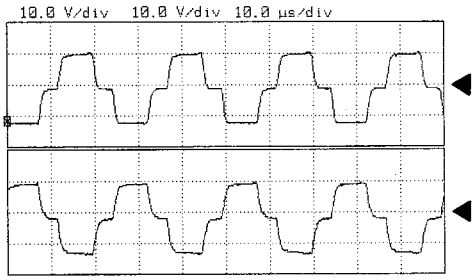
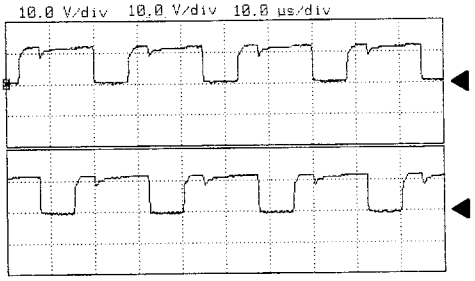
3-8-2. TROUBLESHOOTING AIDS

Table 3-4 shows the troubleshooting waveforms, and Table 3-5 lists the DC output voltage at each test point.

WARNING

DISCONNECT THE POWER CABLE BEFORE WATCHING THE BELOW WAVEFORMS

Table 3-4. Power Supply Troubleshooting Data

HP 4279A 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 4279A Setup:

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.

Table 3-5. A1 DC Voltage and Test Points

Test Point	Name	Actual DC Voltage
A1TP13	-15V	-16.5 V ±0.7 V
A1TP14	+15V	+16.5 V ±0.7 V
A1TP15	-12V	-12.5 V ±0.5 V
A1TP16	+5V	+5.2 V ±0.2 V
A1TP17	+8V	+8.7 V ±0.4 V
A1TP18	+12V	12.5 V ±0.5 V
	-21V	-21.5 V ±2 V
	+48V	+46 V ±3 V
	-48V	-46 V ±3 V

3-8-3. REPLACEABLE PARTS LISTS

The A1 board's replaceable parts are listed in Table 3-6.

3-8-4. COMPONENT LOCATIONS

The A1 board's component locations and pin assignments are shown in Figure 3-3.

3-8-5. SCHEMATIC DIAGRAMS

The A1 board schematic diagram is shown in Figure 3-4.

Table 3-6. A1 Power Supply Replaceable Parts List (1/5)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A1						
A1	04279-66501	3	1	POWER SUPPLY	28480	04279-66501
A1C1	0160-3969	6	2	CAPACITOR-FXD .015UF +-20PF 250VAC(RMS)	28480	0160-3969
A1C2	0180-3253	3	4	CAPACITOR-FXD 470UF+-20% 250VDC AL	28480	0180-3253
A1C3	0180-3253	3		CAPACITOR-FXD 470UF+-20% 250VDC AL	28480	0180-3253
A1C4	0180-3253	3		CAPACITOR-FXD 470UF+-20% 250VDC AL	28480	0180-3253
A1C5	0180-3253	3		CAPACITOR-FXD 470UF+-20% 250VDC AL	28480	0180-3253
A1C6	0160-3969	6		CAPACITOR-FXD .015UF +-20PF 250VAC(RMS)	28480	0160-3969
A1C7	0180-3586	5	1	CAPACITOR-FXD 2200UF+-20% 35VDC AL	28480	0180-3586
A1C8	0160-4835	7	4	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A1C9	0180-3600	4	5	CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A1C10	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A1C11	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A1C12	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A1C13	0160-4830	2	2	CAPACITOR-FXD 2200PF +-10% 100VDC CER	28480	0160-4830
A1C14	0160-4830	2		CAPACITOR-FXD 2200PF +-10% 100VDC CER	28480	0160-4830
A1C15	0160-6812	4	2	CAPACITOR-FXD 2.2UF +-10% 250VDC	28480	0160-6812
A1C16	0160-6812	4		CAPACITOR-FXD 2.2UF +-10% 250VDC	28480	0160-6812
A1C17	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A1C18	0160-4834	6	1	CAPACITOR-FXD .047UF +-10% 100VDC CER	28480	0160-4834
A1C19	0160-6561	0	3	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A1C20	0160-4822	2	1	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A1C21	0160-4833	5	2	CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
A1C22	0180-3583	2	1	CAPACITOR-FXD 10UF+-20% 50VDC AL	28480	0180-3583
A1C23	0160-4833	5		CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
A1C24	0160-3454	4	1	CAPACITOR-FXD 220PF +-10% 1KVDC CER	28480	0160-3454
A1C25	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1C26	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A1C27	0180-3597	8	1	CAPACITOR-FXD 47UF+-20% 25VDC AL	28480	0180-3597
A1C28	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A1C29	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A1C30	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A1C31	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A1C32	0180-3587	6	3	CAPACITOR-FXD 1000UF+-20% 50VDC AL	28480	0180-3587
A1C33	0180-3587	6		CAPACITOR-FXD 1000UF+-20% 50VDC AL	28480	0180-3587
A1C34	0180-3587	6		CAPACITOR-FXD 1000UF+-20% 50VDC AL	28480	0180-3587
A1C35	0180-1075	3	3	CAPACITOR-FXD 2200 UF 16VDC AL	28480	0180-1075
A1C36	0160-4808	4	1	CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
A1C37	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A1C38	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A1C39	0180-1075	3		CAPACITOR-FXD 2200 UF 16VDC AL	28480	0180-1075
A1C40	0180-1075	3		CAPACITOR-FXD 2200 UF 16VDC AL	28480	0180-1075
A1C41	0180-3664	0	1	CAPACITOR-FXD 3300UF+-20% 10VDC AL	28480	0180-3664
A1C42	0180-3603	7	4	CAPACITOR-FXD 10UF+-20% 100VDC AL	28480	0180-3603
A1C43	0180-3603	7		CAPACITOR-FXD 10UF+-20% 100VDC AL	28480	0180-3603
A1C44	0180-3603	7		CAPACITOR-FXD 10UF+-20% 100VDC AL	28480	0180-3603
A1C45	0180-3603	7		CAPACITOR-FXD 10UF+-20% 100VDC AL	28480	0180-3603
A1CR1	1906-0313	1	1	BRIDGE 600V	28480	1906-0313
A1CR2	1906-0006	9	1	DIODE-FW BRDG 400V 1A	1B546	VE48
A1CR3	1902-0969	5	1	DIODE-ZNR 30V 5% DO-35 PD=.4W TC=+.095%	28480	1902-0969
A1CR4	1901-0050	3	30	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

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

Table 3-6. A1 Power Supply Replaceable Parts List (2/5)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A1CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR11	1902-3150	2	2	DIODE-ZNR 9.09V 2% DO-35 PD=.4W	28480	1902-3150
A1CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR13	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR14	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A1CR15	1902-0943	5		DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A1CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR17	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR19	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR20	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR21	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR22	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR23	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR24	1902-3150	2		DIODE-ZNR 9.09V 2% DO-35 PD=.4W	28480	1902-3150
A1CR25	1902-0953	7	1	DIODE-ZNR 6.2V 5% DO-35 PD=.4W TC=+.053%	28480	1902-0953
A1CR26	1906-0317	5	2	DIODE-CT-RECT 200V 5A	28480	1906-0317
A1CR27	1906-0316	4	3	DIODE-CT-RECT 200V 5A	28480	1906-0316
A1CR28	1906-0317	5		DIODE-CT-RECT 200V 5A	28480	1906-0317
A1CR29	1906-0316	4		DIODE-CT-RECT 200V 5A	28480	1906-0316
A1CR30	1906-0316	4		DIODE-CT-RECT 200V 5A	28480	1906-0316
A1CR31	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR32	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR33	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR34	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR35	1901-0731	7	5	DIODE-PWR RECT 400V 1A	14433	1N4004G
A1CR36	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A1CR37	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A1CR38	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A1CR39	1906-0314	2	1	DIODE-CT-S-BARR 40V 15A	28480	1906-0314
A1CR40	1902-0964	0	2	DIODE-ZNR 18V 5% DO-35 PD=.4W TC=+.09%	28480	1902-0964
A1CR41	1902-3188	6	2	DIODE-ZNR 12.7V 2% DO-35 PD=.4W	28480	1902-3188
A1CR42	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR43	1902-0957	1	1	DIODE-ZNR 9.1V 5% DO-35 PD=.4W TC=+.069%	28480	1902-0957
A1CR44	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	28480	1902-0951
A1CR45	1902-3188	6		DIODE-ZNR 12.7V 2% DO-35 PD=.4W	28480	1902-3188
A1CR46	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR47	1902-0964	0		DIODE-ZNR 18V 5% DO-35 PD=.4W TC=+.09%	28480	1902-0964
A1CR48	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR49	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR50	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR51	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A1CR52	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR53	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR54	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1CR55	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A1DS1	1990-0486	6	2	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A1DS2	1990-0486	6		LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A1E1	0837-0337	1	1	THERMISTOR-SURGE PTCTR BKDN V: DC 230V	28480	0837-0337

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

Table 3-6. A1 Power Supply Replaceable Parts List (3/5)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A1F1	2110-0014	3	1	FUSE 4A 250V TD 1.25X.25 UL	75915	313004
A1F2	2110-0746	8	2	FUSE 4A 125V NTD UL	28480	2110-0746
A1F3	2110-0746	8		FUSE 4A 125V NTD UL	28480	2110-0746
A1F4	2110-0741	3	2	FUSE 1A 125V NTD UL	28480	2110-0741
A1F5	2110-0741	3		FUSE 1A 125V NTD UL	28480	2110-0741
A1F6	2110-0743	5	3	FUSE 2A 125V UL	28480	2110-0743
A1F7	2110-0743	5		FUSE 2A 125V UL	28480	2110-0743
A1F8	2110-0743	5		FUSE 2A 125V UL	28480	2110-0743
A1FT1	2110-0663	8	1	FUSE-THERMAL 96 DEG C	28480	2110-0663
A1J1	1251-3819	9	1	CONN-UTIL MT-LK 6-CKT 6-CONT	28480	1251-3819
A1K1	0490-1312	8	1	RELAY IC 5VDC-COIL 10A 240VAC	28480	0490-1312
A1L2	9100-3139	5	2	INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
A1L3	9100-3139	5		INDUCTOR 75UH 15% .5D-INX.875LG-IN	28480	9100-3139
A1L4	9140-1136	2	1	INDUCTOR 27MH 35% .61W-INX.728LG-IN	28480	9140-1136
A1L5	9140-1135	1	1	INDUCTOR 76UH 15% 1.213W-INX1.161LG-IN	28480	9140-1135
A1Q1	1854-0810	2	12	TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q2	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q3	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q4	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q5	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q6	1853-0459	3	4	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A1Q7	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q8	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q9	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q10	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A1Q11	1855-0658	8	2	TRANSISTOR MOSFET N-CHAN E-MODE SI	S0562	2SK386
A1Q12	1855-0658	8		TRANSISTOR MOSFET N-CHAN E-MODE SI	S0562	2SK386
A1Q13	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q14	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q15	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q16	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A1Q17	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q18	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A1R1	0811-3621	8	1	RESISTOR 8 5% 6W PW TC=0+-50	28480	0811-3621
A1R2	0764-0031	7	4	RESISTOR 47K 5% 2W MO TC=0+-200	28480	0764-0031
A1R3	0764-0031	7		RESISTOR 47K 5% 2W MO TC=0+-200	28480	0764-0031
A1R4	0698-0085	0	4	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A1R5	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A1R6	0764-0031	7		RESISTOR 47K 5% 2W MO TC=0+-200	28480	0764-0031
A1R7	0764-0031	7		RESISTOR 47K 5% 2W MO TC=0+-200	28480	0764-0031
A1R8	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
A1R9	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3162-F
A1R10	0698-3455	4	1	RESISTOR 261K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2613-F
A1R11	0757-0280	3	8	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R12	0757-0442	9	6	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R15	0698-3457	6	2	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A1R16	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A1R17	0811-1668	9	1	RESISTOR 1.5 5% 2W PW TC=0+-400	75042	BWH2-1R5-J
A1R18	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	CT4-1/8-T0-121R-F
A1R19	2100-3207	1	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
A1R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F

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

Table 3-6. A1 Power Supply Replaceable Parts List (4/5)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A1R21	0698-0084	9	8	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A1R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R23	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A1R24	0698-3155	1	6	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A1R25	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A1R26	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A1R27	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A1R28	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A1R29	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A1R30	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R31	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A1R32	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R33	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R34	0698-4037	0	3	RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A1R35	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A1R36	0698-3260	9	3	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A1R37	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A1R38	0698-3635	2	1	RESISTOR 680 5% 2W MO TC=0+-200	28480	0698-3635
A1R39	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A1R40	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A1R41	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
A1R42	0698-3454	3	1	RESISTOR 215K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2153-F
A1R43	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A1R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R46	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A1R47	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A1R48	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A1R49	0698-0082	7	5	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A1R50	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A1R51	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	CT4-1/8-T0-681R-F
A1R52	2100-3350	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
A1R53	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A1R54	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A1R55	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A1R56	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A1R57	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A1R58	0698-3628	3	2	RESISTOR 220 5% 2W MO TC=0+-200	28480	0698-3628
A1R59	0698-3628	3		RESISTOR 220 5% 2W MO TC=0+-200	28480	0698-3628
A1R63	0698-3435	0	1	RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A1R64	0757-0274	5	2	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A1R65	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A1R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R67	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A1R68	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A1R69	0757-0984	4	1	RESISTOR 10 1% .5W F TC=0+-100	28480	0757-0984
A1R70	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A1R71	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A1R72	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A1R73	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A1R74	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A1R75	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A1R76	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A1R77	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F

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

Table 3-6. A1 Power Supply Replaceable Parts List (5/5)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A1R78	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A1R79	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A1R80	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A1R81	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A1R82	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A1R83	0698-3162	0	2	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A1R84	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A1RV1	1901-1217	6	2	DIODE-VRTS 150V	28480	1901-1217
A1RV2	1901-1217	6		DIODE-VRTS 150V	28480	1901-1217
A1T1	9100-4618	7	1	XFMR-POWER	28480	9100-4618
A1T2	9100-4499	2	1	TRANSFORMER L(PINS 10 & 11): 5.3 MH+-30%	28480	9100-4499
A1T3	9100-4634	7	1	TRANSFORMER L(21-22): 8.6 MH+-35% @ 1	28480	9100-4634
A1T4	9100-4635	8	1	TRANSFORMER L(21-22): 154 UH+-15% @ 1KHZ	28480	9100-4635
A1TP1	0360-1653	5	18	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP2	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP3	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP4	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP5	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP6	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP7	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP8	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP9	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP10	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP11	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP12	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP13	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP14	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP15	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP16	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP17	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1TP18	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A1U1	1826-0147	9	1	IC 7812 V RGLTR TO-220	04713	MC7812CP
A1U2	1826-1599	7	1	IC V RGLTR-SWG 16-DIP-P PKG	28480	1826-1599
A1U3	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
A1U4	1990-1190	1	3	DOUBLE-COUPLER	28480	1990-1190
A1U5	1990-1190	1		DOUBLE-COUPLER	28480	1990-1190
A1U6	1990-1190	1		DOUBLE-COUPLER	28480	1990-1190
A1W1	1251-4822	6	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A1X1	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A1X2	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	0340-1126	5	1	BARRIER-BLOCK 18-TERM INTERNAL FEED THRU	28480	0340-1126
	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
	0515-1007	2	4	SCREW-MACH M3 X 0.5 16MM-LG	28480	0515-1007
	0515-1550	0	7	SCREW-MACHINE ASSEMBLY M3 X 0.5 8MM-LG	28480	0515-1550
	0515-1551	1	4	SCREW-MACHINE ASSEMBLY M3 X 0.5 10MM-LG	28480	0515-1551
	1258-0141	8	1	JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
	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

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

NOTES

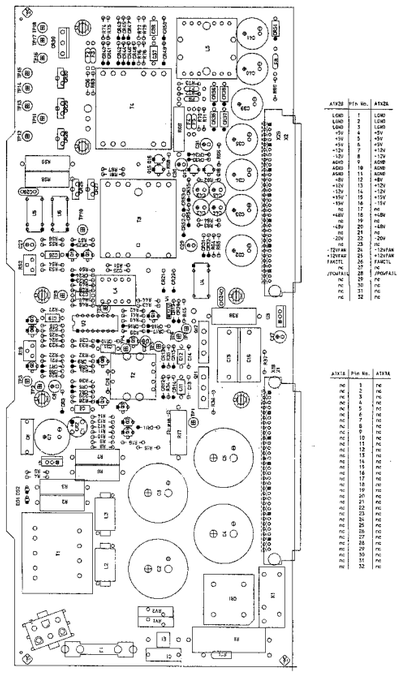
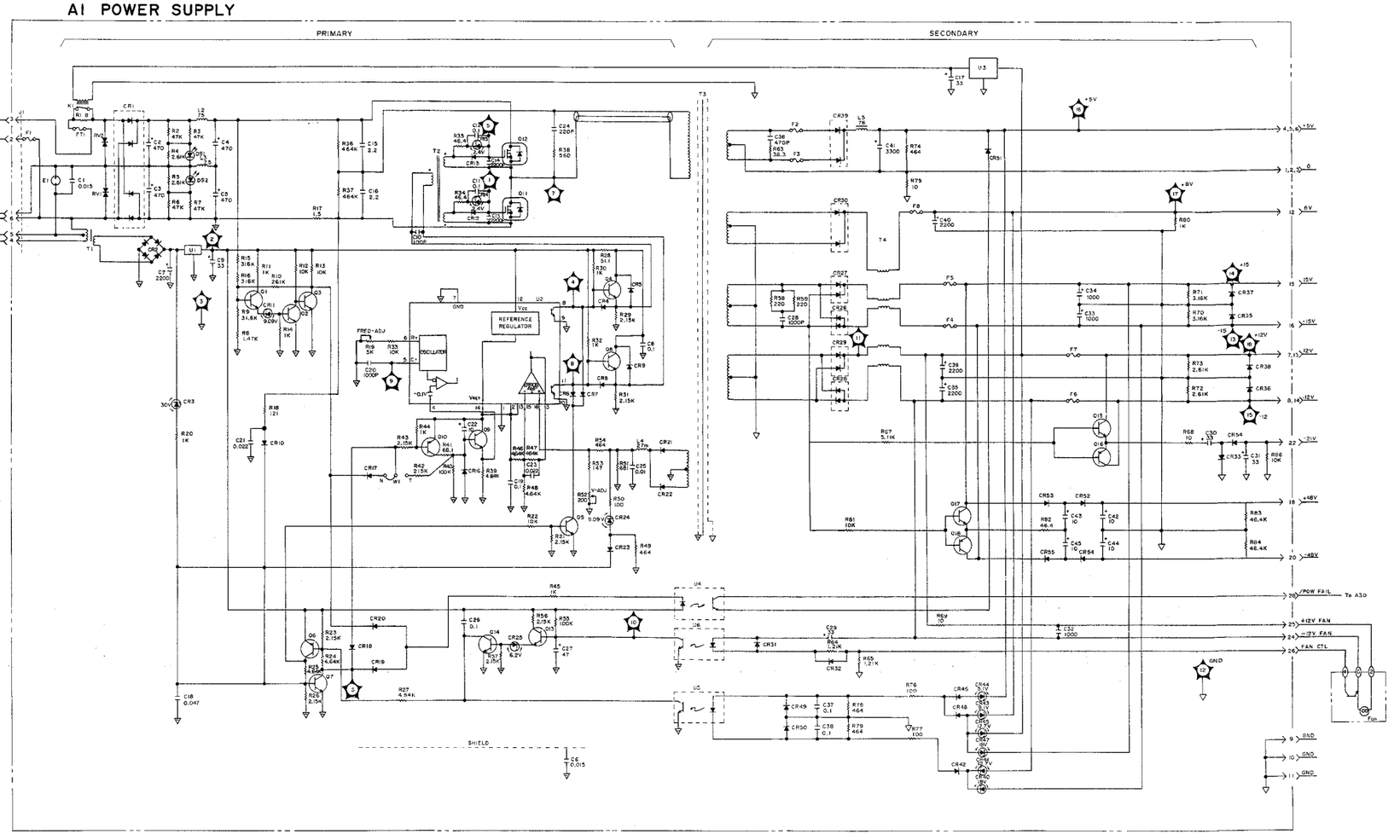


Figure 3-3. A1 Power Supply Component Locations



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 (uF)
   INDUCTANCE IN MICROHENRIES (uH)

Figure 3-4. A1 Power Supply Schematic Diagram

A2 SIGNAL SOURCE BOARD SERVICE SHEET

NOTES

3-9. A2 BOARD SERVICE SHEET

3-9-1. CIRCUIT DESCRIPTION

The A2 signal source board consists of the two sections: oscillator source level, and DC bias voltage source.

[Oscillator Level Source Section]

To generate the 1 MHz test signal, the output of the 8 MHz crystal oscillator (A2U16) is divided by A2U10 to supply the 1 MHz test frequency. The 1 MHz test frequency is filtered by a LPF (Low Pass Filter) and the filtered output (a sine wave) is a fairly constant 2.2 Vrms signal. The 2.2 Vrms signal from the LPF is output to an attenuator consisting of resistors A2R12 to A2R17 and A2R18 to A2R21. A2U6 and A2U7 are used to select voltage levels from the attenuator and thereby to select the oscillator level output. The signal level selected by the attenuator is amplified by an ac power amplifier and is then output to the Hcur Terminal. The source resistor is approximately 20 Ω (A2R65 is used when the OSC level setting is from 200 mVrms to 1000 mVrms, and both A2R83 and A2R84 are used when the OSC level setting is from 20 mVrms to 100 mVrms).

[DC BIAS Voltage Source Section]

The reference voltage (Vref = +5 V, the polarity of Vref is switched by A2U8) supplied by A2U1 is used to generate the DC bias voltage. The Vref output is applied to A2U12 (12-bit D/A Converter), and to A2U11 (multiplexer), which is in effect used as a 3-bit sub DAC. Thus the analog DC bias voltage is effectively set by a 15-bit binary input. The output from the DAC is attenuated by resistors A2R44 to A2R49, to achieve the same resolution on all ranges. The attenuated Vref signal is amplified (×8.5) by a DC power amplifier, which supplies the DC bias voltage to the Hcur terminal. The DC source resistor (A2R51) is 470 Ω. When the DC bias mode is set to the EXT DC BIAS mode, the DC source resistor (A2R37 and A2R52 in series) is 70.2 kΩ.

3-9-2. TROUBLESHOOTING AIDS

The troubleshooting aids provides a list of jumper settings, a list of test points, and helpful troubleshooting information. The jumpers are listed in Table 3-7, the test pins are listed in Table 3-8, and the troubleshooting information is listed in Table 3-9.

Table 3-7. Jumper List

Reference Designator	Description	Use
A2W1	DC Bias Voltage Isolation	**Normal Position:** Connects the DC bias voltage output signal to the Hcur Terminal. **Test Position:** Connects the DC bias voltage output signal to the MONITOR Terminal on the rear connector so only the oscillator signal is output at the Hcur Terminal.
A2W2	Option Identified Selection	**SHORT Position:** This position is used when no options are installed (standard). **OPEN Position:** This position is used when option 003 (1% frequency shift) is installed.

Table 3-8. A2 Test Points

Test Point	Signal Name	Description
A2TP1	*GND*	Ground Line
A2TP2	*GND*	Ground Line
A2TP3	*F*	1 MHz
A2TP4	*GND*	Ground Line
A2TP5	*VREF*	+/- 5 V (the sign depends on the polarity of the DC bias setting)
A2TP6	*VDAC*	Output signal from DAC (Refer to Figure 3-5)
A2TP7	*DCV*	DC bias voltage output
A2TP8	*EOSC*	Output signal at Hcur Terminal
A2TP9	*4M*	4 MHz
A2TP10	*F*	1 MHz
A2TP11	*GND*	Ground Line
A2TP12	*8F*	8 MHz
A2TP13	*ETEST*	This signal is only used during selftest
A2TP14	*+5*	5 V DC
A2TP15	*+8*	8 V DC
A2TP16	*-8*	-8 V DC
A2TP17	*-48*	-48 V DC
A2TP18	*+48*	48 V DC

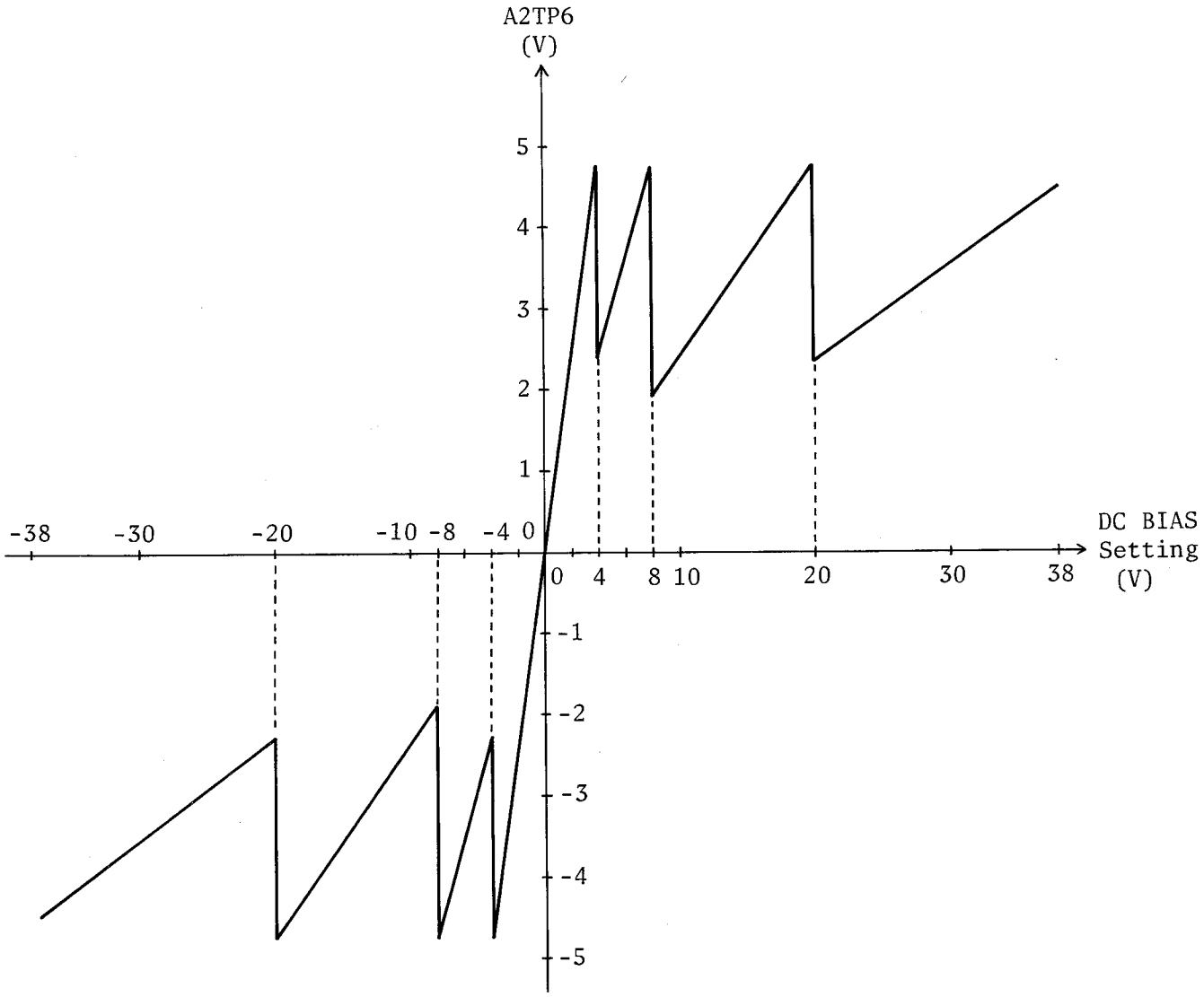
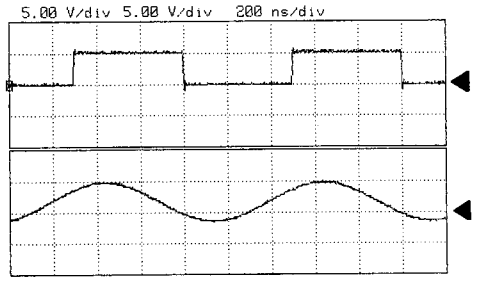
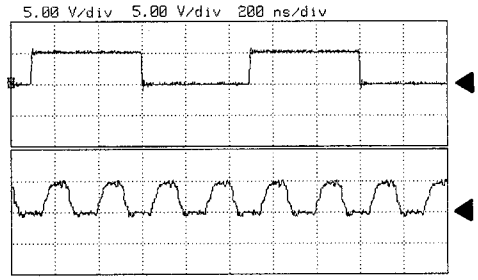
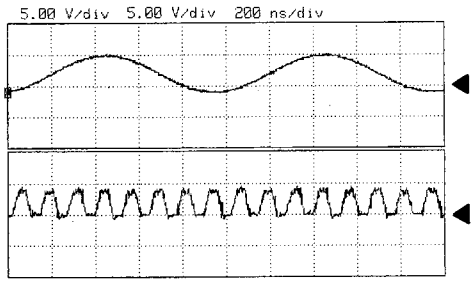
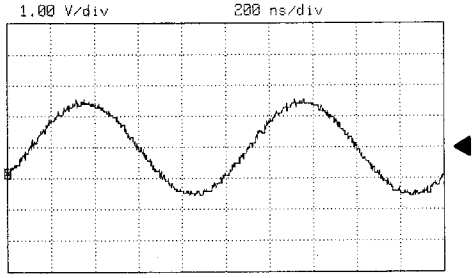


Figure 3-5. Relationship between DC Bias Settings and Voltage at A2TP6.

Table 3-9. Troubleshooting Data

HP 4279A Settings	Measurement Setup	Waveform
Default Settings	CHAN A: A2TP10 CHAN B: A2TP3 TRIG: CHAN A (Negative)	
Default Settings	CHAN A: A2TP10 CHAN B: A2TP9 TRIG: CHAN A (Negative)	
Default Settings	CHAN A: A2TP3 CHAN B: A2TP12 TRIG: CHAN A (Negative)	
Selftest = 1	CHAN A: A2TP13 TRIG: CHAN A (Positive)	

3-9-3. REPLACEABLE PARTS LISTS

The A2 board replaceable parts are listed in Table 3-10.

3-9-4. COMPONENT LOCATIONS

The A2 board component locations and pin assignments are shown in Figure 3-6.

3-9-5. SCHEMATIC DIAGRAMS

The A1 board schematic diagram is shown in Figure 3-7.

Table 3-10. A2 Signal Source Replaceable Parts List (1/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A2						
A2	04279-66502	4	1	SIGNAL SOURCE (STD ONLY)	28480	04279-66502
	04279-66572	8	1	SIGNAL SOURCE (OPTION 003 ONLY)	28480	04279-66572
A2C1	0180-3363	6	35	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C2	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A2C3	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C4	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C5	0160-4822	2	2	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C6	0160-4830	2	1	CAPACITOR-FXD 2200PF +-10% 100VDC CER	28480	0160-4830
A2C7	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C8	0180-3598	9	6	CAPACITOR-FXD 33UF+-20% 100VDC AL	28480	0180-3598
A2C9	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C10	PPNR34087	2	2	C-F .022U 5%200V	28480	PPNR34087
A2C11	0160-4787	8	2	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A2C12	PPNR34086	1	1	C-F .01U 5% 200V	28480	PPNR34086
A2C13	0160-6561	0	12	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C14	0160-4835	7	2	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A2C15	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C16	0160-4810	8	1	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
A2C17	0160-4805	1	1	CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30	28480	0160-4805
A2C18	0160-4823	3	2	CAPACITOR-FXD 820PF +-5% 100VDC CER	28480	0160-4823
A2C19	0160-4814	2	1	CAPACITOR-FXD 150PF +-5% 100VDC CER	28480	0160-4814
A2C20	0160-4823	3		CAPACITOR-FXD 820PF +-5% 100VDC CER	28480	0160-4823
A2C21	0160-4808	4	2	CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
A2C22	0160-4808	4		CAPACITOR-FXD 470PF +-5% 100VDC CER	28480	0160-4808
A2C23	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C25	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C26	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A2C27	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C28	0160-4803	9	1	CAPACITOR-FXD 68PF +-5% 100VDC CER 0+-30	28480	0160-4803
A2C29	0180-3598	9		CAPACITOR-FXD 33UF+-20% 100VDC AL	28480	0180-3598
A2C30	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C31	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A2C32	PPNR34087	2		C-F .022U 5%200V	28480	PPNR34087
A2C33	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C34	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A2C35	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C36	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C37	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C38	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C39	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C40	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C41	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C42	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C43	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C44	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C45	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C46	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C47	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C48	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A2C49	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C50	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A

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

Table 3-10. A2 Signal Source Replaceable Parts List (2/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A2C51	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C52	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C53	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C54	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C55	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C56	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C57	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C58	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C59	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C60	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C61	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C62	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A2C63	0180-3598	9		CAPACITOR-FXD 33UF+-20% 100VDC AL	28480	0180-3598
A2C64	0180-3598	9		CAPACITOR-FXD 33UF+-20% 100VDC AL	28480	0180-3598
A2C65	0180-3598	9		CAPACITOR-FXD 33UF+-20% 100VDC AL	28480	0180-3598
A2C66	0180-3598	9		CAPACITOR-FXD 33UF+-20% 100VDC AL	28480	0180-3598
A2C67	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C68	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C69	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C70	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C71	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C72	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C73	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C74	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2C75	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A2CR1	1901-0376	6	4	DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A2CR2	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A2CR3	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A2CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A2CR5	1901-0050	3	15	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR9	1902-0176	6	2	DIODE-ZNR 47V 5% PD=1W IR=5UA	28480	1902-0176
A2CR10	1901-0731	7	8	DIODE-PWR RECT 400V 1A	14433	1N4004G
A2CR11	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A2CR12	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A2CR13	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A2CR14	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR15	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR17	1902-0176	6		DIODE-ZNR 47V 5% PD=1W IR=5UA	28480	1902-0176
A2CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR19	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR20	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A2CR21	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A2CR22	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A2CR23	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A2CR24	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR25	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR26	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR27	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR28	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A2CR29	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

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

Table 3-10. A2 Signal Source Replaceable Parts List (3/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A2J1	1251-4938	5	1	CONNECTOR 3-PIN M METRIC POST TYPE	28480	1251-4938
A2J2	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J3	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A2J4	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A2K1	0490-1485	6	4	RELAY SW	28480	0490-1485
A2K2	0490-1485	6		RELAY SW	28480	0490-1485
A2K3	0490-1485	6		RELAY SW	28480	0490-1485
A2K4	0490-1485	6		RELAY SW	28480	0490-1485
A2L1	9140-0210	1	5	INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A2L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A2L3	9140-1264	7	1	INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A2L4	9140-1261	4	1	INDUCTOR 39UH 10% 6.6-MM Q=60	28480	9140-1261
A2L5	9140-0762	8	2	INDUCTOR 56UH 10% .31DX.41LG Q=65	28480	9140-0762
A2L6	9140-0762	8		INDUCTOR 56UH 10% .31DX.41LG Q=65	28480	9140-0762
A2L7	9140-1094	1	1	INDUCTOR 47UH 10% .26D-INX.276LG-IN Q=60	28480	9140-1094
A2L8	9140-0761	7	2	INDUCTOR 220UH 10% .31DX.41LG Q=95	28480	9140-0761
A2L9	9140-1259	0	1	INDUCTOR 1UH 20% 6.6D-MM Q=45	28480	9140-1259
A2L10	9140-1278	3	4	INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A2L11	9140-0761	7		INDUCTOR 220UH 10% .31DX.41LG Q=95	28480	9140-0761
A2L12	9140-1262	5	1	INDUCTOR 100UH 10% 6D-MM Q=40	28480	9140-1262
A2L13	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A2L14	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A2L15	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A2L16	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A2L17	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A2L18	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A2Q1	1854-0474	4	2	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A2Q2	1853-0080	6	2	TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A2Q3	1854-0271	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0271
A2Q4	1854-0810	2	5	TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A2Q5	1853-0080	6		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A2Q6	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A2Q7	1853-0232	0	1	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A2Q8	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A2Q9	1853-0459	3	3	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A2Q10	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A2Q11	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A2Q12	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A2Q13	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A2Q14	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A2R1	0699-2328	0	1	RESISTOR 4.3K .1% .1W TF TC=+-5	28480	0699-2328
A2R2	0698-6366	2	1	RESISTOR 800 .1% .125W F TC=0+-25	28480	0698-6366
A2R3	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A2R4	0757-0438	3	4	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R5	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A2R6	0757-0274	5	4	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A2R7	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A2R8	0757-0403	2	2	RESISTOR 121 1% .125W F TC=0+-100	24546	CT4-1/8-T0-121R-F
A2R9	0698-8827	4	3	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A2R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A2R11	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R12	0757-0401	0	12	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R13	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F

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

Table 3-10. A2 Signal Source Replaceable Parts List (4/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A2R14	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R15	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R16	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R17	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R18	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R19	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R20	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R21	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R22	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A2R23	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A2R24	0757-0346	2	4	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A2R25	2100-0552	3	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 1-TRN	28480	2100-0552
A2R26	0757-0402	1	2	RESISTOR 110 1% .125W F TC=0+-100	24546	CT4-1/8-T0-111-F
A2R27	0757-0402	1		RESISTOR 110 1% .125W F TC=0+-100	24546	CT4-1/8-T0-111-F
A2R28	PPNR34085	0	1	RES NET 10KX2	28480	PPNR34085
A2R32	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A2R33	0699-2329	1	1	RESISTOR 38.3K .1% .1W TF TC=+-5	28480	0699-2329
A2R34	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R35	0757-0465	6	3	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A2R36	0698-4037	0	2	RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A2R37	0764-0042	0	1	RESISTOR 2.2K 5% 2W MO TC=0+-200	28480	0764-0042
A2R38	0757-0424	7	2	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A2R39	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A2R40	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A2R41	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1102-F
A2R42	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A2R43	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R44	0699-2398	4	2	RESISTOR 1K .1%		
A2R45	0699-2398	4		RESISTOR 1K .1%		
A2R46	0699-2394	0	1	RESISTOR 800 .1%		
A2R47	0699-1765	7	3	RESISTOR 400 .1% .125W TF TC=+-5	28480	0699-1765
A2R48	0699-1765	7		RESISTOR 400 .1% .125W TF TC=+-5	28480	0699-1765
A2R49	0699-1765	7		RESISTOR 400 .1% .125W TF TC=+-5	28480	0699-1765
A2R50	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A2R51	0698-3634	1	1	RESISTOR 470 5% 2W MO TC=0+-200	28480	0698-3634
A2R52	0698-3657	8	1	RESISTOR 68K 5% 2W MO TC=0+-200	27167	FP42-2-T00-6802-J
A2R53	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R54	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A2R55	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A2R56	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A2R57	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A2R58	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R59	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A2R60	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A2R61	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A2R62	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	CT4-1/8-T0-121R-F
A2R63	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R64	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A2R65	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A2R66	0683-0275	9	4	RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
A2R67	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
A2R68	0757-0277	8	2	RESISTOR 49.9 1% .125W F TC=0+-100	28480	0757-0277
A2R69	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3481-F
A2R70	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346

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

Table 3-10. A2 Signal Source Replaceable Parts List (5/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A2R71	0698-3430	5	2	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A2R72	0757-0463	4	1	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8252-F
A2R73	0698-3243	8	1	RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A2R74	0698-3457	6	1	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A2R75	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A2R76	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A2R77	0698-3155	1	4	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A2R78	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R79	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A2R80	0757-0461	2	1	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6812-F
A2R81	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1782-F
A2R82	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A2R83	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A2R84	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A2R85	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
A2R86	0683-0275	9		RESISTOR 2.7 5% .25W CF TC=0-400	01121	CB27G5
A2R87	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	28480	0757-0277
A2R88	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3481-F
A2R89	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A2R90	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A2R91	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A2R92	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A2R93	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A2R94	1810-0280	8	2	NETWORK-RES 10-SIP 10.0K OHM X 9	91637	
A2R95	1810-0280	8		NETWORK-RES 10-SIP 10.0K OHM X 9	91637	
A2R96	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A2R98	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A2R99	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A2R100	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A2TP1	0360-1653	5	18	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP2	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP3	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP4	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP5	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP6	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP7	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP8	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP9	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP10	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP11	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP12	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP13	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP14	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP15	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP16	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP17	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2TP18	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A2U1	1826-1706	8	1	IC V RGLTR-V-REF-FXD 4.9975/5.0025V	28480	1826-1706
A2U2	1826-0471	2	1	IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-07CJ SELECTED
A2U3	1826-1127	7	1	IC OP AMP PRCN DUAL 8-TO-99 PKG	27014	LF412CH
A2U5	1820-1546	2	1	ANALOG MULTIPLEXER 4 CHNL 16 -CERDIP	04713	MC14052BCL
A2U6	1820-1315	3	2	IC MULTIPLXR 8-CHAN-ANLG 16-DIP-P PKG	3L585	CD4051BE
A2U7	1820-1315	3		IC MULTIPLXR 8-CHAN-ANLG 16-DIP-P PKG	3L585	CD4051BE
A2U8	1820-1545	1	2	IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BY

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

Table 3-10. A2 Signal Source Replaceable Parts List (6/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A2U9	1826-0635	0	1	IC OP AMP LOW-OFS 8-DIP-P PKG	06665	OP-07CP
A2U10	1820-2925	3	1	IC CNTR CMOS/74HC BIN SYNCHRO	04713	MC74HC161N
A2U11	1820-1545	1		IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BY
A2U12	1826-1386	0	1	D/A 12-BIT 18-PLASTIC CMOS	24355	AD11/548
A2U13	1826-0519	9	1	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A2U14	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A2U15	1820-3081	4	1	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG	04713	MC74HC74N
A2U16	1813-0550	1	1	CLK OSC 8.00MHZ (STD ONLY)	28480	1813-0550
	1813-0551	1		CLK OSC 8.08MHZ (OPTION 003 ONLY)	28480	1813-0551
A2U17	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A2U18	1820-3399	7	4	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N
A2U19	1820-3399	7		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N
A2U20	1820-3399	7		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N
A2U21	1820-1568	8	1	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A2U22	1820-3399	7		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N
A2U23	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A2U24	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
A2U25	1826-0146	8	1	IC 7808 V RGLTR TO-220	04713	MC7808CP
A2U26	1826-0971	7	1	IC- UPC7908H	28480	1826-0971
A2W1	1251-4822	6	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A2W2	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
	0340-0060	4	4	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	98291	011-6809 000 209
	0361-1195	2	4	RIVET-SEMITUB OVH ODIA	28480	0361-1195
	1251-7464	8	2	CONTACT-CONN U/W-POST-TYPE FEM CRP	28480	1251-7464
	1251-7681	1	1	CONN-POST TYPE 2.5-PIN-SPCG 3-CONT	28480	1251-7681
	1258-0141	8	1	JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	28480	1258-0141
	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
	8159-0005	0	4	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

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

NOTES

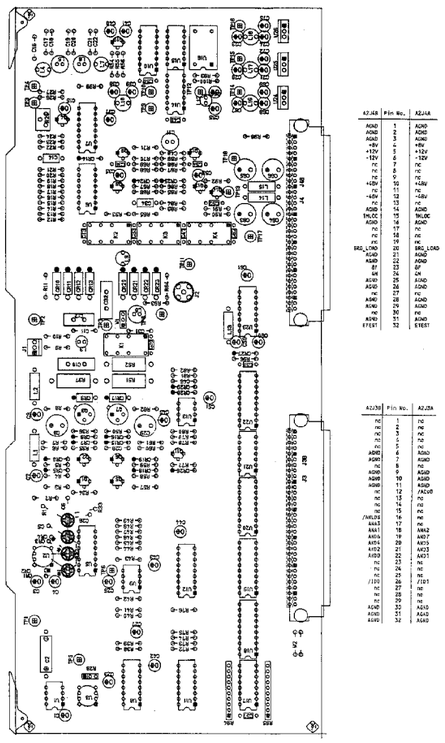
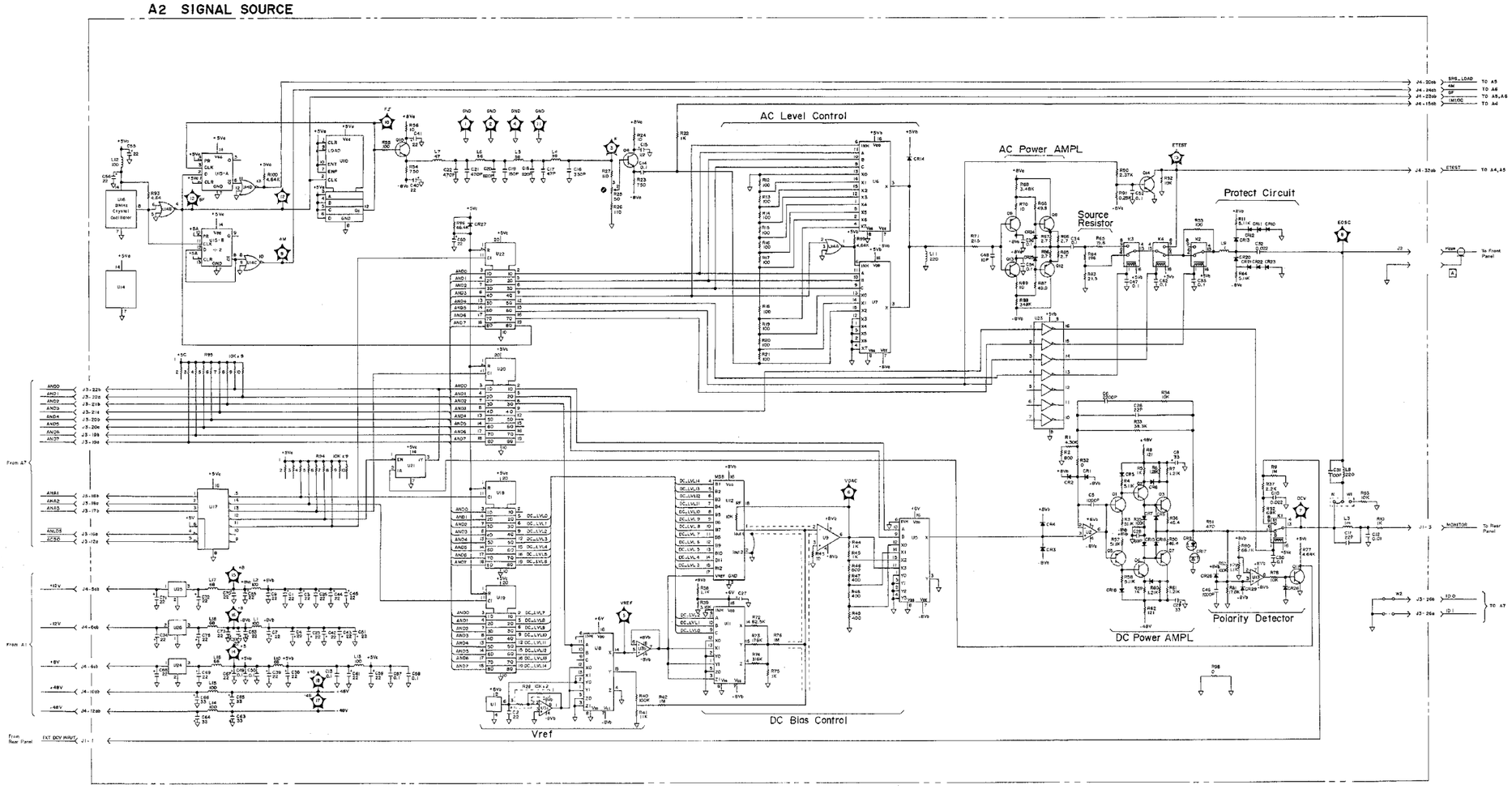


Figure 3-6. A2 Signal Source Component Locations



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 3-7. A2 Signal Source Schematic Diagram

A4 TRANSDUCER BOARD SERVICE SHEET

NOTES

3-10. A4 BOARD SERVICE SHEET

3-10-1. CIRCUIT DESCRIPTION

The A4 transducer board consists of the first and second null amplifiers, the range resistor, the ranging current divider, and the voltage regulator.

[First Null Amplifier]

The first null amplifier is described in the block diagram discussion in SECTION 2. The first null amplifier includes the resonance circuit composed of A4L6, A4C9, A4C10, and A4C11. The output from the first null amplifier goes to transformer A4T1.

[Second Null Amplifier]

The second null amplifier is described in the block diagram discussion in SECTION 2. In the block diagram discussion, the current through the DUT is assumed to be equal to 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 (using A4U13) in the second null amplifier detects and outputs the difference as a proportional error voltage.
Multiplexers A4U10 and A4U12 are 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 A4U17 HIC (hybrid IC), and the normalized error voltage is also converted into a DC voltage proportional to the 90° vector components by the phase detector and the integrator in HIC A4U18. A4Q34, A4L36, A4C94, A4R101, and A4Q35 supply the 0° and 90° reference signals to A4U17 and A4U18 (HICs). The 0° component of the reference signal is amplitude modulated using the 0° component of the error voltage at HIC A4U17, and the 90° component of the reference signal is amplitude modulated with the 90° component error voltage by HIC A4U18. The signals output from A4U17 (0° component) and A4U18 (90° component) are summed, and the phase of the resultant vector signal is inverted and amplified by summing amplifier A4U16. So 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 8.06 kΩ (A4R39). This range resistor is one part of the I-V converter.

[Ranging Current Divider]

As described in the block diagram discussion in Section 2, the ranging current divider consists of transformers, binary output selection switches, and position control switches of the ranging current divider. The transformers are A4T2 to A4T7, the binary output selection switches are A4Q14 to A4Q21, and the ranging current divider's position control switches are A4Q10 to A4Q13. The ON/OFF settings of all switches depends on the measurement range as shown below. Switching control is performed by multiplexers A4U7, A4U8, A4U9, and A4U11.

Table 3-11. Measurement Range and Switches

Measurement Range	Reference Designator											
	Q10	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**	**Q21**
1024 pF	1	0	0	1	1	0	1	0	1	0	0	1
512 pF	1	0	0	1	1	0	1	0	0	1	1	0
128 pF	1	0	0	1	1	0	0	1	1	0	1	0
32 pF	1	0	0	1	0	1	1	0	1	0	1	0
8 pF	0	1	1	0	0	1	1	0	1	0	1	0
2 pF	0	1	1	0	1	0	0	1	1	0	1	0

1: ON
0: OFF

[Voltage Regulator]

The voltage regulator consists of A4U19, A4U20, and A4U21. The voltage regulator regulates the unregulated voltage from the A1 Power Supply board to +5 V and ±8 V. A4U19 regulates the +12 V from the A1 board to the +8 V. A4U20 also regulates the -12 V from the A1 board to -8 V. A4U21 regulates the +8 V from the A1 board to +5 V.

3-10-2. TROUBLESHOOTING AIDS

The troubleshooting aids provides a list of test points, and troubleshooting information. The test point list is shown in Table 3-12, and the troubleshooting information is listed in Table 3-13.

Table 3-12. A4 Test Points

Test Point	Signal Name	Description
A4TP1		1st Null Amp Output
A4TP2	*GND*	Ground Line
A4TP3		Output signal (1) from the 2nd null amplifier preamplifier
A4TP4		Output signal (2) from the 2nd null amplifier preamplifier
A4TP5		Output signal from the I-V converter
A4TP6	*GND*	Ground Line
A4TP7		Local oscillator signal (0°)
A4TP8		Local oscillator signal (90°)
A4TP9		+8 V DC
A4TP10		-8 V DC
A4TP11		+5 V DC

Table 3-13. Troubleshooting Data (1/3)

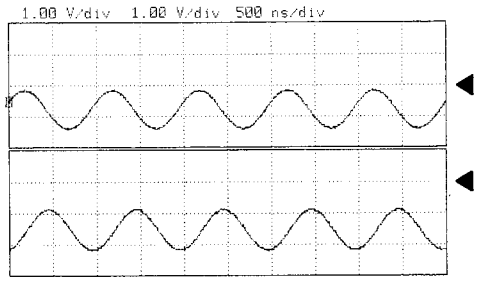
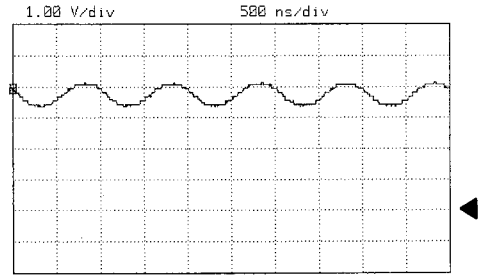
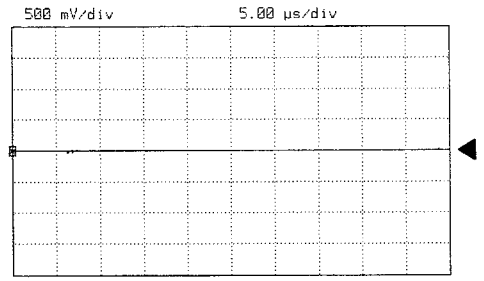
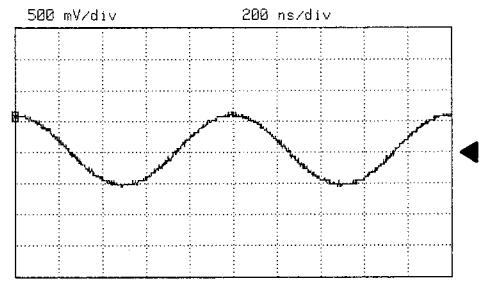
HP 4279A Settings	Measurement Setup	Waveform
Initial Settings	CHAN A: A4TP7 CHAN B: A4TP8 TRIG: CHAN A (Negative)	
Self Test = 1	CHAN A: A4TP2 TRIG: CHAN A (Negative)	
Self Test = 2	CHAN A: A4TP5 TRIG: CHAN A (Negative)	
DUT: 1 pF Meas.Range: 2 pF OSC Level: 1 Vrms	CHAN A: A4TP5 TRIG: CHAN A (Negative)	

Table 3-13. Troubleshooting Data (2/3)

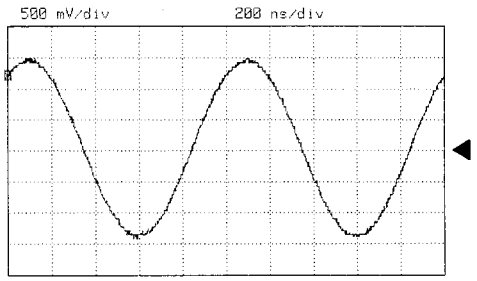
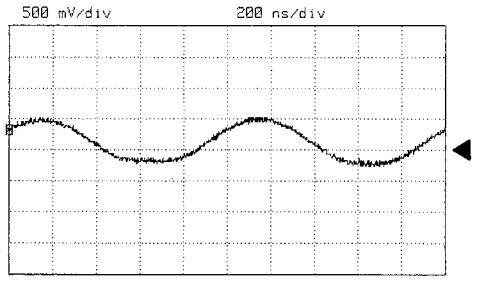
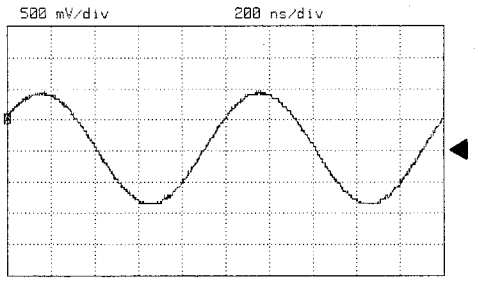
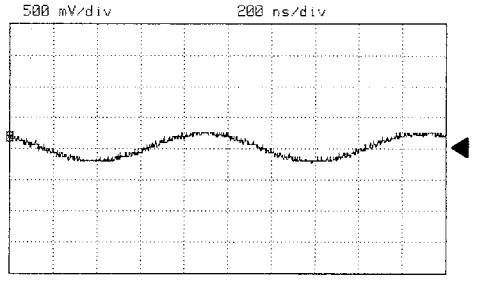
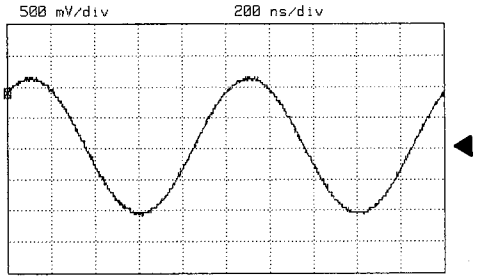
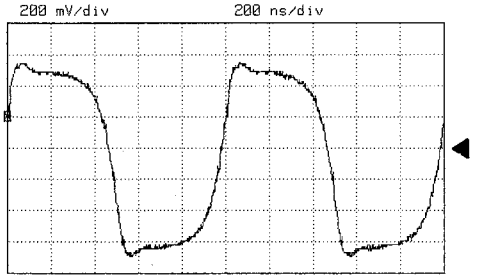
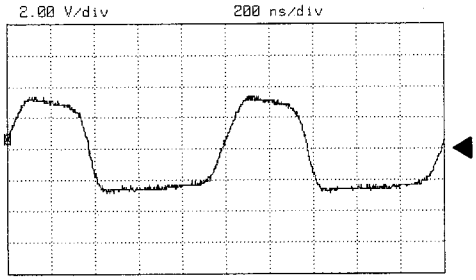
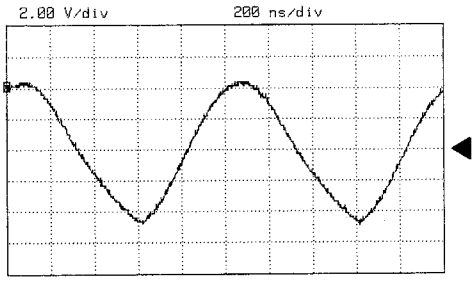
HP 4279A Settings	Measurement Setup	Waveform
DUT: 10 pF Meas.Range: 8 pF OSC Level: 1 Vrms	CHAN A: A4TP5 TRIG: CHAN A (Negative)	
DUT: 10 pF Meas.Range: 32 pF OSC Level: 1 Vrms	CHAN A: A4TP5 TRIG: CHAN A (Negative)	
DUT: 100 pF Meas.Range: 128 pF OSC Level: 1 Vrms	CHAN A: A4TP5 TRIG: CHAN A (Negative)	
DUT: 100 pF Meas.Range: 512 pF OSC Level: 1 Vrms	CHAN A: A4TP5 TRIG: CHAN A (Negative)	

Table 3-13. Troubleshooting Data (3/3)

HP 4279A Settings	Measurement Setup	Waveform
DUT: 1000 pF Meas.Range: 1024 pF OSC Level: 1 Vrms	CHAN A: A4TP5 TRIG: CHAN A (Negative)	
DUT: 1000 pF Meas.Range: 2 pF OSC Level: 1 Vrms Display: UNBAL	CHAN A: A4TP3 TRIG: CHAN A (Negative)	
DUT: 1000 pF Meas.Range: 2 pF OSC Level: 1 Vrms Display: UNBAL	CHAN A: A4TP4 TRIG: CHAN A (Negative)	
DUT: 1000 pF Meas.Range: 2 pF OSC Level: 1 Vrms Display: UNBAL	CHAN A: A4TP5 TRIG: CHAN A (Negative)	

3-10-3. REPLACEABLE PARTS LISTS

The A4 board replaceable parts list is shown in Table 3-14.

3-10-4. COMPONENT LOCATIONS

The A4 component locations with the pin assignment is shown in Figure 3-8.

3-10-5. SCHEMATIC DIAGRAMS

The A4 board schematic diagram is shown in Figure 3-9.

Table 3-14. A4 Transducer Replaceable Parts List (1/7)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A4						
A4	04279-66504	6	1	TRANSDUCER	28480	04279-66504
A4C1	0160-4835	7	6	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A4C2	0160-4799	2	2	CAPACITOR-FXD 2.2PF +-.25PF 100VDC CER	28480	0160-4799
A4C3	0160-4791	4	8	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C4	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A4C5	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C6	0160-4832	4	11	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C7	0180-3363	6	22	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C8	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C9	0160-3916	3	1	CAPACITOR-FXD 220PF +-2% 100VDC CER	28480	0160-3916
A4C10	0121-0105	4	1	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	73899	DV11PR35D
A4C11	0160-4787	8	14	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C12	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C13	0160-4810	8	1	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
A4C14	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A4C15	0160-4799	2		CAPACITOR-FXD 2.2PF +-.25PF 100VDC CER	28480	0160-4799
A4C16	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C17	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C18	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C19	0160-6561	0	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A4C20	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A4C21	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A4C22	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A4C23	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C24	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C25	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C26	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C27	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C28	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C29	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C30	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C31	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C32	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C33	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A4C34	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C35	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C36	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C37	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C38	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C39	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C40	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C41	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C42	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C43	0160-4789	0	1	CAPACITOR-FXD 15PF +-5% 100VDC CER 0+-30	28480	0160-4789
A4C44	0160-4795	8	1	CAPACITOR-FXD 4.7PF +-.5PF 100VDC CER	28480	0160-4795
A4C45	0160-4801	7	2	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A4C46	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A4C47	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A4C48	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C49	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C50	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832

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

Table 3-14. A4 Transducer Replaceable Parts List (2/7)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A4C51	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C52	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C53	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C54	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C55	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C56	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C57	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C58	0160-4812	0	1	CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A4C59	0160-4788	9	1	CAPACITOR-FXD 18PF +-5% 100VDC CER 0+-30	28480	0160-4788
A4C60	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C61	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C62	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C63	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C64	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A4C65	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C66	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C67	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A4C68	0160-4792	5	1	CAPACITOR-FXD 8.2PF +-.5PF 100VDC CER	28480	0160-4792
A4C69	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C70	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C71	0160-4822	2	1	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A4C72	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C73	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C74	0180-3600	4	6	CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A4C75	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A4C76	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A4C77	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A4C78	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A4C79	0180-3600	4		CAPACITOR-FXD 33UF+-20% 25VDC AL	28480	0180-3600
A4C80	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C81	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A4C82	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A4C83	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4C84	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	28480	0160-4787
A4CR1	1901-0731	7	8	DIODE-PWR RECT 400V 1A	14433	1N4004G
A4CR2	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A4CR3	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A4CR4	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A4CR5	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A4CR6	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A4CR7	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A4CR8	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A4CR9	1901-0050	3	27	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR13	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR14	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR15	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR17	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR19	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR20	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150

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

Table 3-14. A4 Transducer Replaceable Parts List (3/7)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A4CR21	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR22	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR23	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR24	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR25	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR26	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR27	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR28	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR29	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR30	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR31	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR32	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR33	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR34	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4CR35	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A4J1	1250-0257	1	3	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A4J2	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A4J3	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A4J4	1252-1598	9	2	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A4J5	1252-1598	9		CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
A4K1	0490-1477	6	2	RELAY	28480	0490-1477
A4K2	0490-1477	6		RELAY	28480	0490-1477
A4L1	9140-0761	7	3	INDUCTOR 220UH 10% .31DX.41LG Q=95	28480	9140-0761
A4L2	9140-0761	7		INDUCTOR 220UH 10% .31DX.41LG Q=95	28480	9140-0761
A4L3	9140-1264	7	15	INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L4	9140-1263	6	2	INDUCTOR 120UH 10% 6D-MM Q=40	28480	9140-1263
A4L5	9140-1263	6		INDUCTOR 120UH 10% 6D-MM Q=40	28480	9140-1263
A4L6	9140-0210	1	6	INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A4L7	9140-0129	1	2	INDUCTOR RF-CH-MLD 220UH 5%	28480	9140-0129
A4L8	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A4L9	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5%	28480	9140-0129
A4L10	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A4L11	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L12	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L13	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L14	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L15	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L16	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L17	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L18	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L19	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L20	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L21	9140-0761	7		INDUCTOR 220UH 10% .31DX.41LG Q=95	28480	9140-0761
A4L22	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L23	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L24	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4L25	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A4L26	9140-0137	1	2	INDUCTOR RF-CH-MLD 1MH 5%	28480	9140-0137
A4L27	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5%	28480	9140-0137
A4L28	9140-1278	3	5	INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A4L29	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A4L30	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A4L31	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A4L32	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278

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

Table 3-14. A4 Transducer Replaceable Parts List (4/7)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A4L33	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A4L34	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A4L35	9140-1264	7		INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264
A4Q1	1854-0810	2	15	TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q2	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q3	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q4	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q5	1855-0570	3	2	TRANSISTOR J-FET D-MODE TO-92 SI	S0545	2SK523
A4Q6	1853-0459	3	2	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A4Q7	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A4Q8	1855-0570	3		TRANSISTOR J-FET D-MODE TO-92 SI	S0545	2SK523
A4Q9	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q10	1854-1074	2	16	TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q11	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q12	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q13	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q14	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q15	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q16	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q17	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q18	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q19	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q20	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q21	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q22	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q23	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q24	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q25	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q26	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q27	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q28	1854-1074	2		TRANSISTOR NPN SI PD=200MW FT=.03HZ	28480	1854-1074
A4Q29	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q30	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q31	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q32	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q33	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q34	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4Q35	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A4R1	0683-0475	1	1	RESISTOR 4.7 5% .25W CF TC=0-400	01121	CB47G5
A4R2	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A4R3	0698-3155	1	19	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R4	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R5	0698-3153	9	3	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A4R6	0757-0424	7	3	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A4R7	0698-3447	4	3	RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A4R8	0698-0082	7	4	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A4R9	0757-0459	8	2	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5622-F
A4R10	0757-0459	8		RESISTOR 56.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5622-F
A4R11	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4R12	0757-0180	2	6	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4R13	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A4R14	0757-0421	4	4	RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A4R15	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 3-14. A4 Transducer Replaceable Parts List (5/7)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A4R16	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4R19	1810-0279	5	2	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A4R20	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R21	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R22	0757-1094	9	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
A4R23	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A4R24	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	
A4R25	0757-0401	0	4	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4R26	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3481-F
A4R27	0757-0438	3	4	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A4R28	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A4R29	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A4R30	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4R31	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R32	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R33	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R34	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R35	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R36	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R37	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R38	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R39	0699-2242	7	1	RESISTOR 8.06K .1% .125W TF TC=+-10	28480	0699-2242
A4R40	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4R42	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A4R43	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A4R44	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A4R45	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A4R46	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R47	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R48	0698-3154	0	3	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A4R49	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A4R50	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A4R51	0698-0084	9	4	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4R52	0757-0441	8	2	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4R53	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A4R54	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A4R55	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A4R56	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A4R57	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R58	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R59	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4R60	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4R61	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4R62	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A4R63	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A4R64	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A4R65	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
A4R66	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A4R67	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A4R68	0698-4037	0	4	RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A4R69	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A4R70	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F

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

Table 3-14. A4 Transducer Replaceable Parts List (6/7)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A4R71	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4R72	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4R73	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4R74	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4R75	0757-0440	7	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A4R76	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A4R77	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4R78	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A4R79	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
A4R80	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A4R81	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A4R82	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1782-F
A4R83	2100-3161	6	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	73138	89PR20K
A4R84	2100-3161	6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	73138	89PR20K
A4R85	0698-8827	4	2	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A4R86	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A4R87	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4R88	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4R89	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4R90	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4R91	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4R92	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A4R93	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A4R94	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A4R95	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4R96	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A4R97	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A4R98	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A4R99	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4R100	0757-0439	4	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A4R101	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A4T1	04278-61501	2	1	COIL ASSY	28480	04278-61501
A4T2	9100-4631	4	6	TRANSFORMER-PULSE L(N1): 325 UH+-30% @ 1	28480	9100-4631
A4T3	9100-4631	4		TRANSFORMER-PULSE L(N1): 325 UH+-30% @ 1	28480	9100-4631
A4T4	9100-4631	4		TRANSFORMER-PULSE L(N1): 325 UH+-30% @ 1	28480	9100-4631
A4T5	9100-4631	4		TRANSFORMER-PULSE L(N1): 325 UH+-30% @ 1	28480	9100-4631
A4T6	9100-4631	4		TRANSFORMER-PULSE L(N1): 325 UH+-30% @ 1	28480	9100-4631
A4T7	9100-4631	4		TRANSFORMER-PULSE L(N1): 325 UH+-30% @ 1	28480	9100-4631
A4TP1	0360-1653	5	12	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP2	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP3	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP4	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP5	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP6	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP7	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP8	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP9	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP10	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP11	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4TP12	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A4U1	1820-0471	0	1	IC INV TTL HEX 1-INP	01295	SN7406N
A4U2	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A4U3	1820-3399	7	3	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N

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

Table 3-14. A4 Transducer Replaceable Parts List (7/7)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A4U4	1820-1568	8	1	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A4U5	1820-3399	7		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N
A4U6	1820-3399	7		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N
A4U7	1820-1510	0	7	IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
A4U8	1820-1510	0		IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
A4U9	1820-1510	0		IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
A4U10	1820-1510	0		IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
A4U11	1820-1510	0		IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
A4U12	1820-1510	0		IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
A4U13	1813-0300	9	3	IC OP AMP WB	28480	1813-0300
A4U14	1813-0300	9		IC OP AMP WB	28480	1813-0300
A4U15	1820-1510	0		IC MULTIPLXR 2-CHAN-ANLG TRIPLE 16-DIP-C	3L585	CD4053BF
A4U16	1813-0300	9		IC OP AMP WB	28480	1813-0300
A4U17	04278-81801	7	2	MODEM HIC	28480	04278-81801
A4U18	04278-81801	7		MODEM HIC	28480	04278-81801
A4U19	1826-0146	8	1	IC 7808 V RGLTR TO-220	04713	MC7808CP
A4U20	1826-0971	7	1	IC- UPC7908H	28480	1826-0971
A4U21	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
	04278-00611	7	1	SHIELD	28480	04278-00611
	04278-00612	8	2	SHIELD	28480	04278-00612
	04279-00600	5	1	BOX SHIELD	28480	04279-00600
	04279-00601	6	1	BOX SHIELD	28480	04279-00601
	04279-00602	7	1	BOX SHIELD	28480	04279-00602
	04279-00603	8	1	BOX SHIELD	28480	04279-00603
	04279-00604	9	1	BOX SHIELD	28480	04279-00604
	04279-00605	0	1	BOX SHIELD	28480	04279-00605
	04279-00608	3	1	SHIELD	28480	04279-00608
	0515-1005	0	9	SCREW-MACH M3 X 0.5 10MM-LG	28480	0515-1005
	0515-1550	0	9	SCREW-MACHINE ASSEMBLY M3 X 0.5 8MM-LG	28480	0515-1550
	0890-0790	2	1	TUBING-HS .046-IN-D/.023-IN-RCVD	28480	0890-0790
	0890-1480	9	1	TUBING-HS 2-MM-D/1-MM-RCVD .36-MM-WALL	28480	0890-1480
	1400-0249	0	1	CABLE TIE .062-.625-DIA .091-WD NYL	28480	1400-0249
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	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

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

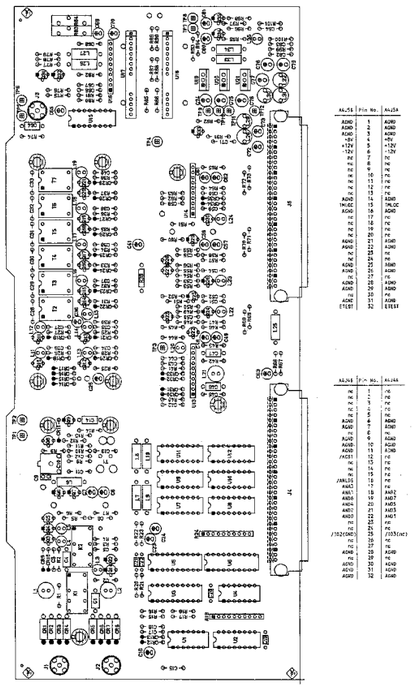
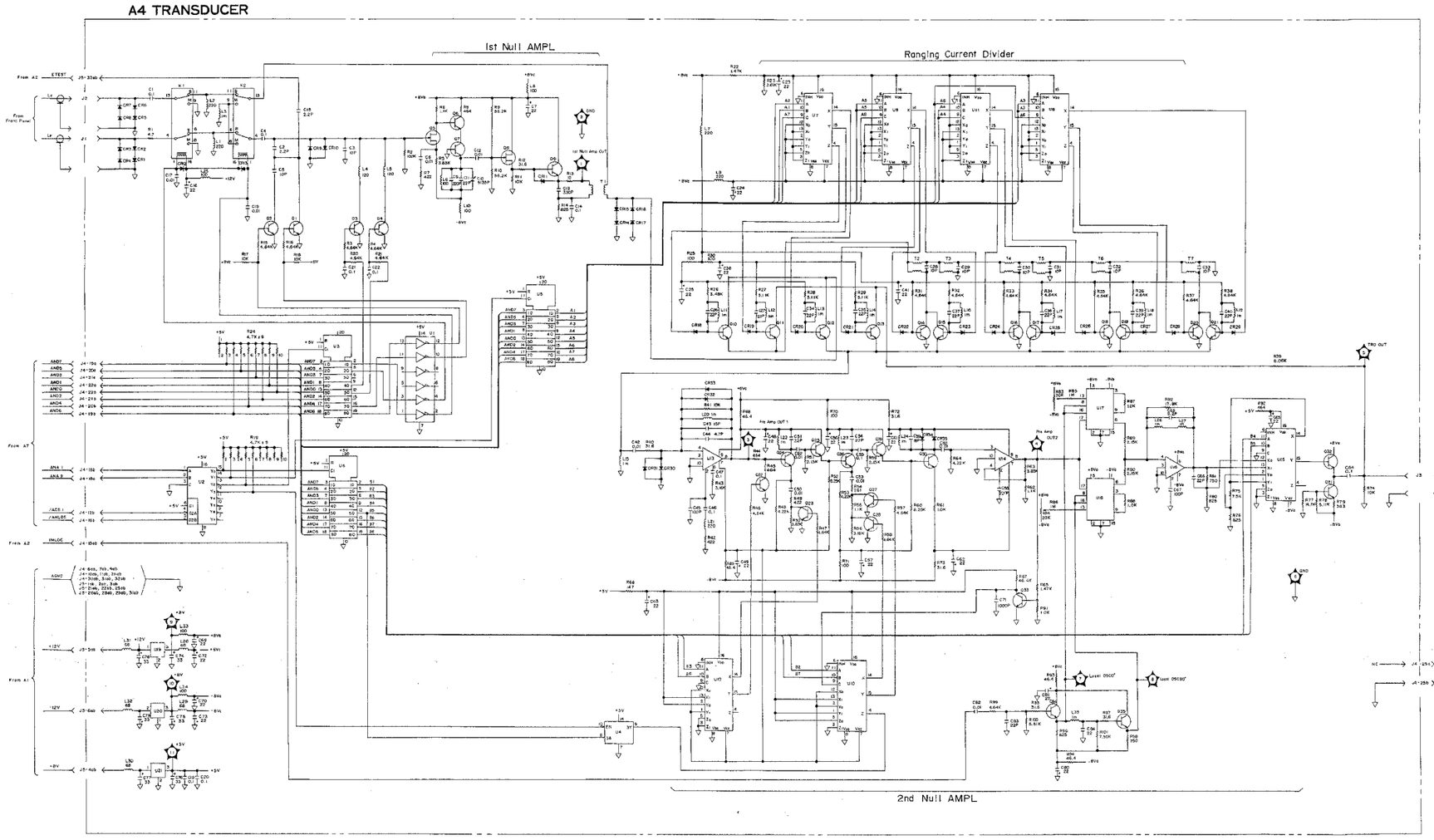


Figure 3-8. A4 Transducer Component Locations



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 3-9. A4 Transducer Schematic Diagram

A5 PHASE DETECTOR BOARD SERVICE SHEET

NOTES

3-11. A5 BOARD SERVICE SHEET

3-11-1. CIRCUIT DESCRIPTION

The A5 phase detector board consists of phase detectors, a double wave detector, a detection phase generator, voltage regulators, and a switching matrix circuit.

[Phase Detector]

The phase detector consists of A5U2, A5U8, A5U13, and A5U18. A5U2 and A5U13 detect the inphase component of the *Err* and *Edut* signals, and A5U8 and A5U18 detect the 90° component of the *Err* and *Edut* signals. Each phase detector is driven by a detection phase generator.

[Double Wave Detector]

The double wave detector consisting of transformers A5T4 and A5T7 receive the *Err* or *Edut* signal, and outputs the 0° and 180° signal to the phase detector (refer to Figure 3-10).

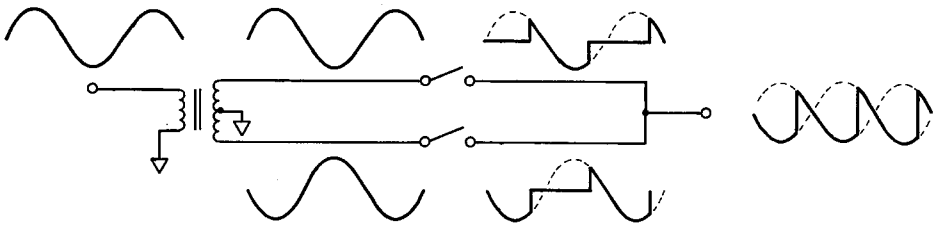


Figure 3-10. Double Wave Phase Detection Example

[Detection Phase Generator]

The detection phase generator consists of shift registers A5U9 and A5U10. A5U9 receives the *SRG_CLK* signal from the A6 board, and generates an inphase signal used by A5U2 and A5U13 to detect the test signal's inphase component. A5U10 receives the *SRG_CLK* signal from the A6 board, and generates the 90° signal used by A5U8 and A5U18 to detect the test signal's 90° component.

[Voltage Regulators]

The voltage regulators, A5U22, A5U23, and A5U24, regulates the unregulated voltage from the A1 Power Supply board to +5 V and ±12 V. A5U22 regulates the +8 V from the A1 board to +5 V. A5U23 regulates the +15 V from the A1 board to +12 V. A5U24 regulates the -15 V from the A1 board to -12 V.

[Switching Matrix Circuit]

The switching matrix circuit, consisting of A5Q1 to A5Q12, routes the *Err* voltage to one of the two double wave detectors (A5T4 or A5T7), and routes the *Edut* voltage to the other double wave detector. The switching matrix circuit is controlled by A5U11.

3-11-2. TROUBLESHOOTING AIDS

These troubleshooting aids contain a jumper list, test point list, and troubleshooting information. The jumpers are listed in Table 3-15, and the test points are listed Table 3-16, and the troubleshooting data is listed in Table 3-17.

Table 3-15. Jumper List

Reference Designator	Description	Use
A5W1 A5W2	Phase detection input Signal	**Normal Position:** Connects the *Err* or *Edut* signal to the phase detector. **Test Position:** Grounds the phase detector input.
A5W3	Shift Register Clock Signal	**Normal Position:** Connect the *SRG_CLK* signal (the clock for the shift register) to the shift registers. **Test Position:** Connect the *8F* signal (8 MHz) to the shift registers.

Table 3-16. A5 Test Points List

Test Point	Signal Name	Description
A5TP1	*GND*	Ground Line
A5TP2	*GND*	Ground Line
A5TP3	*A1*	A channel output signal (1)
A5TP4	*A2*	A channel output signal (2)
A5TP5	*A3*	A channel output signal (3)
A5TP6	*VDC1*	Output DC voltage (1) from the phase detector
A5TP7	*0*	Reference phase Signal (0°)
A5TP8	*VDC2*	Output DC voltage (2) from the phase detector
A5TP9	*90*	Reference phase Signal (90°)
A5TP10	*B1*	B channel output signal (1)
A5TP11	*B2*	B channel output signal (2)
A5TP12	*B3*	B channel output signal (3)
A5TP13	*VDC3*	Output DC voltage (3) from the phase detector
A5TP14	*VDC4*	Output DC voltage (4) from the phase detector
A5TP15	*+5*	+5 V DC
A5TP16	*+12*	+12 V DC
A5TP17	*-12*	-12 V DC

NOTE

Phase detector outputs 1 to 4 (A5TP6, A5TP8, A5TP13, and A5TP14) are DC output voltages. When the HP 4279A is set as listed below, the cross point of between phase detector output 1 and phase detector output 2 on the coordinates will be on a circle with a radius of approximately 1.7 V as shown in the figure below. Also the cross point of between phase detector output 3 and 4 will be on a circle with a radius of approximately 1.7 V shown in the following figure.

4279A Settings:

DUT: 10 pF
Meas. Range: 8 pF
OSC Level: 1 Vrms
Trigger Mode: EXT.TRIG

Figure

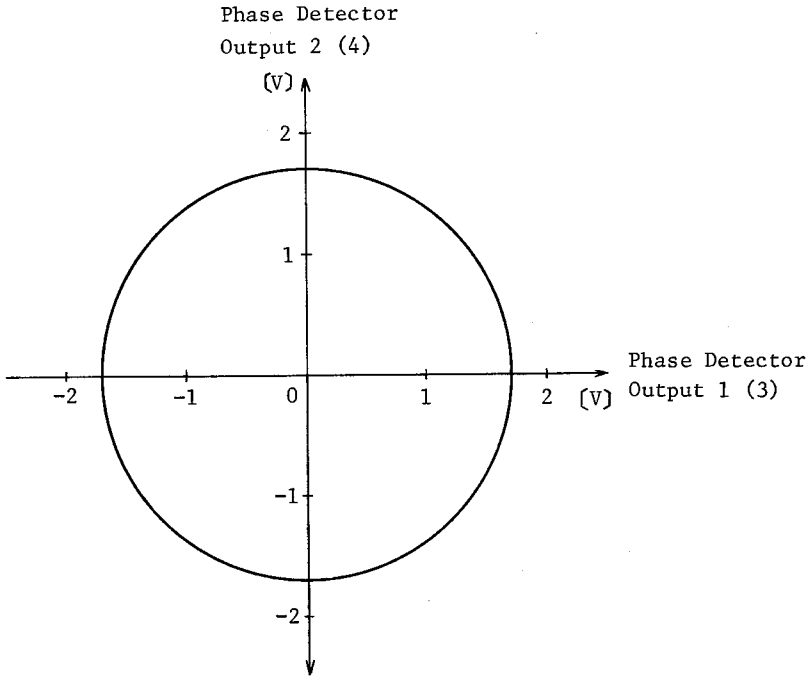


Table 3-17. Troubleshooting Data (1/2)

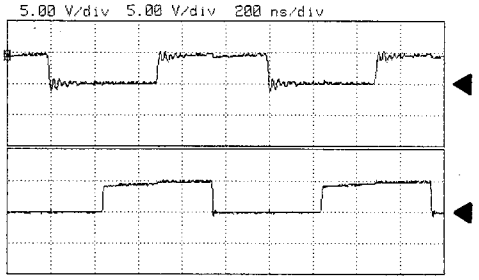
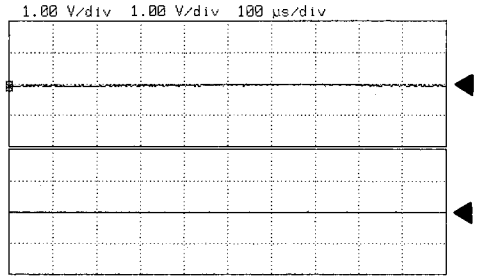
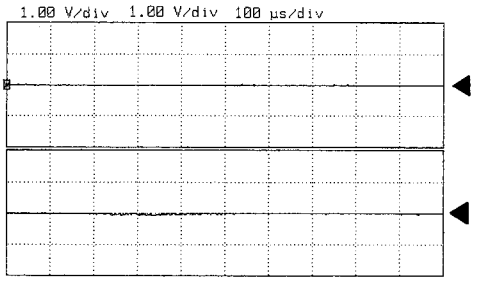
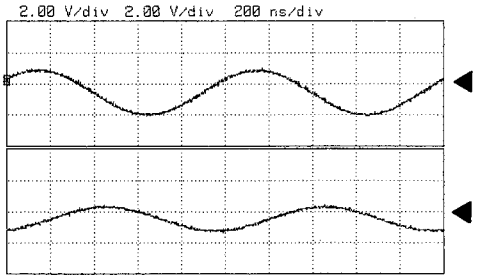
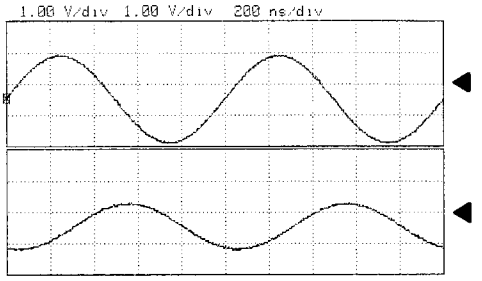
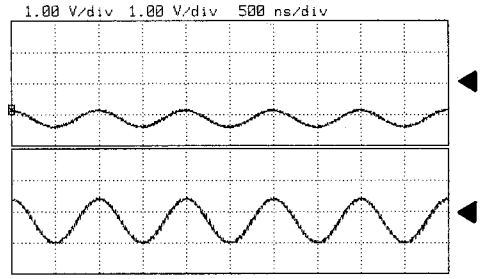
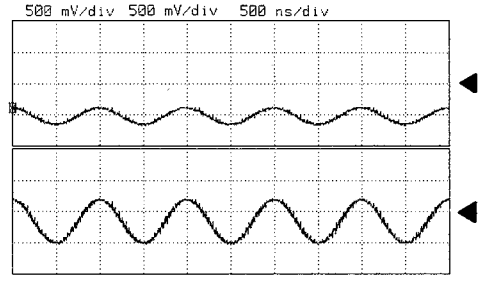
HP 4279A Settings	Measurement Setup	Waveform
A5W1: Normal A5W2: Normal A5W3: Test	CHAN A: A5TP7 CHAN B: A5TP9 TRIG: CHAN A (Negative)	
A5W1: Test A5W2: Normal A5W3: Normal	CHAN A: A5TP6 CHAN B: A5TP8 TRIG: CHAN A (Negative)	
A5W1: Normal A5W2: Test A5W3: Normal	CHAN A: A5TP13 CHAN B: A5TP14 TRIG: CHAN A (Negative)	
DUT: 10 pF Meas.Range: 8 pF OSC Level: 1000 mV Trig.Mode: EXT.TRIG A5W1: Normal A5W2: Normal A5W3: Normal	CHAN A: A5TP3 CHAN B: A5TP5 TRIG: CHAN A (Negative)	

Table 3-17. Troubleshooting Data (2/2)

HP 4279A Settings		Measurement Setup		Waveform
DUT:	10 pF	CHAN A:	A5TP10	
Meas.Range:	8 pF	CHAN B:	A5TP12	
OSC Level:	1000 mV	TRIG:	CHAN A	
Trig.Mode:	EXT.TRIG		(Negative)	
A5W1:	Normal			
A5W2:	Normal			
A5W3:	Normal			
DUT:	10 pF	CHAN A:	A5TP3	
Meas.Range:	8 pF	CHAN B:	A5TP4	
OSC Level:	100 mV	TRIG:	CHAN A	
Trig.Mode:	EXT.TRIG		(Negative)	
A5W1:	Normal			
A5W2:	Normal			
A5W3:	Normal			
DUT:	10 pF	CHAN A:	A5TP10	
Meas.Range:	8 pF	CHAN B:	A5TP11	
OSC Level:	100 mV	TRIG:	CHAN A	
Trig.Mode:	EXT.TRIG		(Negative)	
A5W1:	Normal			
A5W2:	Normal			
A5W3:	Normal			

3-11-3. REPLACEABLE PARTS LISTS

The A5 board replaceable parts list is shown in Table 3-18.

3-11-4. COMPONENT LOCATIONS

A5's component locations and pin assignments are shown in Figure 3-11.

3-11-5. SCHEMATIC DIAGRAMS

The A5 Phase Detector board schematic diagram is shown in Figure 3-12.

Table 3-18. A5 Phase Detector Replaceable Parts List (1/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A5						
A5	04279-66505	7	1	PHASE DETECTOR	28480	04279-66505
A5C1	0180-3363	6	28	CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C2	0160-4830	2	1	CAPACITOR-FXD 2200PF +-10% 100VDC CER	28480	0160-4830
A5C3	0160-4835	7	6	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A5C4	0160-6561	0	9	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C5	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A5C6	0160-4801	7	2	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A5C7	0160-4791	4	4	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A5C8	0160-4805	1	2	CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30	28480	0160-4805
A5C9	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C10	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C11	0160-4822	2	4	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A5C12	0160-4812	0	6	CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A5C13	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C14	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C15	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C16	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A5C17	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A5C18	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C19	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C20	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C21	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A5C22	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C23	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A5C24	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A5C25	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C26	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C27	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C28	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C29	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C30	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A5C31	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C32	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A5C33	0160-4801	7		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A5C34	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A5C35	0160-4805	1		CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30	28480	0160-4805
A5C36	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C37	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C38	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A5C39	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A5C40	0160-2230	2	2	CAPACITOR-FXD 3300PF +-5% 300VDC MICA	28480	0160-2230
A5C41	0160-2230	2		CAPACITOR-FXD 3300PF +-5% 300VDC MICA	28480	0160-2230
A5C42	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C43	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C44	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A5C45	0160-4791	4		CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A5C46	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C47	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C48	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C49	0160-4835	7		CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A5C50	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363

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

Table 3-18. A5 Phase Detector Replaceable Parts List (2/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A5C51	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A5C52	0160-4812	0		CAPACITOR-FXD 220PF +-5% 100VDC CER	28480	0160-4812
A5C53	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C54	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C55	0180-3469	3	3	CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
A5C56	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C57	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
A5C58	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C59	0180-3469	3		CAPACITOR-FXD 100UF+-20% 25VDC AL	28480	0180-3469
A5C60	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A5C61	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C62	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C63	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C64	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C65	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C66	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5C67	0180-3363	6		CAPACITOR-FXD 22UF+-20% 25VDC AL	28480	0180-3363
A5CR1	1901-0050	3	8	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR5	1901-0731	7	10	DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR6	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR7	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR8	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR9	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR10	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR11	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR12	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR13	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR14	1901-0731	7		DIODE-PWR RECT 400V 1A	14433	1N4004G
A5CR15	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR16	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR17	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5CR18	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A5J1	1250-0257	1	2	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A5J2	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A5J3	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
A5J4	1252-1745	8		CONN-POST TYPE 2.54-PIN-SPCG 64-CONT	28480	1252-1745
A5K1	0490-1477	6	6	RELAY	28480	0490-1477
A5K2	0490-1477	6		RELAY	28480	0490-1477
A5K3	0490-1477	6		RELAY	28480	0490-1477
A5K4	0490-1477	6		RELAY	28480	0490-1477
A5K5	0490-1477	6		RELAY	28480	0490-1477
A5K6	0490-1477	6		RELAY	28480	0490-1477
A5L1	9140-0210	1	10	INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L4	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L5	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L6	9100-3562	8	1	INDUCTOR RF-CH-MLD 4.7UH 5%	28480	9100-3562
A5L7	9100-3313	7	1	INDUCTOR RF-CH-MLD 22UH 5%	28480	9100-3313
A5L8	9140-1264	7	1	INDUCTOR 1MH 10% 6D-MM Q=30	28480	9140-1264

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

Table 3-18. A5 Phase Detector Replaceable Parts List (3/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A5L9	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L10	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L11	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L12	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L13	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A5L14	9140-1278	3	3	INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A5L15	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A5L16	9140-1278	3		INDUCTOR 68UH 10% 7.5D-MM Q=45	28480	9140-1278
A5Q1	1855-0091	3	8	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q2	1853-0036	2	4	TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A5Q3	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q4	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q5	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A5Q6	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q7	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q8	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A5Q9	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q10	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5Q11	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A5Q12	1855-0091	3		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0091
A5R1	0698-3162	0	4	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A5R2	0757-0465	6	18	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R3	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R4	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R5	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	5033R-1/8-T0-9091-F
A5R6	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A5R7	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R8	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R9	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A5R10	0757-0180	2	2	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A5R11	0757-0346	2	10	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R12	0698-6320	8	8	RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A5R13	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A5R14	0698-6630	3	4	RESISTOR 20K .1% .125W F TC=0+-25	28480	0698-6630
A5R15	0698-4037	0	7	RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A5R16	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A5R17	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R18	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R19	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A5R20	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R21	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R22	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R23	0698-6624	5	2	RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A5R24	0698-3447	4	2	RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A5R25	0698-6360	6	2	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A5R26	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R27	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R28	0698-6347	9	2	RESISTOR 1.5K .1% .125W F TC=0+-25	28480	0698-6347
A5R29	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A5R30	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R31	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A5R32	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A5R33	0698-6630	3		RESISTOR 20K .1% .125W F TC=0+-25	28480	0698-6630

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

Table 3-18. A5 Phase Detector Replaceable Parts List (4/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A5R34	1810-0126	1	2	NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
A5R35	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A5R36	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A5R37	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R38	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A5R39	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R40	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A5R42	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R43	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R44	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A5R45	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A5R46	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R47	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A5R48	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A5R49	0698-6630	3		RESISTOR 20K .1% .125W F TC=0+-25	28480	0698-6630
A5R50	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A5R51	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A5R52	1810-0126	1		NETWORK-RES 14-DIP 10.0K OHM X 13	11236	760-1-R10K
A5R53	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A5R54	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R55	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R56	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A5R57	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R58	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A5R59	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R60	0698-6624	5		RESISTOR 2K .1% .125W F TC=0+-25	28480	0698-6624
A5R61	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A5R62	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A5R63	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R64	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R65	0698-6347	9		RESISTOR 1.5K .1% .125W F TC=0+-25	28480	0698-6347
A5R66	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A5R67	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A5R68	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A5R69	0698-6320	8		RESISTOR 5K .1% .125W F TC=0+-25	03888	PME55-1/8-T9-5001-B
A5R70	0698-6630	3		RESISTOR 20K .1% .125W F TC=0+-25	28480	0698-6630
A5R71	8159-0005	0	3	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A5R72	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	28480	0698-4037
A5R73	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A5R74	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A5R75	1810-0280	8	1	NETWORK-RES 10-SIP 10.0K OHM X 9	91637	
A5R76	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A5R77	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A5T1	9100-0823	8	1	TRANSFORMER(TDK113B1) 1:1:1	28480	9100-0823
A5T2	9100-0820	5	6	TRANSFORMER:PULSE	28480	9100-0820
A5T3	9100-0820	5		TRANSFORMER:PULSE	28480	9100-0820
A5T4	9100-0820	5		TRANSFORMER:PULSE	28480	9100-0820
A5T5	9100-0820	5		TRANSFORMER:PULSE	28480	9100-0820
A5T6	9100-0820	5		TRANSFORMER:PULSE	28480	9100-0820
A5T7	9100-0820	5		TRANSFORMER:PULSE	28480	9100-0820
A5TP1	0360-1653	5	18	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP2	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 3-18. A5 Phase Detector Replaceable Parts List (5/6)

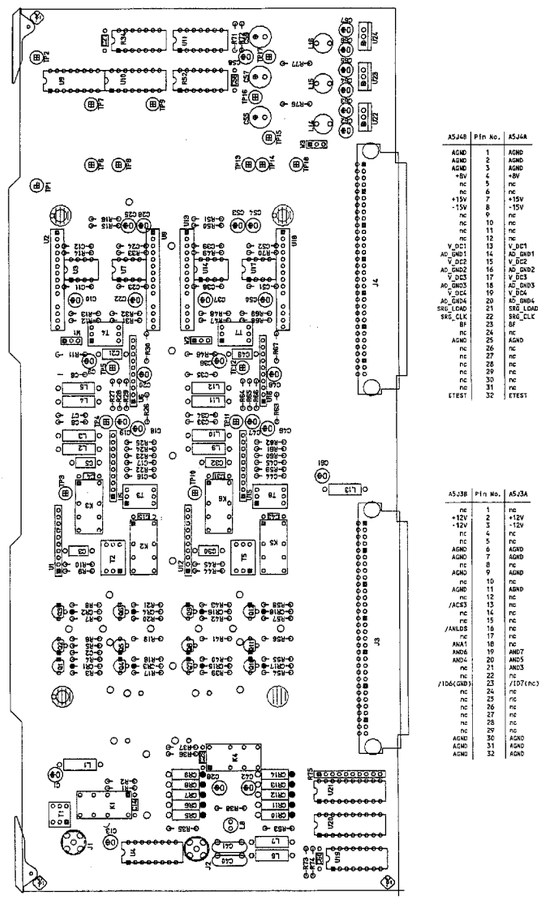
Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A5TP3	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP4	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP5	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP6	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP7	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP8	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP9	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP10	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP11	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP12	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP13	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP14	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP15	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP16	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP17	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5TP18	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A5U1	1813-0299	5	4	IC WIDEBAND AMPL H-SLEW-RATE	28480	1813-0299
A5U2	04194-81804	9	4	HIC PHASE DET	28480	04194-81804
A5U3	1826-0519	9	4	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A5U4	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A5U5	1813-0300	9	2	IC OP AMP WB	28480	1813-0300 4279D
A5U6	1813-0299	5		IC WIDEBAND AMPL H-SLEW-RATE	28480	1813-0299
A5U7	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A5U8	04194-81804	9		HIC PHASE DET	28480	04194-81804
A5U9	1820-1975	1	2	IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165AN
A5U10	1820-1975	1		IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165AN
A5U11	1826-0138	8	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A5U12	1813-0299	5		IC WIDEBAND AMPL H-SLEW-RATE	28480	1813-0299
A5U13	04194-81804	9		HIC PHASE DET	28480	04194-81804
A5U14	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A5U15	1813-0300	9		IC OP AMP WB	28480	1813-0300
A5U16	1813-0299	5		IC WIDEBAND AMPL H-SLEW-RATE	28480	1813-0299
A5U17	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A5U18	04194-81804	9		HIC PHASE DET	28480	04194-81804
A5U19	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3-INP	01295	SN74ALS138N
A5U20	1820-3399	7	2	IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N
A5U21	1820-3399	7		IC FF CMOS/74HC D-TYPE POS-EDGE-TRIG COM	04713	MC74HC273N
A5U22	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
A5U23	1826-0147	9	1	IC 7812 V RGLTR TO-220	04713	MC7812CP
A5U24	1826-0221	0	1	IC V RGLTR TO-220	04713	MC7912CT
A5W1	1251-4822	6	3	CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A5W2	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
A5W3	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	28480	1251-4822
	04278-00616	2	1	SHIELD	28480	04278-00616
	04278-61629	5	1	FL CBL ASSY 34P	28480	04278-61629
	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	28480	04278-61625
	04279-00606	1	1	BOX SHIELD	28480	04279-00606
	04279-00607	2	1	BOX SHIELD	28480	04279-00607
	0515-1005	0	4	SCREW-MACH M3 X 0.5 10MM-LG	28480	0515-1005
	0515-1550	0	4	SCREW-MACHINE ASSEMBLY M3 X 0.5 8MM-LG	28480	0515-1550
	1400-1334	6	1	CLAMP-CABLE STL	28480	1400-1334

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

Table 3-18. A5 Phase Detector Replaceable Parts List (6/6)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	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

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



A5J4B	Pin No.	A5J4A
AGND	1	AGND
AGND	2	AGND
AGND	3	AGND
+8V	4	+8V
nc	5	nc
nc	6	nc
+15V	7	+15V
-15V	8	-15V
nc	9	nc
nc	10	nc
nc	11	nc
nc	12	nc
V_DC1	13	V_DC1
AD_GND1	14	AD_GND1
V_DC2	15	V_DC2
AD_GND2	16	AD_GND2
V_DC3	17	V_DC3
AD_GND3	18	AD_GND3
V_DC4	19	V_DC4
AD_GND4	20	AD_GND4
SRG_LOAD	21	SRG_LOAD
SRG_CLK	22	SRG_CLK
BF	23	BF
nc	24	nc
AGND	25	AGND
nc	26	nc
nc	27	nc
nc	28	nc
nc	29	nc
nc	30	nc
nc	31	nc
ETEST	32	ETEST

A5J3B	Pin No.	A5J3A
nc	1	nc
+12V	2	+12V
+12V	3	+12V
nc	4	nc
nc	5	nc
AGND	6	AGND
AGND	7	AGND
nc	8	nc
AGND	9	AGND
nc	10	nc
AGND	11	AGND
nc	12	nc
/AGC3	13	nc
nc	14	nc
nc	15	nc
/ANLDS	16	nc
nc	17	nc
ANA1	18	nc
AND6	19	AND7
AND4	20	AND5
nc	21	AND3
nc	22	nc
/106(GND)	23	/107(nc)
nc	24	nc
nc	25	nc
nc	26	nc
nc	27	nc
nc	28	nc
nc	29	nc
AGND	30	AGND
AGND	31	AGND
AGND	32	AGND

Figure 3-11. A5 Phase Detector Component Locations

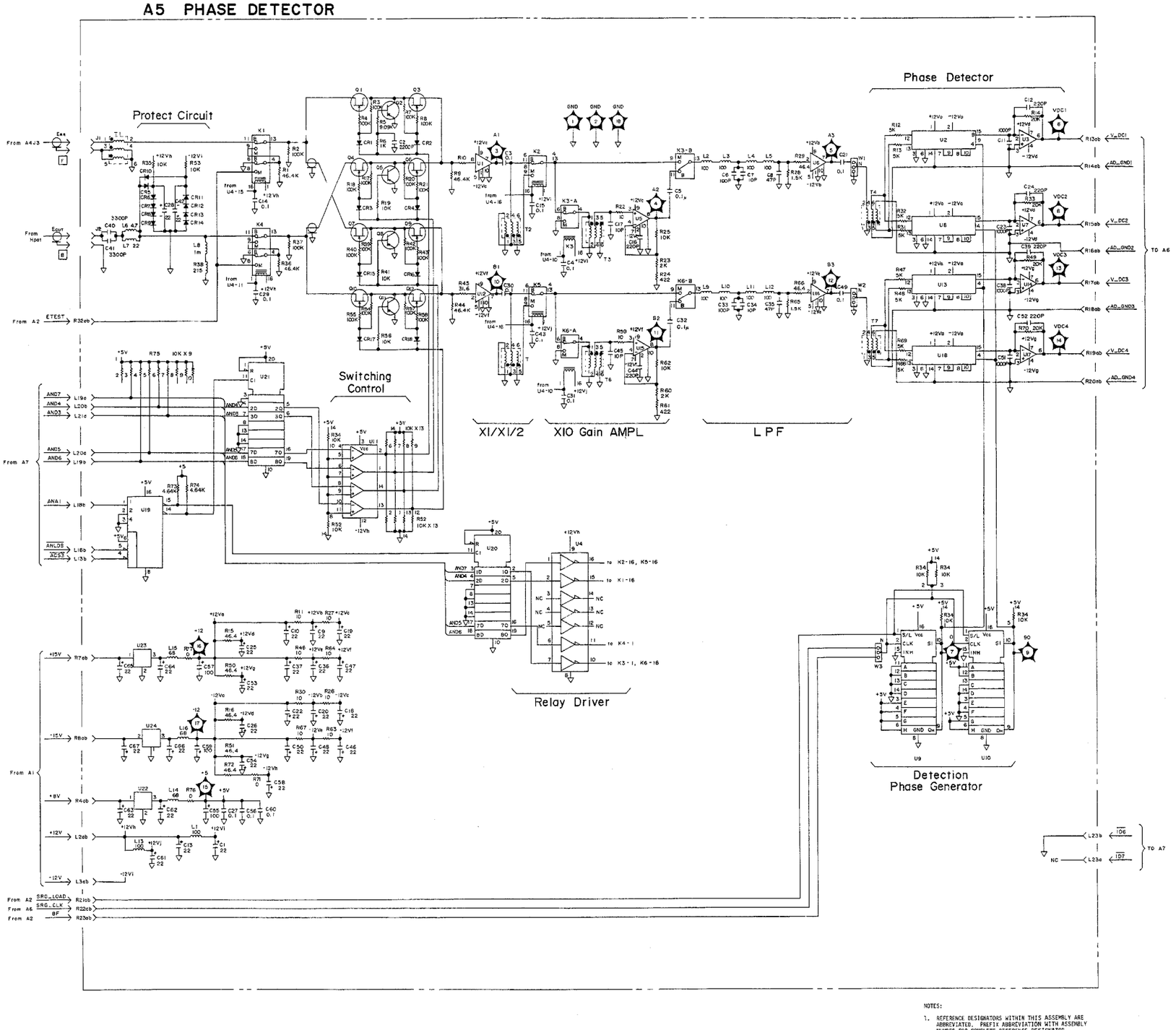


Figure 3-12. A5 Phase Detector Schmetic Diagram

A6 A-D CONVERTER BOARD SERVICE SHEET

NOTES

3-12. A6 BOARD SERVICE SHEET

3-12-1. CIRCUIT DESCRIPTION

The A6 A-D Converter board consists of an A-D converter, an A-D counter, a phase shifter, and a voltage regulator.

[A-D Converter]

The simplified circuit diagram of a multi-slope A-D converter is shown in Figure 3-13. The multi-slope A-D converter contains an offset current source, an integrator and three comparators, a coarse gate and current source, and a fine gate and current source.

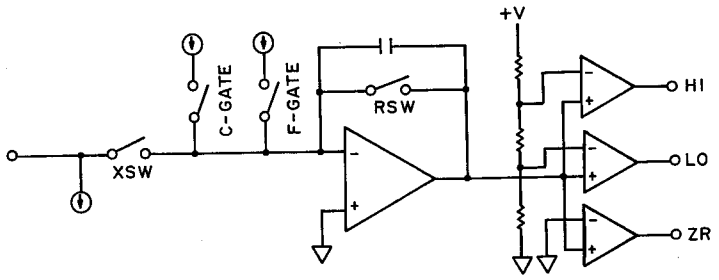


Figure 3-13. Multi-Slope A-D Converter

The offset current source offsets A5's phase detected output signal by one-half of the full-scale range. This makes it always possible to maintain one polarity, even though the input signal is bipolar. The offset current is approximately -450 µA. 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 A5's phase detected output 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's output is 1.2 V or greater. The LO comparator's limit is set to determine if the integrator's output is less than 0.1 V. The ZR comparator's limit is set to determine if the integrator output voltage is positive.

There are four hybrid ICs (HIC) in the 4279A (A6U19, A6U20, A6U29, and A6U30). Each HIC contains one integrator and three comparators.

The coarse current source discharges the integrator capacitor until the LO comparator detects that it has discharged to the LO limit ($\leq$ 0.1 V) level. The coarse current is approximately 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 the switching of the coarse current to the integrator. The coarse gate signals are *CGT0A*, *CGT90A*, *CGT0B*, and *CGT90B*.

The fine current source is used to discharge the integrator capacitor to 0 V 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 approximately 7 µA. The formula used to determine the fine current is:

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

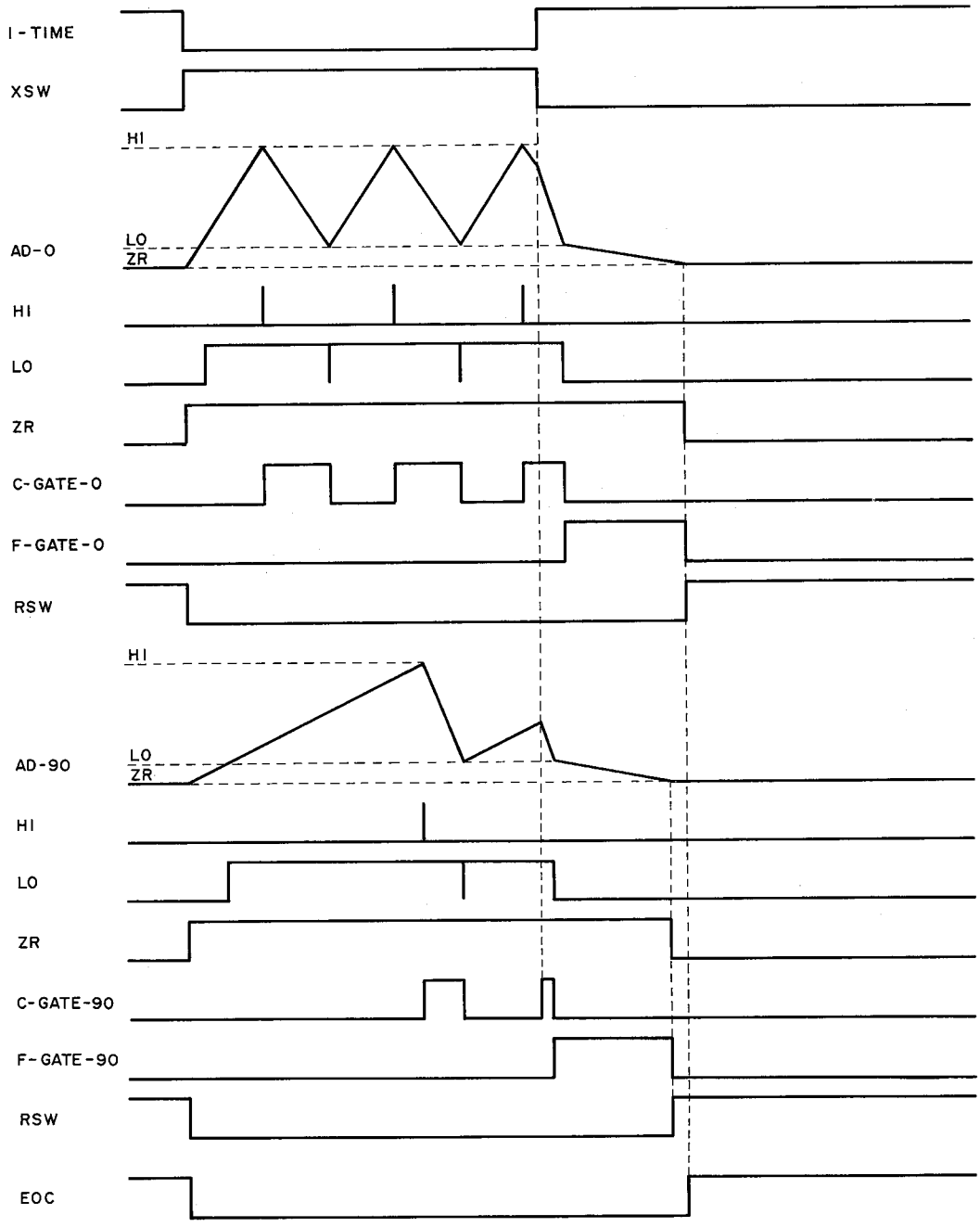
Where:

V_R:	9 V
Rfc:	1.28 MΩ (A6R20, A6R31, A6R43, and A6R54)

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

The A-D Converter Timing Diagram is shown in Figure 3-14.

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.

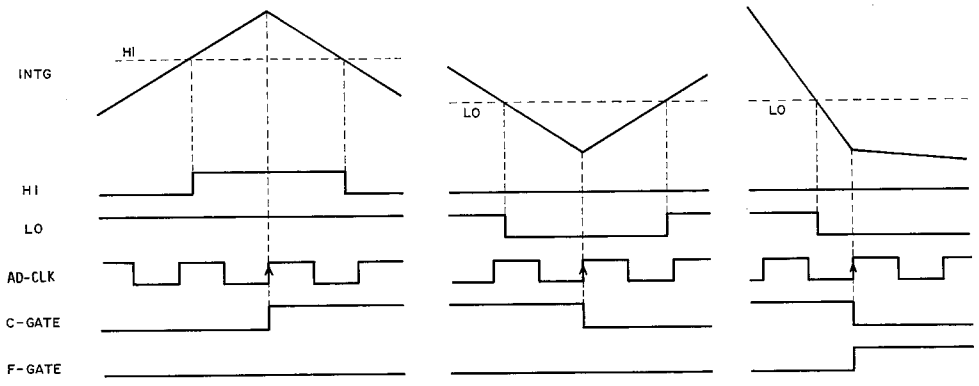


Figure 3-14. A-D Converter Timing Chart

The relationship between the 4279A **INTEG.TIME** softkeys and the multi-slope A-D converter operation are listed in Table 3-19.

Table 3-19. INTEG.TIME and A-D Converter

INTEG.TIME	A-D Converter	A-D Conversion Operation Integration Time	Number of Integrations
SHORT	A6U30(0A)	1 ms	2
	A6U20(90A)	1 ms	2
	A6U19(0B)	1 ms	2
	A6U29(90B)	1 ms	2
MEDIUM	A6U30(0A)	2 ms	4
	A6U20(90A)	2 ms	4
	A6U19(0B)	2 ms	4
	A6U29(90B)	2 ms	4
LONG	A6U30(0A)	2 ms	8
	A6U20(90A)	2 ms	8
	A6U19(0B)	2 ms	8
	A6U29(90B)	2 ms	8

[A-D Counter]

The A-D counter consists of A6U14, A6U15, and A6U16. The A-D counter inputs the coarse and fine gate signals, 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_TIME signal, and during the integration period, the I_TIME signal goes LOW.

[Phase Shifter]

The phase shifter is used to generate the shift register clock signal for the detection phase generator on the A5 board. By using the sift register clock signal, the detection phase can be shifted. (Then the detection phase generator still maintain a 90° phase difference). The shift register clock signal (SRG-CLK) generated from the 8F clock by hexadecimal counter, A6U26.

[Voltage Regulators]

The voltage regulators, A6U11, A6U12, A6U32, and A6U33, regulate the unregulated voltage from the A1 Power Supply board to +5 V and ±12 V. A6U11 and A6U12 regulate +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.

3-12-2. TROUBLESHOOTING AIDS

The troubleshooting aids for the A6 board includes a list of jumpers, a list of test points, and troubleshooting information. The jumpers are listed in Table 3-20, and the test points are listed in Table 3-21, and the troubleshooting data is listed in Table 3-22.

Table 3-20. Jumper List

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

Table 3-21. A6 Test Points

Test Point	Signal Name	Description
A6TP1	*GND*	Ground Line
A6TP2	*MEAS*	Measurement Signal
A6TP3	*AD90B*	A-D converter output signal (90B)
A6TP4	*AD0B*	A-D converter output signal (0B)
A6TP5	*AD90A*	A-D converter output signal (90A)
A6TP6	*AD0A*	A-D converter output signal (0A)
A6TP7	*IT*	Integration Time signal
A6TP8	*+5B*	+5 V DC (b)
A6TP9	*+5A*	+5 V DC (a)
A6TP10	*-12*	-12 V DC
A6TP11	*+12*	+12 V DC

Table 3-22. Troubleshooting Data (1/2)

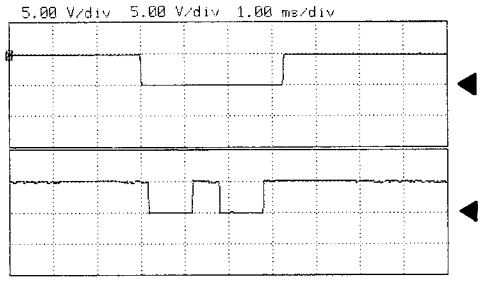
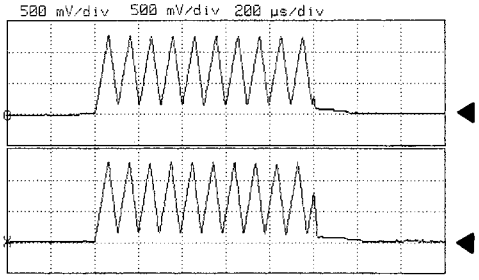
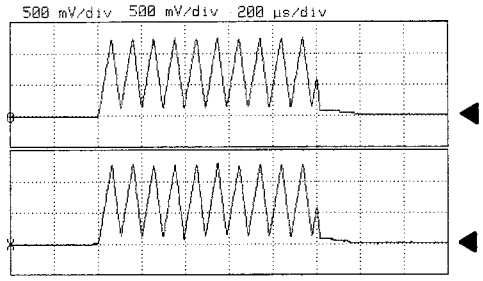
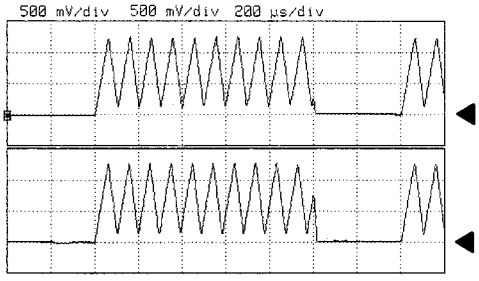
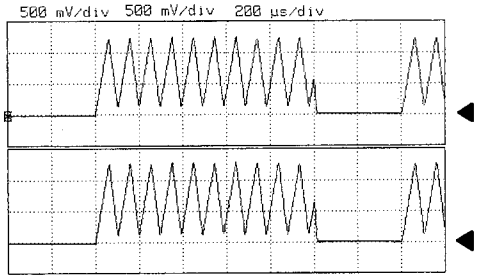
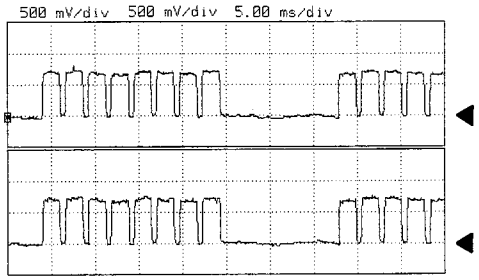
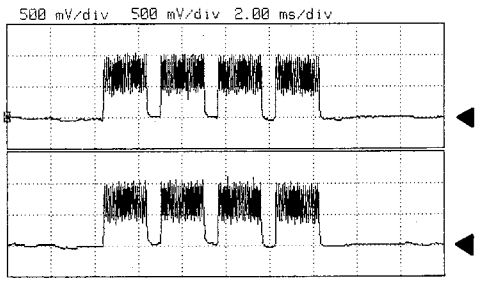
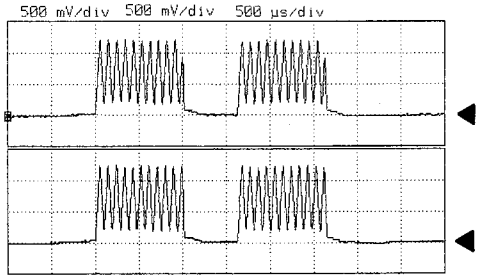
HP 4279A Settings	Measurement Setup	Waveform
Selftest = 3	CHAN A: A6TP2 CHAN B: A6TP7 TRIG: CHAN A (Negative)	
Selftest = 3 A6W1: Normal A6W3: Normal	CHAN A: A6TP3 CHAN B: A6TP4 TRIG: A6TP7 (Negative)	
Selftest = 3 A6W2: Normal A6W4: Normal	CHAN A: A6TP5 CHAN B: A6TP6 TRIG: A6TP7 (Negative)	
Selftest = 3 A6W1: Test Position A6W3: Test Position	CHAN A: A6TP3 CHAN B: A6TP4 TRIG: A6TP7 (Negative)	

Table 3-22. Troubleshooting Data (2/2)

HP 4279A Settings	Measurement Setup	Waveform
Selftest = 3 A6W2: Test Position A6W4: Test Position	CHAN A: A6TP5 CHAN B: A6TP6 TRIG: A6TP7 (Negative)	
A5W1: Test Position A5W2: Test Position INTEG.TIME: LONG	CHAN A: A6TP3 or TP5 CHAN B: A6TP4 or TP6 TRIG: A6TP7 (Negative)	
A5W1: Test Position A5W2: Test Position INTEG.TIME: MED	CHAN A: A6TP3 or TP5 CHAN B: A6TP4 or TP6 TRIG: A6TP7 (Negative)	
A5W1: Test Position A5W2: Test Position INTEG.TIME: SHORT	CHAN A: A6TP3 or TP5 CHAN B: A6TP4 or TP6 TRIG: A6TP7 (Negative)	

3-12-3. REPLACEABLE PARTS LISTS

The A6 board is covered by the exchange assembly program. The A6 board replaceable parts are listed in Table 3-23. The part number for a rebuilt A6 exchange board is listed on the first page of the A6 replaceable parts list.

3-12-4. COMPONENT LOCATIONS

The component locations and pin assignments are shown in Figure 3-15.

3-12-5. SCHEMATIC DIAGRAMS

The A6 board schematic diagram is shown in Figure 3-16.

Table 3-23. 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 3-23. 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 3-23. A6 A-D Converter Replaceable Parts List (3/4)

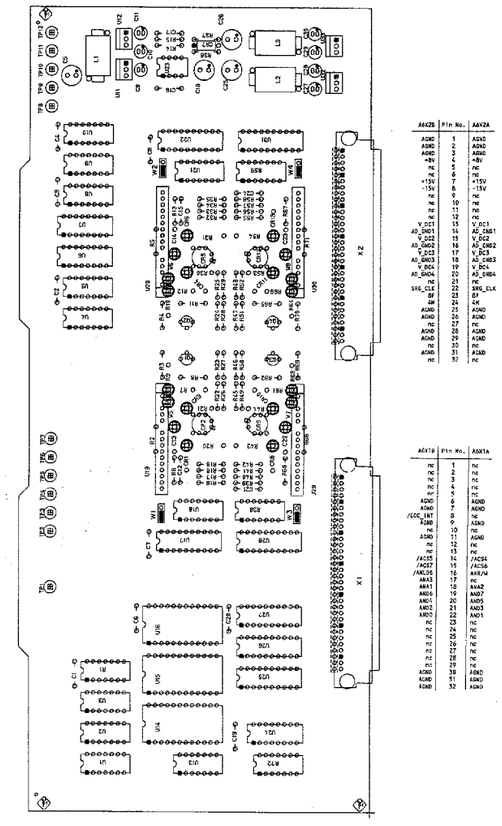
Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A6U31	04194-80001	6		PAL 16L8A-2	28480	04194-80001
A6U32	1826-0221	0	1	IC V RGLTR TO-220	04713	MC7912CT
A6U33	1826-0147	9	1	IC 7812 V RGLTR TO-220	04713	MC7812CP
A6W1	1258-0141	8	4	JUMPER-REMOVABLE FOR 0.025 IN SQ PINS	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.**

Table 3-23. A6 A-D Converter Replaceable Parts List (4/4)

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.**

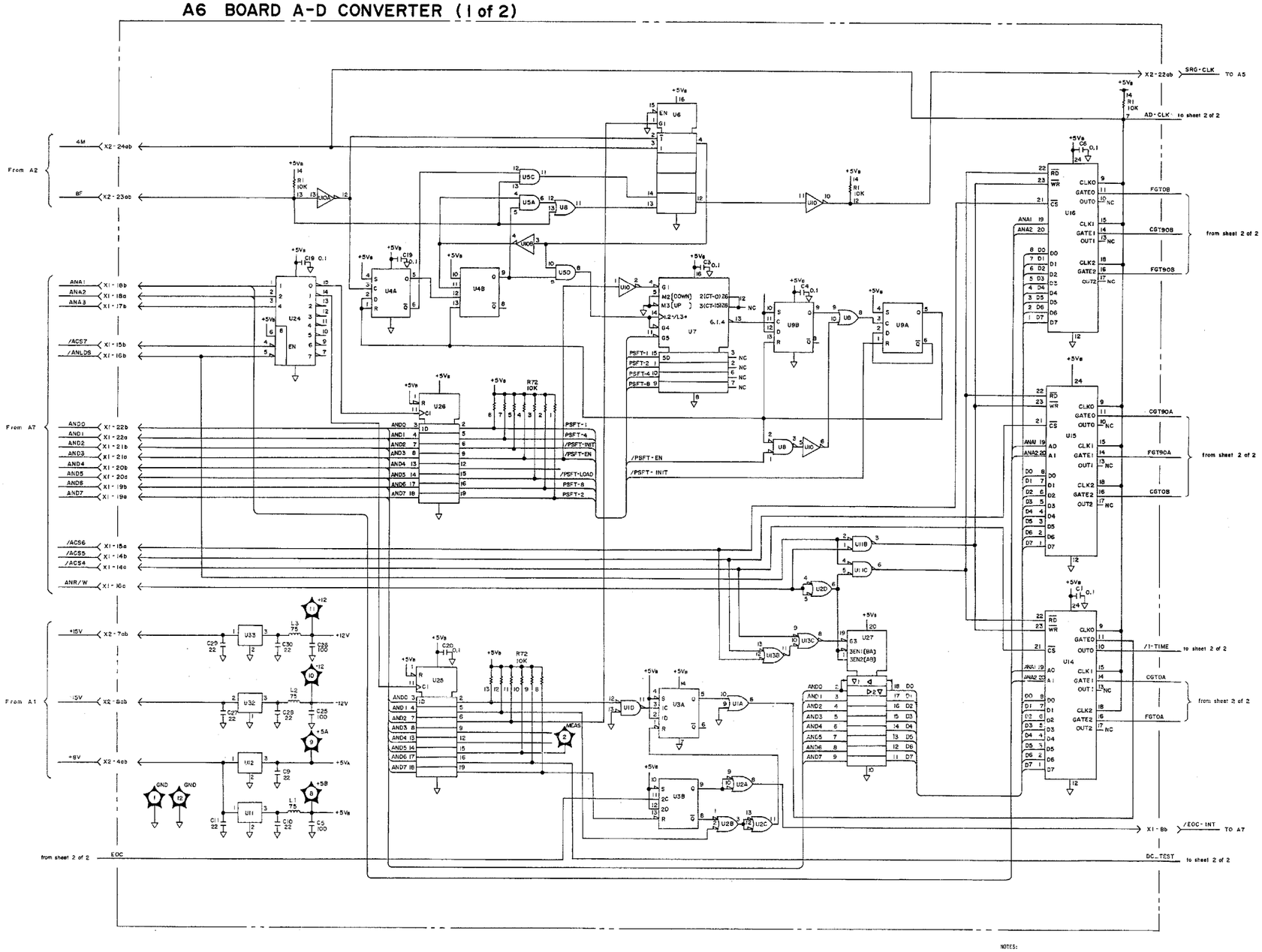


A6X2B	Pin No.	A6X2A
AGND	1	AGND
AGND	2	AGND
AGND	3	AGND
+8V	4	+8V
nc	5	nc
nc	6	nc
+15V	7	+15V
-15V	8	-15V
nc	9	nc
nc	10	nc
nc	11	nc
nc	12	nc
V_DC1	13	V_DC1
AD_GND1	14	AD_GND1
V_DC2	15	V_DC2
AD_GND2	16	AD_GND2
V_DC3	17	V_DC3
AD_GND3	18	AD_GND3
V_DC4	19	V_DC4
AD_GND4	20	AD_GND4
nc	21	nc
SRG_CLK	22	SRG_CLK
BF	23	BF
4M	24	4M
AGND	25	AGND
AGND	26	AGND
nc	27	nc
AGND	28	AGND
AGND	29	AGND
nc	30	nc
AGND	31	AGND
nc	32	nc

A6X1B	Pin No.	A6X1A
nc	1	nc
nc	2	nc
nc	3	nc
nc	4	nc
AGND	5	AGND
AGND	6	AGND
/ADC_INT	7	nc
AGND	8	AGND
nc	9	nc
AGND	10	nc
nc	11	AGND
nc	12	nc
nc	13	nc
/ACS5	14	/ACS4
/ACS7	15	/ACS6
/ANLDS	16	ANR/W
ANA3	17	nc
ANA1	18	ANA2
AND6	19	AND7
AND4	20	AND5
AND2	21	AND3
AND0	22	AND1
nc	23	nc
nc	24	nc
nc	25	nc
nc	26	nc
nc	27	nc
nc	28	nc
nc	29	nc
AGND	30	AGND
AGND	31	AGND
AGND	32	AGND

Figure 3-15. A6 A-D Converter Component Locations

A6 BOARD A-D CONVERTER (1 of 2)

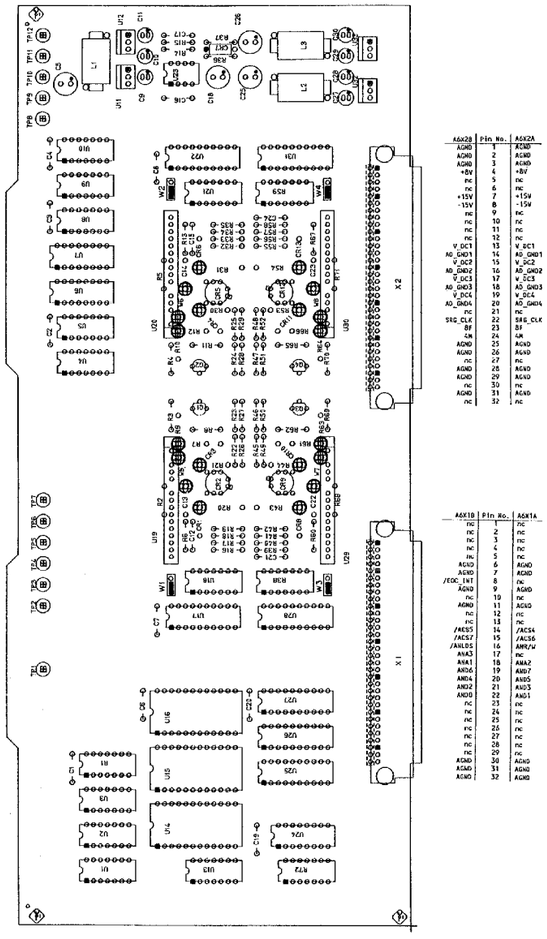


NOTES:

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 3-16. A6 A-D Converter Schematic Diagram (1/2)

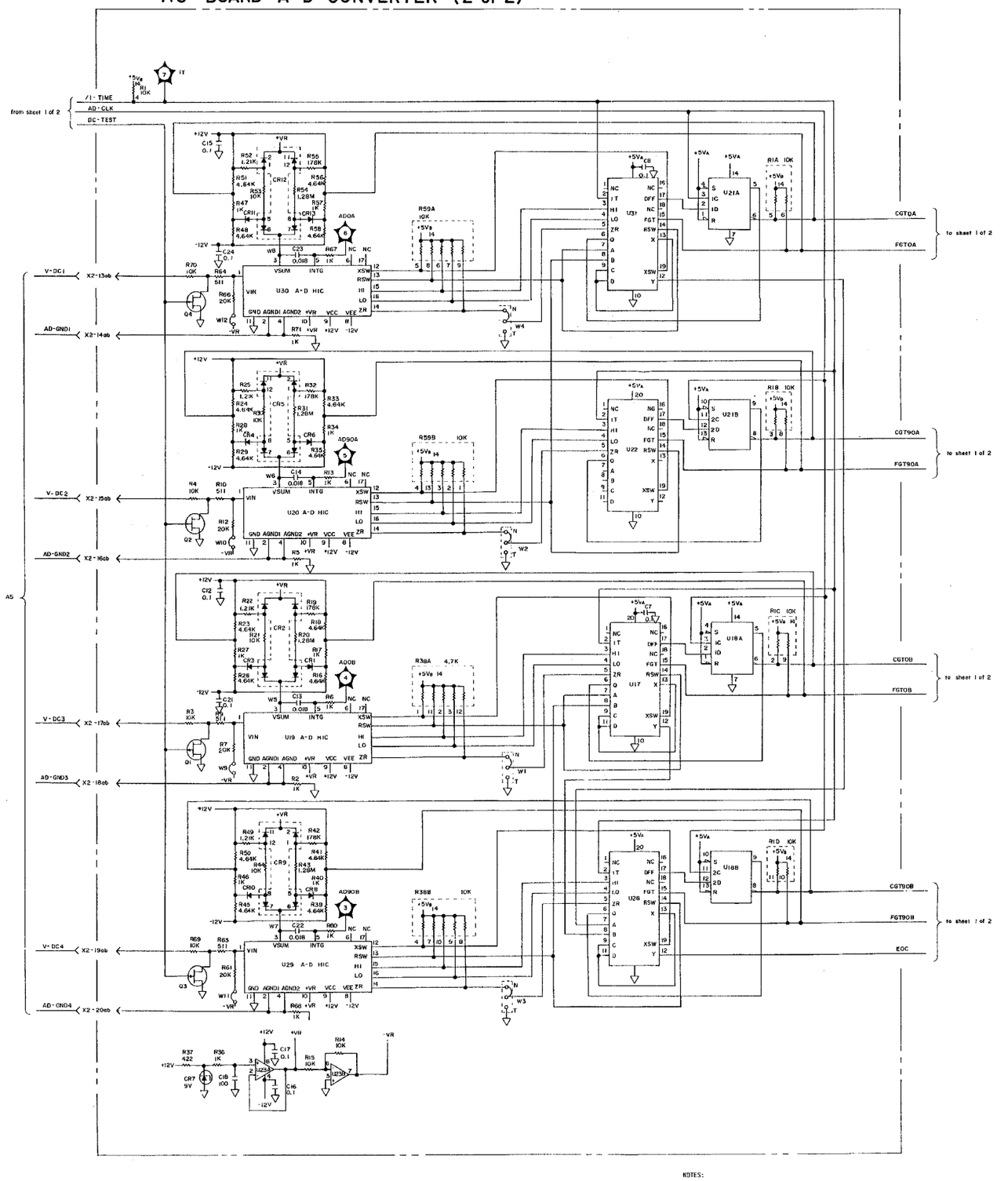


A6XZB	Pin No.	A6XZA
AGND	1	AGND
AGND	2	AGND
AGND	3	AGND
+8V	4	+8V
nc	5	nc
nc	6	nc
+15V	7	+15V
-15V	8	-15V
nc	9	nc
nc	10	nc
nc	11	nc
nc	12	nc
V_DC1	13	V_DC1
AD_GND1	14	AD_GND1
V_DC2	15	V_DC2
AD_GND2	16	AD_GND2
V_DC3	17	V_DC3
AD_GND3	18	AD_GND3
V_DC4	19	V_DC4
AD_GND4	20	AD_GND4
nc	21	nc
SIG_CLK	22	SIG_CLK
BI	23	BI
GN	24	GN
AGND	25	AGND
AGND	26	AGND
nc	27	nc
AGND	28	AGND
AGND	29	AGND
nc	30	nc
AGND	31	AGND
AGND	32	AGND

A6X1B	Pin No.	A6X1A
nc	1	nc
nc	2	nc
nc	3	nc
nc	4	nc
nc	5	nc
AGND	6	AGND
AGND	7	AGND
/EOC_INT	8	nc
AGND	9	AGND
nc	10	nc
AGND	11	AGND
nc	12	nc
nc	13	nc
/ACS5	14	/ACS4
/ACS7	15	/ACS6
/AXLOS	16	AMUX
AIN3	17	nc
AIN1	18	AIN2
AIN6	19	AIN7
AIN4	20	AIN5
AIN2	21	AIN3
AIN5	22	AIN1
nc	23	nc
nc	24	nc
nc	25	nc
nc	26	nc
nc	27	nc
nc	28	nc
nc	29	nc
AGND	30	AGND
AGND	31	AGND
AGND	32	AGND

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

A6 BOARD A-D CONVERTER (2 of 2)



NOTES:

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

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

Figure 3-16. A6 A-D Converter Schematic Diagram (2/2)

A7 DIGITAL CONTROL BOARD SERVICE SHEET

NOTES

3-13. A7 BOARD SERVICE SHEET

3-13-1. CIRCUIT DESCRIPTION

The A7's (Digital Control board) MPU is A7U5 (16-bit micro processor). A7U9, A7U10, A7U33, and A7U34 are the 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 and corresponding messages are listed in Table 3-24.

Table 3-24. ROM number

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

3-13-2. 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 paragraph 2-11, Assembly Level Troubleshooting, SECTION 2.

3-13-3. REPLACEABLE PARTS LIST

The replaceable parts for the A7 board are divided into two groups: a ROMless A7 board and a set of 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 without ROMs installed and the ROMs are not defective, order a ROMless A7 board. (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 the four ROMs.

The A7 board's replaceable parts are listed in Table 3-26. The part number for a rebuilt exchange board is listed on the first page of the A7 board's replaceable parts list.

3-13-4. COMPONENT LOCATIONS

The component locations of the A7 Digital Control Board are shown in Figure 3-17.

3-13-5. 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 3-26. A7 Digital Control Replaceable Parts Lists (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	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

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

Table 3-26. A7 Digital Control Replaceable Parts Lists (2/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7J21	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J22	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J23	1200-0567	1		SOCKET-IC 28-CONT DIP DIP-SLDR	28480	1200-0567
A7J24	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
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

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

Table 3-26. A7 Digital Control Replaceable Parts Lists (3/4)

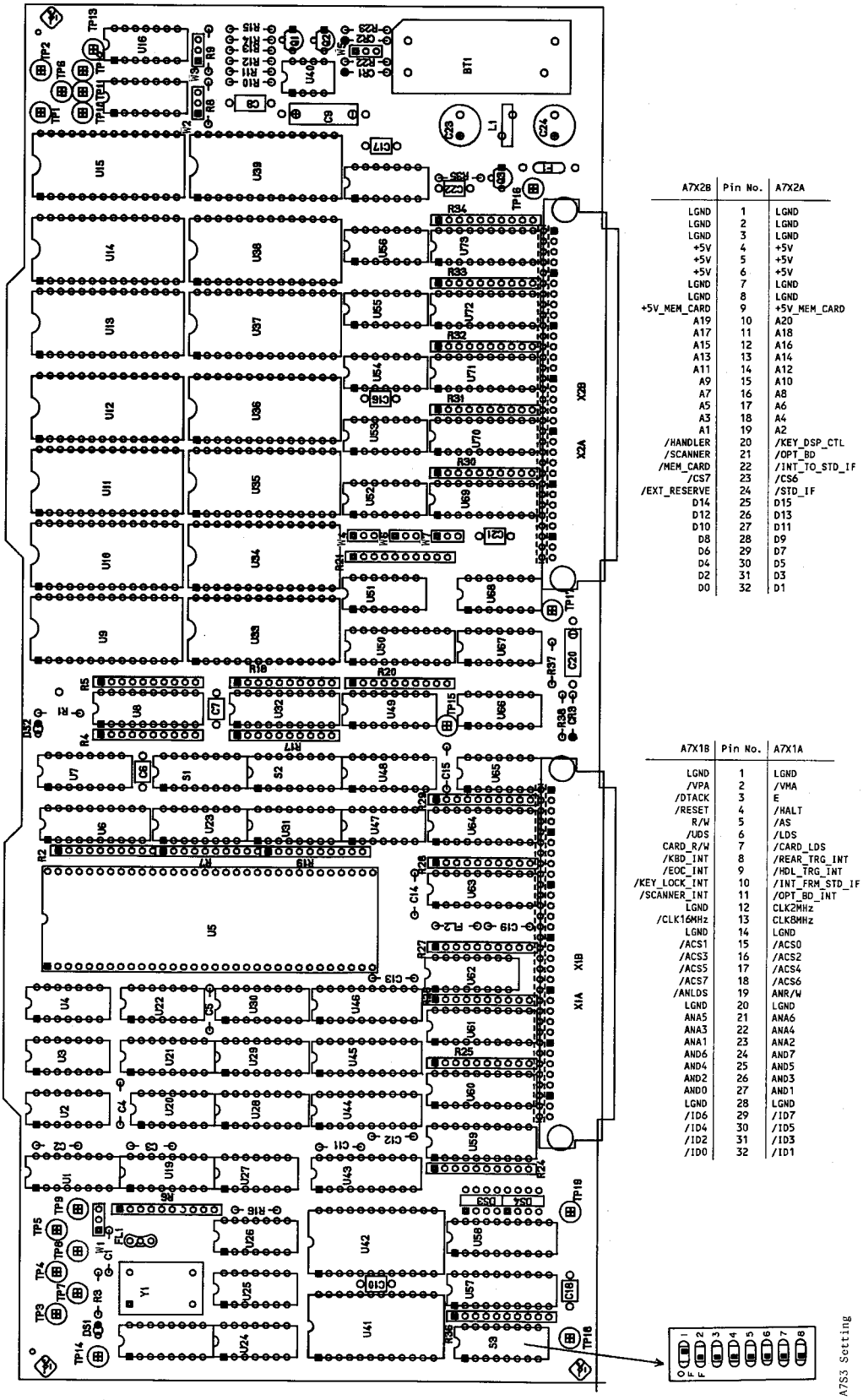
Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A7TP11	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP12	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1653
A7TP13	0360-1653	5		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	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
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

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

Table 3-26. A7 Digital Control Replaceable Parts Lists (4/4)

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
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
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 1.0		
A7U9	04279-85001	8	1	ROM 0K BIT0 (ROM Version 1.0)	28480	04279-85001
A7U10	04279-85003	0	1	ROM 20K BIT0 (ROM Version 1.0)	28480	04279-85003
A7U33	04279-85002	9	1	ROM 0K BIT8 (ROM Version 1.0)	28480	04279-85002
A7U34	04279-85004	1	1	ROM 20K BIT8 (ROM Version 1.0)	28480	04279-85004
				Version 2.0		
A7U9	04279-85101	9	1	ROM 0K BIT0 (ROM Version 2.0)	28480	04279-85101
A7U10	04279-85103	1	1	ROM 20K BIT0 (ROM Version 2.0)	28480	04279-85103
A7U33	04279-85102	0	1	ROM 0K BIT8 (ROM Version 2.0)	28480	04279-85102
A7U34	04279-85104	2	1	ROM 20K BIT8 (ROM Version 2.0)	28480	04279-85104

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



A7X2B	Pin No.	A7X2A
LGND	1	LGND
LGND	2	LGND
LGND	3	LGND
+5V	4	+5V
+5V	5	+5V
+5V	6	+5V
LGND	7	LGND
LGND	8	LGND
+5V_MEM_CARD	9	+5V_MEM_CARD
A19	10	A20
A17	11	A18
A15	12	A16
A13	13	A14
A11	14	A12
A9	15	A10
A7	16	A8
A5	17	A6
A3	18	A4
A1	19	A2
/HANDLER	20	/KEY_DSP_CTL
/SCANNER	21	/OPT_BD
/MEM_CARD	22	/INT_TO_STD_IF
/CS7	23	/CS6
/EXT_RESERVE	24	/STD_IF
D14	25	D15
D12	26	D13
D10	27	D11
D8	28	D9
D6	29	D7
D4	30	D5
D2	31	D3
D0	32	D1

A7X1B	Pin No.	A7X1A
LGND	1	LGND
/VPA	2	/VMA
/DTACK	3	E
/RESET	4	/HALT
R/W	5	/AS
/UDS	6	/LDS
CARD_R/W	7	/CARD_LDS
/KBD_INT	8	/REAR_TRG_INT
/EOC_INT	9	/HDL_TRG_INT
/KEY_LOCK_INT	10	/INT_FRM_STD_IF
/SCANNER_INT	11	/OPT_BD_INT
LGND	12	CLK2MHz
/CLK16MHz	13	CLK8MHz
LGND	14	LGND
/ACS1	15	/ACS0
/ACS3	16	/ACS2
/ACS5	17	/ACS4
/ACS7	18	/ACS6
/ANLDS	19	ANR/W
LGND	20	LGND
ANA5	21	ANA6
ANA3	22	ANA4
ANA1	23	ANA2
AND6	24	AND7
AND4	25	AND5
AND2	26	AND3
AND0	27	AND1
LGND	28	LGND
/ID6	29	/ID7
/ID4	30	/ID5
/ID2	31	/ID3
/ID0	32	/ID1

A7S3 Setting

Figure 3-17. A7 Digital Control Component Locations

NOTES

A9, A13, A90, A91 BOARDS SERVICE SHEET

NOTES

3-14. A9, A13, A90, AND A91 BOARDS SERVICE SHEET

3-14-1. CIRCUIT DESCRIPTION

The A9 keyboard consists of Key switches, LED indicators, a buzzer, and the LCD contrast potentiometer. The A13 DC-AC Converter Board converts ±12 V DC into 600 V AC to supply the 600 V AC to the A91 LCD Module board to backlight the LCD. The A90 Keyboard/ Display Control Module board interfaces the A7 CPU board to both the A9 Keyboard and the A91 LCD module board. The A91 LCD module is the HP 4279A's display screen.

3-14-2. TROUBLESHOOTING AIDS

Fuse A9F1 on the A9 Keyboard is the fuse for the A90 board. If the 4279A 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 they are difficult to be replace. Thus, if the A90 or A91 board is faulty, it must be repaired at the assembly level only.

3-14-3. REPLACEABLE PARTS LISTS

The A9 Keyboard's replaceable parts are listed in Table 3-27. The A13 DC-AC Convertor's replaceable parts are listed in Table 3-28. The A90 Keyboard/Display Control and the A91 LCD module replaceable parts are listed in Table 3-29. 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 3-29.

3-14-4. COMPONENT LOCATIONS

The component locations for the A9 Keyboard and the A13 DC-AC Converter board are shown in Figure 3-18. Component locations for the A90 and A91 boards are not shown because these boards are repaired at the assembly level only.

3-14-5. SCHEMATIC DIAGRAMS

The A9 Keyboard, A13 DC-AC Converter, A90 Keyboard/Display Control Unit, and A91 LCD Module schematic diagrams are shown in Figure 3-19.

Table 3-27. A9 Keyboard Replaceable Parts List

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A9						
A9	04279-66559	1	1	KEY BOARD	28480	04279-66559
A9C1	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
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
A9DS5	1990-1226	4	1	LED-LAMP LUM-INT=2.2MCD IF=20MA-MAX	28480	1990-1226
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
A9R1	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A9R2	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A9R3	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A9R4	0698-0082	7	4	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A9R5	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A9R6	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A9R7	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A9R8	2100-4174	3	1	RESISTOR-VAR CONTROL CF 20K 10% LIN	28480	2100-4174
A9R9	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A9SP10	9164-0295	2	1	ALARM-AUDIBLE	28480	9164-0295
A9U1	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
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 3-28. A13 DC-AC Converter Replaceable Parts List

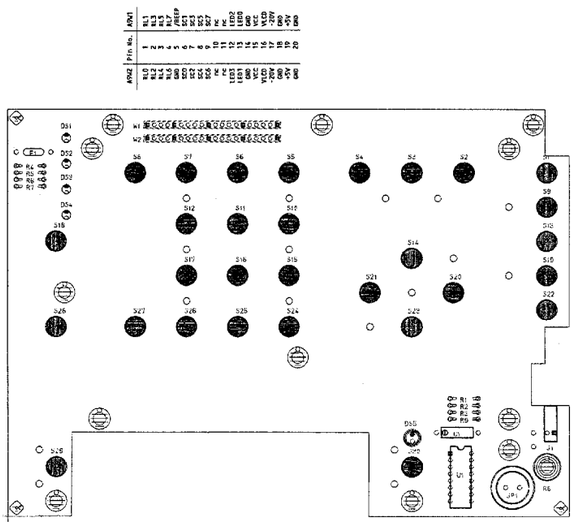
Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A13						
A13	04278-66513	6	1	DC-AC CONVERTER	28480	04278-66513
A13C1	0180-3602	6	1	CAPACITOR-FXD 22UF+-20% 50VDC AL	28480	0180-3602
A13DS1	2140-0127	2	1	LAMP-NEON 90V	28480	2140-0127
A13E1	04278-61101	8	1	CONVERTER DCIAC	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.**

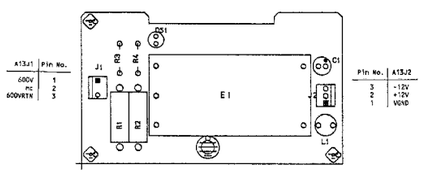
Table 3-29. A90 and A91 Boards Replaceable Parts List

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 3-18. A9 Keyboard and A13 DC-AC Converter Component Locations

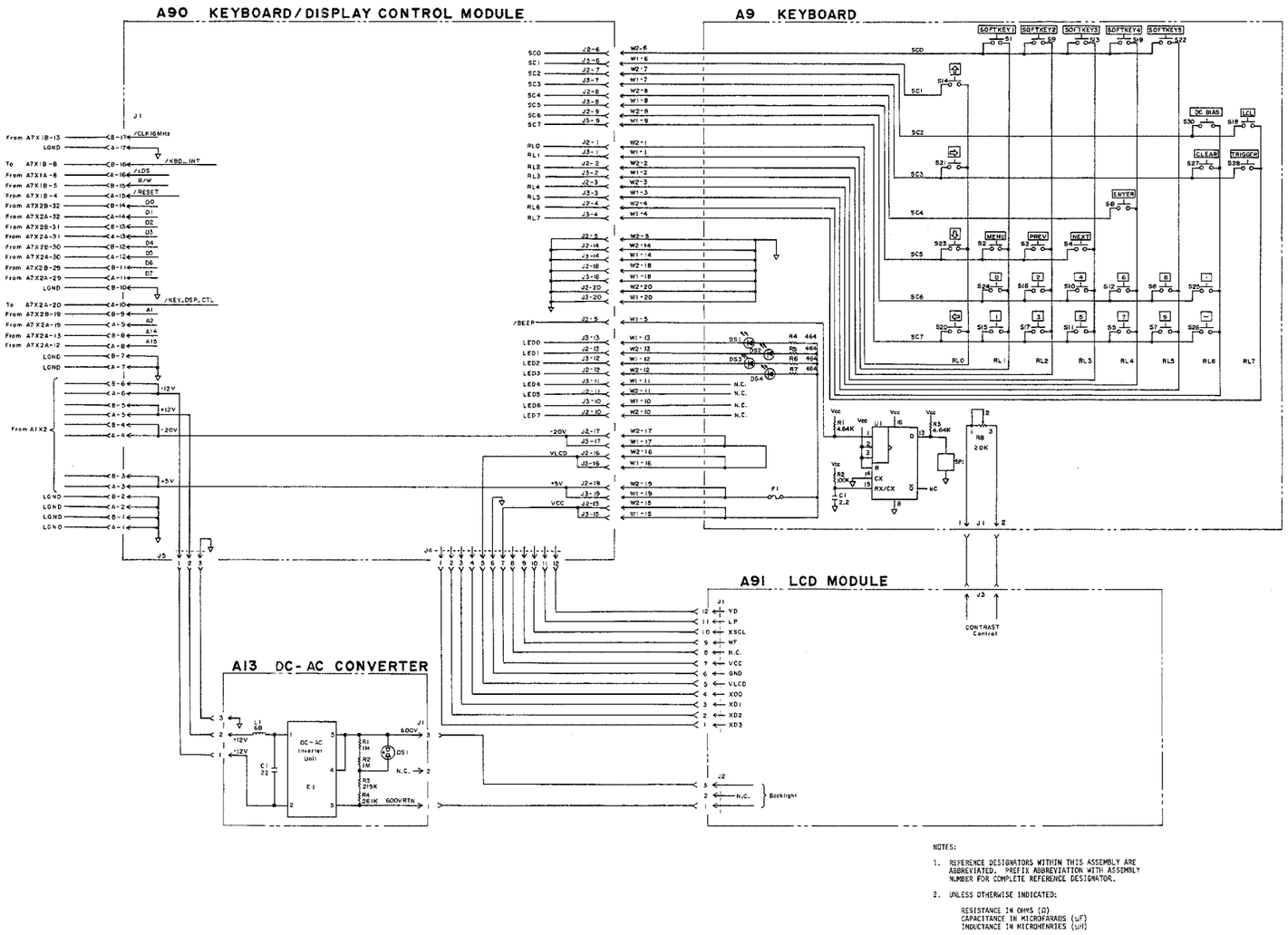


Figure 3-19. A9, A13, A90, and A91 Schematic Diagram

A11 MOTHER BOARD SERVICE SHEET

NOTES

3-15. A11 BOARD SERVICE SHEET

3-15-1. CIRCUIT DESCRIPTION

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

3-15-2. TROUBLESHOOTING AIDS

No troubleshooting data for the A11 Motherboard is given. The pin assignment for each board gives the information needed for troubleshooting.

3-15-3. REPLACEABLE PARTS LISTS

The replaceable parts list of the A11 Mother board are listed in Table 3-30.

3-15-4. COMPONENT LOCATIONS

The A11 Motherboard's component locations are shown in Figure 3-20.

3-15-5. SCHEMATIC DIAGRAMS

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

Table 3-30. A11 Motherboard Replaceable Parts List

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A11						
A11	04279-66511	5	1	A11 MOTHERBOARD	28480	04279-66511
J1	1252-1745	8	14	CONN-POST TYPE 64-CONT	28480	1252-1745
J2	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J4	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J5	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J6	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J7	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J8	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J9	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J10	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J11	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J13	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J14	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J15	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J16	1252-1745	8		CONN-POST TYPE 64-CONT	28480	1252-1745
J19	1251-4938	5	1	CONNECTOR 3-PIN	28480	1251-4938
J20	1251-5066	2	1	CONN-POST TYPE 2-CONT	28480	1251-5066
J21	1252-1404	6	1	CONN-POST 34-CONT	28480	7834-0000T
	04278-61629	5	1	FL CBL ASSY 34P	28480	04278-61629

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

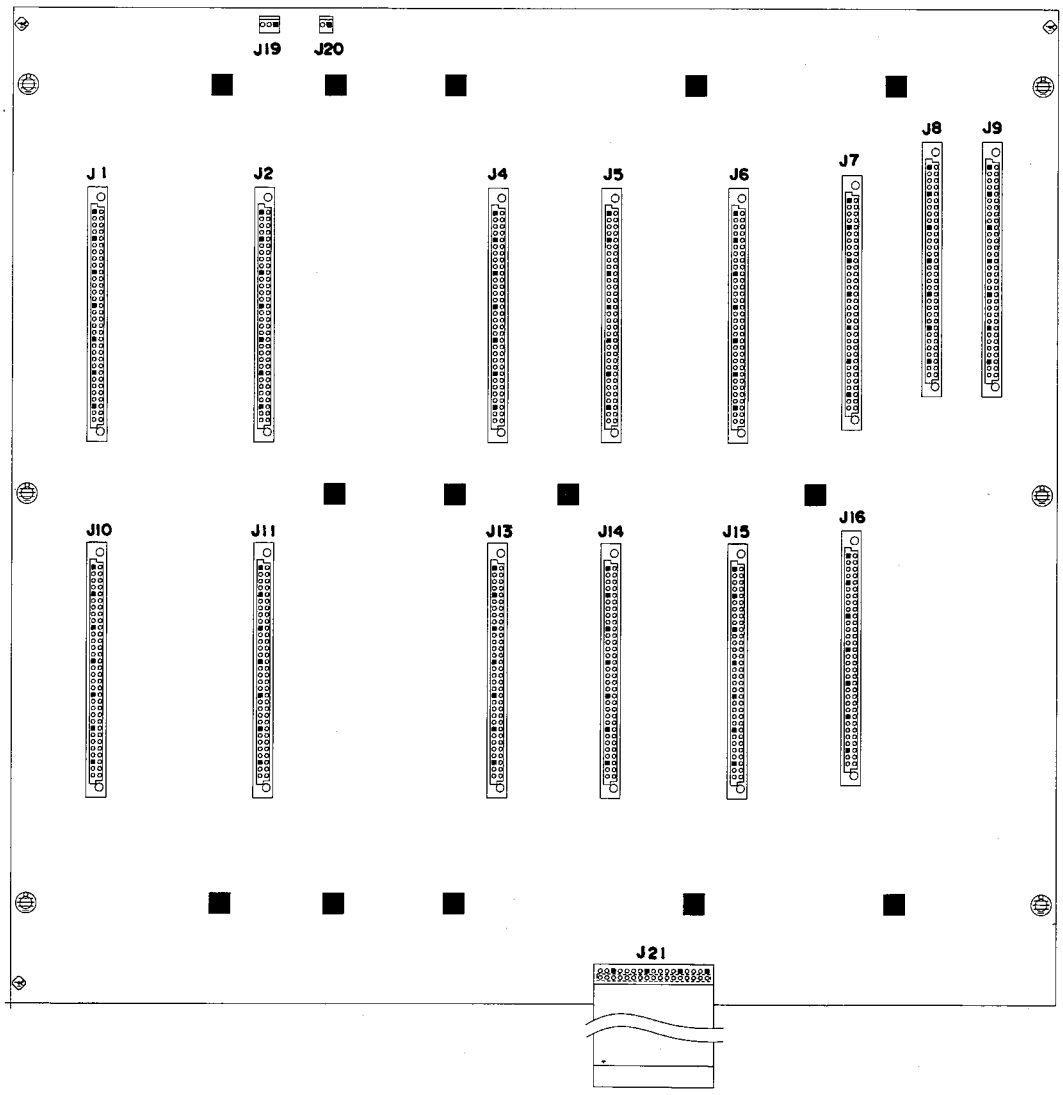


Figure 3-20. A11 Motherboard Component Locations

NOTES

A20 HP-IB INTERFACE BOARD SERVICE SHEET

NOTES

3-16. A20 BOARD SERVICE SHEET

3-16-1. CIRCUIT DESCRIPTION

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 IC is A20U8 (8291A HP-IB controller).

3-16-2. TROUBLESHOOTING AIDS

The test points are listed in Table 3-31.

Table 3-31. A20 Test Points

Test Point	Signal Name	Description
A20TP1	*GND*	Ground reference for the +5 V digital supply
A20TP2	*+5V*	+5 V digital supply
A20TP3	*LDS*	Lower Data Strobe Signal
A20TP4	*4MHz*	4 MHz is counted down from the A7 */CLK16MHz*

3-16-3. REPLACEABLE PARTS LISTS

The A20 HP-IB Interface board's replaceable parts are listed in Table 3-32.

3-16-4. COMPONENT LOCATIONS

The A20 HP-IB Interface board component locations are shown in Figure 3-21.

3-16-5. SCHEMATIC DIAGRAMS

The A20 HP-IB Interface board schematic diagram is shown in Figure 3-22.

Table 3-32. A20 HP-IB Interface Replaceable Parts List

Reference Designator	HP Part Number	C D	Qty.	Description	Mfr Code	Mfr Part Number
A20						
A20	04278-66520	5	1	HP-IB	28480	04278-66520
A20C1	0160-6561	0	6	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A20C2	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A20C3	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A20C4	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A20C5	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A20C6	0160-6561	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC02Z5U104M050A
A20C7	0180-3590	1	1	CAPACITOR-FXD 470UF+-20% 10VDC AL	28480	0180-3590
A20F1	2110-0742	4	1	FUSE 1.5A 125V NTD UL	28480	2110-0742
A20J1	1251-5650	0	1	CONNECTOR 26-PIN M POST TYPE	28480	1251-5650
A20R1	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A20U1	1820-1208	3	1	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A20U2	1820-2058	3	4	IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	04713	MC3448AL
A20U3	1820-2058	3		IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	04713	MC3448AL
A20U4	1820-2058	3		IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	04713	MC3448AL
A20U5	1820-1433	6	1	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN74LS164N
A20U6	1820-1430	3	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
A20U7	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A20U8	1820-2549	7	1	IC-8291A P HPIB	28480	1820-2549
A20U9	1820-2058	3		IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	04713	MC3448AL
A20U10	1820-1200	5	1	IC INV TTL LS HEX	01295	SN74LS05N
A20U11	1820-2711	5	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS541N
A20U12	1820-2075	4	1	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS245N
A20W1	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A20X1	1252-1598	9	1	CONN-POST TYPE 2.54-PIN-SPCG 96-CONT	09922	PI96B30P00F50N9
	0360-1653	5	5	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
	4040-0750	7	1	EXTR-PC BD RED POLYC .062-IN-BD-THKNS	28480	4040-0750

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

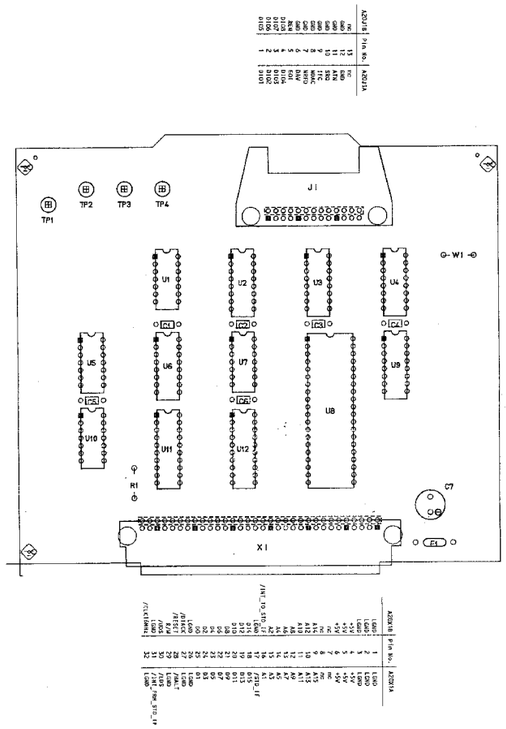
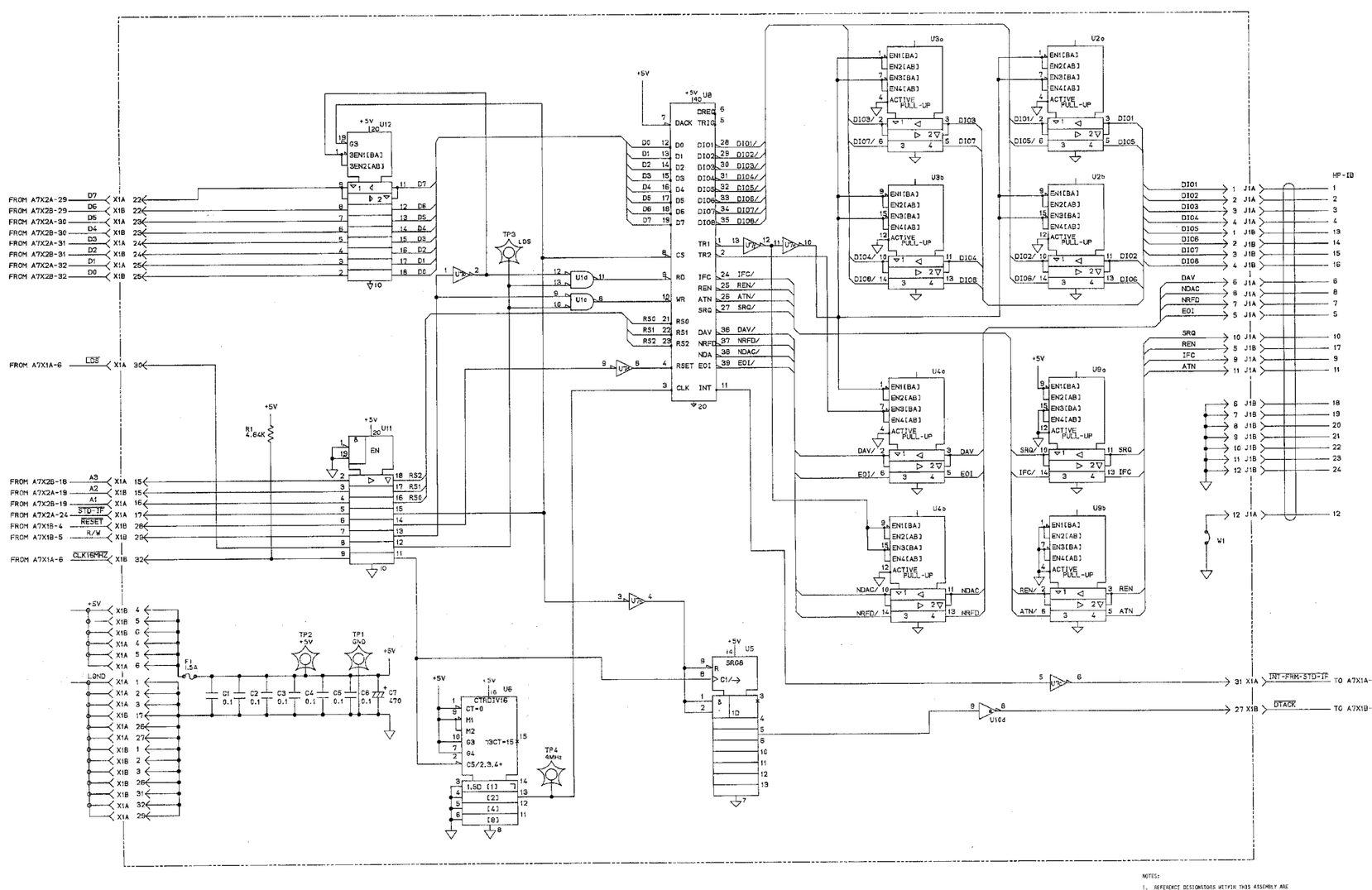


Figure 3-21. A20 HP-IB Interface Component Locations

A20 #101 HP-IB



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 3-22. A20 HP-IB Interface Schematic Diagram

SECTION 4

MANUAL CHANGES

4-1. INTRODUCTION

This section contains information for adapting this manual to instruments for which the content does not directly apply. The following paragraphs explain how to adapt this manual to apply to an older instrument with a serial prefix/number or ROM version lower than that given on the title page.

4-2. MANUAL CHANGES

To adapt this manual to your instrument, refer to Table 4-1 and make all of the manual changes listed opposite your instrument 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 4-1, it may be documented in a yellow **MANUAL CHANGES** supplement. For additional information about serial number coverage, refer to **INSTRUMENTS COVERED BY MANUAL** in **SECTION 8** of the 4279A's Operation Manual.

Table 4-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes

NOTES

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